



# Thermal News Autumn 2016

*closing the loop on thermal solutions*

## SEMICON West 2016

Durex exhibited at SEMICON West 2016 in July. Our exhibit featured new thermal solutions focused on next generation wafer processing and back end assembly equipment.

Randy Nelson, Durex Industries' General Manager said "As next generation semiconductor devices continue to become smaller, faster and more complex, requirements for precision thermal solutions increase. Durex continues to develop new thermal technologies such as aluminum nitride (AlN) Z-Axis™ Thermal Solutions. Z-Axis thermal solutions are 3-dimensional, allowing the integration of multiple heater layers, RTD sensors, RF grid, ground plane, and vacuum and cooling channels in a single monolithic solution."

At SEMICON West, we enjoyed many creative technical discussions with engineers and scientists visiting the Durex exhibit. ■

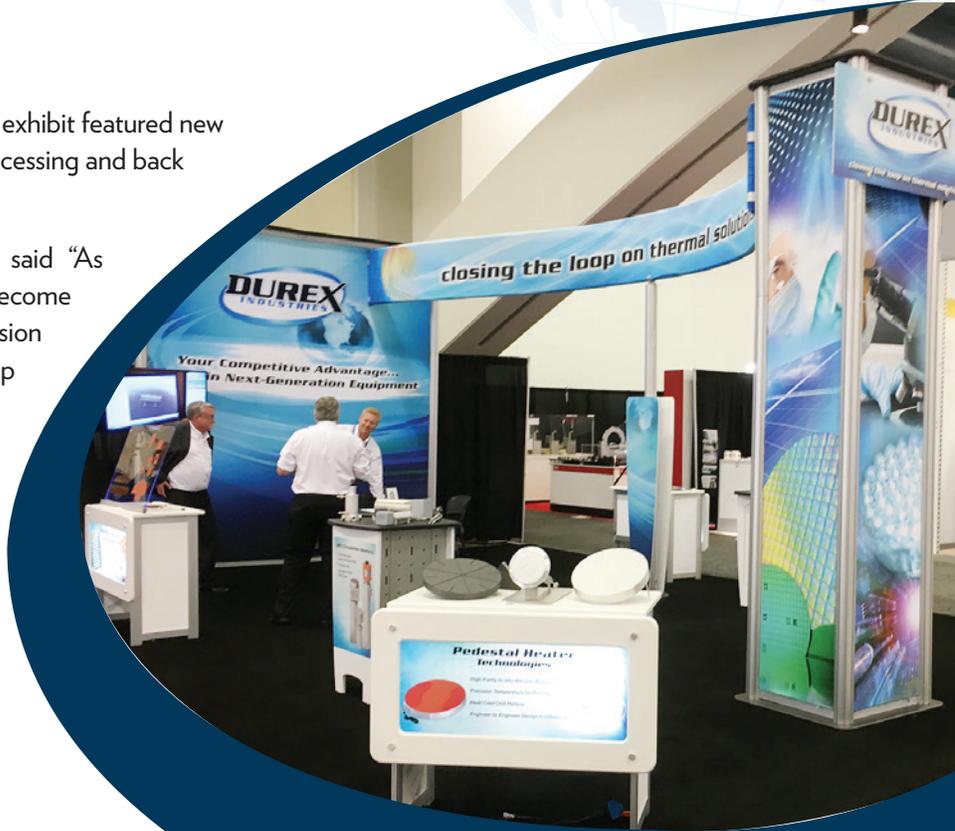
## Sensor Element Selection Guideline

Selection of the best temperature sensor element and assembly is critical to the thermal accuracy and performance of industrial equipment, analytical instrumentation and medical devices. Operating environment, temperature range, sensor location, material compatibility and other variables need to be evaluated during the design process.

We asked Jim Kreisel, Durex Industries' Director of Strategic Business Development to provide general guidelines for temperature sensor selection. Jim summarized by saying:

*There are 4 primary sensor types: Resistance Temperature Devices (RTD), Thermocouples (TC), Thermistors and Integrated Circuits (IC). Each sensor type has performance and cost attributes that make them the best solution for specific types of applications. To help with the selection process Durex created the Sensor Element Selection Guideline. See guide on next page >*

Durex helps customers select the best sensor element for their application, then designs sensor assemblies that optimize the performance of the sensor element. ■



SEMICON West 2016, San Francisco, CA

*"Durex Industries continues to be an industry leader by pushing the limits of thermal technology."*

**heaters • sensors • controls • process systems**

## Temperature Sensor Element Selection Guide

Attributes	Resistance Temperature Detector (RTD)	Thermocouple	Thermistor	Integrated Circuit (IC) Temperature Transducer
Symbol				
Signal Characteristic	Resistance increases with temperature rise (PTC)	Voltage increases with temperature rise	Resistance decreases with temperature rise (NTC)	Voltage or current increases with temperature rise
Construction	Thin-film or Wirewound	2 unlike metal alloys	Sintered metals	Silicone
Temperature Range	-200 to 1475°F (-129 to 802°C)	-400 to 4200°F (-240 to 2316°C)	-100 to 500°F (-73 to 260°C)	-70 to 300°F (-57 to 149°C)
Temperature Accuracy	Highly accurate	Least accuracy unless purchasing special calibrated TC	Highly accurate	Most accurate
Robustness (Shock and Vibration)	Somewhat sensitive to shock and vibration	Generally considered most robust	Somewhat sensitive to shock and vibration	Most sensitive to shock and vibration
Linearity Across Temperature Span	Linear	Most NON-linear	Non-linear	Most linear
Accuracy Drift over Life of Sensor Element	Less drift than thermocouple	Highly subject to drift	Less drift than thermocouple	Minimal drift
Response to change in temperature	Fast response with thin-film RTDs	Fastest response	Fast response	Fast response
Cold junction compensation in associated temperature controller	None	Required	None	None
Cost of Sensor element	Thin-Film Low	"Type E,J,K, and T lowest / Type B,S,R (Noble Metals) Highest"	Low	Low
Standard temperature control available with sensor input	Available	Available	Limited availability	Not available

## Foodservice Temperature Sensor Applications

Durex has been in the business of designing and manufacturing temperature sensor solutions for over 30 years. Understanding the Foodservice Equipment Industry requirements and supplying OEMs with custom temperature sensors is a Durex success story.

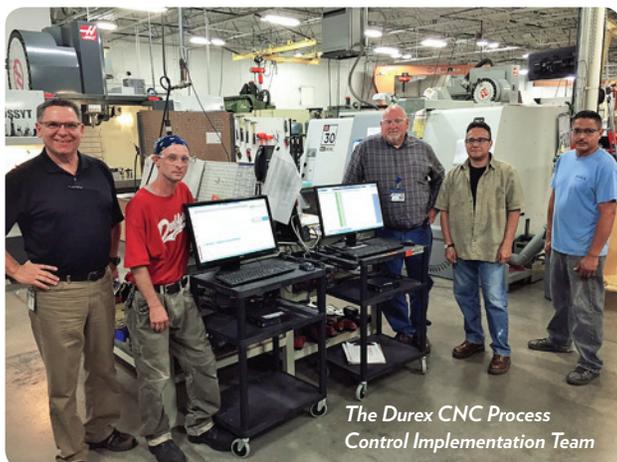
Foodservice Equipment applications include the same types of equipment that most of us watched our grandmothers and mothers use in their kitchens. The difference being that restaurants, institutions, and other food-away-from-home kitchens require highly accurate, repeatable and robust cooking equipment.

All types of fryers, griddles, ovens, and other cooking equipment use temperature sensors. Durex' RTD and thermocouple sensor solutions are designed to provide the accuracy, repeatability, and industrial robustness that OEM's require for their equipment.

A fryer example would be a recent sensor design that incorporated 2 RTD sensor elements and 1 thermocouple sensor junction. Each sensor element needed to be isolated from each other. For optimum performance each sensor element had to be located in the sensor assembly with a high degree of precision and repeatability.

Designing robust sensor probes and assuring production repeatability is one of the reasons that Durex is a preferred sensor partner with Foodservice Equipment OEMs. ■





The Durex CNC Process  
Control Implementation Team

## **CNC Machining High-Level Predictive Analytical Software**

In response to requirements in their next generation semiconductor equipment, Durex recently implemented CNC Machining High-Level Predictive Analytical Software as a quality improvement tool.

David Christopher, Quality Manager led the implement project and described the value of the Predictive Analytical Software in this way.

“To meet Durex’ expected growth plans and improve machining quality, the predictive machining software package provides part-by-part feedback for CNC machining operators on the dimensions measured by CMM and data-reporting. Real-time information on dimensional

performance to tolerance as well as data driven trends and tool performance can now be seen well ahead of any impact to product. With CMM data reporting, the software package will provide dynamic analysis of variation for machining, specifically on critical dimensions. This will be used by operators and engineering to dial in parameters on equipment, provide optimal performance, elimination of scrap, and meet tightening product quality standards.”

Durex customers have responded positively to the software implementation. Thank you to David and the CNC Process Control Implementation Team. ■

## **Aerospace - Defense - Security**



Durex is an experienced industry leader in supplying robust innovative thermal solutions for the critical applications in the Aerospace, defense and security industries.

Most aerospace, defense and security thermal applications require heating components that are critical to the successful operation of a sub-system. The thermal solution must address a combination of harsh environments, heating 3-dimensional components, precision accuracy, fast response, robustness and other design specifications. Customer test and validation requirements vary with application and intended end use.

Durex designs and manufactures thermal solutions using our core heater and sensor technologies combined with other electro-mechanical components to supply customers with turnkey assemblies. Standard validation, manufacturing and quality processes align with industry requirements. Thermal solutions may range from low temperature de-icing applications using flexible polyimide heater technologies to sensors used in high temperature engines and turbines. ■

View more online @ <http://durexindustries.com/aerospace-defense-security>



Contact Durex Industries for  
all your heater, sensor and  
control requirements.

For more information, visit our website!

[www.durexindustries.com](http://www.durexindustries.com)

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