



POWER^V™ TECHNOLOGY

THE INNOVATIVE SOLUTION THAT LEVERAGES HIGHER VOLTAGES TO ACHIEVE GREATER THERMAL PRECISION AND EFFICIENCY

From the global leader in advanced thermal technologies

- Decreases installation costs by 30% with fewer connection points and components.
- Increases efficiency to 99% by reducing energy losses (I^2R).
- Reduces infrastructure requirements with condensed product footprint and weight.
- Reduce maintenance inspection times by 80%.
- Utilizes clean energy with no regulatory compliance issues.



POWER^V_{TM} TECHNOLOGY

Increase efficiency and decrease costs with Power^V_{TM} Technology

Power^V_{TM} Technology is an innovative technology from Chromalox that leverages the benefits of higher power sources to create more effective and powerful heating products. Harnessing the benefits of higher voltage, Power^V_{TM} provides increased efficiency and cost savings, while providing the benefits of zero emissions.

While electricity's efficiency and sustainability make it a preferred heat source for many products and applications, installation costs can become burdensome for applications that require large amounts of power. Power^V_{TM} Technology unlocks electric heating as a solution for high-

demand applications, enabling end users to enjoy the benefits of electric heating while improving operating costs and lowering installation costs, even for many smaller heating applications.

Power^V_{TM} brings together material science, proprietary manufacturing processes, and engineering expertise to a variety of Chromalox heating products. It is available for Chromalox heat trace cable, industrial heaters and systems, and temperature and power control products. Power^V_{TM} is the solution that leverages higher voltages to increase operating efficiency across your infrastructure.

Scientifically Designed Materials

Chromalox research has identified scientifically blended ceramic and polymer mixtures that generate greater dielectric resistance while maintaining the superior heat transfer characteristics that Chromalox is known for. High dielectric strength enables the heating components to perform optimally at higher voltages and higher temperatures. This ensures consistent performance, even in high-stress applications.

The design efficiency of Power^V™ is realized through highly customized material geometries. Configurations such as interlocking elements, engineered extrusion matrices, and material spacing patterns provide increased power conversion efficiency and reduced energy losses.

There is a vital correlation between material selections, custom-engineered formations, and product performance. Power^V™ eclipses any other product class for performance, efficiency, and durability.

Proprietary Manufacturing Processes

The effectiveness of Power^V™ is only realized through the highest level of manufacturing integrity. Raw materials, blending mixtures, and trade skills must be fused together. Thanks to 100 years of advanced thermal technology innovations from Chromalox, the integrated elements of Power^V™ are crafted together by experienced professionals.

Proprietary manufacturing equipment has been dedicated to the Power^V™ product line. This ensures higher process and quality control, ultimately leading to the superior product performance, even in high-stress applications. The highly customized equipment allows for the components

and equipment to integrate effectively, essentially working together as one technology.

Power^V™ is ultimately proven through rigorous testing and validation methods before the products leave the factory. Multiple electrical, strength, and third-party testing, as conducted by UL, FM, CSA, Intertek, and others, must all be passed to assure product performance. Power^V™ is constructed to ensure thermal performance and maintain the highest dielectric properties throughout the product life cycle.

Engineering Ingenuity

Chromalox Power^V™ Technology is unlike any other in the market because of its engineering ingenuity. For over a century, integrating advanced thermal technologies with product design has been a hallmark of Chromalox.

Power^V™ technology is harnessed and then applied through multiple product lines such as DirectConnect™, mineral insulated heating cable, and industrial air heaters. Chromalox engineering leverages its patented technology to create the most robust electric heating element for optimal performance under high voltage demand.

Chromalox also provides Power^V™ control systems that bring better process control through the development of proprietary control algorithms to provide proactive alerts of potential system errors and advanced, real-time monitoring for predictive analysis.

The integration of Power^V™ technology, heating products and control offers a complete system package to harness the power, efficiency, and savings of higher voltage to almost any industrial application.



The Unique Benefits of Power^V™ Technology

Power^V™ Technology allows heating products to run on higher voltage in a compact, zero-emission footprint. This provides users with short- and long-term savings for both installation and operation. The unique benefits of Power^V™ include:

Decreased Installation Costs

With Power^V™, a wide range of operations can now benefit from the superior option of electric process heating. The reduced wiring, labor savings, and smaller footprint means immediate installation savings for even the largest heating application.

One Chromalox Power^V™ product, the DirectConnect™ medium voltage electric system for process heating, provides end users with greatly reduced installation costs. In one 2.4 MW (8.2 MMBtu/hr) installation, a low voltage system would have required 24 circuits with over 250 labor hours to install. A DirectConnect™ 4160 V process heating system requires only two circuits and 20 labor hours. This offers an instant installation

savings of \$224,995 due to the need for less wiring, less labor, and the elimination of step down transformers.

Increased Operational Efficiency

Traditionally, most industries have used low voltage systems (typically less than 1,000 V) for electric heating applications. Lower voltages can lose excessive energy in the form of wiring losses, commonly known as I²R losses. Power^V™ unlocks that wasted energy by converting it into usable heating energy, thereby raising operating efficiency.

Power^V™ enables DirectConnect™ medium voltage heating systems to increase the efficiency of power distribution and consumption. Low voltage systems operate at about 96% efficiency with losses coming from current transmission across wires, bussing, connections, and instrumentation, or I²R losses. A multi-megawatt process heating system operating at 4,160 V, using the Chromalox SCR power control option maximizes efficiency to nearly 99%. In one instance, that 3% improvement resulted in a lifetime savings of \$633,140.

DIRECTCONNECT™ WITH POWER^V™ TECHNOLOGY

Chromalox studies indicate that using Power^V™ Technology for a 2400 kW (8.2 MMBtu/hr) electric heating system will produce savings that amount to more than \$1 million over a 20-year span, or about \$50,000 per year.

COST OF OWNERSHIP	480 V	4160 V	SAVINGS
Installation	\$753,650	\$528,655	\$224,995
Operating	\$873,940	\$240,800	\$633,140
Maintenance	\$61,200	\$10,200	\$51,000
10-Year Life Cycle Replacements	\$163,655	\$69,500	\$94,155
20-Year Costs	\$1,852,445	\$849,155	\$1,003,290
Annualized Costs	\$92,622	\$42,458	\$50,164

Reduced Product Footprint and Weight

By leveraging the benefits of higher voltage power, Chromalox products with Power^V™ technology offer a significantly reduced footprint and weight savings within a process heating system. Electric heating systems have always offered a more compact design than a fuel-fired offering. Power^V™ makes a heating package smaller and lighter than ever before by offering less wiring, less conduit, less connection points, and even a smaller power transformer.

Heavy gauge wires, used in a lower voltage application, can consume valuable floor space. In addition, the wire weight can have a compound effect by adding even more weight due to the supporting infrastructure needed to accommodate their bulk. However, Power^V™ enables a reduction in the number of wires used and typically allows a much lighter gauge through the use of higher voltage. Likewise, Power^V™ has the same effect by reducing the weight or even the need of a power transformer.

In applications like offshore environments, Power^V™ can offer a tremendous cost savings. Platforms use multiple air heaters, such as models CXH and

HD3D. In a common platform layout, the use of Power^V™ products created a savings of over \$360,000 by eliminating 11.5 tons (10,450 kg) of excess wiring and structural steel.



OFFSHORE OIL RIG CASE STUDY

Oil rig designers and builders face several design and selection challenges from the extreme environments in which their equipment operates. For offshore applications, every pound of drilling rig requires four pounds of structural steel. Power^V™ enables higher voltages with fewer cables and transformers, which ultimately reduces weight and associated costs significantly.

Challenges:

- Punishing environments
- Servicing difficulty
- Safety hazards
- Weight ratio of equipment to drilling platform
- Flammable gases and chemicals

Chromalox model CXH-XD and HD3D air heaters are ideally suited for offshore applications thanks to the Power^V™ Technology. They offer the following solutions to offshore customer pain points.



Solutions:

- Electric-powered and explosion-proof
- Durable against saltwater, air, and cold temperatures
- Protected from moisture and dust
- Capable of voltages higher than normal heater designs (690 V)
- Lighter in weight because they require less wire

WEIGHT AND COST SAVINGS *For an offshore platform requiring 68 total units, rated 15 kW each:*

400 V Construction		690 V Construction	
Heaters, Wiring, Equipment Weight	32,101 lbs (14,561 kg)	Heaters, Wiring, Equipment Weight	27,494 lbs (12,471 kg)
Structural Steel Weight	128,406 lbs (58,244 kg)	Structural Steel Weight	109,975 lbs (49,884 kg)
Total Weight	160,507 lbs (72,805 kg)	Total Weight	137,469 lbs (62,355 kg)
Total Cost	\$3,108,568	Total Cost	\$2,739,751

Total Weight Savings 23,038 lbs (10,450 kg) • Total Cost Savings: \$368,818

Simplified Maintenance

Savings are felt long term thanks to the optimal design and performance that Power^V™ equipment delivers. Fewer connections, circuits, and wiring translate into time saved by maintenance staff for faster inspections each cycle.

In one instance, when comparing a traditional 300 V MI cable with a Chromalox 600 V Power^V™ MI cable, the 600 V cable required half the connections points, fewer accessories, and a less expensive control panel. Yearly inspection of this 5,000 ft pipeline was reduced by over \$10,000 with a greatly simplified maintenance process.

With skin effect heating, the higher voltage allows for extremely long (2,000 ft [610 m] to 16 mi [26 km]) lengths of heat to be applied with only one point of supply voltage. This installation style allows for streamlined operation and greatly simplified maintenance, significantly reducing long-term costs.

Clean Energy Utilization

Most fossil-fired heating sources are subject to strict regulations as well as ongoing environmental concerns. Power^V™ electric heating helps remove this concern from the user, while capitalizing on the most efficient conversion of energy to heat. This allows an emissions-free, safe alternative at the point of use that does not produce carbon monoxide. Electric heat preserves natural resources by using energy more efficiently and is not subject to government emissions regulations or permit requirements.

Power^V™ enabled one petrochemical manufacturer to expand production in a residential setting. Local restrictions had long since capped the amount of emissions that could be generated from the existing site. Power^V™ heating provided the solutions with clean, cost effective design that increased operation directly on site. This saved the manufacturer the immeasurable cost of relocation and hearings for government compliance, along with the months of production loss.

SKIN EFFECT CASE STUDY



PROBLEM

An operation is challenged to supply a gathering system in a new oil field in a remote location where temperatures are as low as -40° F (-40° C). There is no distributed power grid availability, and maintenance is very difficult and costly.

SOLUTION

A pre-insulated, prefabricated piping system with skin effect current tracing.

RESULT

Six heating systems were installed with over 11 miles of pipe in total. The system has functioned for more than 20 years with minimal maintenance, resulting in a savings of over \$250,000.

RedSage™: 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 Power^V™ 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.



CHROMALOX WORLDWIDE LOCATIONS



• Sales Offices
■ Manufacturing Facilities

Chromalox Headquarters

103 Gamma Drive
 Pittsburgh, PA 15238
 USA

Phone: (412) 967-3800
 Fax: (412) 967-5148
 Toll-Free: 1-800-443-2640

Email: sales@chromalox.com
www.chromalox.com

Canada

Tel: 877-238-4754
 Fax: 888-292-9607

Email: sales@chromalox.com
www.chromalox.com

China

Tel: +86 (0) 21-5866-8802
 Fax: +86 (0) 21-5866-8803

Email: shanghai.office@chromalox.com
www.chromalox.cn

France

Tel: +33 (0) 3 23 74 39 39
 Fax: +33 (0) 3 23 74 39 00

Email: ventes@chromalox.fr
www.chromalox.fr

Germany

Tel: +49 (0) 231-58 44 990-0
 Fax: +49 (0) 231-58 44 990-9

Email: kontakt@chromalox.com
www.chromalox.de

Middle East

Tel: +971 4 8879776
 Fax: +971 4 8879793

Email: middle-eastsales@chromalox.com
www.chromalox.com

India

Tel: +91-11-25623134
 Fax: +91-11-25623480

Email: indiasales@chromalox.com
www.chromalox.in

Singapore

Tel: +65 (0) 6339 1228
 Fax: +65 (0) 6339 2648

Email: singaporesales@chromalox.com
www.chromalox.com

Thailand

Tel: +66 (0) 38 190916
 Fax: +66 (0) 38 190919

Email: asiasales@chromalox.com
www.chromalox.com

UK

Tel: +44 (0) 20 8665 8900
 Fax: +44 (0) 20 8689 0571

Email: uksales@chromalox.com
www.chromalox.co.uk

