Industrial Vacuum Furnace Thermocouples - Type 40 & 41

Ceramic insulated thermocouple sensors with integral Spectite® vacuum seal.

For high temperature service up to 1600°C in vacuum applications.

Wide range of designs and sizes to suit all styles of vacuum furnace.

TC Ltd for Temperature Sensing, Measurement and Control

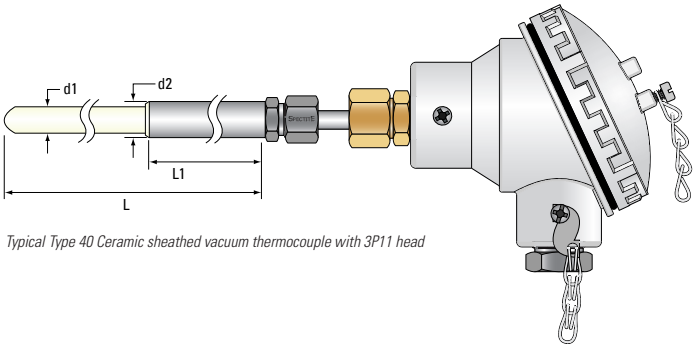
Type 40 & 41 Industrial Vacuum Furnace Thermocouples

Ceramic Sheathed Vacuum Thermocouples

Type 40/41 assemblies incorporate an integral Spectite® seal and are ideal for vacuum furnace applications. The Spectite® vacuum seal is rated to 5 x 10^{-6} torr with low leak rates (better than or equal to 1 x 10^{-6} scc/sec. under 1 Atm @ 20°C). These sensors can be supplied to all recognised standards and tolerances when combined with our UKAS calibration services (see section 7). They are available as simplex or duplex and a wide range of support tube fittings for attachment into the process is available.

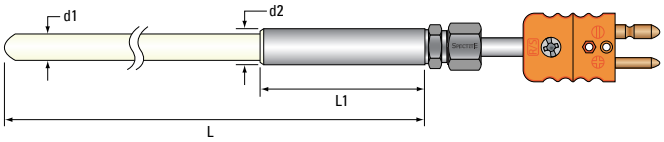
- **Vacuum seal rated 5 x 10^{-6} torr**
- **Low leak rates**
- **Integral Spectite® seal on internal wires maintains vacuum even if sheath is damaged**
- **Wide operating temperature range up to 1600°C**
- **Wide range of attachments for process installation**
- **Simplex and Duplex versions available**
- **UKAS and In-House calibration options available to all major international and industry specific standards**
- **Flexible tagging options available for clear traceability**
- **Support tubes as standard are made from 316 Stainless Steel**

Type 40 - Ceramic Sheathed Vacuum Furnace Thermocouple with Insulated Junction



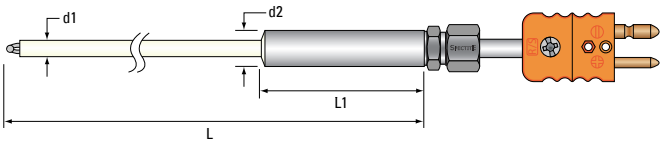
Typical Type 40 Ceramic sheathed vacuum thermocouple with 3P11 head

Type 40 - Ceramic Sheathed Vacuum Furnace Thermocouple with Insulated Junction



Typical Type 40 Ceramic sheathed vacuum thermocouple with standard plug

Type 41 - Ceramic Sheathed Vacuum Furnace Thermocouple with Exposed Junction



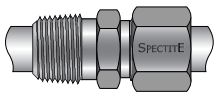
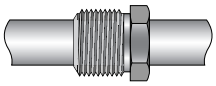
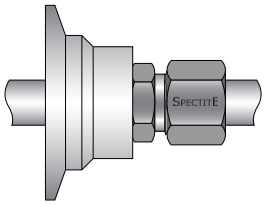
Typical Type 41 Exposed junction ceramic sheathed vacuum thermocouple with standard plug

SECTION 1	Thermocouple Type	Temperature Range (continuous)	Temperature Range (short term)
K	Nickel Chromium vs Nickel Aluminium	0°C to +1100°C	-180 to +1350°C
N	Nicrosil vs Nisil	0°C to +1200°C	-270 to +1300°C
R	Platinum - 13% Rhodium vs Platinum	0 to +1600°C	-50 to +1750°C
S	Platinum - 10% Rhodium vs Platinum	0 to +1550°C	-50 to +1700°C
B	Platinum - 30% Rhodium vs Platinum - 6% Rhodium	+100 to +1600°C	+100 to +1820°C

SECTION 2	Sheath Material	Operational Properties	Maximum Temperature
IAP	**Impervious Aluminous Porcelain**	Ideally suited for use with base metal thermocouples. Has a very low temperature coefficient of expansion thus giving excellent resistance to thermal shock. Offers high strength and high resistance to flux and slag attack. Suited to kiln applications where low contamination requirements preclude the use of a metal sheath. NB. Requires support at high temperature if horizontal.	1400°C
IRA	**Impervious Recrystallised Alumina**	Ideally suited for use with precious metal thermocouples at high temperatures. Provides a fair resistance to thermal shock. High degree of inertness to chemicals. Ideal for reducing carbonaceous atmospheres and offers a high resistance to alkaline and other fluxes.	1600°C

SECTION 3	Ceramic Sheath Diameter 'd1'	Support Tube Diameter 'd2'	Type No.
Standard Sizes	3.0mm	6.0mm	41 (simplex only)
	3.5mm	6.0mm	41 (duplex only)
	4.0mm	6.0mm	40 or 41
	6.0mm	10.0mm	40 or 41
	8.0mm	12.0mm	40
	10.0mm	15.9mm	40
	12.0mm	15.9mm	40

SECTION 4	Types of Sensing Junction	
2I		**Insulated (Type 40)** Hot junction insulated from sheath (or **2ID** if **Duplex** element is required).
2X		**Exposed (Type 41)** Fastest response, mainly for the measurement of air temperature in ducts (or **2XD** if **Duplex** element is required).

SECTION 5	Support Tube Mounting Fittings: Description	Material	Thread	Sketch
PF	Vacuum Feedthrough with Viton sealant as standard	Stainless Steel	1/4" BSPT 1/2" BSPT or 3/4" BSPT	
WBPSA	Welded Fixed Position Screwed Bushes	Stainless Steel	3/4" BSPP	
WBTSA			3/4" BSPT	
WBPSB			1" BSPP	
WBTSB			1" BSPT	
KFW	KFW - Welded KF vacuum flange	Stainless Steel	N/A	
CFW	CFW - Welded CF (ConFlat) vacuum flange	Stainless Steel	N/A	

Industrial Vacuum Furnace Thermocouples Type 40 & 41

SECTION 6 — Types of End Seal Configuration

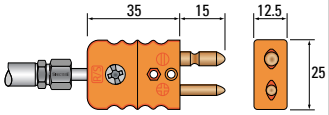
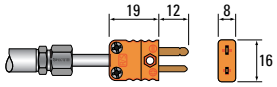
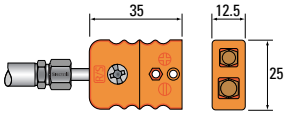
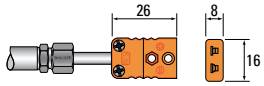
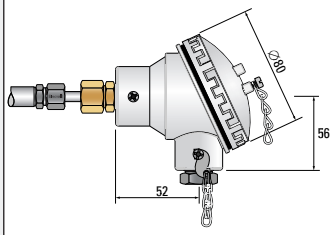
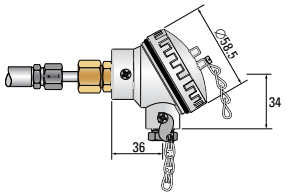
	Diagram	Specification
3P6	 *3P6 illustrated*	**Standard 2-pin (round) Plug** **3P6** Plug rated to **220**°C **3P6H** Plug rated to **300**°C **3P6UH** Plug rated to **425**°C **3P6C** Plug rated to **600**°C
3P6M	 *3P6M illustrated*	**Miniature 2-pin (flat) Plug** **3P6M** Plug rated to **220**°C **3P6MH** Plug rated to **300**°C **3P6MUH** Plug rated to **425**°C **3P6MC** Plug rated to **600**°C
3P7	 *3P7 illustrated*	**Standard 2-pin (round) Socket** **3P7** Socket rated to **220**°C **3P7H** Socket rated to **300**°C **3P7UH** Socket rated to **425**°C **3P7C** Socket rated to **600**°C
3P7M	 *3P7M illustrated*	**Miniature 2-pin (flat) Socket** **3P7M** Socket rated to **220**°C **3P7MH** Socket rated to **300**°C **3P7MUH** Socket rated to **425**°C **3P7MC** Socket rated to **600**°C

	Diagram	Specification
3P11		**Standard Die Cast Alloy Head** Weatherproof die cast alloy, epoxy coated, screw top terminal head with the tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex, duplex and triplex assemblies. Supplied with a 20mm x 1.5mm ISO metal pinch gland on cable entry for cables from 6mm to 14mm diameter.
3P10		**Miniature Die Cast Alloy Head** Weatherproof die cast alloy, epoxy coated, screw top terminal head with the tube entry and cable entry at a right angle to each other. Supplied with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 16mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 3mm to 8mm diameter.

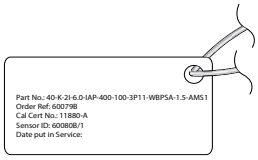
Other terminations are available, please contact us for details.

SECTION 7 — Calibration Accuracies

Standard		Accuracy Supplied	Certification
IEC1	**IEC 60584.1 Class 1**	Types K/N: +/-1.5°C (-40 to +375°C) or 0.4% (375 to 1000°C) Types R/S: +/-1.0°C (0 to 1100°C) or 1°C + 0.3% of temperature above 1100°C (1100 to 1600°C)	TC Ltd offer both UKAS and In-House (traceable to national standards) calibrations to all major international standards up to 1590°C. Our laboratory is fully accredited to ISO17025 and our reports are designed with the requested standard in mind. Our sales engineers are on hand to discuss any requirements so please do not hesitate to contact us for more details.
AMS1	**AMS2750**	Types K/N: ±1.1°C or 0.4% Type R/S: +/-1.0°C or 0.25% Type B: +/-1.0°C or 0.50% (whichever is greater)	
BAC2	**BAC5621**	±1.1°C <538°C or 0.4% of reading >538°C	

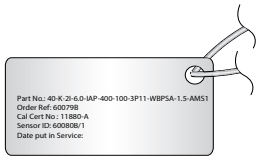
SECTION 8 — Optional Tagging

PL



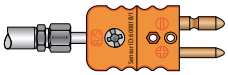
Plastic ID Label
Rated 70°C. Suitable for all end seals.

ML



Laser Etched Metal Tag
Rated 250°C. Suitable for all end seals.

EL



Laser Etching on Sensor
Laser etch of serial number. This can be instead of or in addition to either of the options above and positioned on the support tube, vacuum fitting or connector as required.

Order Code - Example

Style No.	Thermocouple Type (see section 1)	No. of Elements (see section 4)	Sheath Diameter (d1) (see section 3)	Sheath Material (see section 2)	Sensor Length (L) (in mm)	Support Tube Length (L1) (in mm, if required)	End Seal Termination (see section 6)	Sheath Fitting* (if required, see section 5)	Calibration Accuracy (see section 7)
40	**K**	**2I**	**6.0**	**IAP**	**400**	**100**	**3P11**	**WBPSA**	**AMS1**

** If fixed, specify sheath length under hex (parallel thread) or under thread start (tapered thread) or under flange (welded flange).*

Calibration Details (Optional)

UKAS (U) / In House (I)	Calibration Range (see section 1)	Interval / Custom Temperatures (in °C)
U	**500/1300**	**100**

Tagging Options

Plastic ID Label (see section 8)	or	Metal Tag Label (see section 8)	Etched on Sensor (see section 8)
PL	**or**	**ML**	**EL**

Type 40S Industrial SAT Vacuum Furnace Thermocouples

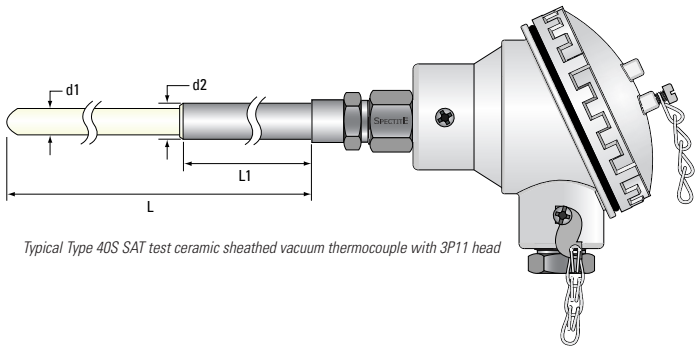
SAT Ceramic Sheathed Vacuum Thermocouples

Type 40S assemblies incorporate an integral Spectite® seal and are ideal for vacuum furnace applications. The Spectite® vacuum seal is rated to 5 x 10^{-6} torr with low leak rates (better than or equal to 1 x 10^{-6} scc/sec. under 1 Atm @ 20°C). These sensors can be supplied to all recognised standards and tolerances when combined with our UKAS calibration services (see section 8). They are available as simplex or duplex and include a test sensor hole for calibration / survey work. A wide range of support tube fittings for attachment into the process is available.

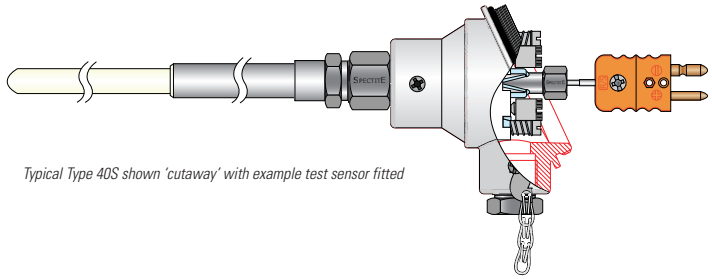
- **Vacuum seal rated 5 x 10^{-6} torr**
- **Low leak rates**
- **Integral Spectite® seal on internal wires maintains vacuum even if sheath is damaged**
- **Wide operating temperature range up to 1600°C**
- **Wide range of attachments for process installation**
- **Test sensor hole for calibration or system accuracy tests (SAT) without removal from process***
- **Simplex and Duplex versions available**
- **UKAS and In-House calibration options available to all major international and industry specific standards**
- **Flexible tagging options available for clear traceability**
- **Support tubes as standard are made from 316 Stainless Steel**

** Available with terminal head end seals only, see section 7 for details*

Type 40S - SAT Test Ceramic Sheathed Vacuum Furnace Thermocouple with Insulated Junction



Typical Type 40S SAT test ceramic sheathed vacuum thermocouple with 3P11 head



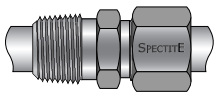
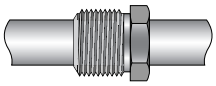
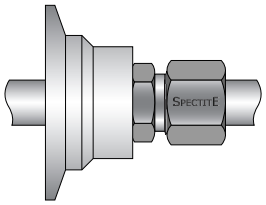
Typical Type 40S shown 'cutaway' with example test sensor fitted

SECTION 1	Thermocouple Type	Temperature Range (continuous)	Temperature Range (short term)
K	Nickel Chromium vs Nickel Aluminium	0°C to +1100°C	-180 to +1350°C
N	Nicrosil vs Nisil	0°C to +1200°C	-270 to +1300°C
R	Platinum - 13% Rhodium vs Platinum	0 to +1600°C	-50 to +1750°C
S	Platinum - 10% Rhodium vs Platinum	0 to +1550°C	-50 to +1700°C
B	Platinum - 30% Rhodium vs Platinum - 6% Rhodium	+100 to +1600°C	+100 to +1820°C

SECTION 2	Sheath Material	Operational Properties	Maximum Temperature
IAP	**Impervious Aluminous Porcelain**	Ideally suited for use with base metal thermocouples. Has a very low temperature coefficient of expansion thus giving excellent resistance to thermal shock. Offers high strength and high resistance to flux and slag attack. Suited to kiln applications where low contamination requirements preclude the use of a metal sheath. NB. Requires support at high temperature if horizontal.	**1400°C**
IRA	**Impervious Recrystallised Alumina**	Ideally suited for use with precious metal thermocouples at high temperatures. Provides a fair resistance to thermal shock. High degree of inertness to chemicals. Ideal for reducing carbonaceous atmospheres and offers a high resistance to alkaline and other fluxes.	**1600°C**

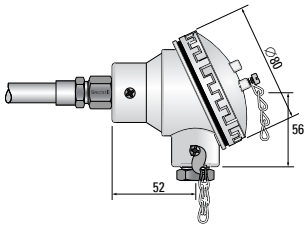
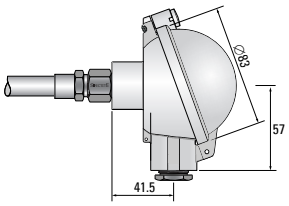
SECTION 3	Ceramic Sheath Diameter 'd1'	Support Tube Diameter 'd2'	Type No.
Standard Sizes	12.0mm	15.9mm	40S
	17.0mm	26.7mm	40S
	20.0mm	26.7mm	40S

SECTION 4	Types of Sensing Junction	
2I		**Insulated (Type 40)** Hot junction insulated from sheath (or **2ID** if **Duplex** element is required).

SECTION 5	Support Tube Mounting Fittings: Description	Material	Thread	Sketch
PF	Vacuum Feedthrough with Viton sealant as standard	Stainless Steel	1/4" BSPT 1/2" BSPT or 3/4" BSPT	
WBPSA	Welded Fixed Position Screwed Bushes	Stainless Steel	3/4" BSPP	
WBTSA			3/4" BSPT	
WBPSB			1" BSPP	
WBTSB			1" BSPT	
KFW	KFW - Welded KF vacuum flange	Stainless Steel	N/A	
CFW	CFW - Welded CF (ConFlat) vacuum flange	Stainless Steel	N/A	

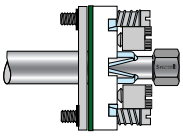
Industrial SAT Vacuum Furnace Thermocouples Type 40S

SECTION 6 — Types of End Seal Configuration

	Diagram	Specification		Diagram	Specification
3P11		**Standard Die Cast Alloy Head** Weatherproof die cast alloy, epoxy coated, screw top terminal head with the tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex and duplex assemblies. Supplied with a 20mm x 1.5mm ISO metal pinch gland on the cable entry for cables from 6mm to 14mm diameter.	**3P13A**		**Die Cast Alloy Head with Flip Top Lid** DIN Form A weatherproof die cast alloy, epoxy coated, flip top terminal head with the tube entry and cable entry at a right angle to each other, with a ceramic terminal block. Suitable for simplex, and duplex assemblies. Supplied with a PG16 metal pinch gland on the cable entry for cables from 6mm to 14mm diameter.

Other terminations are available, please contact us for details.

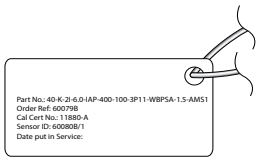
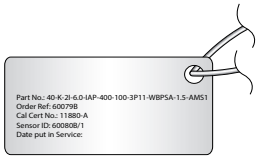
SECTION 7 — Test Sensor Hole

	Sketch	Description
		Hole supplied for test sensors with a diameter of 1.5mm or 2.0mm. Other diameters are available on request, please contact us for more details.

SECTION 8 — Calibration Accuracies

	Standard	Accuracy Supplied	Certification
IEC1	**IEC 60584.1 Class 1**	Types K/N: +/-1.5°C (-40 to +375°C) or 0.4% (375 to 1000°C) Types R/S: +/-1.0°C (0 to 1100°C) or 1°C + 0.3% of temperature above 1100°C (1100 to 1600°C)	TC Ltd offer both UKAS and In-House (traceable to national standards) calibrations to all major international standards up to 1590°C. Our laboratory is fully accredited to ISO17025 and our reports are designed with the requested standard in mind. Our sales engineers are on hand to discuss any requirements so please do not hesitate to contact us for more details.
AMS1	**AMS2750**	Types K/N: ±1.1°C or 0.4% Type R/S: +/-1.0°C or 0.25% Type B: +/-1.0°C or 0.50% (whichever is greater)	
BAC2	**BAC5621**	±1.1°C <538°C or 0.4% of reading >538°C	

SECTION 9 — Optional Tagging

PL	 **Plastic ID Label** Rated 70°C. Suitable for all end seals.
ML	 **Laser Etched Metal Tag** Suitable for all end seals.

Order Code - Example

Style No.	Thermocouple Type (see section 1)	No. of Elements (see section 4)	Sheath Diameter (d1) (see section 3)	Sheath Material (see section 2)	Sensor Length (L) (in mm)	Support Tube Length (L1) (in mm, if required)	End Seal Termination (see section 6)	Sheath Fitting* (if required, see section 5)	Test Sensor Hole (see section 7, specify diameter of 1.5mm or 2mm)	Calibration Accuracy (see section 8)
40S	**K**	**2I**	**12.0**	**IAP**	**400**	**100**	**3P11**	**WBPSA**	**1.5**	**AMS1**

** If fixed, specify sheath length under hex (parallel thread) or under thread start (tapered thread) or under flange (welded flange)*

Calibration Details (Optional)

UKAS (U) / In House (I)	Calibration Range (see section 1)	Interval / Custom Temperatures (in °C)
U	**500/1300**	**100**

Tagging Options

Plastic ID Label (see section 9)	or	Metal Tag Label (see section 9)	Etched on Sensor (see section 9)
PL	**or**	**ML**	**EL**

PO Box 130
Uxbridge
UB8 2YS
United Kingdom
Tel: 01895 252222
International: +44 1895 252222
Email: info@tc.co.uk
Web: www.tc.co.uk

Issue Number: 0920

TC Ltd for Temperature Sensing, Measurement and Control