For the plastics machinery industry
Nozzle thermocouple
Model TC47-NT

Applications
- Plastics and rubber industry
- Nozzle extensions on injection mould machines
- Manifolds for injection mould machines
- Compression platens
- Packaging

Special features
- The sensor is fixed with a pre-determined threaded bolt and mounted into the process
- The nozzle thermocouples are a low profile in design
- Extension cable is available in a variety of insulation and jacketed materials. These include fibreglass, PTFE or PVC to name a few.
- With or without stainless steel overbraid
- Interchangeable and easily replaceable

Description
The TC47-NT nozzle thermocouple is a general purpose temperature sensor designed to suit applications where low profile temperature detection is required. The thermocouple sensor is designed to sense temperature in a pre-determined threaded hole.

The nozzle thermocouple is held in place with a threaded bolt. This allows the sensor to have a positive pressure at the tip when installed correctly. Due to the construction design, these sensors can be applied in areas that have a harsh environment that need a good positive securing method.
### Sensor

**Sensor type**
- Type J (Fe-CuNi)
- Type L (Fe-CuNi)
- Type K (NiCr-Ni)
- Type T (CuNi)
- Others on request

**Number of sensors**
- 2-wire single circuit
- 4-wire dual circuit

**Classification tolerance**
- European Class 1 and 2 per DIN EN 60584-2
  - DIN 43714 and DIN 43713: 1991
  - International (IEC) DIN 43722: 1994
  - JISC 1610: 1981
  - NFC 4232
  - BS 1843
- North American Class 1 and 2
  - ISA standard and special per ANSI MC 96.1 - 1982

**Measuring point**
- Isolated (ungrounded)
- Non isolated (grounded)

**Tip construction**
The sensor junction tip is built to your individual specifications. This consists of a stainless steel outer sheath with thermocouple wire drawn through it and secured into place. Due to the construction design, these sensors can be applied in areas that are not difficult to access.

**Options**
- Lengths and diameters are customer specified
- Calibration classifications are customer specified
- Tag identification (customer specific identification number)
- Selectable accuracy tolerance
- Mounting options customer specified

### Basic values and limiting errors

A cold junction temperature of 0 °C is taken as the basis for the definition of the thermocouple’s sensor limiting error.

<table>
<thead>
<tr>
<th>Temperature (ITS 90) °C</th>
<th>Limiting error DIN EN 60584</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type J °C</td>
</tr>
<tr>
<td>0</td>
<td>± 2.5</td>
</tr>
<tr>
<td>200</td>
<td>± 2.5</td>
</tr>
<tr>
<td>400</td>
<td>± 3.0</td>
</tr>
<tr>
<td>600</td>
<td>± 4.5</td>
</tr>
<tr>
<td>800</td>
<td>not defined</td>
</tr>
</tbody>
</table>

#### Types J, L DIN EN 60584, ANSI MC 96.1

<table>
<thead>
<tr>
<th>Class</th>
<th>Temperature range</th>
<th>Limiting error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-40 ... +375 °C</td>
<td>± 1.5 °C</td>
</tr>
<tr>
<td>1</td>
<td>+375 ... +750 °C</td>
<td>± 0.0040 ·</td>
</tr>
<tr>
<td>2</td>
<td>-40 ... +333 °C</td>
<td>± 2.5 °C</td>
</tr>
<tr>
<td>2</td>
<td>+333 ... +750 °C</td>
<td>± 0.0075 ·</td>
</tr>
</tbody>
</table>

#### Type K DIN EN 60584, ANSI MC 96.1

<table>
<thead>
<tr>
<th>Class</th>
<th>Temperature range</th>
<th>Limiting error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-40 ... +375 °C</td>
<td>± 1.5 °C</td>
</tr>
<tr>
<td>1</td>
<td>+375 ... +750 °C</td>
<td>± 0.0040 ·</td>
</tr>
<tr>
<td>2</td>
<td>-40 ... +333 °C</td>
<td>± 2.5 °C</td>
</tr>
<tr>
<td>2</td>
<td>+333 ... +750 °C</td>
<td>± 0.0075 ·</td>
</tr>
</tbody>
</table>

#### Type T DIN EN 60584, ANSI MC 96.1

<table>
<thead>
<tr>
<th>Class</th>
<th>Temperature range</th>
<th>Limiting error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-40 ... +125 °C</td>
<td>± 0.5 °C</td>
</tr>
<tr>
<td>1</td>
<td>+125 ... +350 °C</td>
<td>± 0.0040 ·</td>
</tr>
<tr>
<td>2</td>
<td>-40 ... +133 °C</td>
<td>± 1.0 °C</td>
</tr>
<tr>
<td>2</td>
<td>+133 ... +350 °C</td>
<td>± 0.0075 ·</td>
</tr>
</tbody>
</table>

1) |t| is the value of the temperature in °C without consideration of the sign.

### Sensor tip designs

In the standard version a sensor in incorporated which is appropriate for the selected measuring range. Model TC47-NT can be constructed in two different ways:

- **ungrounded measuring point (hot junction) isolated**
- **grounded measuring point (hot junction) non isolated**

### Sheath material

- Stainless steel
  - up to 1200 °C
  - good corrosion resistance with aggressive media
- Ni-alloy 2.4816 (Inconel 600)
  - standard material for applications which require specific corrosion resistance properties, exposure to high temperatures and resistant to induced stress
- Others on request
Lead wire

A variety of insulating materials are available to adapt to different prevailing process conditions. The lead wire termination end can be supplied ready for connection or fitted with a plug as an option.

- Thermocouple, fit to process connection
- Lead extension cross section: min. 0.22 mm² (24 awg)
- Insulation material: fibreglass, Kapton, PTFE or PVC
- Other options available

Process connections

The thermocouple is fitted with a rotating bolt for a good positive connection. The bolts have various threads and are individually specified.

Lead wire coverings

- Stainless steel overbraid (no tracer)
  Stainless steel overbraid is by far the most common of the overbraids and is available on almost all thermocouples and extension duplex wire constructions. While highly resistant to corrosion, stainless steel is able to maintain a continuous operating temperature of 1400 °F (760 °C).

- Stainless steel overbraid (with tracer)
  Resembles stainless steel with a colour coded fibre tracer identifying the calibration type with minimum braid coverage of 85%.

- Tinned copper overbraid
  Although similar in some characteristics to stainless steel, is a more economical alternative. This product offers an improved feature of shielding against static noise (if it is properly insulated and grounded) with a continuous operating temperature of 400 °F (204 °C).

- Interlocking flexible stainless steel armour
  Is a half oval armour applied in a spiral wrap fashion. In addition to having similar characteristics to the overbraids, stainless steel armour maintains better crush and piercing resistant properties. It can operate in higher temperature 1400 °F (760 °C). This covering is a non-magnetic corrosive, and piercing resistant shield. Resistant to rusting in outdoor applications.

Operating temperatures

The following temperatures limits apply to the conventional connecting lead wire.

- Fibreglass: -50 ... +482 °C
- Kapton: -25 ... +260 °C
- PTFE: -50 ... +260 °C
- PVC: -20 ... +105 °C

Kapton / Kapton

500 °F (260 °C)
Polyimide tape insulation for improved electrical properties and high temperature applications.

500 °F (260 °C)
Polyimide tape jacket for excellent abrasion and cut through properties and very high resistance to moisture and chemicals.

Fibreglass / Fibreglass

900 °F (482 °C)
Wrapped fibreglass insulation for improved moisture and abrasion resistance at high temperatures.

900 °F (482 °C)
Braided fibreglass for additional flexibility and abrasion resistance at high temperatures.

PVC / PVC

221 °F (105 °C)
PVC insulation for economy, durability and mechanical strength.

221 °F (105 °C)
PVC jacket for economy, durability and mechanical strength. It is also tough and resistant to flame, abrasion and moisture.

PTFE / PTFE

500 °F (260 °C)
PFA insulation for improved electrical properties and high temperature applications.

500 °F (260 °C)
PFA jacket for chemical inertness to solvents, acids and oils.
Plug (option)

TC47-NT thermocouple can be supplied with plugs attached to the conductors. The maximum permissible temperature at the plug is 85 °C.

The following options are available:

- **Spade lugs**
  (not suitable for versions with bare connecting wires)

- **Lemosa plug size 1 S** (male)
- **Lemosa plug size 2 S** (male)

- **Lemosa plug size 1 S** (female)
- **Lemosa plug size 2 S** (female)

- **Screw-in-plug, Binder** (male)
- **Screw-in-plug, Binder** (female)

- **Standard thermo plug 2-pin** (male)
- **Miniature thermo plug 2-pin** (male)

- **Standard cable clamp** (option with thermo plug)
- **Miniature cable clamp** (option with thermo plug)

- **Standard thermo plug 2-pin** (female)
- **Miniature thermo plug 2-pin** (female)
Electrical connection

Thermocouple and extension wire colour codes
## IEC tolerance values per EN 60584-2

<table>
<thead>
<tr>
<th>Thermocouple type</th>
<th>Temperature range</th>
<th>Tolerance class 1</th>
<th>Tolerance class 2</th>
<th>Tolerance class 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td></td>
<td>±0.5 °C</td>
<td>±1.0 °C</td>
<td>±1.0 °C</td>
</tr>
<tr>
<td></td>
<td>-40...+125 °C</td>
<td>±0.004 °C</td>
<td>±0.0075 °C</td>
<td>±0.015 °C</td>
</tr>
<tr>
<td>J</td>
<td></td>
<td>±1.5 °C</td>
<td>±2.5 °C</td>
<td>±2.5 °C</td>
</tr>
<tr>
<td></td>
<td>-40...+375 °C</td>
<td>±0.004 °C</td>
<td>±0.0075 °C</td>
<td>±0.015 °C</td>
</tr>
<tr>
<td>E</td>
<td></td>
<td>±1.5 °C</td>
<td>±2.5 °C</td>
<td>±2.5 °C</td>
</tr>
<tr>
<td>K or N</td>
<td></td>
<td>±0.004 °C</td>
<td>±0.0075 °C</td>
<td>±0.015 °C</td>
</tr>
<tr>
<td>R or S</td>
<td></td>
<td>±1.0 °C</td>
<td>±1.5 °C</td>
<td>±1.5 °C</td>
</tr>
<tr>
<td></td>
<td>0...+1100 °C</td>
<td>±0.004 °C</td>
<td>±0.0075 °C</td>
<td>±0.015 °C</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>±2.2 °C</td>
<td>±4.0 °C</td>
<td>±2.0 °C</td>
</tr>
</tbody>
</table>

## ASTM tolerance values (ASTM E230)

<table>
<thead>
<tr>
<th>Thermocouple type</th>
<th>Standard limits (whichever value is greater)</th>
<th>Special limits (whichever value is greater)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>0...+370 °C ±1 °C or ±0.75 %</td>
<td>0...+370 °C ±1.8 °C or ±0.75 %</td>
</tr>
<tr>
<td></td>
<td>±32 °C or ±2300 °F</td>
<td>±32 °C or ±2.30 °F</td>
</tr>
<tr>
<td></td>
<td>-200 °C or -32 °C ±1.8 °F or ±1.5 %</td>
<td>-200 °C or -32 °C ±4.0 °F or ±1.5 %</td>
</tr>
<tr>
<td>J</td>
<td>0...+760 °C ±2.2 °C or ±0.75 %</td>
<td>0...+760 °C ±4.0 °C or ±0.75 %</td>
</tr>
<tr>
<td></td>
<td>±32 °C or ±1400 °F</td>
<td>±32 °C or ±2.10 °F</td>
</tr>
<tr>
<td></td>
<td>-200 °C or -32 °C ±1.8 °F or ±1.5 %</td>
<td>-200 °C or -32 °C ±4.0 °F or ±1.5 %</td>
</tr>
<tr>
<td>E</td>
<td>0...+870 °C ±1.7 °C or ±0.5 %</td>
<td>0...+870 °C ±3.1 °C or ±0.5 %</td>
</tr>
<tr>
<td></td>
<td>±32 °C or ±1600 °F</td>
<td>±32 °C or ±3.10 °F</td>
</tr>
<tr>
<td></td>
<td>-200 °C or -32 °C ±1.8 °F or ±1.5 %</td>
<td>-200 °C or -32 °C ±4.0 °F or ±1.5 %</td>
</tr>
<tr>
<td>K</td>
<td>0...+1260 °C ±2.2 °C or ±0.75 %</td>
<td>0...+1260 °C ±4.0 °C or ±0.75 %</td>
</tr>
<tr>
<td></td>
<td>±32 °C or ±2300 °F</td>
<td>±32 °C or ±2.30 °F</td>
</tr>
<tr>
<td></td>
<td>-200 °C or -32 °C ±1.8 °F or ±1.5 %</td>
<td>-200 °C or -32 °C ±4.0 °F or ±1.5 %</td>
</tr>
<tr>
<td>N</td>
<td>0...+1260 °C ±2.2 °C or ±0.75 %</td>
<td>0...+1260 °C ±4.0 °C or ±0.75 %</td>
</tr>
<tr>
<td></td>
<td>±32 °C or ±2300 °F</td>
<td>±32 °C or ±2.30 °F</td>
</tr>
<tr>
<td>R or S</td>
<td>0...+1480 °C ±1.5 °C or ±0.25 %</td>
<td>0...+1480 °C ±2.7 °C or ±0.25 %</td>
</tr>
<tr>
<td></td>
<td>±32 °C or ±2700 °F</td>
<td>±32 °C or ±2.70 °F</td>
</tr>
<tr>
<td></td>
<td>-200 °C or -32 °C ±1.6 °F or ±1.0 %</td>
<td>-200 °C or -32 °C ±4.0 °F or ±1.0 %</td>
</tr>
<tr>
<td>B</td>
<td>870 °C or 1700 °C ±0.5 °C or ±0.5 %</td>
<td>870 °C or 1700 °C ±0.5 °C or ±0.5 %</td>
</tr>
<tr>
<td></td>
<td>±1600 °C or ±3100 °F</td>
<td>±1600 °C or ±3100 °F</td>
</tr>
</tbody>
</table>
Ordering information

The nozzle thermocouple is secured into place by a threaded bolt. This sensor measures temperature at the bottom of the bored hole. The nozzle thermocouple is a low profile sensor that is used in applications where tight secure lockdown is necessary.

When ordering choose from each category.

Nozzle bolt material
- Stainless steel
- Brass
- Others on request

Junction
- Grounded (unisolated)
- Ungrounded (isolated)

Nozzle bolt thread size
- 1/4 x 28
- M6
- M8
- Others on request

Lead length
- 500 mm
- 1000 mm
- 1500 mm
- 2000 mm
- 2500 mm
- Others on request

Lead wire
- Fibreglass / fibreglass
- PTFE / PTFE
- PVC / PVC
- Kapton / Kapton
- Others on request

Lead wire covering
- None
- Stainless steel overbraid (no tracer)
- Stainless steel overbraid (with tracer)
- Tin copper overbraid

Termination at lead end
- Bare ends
- Standard thermo plug 2-pin (male)
- Miniature thermo plug 2-pin (male)
- Standard plug with cable clamp (male)
- Miniature plug with cable clamp (male)
- Lemosa plug size 1S (male)
- Lemosa plug size 2S (male)
- Screw-in plug, Binder (male)
- Others on request

Calibration type
- J ANSI MC96.1 red ⊖ white ⊕
- K ANSI MC96.1 red ⊖ yellow ⊕
- T ANSI MC96.1 red ⊖ blue ⊕
- J IEC 584-3 white ⊖ black ⊕
- K IEC 584-3 white ⊖ green ⊕
- T IEC 584-3 white ⊖ brown ⊕
- J DIN 43714 blue ⊖ red ⊕
- K DIN 43714 green ⊖ red ⊕
- T DIN 43714 brown ⊖ red ⊕
- Others on request