



closing the loop on thermal solutions



Life Sciences

*Analytical Instrumentation,
Clinical Diagnostics, and Medical Devices*



www.durexindustries.com

Durex Industries is a preferred supplier of high performance radiant, convection and conduction thermal solutions to Life Science and Physical Science Industries. Instrumentation used in preparation and analysis of organic and inorganic materials require precision control of process temperature. Depending on the type of sample, the process temperature may vary from 37°C (98.6°F) for analysis of biological cells to over 500°C (932°F) for analysis of inorganic materials. Some test procedures may require long incubation periods while others require rapid heating of small sample sizes. In medical devices, heating gases or liquids enhances patient comfort and aids recovery. Understanding the application requirements and having a broad base of potential thermal solutions gives Durex the ability to provide the best thermal solution for most applications.

Durex Industries Capabilities

Design

- Conduction, radiation and convection heat transfer expertise
- CAD/CAM and solid modeling
- Finite Element Analysis (FEA) thermal system modeling
- R&D laboratory and qualification systems
- Rapid prototyping
- Mechanical and electronic design
- Structural mechanics

Manufacturing

- CNC equipment for repeatable precision machining
- Lapping machines for smooth flat surfaces
- E-beam welding
- Brazing (torch and vacuum braze)
- Class 1,000 cleanroom
- Special coatings such as anodizing, electroless nickel and Teflon®
- Chemical cleaning and packaging
- High purity gas tube welding (class 100)

Validation Test

- Temperature uniformity
- Structural characteristics and analysis
- Coating performance
- Digital X-ray
- Electrical and mechanical tests

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High Performance • Fast-Reacting

A hallmark of working with Durex Industries is our process for interfacing with our customers' engineering teams to provide rapid prototyping of new designs. Fast prototyping helps Durex customers to validate design options faster and deliver winning solutions to their customers.

Analytical Instrumentation and Laboratory Equipment

Identifying the structure of organic and inorganic liquids and gases requires preparation of samples followed by separation, detection, and analysis of the compounds or elements. Depending on the type of sample, many analysis procedures require heating the sample to a specific temperature between 300 to 500°C (572 to 932°F), in order to achieve the desired separation and analysis. In most applications, sample sizes are small. Speed in quickly receiving test results is critical.

Durex Industries' heater and sensor solutions are designed to achieve fast thermal response and precision temperature control in gas chromatographic (GC), high performance liquid chromatographic (HPLC), mass spectrometers (MS) and other instrumentation.



Cartridge Heaters with integrated RTD or thermocouple sensors are used in applications requiring high temperature and watt density heaters. When integrated into a thermal assembly, cartridge heaters are an excellent solution for rapidly heating GC detectors, and MS ion sources and nebulizers.

- 870°C (1,958°F) on Inconel® sheath
- Watt density to 400 W/in² (62 W/cm²)
- Mineral insulated lead wire
- 1/4 to 1.0 in. diameter heaters sizes



Gas Chromatograph Application

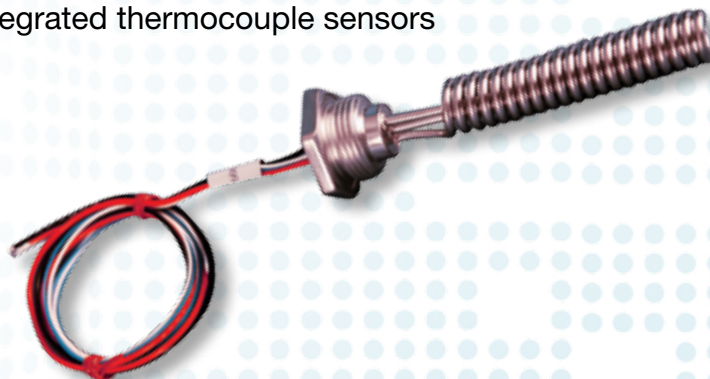
An original equipment manufacturer (OEM) of portable gas chromatographs (GC) used for on-site analysis of potentially hazardous chemical and biological materials had a requirement for small, light weight, and low power solutions for heating the GC desorption system. The GC specifications called for rapid heating from ambient to 450°C with a temperature accuracy of +/-5°C. On the supply side the engineers were looking for ways to reduce the number of components and lead-time.

Using Finite Element Analysis (FEA) design tools, several thermal assembly design options were quickly evaluated. Models of the thermal assemblies were made and reviewed with the OEM. This eliminated the need for unnecessary and costly redundant prototype builds. The final designs incorporated miniature cable heaters that were precision formed as an integral component within a thermal assembly machined from highly conductive light weight materials.



Cable Heaters with operating temperatures to 650°C (1200°F) are formed into small, light weight, and fast responding assemblies for GC injectors, GC/MS transfer lines and other critical instrumentation thermal applications.

- 304, 316 stainless steel or Inconel®
- Diameter < 0.40 inches (10.16 mm)
- Voltage to 240V
- Paralleled coil resistance wire for applications to 1000 inches
- Series resistance wire for applications to 1000 inches
- High ductility for forming geometries
- Integrated thermocouple sensors



Cast Heater technology can be designed as a turnkey heating or cooling thermal solution that optimizes the temperature profile in GC headspace auto-sampler, DNA replication and other critical instrumentation.

- Three dimensional cast aluminum assemblies
- Operating temperature > 450°C (842°F)
- Aluminum alloys 170.1, 319 or 356
- Precision machining
- Integral RTD or thermocouple sensors

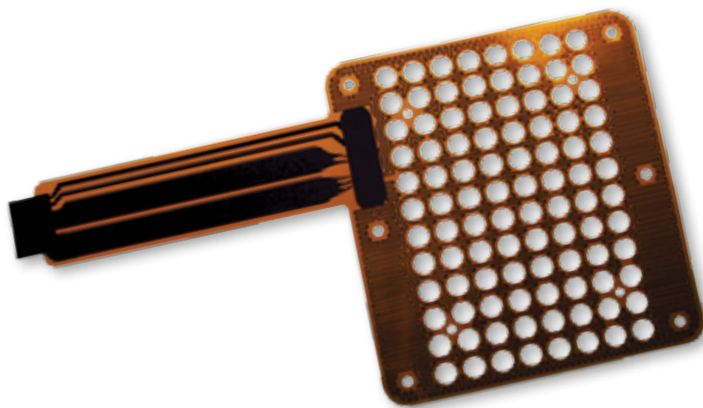


Electronic Temperature Controls complete the heater, sensor and control thermal loop. Durex's standard PID temperature controls and limit controls are available in industry standard 1/32, 1/16, 1/8, and 1/4 Din packages. Optimized thermal performance of most analysis and laboratory instrumentation is accomplished by tuning the PID algorithms to reduce or eliminate inherent variables in thermal applications.



Clinical Diagnostics

Analyzing organic cells for potential diseases and their genomic and proteomic structure is critical for research and development, diagnosing illnesses, development of hybrid food sources, and many other biotechnology advancements. Most clinical analysis samples require incubation time at body temperature 37°C (98.6°F) or rapid thermal cycling in a Polymerase Chain Reaction (PCR) for DNA analysis. Durex's polyimide heater assemblies are designed and manufactured to achieve precision thermal profiles in up to 384 well microtiter plates and in lab-on-a-chip diagnostic equipment.



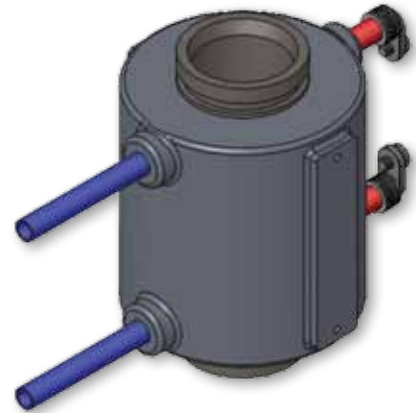
Polyimide Heaters and Integrated Assemblies are a thermal solution for applications requiring precision temperature profiles. By supplying a thermal assembly that has been optimized for an application, Durex can assure that part-to-part performance will meet the clinical diagnostics equipment specifications. Polyimide heater solutions are commonly used in PCR thermal cycler, lab-on-a-chip and other applications.

- Process temperature 200°C (392°F)
- Kapton® or silicone rubber materials
- Moisture and chemical-resistant
-  recognitions

Kapton® is a registered trademark of E.I. du Pont de Nemours and Company.
 registered trademark of Underwriters Laboratories, Inc.

Cast Aluminum Heaters used in immunoassay, clinical chemistry, and hematology analyzers include precision preformed tubular or cable heaters positioned in cast aluminum to provide the best temperature profile for an application. RTD sensor assemblies, electro-mechanical components and Computer Numerical Control (CNC) machining provide a repeatable and cost efficient integrated thermal solution.

- Integrated thermal assembly
- Chillers with heating coils and cooling tubes
- CNC machining
- Finite Element Analysis (FEA) heater design



RTD and Thermocouple Sensors Assemblies

are designed for repeatability, accuracy and stability over the life cycle of the instrumentation. Durex's sensor assemblies can be specially designed for challenging applications using our applied knowledge of thermodynamics, metallurgy, and electrical properties of materials.

- Single or multipoint sensor assemblies
- NIST traceable calibration on refractory thermocouple materials
- 100, 1000, and 2000 Ω RTD assemblies
- Stock & standard designs for quick delivery
- Teflon coated probe capability



Medical Devices

Optimizing temperature of a medical device is critical for most test and surgical procedures. Heating fluids being injected into a patient during transfusions and gases used in anesthesiology or respiratory therapy procedures are essential for the patient's wellbeing, comfort and recovery. Durex's advanced heater and sensor thermal assemblies are found in many medical devices such as renal dialysis machines, incubators, blood transfusions, and many other applications.



Silicone Rubber Heater Assemblies with integrated RTD sensors are the preferred solution for many medical applications including IV fluid delivery, respiratory therapy medications and gases, and for patient comfort during MRI imaging procedures. By heating fluids and gases to 37°C (98.6°F) the likelihood of hypothermia is reduced and patient comfort is enhanced.

- 220°C (428°F) process temperature
- Watt density to 50 W/in² (7.5 W/cm²)
- Maximum voltage: 600V~(ac)
-  recognized
- Vulcanizing, adhesive or mechanical bonding



Tubular Heaters are commonly used in radiant and immersion heating applications such as infant incubators where a formed tubular heater warms the air flow and an immersion tubular heater assembly vaporizes water to provide humidity. Tubular heater assemblies are also the preferred solution for laboratory sterilizers and environmental chambers.

- Precision intricate forming
- Operating temperature to 800°C
- Diameters from 0.210 to 0.475 inch
- High temperature moisture seals
- Helium leak, electrical, and X-ray testing



Fluid Warming Application



Injection of saline, plasma, contrast media and other fluids are common in medical diagnostic evaluations and post-operative recovery. If the fluid is more than a few degrees below body temperature 37°C, the patient can experience varying levels of hypothermia and considerable discomfort. By injecting fluid at body temperature, patient comfort increases and aids the healing process.

A medical device design team needed a thermal solution for rapidly heating plasma that is stored in a refrigerated environment. The thermal solution required rapid heating of the plasma. The solution would require an assembly designed with precision dimensions to optimize temperature uniformity. A low watt density silicone rubber heater was designed with distributed wattage to provide uniform temperature. The heater was vulcanized to a robust conductive housing material. By supplying a complete thermal solution that met the specifications, design and production costs were reduced for the medical device OEM.



Custom Temperature Control Platforms are a proven cost saving methodology for providing fast design and prototype solutions for medical applications requiring combinations of temperature,

humidity, time, pressure, and logic process functions. Durex's control platforms leverage proven hardware and firmware designs. Most applications only require customization of firmware that is unique to the medical device. By using a common platform, Durex's designers cost-effectively achieve the distinctive operation and user interface required for our customer's specialized equipment.

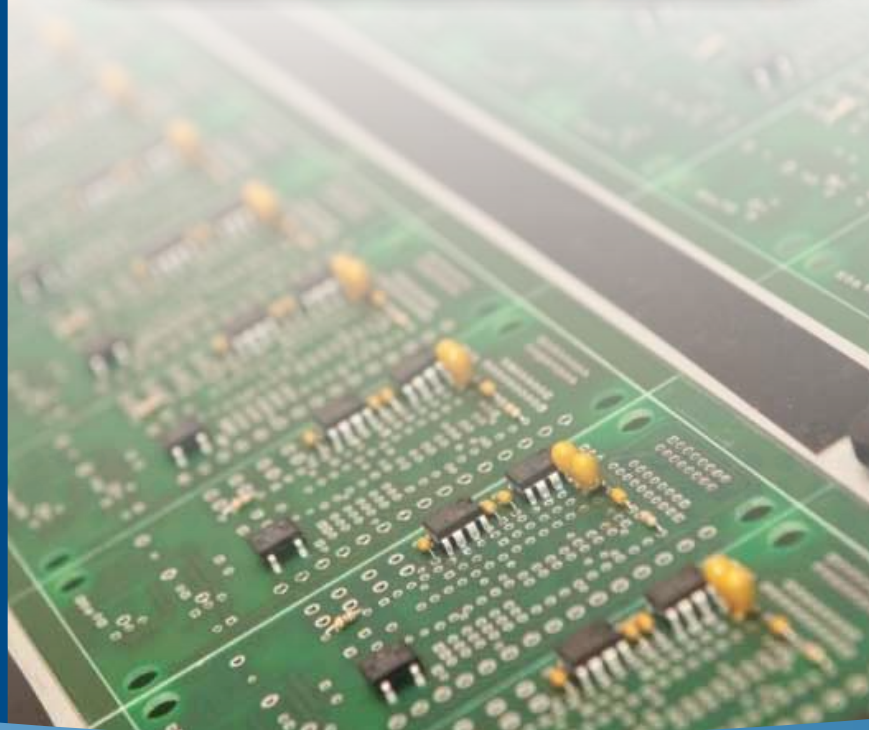
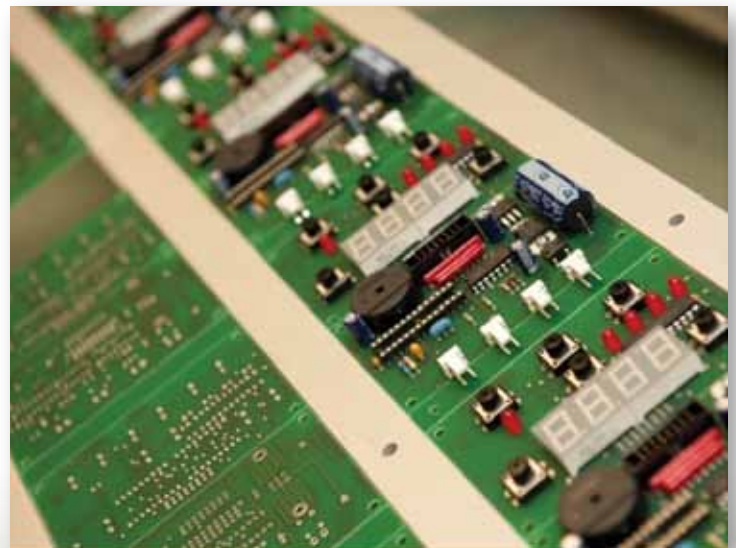


Molecular Analysis Application

Pharmaceutical and clinical diagnostic laboratories have expanding requirements for faster and more accurate analysis of antigens found in tissue samples. A decloaking process is used in stain removal from tissue samples in preparation for pathological analysis. Historical recordings of decloaking processes are a requirement of many international quality procedures.

The decloaking instrumentation specifications called for a chamber that could be heated and cooled to precision temperature tolerances with a timing function for controlling the tissue sample dwell times. A USB serial port was required for accessing process data. Since physical space was limited, the OEM needed a small compact control that could be easily mounted on the outside of the chamber while enhancing the products ascetics.

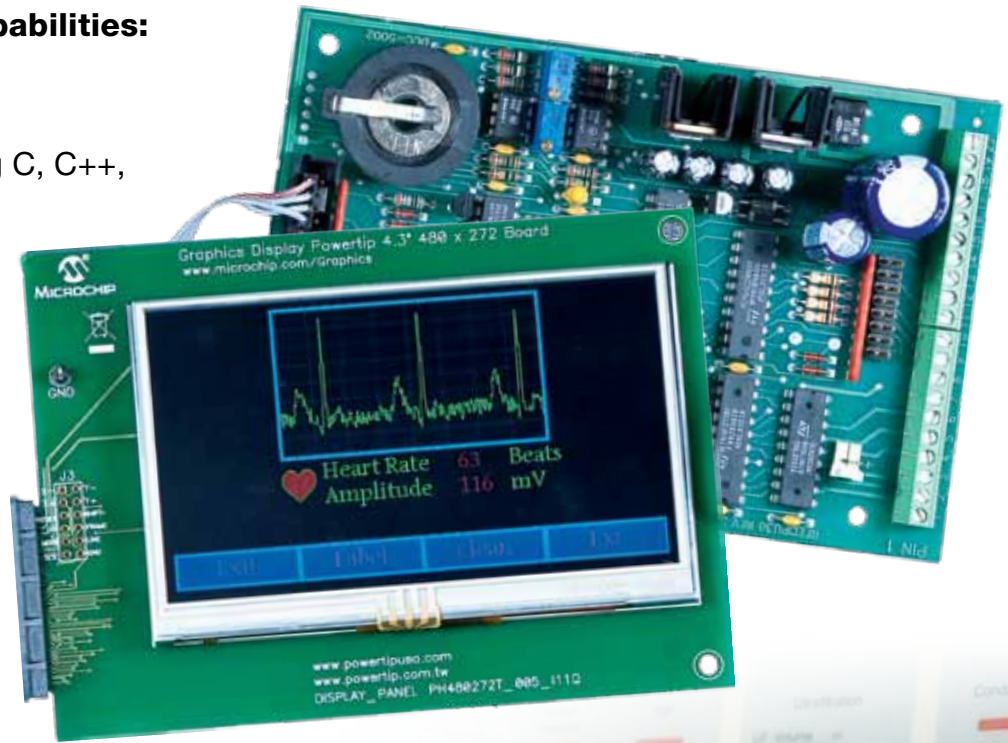
Working closely with the OEM's design team, within six weeks Durex Industries designed and delivered a custom electronic controls solution well within the project budget. The custom control was designed to the OEM's mechanical specifications and included a precision 2,000 ohm RTD input to achieve the accuracy requirements, digital display, output drivers, and USB serial port. The short design cycle enabled the OEM to achieve early market acceptance and significant market share.



Custom Electronic Design Capabilities:

Design

- Digital control design, including C, C++, Assembly...
- Printed circuit board (PCB) design and layout
- Thermocouple, RTD, and thermistor inputs
- Advance display (HMI) technologies
- Product specification and design processes
- Design and manufacturing verification processes



Manufacturing

- Printed circuit board assembly; surface mount (SMT), through-hole and mixed technology
- Automated conformal coating and potting
- Custom PCB and cable/wiring engineering and assembly solutions
- Electronics supply chain management solution
- Turn-key and consignment services
- Timely and accurate pricing, quote, and ordering
- Rapid prototype and development
- RoHS compliant processing



About Durex Industries

Founded in 1980 by Ed Hinz, CEO & President, Durex Industries is a privately owned thermal solutions company specializing in electric heaters, temperature sensors, and temperature controls. Durex's 145,000 sq. ft. business, engineering, and manufacturing center is conveniently located 25 miles northwest of Chicago in Cary, Illinois.

Since our founding, providing customers with reliable products and excellence in all aspects of the business have been the hallmark of Durex and the basis of our name. "Dur" means durable and "ex" means excellence. Durex Industries, an ISO 9001/2008 registered company, supplies engineering and manufactures thermal solutions for most global industrial equipment markets, including food service, life sciences, packaging, photovoltaic, plastics, process, and semiconductor. Our focus on lean design, manufacturing, and business systems continues to provide customers with the best design and product value in our industry.



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