



ARi Industries Inc.



Mineral-Insulated Cable  
Thermocouples  
RTD's  
Heater Assemblies  
Custom Designs  
Thermal Management Hardware

Exploring New Horizons In Thermal Management





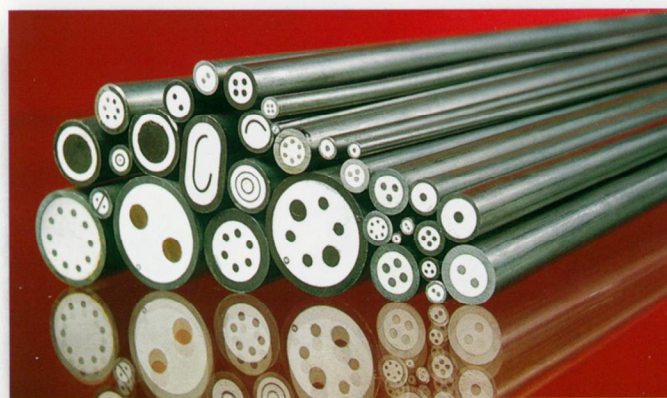
## From A Solid Foundation, We Keep Exploring New Horizons In Thermal Management

ARI Industries began as a manufacturer and supplier of quality thermal management products for a world of industrial and commercial process applications.

We began in 1952 as Aero Research Instruments, in Chicago, Illinois. ARI was among the first pioneering companies to manufacture mineral-insulated cable to improve product performance and reliability. Over the decades, we've refined and improved that technology, as it remains the heart of our products to this day.

ARI is recognized as an industry leader of metal-sheathed, mineral-insulated thermocouple cable. All our standard AerOpak® thermocouple cable is supplied with high-purity MgO (magnesium oxide) insulation and accuracies per ASTM E-230 limits of error. We maintain large inventories of finished cable and ARI also specializes in custom thermocouple, conductor and heater cables to meet virtually any application requirement of temperature, environment or process conditions.

ARI uses that same high-quality cable to fabricate and manufacture in quantity our wide range of thermocouple, RTD (resistance temperature detector) and heater assemblies for myriad industrial and commercial uses. AerOpad® and Fan Type welded pad thermocouples are world-renowned for their



quality and are used in power plants and in refinery operations for furnace heater tube measurements. Multi-point thermocouples and RTD's perform critical profiling of reactor and furnace temperatures. Our rugged-duty thermocouples and RTD's are used in aerospace applications, including engine and brake temperature measurements on commercial and military aircraft. ARI also supplies high-temperature thermocouples for applications up to 4000°F, using noble and refractory metals, for commercial heat treating and advanced laboratory/R&D applications.

ARI is a leading supplier of mineral-insulated heater assemblies and cable, as well. AerOrod® high-watt density heaters can supply up to 150 watts per square inch, yielding quick response and long use life in the most demanding applications. By using internally welded transitions between hot and cold sections, potential cold end failure is virtually eliminated. ARI heaters are used throughout the semiconductor manufacturing process, as well as in furnace element production, aerospace and heat tracing applications. Our reputation for custom solutions to the most demanding heater challenges is known worldwide, a fact in which ARI takes great pride. Nonetheless, we are constantly

exploring new technologies for heater thermodynamics and fabrication techniques, to meet the emerging markets we serve, every day at ARI. This forward-thinking philosophy benefits our customers and it remains our commitment to them.

In addition to industry's most advanced thermal management products, ARI also offers our customers complete NDT (non-destructive testing) procedures and certification for all cable and finished assemblies. All of our certifications are traceable to NIST (National Institute of Standards and Technology). Our own quality management system meets the stringent requirements of ISO 9001:2000, as certified by Lloyd's Register Quality Assurance, as well as a host of international standards.

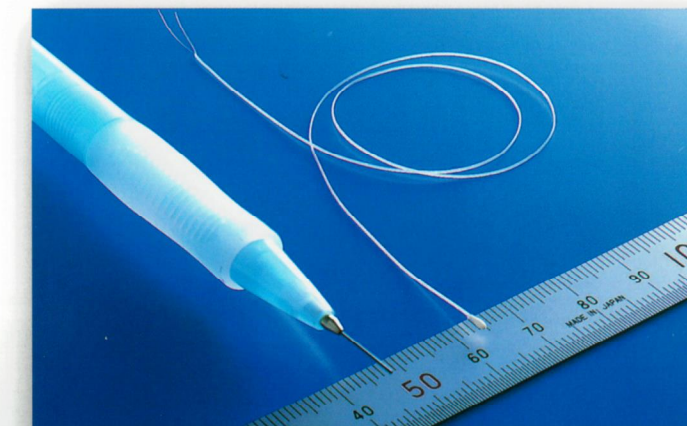
Our products are found around the world, in a "world" of thermal management applications. As part benefit from the synergy and cooperative engineering ventures we can achieve together. Okazaki, like ARI, has an international reputation for quality and innovative design in products ranging from fuel cell thermocouples and platen heaters for CVD and ion implantation on semiconductors to plastic mold cartridge heaters and "piggy mat" floor heater pads for the livestock industry. As you say, truly a "world" of applications in thermal management.

ARI operates from its headquarters in Addison, Illinois, near Chicago, housing our design and engineering departments, our mineral-insulated cable production, sensor fabrication, cleanroom manufacturing, quality testing and final assembly areas. ARI was "turnkey" before the term became fashionable and remains so, to this day. It's one of the reasons customers can look to

ARI for quick solutions to their thermal process requirements, plus quick delivery of those solutions to their plant or process facility.

Of particular note are the specialty products ARI brings to market for highly engineered solutions to particularly tough process or challenging environmental applications. We pioneered SPND's (self-powered neutron detectors) for in-core flux monitoring in the nuclear industry, we provide unique conductors assemblies on special transducers for jet engine signal sending, we been on the leading edge in heated substrates for thin film deposition and we developed the first maintenance-free thermocouple for sensing molten aluminum. Various industries worldwide look to ARI for special engineering and manufacturing expertise, every day. We're proud of that fact.

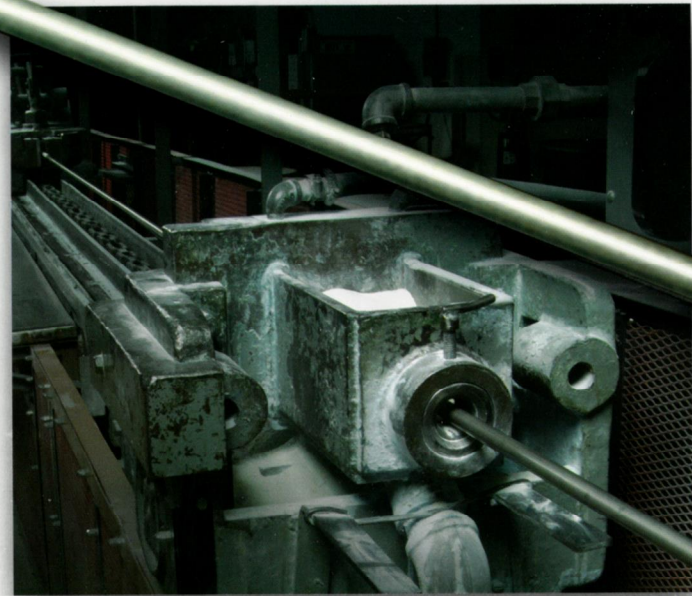
An interesting fact...Okazaki, in addition to a broad range of heavy-duty industrial products, also developed the **world's smallest production thermocouple**, only 0.1mm dia. OD with a 1ms response time, in 2003. Such developments represent the forward-thinking and continuous innovation of our companies.







## MINERAL-INSULATED CABLE



Simply put, because we manufacture our own MI cable, ARi starts from a quality foundation few can match.

Custom designs, different signal wire configurations, assorted sheath materials and a wide variety of alloys are offered.

Our standard MI thermocouple cable starts with fully annealed and cleaned tubing, high-purity (99.4% min.) MgO insulation material and thermocouple wire that meet per ASTM E-230 Special Limits of Error. In the ARi production process, precise dimensionality and uniform insulation are maintained throughout the multiple reduction drawing and annealing process, assuring the end product integrity. All commercially available thermocouple, conductor and heater wire materials are offered as standards from ARi.

**AerOcoax® single conductor cable**

**AerObiax® dual conductor cable**

**AerOpak® thermocouple cable**

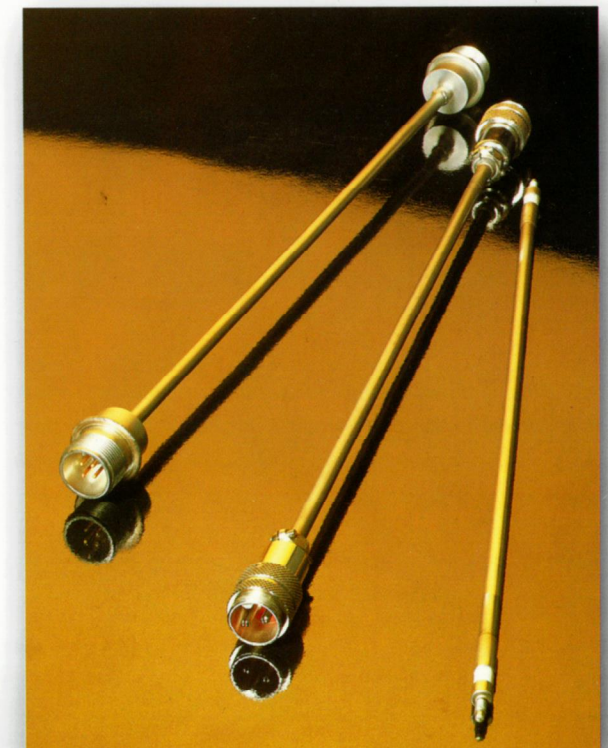
Our standard ARi MI thermocouple cable can be supplied in long lengths and most can be formed or bent up to a radius equal to twice the sheath diameter, with no loss of performance. Sheath materials are offered in a variety of stainless steel, Inconel and Hastelloy variations. The sheath materials can be welded or brazed, when proper techniques are used. Standard sheath diameters are available from 0.020" to 0.750". Metric sizes, custom sizes and heavy wall thicknesses are all available on request. Contact ARi for a full inventory or to discuss your particular requirement.



Our conductor cable and cable assemblies are found on transducers for jet engines, heavy-duty petrochem equipment, remote communications devices, hazardous area equipment and numerous other applications where exposure to harsh environment or even radiation is present. Stainless steel and other sheath materials complement stainless, Inconel, nickel-clad copper or copper conductors. ARi can supply finished assemblies with hermetically sealed connectors in various styles, plus insulation materials with high-purity MgO, alumina or silicon oxide for applications where non-hydroscopic insulation is required.

ARi cable is offered with a variety of support testing procedures, including temperature calibration, radiography, hi-temp IR, capacitance, dielectric strength, liquid penetrant and helium leak testing. All standards are traceable to NIST.

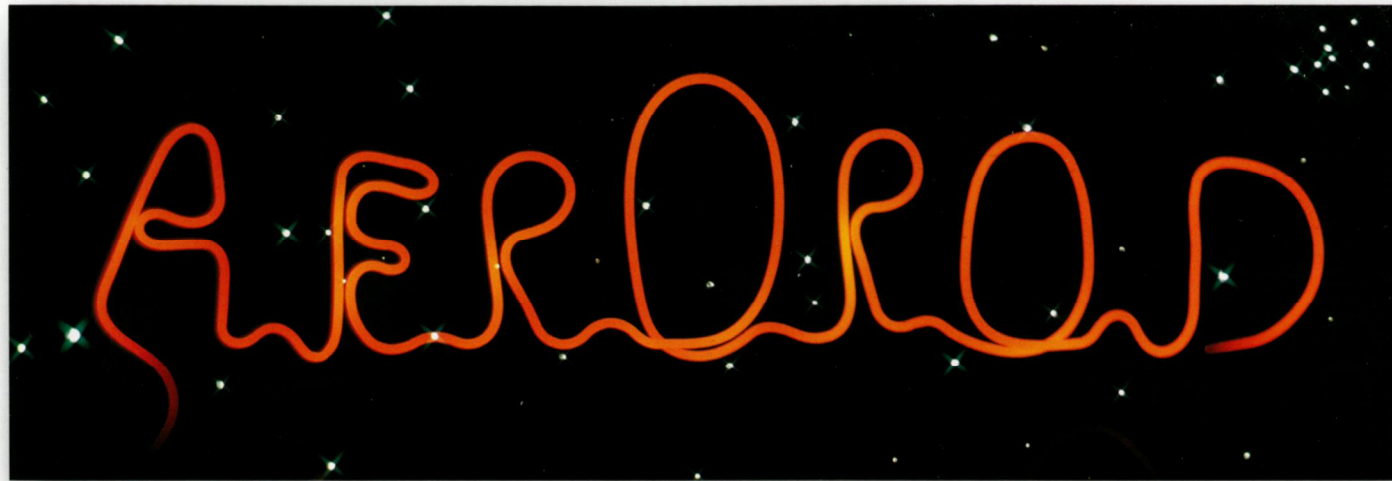
ARi heater cable is used to make heater assemblies for a variety of furnace and tracing applications. Standard cable is manufactured in sizes from .040" up to 0.375" with sheath materials in Inconel 600 and stainless steel. ARi maintains a large inventory of finished cable with specific resistance values (Ohms/ft) to suit most applications. Custom heater cables with special materials and resistance requirements can also be produced.







## AEROROD® FLEXIBLE ELECTRIC HEATERS



### "The Dependable Bendables"

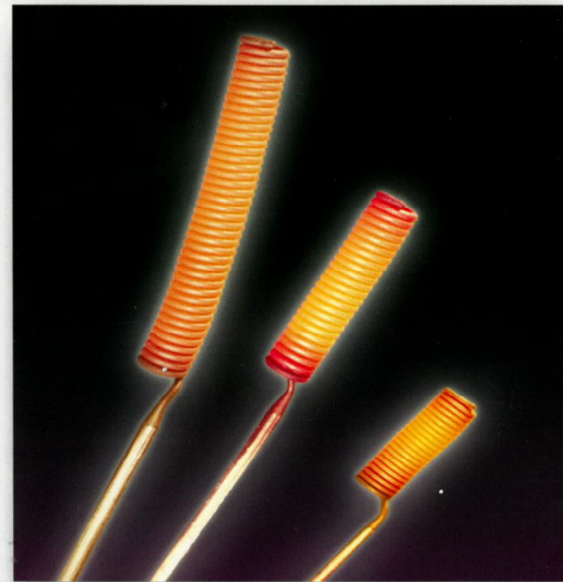
Our AerOrod® electric heaters are offered in a wide assortment of sizes, styles and terminations. They feature **flexibility** with no loss of performance, even in tight spots; **high watt density**, up to 150 watts per square inch; **fast response times**, through our engineered elimination of unnecessary volume; **corrosion resistance**, with various sheath materials such as Inconel 600 offered for immersion in the most corrosive fluids; **long use life**, the result of ARi proven technology in leadwire attachment and fabrication; plus **high reliability** in applications as severe as nuclear reactor cores.

BXX style heaters have an internal splice from high resistance heater wires to low resistance Nickel wires, to create an unheated-to-heated resistance ratio approximately 10:1.

All AerOrod heaters are manufactured with our own high-purity MgO insulation in a multiple reduction process that ensures uniform cross sections and minimum wire-to-sheath spacing for maximum efficiency in the heat transfer.

Elements can be bent by hand or on production equipment to any desired configuration.

ARi heaters have a maximum recommended sheath surface temperature of 1000°C (1832°F). Standard diameters range from 0.040" to 0.250". Contact ARi with your requirements.



## AEROPAK® and AEROPAD® THERMOCOUPLES ARIDET® RTD'S

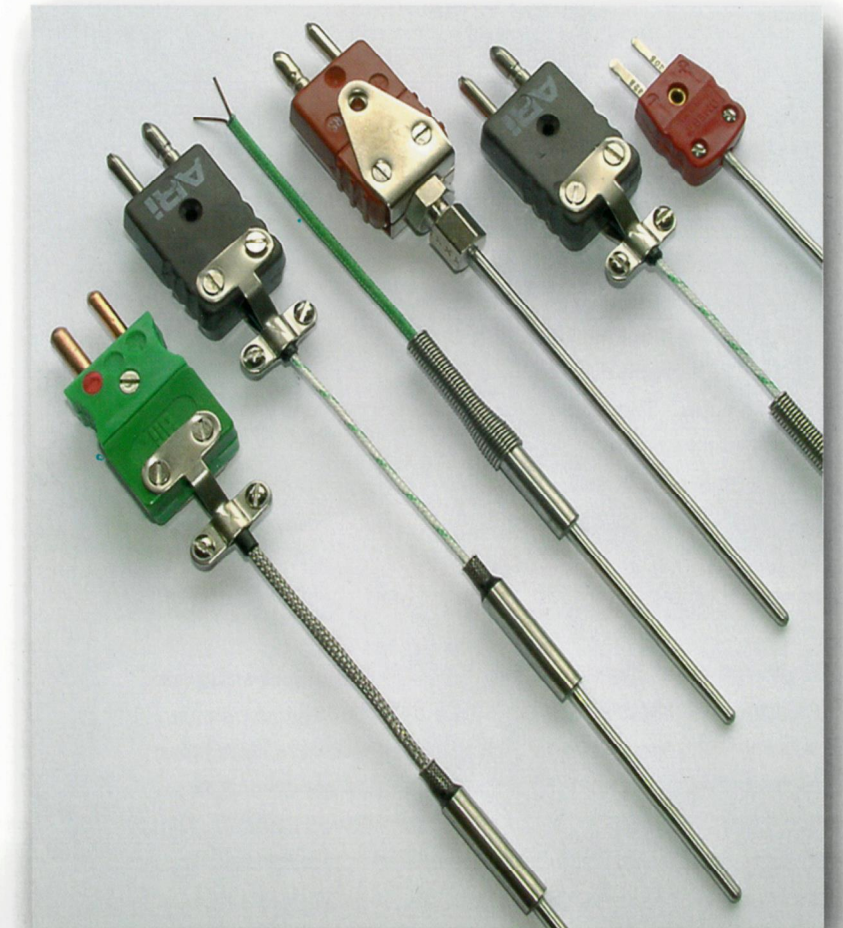


niobium-1% zirconium. Special insulation materials of hafnium oxide (HfO<sub>2</sub>) and beryllium oxide (BeO) are available for applications above 1700°C (3092°F). Disilicide for oxidation resistance and tungsten coatings for resistance to graphite attack are offered on molybdenum sheaths.

As a natural evolution from our MI cable production, ARi offers the industry's broadest assortment of standard thermocouples and RTD's, all made to the same exacting specifications as our cable and heater products.

ARi offers base metal thermocouples for temperatures ranging from -200° to 1260°C (-320° to 2300°F), with high-temperature versions suitable to 2300°C (4172°F). Calibration types in K, J, E, N and T to ASTM E-230 are offered in sheath diameters from 0.020" to 0.750". Open wire termination and plug styles, with standard or explosion-proof heads and fixed ceramic or DIN type terminal blocks can be ordered standard, using our easy "build your part number" system. High-purity MgO and Al<sub>2</sub>O<sub>3</sub> insulation materials are available. Others on request.

ARi also offers high-temperature thermocouple designs for inert, vacuum, reducing or oxidizing atmospheres. Assemblies can be supplied with Type R, S and B thermocouple wire. Combinations per ASTM E-230. Also available are Type C (W5%Re/W26%Re) and Type D (W3%Re/W25%Re) per ASTM E-988. Standard sheath materials include tantalum, molybdenum, platinum-10% rhodium and





## AEROPAK® and AEROPAD® THERMOCOUPLES ARiDET® RTD'S

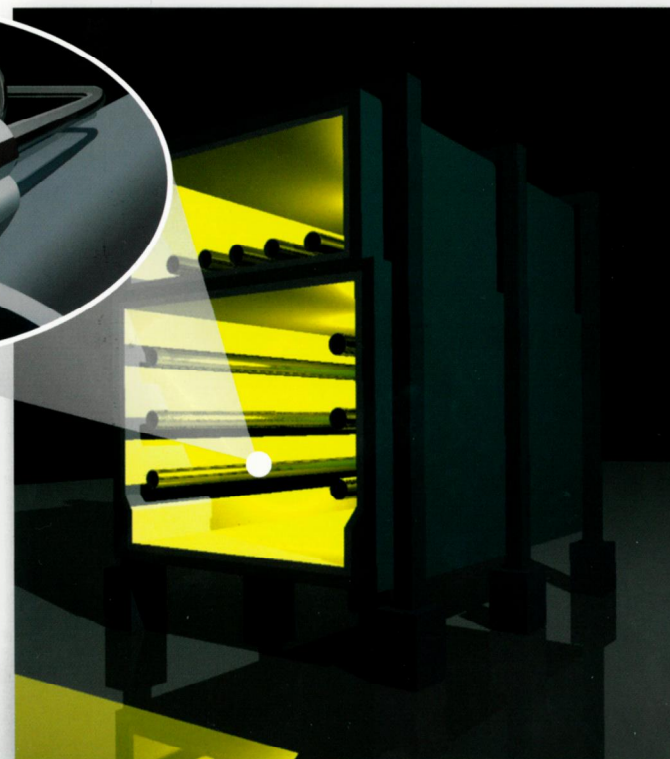
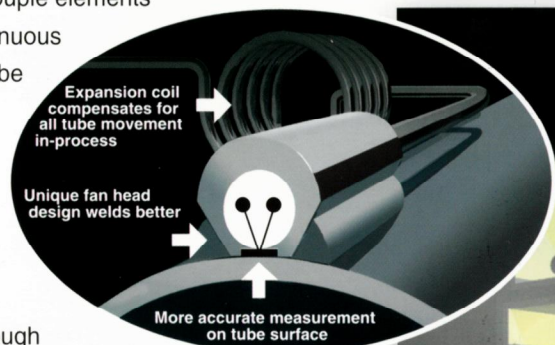
Tube skin thermocouples in the AerOpad® family are offered for any tube surface measurement up to 1093°C (2000°F). 1" standard weld pads and custom styles available. ARi offers our unique Fan Tip type thermocouple assembly, with Hastelloy X or 310 S.S. sheaths, integral expansion coil design, mounting pads and compression fittings, for the special applications of thru-wall petrochem furnaces and other corrosive, high-heat environments. Our PermAmelt® thermocouple/protection tube assemblies were developed specially to measure steady state molten aluminum temperatures.

ARi pioneered the multi-level thermocouple for stack furnaces, nuclear reactors, boiler and pressurized process chamber applications. Multiple thermocouple elements in a single sheath provide continuous profile measurements that can be remotely monitored. Up to 18 points can be measured in a single .125" sheath diameter thermocouple. They can be installed into existing thermowells or fast-response protection tubes, or moved through instrument guide tubes to obtain vessel temperature profiles.

Explosion-proof, flameproof thermocouple and thermowell assemblies are an ideal solution when accurate temperature measurement is demanded in high-flow, hazardous duty applications. Our unique velocity collar and helical strake design minimize vortex formation in cooling towers and prevent VIV on offshore drilling applications, as typical examples of this engineered solution to critical process requirements.



Miniature, superfine thermocouples are available for fuel cells, medical research and other applications where space is limited. Sheath diameters start at 0.004" with bare leadwire, potting adaptor or miniature plug connector styles offered.



Custom ARi temp sensor designs are available for virtually any application, from nuclear grade thermocouples to portable or handheld industrial sensors. With over 50 years of service to industry worldwide, we can engineer a solution to any temperature measuring requirement and manufacture that solution in a cost-competitive scenario to satisfy your needs. Our global manufacturing presence further enhances this capability. Any application, anywhere in the world, can be addressed by our engineering staff and we welcome your challenges.

ARiDET® RTD's have a temperature range from -200° to 600°C (-320° to 1100°F) and are used wherever superior accuracy is needed. These products will bring an extremely reliable degree of accuracy to your toughest industrial process, without special handling. ARi combines the inherent accuracy of precision-wound platinum elements with our own AerOpak

compacted mineral-insulated cable, resulting in a lower-cost yet rugged sensor that takes on the most demanding environments, while retaining the stability and accuracy demanded by today's process control protocols.



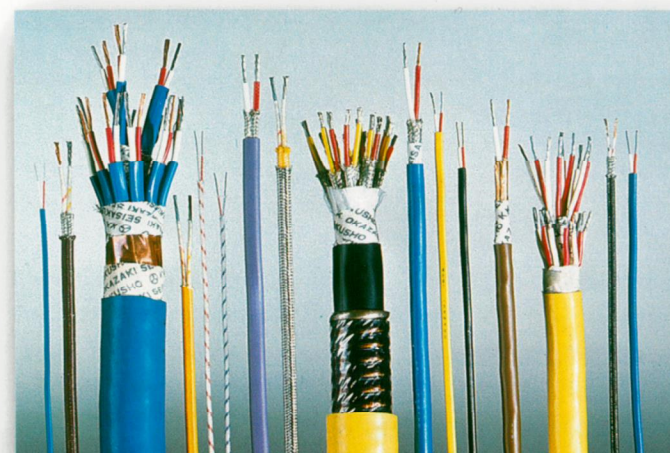


**ARi HARDWARE/ACCESSORIES**

For temperature management systems



ARi offers a full complement of connectors, connection heads, thermowells, compression fittings, mounting hardware and sheath stripping kits, as well as thermocouple leadwire, AerOseal® moisture barrier for MgO cable, temperature transmitters, panel meters, controllers, meter relays and more, for complete temperature measurement/monitoring system integration.



ARi offers SPND's (self-powered neutron detectors) for in-core flux monitoring in the nuclear industry.

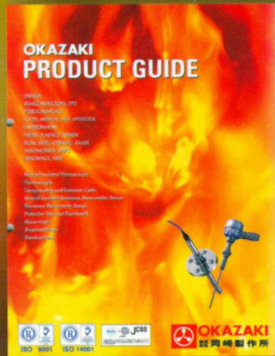
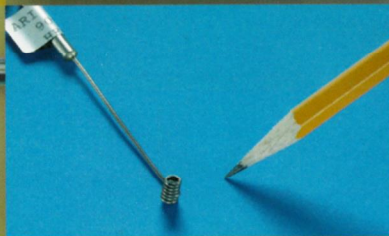
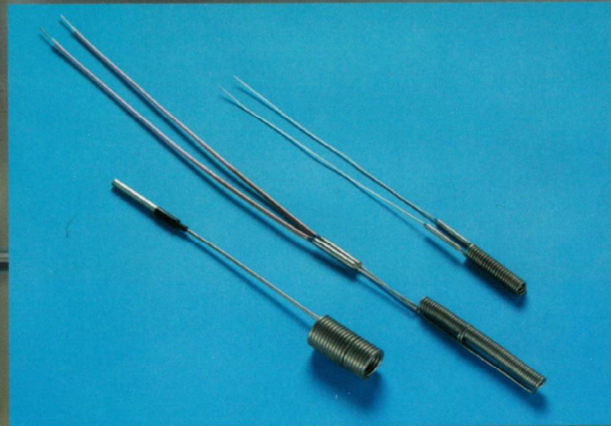


Vertical integration was and remains a key to our success at ARi. Here's a sampling of all we do at our factory: Clockwise from bottom left:

Cleanroom assembly of hi-temp thermocouples  
Cable drawing process  
Polishing machinery

TIG welding for thermocouple assembly  
Laser welding of thermocouple junction  
Die maintenance for cable production





ARi is part of the Okazaki Group, companies who serve a wide variety of worldwide industrial and commercial customers with highly engineered solutions to their process temperature measuring and other thermal management needs. We maintain an ongoing cooperative engineering effort with our parent company, resulting in ever-expanding capabilities, all of which improve our value to you as a supplier and engineering resource.

For all your thermal management requirements, just ask ARi. We're built on a solid foundation of products and services, but we're always exploring those new horizons in technology to better serve our customers. We welcome your call.

ARi has representatives worldwide to assist you. Please contact us or visit our web site for further assistance.



## ARi Industries Inc.

381 ARi Court • Addison, Illinois 60101 USA • Toll-Free: 800-237-6725  
Phone: 630-953-9100 • Fax: 630-953-0590 • Web: [www.ariindustries.com](http://www.ariindustries.com) • Email: [sales@ariindustries.com](mailto:sales@ariindustries.com)