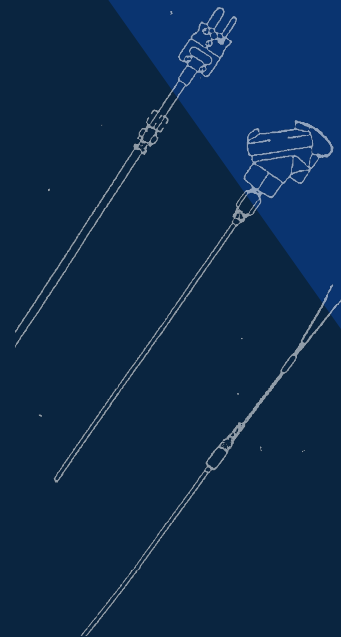


Product Catalogue

TEMPERATURE TECHNOLOGY

- SENSING
- CONTROL
- INDICATION
- CALIBRATION



01
DESIGN

02
MANUFACTURE

03
DELIVERY

04
SERVICE

About us

We have a wealth of thermocouple and platinum resistance detector (RTD) know-how: collectively the management and staff of Thermocouple Products have over 89 years of experience in the manufacture of thermocouples and RTDs.

Design In-house design to your process requirements	Manufacture Argon arc micro-welded, built in South Africa	Delivery First-class, on time	Service Calibration, repair and technical support
---	---	---	---

Contents

Introduction	3
1.1 Mineral Insulated Thermocouples	4
1.2 Standard Thermocouples	8
1.3 Angle Thermocouples	11
2.1 Mineral Insulated Platinum RTD	13
2.2 Standard Platinum RTD	15
3 Spring Loaded (Bayonet Cap) Thermocouples	17
4 Standard Thermocouple Inserts	18
5 Drilled Wells	20
6 Connectors — Plugs & Jacks	22
7 Cables	24
8 Protection Sheaths	25
9 Technical Data	26

Manufacturing capability

- Single and duplex thermocouple assemblies
- Platinum resistance thermometer (Pt 100) assemblies
- Inserts and resistance elements
- Compensating and extension cables
- Thermowells and protection sheaths
- Argon arc micro-welded junctions

Instrumentation supplied

- Transmitters
- Indicators
- Recorders
- Controllers

Measurement range

–250°C to 1 700°C and above, depending on element and sheath selection.

All assemblies are manufactured in South Africa to exacting standards. Where a required configuration does not appear in this catalogue, please contact us — most items can be supplied to order.

Introduction

General

Temperature is the most widely measured and most frequently controlled variable in the process industry.

Temperature measurement plays an important part in many processes, and its control is critical in energy generation, chemical manufacture, steel production and other industries. With measurement ranges from near absolute (-250°C) to 1700°C and above, the demands made on temperature sensors are severe. Expertise and sound engineering skills must be applied to produce a thermocouple or RTD capable of working reliably at such extremes.

Thermocouple Products manufactures a wide variety of thermocouple and resistance thermometer assemblies in South Africa to exacting standards. The company pioneered argon arc micro-welding techniques in the South African thermocouple manufacturing industry, producing sensors of unmatched quality.

Our range includes complete single and duplex thermocouple and resistance thermometer assemblies, inserts and resistance elements, as well as compensating cables and thermowells.

For onward transmission and processing we supply a wide range of transmitters, indicators, recorders and controllers to meet the needs of process instrumentation.

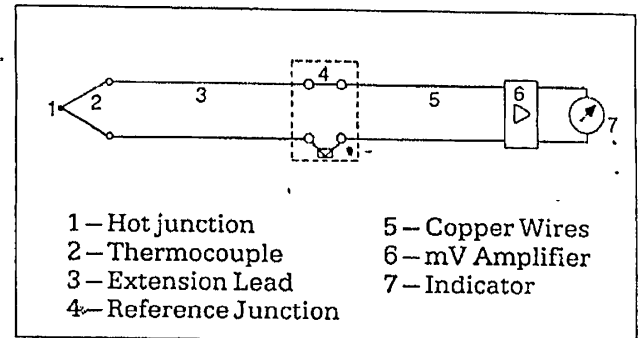


Fig 1 — Thermocouple measurement circuit with cold junction compensation.

Temperature measurement with platinum RTD

The principle used for this type of temperature measurement is the change in electrical resistance of metals with temperature.

The RTD is usually made up of fine platinum wire wound onto a ceramic former. Platinum is the metal most commonly used, being best suited to this type of measurement: it offers a high temperature coefficient, good reproducibility and consistency, and adequate resistance to chemical attack.

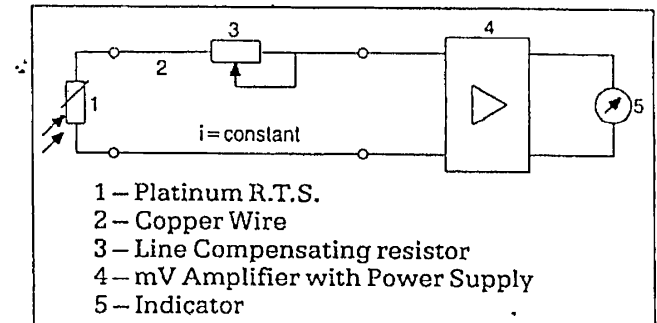


Fig 2 — RTD measuring circuit using a 2-wire configuration.

To avoid line resistance effects, 3-wire or 4-wire configurations are used.

Thermocouple principle

When two electrical conductors of dissimilar metals are joined at one end — a thermocouple — an electromotive force (EMF, a thermoelectric voltage in mV) is generated between the heated junction and the measuring junction (reference junction). The EMF generated is proportional to the temperature difference between the two junctions: an increase in that difference produces an increase in EMF.

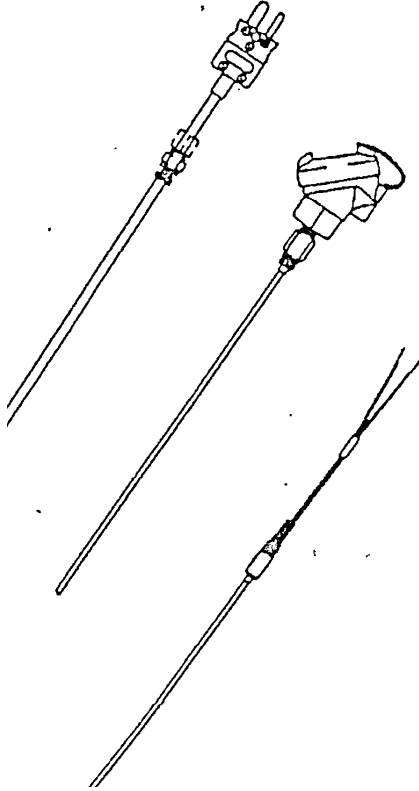
To obtain accurate temperatures it is therefore necessary to hold the reference junction (cold junction) at a constant temperature. This can be done by using 0°C as a reference (melting ice), but that method is impractical, so room temperature (20°C) is normally used instead.

To establish the reference temperature, electrical cold junction compensation circuitry is incorporated in the instrument to maintain a constant reference of 20°C .

SECTION 1.1

Mineral Insulated Thermocouples

MI in this catalogue refers to magnesium oxide (MgO) packed, metal sheathed thermocouples.



MI thermocouple assemblies have a fast response because the protective metal outer sheath allows the use of smaller diameter thermocouple conductors. The hard compacted MgO insulation further enhances the sensor's ability to read temperature by transferring heat quickly to the measurement junction.

Product features

- Temperature range -270°C to $+1\,370^{\circ}\text{C}$
- Long, stable life
- Quick response
- Ease of installation
- Mechanical strength
- Superior electrical shielding
- High level of insulation resistance
- High degree of corrosion resistance
- Moisture resistance
- Withstands high pressure

How to order

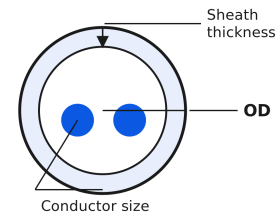
Select one order symbol from each group to construct a complete assembly part number.

TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5	TABLE 6	TABLE 7
Sheath Diameter	Thermocouple Element	Sheath Material	Hot Junction	Immersion Depth mm	Termination	Mounting Fitting
60	K	316	U	150	A	FSS

If any modifications are required, indicate by placing an "X" before Table 1 and describe the modifications.

Table 1 · Sheath diameter

Ordering Code	Diameter mm	Conductor size mm	Sheath thickness mm	Max continuous length (m)
80	8,0	1,31	1,12	20
60	6,0	1,04	0,89	40
45	4,5	0,79	0,69	70
30	3,0	0,53	0,46	170
20	2,0	0,33	0,28	350
15	1,5	0,25	0,23	400



Suggested upper temperature limits

Calibration	1,5 mm	2,0 mm	3,0 mm	4,5 mm	6,0 mm	8,0 mm
J	540°C	540°C	650°C	650°C	650°C	650°C
T	205°C	205°C	370°C	370°C	370°C	370°C
K	980°C	980°C	1095°C	1095°C	1095°C	1150°C
E	540°C	540°C	540°C	540°C	595°C	705°C

Table 2 · Thermocouple element calibration

Single	Duplex	Temperature range	Limits of error Standard	Limits of error Special	ISA code — positive	ISA code — negative
J	JJ	0° to 280°C 280° to 760°C	±2°C ±3/4%	±1°C ±3/8%	Iron — white Magnetic	Constantan — red Non-magnetic
K	KK	0° to 280°C 280° to 1260°C	±2°C ±3/4%	±1°C ±3/8%	Chromel — yellow Non-magnetic	Alumel — red Magnetic
T	TT	-184° to -60°C -25° to -60°C -60° to 95°C 95° to 370°C	— ±2% ±3/4°C ±3/4%	±1% ±1% ±3/8°C ±3/8%	Copper — blue Non-magnetic	Constantan — red Non-magnetic
E	EE	0° to 315°C 315° to 870°C	±1 1/2°C ±1/2%	—	Chromel — purple Non-magnetic	Constantan — red Non-magnetic
S R	SS RR	0° to 540°C 540° to 1480°C	±1 1/2°C ±1/4%	—	S — platinum 10% rhodium R — platinum 13% rhodium	Platinum — red Softer than positive lead

Table 3 · Sheath material

Ordering code	Material	Max temp °C
304	304 stainless steel	925
316	316 stainless steel	925
600	Inconel 600	1150
310	310 stainless steel	1095
446	446 stainless steel	1040
321	321 stainless steel	925

Table 4 · Measuring junction

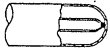
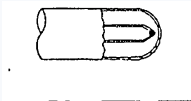
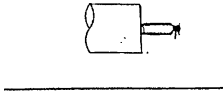
Code	Type	Description
G		Grounded to sheath
U		Insulated from sheath (single & duplex)
E		Exposed junction

Table 5 · Immersion depth

Specify the immersion depth in mm.

Table 6 · Termination

Code	Termination type
ST	STRIPPED — 75 mm of exposed conductors
PS	PLUG — quick connect male (solid)
PH	PLUG — quick connect male (hollow)
J	JACK — quick connect female adaptor
MP	MINI PLUG
MJ	MINI JACK
T---	TRANSITION — with cable. Specify cable length in m only and type of cable (PVC or Teflon)
KH	KH HEAD — aluminium with screw cover (large)
KS	KS HEAD — aluminium with screw cover (small)
N	NYLON HEAD
B	BAKELITE HEAD
SLB	SPRING LOADED BLOCK
DB	DIN BLOCK

Table 7 · Mounting

A · Adjustable compression fittings (ACF)

Ordering code	Size (inch NPT)	Material
ACF-BR-1/8	1/8	Brass
ACF-BR-1/4	1/4	Brass
ACF-BR-3/8	3/8	Brass
ACF-BR-1/2	1/2	Brass
ACF-SS-1/8	1/8	316 S/S
ACF-SS-1/4	1/4	316 S/S
ACF-SS-3/8	3/8	316 S/S
ACF-SS-1/2	1/2	316 S/S

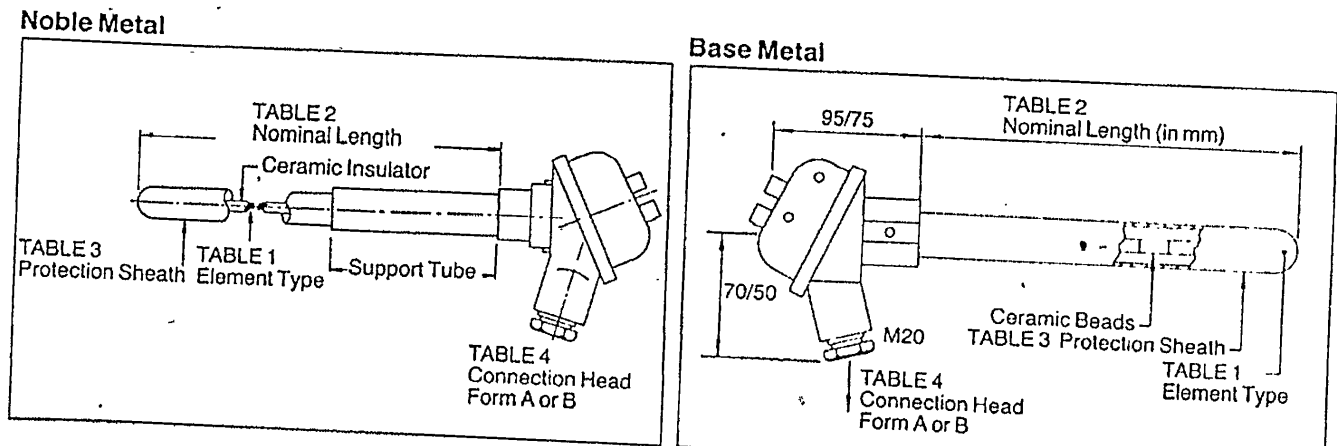
B · Fixed fittings (FF)

Ordering code	Example
FF-SS-1/4-IL-100	Stainless steel, 1/4" NPT, insertion length IL = 100

Other fittings on request.

SECTION 1.2

Standard Thermocouples



How to order

Select one order symbol from each group to construct a complete assembly part number.

TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5
Element Type	Nominal Length (mm)	Protection Sheath	Connection Head	Mounting

Ordering example

Single type K thermocouple, 500 mm long, with 316 stainless steel sheath 21,3 mm O.D., complete with type KH connection head and adjustable flange.

K - 500 - 316-2 - KH - AFL - 22

Table 1 · Element type

Single	Duplex	Composition	Recommended temperature range*
J	JJ	Iron / constantan	−250°C to +750°C
K	KK	Chromel / alumel	−180°C to +1 100°C
R	RR	Platinum 13% rhodium / platinum	0°C to 1 600°C
S	SS	Platinum 10% rhodium / platinum	0°C to 1 600°C
B	BB	Pt 30% rhodium / Pt 6% rhodium	up to 1 600°C

Other element types on request. *These are guide values only — strongly dependent on wire size and application.

Table 2 · Nominal length

Specify length in mm between 100 mm and 2 000 mm. Standard lengths: 100, 200, 350, 500, 700, 1 000, 1 400 and 2 000 mm. Longer lengths on request.

Table 3 · Protection sheath

Ordering code	Sheath material	Sheath dimension (mm)
610	Pythagoras 610	10 x 7
615	Pythagoras 610	15 x 11
710	Alsint 710	10 x 6
715	Alsint 710	15 x 11
CS 13	Mild steel	13,7 x 9,24
CS 21	Mild steel	21,3 x 15,8
316-4	Stainless steel 316	13,7 x 9,24
316-2	Stainless steel 316	21,3 x 15,8
446	Stainless steel 446	21,3 x 15,8
310	Stainless steel 310	21,3 x 15,8
600	Inconel 600	21,3 x 15,8

Other protection sheaths on request.

Table 4 · Connection head

Ordering code	Standard head type	Sheath O.D.
KS	KS head	13,7 mm
KH	KH head	21,3 mm

Table 5 · Mounting

A · Flanges

Protecting / support tube dia. (mm)	a	b	c	d ₂	d ₃
13,7 mm	75	50	55	28	16
21,3 mm	90	65	70	33	23

Ordering code	Adjustable flange (AFL)
AFL-13	Sheath diameter 13,7 mm
AFL-22	Sheath diameter 21,3 mm

Ordering code	Fixed flange (FFL) — example
FFL-A.N.S.I.-2-600-IL-10 0	A.N.S.I. 2 inch 500 P.S.I. 316 st/st flange, insertion length (I.L.) 100 mm

B · Fittings

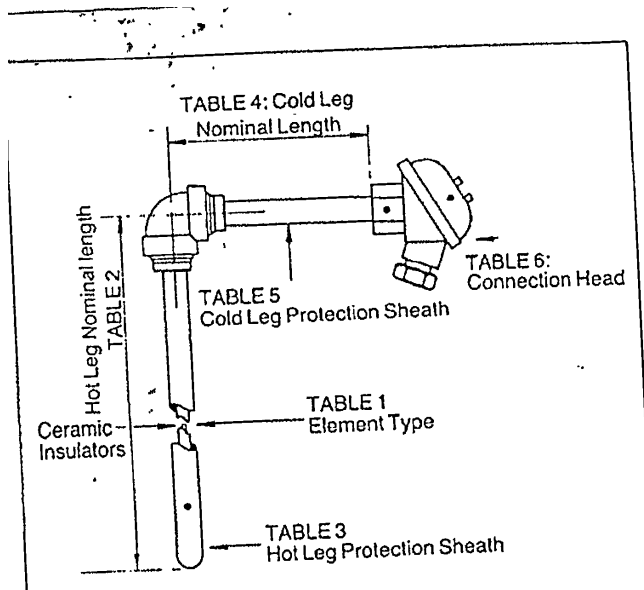
Ordering code	Material	Size (inch NPT)
ACF-BR-1/2	Brass (BR)	1/2
ACF-BR-3/4	Brass (BR)	3/4
ACF-BR-1	Brass (BR)	1"
ACF-SS-1/2	316 stainless steel (SS)	1/2
ACF-SS-3/4	316 stainless steel (SS)	3/4
ACF-SS-1	316 stainless steel (SS)	1"

Ordering code	Fixed fitting (FF) — example
FF-BR-3/8-IL-200	Brass, 3/8" NPT, insertion length (IL) 200 mm

Other mounting arrangements on request.

SECTION 1.3

Angle Thermocouples



How to order

Select one order symbol from each group to construct a complete assembly part number.

TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5	TABLE 6
Hot Leg Element Type	Hot Leg Nominal Length (mm)	Hot Leg Protection Sheath	Cold Leg Nominal Length (mm)	Cold Leg Protection Sheath	Connection Head

Ordering example

Single angle thermocouple, type K hot leg 600 mm, 446 S/S sheath 21,3 mm O.D., cold leg 400 mm standard sheath.

X - K - 600 - 446 - 400 - P21 - KH

Standard cold leg sheath supplied is plated mild steel.

Table 1 · Element type

Single	Duplex	Composition
K	KK	Chromel / alumel
R	RR	Platinum 13% rhodium / platinum
S	SS	Platinum 10% rhodium / platinum

Table 2 · Hot leg nominal length

Specify nominal length of hot leg in mm between 100 and 2 000 mm. Standard lengths: 100, 200, 350, 500, 700, 1 000, 1 400 and 2 000 mm. Longer lengths on request.

Table 3 · Hot leg protection sheath

Ordering code	Sheath material	Dimensions (mm)
600	Inconel 600	21,3 x 15,8
316	Stainless steel 316	21,3 x 15,8
446	Stainless steel 446	21,3 x 15,8
CS32	Carbon steel	32 x 16

Note: if a noble metal thermocouple is specified, a porcelain 710 inner tube is supplied. Other sheath materials available on request.

Table 4 · Cold leg nominal length

Specify cold leg nominal length in mm, from 300 mm to 1 000 mm.

Table 5 · Cold leg sheath material

Ordering code	Material	Dimensions (mm)
P21	Mild steel (plated)	21,3 x 15,8

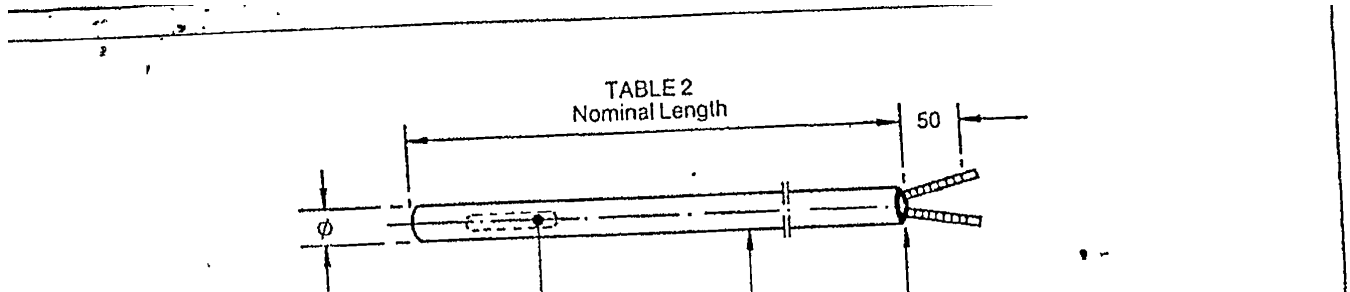
Table 6 · Connection head

Ordering code	Standard head type	Sheath diameter
KH	KH head	21,3 mm

SECTION 2.1

Mineral Insulated Platinum RTD

Pt 100 resistance temperature detectors.



How to order

Select one order symbol from each group to construct a complete assembly part number.

TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5
Element Type	Nominal Length (mm)	Protection Sheath	Connection Head	Mounting

Ordering example

Mineral insulated duplex Pt 100, 3 wire, 150 mm long, 6 mm O.D. 316 S/S sheath, type N head (nylon).

32MP - 150 - SS6 - N

Table 1 · Element type

Ordering code	Element type	Configuration
21 MP	Single Pt 100	2 wire
31 MP	Single Pt 100	3 wire
22 MP	Duplex Pt 100	2 wire
32 MP	Duplex Pt 100	3 wire
23 MP	Triplex Pt 100	2 wire

Other element types and configurations on request.

Table 2 · Nominal length

Specify length in mm from 100 mm to 1 000 mm. Standard lengths: 100, 200, 350, 500, 700 and 1 000 mm. Other lengths on request.

Table 3 · Protection sheath

Ordering code	Material	Outside diameter (mm)	Recommended upper temp. limit
SS 3	Stainless steel 316	3	600°C
SS 6	Stainless steel 316	6	600°C
Z 6	Inconel 600	6	800°C

Other outside diameters on request.

Table 4 · Termination

Code	Termination type
ST	STRIPPED — 75 mm of exposed conductors
T---	TRANSITION — with cable. Specify cable length in m only and type of cable (PVC or Teflon)
KH	KH HEAD — aluminium with screw cover (large)
KS	KS HEAD — aluminium with screw cover (small)
N	NYLON HEAD

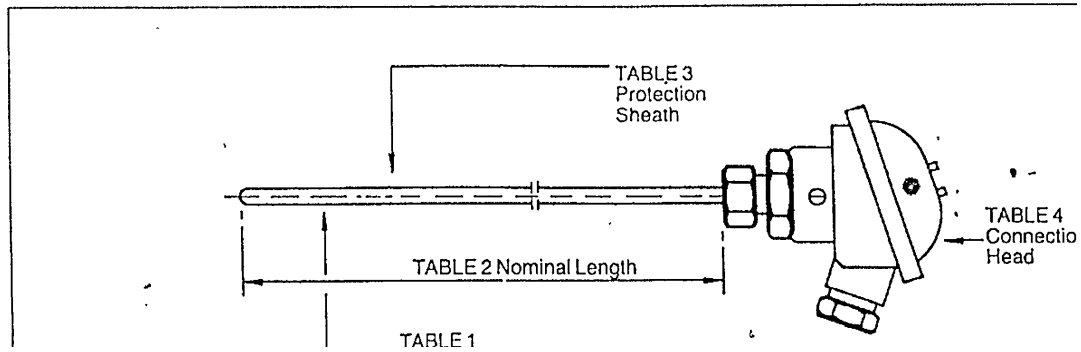
Table 5 · Mounting — adjustable compression fittings (ACF)

Ordering code	Size (inch NPT)	Material
ACF-BR-1/8	1/8	Brass
ACF-BR-1/4	1/4	Brass
ACF-BR-3/8	3/8	Brass
ACF-BR-1/2	1/2	Brass
ACF-SS-1/8	1/8	316 S/S
ACF-SS-1/4	1/4	316 S/S
ACF-SS-3/8	3/8	316 S/S
ACF-SS-1/2	1/2	316 S/S

Other fittings on request.

SECTION 2.2

Standard Platinum RTD



How to order

Select one order symbol from each group to construct a complete assembly part number.

TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5
Element Type	Nominal Length	Protection Sheath	Connection Head	Mounting

Ordering example

2 wire single Pt 100, 6 mm O.D. 316 S/S, 250 mm long, connection head (small head).

21P - 250 - 6 - KS

Table 1 · Element type

Ordering code	Element type	Configuration
21P	Single Pt 100	2 wire
31P	Single Pt 100	3 wire
22P	Duplex Pt 100	2 wire
32P	Duplex Pt 100	3 wire
23P	Triplex Pt 100	2 wire

Other element types and configurations available on request.

Table 2 · Nominal length

Specify nominal length in mm from 50 mm to 2 000 mm. Standard lengths: 100, 200, 350, 500, 700, 1 000, 1 400 and 2 000 mm. Longer lengths on request.

Table 3 · Protection sheath

Ordering code	Material	Dimensions (mm)
3	Stainless steel 316 S/S	3
4	Stainless steel 316 S/S	4,5
6	Stainless steel 316 S/S	6
8	Stainless steel 316 S/S	8
9	Stainless steel 316 S/S	9,5
12	Stainless steel 316 S/S	12

Other sheath materials on request.

Table 4 · Termination

Code	Termination type
ST	STRIPPED — 75 mm of exposed conductors
T---	TRANSITION — with cable. Specify cable length in m only and type of cable (PVC or Teflon)
KH	KH HEAD — aluminium with screw cover (large)
KS	KS HEAD — aluminium with screw cover (small)
N	NYLON HEAD
SLB	SPRING LOADED BLOCK

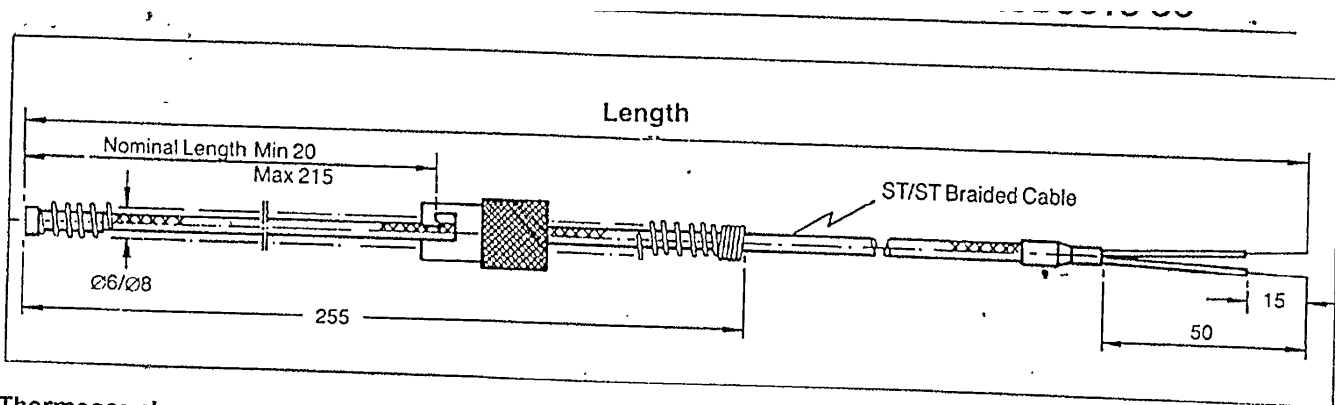
Table 5 · Mounting — adjustable fittings

Ordering code	Size (inch NPT)	Material
ACF-BR-1/8	1/8	Brass
ACF-BR-1/4	1/4	Brass
ACF-BR-3/8	3/8	Brass
ACF-BR-1/2	1/2	Brass
ACF-SS-1/8	1/8	316 S/S
ACF-SS-1/4	1/4	316 S/S
ACF-SS-3/8	3/8	316 S/S
ACF-SS-1/2	1/2	316 S/S

Other fittings on request.

SECTION 3

Spring Loaded (Bayonet Cap) Thermocouples



Thermocouples

Thermocouples

Ordering code	Element type	Sheath O.D. (mm)
A	J	6
B	J	8

Bayonet cap

Ordering code	Bayonet cap — size 2 slot (plated)
12	12 mm ID
15	15 mm ID

Others on request.

Mountings

Ordering code	Size
Q	1/4" NPT
T	3/8" NPT
M	M12

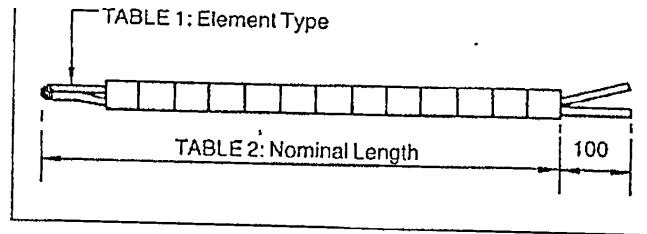
Length

Specify length in mm. Nominal length min 20, max 215.

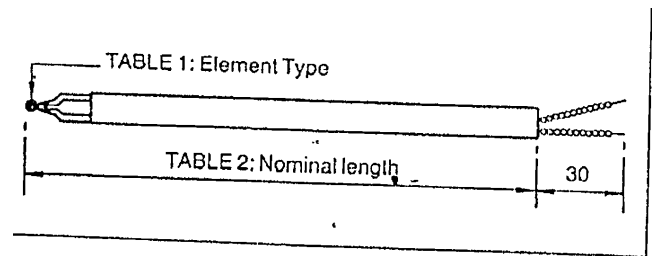
SECTION 4

Standard Thermocouple Inserts

Base metal



Noble metal



How to Order:

How to order

Select one order symbol from each group to construct a complete assembly part number.

TABLE 1	TABLE 2	TABLE 3
Element Type	Nominal Length (mm)	Conductor Diameter

Ordering example

Type K element, 500 mm long, 3 mm conductors.

K - 500 - 3

Table 1 · Element type

Single	Duplex	Composition	Element type
K	KK	Chromel / alumel	K
R	RR	Platinum 13% / rhodium / platinum	*R
S	SS	Platinum 10% / rhodium / platinum	*S
B	BB	Pt 30% rhodium / Pt 6% rhodium	*B

Table 2 · Nominal length

Specify length in mm for the insulated section, up to 2 000 mm. Standard lengths: 100, 200, 350, 500, 700, 1 000, 1 400 and 2 000 mm. Longer lengths on request.

Table 3 · Conductor size

Ordering code	Element type	Conductor O.D. (mm)
1,5	K	1,5
3	K	3
0,38	R	0,38
0,45	R	0,45
0,50	R	0,50
0,38	S	0,38
0,45	S	0,45
0,50	S	0,50
0,50	B	0,50

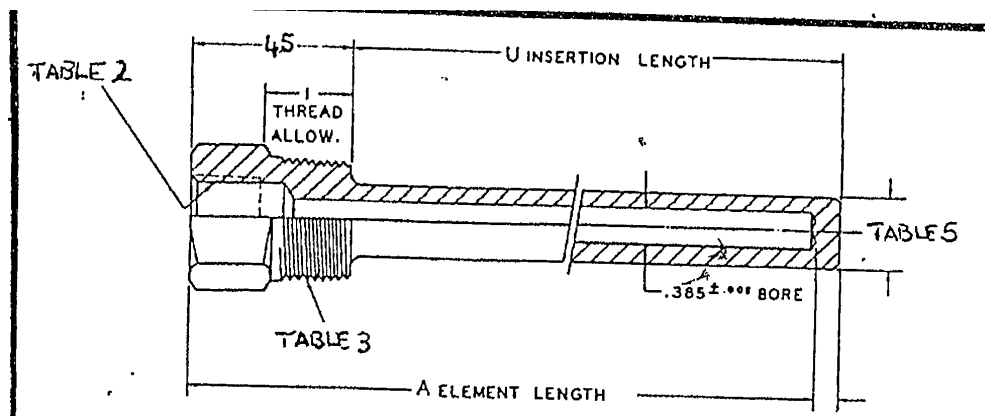
SECTION 5

Drilled Wells

TABLE 1	TABLE 2	TABLE 3	TABLE 4	TABLE 5	TABLE 6
Style Code / Series Code	Female Thread A	Process Thread or Flange B	U Length	Insertion Diameter	Material

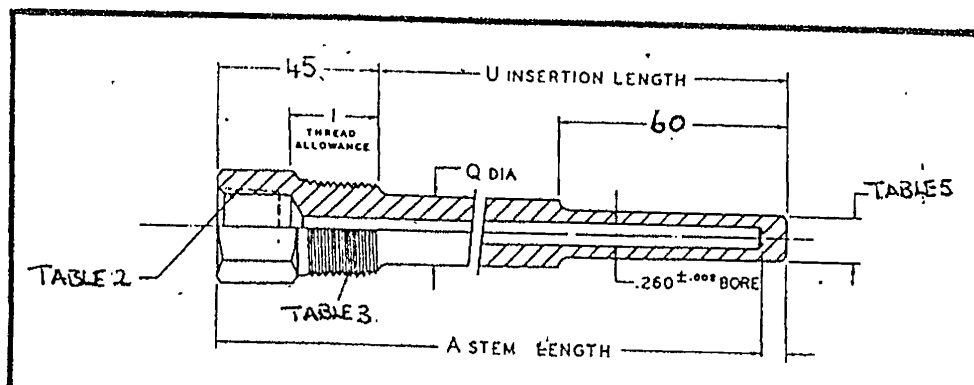
Series code 6062

Threaded well, straight shank, .385 bore



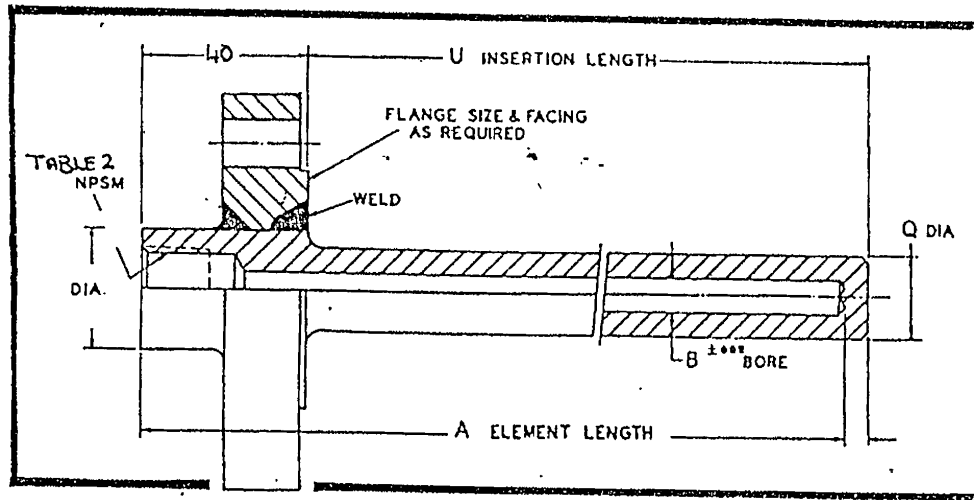
Series code 6063

Threaded well, stepped/tapered shank, .260 bore



Series code 6064

Flanged well, flange size & facing as required



Please supply full information and drawings when ordering.

SECTION 6

Connectors — Plugs & Jacks

Quick connect plugs and jacks provide a reliable connection between the thermocouple sensor and extension wire. Plugs are of solid or hollow pin construction with colour-coded moulded bodies of high performance nylon, withstanding ambient temperatures to 204°C. Also available in high temperature styles to 427°C.

Product features

- Lightweight, rugged and accurate
- Quick, positive wiring hook-up
- Exclusive channel design isolates all wires for clean, strong signals
- ANSI colour coded

Plug — standard hollow pin (male)

Order symbol	Calibration
H10K	K
H10J	J
H10T	T
H10E	E
H10R	R
H10S	S
H10B	B
H10U	U

Jack — standard (female)

Order symbol	Calibration
H20K	K
H20J	J
H20T	T
H20E	E
H20R	R
H20S	S
H20B	B
H20U	U

Plug — standard solid pin (male)

Order symbol	Calibration
H11K	K
H11J	J
H11T	T
H11E	E
H11R	R
H11S	S
H11B	B
H11U	U

Jack — panel ear type (female)

Order symbol	Calibration
H30K	K
H30J	J
H30T	T
H30E	E
H30R	R
H30S	S
H30B	B
H30U	U

Plug — miniature (male)

Order symbol	Calibration
H110K	K
H110J	J
H110T	T
H110E	E
H110R	R
H110S	S
H110B	B
H110U	U

Jack — miniature (female)

Order symbol	Calibration
H120K	K
H120J	J
H120T	T
H120E	E
H120R	R
H120S	S
H120B	B
H120U	U

Panel jack — circular (female)

Order symbol	Calibration
H32K	K
H32J	J
H32T	T
H32E	E
H32R	R
H32S	S
H32B	B
H32U	U

Panel jack — miniature ear (female)

Order symbol	Calibration
H130K	K
H130J	J
H130T	T
H130E	E
H130R	R
H130S	S
H130B	B
H130U	U

Cable clamp

Used to provide strain relief between thermocouple wire and standard connectors.

Order symbol	Cable clamp
H40	Standard cable clamp
H140	Mini cable clamp

Tube adaptor

Compression fittings used to interface standard plugs or jacks to tubing.

Order symbol	Tube O.D.
H51	1,5 mm
H52	3 mm
H53	4,7 mm
H54	6 mm
H55	8 mm
H56	9,5 mm

SECTION 7

Cables

Insulated thermocouple extension wire.

Type J (iron / constantan)

Colour code: neg — red · pos — white · O/A black (magnetic)

Order symbol	AWG	Strand	Conductor / insulation	Jacket material
J-24S-PP	24	Stranded	PVC	PVC
J-24S-GG-SS	24	Stranded	Glass braid	Glass braid — O/A wire braid
J-24S-TT	24	Stranded	Teflon	Teflon
J-30-GG	30	Solid	Glass wrap	Glass braid

Type K (chromel / alumel)

Colour code: neg — red · pos — yellow · O/A yellow (magnetic)

Order symbol	AWG	Strand	Conductor / insulation	Jacket material
K-24S-PP	24	Stranded	PVC	PVC
K-24S-GG-SS	24	Stranded	Glass braid	Glass braid — O/A wire braid
KX-24S-TT	24	Stranded	Teflon	Teflon

Type T (copper / constantan)

Colour code: neg — red · pos — blue · O/A blue

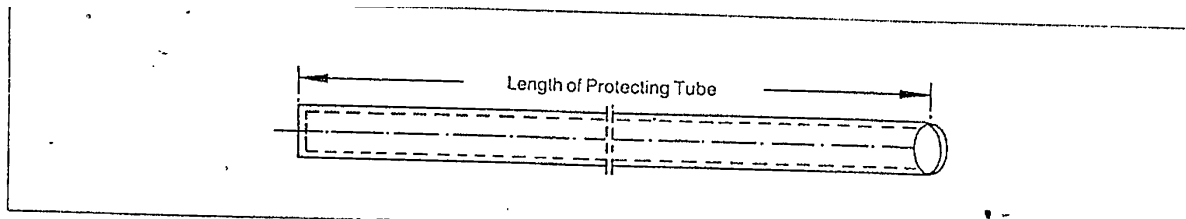
Order symbol	AWG	Strand	Conductor / insulation	Jacket material
T-24S-GG/SS	24	Stranded	Glass braid	Glass braid — O/A wire braid
T-24S-TT	24	Stranded	Teflon	Teflon
T-24S-PP	24	Stranded	PVC	PVC

Type RSX (copper / alloy #11)

Order symbol	AWG	Strand	Conductor / insulation	Jacket material
RSX-24S-PP	24	Stranded	PVC	PVC
RSX-24S-TT	24	Stranded	TEF	TEF
RSX-24S-GG-SS	24	Stranded	GF	GF

SECTION 8

Protection Sheaths



How to order

Specify the material ordering code and add the nominal length in mm.

Ordering example

446 S/S sheath 21,3 mm O.D. x 500 mm long, closed one end, open the other.

446 - 500 mm

Ordering code	Sheath material	Sheath dimensions (mm)
610	Pythagoras 610 (P)	10 x 7
615	Pythagoras 610 (P)	15 x 11
614	Pythagoras 610 (P)	24 x 19
710	Alsint 710	10 x 6
715	Alsint 710	15 x 10
CS13	Mild steel (M)	13,7 x 9,24
CS21	Mild steel (M)	21,3 x 15,8

Ordering code	Sheath material	Sheath dimensions (mm)
316-4	316 stainless steel (SS)	13,7 x 9,24
316-2	316 stainless steel (SS)	21,3 x 15,8
310	310 stainless steel	21,3 x 15,8
446	446 stainless steel	21,3 x 15,8
600	Inconel 600	21,3 x 15,8

Other protection tubes on request. Please supply full information and drawings when ordering.

Pythagoras

A dense matrix of mullite and glass formulated to give the best combination of thermal shock and sag resistance. It possesses good chemical and atmosphere resistance. Maximum working temperature 1 600°C.

Alsint

Generally more chemically resistant, harder, stronger and more refractory than mullite. Inert to hydrogen, carbon and refractory metals. Gas tight to 1 500°C. Maximum temperature 1 900°C.

SECTION 9

Technical Data

Material selection guide for corrosive service

In recommending the above materials, consideration has been given to providing service life at reasonable cost. Celsius values are converted from the original Fahrenheit figures and rounded to the nearest 5°.

Chemical	°F	°C	Conc. %	Recommended material
Acetic acid	212	100	ALL	Monel, 430 SS
Acetic anhydride	300	150	ALL	Nickel, Monel
Acetone	212	100	ALL	304 SS
Acetylene	400	205	ALL	304 SS, Monel, Nickel
Alcohols (methyl, ethyl)	212	100	ALL	304 SS
Alum (potassium or sodium)	300	150	ALL	Hast C
Aluminium acetate	70	20	ALL	304 SS
Aluminium chloride	212	100	ALL	Hast C
Aluminium sulfate	212	100	ALL	316 SS
Ammonia, dry	70	20	DRY	304, 316 SS
Ammonium hydroxide (aqua ammonia)	212	100	ALL	304, 316 SS
Ammonium chloride	200	95	ALL	Monel
Ammonium nitrate	212	100	ALL	304 SS
Ammonium sulfate	125	50	ALL	316 SS
Amyl acetate	70	20	ALL	304 SS, Monel
Aniline	212	100	ALL	Monel
Asphalt	70	20	ALL	304 SS
Barium compounds	175	80	ALL	Hast C
Beer	212	100	ALL	304 SS
Benzene (benzol)	212	100	ALL	Steel (C1018)
Benzine	212	100	ALL	Steel (C1018)
Benzoic acid	212	100	ALL	316 SS
Bleaching powder	70	20	ALL	Monel
Borax	212	100	ALL	Brass
Bordeaux mixture	212	100	ALL	304 SS
Boric acid	212	100	ALL	316 SS
Bromine	70	20	ALL	Monel, tantalum
Butadiene	70	20	ALL	Brass, 304 SS
Butane	70	20	ALL	Steel, 304 SS
Butyl alcohol	212	100	ALL	304 SS
Butyric acid	212	100	ALL	Hast C, 304 SS
Calcium bisulphate	212	100	ALL	Hast C, 316 SS
Calcium chloride	212	100	50	Hast C, 304 SS
Calcium hydroxide	212	100	ALL	Hast C, 317 SS
Calcium hypochlorite	70	20	ALL	Monel
Carbolic acid	212	100	ALL	316 SS
Carbon dioxide, dry	212	100	DRY	Brass, steel (C1018)
Carbonated water	212	100	ALL	304 SS
Carbonated beverages	212	100	ALL	304 SS
Carbon disulfide	212	100	ALL	304 SS
Carbon tetrachloride	212	100	ALL	Monel
Chloride, dry	300	150	DRY	Monel
Chloride, moist	300	150	ALL	Hast C
Chloracetic acid	180	80	ALL	Monel

Chemical	°F	°C	Conc. %	Recommended material
Chloroform, dry	75	25	DRY	Monel
Chromic acid	300	150	ALL	Hast C, 316 SS
Cider	300	150	ALL	304 SS
Citric acid	200	95	ALL	Hast C, 316 SS
Coal tar	300	150	ALL	304 SS
Copper (II) chloride	300	150	ALL	Hast C
Copper (II) nitrate	500	260	ALL	316 SS
Copper (II) sulfate	212	100	ALL	316 SS
Copper plating solution (cyanide)	75	25	ALL	304 SS
Copper plating solution (acid)	500	260	ALL	304 SS
Corn oil	75	25	ALL	304 SS
Cottonseed oil	70	20	ALL	304 SS
Creosote, crude	212	100	ALL	304 SS, Monel
Crude oil	150	65	ALL	Monel
Ethyl acetate	100	40	ALL	Monel
Ethyl chloride, dry	450	230	DRY	Steel
Ethylene glycol	150	65	ALL	Steel
Ethylene oxide	70	20	ALL	Steel
Fatty acids	300	150	ALL	316 SS
Ferric chloride	300	150	ALL	Hast C
Ferric sulphate	212	100	ALL	Tantalum
Formaldehyde	212	100	ALL	304 SS
Formic acid	212	100	ALL	316 SS
Freon	212	100	ALL	316 SS
Fluorine, anhydrous	212	100	ALL	Steel
Furfural	212	100	ALL	304 SS
Gallic acid	212	100	ALL	316 SS
Gasoline	212	100	ALL	Monel
Glucose	212	100	ALL	Steel, 304 SS
Glue pH 6–8	300	150	ALL	304 SS
Glycerine	300	150	ALL	304 SS
Glycerol	212	100	ALL	Brass, 304 SS
Hydrobromic acid	212	100	ALL	Hast B
Hydrochloric acid (37–38%)	225	105	ALL	Hast B
Hydrogen chloride, dry	300	150	DRY	304 SS
Hydrocyanic acid	212	100	ALL	316 SS
Hydrofluoric acid	212	100	60	Monel, Hast C
Hydrogen fluoride, dry	175	80	DRY	Steel
Hydrofluosilicic acid	212	100	40	Monel
Hydrogen peroxide	212	100	10–100	316 SS
Iodine	70	20	ALL	Tantalum
Kerosene	70	20	–	Steel, 304 SS
Lacquers & thinners	300	150	ALL	Monel
Lactic acid	212	100	ALL	316 SS, tantalum

Material selection guide for corrosive service (continued)

Chemical	°F	°C	Conc. %	Recommended material
Lime	212	100	ALL	316 SS
Linseed oil	212	100	–	Steel, 304 SS
Magnesium chloride	212	100	50	Nickel
Magnesium hydroxide	75	25	ALL	304 SS
Magnesium sulphate	212	100	40	304 SS
Malic acid	212	100	ALL	316 SS
Mercuric chloride	75	25	10	Hast C
Mercury	–	–	–	Steel, 304 SS
Methane	70	20	ALL	Steel
Methylene chloride	212	100	ALL	304 SS
Methyl chloride, dry	75	25	DRY	Steel
Milk, fresh or sour	180	80	–	304 SS, nickel
Molasses	300	150	ALL	304 SS
Natural gas	70	20	–	304 SS
Nitric acid	75	25	ALL	304 SS
Nitric acid	300	150	ALL	316 SS, tantalum
Nitrobenzene	70	20	–	304 SS
Oxygen	70	20	ALL	Steel
Oleic acid	500	260	ALL	316 SS
Oxalic acid	212	100	ALL	Monel
Palmitic acid	500	260	ALL	316 SS
Photographic bleaching	100	40	ALL	304 SS
Phosphoric acid	212	100	ALL	316 SS
Phenol	212	100	ALL	316 SS
Potassium compounds	–	–	–	See sodium compounds
Propane	70	20	ALL	Steel
Rosin	700	370	100	316 SS
Sea water	212	100	–	Monel
Soap & detergents	212	100	ALL	304 SS
Sodium bicarbonate	212	100	20	316 SS
Sodium bisulphite	212	100	20	304 SS
Sodium bisulphate	212	100	20	304 SS
Sodium carbonate	212	100	40	316 SS
Sodium chloride	300	150	30	Monel
Sodium chromate	212	100	ALL	316 SS
Sodium cyanide	212	100	ALL	304 SS
Sodium hydroxide	212	100	30	316 SS
Sodium hypochlorite	75	25	10	Hast C
Sodium nitrate	212	100	40	304 SS
Sodium nitrite	75	25	20	316 SS
Sodium phosphate	212	100	10	Steel
Sodium silicate	212	100	10	Steel
Sodium sulphate	212	100	30	316 SS
Sodium sulphide	212	100	10	316 SS

Chemical	°F	°C	Conc. %	Recommended material
Sodium sulphite	212	100	30	304 SS
Sodium thiosulphate	212	100	ALL	304 SS
Steam	–	–	–	304 SS
Stearic acid	500	260	ALL	316 SS
Sugar solutions	300	150	ALL	304 SS
Sulphur	500	260	–	304 SS
Sulphur chloride, dry	75	25	DRY	316 SS
Sulphur dioxide, dry	500	260	DRY	316 SS
Sulphur trioxide, dry	500	260	DRY	316 SS
Sulphuric acid	212	100	5	Hast B
Sulphuric acid	212	100	5–100	Hast B, D
Sulphuric acid, fuming	175	80	–	Hast C
Sulphurous acid	75	25	20	316 SS
Titanium tetrachloride	75	25	ALL	316 SS
Tannic acid	75	25	40	Hast B
Toluene	75	25	–	Steel
Trichloroacetic acid	75	25	ALL	Hast B
Trichlorethylene	–	–	–	Steel (C1018)
Turpentine	75	25	ALL	316 SS
Varnish	150	65	–	Steel, 304 SS
Vinegar	212	100	ALL	Monel, 304 SS
Zinc chloride	212	100	ALL	Hast B
Zinc sulphate	212	100	ALL	316 SS

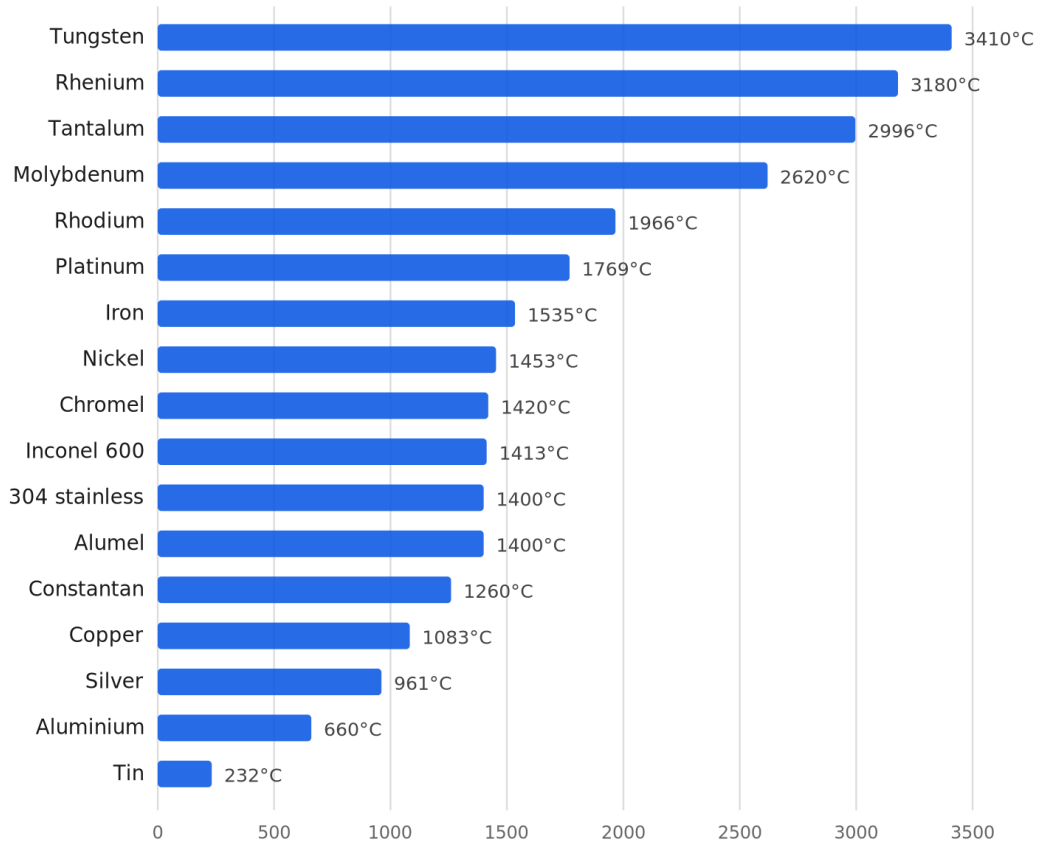
Temperature conversion

Degrees F = (°C × 9/5) + 32

Degrees C = (°F – 32) × 5/9

Melting points of commonly used elements & alloys

Degrees Celsius



Time constants

Relative response characteristics of thermocouples — the time required for the thermocouple temperature to reach 63,2% of the total step change in temperature.

Code	Response time
A	0,110 – 0,8 second
B	0,8 – 1,0 second
C	1,1 – 2,3 second



TEMPERATURE TECHNOLOGY

10 Edendale Road West
Eastleigh, Edenvale
Gauteng, South Africa

Tel (011) 452-6617

tcprod@mweb.co.za

thermocoupleproducts.co.za

SENSING · CONTROL · INDICATION · CALIBRATION

Specifications are subject to change without notice. Dimensions in millimetres unless stated otherwise.

© Thermocouple Products (Pty) Ltd