

THERMOCOUPLES

HIGH TEMPERATURE
MEASUREMENT SOLUTIONS



MINERAL INSULATED
THERMOCOUPLES



CERAMIC INSULATED
THERMOCOUPLES



CUSTOM SENSOR
ASSEMBLIES



PRODUCT CATALOGUE
2026 EDITION



INDUSTRIAL



AEROSPACE



RESEARCH

02

THERMOCOUPLE TECHNOLOGY

PRINCIPLES OF TEMPERATURE MEASUREMENT

Thermocouples convert temperature differences into electrical voltage using the Seebeck effect.

They are simple, reliable sensors capable of measuring a wide range of temperatures in the most demanding environments.

With fast response, high durability and excellent stability, thermocouples provide accurate temperature data essential for safe operation, performance optimization and product innovation.



HOW IT WORKS



Temperature
Difference



Thermoelectric
Voltage



Temperature
Measurement

WHY THERMOCOUPLES?



WIDE MEASUREMENT RANGE

From cryogenic to extreme
high temperatures.



FAST RESPONSE TIME

Rapid detection of temperature
changes for real-time control.



HARSH ENVIRONMENT CAPABILITY

Reliable performance in
vibration, pressure, shock and
corrosive conditions.



COMPACT DIMENSIONS

Small size allows measurement
in tight or hard-to-reach
locations.



MECHANICAL ROBUSTNESS

Durable construction ensures
long-term stability and
repeatability.



LONG-DISTANCE SIGNAL TRANSMISSION

Low-voltage output allows
accurate measurement over
long cable runs.

03

MINERAL INSULATED THERMOCOUPLES

RUGGED. PRECISE. BUILT FOR EXTREMES.

Mineral insulated (MI) thermocouples consist of thermoelectric conductors surrounded by a highly compacted insulation material, typically magnesium (MgO), and enclosed in a metallic sheath.

This construction delivers excellent mechanical strength, high vibration resistance, fast response time and outstanding performance in extreme temperatures and harsh environments.

KEY FEATURES



Wide temperature range
-269 to +900 and beyond



High mechanical strength
and vibration resistance



Fast response time



Excellent resistance to
corrosion and oxidation



Long service life
in demanding conditions



Customizable to meet
application requirements



METALLIC SHEATH

Provides mechanical protection
and environmental sealing.

MINERAL INSULATION (MgO)

High-purity, densely compacted
magnesium oxide ensures
electrical insulation and efficient
heat transfer.

THERMOCOUPLE CONDUCTORS

High-quality thermoelectric wires
deliver accurate and stable
temperature measurement.

MEASURING JUNCTION

Welded tip (hot junction) for
reliable and fast temperature
response.



ENGINEERED FOR ACCURACY. BUILT TO LAST.

Mineral insulated thermocouples are the ideal choice
for applications where reliability and performance
cannot be compromised.



Industrial Furnaces
and Ovens



Gas and Steam
Turbine



Petromechanical
Processing



Aerospace and
Engine Testing



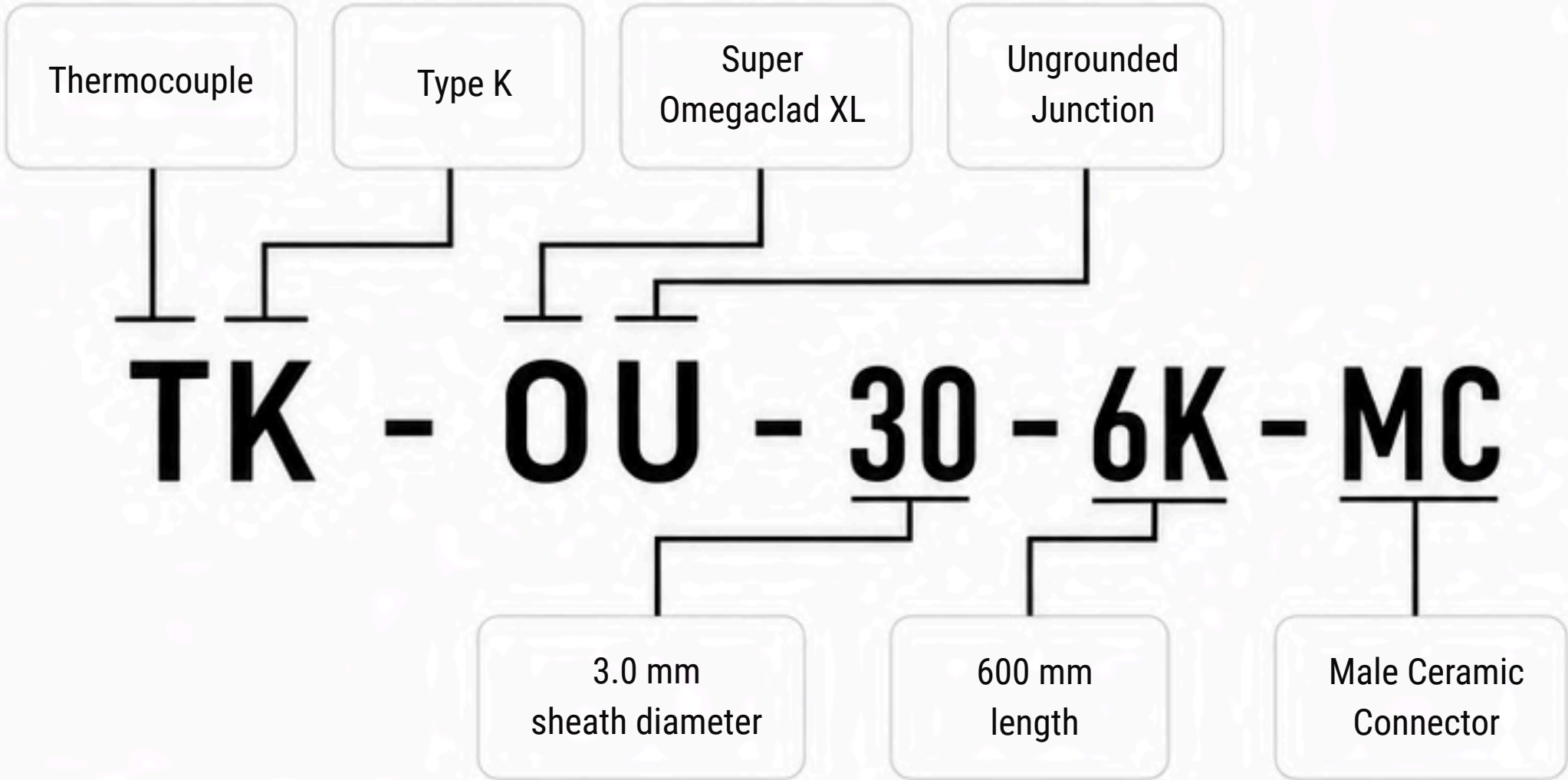
Research and
Development



04

PRODUCT CONFIGURATION GUIDE

Example Ordering Code



1 THERMOCOUPLE TYPE

CODE	TYPE
K	Type K
N	Type N
J	Type J
T	Type T
E	Type E

2 SHEATH MATERIAL

CODE	MATERIAL
I	Inconel 600
O	Super Omegaclad XL

3 SHEATH DIAMETER

CODE	DIAMETER (MM)
05	0.5
10	1.0
15	1.5
20	2.0
30	3.0
45	4.5
60	6.0

4 JUNCTION TYPE

CODE	DESCRIPTION
G	Grounded
U	Ungrounded
E	Exposed

5 THERMOCOUPLE LENGTH

CODE	LENGTH
6K	600 mm
9K	900 mm
Any length on request	

6 TERMINATION

CODE	DESCRIPTION
BL	Bare Leads
MC	Male Ceramic Connector
MMC	Male Mini Ceramic Connector



05

AVAILABLE CONFIGURATIONS

Measuring Junction Configurations

The measuring junction design influences response time, electrical isolation and suitability for specific operating conditions.

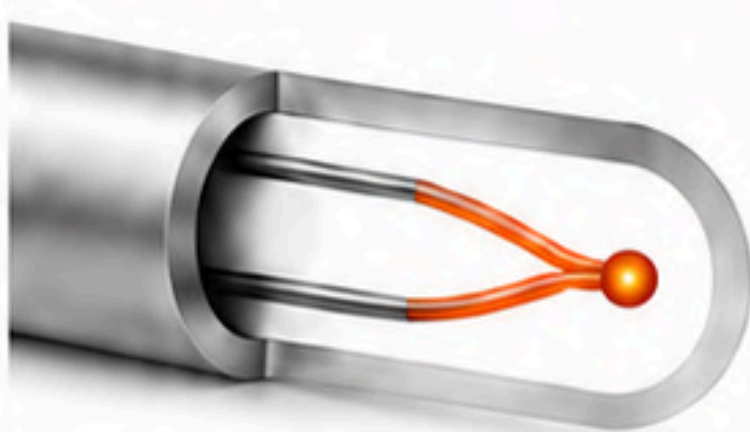
GROUNDING JUNCTION



In a grounded junction design, the measuring junction is welded directly to the metallic sheath.

- Fast response
- Excellent heat transfer
- Dynamic measurements

UNGROUNDING JUNCTION



The measuring junction is electrically isolated from the metallic sheath by MgO insulation.

- Electrical isolation
- Reduced electrical noise
- Stable signal

EXPOSED JUNCTION



The measuring junction extends beyond the sheath and is directly exposed to the measured medium.

- Fastest response
- Minimal thermal inertia
- Reduced mechanical protection

FEATURE	GROUNDING	UNGROUNDING	EXPOSED
Response time	★★★★★	★★★★★	★★★★★
Electrical Isolation	×	✓	×
Mechanical Protection	★★★★★	★★★★★	★★★☆☆
Signal Stability	★★★★★	★★★★★	★★★★★
Recommended Applications	Dynamic measurements	Precision measurements	Fast response applications



06

PRODUCT SERIES

HPM mineral insulated thermocouples are offered in two series optimised for industrial operation, enhanced accuracy and long-term stability.



PRECISE

High accuracy and stability



RELIABLE

Robust construction for demanding environments



INDUSTRIAL GRADE

Reliable performance for general industrial applications.



ROBUST & RELIABLE

Inconel 600 sheath for mechanical strength and protection in harsh industrial environments.



ACCURACY

Class 1 accuracy according to IEC 60584-1 for dependable measurements.



WIDE OPERATING RANGE

Operates from cryogenic temperatures to +1150°C.



CONTINUOUS OPERATION

Designed for stable, long-term operation in industrial environments.



VIBRATION RESISTANT

Excellent resistance to vibration and thermal cycling.



ENHANCED ACCURACY

For demanding applications where accuracy and stability are critical.



PREMIUM SHEATH MATERIAL

Super Omegaclad® XL sheath for superior oxidation resistance and stability.



SPECIAL LIMITS OF ERROR (SLS)

SLE per ASTM E230 for high accuracy measurements.



HIGH TEMPERATURE CAPABILITY

Reliable operation up to 1300°C for extreme environments.



LONG-TERM STABILITY

Improved stability for long-duration monitoring programs.



LOW THERMOELECTRIC DRIFT

Signal drift less than 2.8°C after 25 weeks at elevated temperatures.

REQUIREMENTS	TK-IG INDUSTRIAL GRADE	TK-OU ENHANCED ACCURACY
General industrial applications	✓	—
Heat treatment / Furnaces	✓	—
Continuous operation	✓	✓
Aerospace / Aviation testing	—	✓
R&D / Research	—	✓
High measurement accuracy	—	✓
Low thermoelectric drift	—	✓

CONNECTORS AND TERMINATIONS

Reliable Connections for High-Temperature Measurement



RELIABLE CONNECTION

Secure electrical contact and polarity protection



EASY INTEGRATION

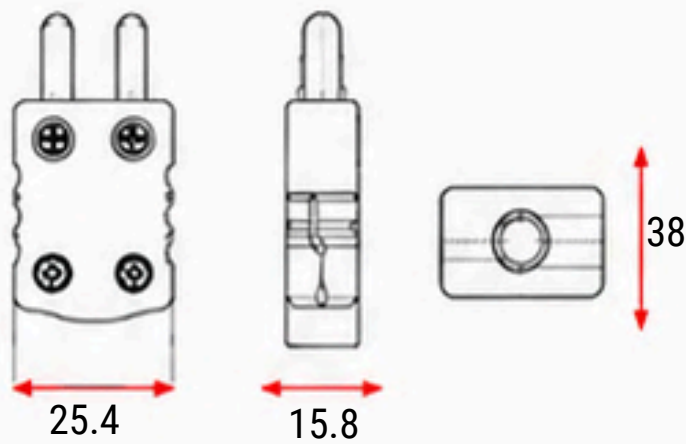
Designed for quick installation and instrumentation compatability

HPM thermocouples are avalaible with a variety of termination options to meet different installation and measurement requirements. Termination systems are designed to provide reliable electrical contact, polarity protection and convenient integration into industrial and laboratory instrumentation.

STANDARD CERAMIC CONNECTOR (MALE)



OVERALL DIMENSIONS



DIMENSION	VALUE
Width	25.4 mm
Height	38 mm
Depth	15.8 mm

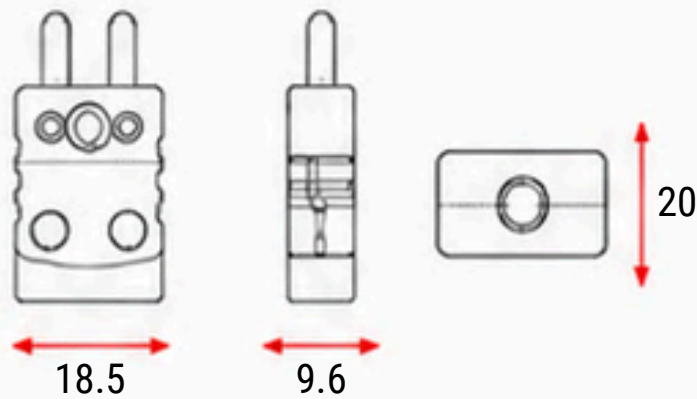
- High-temperature ceramic body
- Polarized contacts
- Excellent electrical insulation
- Robust mechanical construction
- Suitable for industrial and laboratory environments

BARE LEAD TERMINATION

MINI CERAMIC CONNECTOR (MALE)



OVERALL DIMENSIONS



DIMENSION	VALUE
Width	18.5 mm
Height	20 mm
Depth	9.6 mm

- Compact design
- High-temperature ceramic construction
- Polarized contacts
- Reduced weight
- Suitable for confined installations

AVAILABLE TERMINATIONS

BARE LEAD TERMINATION



For applications requiring direct connection to instrumentation, thermocouples can be supplied with bare conductors or custom lead configurations

AVAILABLE OPTIONS

- Bare conductors
- Extended conductors
- Custom lead length
- Custom conductor materials
- Insulated or uninsulated configurations

AVAILABLE TERMINATIONS



Ceramic Connector



Mini Ceramic



Bare Leads



Extension Cable



Transition Joint



Custom Assembly



HIGH TEMPERATURE CAPABILITY
Engineered for extreme environments



POLARITY PROTECTION
Ensures correct connection and measurement reliability



DURABLE & ROBUST
Designed for long-term industrial and lab use



CUSTOM SOLUTIONS
Flexible configurations to meet specific requirements



08

CUSTOM CONFIGURATIONS

Tailore Solutions for Unique Requirements

HPM delivers engineered thermocouple solutions adapted to your specific installation, process and environmental requirements. We design, build and test to your specification.



ENGINEERED SOLUTIONS

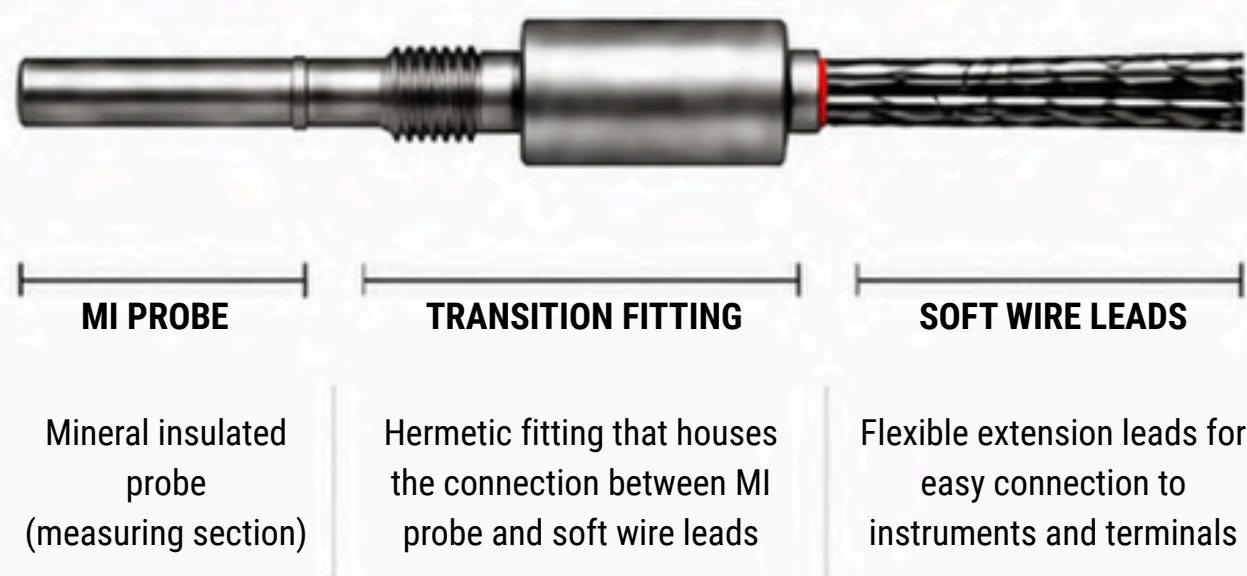
Designed and built for demanding applications



INSTALLATION READY

Pre-configured assemblies that simplify installation and reduce downtime

SPECIAL CONSTRUCTION TRANSITION TO SOFT WIRE LEADS



Hermetic transition fittings provide a sealed interface between the mineral insulated probe and flexible leads, improving reliability and ease of installation.

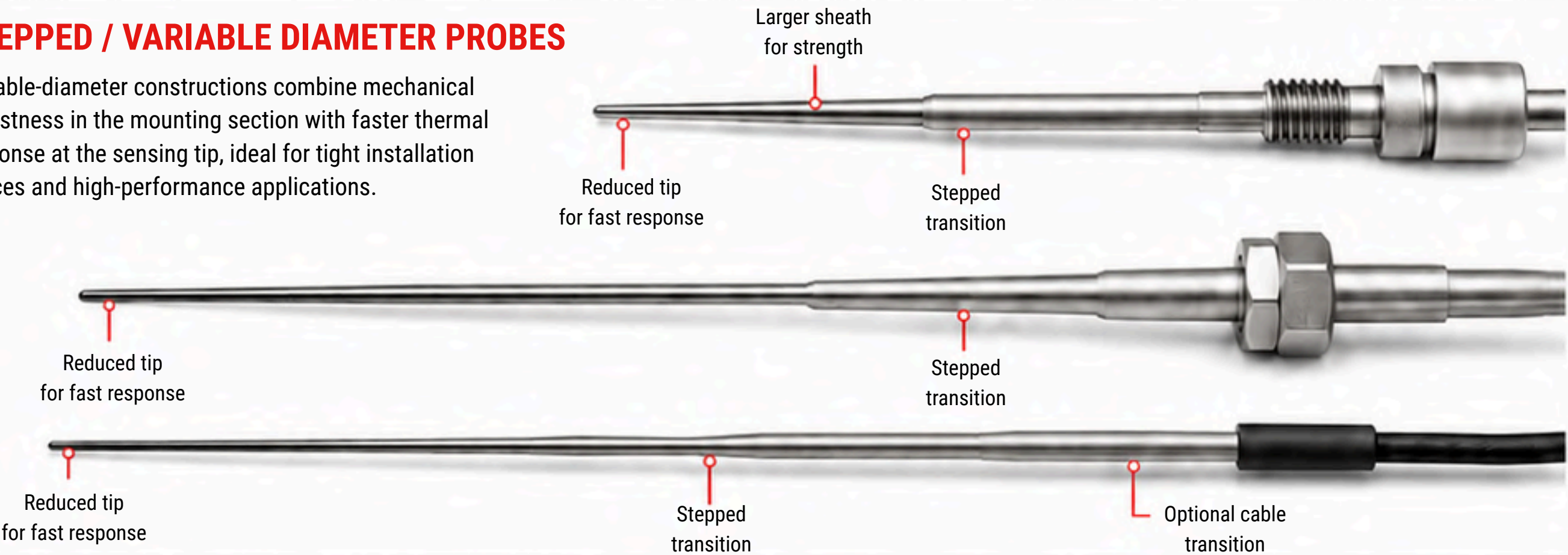
SPECIAL ASSEMBLIES



Custom engineered assemblies with bends, fittings, mounting hardware, ceramic insulating sleeves, and application-specific designs are available to suit the most demanding installations and operating environments.

STEPPED / VARIABLE DIAMETER PROBES

Variable-diameter constructions combine mechanical robustness in the mounting section with faster thermal response at the sensing tip, ideal for tight installation spaces and high-performance applications.



CUSTOM DESIGN FEATURES

STEPPED TIP	TAPERED TIP	REDUCED DIAMETER END	THREADED / COMPRESSION FITTINGS	TRANSITION TO FLEXIBLE CABLES	SPRING-LOADED OR CUSTOM ASSEMBLIES
Multiple diameter steps to balance strength and response.	Gradual taper for smooth transitions and fast thermal response.	Slim end design for tight spaces and high speed response.	Wide range of fittings for secure, leak-tight installation.	Hermetic transition to flexible wires for easy instrument connection.	Spring-loaded, bent or custom assemblies for unique applications.



09

CERAMIC INSULATED THERMOCOUPLES

High stability. High insulation. Built for Extreme Temperatures.

DESCRIPTION

Ceramic insulated thermocouples are designed for temperature measurements in applications where maximum thermal stability, high insulation resistance and operation at elevated temperatures are required.

The thermoelectric conductors are electrically isolated by high-purity alumina (Al_2O_3) ceramic insulators. They can be supplied as bare ceramic assemblies or integrated into protection tube assemblies for industrial applications.

Unlike mineral insulated constructions, ceramic insulated thermocouples provide excellent dimensional stability at elevated temperatures and are particularly suitable for laboratory, aerospace, and turbine development programs.

The robust ceramic construction ensures superior oxidation resistance and long-term performance in air, inert gases, vacuum and many corrosive atmospheres.

MEASURE INSIDE THE TBC, NOT ON THE SURFACE

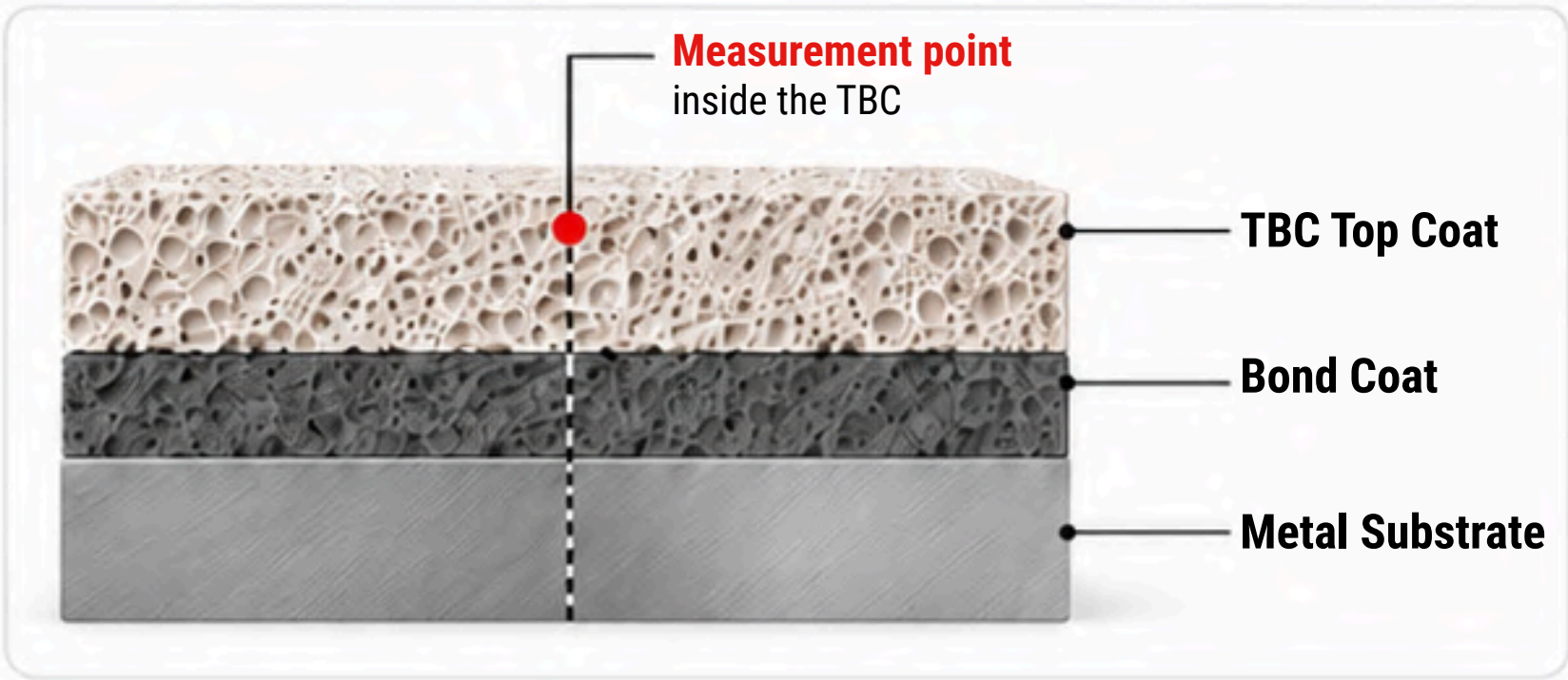
The thermocouple junction is **embedded inside the TBC** (under the top coat) to measure the true temperature at the depth of the ceramic coating.

✓ **MEASUREMENT POINT INSIDE THE TBC**

Accurate data for process control and life prediction.

✗ **NOT ON SURFACE, NOT IN METAL**

Surface or substrate temperature does not represent actual coating conditions.



MANUFACTURING PROCESS (BARE CERAMIC ASSEMBLY)



PRODUCT HIGHLIGHTS

TEMPERATURE RANGE Up to 1600°C (depending on application and configuration)	INSULATION RESISTANCE > $10^{12} \Omega$ at 1000 °C (typical)	CERAMIC INSULATOR High-purity Al_2O_3 (Alumina)	MECHANICAL STABILITY Excellent dimensional stability at high temperatures	CONFIGURATIONS Bare ceramic or integrated into protection tube assemblies
--	--	--	---	---



10

INSTALLATION & APPLICATION SUPPORT

On-Site Expertise for Reliable Measurement

HPM provides professional on-site installation and application support for high-temperature thermocouple assemblies in industrial and process environments.

Our experienced technicians ensure precise installation, secure mounting and optimal thermal contact for accurate and stable temperature measurement.

We combine mechanical expertise with advanced coating technology to guarantee long-term performance even in the most demanding conditions.



Reliable
Installation



High Temperature
Ready



Precision
Application

THERMOCOUPLE INSTALLATION ON COMPONENTS



Professional installation of thermocouple assemblies directly on component surfaces for accurate and stable temperature monitoring.

MOUNTING METHODS



- ✓ High-temperature adhesives
- ✓ Mechanical fixing (clips, straps)
- ✓ Welding or brazing (where applicable)

THERMAL CONTACT OPTIMIZATION



- ✓ Surface preparation and cleaning
- ✓ Optimal contact for accurate readings
- ✓ Minimized thermal resistance

SECURE & DURABLE INSTALLATION



- ✓ Vibration and shock resistant mounting
- ✓ Long-term stability in harsh conditions
- ✓ Engineered for tight spaces



GAS FLAME SPRAYING

HPM also performs gas flame spraying (thermal spray) as part of our installation services to protect and enhance component surfaces.

- ✓ Protective & functional coating application
- ✓ Enhances component life and performance
- ✓ Resistant to corrosion, wear and oxidation
- ✓ Executed by skilled technicians with field expertise



Gas flame spraying for protective and performance coatings.



Skilled execution by HPM technicians on-site in demanding environments.



11

EQUIPMENT & ACCESORIES

Welding and Installation Tools

CDWT-6001 Capacitive Discharge Welding Tool

Portable autonomous capacitive discharge welding tool for installation of sensors, strain gauges, thin foil elements and auxiliary wiring in demanding applications. Designed for precise joining of thin metallic components and sensor leads during high-temperature test preparation and instrumentation work.

General information

- Mounting of weldable strain gauges with metal foil carrier up to 0.2 mm thick
- Fixing elongation wires on details and assembly units using thin metal band strips
- Welding of thin foil covers for wire protection
- Welding of elongation wires to lead wires of strain gauges
- Welding of thermocouples to details and assembly units
- Suitable for thin-sheet metal and foil applications up to 0.2 mm

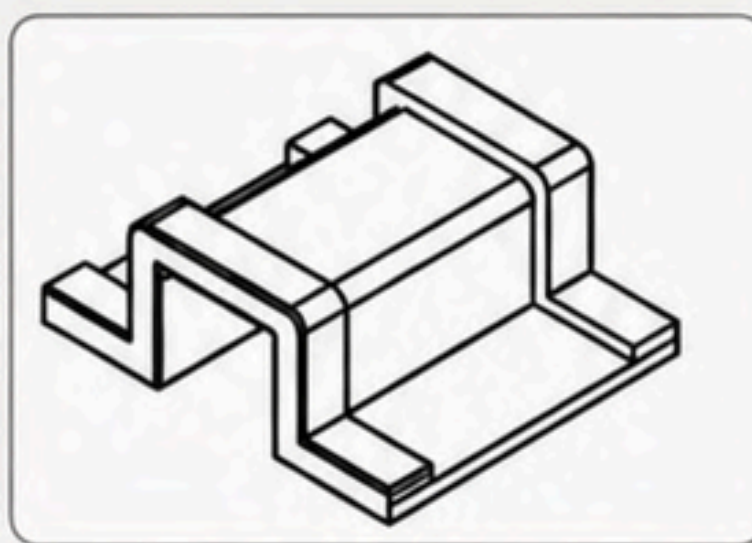
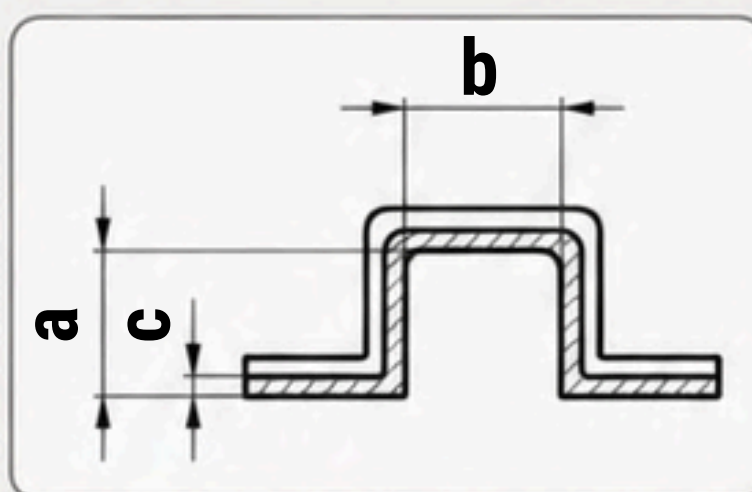


Recharge time after welding

- Power levels 0–7: not more than 1 s
- Power levels 8–9: not more than 1.5 s

Foil Clip for Wire Retension

Accessory for securing insulated wiring to high-temperature components. Manufactured from 0.1 mm Inconel alloy foil and attached by spot welding. Folded edges help prevent abrasion and insulation damage.



- **Material:** Inconel alloy foil
- **Thickness:** 0.1 mm
- **Typical use:** thermocouple and strain-gauge wiring retension



12

CONTACTS & TECHNICAL SUPPORT

ENGINEERING SOLUTIONS FOR HIGH-TEMPERATURE MEASUREMENTS

HPM provides engineering support throughout the complete sensor development process, from concept evaluation and prototype manufacturing to production and implementation.

We work closely with customers to develop reliable temperature measurement solutions for industrial, aerospace and research applications.

OUR CAPABILITIES



Custom production of mineral Insulated thermocouples



Development of ceramic insulated thermocouples for high-temperature applications



Design and manufacturing of custom sensor assemblies



Integration of thermocouples into test articles and experimental systems



Prototype development and small-batch production



Engineering support for aerospace, power generation and industrial applications

CONTACT



+38 067 675 8601



info@hpm-gages.com



Ukraine

High Precision Measurements LLC
Radomyshlska str. 4-K, Kyiv 04082, Ukraine



USA

HPM America LLC
278 Oakwood Drive Glastonbury,
CT 06033 USA



Poland

HPM Poland sp. z o.o.
ul. CEGIELNIANA 12/ 49-300 BRZEG



m.glowacki@hpm-gages.com

