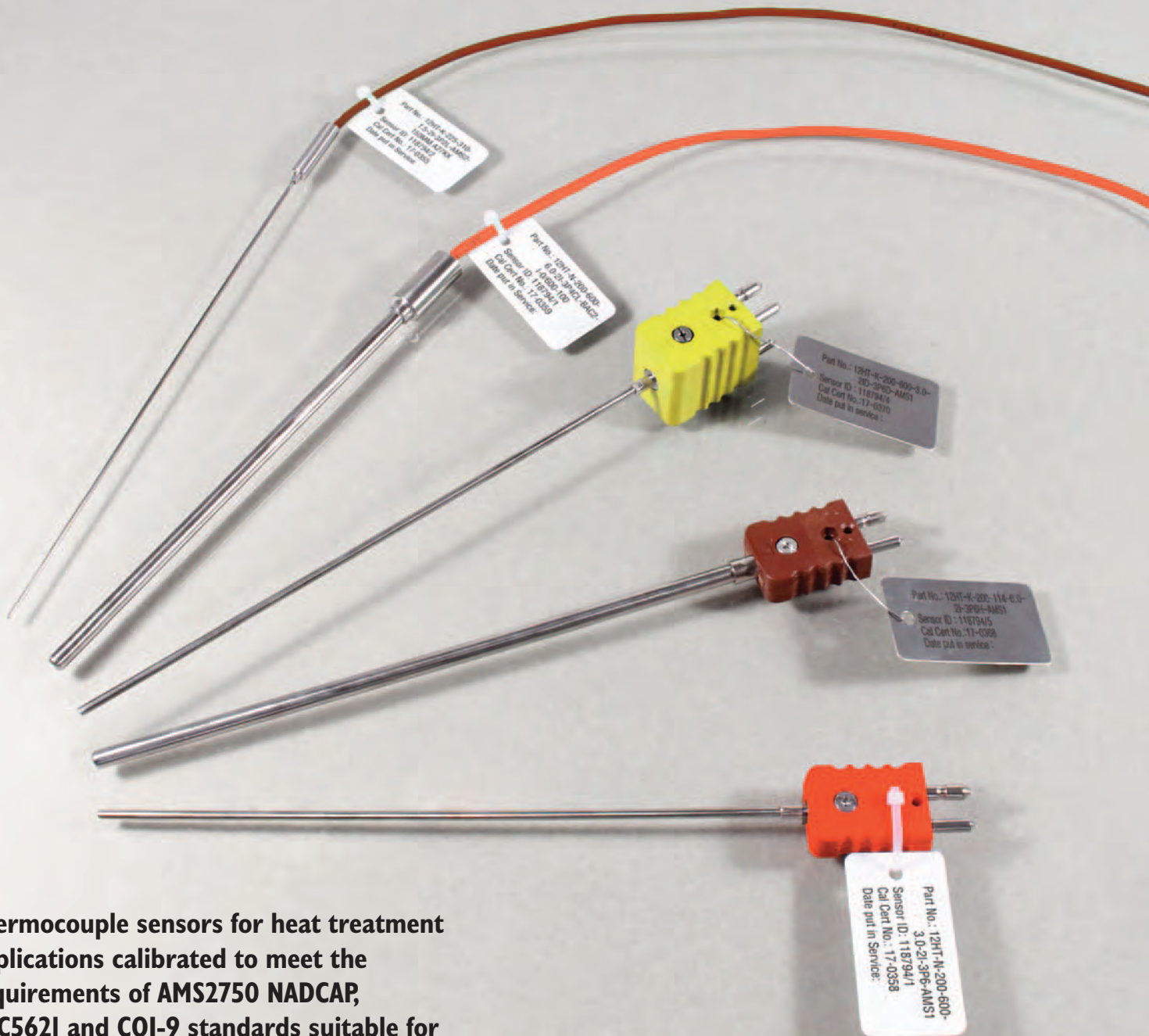




Calibrated Thermocouples for Heat Treatment Applications - Type 12HT



Thermocouple sensors for heat treatment applications calibrated to meet the requirements of AMS2750 NADCAP, BAC562I and CQI-9 standards suitable for use in Temperature Uniformity Surveys (TUS), System Accuracy Tests (SAT) and as Control, Monitoring and Load Sensors.

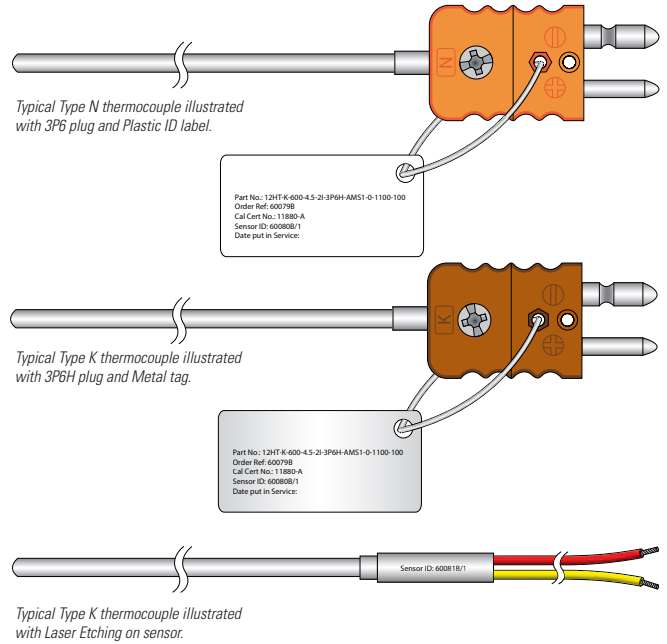
Type 12HT Calibrated Heat Treatment Thermocouples

Calibrated Mineral Insulated Thermocouples

Our range of **AMS2750 NADCAP, BAC5621 or CQI-9 Compliant** mineral insulated thermocouples are designed to meet the high quality and accuracies demanded for heat treatment applications within the Aerospace industry. Through careful material selection and a comprehensive calibration program in our ISO17025 UKAS accredited laboratory, we can offer a wide range of sheath diameters and materials from stock with quick manufacture times. Their semi rigid construction allows them to be bent and formed to suit particular applications without impairing performance.

- Calibrated in line with **AMS 2750 NADCAP, BAC5621 or CQI-9** requirements
- Suitable for use in **Temperature Uniformity Surveys (TUS), System Accuracy Tests (SAT), Control Recording and Monitoring and Load sensors**
- **Batch calibration certificate supplied as standard**
- **Sensors are individually tagged and numbered for full traceability**
- Available in thermocouple types **N, K, T and J**
- **Wide range of sheath diameters and materials**

**AMS2750 NADCAP,
BAC5621 or CQI-9
certified**



SECTION 1	Thermocouple Type	Temperature Range	
		(continuous)	(short term)
N	Nicrosil vs Nilil	32°F to +2010°F	-450°F to +2370°F
K	Nickel Chromium vs Nickel Aluminium	32°F to +2010°F	-290°F to +2460°F
T	Copper vs Constantan	-300°F to +570°F	-420°F to +750°F
J	Iron vs Constantan	+68°F to +1290°F	-290°F to +1380°F

SECTION 2	Sheath Specifications	Operational Properties	Maximum Temperature
600	Inconel 600* Nickel/Chromium/Iron alloy To BS 3074 : 1974, Werkstoff No : 2.4816	Used in severely corrosive atmospheres to elevated temperatures. Has good resistance to oxidation. Do not use in sulphur bearing atmospheres above 1020°F.	2010°F
114	Microtherm D™ Nickel/Chromium/Silicon/Molybdenum 73/22/1.4/3	For high temperature Type 'K' and almost all Type 'N'. Very good high temperature strength. Excellent in oxidising, carburising, reducing and vacuum atmospheres. Do not use in sulphur containing atmospheres.	2280°F
310	Grade 310 Stainless Steel 25/20 Nickel/Chromium To BS 970 Part 4 : 1970	Good high temperature corrosion resistance and suitable for use in sulphur bearing atmospheres. Has high oxidation resistance which is maintained if subsequent manipulation is strictly limited.	2010°F
321	Grade 321 Stainless Steel 18/8/1 Nickel/Chromium/Titanium Stabilized To BS 970 Part 4 : 1970	Very good corrosion resistance throughout the operating temperature range. Suited to a wide range of industrial applications. Enjoys high ductility.	1470°F

SECTION 3	Sheath Diameter (inches)	Sheath Diameter (mm)
Standard Sizes	0.059"	1.5mm
	0.063"	1.6mm (1/16")
	0.079"	2.0mm
	0.118"	3.0mm
	0.125"	3.2mm (1/8")
	0.177"	4.5mm
	0.236"	6.0mm
	0.250"	6.35mm (1/4")
	0.315"	8.0mm

SECTION 4	Types of Sensing Junction	
2I		Insulated The hot (measuring) junction is insulated from the sheath and this gives a floating output with a typical insulation resistance in excess of 100 megohms. Enter 2I for simplex or 2ID for duplex.
2ID		

SECTION 5	Tagging
PL	 Plastic ID Label Rated 150°F. For use with all end seals.
ML	 Laser Etched Metal Tag For use with all end seals above 480°F.
EL	 Laser Etching on Sensor Laser etch of serial number. This can be instead of or in addition to either of the options above.

SECTION 6	Calibration Accuracies			
	Standard	Accuracy Supplied	Permitted Applications	Certification
AMS1	AMS2750	±2.0°F or 0.4% of reading (whichever is greater). End to end deviation of material batch no greater than 2.0°F	Temperature Uniformity Survey (TUS) System Accuracy Test (SAT) Control, Monitoring & Recording (Class 1 & 2)	An in-house 3-page report for the start/end of batch from 32-2190°F with all the information NADCAP auditors require (please refer to the Calibration Details section for a detailed explanation). Please note: UKAS calibration is available on request.
BAC2	BAC5621	±2.0°C <1000°F or 0.4% of reading >1000°F. End to end deviation of material batch no greater than 1.0°F	Secondary/Field Test Sensor	
CQI1	CQI-9	±2.0°F or 0.4% of reading (whichever is greater). End to end deviation of material batch no greater than 2.2°F	Temperature Uniformity Survey (TUS) System Accuracy Test (SAT) Control, Monitoring & Recording (Class 1 & 2) Load	

Calibrated Heat Treatment Thermocouples **Type 12HT**

SECTION 7		Types of End Seal Configuration			
	Diagram	Specification		Diagram	Specification
3P1		Internal Seal with Bare Conductors for all sheath diameters 3P1 Maximum end seal temperature 275°F 3P1B Maximum end seal temperature 570°F	3P6		Standard 2-pin (round) Plug for sheath diameters between 0.059" & 0.315" 3P6 Plug rated to 425°F 3P6H Plug rated to 570°F 3P6UH Plug rated to 790°F 3P6E Plug rated to 1110°F
3P2L		Crimp on Stainless Steel Pot Seal for sheath diameters up to 0.118" 3P2L Pot Seal rated to 275°F 3P2LA Pot Seal rated to 455°F 3P2LB Pot Seal rated to 570°F <i>see section 9 if extension leads are required</i>	3P6M		Miniature 2-pin (flat) Plug for sheath diameters between 0.059" & 0.118" 3P6M Plug rated to 425°F 3P6MH Plug rated to 570°F 3P6MUH Plug rated to 790°F 3P6ME Plug rated to 1110°F
3P2TRL		Stainless Steel Pot Seal with Anti Chafe Spring for sheath diameters up to 0.118" 3P2TRL Pot Seal rated to 275°F 3P2TRLA Pot Seal rated to 455°F 3P2TRLB Pot Seal rated to 570°F <i>see section 9 if extension leads are required</i> <small>* It is unlikely that any benefit would be derived from specifying this type of pot seal with the standard 4" tails.</small>	3P7		Standard 2-pin (round) Socket for sheath diameters between 0.059" & 0.315" 3P7 Socket rated to 425°F 3P7H Socket rated to 570°F 3P7UH Socket rated to 790°F 3P7E Socket rated to 1110°F
3P4CL		Crimp on Stainless Steel Pot Seal for sheath diameters between 0.118" & 0.315" 3P4CL Pot Seal rated to 275°F 3P4CLA Pot Seal rated to 455°F 3P4CLB Pot Seal rated to 570°F <i>see section 9 if extension leads are required</i>	3P7M		Miniature 2-pin (flat) Socket for sheath diameters between 0.059" & 0.118" 3P7M Socket rated to 425°F 3P7MH Socket rated to 570°F 3P7MUH Socket rated to 790°F 3P7ME Socket rated to 1110°F
3P4CTRL		Stainless Steel Pot Seal with Anti Chafe Spring for sheath diameters between 0.118" & 0.315" 3P4CTRL Pot Seal rated to 275°F 3P4CTRLA Pot Seal rated to 455°F 3P4CTRLB Pot Seal rated to 570°F <i>see section 9 if extension leads are required</i> <small>* It is unlikely that any benefit would be derived from specifying this type of pot seal with the standard 4" tails.</small>	3P6D		Standard DUPLEX 2-pin (round) Plug for sheath diameters 0.236" & 0.315" 3P6D Plug rated to 425°F 3P6DH Plug rated to 570°F 3P6DUH Plug rated to 790°F 3P6DE Plug rated to 1110°F

SECTION 8		Extension Wires			
	Diagram	Specification		Diagram	Specification
A30		HR PVC Flat Twin (220°F) One pair of stranded 24AWG conductors. Cores HR PVC insulated. Pair laid flat. HR PVC sheathed overall.	C20		Fibreglass Flat Twin (896°F) One pair of solid 24AWG conductors. Cores double glass fibre lapped, braided and silicone varnished. Pair laid flat, glass fibre braided overall and silicone varnished.
A27		HR PVC Twisted Pair with Screen (220°F) One pair of stranded 24AWG conductors. Cores HR PVC insulated. Pair twisted, screened with Mylar aluminium tape and drain wire. HR PVC sheathed overall.	C40		Fibreglass Flat Twin (896°F) One pair of stranded 24AWG conductors. Cores double glass fibre lapped, braided and silicone varnished. Pair laid flat, glass fibre braided overall and silicone varnished.
B20		PFA Flat Twin (480°F) One pair of solid 24AWG conductors. Cores PFA insulated. Pair laid flat. PFA sheathed overall.	C60		Fibreglass Flat Twin with Steel Braid (896°F) One pair of stranded conductors. Cores double glass fibre lapped, braided and silicone varnished. Pair laid flat, glass fibre braided and silicone varnished. Steel wire braided overall.
B50		PFA Flat Twin (480°F) One pair of stranded 24AWG conductors. Cores PFA insulated. Pair laid flat. PFA sheathed overall.	M 1702		PVC 2-Pair - for Duplex Sensors (220°F) 2 pairs of 24AWG dia conductors FR PVC insulated. Pairs twisted and individually screened with Mylar aluminium tape with a drainwire. Pairs laid up, overall screened with Mylar aluminium tape with a drainwire. FR PVC sheathed.
B80		PFA Twisted Pair with Screen (480°F) One pair of stranded 24AWG conductors. Cores PFA insulated. Pair twisted, screened with Mylar aluminium tape and drain wire. PFA sheathed overall.	BM 0702		PFA 2-Pair - for Duplex Sensors (480°F) Two pairs of 24AWG dia conductors PFA insulated. Pairs twisted and bunched and screened with Mylar aluminium tape with a drainwire. PFA sheathed.

If no wire is required, leave this section of the order code blank and the sensor will be supplied with 2" PTFE tails

Order Code - Example									
Style No.	Thermocouple Type (see section 1)	Sheath Length (in inches)	Sheath Material (see section 2)	Sheath Diameter (see section 3)	Sensing Junction (see section 4)	End Seal Termination (see section 7)	Extension Wire (see section 8)	Calibration Accuracy (see section 6)	
12HT	- N	- 70	- 600	- 0.118"	- 2I	- 3P4CLA	- 40"	B50NX	- AMS1

Alternative Calibration Details (Optional)*		
UKAS (U) / In House (I)	Calibration Range (see section 1)	Interval / Custom Temperatures (in °F)
U	- 930/2370	- 212

Tagging Options		
Plastic ID Label (see section 5) or	Metal Tag Label (see section 5)	Etched on Sensor (see section 5)
PL or	ML	- EL

*For custom ranges or individual probe calibration. See section 6 and page 4 for further details of our standard calibration report.

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Calibration Details

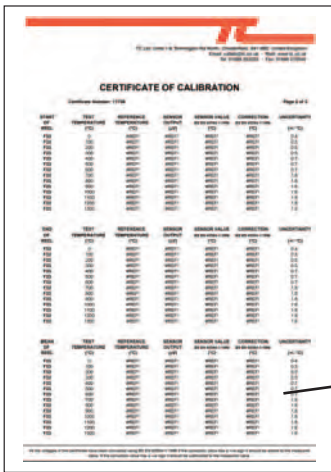
All 12HT sensors are supplied with a 3-page batch calibration report (shown left) over the temperature range 32-2192°F. Calibration is performed in our ISO17025 approved laboratory and is fully traceable to NPL/NIST standards. The report is designed with the needs of the selected standard in mind and includes a list of calibrated equipment used, results for start/end/average of batch (figure 1), correction factors, start/end differential and graphical representation of the output curves (figure 2). All appliwire standards are referenced in a conformity statement (figure 3).

Calibration reports are generated for each batch of sensors manufactured with a unique certificate number and the following order-specific information:

- Customer Name and Address
- Order Reference
- Coil Reference
- Coil Length
- Serial Number
- Description of Product
- Sensor Part Code

TC Ltd operate an extensive pre-testing calibration program. All of our mineral insulated wires used to manufacture the 12HT range are calibrated in our laboratory, all reels meeting the requirements of the AMS2750, BAC5621 & CQI-9 standards are stocked ready for quick manufacture with a 7/10 day typical lead time for completed sensors with calibration report.

If your application requires individual sensor calibration or uses custom temperatures not shown on the report, these requirements can be added to the 12HT part code as shown in the order code example below. We will then perform the custom calibration before despatch and amend the report accordingly. It is also possible to specify full UKAS calibration if required. Please contact one of our experienced sales engineers for more details.



START OF REEL	TEST TEMPERATURE (°C)	REFERENCE TEMPERATURE (°C)	SENSOR OUTPUT (µV)	SENSOR VALUE BS EN 60584-1:1996 (°C)	CORRECTION BS EN 60584-1:1996 (°C)	UNCERTAINTY (+/- °C)
E93	0	0.18	10.2	0.39	-0.21	0.4
E93	100	99.60	2743.2	98.94	+0.66	0.6
E93	200	199.76	5874.4	198.83	+0.93	0.6
E93	300	300.01	9325.7	299.55	+0.46	0.6
E93	400	400.21	12970.2	399.91	+0.30	0.8
E93	500	500.42	16759.2	500.29	+0.13	0.8
E93	600	600.77	20548.7	600.91	-0.14	0.8
E93	700	700.39	24489.7	699.06	+1.33	1.6
E93	800	799.53	28380.7	798.12	+1.41	1.7
E93	900	899.31	32274.2	897.51	+1.80	1.7
E93	1000	1000.46	36222.4	999.15	+1.31	1.8
E93	1100	1100.51	40050.0	1099.03	+1.48	1.8
E93	1200	1199.45	43765.4	1197.82	+1.63	1.9

Figure 1: Example of sensor results table

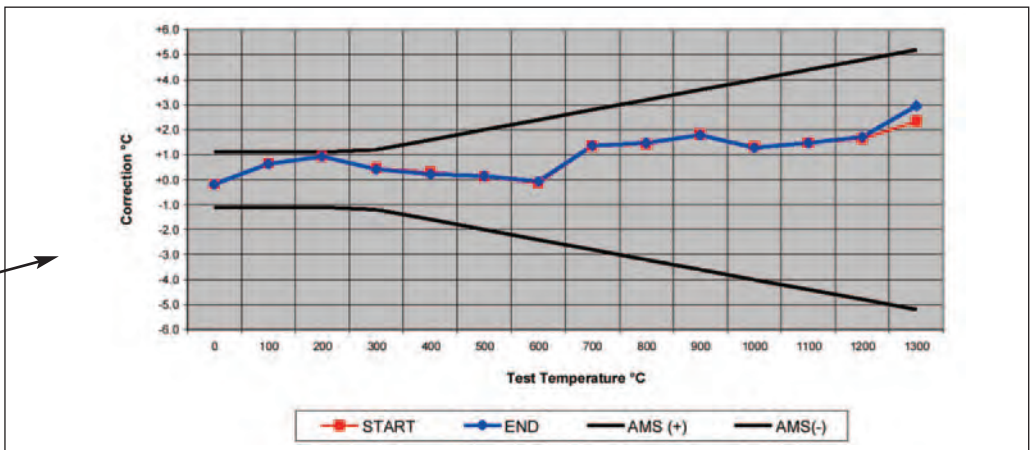
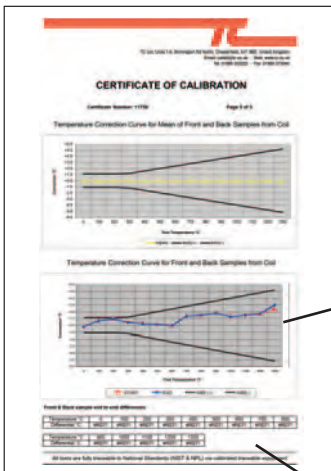


Figure 2: Example of sensor results graph



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Front & Back sample end to end differences									
Temperature °C	0	100	200	300	400	500	600	700	800
Differential °C	-0.02	0.03	0.01	0.05	0.07	-0.02	-0.08	-0.02	-0.06
Temperature °C	900	1000	1100	1200	1300				
Differential °C	0.02	0.03	0.00	-0.08	-0.63				

All tests are fully traceable to National Standards (NIST & NPL) via calibrated traceable equipment

Figure 3: Example of deviation table and conformity statement