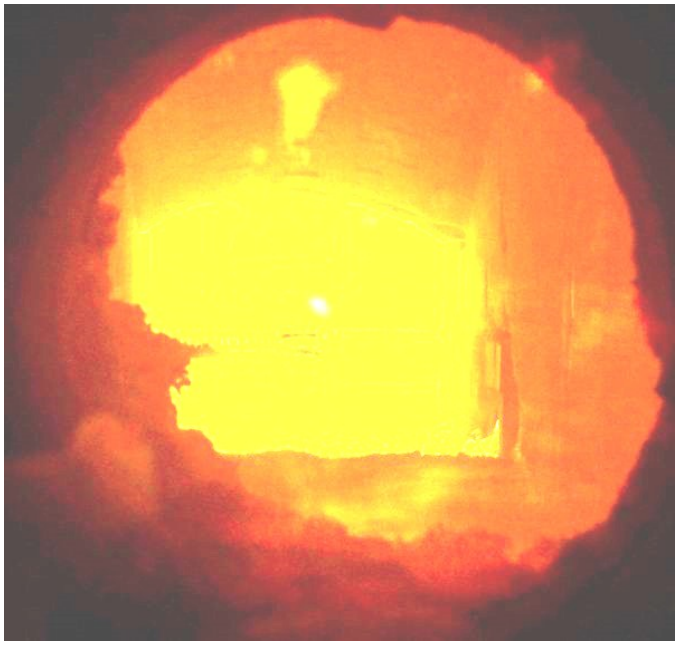
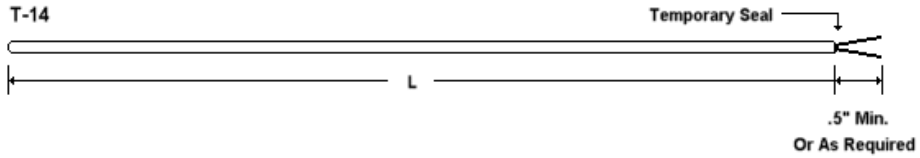
High temperature thermocouple
For applications up to 2300°C



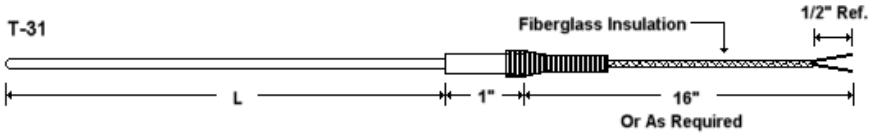
Selection guide

Standard Termination Styles

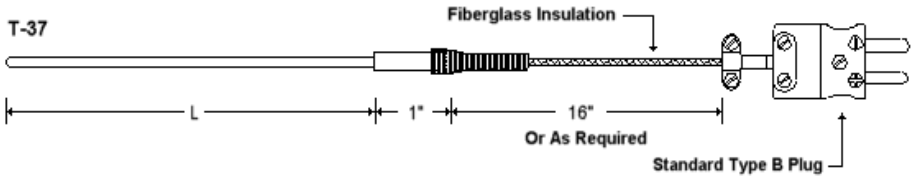
(Insert style number)



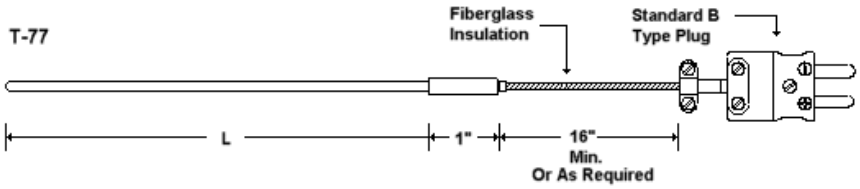
T-14
Ca 15 mm bare wire leads with epoxy seal.



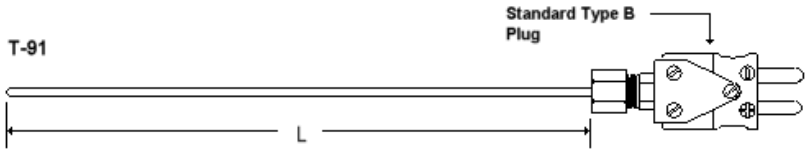
T-31
200°C Transition with spring strain relief, fiberglass insulated extension wire



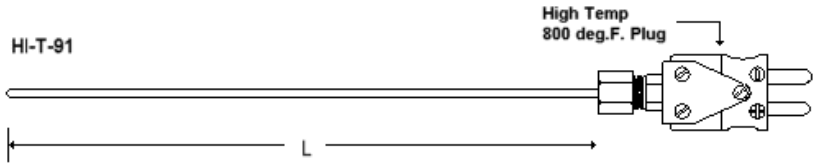
T-37
200°C Transition with spring strain relief, fiberglass insulated extension wire and standard 200°C male plug



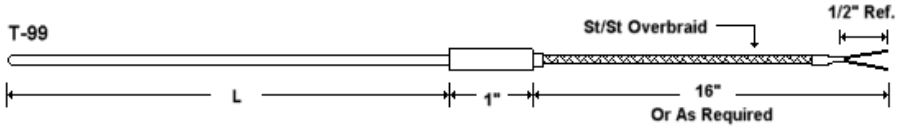
T-77
200°C Transition with fiberglass insulated extension wire and standard 200°C male plug



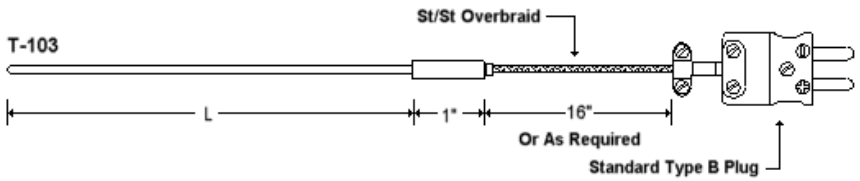
T-91
200°C Standard male plug



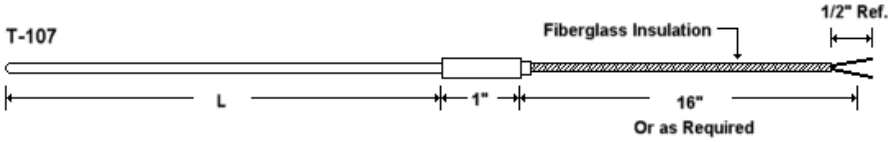
HI-T-91
427°C High temperature male plug



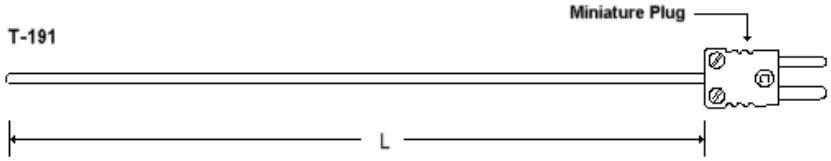
T-99
200°C Transition with fiberglass insulated extension wire and stainless steel overbraid



T-103
200°C Transition with spring strain relief, fiberglass insulated extension wire with stainless steel overbraid and standard 200° male plug



T-107
200°C Transition with fiberglass insulated extension wire



T-191
200°C Miniature male plug

Partnumber breakdown

Symbol	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Example	T-107	N	- 12	B	AE	(8.1)	N	- 24

Since almost all of our thermocouples are made to your order requirement, we can easily supply any modification or custom design based on your application

(1) Insert style number
(2) Insulation material (table 1)
(3) Insert sheath length (L) in Inches
(4) Sheath diameter (table 2)
(5) Thermocouple wire type (table 3)
(6) Junction number code (table 4)
(7) Sheath material (table 5)
(8) Length of extension wire in Inches (if required). Standard length of 16" supplied if not specified

Insulation Materials
Table 1

Insulation type	Symbol	Recom. max operating temperature	Approx melting temperature	Comments
Magnesium Oxide (MgO)	**N**	1700°C	2800°C	Very hygroscopic and used mostly in compacted sheaths
Alumina Oxide (AL2O3)	**A**	1550°C	2040°C	Excellent with Platinum Alloys
Hafnium Oxide (HFO2)	**H**	2200°C	2790°C	Comparable to Beryllium Oxide and safe to hand-le
Beryllium Oxide (BeO)*	**B**	2200°C	2650°C	Excellent high temp thermal conductivity and re-sistivity

*Beryllium is considered a toxic material and can cause health problems if particles are inhaled.

Sheath diameter
Table 2

Symbols	(F)	(B)	(D)	(E)	(F)
Standard sheath diameters	.040	.062	.125	.188	.250

For non standard sheath diameters write down the diameter in Inches. Example : .236 for a 6 mm

Thermocouple Wire types
Table 3

Thermocouple	Symbol	Standard limits of error	Recommended temperature range
Pt10%Rh-Pt (type S)	S	± 1.5°C or 0.25% per ASTM E230	0-1450°C
Pt13%Rh-Pt (type R)	R	± 1.5°C or 0.25% per ASTM E230	0-1450°C
Pt30%Rh-Pt6%Rh (type B)	B	± .5°C per ASTM E230	870-1700°C
Tungsten 5% Rhenium Tungsten 26% Rhenium (type C)	AE	± 4.4°C (0-426°C) ± 1% (426 - 2315°C) per ASTM E988	0-2200°C
Tungsten 3% Rhenium Tungsten 25% Rhenium (type D)	AO	± 4.4°C (0-426°C) ± 1% (426 - 2315°C) per ASTM E988	0-2200°C

Junction number codes
Table 4

Sheath type	Thermocouple type	Junction code	
		Grounded	Ungrounded
Inconel 600	R, S & B	**(8.1)**	**9**
Pt10%Rh	R, S & B	**8**	**9**
Coated Molybdenum	AE & AO	**N/A**	**(9.3)**
Tantalum	R, S, B, AE & AO	**(8.1)**	**(9.5)**
Molybdenum	R, S & B	**N/A**	**(9.4)**
Molybdenum	AE & AO	**N/A**	**(9.3)**
Niobium 1% Zirc	AE & AO	**(8.1)**	**(9.5)**

Sheath material
Table 5

Sheath type	Symbol	Recommended max. temp.	Melting temp.	Allowable enviroment	Standard sheath diameter	Minimum bend radius
Inconel 600	**B**	1175°C	1345°C	Inert, vacuum, oxidizing	.040, .062, .125, .188, .250"	5 x diameter
Pt10%Rh	**AH**	1550°C	1850°C	Inert, oxidizing	.040, .062, .125"	5 x diameter
Tantalum	**N**	2200°C	2995°C	Inert, vacuum	.040, .062, .125"	10 x diameter
Molybdenum	**O**	2000°C	2620°C	Inert, vacuum, reducing	.062, .125, .188, .250"	do not bend
Niobium 1% Zirconium	**AV**	2200°C	2495°C	Inert, vacuum	.062, .125"	10 x diameter
Coated Molybdenum	**OCR**	1600°C	2000°C	Inert, oxidizing	.125, .250"	do not bend

Argon Backfill

In order to minimize the effects of any residual oxidation remaining inside non-compacted sheath designs, ARi standard backfill the sheath with inert Argon gas prior to sealing the cold end.

Special refractory sheaths and sheath coating

In addition to the sheaths listed in table below, ARi can also provide the following sheaths on special order.
Contact Kamet Trading for dimensions and availability:

Sheath type	Sym-bol	Recommended max. temp.	Melting temp.	Comments
Tungsten	**BC**	2300°C	3410°C	Very high melting point and low vapor pressure for vacuum applications
Molybdenum 50% Rhenium	**BE**	2300°C	2550°C	Easily weldable and ductile up to 2200°C. Suitable for inert, vacuum, hydrogen, nitrogen and amonia atmospheres
UCAR Metal ceramic LT-1 tubes	**BV**	1371°C	1538°C	Good mechanical strength can withstand up to 2000° C in protected atmospheres
Moly Disillicide	**BW**	1700°C	Varies	Exceptional corrosive/chemical resistance In oxidizing/reducing environments.

Special coating for sheaths

In addition to the coated molybdenum sheath (OCR) shown in table below, the following coatings are also available:

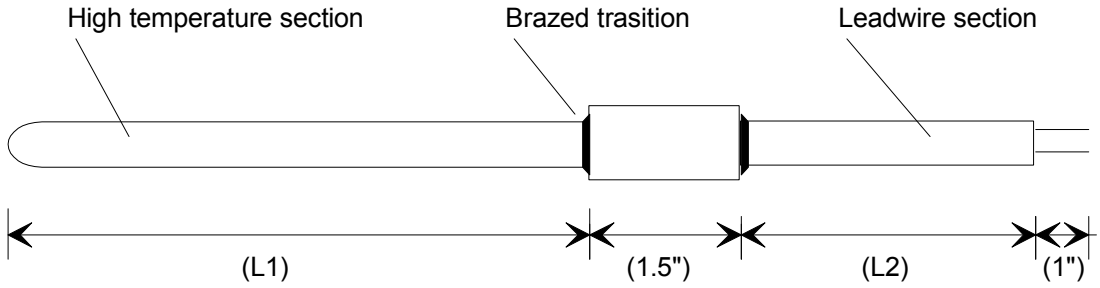
Coating type	Symbol	Max. temp.	Comments
Tungsten (plasma spray)	**TPL**	2200°C	For resistance to graphite attach in vacuum applications. Applied to Molybdenum sheath
Boron Nitride	**BN**	1800°C	Non-wetting most molten metals an slags. Use in oxidizing atmospheres to 1100°C

Transition style thermocouples

When exotic applications require long thermocouples with expensive noble metal or refractory sheaths, ARi can supply custom made transition style thermocouples for substantial cost savings.

Thermocouples can be supplied with suitable high temperature “hot section” sheath and insulating materials long enough to reach a cooler zone in the furnace or reactor (maximum 870° C).
At this point, a brazed transition can be made to a less expensive thermocouple or compensating material with Inconel 600 or stainless steel sheath.

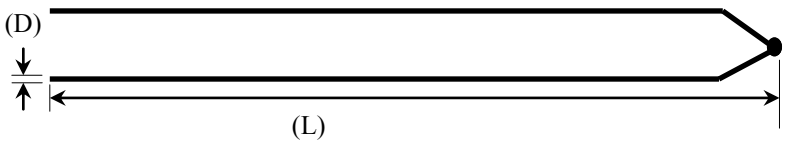
Contact Kamet for specific part numbers and specifications.



Bare wire thermocouple elements

ARi can supply un-sheathed bare wire thermocouple elements where quick time response and accurate measurements are critical.
Elements can be supplied in three (3) standard diameters, custom built to your length requirements.
Type R, S and B are supplied with a standard bead type junction, while tungsten rhenium types C and D (ARi type AE and AO) are supplied with our patented wire wound junction type (9.3)

Specify P/N	T-50994-**(L)-(D)-Type**
(L)	Length in Inches
(D)	Diameter (.010, .020 or .032)
(Type)	R, S, B, AE or AO



Options and Modifications

High Temperature termination
In applications where the cold end termination will see temperatures in excess of 200°C, standard epoxy seals may breakdown causing failure. In this case, ARi can supply a ceramic cement seal which can withstand temperatures up to 450°C. To specify this option, add prefix **HI-** in front of the partnumber selected.

Example **HI**—T-107N-12DEA(9.5)

Duplex element Construction
Most thermocouple combinations with an outside sheath diameter of 1/8" (3.2mm) or larger are available in duplex element construction. (2 separate measuring circuits in 1 sheath) To specify this option, add the suffix **.4** after the style number. **Repeat the junction code a 2nd time and add parentheses.**

Example T-91**.4**N-12FR(9.9)B or T-91**.4**B-18DAE**(9.3)(9.3)**O

Mating Jack
If required with any of our male plug type thermocouples (T-91, T-191 and HI-T-91) we can supply the appropriate mating jack with the assembly. To specify this modification, add **(MOD)** after the part number and specify "**supplied with mating jack**"

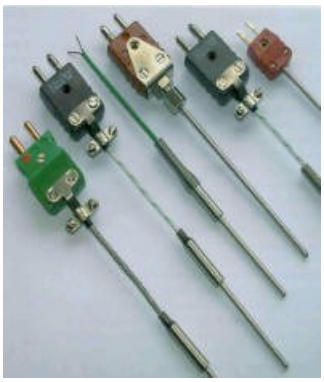
Teflon insulated extension wires
For designs where extension wire attachment is required, we can supply moisture resistant Teflon insulated extension wire in place of our standard fiberglass. Other insulation types can be supplied subject to availability. To specify this modification, add (MOD) after the part number and specify "With Teflon Insulated Leads" in the description.

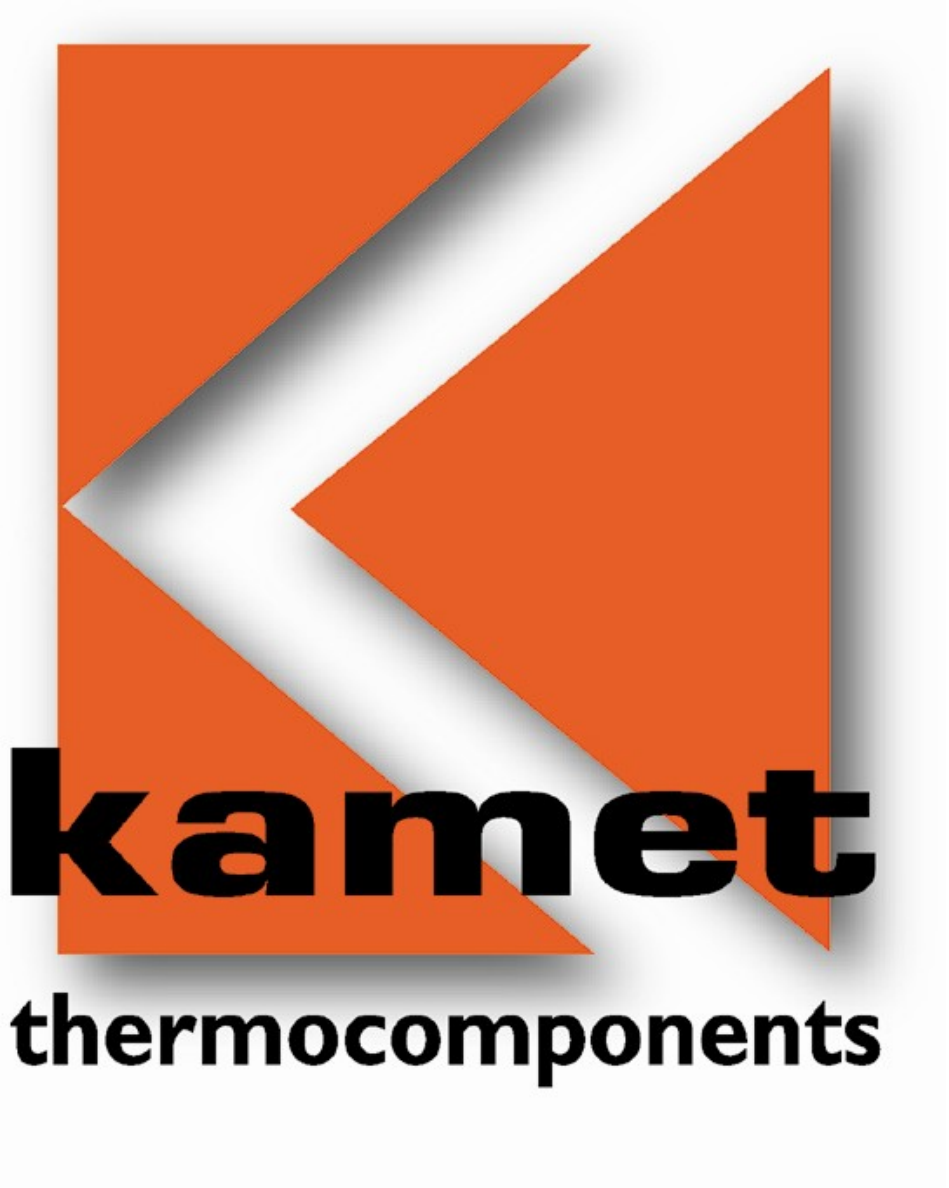
Special limits of error
Thermocouples with R, S & B calibrations made with mineral insulated construction can be supplied with special limits of error tolerances per ASTM E-230 or Class 1 per IEC-584 subject to availability of material from stock.
To specify this modification, add (MOD) after the part number and specify "Per Special Limits of Error" or "Per Class 1 Tolerance" in the description.

Special Testing

- Temperature calibration
- Radiography
- Liquid penetrant
- Helium leak
- Dimensional & Insulation resistance

All ARi standard are traceable to the National Institute of Standards and Technology (NIST). ARi's quality management system meets the requirements of ISO9002 as certified by Lloyds Register Quality Assurance.





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