SFMS
SENSORS AND FLUID MANAGEMENT SYSTEMS

AMETEK



Gas Turbine Thermocouple Systems

Temperature Experts

AMETEK has extensive experience in designing, manufacturing, and applying gas turbine temperature measurement systems. That experience has made AMETEK a world leader in the supply of qualified thermocouple systems to the aerospace and land/marine industry. AMETEK thermocouple reliability and performance means more power when needed, longer engine life, and lower cost of ownership.

Field experience and advanced designs at AMETEK result in thermocouple probes operating over 2000°F (1093°C). Thermocouple harnesses feature either common junction arrangements, where the resistance of each thermocouple circuit is balanced, eliminating errors due to resistance variation; or individually wired probes for detailed gas path measurements. The averaging of thermocouple temperatures is a method commonly used for exhaust temperature systems.

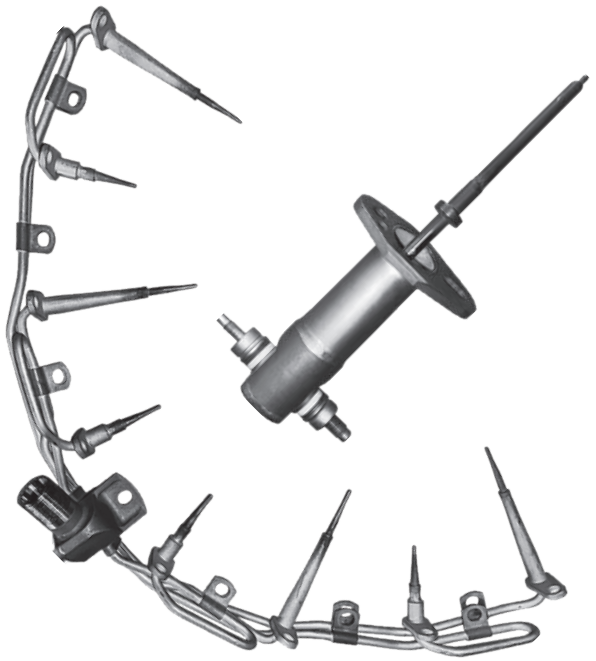
AMETEK's unitized construction yields greater temperature measurement accuracy by eliminating junctions that could cause secondary thermocouple effects due to either difference in the homogeneity of contacting materials, or the addition of circuit resistances resulting from the electrical connections. AMETEK's use of high accuracy, individual wire conductor specified, mineral-insulated cable provides superior system accuracy for the customer.

Operation

AMETEK's Type K thermocouple products use the Seebeck effect in a KN and KP wire junction to generate voltage in accordance with NIST Monograph 175. This signal is measured relative to a reference junction voltage and then used for temperature calculation in an electronic engine control. The resulting signal is proportional to engine gas temperature.

Welding the wires together forms the junction. It may be uncovered at the probe tip for fast response time or completely sealed in a metal sheath for longer life and high temperature capability. Type K calibration is available to 2300+°F (1260°C), with probe life at such challenging temperatures supported by the latest super alloy materials and processes.

AMETEK's continuous product development is focused on improving the Type K thermocouple performance for the aircraft engine extreme environment. New manufacturing processes and new materials are being tested to push the envelope for these sensors every day. Sophisticated material testing techniques are being applied to traditional mineral-insulated cable to learn exactly how they contribute to product performance, i.e., what attributes are related to calibration stability, corrosion prevention, and mechanical strength.



Features

- *Superior reliability Highest accuracy available*
- *High temperature life AMETEK's comprehensive service*
- *Gas path routing for response time*
- *Vibration damping support*
- *High temperature connector*

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Custom Engineered Product

AMETEK thermocouple systems are designed to meet individual customer applications. The engine set configuration, whether a single probe, multiprobe harness, or multiple harnesses can be tailored to meet the increasingly more demanding gas turbine performance requirements and specific market needs.

Innovation for High Performance

Many of the AMETEK harnesses and probes are hermetically sealed, allowing for longer life of the thermocouple sensing wires and insulation. The connection points on the thermocouple transitions can be specified either as an open style, using nut, bolt and washer terminations, or an enclosed design using pin and socket contacts in a hermetically sealed connector. AMETEK-designed, high temperature connectors feature a stainless steel shell and receptacle with platinum-plated contacts to maximize accuracy and reliability. The sockets use AMETEK's patented spring design with a controlled retention force to prevent intermittence due to engine induced vibration.

Manufacture and Test Capabilities

AMETEK manufactures thermocouples utilizing state-of-the-art equipment and facilities including multiple workstations for TIG, plasma and laser welding, torch, induction and vacuum brazing capabilities, heat treating and annealing furnaces. Computer-controlled, automated bending equipment and the swaging and drawing of mineral-insulated cable form a part of our routine manufacturing operations.

In-process testing is performed on all probes to verify proper construction. Tests include radiographic inspection, water immersion, insulation resistance, dielectric strength, and polarity. These tests ensure the manufactured probes meet the customer's design requirements.

AMETEK utilizes metal freeze points, spherical calibration furnaces, dry-well calibrators, and jet cal systems for accurately calibrating thermocouple probes and harnesses. Mass flow stands for time response testing, and equipment for thermal cycling and vibration testing provide the resources for environmental and qualification testing.

Specifications

Environmental Characteristics

Temperature Range:	-65° to 2100°F (-54° to 1149°C)
Connector Temp. Range:	-65° to 1000°F (- 54°to 538°C)
Typical Accuracy:	0.4% of point above 500°F (260°C), +2° to 500°F (+1.1° to 260°C)
Time Response:	>100 milliseconds
Output:	Type K per NIST Monograph 175 Vibration: Up to 50 Gs
Connector:	MIL-C-5015, MIL-C-38999, MIL-C-83723, terminals, AMETEK 5015 connectors rated to 1000°F (538°C)
Other Environmental:	RTCA/DO-160 and/or MIL-STD-810

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