



high precision measurements

INSTALLATION SERVICES FOR TURBOMACHINERY

Engineering, sensors, installation
and verification for turbine applications



MEASUREMENT
DESIGN



CUSTOM
SENSORS



HOT-ZONE
INSTALLATION



SIGNAL
VERIFICATION

Ø1250

Ø880

450

FROM **MEASUREMENT TASK** TO VERIFIED DATA



WHO WE ARE

WE DELIVER **TURNKEY** HIGH-TEMPERATURE MEASUREMENT PROJECTS

For turbine engineering.



CONSULTING

Task definition
& feasibility



ENGINEERING

Sensors, routing
& system design



IMPLEMENTATION

Manufacturing &
on-site installation



VERIFICATION

Calibration, training
& support



HPM
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ON-SITE INSTALLATION



IN-LAB INSTALLATION



INSTALLATIONS IN

**USA
POLAND
UKRAINE**



FROM MEASUREMENT TASK TO **VERIFIED DATA.**

FLAME SPRAYING INSTALLATION



KEY ADVANTAGES

- ✓ Strong mechanical bond on high-temperature surfaces
- ✓ Excellent resistance to thermal shock
- ✓ Dense coating with low porosity
- ✓ High wear and oxidation resistance



BEST USED WHEN

- ✓ Operating temperature exceeds adhesive limits
- ✓ Components face severe thermal cycling
- ✓ A durable protective ceramic layer is required
- ✓ Harsh erosion or oxidation conditions are present

ROD FLAME SPRAYING

Long-term operation: **1000°C**

Short-term: up to **1100°C**

→ FROM MEASUREMENT TASK TO VERIFIED DATA →

CERAMIC CEMENT INSTALLATION

Process overview

1 CC-2 CEMENT



High-temperature ceramic adhesive

2 GAUGE INSTALLATION



Gauge mounted and cured

3 INSTALLED EXAMPLES



Used on real components



KEY ADVANTAGES

- High adhesion to metals
- High mechanical strength after thermal curing
- Suitable for local installation
- Good option for complex geometries



BEST USED WHEN

- Flame spraying is impractical
- Local mounting area is limited
- Repair or small-series installation is needed
- High-temperature adhesive mounting is required



CC-2 CERAMIC CEMENT

Long-term operation: **900°C**

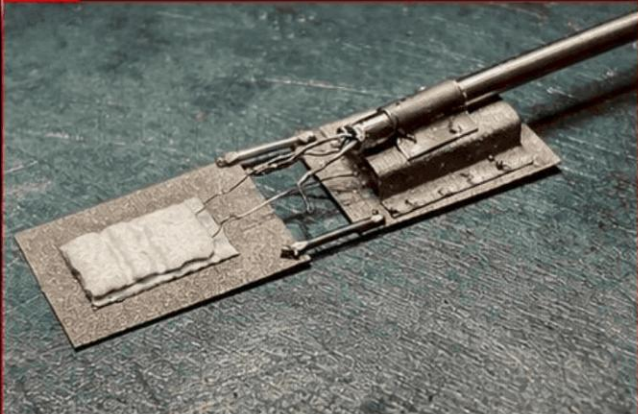
Short-term: up to **950°C**

A practical solution for localized high-temperature gauge installation

WELDABLE STRAIN GAUGE INSTALLATION

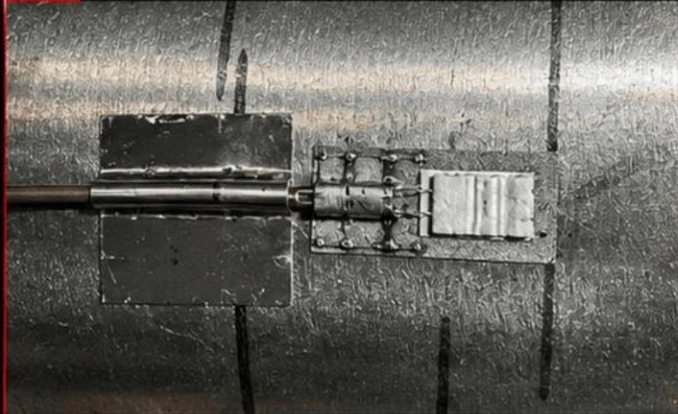
Process overview

1 GAUGE ASSEMBLY



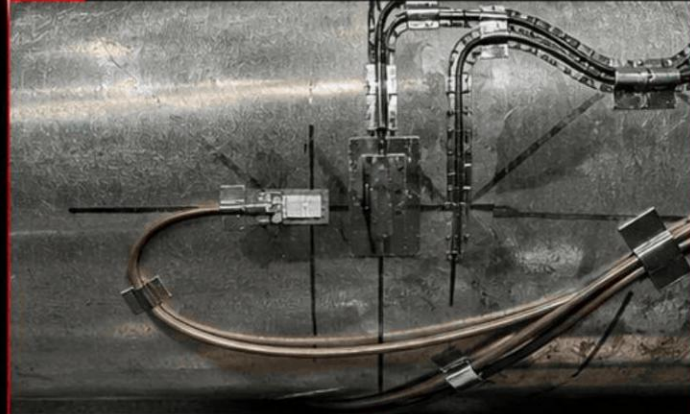
Pre-assembled weldable gauge

2 GAUGE INSTALLATION



Gauge positioned and spot-welded

3 ROUTING & FIXATION



MI cable routed and secured



KEY ADVANTAGES

- ✓ No adhesive curing required
- ✓ Fast and repeatable installation
- ✓ Stable under vibration and thermal cycling
- ✓ Consistent strain transfer to the sensing element



BEST USED WHEN

- ✓ Metallic components allow spot welding
- ✓ Adhesive installation is impractical
- ✓ Severe vibration or thermal cycling is expected
- ✓ Fast on-site installation is required



WELDABLE GAUGE SYSTEM

- ✓ **Attachment:** controlled spot welding
- ✓ **Hot zone:** MI cable routing
- ✓ **Outside hot zone:** flexible cable to DAQ
- ✓ **Final checks:** continuity and signal verification

FROM SURFACE PREPARATION TO VERIFIED STRAIN SIGNAL

THERMOCOUPLE INSTALLATION

Process overview

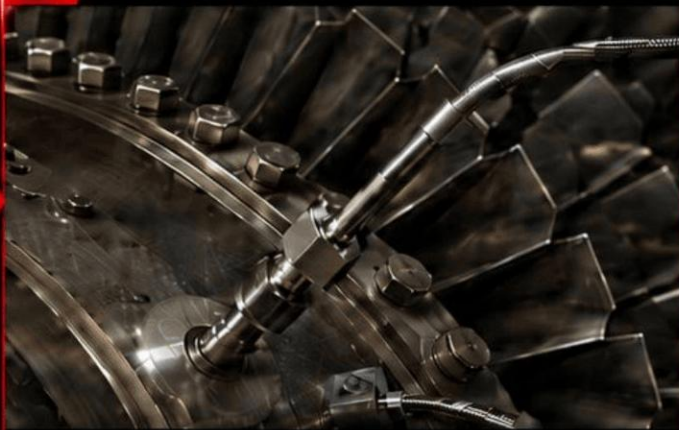
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1 THERMOCOUPLE DESIGN



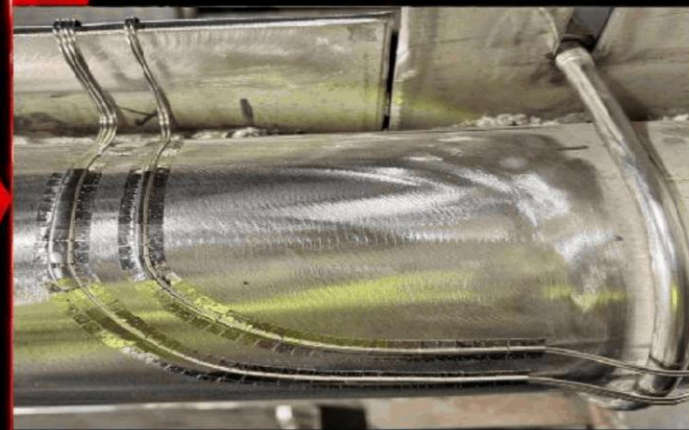
Different sheath diameters available

2 PROBE INSTALLATION



Probe positioned and secured on the component

3 ROUTING & TERMINATION



Cable routed and secured along the component



KEY ADVANTAGES

- ✓ Operating range: up to 1150°C
- ✓ Fast thermal response
- ✓ High resistance to vibration and mechanical loads
- ✓ Corrosion- and oxidation-resistant construction



BEST USED WHEN

- ✓ Direct temperature monitoring is needed on hot components
- ✓ The installation must withstand harsh industrial conditions
- ✓ Protected routing is required between the hot zone and instrumentation
- ✓ Reliable long-term operation is critical for the test or process



MI THERMOCOUPLE SYSTEM

- ✓ Extended capability: up to 1300°C on request
- ✓ Thermocouple calibration available on request
- ✓ Connector options available on request
- ✓ Custom sheath diameter, probe length and junction style

FROM SENSOR SELECTION TO VERIFIED TEMPERATURE DATA

THERMAL INDICATING PAINT INSTALLATION

Process overview

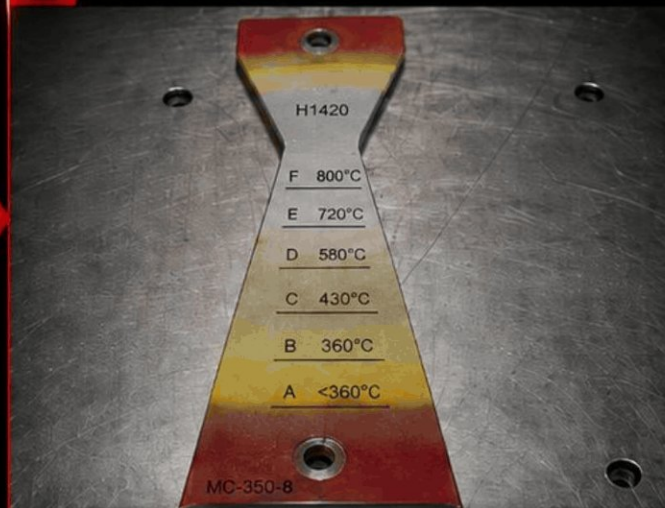
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1 PAINT SELECTION



MC350-8 multichange paint selected for the test

2 REFERENCE COUPON



Reference coupon used to correlate colour changes with temperature

3 TEMPERATURE MAP ON COMPONENT



Post-test colour map used to identify peak surface temperatures



KEY ADVANTAGES

- ✓ Full-field surface temperature indication
- ✓ No wiring on the measured surface
- ✓ Suitable for complex or hard-to-instrument parts
- ✓ Permanent record of peak temperature exposure



BEST USED WHEN

- ✓ A temperature map over a large area is required
- ✓ Thermocouple placement is limited or impractical
- ✓ Peak temperature exposure must be verified after testing
- ✓ Combustion hardware or hot zone components are being evaluated



MC350-8 MULTICHANGE PAINT

- ✓ Initial colour: red
- ✓ Applied at room temperature
- ✓ Colour changes after 5 minutes at temperature
- ✓ Multiple transition points enable temperature zoning

FROM COLOUR CHANGE TO VERIFIED TEMPERATURE MAP

INSTALLATION OF WELDABLE STRAIN GAUGES AND THERMOCOUPLES DURING NEW GAS TURBINE INSTALLATION



1. TASK

- Measure strain on a turbine component in real operating conditions.
- Route multiple measurement channels through a high-temperature area over a long distance.



2. SOLUTION

- Weldable strain gauges, 15 m MI cable through the hot zone, 23 m flexible cable outside the hot zone.
- The cable architecture was selected to combine thermal resistance in the hot zone with flexible connection to the measurement system.

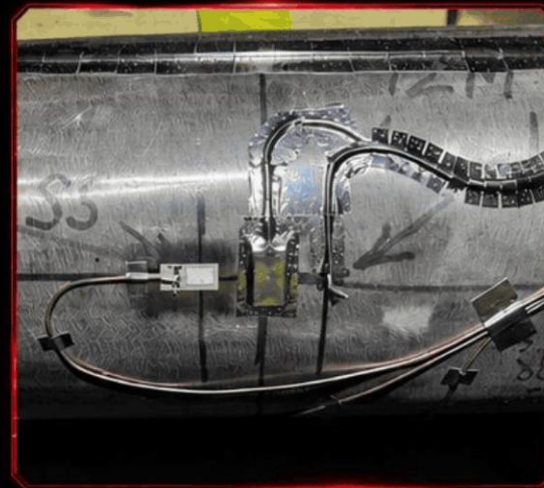


3. INSTALLATION

- On-site routing and fixation with welded foil clamps.
- The complete route was adapted to the component geometry and mechanically secured along straight sections, bends and transition areas.



All routing secured with welded foil clamps.



Strain gauge



15 m MI cable



Transition



23 m flexible cable



DAQ

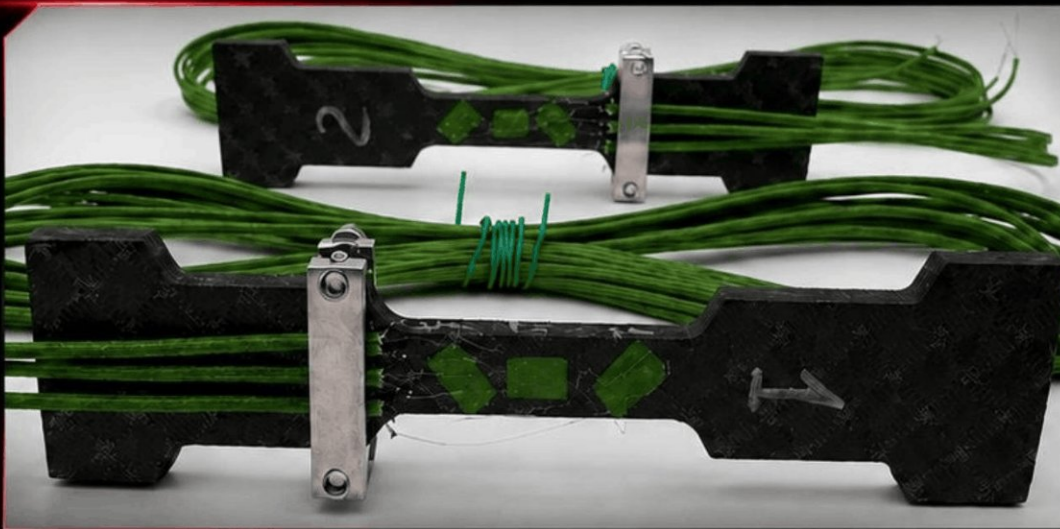


4. DELIVERED

- Complete measurement path ready for DAQ connection.
- The customer received an installed turnkey solution comprising sensors, hot-zone cabling, flexible extensions and protected routing.

HIGH-TEMPERATURE COMPOSITE MEASUREMENT CASE

0° / 45° / 90° strain measurement with thermal compensation



TASK

Measure strain in 0°, 45° and 90° directions under thermal loading.
Ensure accurate strain capture with thermal compensation.

Requires development of a dedicated adhesive for ceramic-to-composite bonding.



SOLUTION

Three active gauges on the test specimen.
Matched dummy gauges on the reference specimen for thermal compensation.
Dedicated high-temperature adhesive ensures reliable bonding to ceramic.

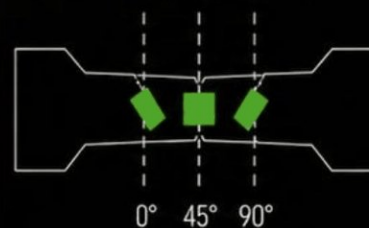


RESULT

Multi-directional strain data with compensated thermal effect.

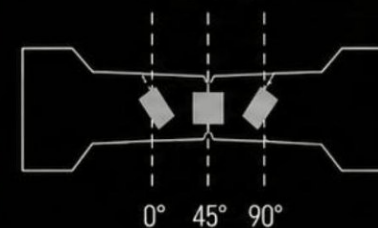
TEST SPECIMEN

active gauges



REFERENCE SPECIMEN

dummy gauges



Reliable multi-directional strain measurement with thermal compensation up to 950°C.

EXTENSOMETER COVERS FOR HYDROGEN TESTING

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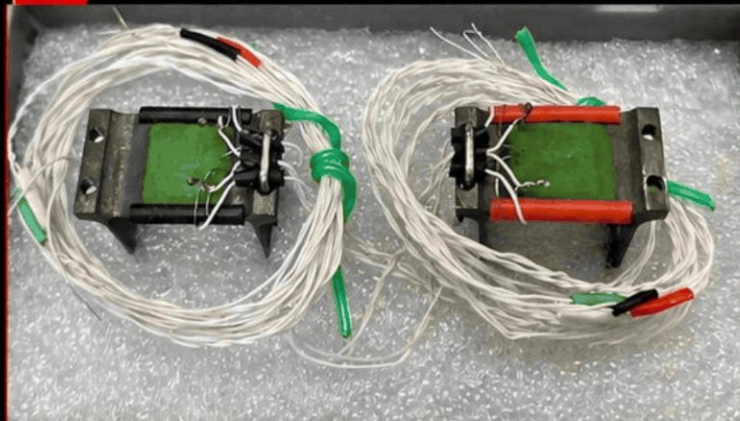
4-gauge full-bridge strain measurement case

1 COVER DETAIL



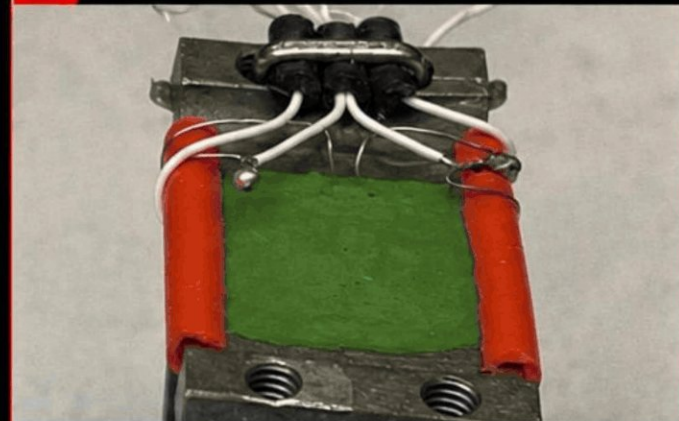
Instrumented extensometer cover

2 FULL-BRIDGE SET



Prepared assemblies for hydrogen test

3 WIRING DETAIL



Bridge wiring and lead routing



CASE TASK

- ✓ Instrument extensometer covers for strain measurement during hydrogen testing
- ✓ Capture mechanical response under test loading
- ✓ Provide a stable bridge output for the measurement system



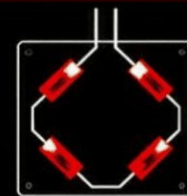
SENSOR CONFIGURATION

- ✓ Four strain gauges were applied to the cover assembly
- ✓ The gauges were soldered into a full Wheatstone bridge
- ✓ Lead wires were routed and secured for test connection



DELIVERED SOLUTION

- ✓ Compact ready-to-test extensometer cover assemblies
- ✓ Full-bridge measurement for higher sensitivity and balanced output
- ✓ Suitable for integration into hydrogen test programs



**4 ACTIVE GAUGES /
FULL BRIDGE**

FROM COVER INSTRUMENTATION TO VERIFIED HYDROGEN TEST DATA

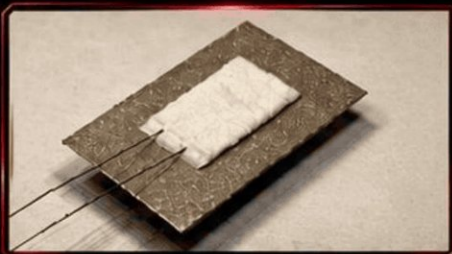
CUSTOM GAUGES, BRIDGE MODULES & THERMOCOUPLES

Sensor designs matched to the component and measurement task

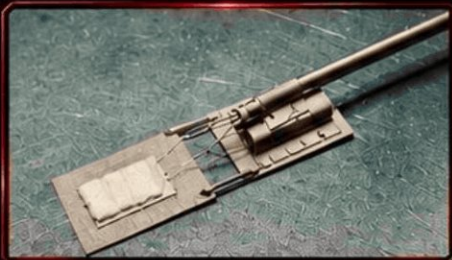


WELDABLE STRAIN GAUGES

Single-gauge and dummy-gauge assemblies for high-temperature installation



Single gauge

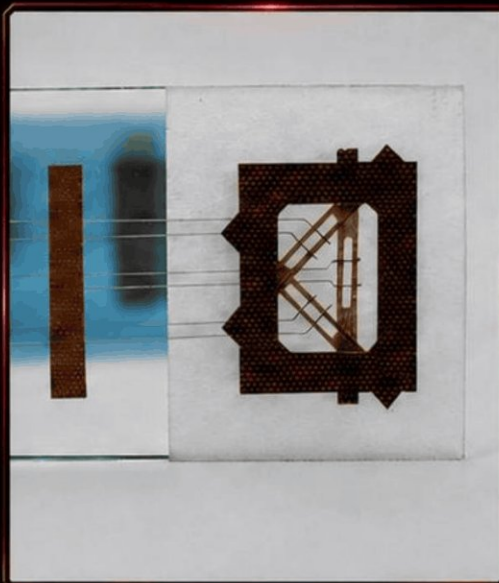


Gauge with dummy



CUSTOM STRAIN GAUGES

Grid geometry, resistance and orientation tailored to the task



BRIDGE MODULES / ADAPTERS

BCM2 / BCM4 bridge completion and connection modules



CUSTOM THERMOCOUPLES

Variable diameter, sheath length and connector options



DESIGN INPUTS

Geometry

Temperature profile

Strain direction

Cable length

Connector / interface

From custom sensing elements to complete measurement-chain accessories

CONTACTS & TECHNICAL SUPPORT

ENGINEERING SOLUTIONS FOR HIGH-TEMPERATURE MEASUREMENTS

We provide 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.



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