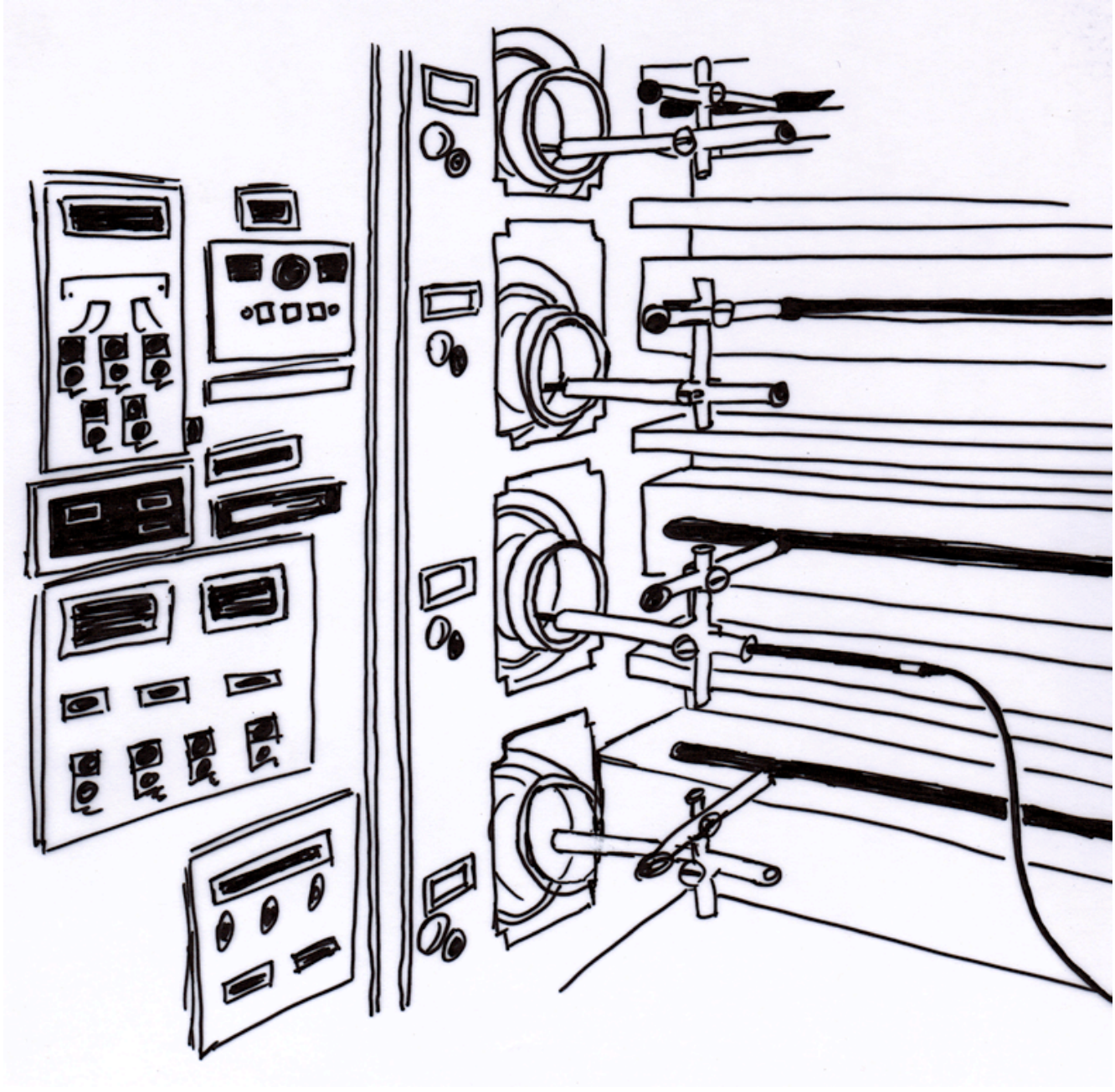
THERMOCOUPLES FOR THE SEMICONDUCTORS INDUSTRY

NT 31-01A



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PYRO CONTROLE
CHAUVIN ARNOUX GROUP

THERMOCOUPLES FOR THE SEMICONDUCTORS INDUSTRY

NT 31-01A

INTRODUCTION

PYRO-CONTROLE CHAUVIN ARNOUX acts as a leader in the temperature sensing business since more than 50 years.
We are present in various industries. In the semiconductor industry, we provide accurate temperature measurement with high purity of material to avoid any kind of pollution in the furnaces.

This brochure describes the services and products PYRO-CONTROLE CHAUVIN ARNOUX provides for the temperature measurement in the semiconductors industry.

SPECIFICATIONS AND STANDARDS

The following table identifies the differents thermocouples available.

THERMOCOUPLE CALIBRATION CODE

THERMOCOUPLE CODE	COMBINATION
K	Ni Cr / Ni Al
N	Nicrosil / Nisil
S	Pt 10% Rh / Pt
R	Pt 13% Rh / Pt
B	Pt 6% Rh / Pt 30% Rh
C	W5 Re / W26 Re
D	W3 Re / W25 Re

THERMOCOUPLE WIRE

The EMF of all thermocouple is conform to IEC (International Electro Technical Commission) standard 584-1

The equivalent National Standard commonly found, referenced on a local basis are:

- NBS 125
- BS4937
- JIS 1602
- DIN 43710
- NF C 42-321
- NF EN60-584-2

	Class 1	Class 2
Thermocouple type R, S		
• Temperature range	0 °C to 1100 °C	0 °C to 600 °C
• Tolerance value	± 1 °C	± 1,5 °C
• Temperature range	1100 °C to 1600 °C	600 °C to 1600 °C
• Tolerance value	± [1 + 0,003(t-1000)] °C	± 0,0025 x t °C
Thermocouple type B		
• Temperature range		600 °C to 1700 °C
• Tolerance value		± 0,0025 x t °C

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THERMOCOUPLES FOR THE SEMICONDUCTORS INDUSTRY

THERMOCOUPLE WIRE DIMENSIONS

All wire is supplied at 0,5 mm (0,02") diameter
Small size such as 0,35 mm can be supplied on special order.

CONNECTOR COLOR CODE

Plug and socket are in compensating material and conform to the following color according to IEC 584-3.

THERMOCOUPLE CODE	CONNECTOR COLOR
K	Green
N	Pink
S	Orange
R	Orange
B	Grey

CERAMIC INSULATOR

The purity of the ceramic insulation is extremely important to the life and service of precious metal thermocouples.
All the thermocouple insulation shall be high purity aluminium of at least 99,7 % purity.

Typical physical properties

Al2 O3 content	99,7 %
Alkali content	0,05 %
Water absorption	≤ 0,2 %
Young's modulus	370 GPa
Thermal expansion 20…1000 °C	8,6 10E-6 / K
Thermal conductivity 20…100 °C	26,0 W / (m.K)
Maximum working temperature	1700 °C

QUARTZ TUBE

To protect the process a quartz tube is generally used. The purity of these tube is tested, and the impurity are (in p.p.m weigth):

Al: 20,3 , Ca: 1,8, Fe: 1,9, K: ≤ 3,0, C: 1,0, Mg: 0,5, Mn: 0,1, Na: 1,3, Ti: 1,4

FLEXIBLE LEADS

Many thermocouple designs have flexible leads. These leads are supplied as full lenght thermocouples wire with insulated by teflon sleeving.

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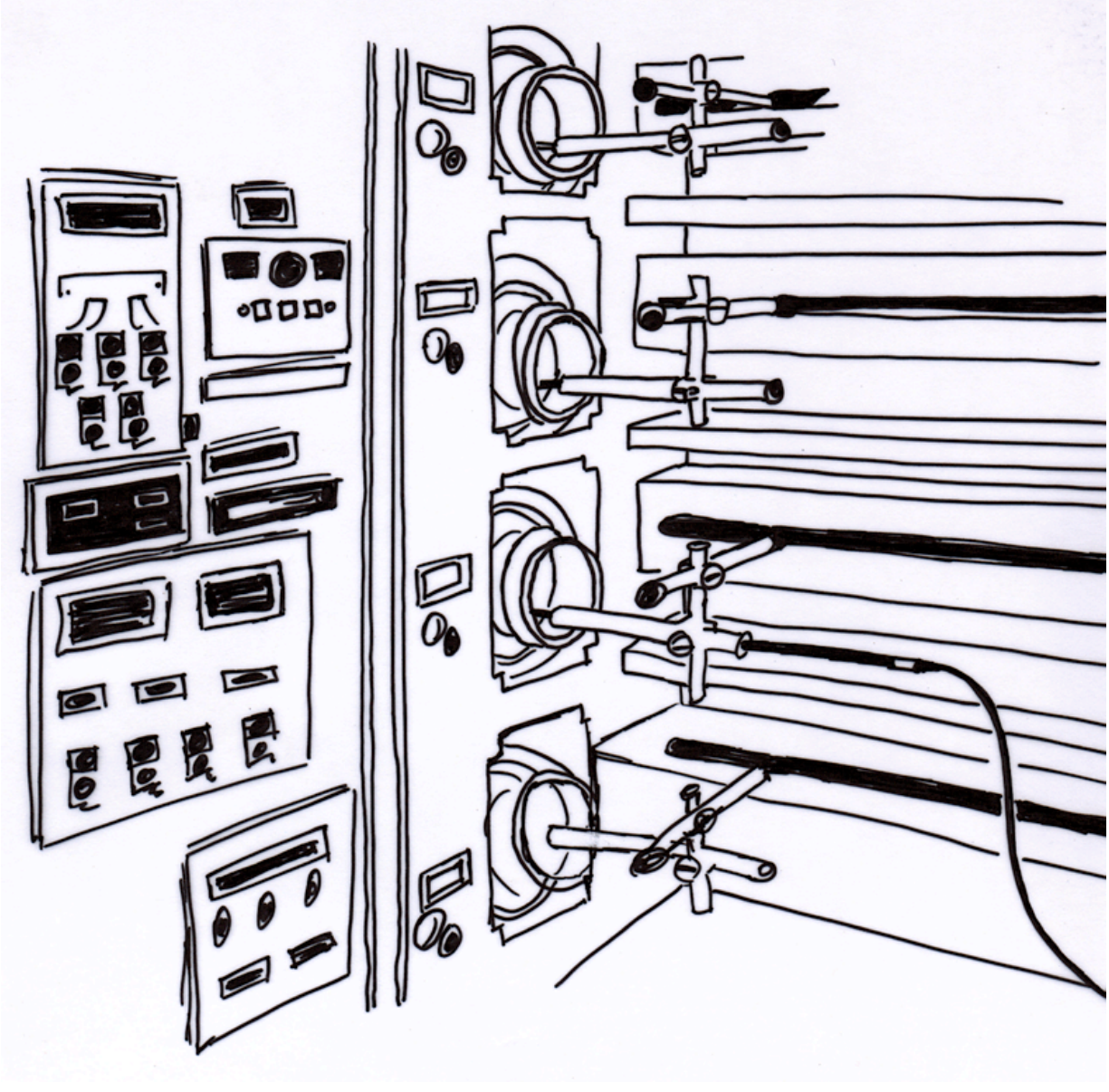
CONTROL SPIKE

Control Spike are used to monitor the diffusion furnace set point temperature and provide control signals to process equipment.

We introduce the basic standards, specifications and designs.
Special requirements or custom modifications are easily and readily accomodated by PYRO-CONTROLE CHAUVIN ARNOUX.

Any of the standard designs shown in this presentation can be modified according your requirement.



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THERMOCOUPLES FOR THE SEMICONDUCTORS INDUSTRY

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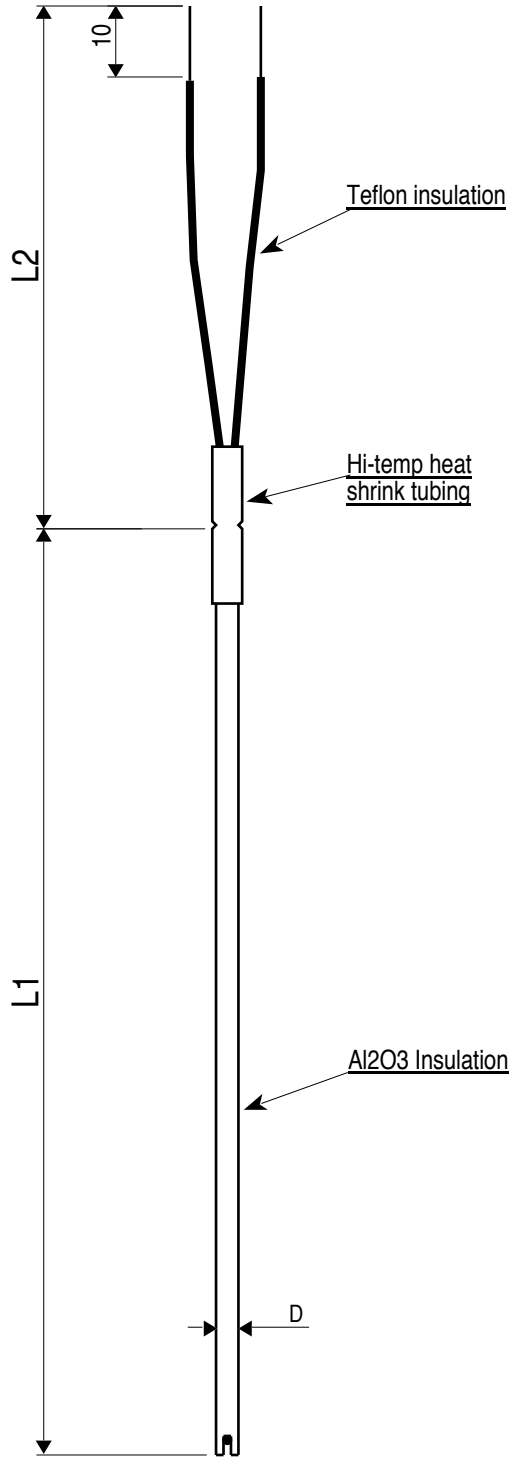
Recessed Junction Control Spike



YOUR CONTROL SPIKE

RJCS			X
THERMOCOUPLE	Code	K	☐
		S	☐
		R	☐
		B	☐
	Number	1	☐
		2	☐
	Diameter	Ø 0,5 mm	☐
		Other:	Ø.....mm
DIMENSIONS	Length **L1**		L1 =.....mm
	Length **L2**		L2 =.....mm
INSULATOR	Diameter		D= 4 mm
COMPENSATING MINI PLUG		YES	☐
		NO	☐

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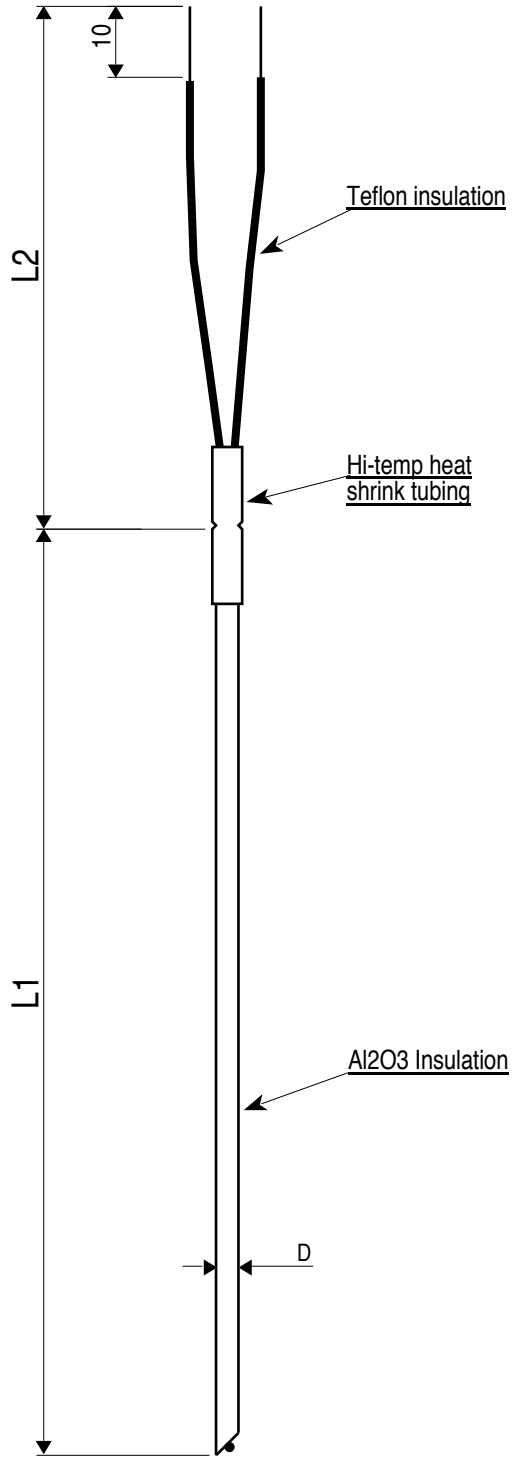
Wedge Junction Control Spike



YOUR CONTROL SPIKE

WJCS			X
THERMOCOUPLE	Code	K	☐
		S	☐
		R	☐
		B	☐
	Number	1	☐
		2	☐
	Diameter	Ø 0,5 mm	☐
		Other:	Ø.....mm
DIMENSIONS	Length **L1**		L1 =.....mm
	Length **L2**		L2 =.....mm
INSULATOR	Diameter		D= 4 mm
COMPENSATING MINI PLUG		YES	☐
		NO	☐

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THERMOCOUPLES FOR THE SEMICONDUCTORS INDUSTRY

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Small Diameter Control Spike

YOUR CONTROL SPIKE

SDCS			X
THERMOCOUPLE	**Code**	K	☐
		S	☐
		R	☐
		B	☐
	Number	1	X
	Diameter	Ø 0,35 mm	X
DIMENSIONS	Length **L**		**L = ...mm**
INSULATOR	**Diameter**		Ø 2 mm

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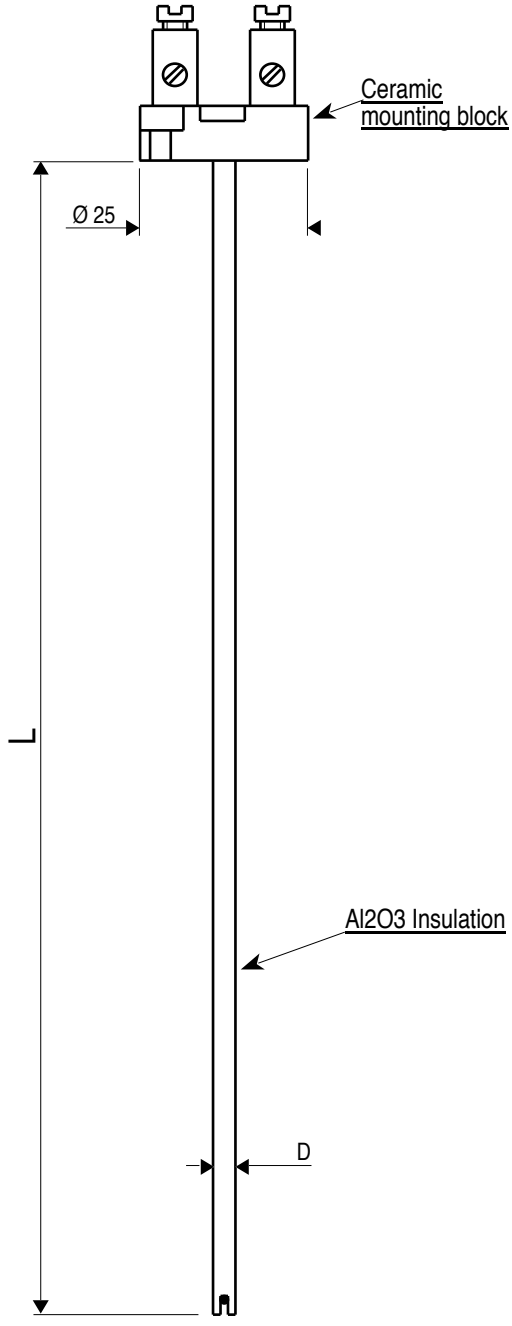
Ceramic Block Control Spike

YOUR CONTROL SPIKE



CBCS			X
THERMOCOUPLE	Code	K	☐
		S	☐
		R	☐
		B	☐
	Number	1	☐
		2	☐
	Diameter	Ø 0,5 mm	☐
		Other:	Ø ..... mm
DIMENSIONS	Length **L**		L = ... mm
INSULATOR	Diameter		D= 4 mm

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THERMOCOUPLES FOR THE SEMICONDUCTORS INDUSTRY

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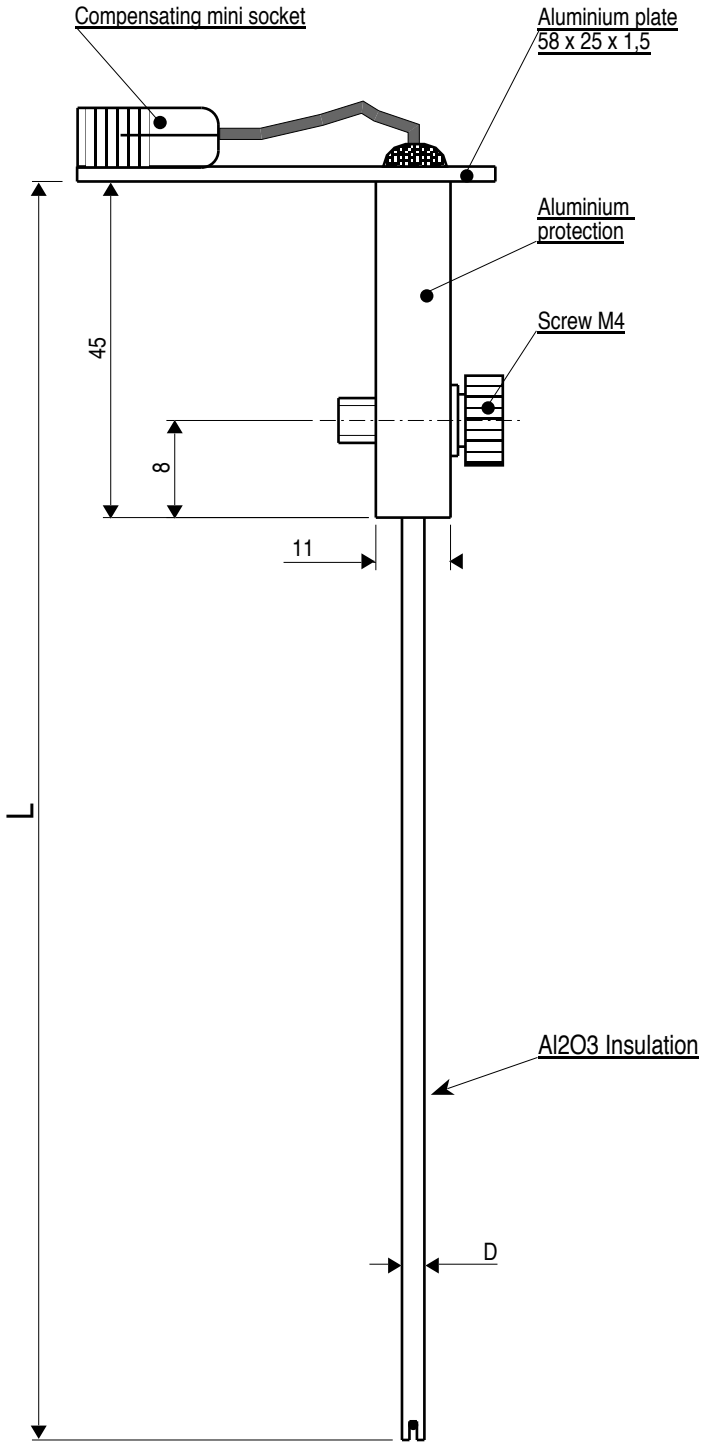
90° Angle Control Spike

YOUR CONTROL SPIKE



9ASC			X
THERMOCOUPLE	**Code**	K	☐
		S	☐
		R	☐
		B	☐
	Number	1	☐
		2	☐
	Diameter	Ø 0,5 mm	X
DIMENSIONS	Length **L**		**L = ... mm**
INSULATOR	**Diameter D**		1 TC: 3 mm ☐ 2 TC: 4 mm ☐
COMPENSATING MINI SOCKET	**Number**	1	☐
		2	☐
JUNCTION	**Recessed**		☐
	Wegded		☐

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THERMOCOUPLES FOR THE SEMICONDUCTORS INDUSTRY

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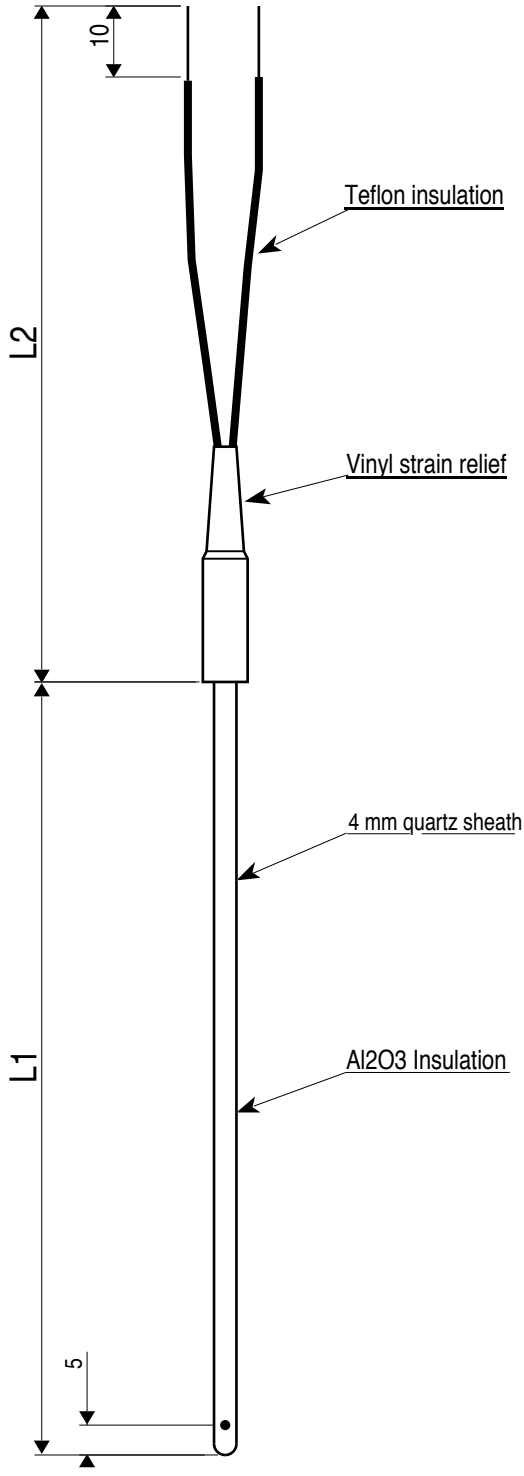
Quartz-Sheathed Control Spike



YOUR CONTROL SPIKE

QSCS			☒
THERMOCOUPLE	**Code**	K	☐
		S	☐
		R	☐
		B	☐
	Number	1	☒
	Diameter	Ø 0,5 mm	☒
DIMENSIONS	Length **L1**		**L1 = ... mm**
	Length **L2**		**L2 = ... mm**
COMPENSATING MINI PLUG		YES	☐
		NO	☐

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THERMOCOUPLES FOR THE SEMICONDUCTORS INDUSTRY

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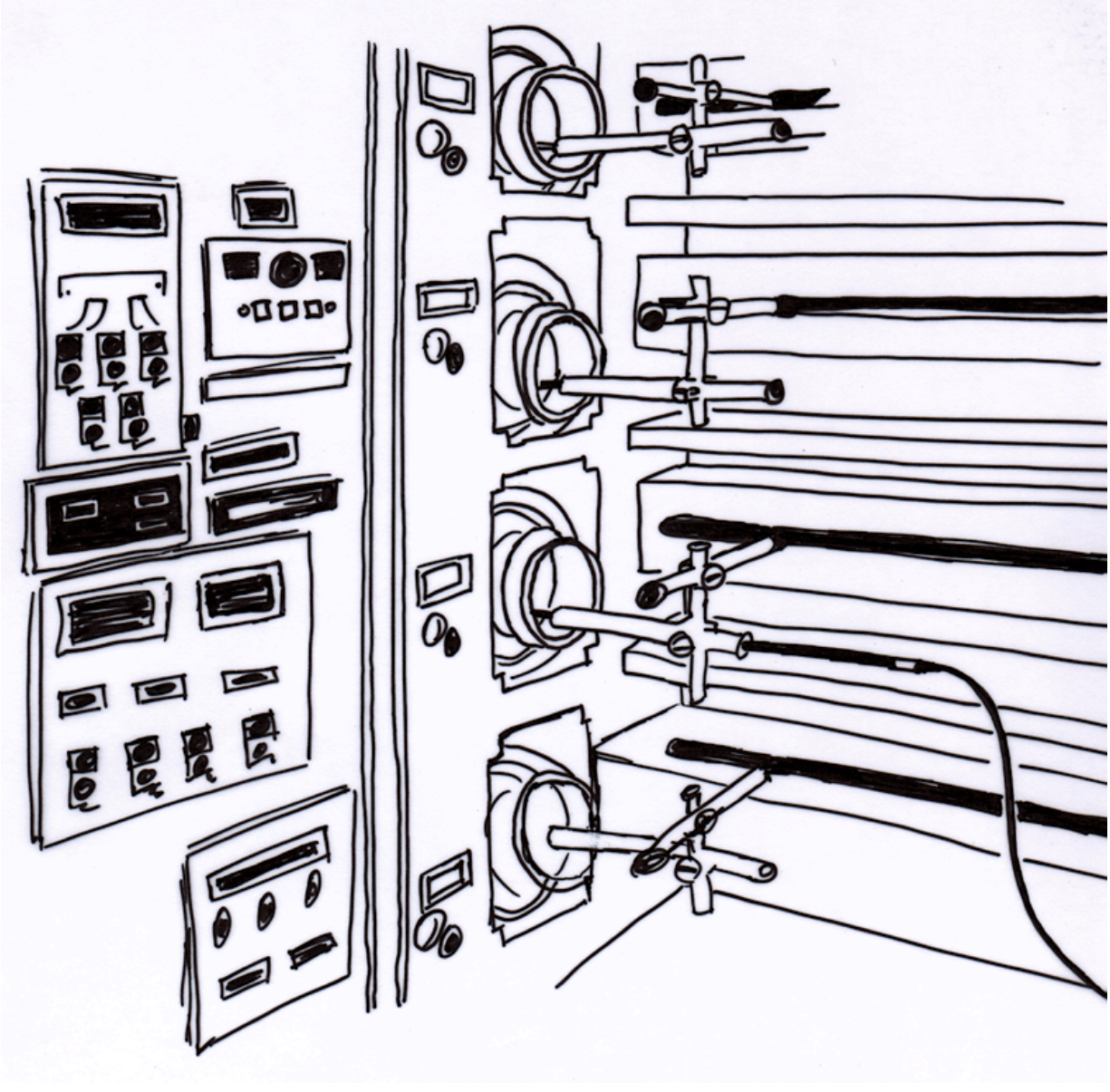
PROFILE THERMOCOUPLES

Three or five junctions thermocouple assemblies are usually employed in diffusion furnaces. The hot junctions are spaced out inside a high quality quartz sheath.

We introduce the basic standards, specifications and designs.

Special requirements or custom modifications are easilly and readily accomodated by PYRO-CONTROLE CHAUVIN ARNOUX.



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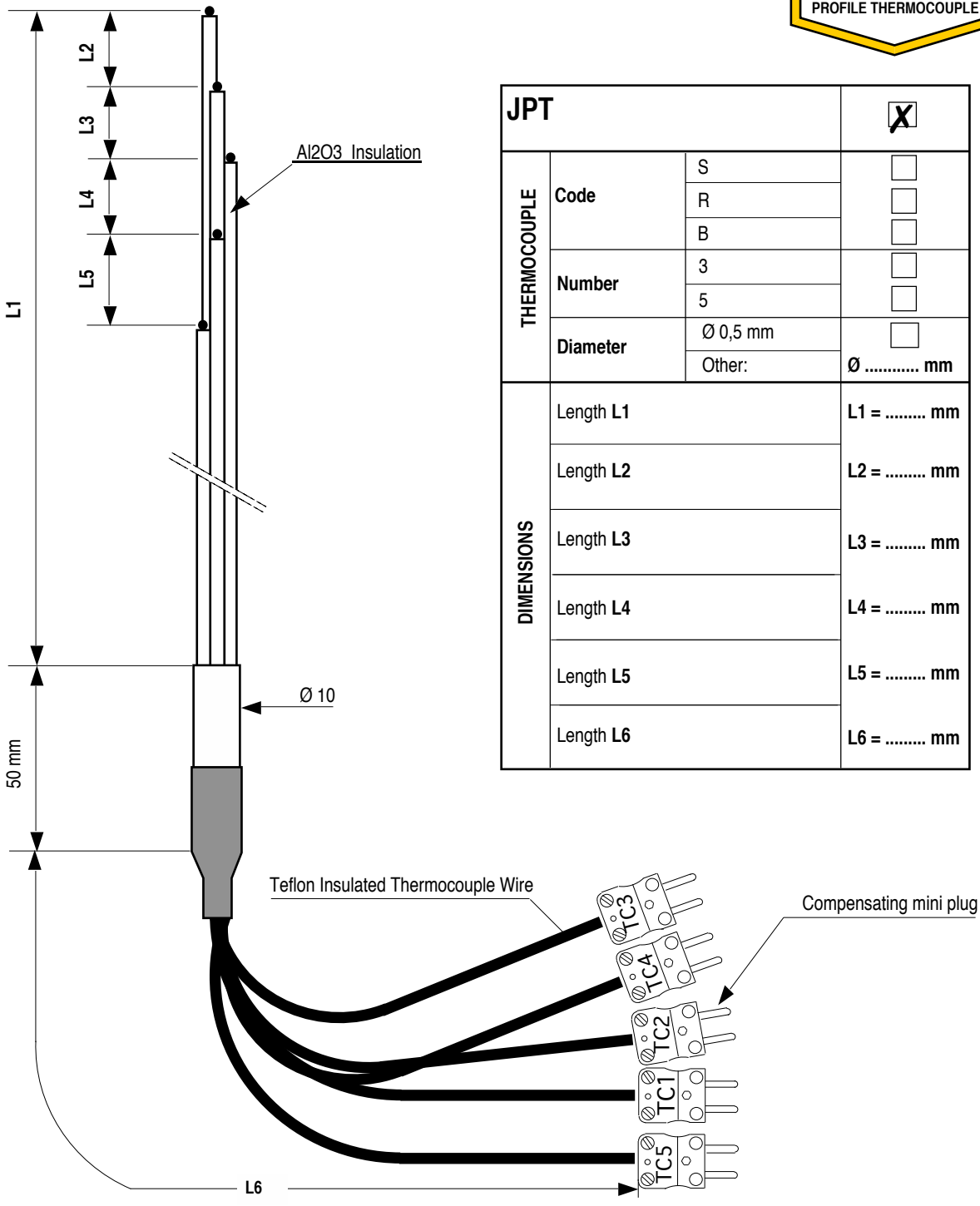
THERMOCOUPLES FOR THE SEMICONDUCTORS INDUSTRY

NT 31-01A

Junction Profile Thermocouple

YOUR OWN PROFILE THERMOCOUPLE



JPT			X
THERMOCOUPLE	Code	S	☐
		R	☐
		B	☐
	Number	3	☐
		5	☐
	Diameter	Ø 0,5 mm	☐
		Other:	Ø ..... mm
DIMENSIONS	Length **L1**		**L1 = ... mm**
	Length **L2**		**L2 = ... mm**
	Length **L3**		**L3 = ... mm**
	Length **L4**		**L4 = ... mm**
	Length **L5**		**L5 = ... mm**
	Length **L6**		**L6 = ... mm**

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THERMOCOUPLES FOR THE SEMICONDUCTORS INDUSTRY

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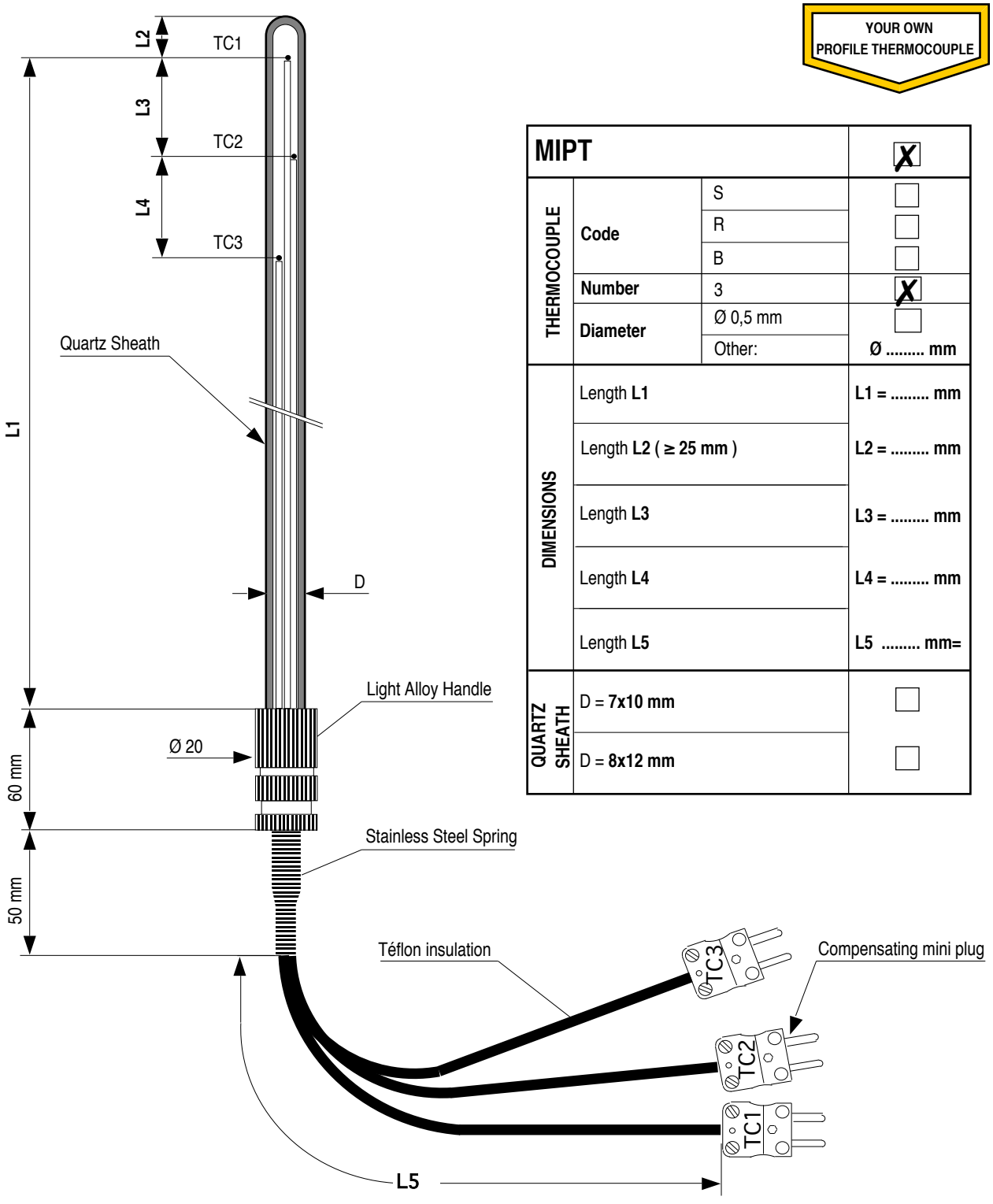
Multi-Insulation Profile Thermocouple

YOUR OWN PROFILE THERMOCOUPLE



MIPT			X
THERMOCOUPLE	Code	S	☐
		R	☐
		B	☐
	Number	3	X
	Diameter	Ø 0,5 mm	☐
		Other:	Ø ..... mm
DIMENSIONS	Length **L1**		**L1 = ... mm**
	Length **L2 (≥ 25 mm)**		**L2 = ... mm**
	Length **L3**		**L3 = ... mm**
	Length **L4**		**L4 = ... mm**
	Length **L5**		**L5 ..... mm=**
QUARTZ SHEATH	D = **7x10 mm**		☐
	D = **8x12 mm**		☐

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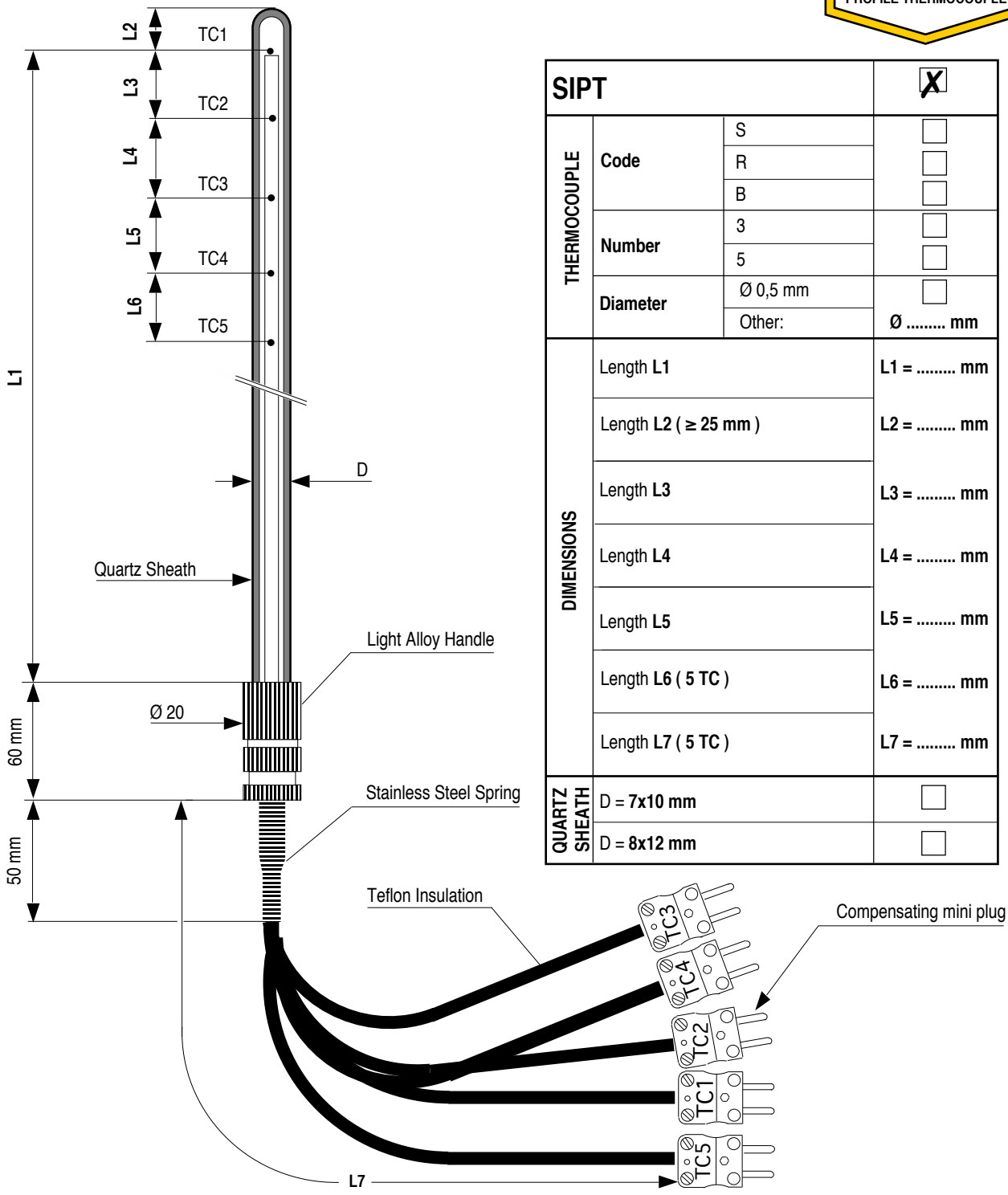
Single-Insulation Profile Thermocouple

YOUR OWN PROFILE THERMOCOUPLE



SIPT			X
THERMOCOUPLE	Code	S	☐
		R	☐
		B	☐
	Number	3	☐
		5	☐
	Diameter	Ø 0,5 mm	☐
		Other:	Ø ..... mm
DIMENSIONS	Length **L1**		**L1 = ... mm**
	Length **L2 (≥ 25 mm)**		**L2 = ... mm**
	Length **L3**		**L3 = ... mm**
	Length **L4**		**L4 = ... mm**
	Length **L5**		**L5 = ... mm**
	Length **L6 (5 TC)**		**L6 = ... mm**
	Length **L7 (5 TC)**		**L7 = ... mm**
QUARTZ SHEATH	D = **7x10 mm**		☐
	D = **8x12 mm**		☐

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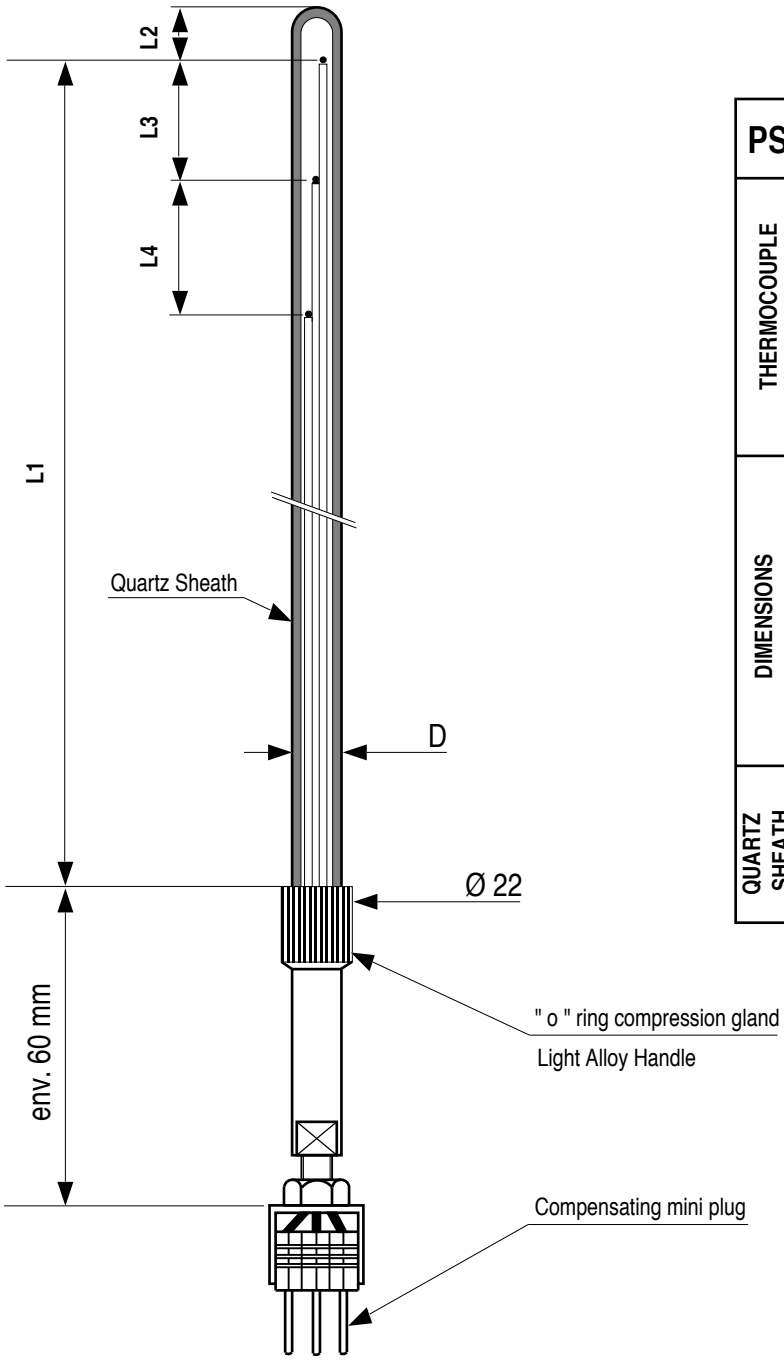
Plug-Stack Profile Thermocouple

YOUR OWN PROFILE THERMOCOUPLE



PSPT			X
THERMOCOUPLE	Code	S	☐
		R	☐
		B	☐
	Number	3	☐
		5	☐
	Diameter	Ø 0,5 mm	☐
		Other:	Ø ..... mm
DIMENSIONS	Length **L1**		**L1 = ... mm**
	Length **L2 (≥ 25 mm)**		**L2 = ... mm**
	Length **L3**		**L3 = ... mm**
	Length **L4**		**L4 = ... mm**
QUARTZ SHEATH	D = **7x10 mm**		☐
	D = **8x12 mm**		☐

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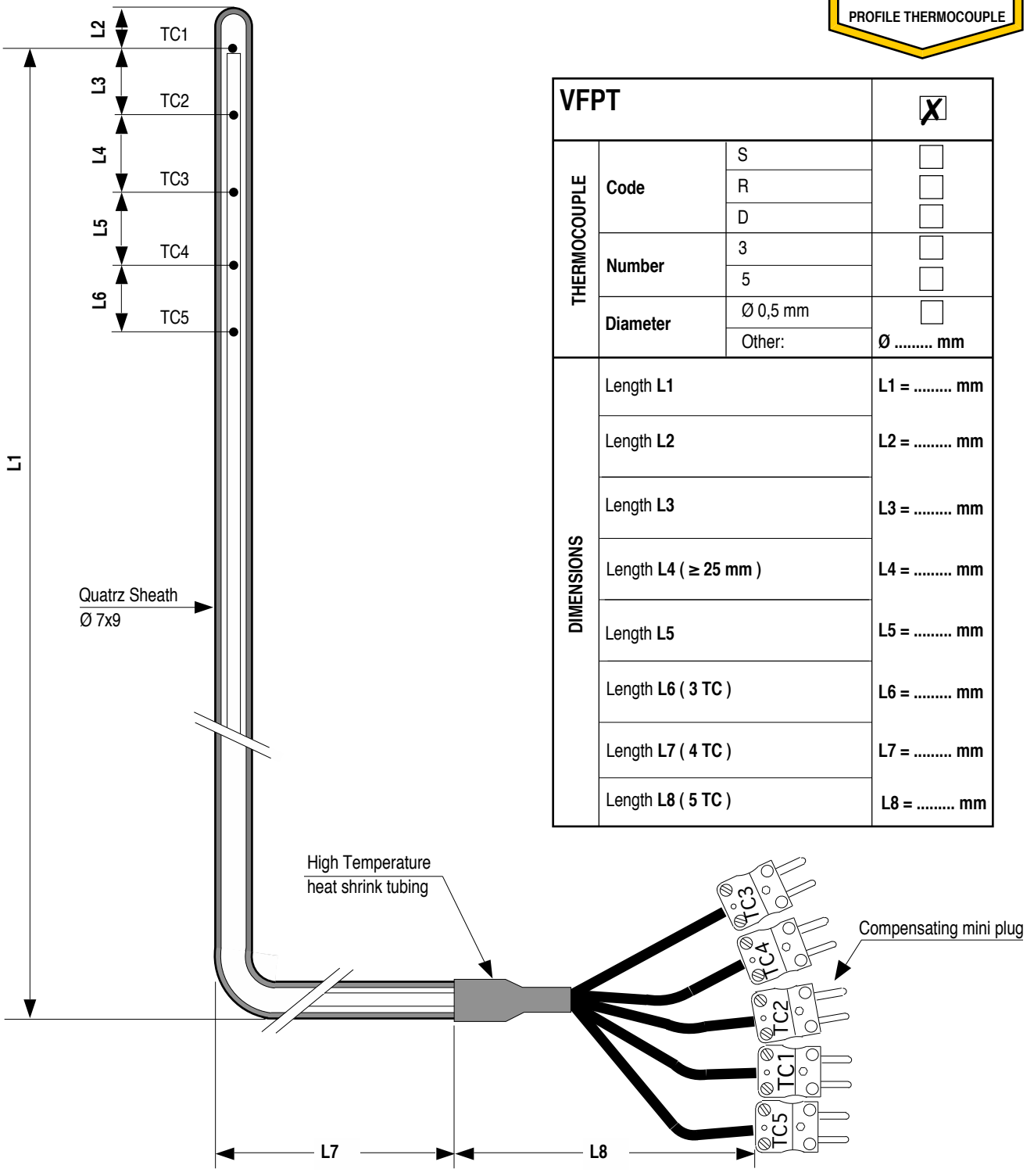
Vertical Furnace Profile Thermocouple

YOUR OWN PROFILE THERMOCOUPLE



VFPT			X
THERMOCOUPLE	Code	S	☐
		R	☐
		D	☐
	Number	3	☐
		5	☐
	Diameter	Ø 0,5 mm	☐
		Other:	Ø ..... mm
DIMENSIONS	Length **L1**		**L1 = ... mm**
	Length **L2**		**L2 = ... mm**
	Length **L3**		**L3 = ... mm**
	Length **L4 (≥ 25 mm)**		**L4 = ... mm**
	Length **L5**		**L5 = ... mm**
	Length **L6 (3 TC)**		**L6 = ... mm**
	Length **L7 (4 TC)**		**L7 = ... mm**
	Length **L8 (5 TC)**		**L8 = ... mm**

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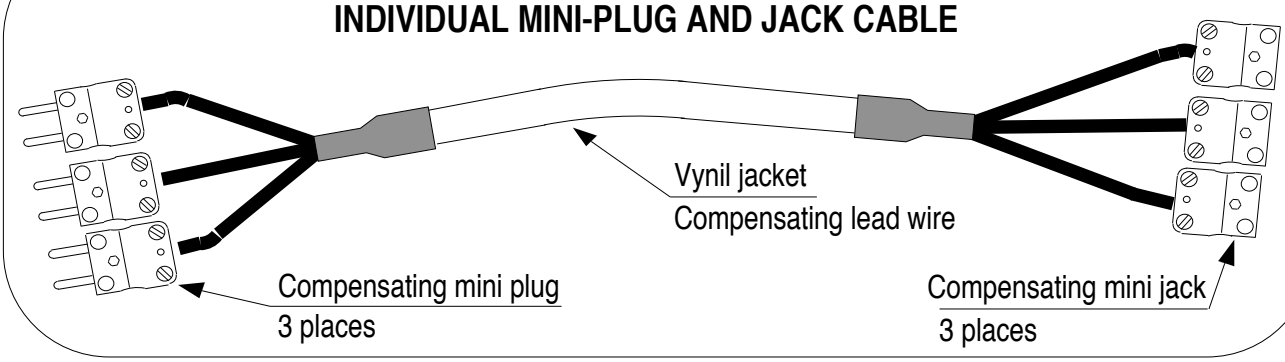
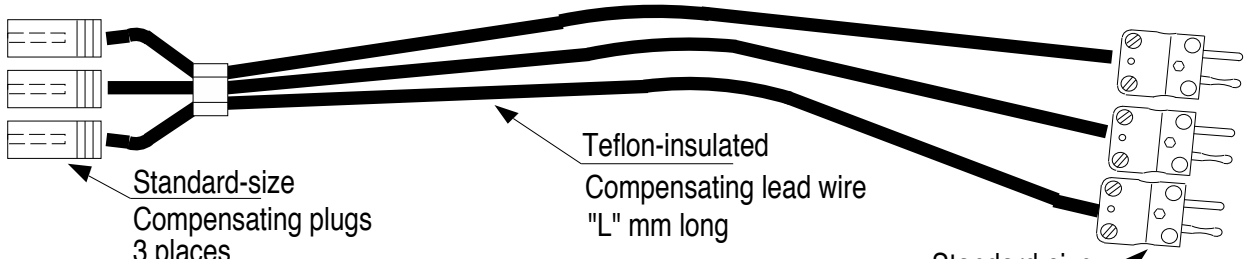
CABLES AND ADAPTATORS

Different low cost adaptator cable are available.
We introduce some standardized designs, many others are possible.

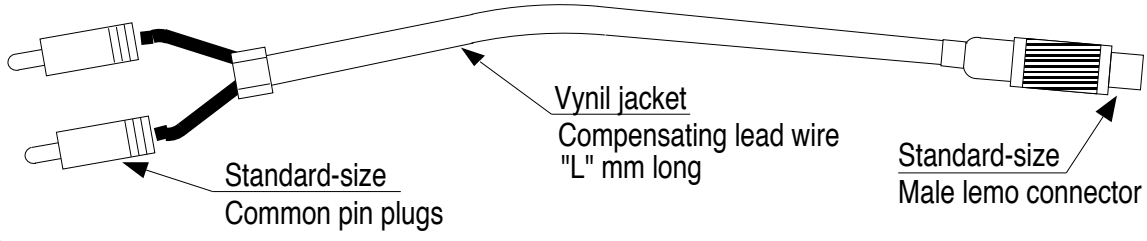
EXTENSION LEAD
INDIVIDUAL MINI-PLUG AND JACK CABLE



ADAPTATOR CABLE
COMMON WIRE JACK TO INDIVIDUAL STANDARD-SIZE PLUGS



ADAPTATOR CABLE
STANDARD-SIZE MALE LEMO CONNECTOR TO COMMON WIRE PLUG



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QUALITY ASSURANCE

The PYRO-CONTROLE CHAUVIN ARNOUX Quality Assurance is conform to the ISO 9002 standards.

All our material is identified by numbers and all standards used for calibration and traceable to COFRAC French accreditation (WECC).

The Quality manuel details how the system works with incoming, receiving, inprocess, and inspection .

Calibration certificats, certificats of confiance, and analytical data are available and supplied as required to our customers.

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REPAIR AND RECALIBRATION

The PYRO-CONTROLE CHAUVIN ARNOUX service provides process specialists with the opportunity to gain greater service life from their thermocouples while sustaining confidence in the accuracy of the thermocouple's temperature control. Repairing a profile or spike thermocouple may not always be possible or economically feasible.

In general, replacement of broken ceramics, sheath, or damaged leads, plugs or hardware is always possible. Damage to the thermocouple wire may not be repairable depending on the nature of the problem. If the wire has developed excessive grain growth, or necking down and thinning out, it might be too weak to withstand the routine handling required for service or use.

All thermocouples sent to PYRO-CONTROLE CHAUVIN ARNOUX for repair and recalibration are thoroughly inspected and evaluated :

• Upon receipt for recalibration each thermocouple is disassembled and inspected to identify broken or damaged components.
Particular attention is paid to conditions of the wire that are often hidden. Ceramic components are inspected for discoloration that also could suggest contamination. Quartz sheaths are also evaluated for devitrification.The results of this inspection are relayed to the user with recommendations for corrective action, if required, prior to any work being carried out.

• After making any wire repairs or replacements as authorized by the requisitioner, the thermocouples are annealed.
Annealing eliminates any calibration errors caused by stress or strain. Annealing also thermally tests the physical integrity of the wire for its intended use, as well as highlighting the presence of surface contamination that might not be evident by simple visual means.

• Calibration of each thermocouple is performed in a specially designed furnace with an automatic data acquisition system. Comparison with standards fully detailed reference tables that tabulate corect emf, differential emf, and differential equivalent degrees (commonly referred to as mode 1, 2 and 6). The accompanying samples show the general form of the calibration report.

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