Dynatherm

1.1 Introduction

Dynatherm's 100 Series thermocouples are manufactured from high quality, metal sheathed, mineral insulated thermocouple wire (commonly known as MgO). The thermo-elements are insulated from the sheath and each other by a compacted mineral insulation. MgO thermocouples have the following advantages;

- Wide range of sheath diameters and materials
- Robust and flexible
- Withstands vibration
- Single, double or triple elements
- Wide range of terminations and mountings
- Fast response
- Corrosion resistant
- Gas tight and moisture proof

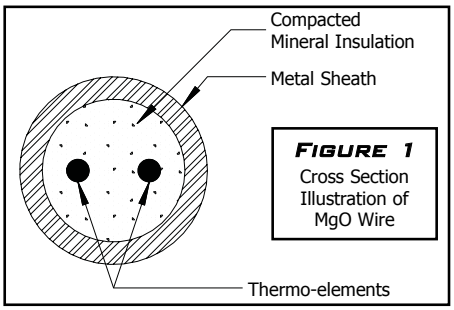


Figure 1
Cross Section Illustration of MgO Wire

All common materials are stocked at our in-house manufacturing facilities allowing us to ***quickly deliver high quality*** and ***competitively priced*** products. This catalogue illustrates the most common thermocouple models and options, consult factory for models or options not illustrated.

1.2 "Quick Ship" Items

When selecting materials or options, you'll come across tables and lists where you must make selections. Order codes with grey highlights are most common and we take extra precautions to keep inventory for these items. When making choices, using ***"Quick Ship"*** items will ensure quick delivery of merchandise. Other items might also be in stock. Below are examples of ***"Quick Ship"*** items.

③ **Sheath Dia. Code**
Select probe diameter.

Sheath Diameter	Order Code
0.020″	**2**
0.040″	**3**
0.063″	**4**
0.125″	**5**
0.188″	**6**
0.250″	**7**
0.313″	**8**
0.375″	**9**
0.500″	**A**

"Quick Ship" items are common and in stock

① **Calibration Code**
Specify calibration and limits of error.

Calibration	Limits Of Error	
	Standard	Special
K	**K**	**KK**
J	**J**	**JJ**
T	**T**	**TT**
E	**E**	**EE**
N	**N**	**NN**

Instrumentation Dynatherm inc
4127 Cousens Montreal QC H4S 1V6 Tel: (514) 636-7800 / (866) 460-7739 Fax: (514) 636-7801

2.1 Calibration And Alloys

In 1821, Thomas Seebeck discovered that by joining two dissimilar metals and heating the junction, a small voltage was produced, the thermocouple was invented. Thermocouples come in a wide range of calibrations, in the next tables you'll find application information and specifications for most common thermocouple calibrations.

Calibration	Application Range	Positive Alloy	Negative Alloy	Application Notes
K	0°C to 1250°C	Chromel	Alumel	Well suited for clean oxidizing atmospheres.
J	0°C to 750°C	Iron	Constantan	Recommended for use in reducing atmospheres.
T	-200°C to 350°C	Copper	Constantan	Recommended in both reducing and oxidizing atmospheres up to 400°C. Well suited for cryogenic temperature measurements.
E	0°C to 750°C	Chromel	Constantan	Recommended for use in vacuum or inert atmospheres. Highest emf output of base metal thermocouples.
N	0°C to 1250°C	Nicrosil	Nisil	Better stability and resistance to oxidation than Type K.

2.2 Calibration Tolerances

Most common sheath material and diameter combinations are available in both standard or special limits of error. The table below lists tolerances for different thermocouple calibrations, tolerances are stated by 2 values, a fixed value and a percentage of reading, use whichever value is greater.

Calibration	Range	Standard Limits	Special Limits
Type K	-200° C to 0° C	± 2% 0r 2.2° C	-
Type K	0° C to 1250° C	± 0.75% 0r 2.2° C	± 0.4% 0r 1.1° C
Type J	0° C to 750° C	± 0.75% 0r 2.2° C	± 0.4% 0r 1.1° C
Type T	-200° C to 0° C	± 1.5% 0r 1° C	-
Type T	0° C to 350° C	± 0.75% 0r 1° C	± 0.4% 0r 0.5° C
Type N	0° C to 1260° C	± 0.75% 0r 2.2° C	± 0.4% 0r 1.1° C
Type E	-200° C to 0° C	± 1% 0r 1.7° C	-
Type E	0° C to 900° C	± 0.5% 0r 1.7° C	± 0.4% 0r 1 C

Instrumentation Dynatherm inc
4127 Cousens Montreal QC H4S 1V6 Tel: (514) 636-7800 / (866) 460-7739 Fax: (514) 636-7801

2.3 Sheath Material Information

Metal sheaths protect the sensing element against harsh process conditions and give the sensor good mechanical strength. 100 Series are available in a wide variety of sheaths like;

- Stainless Steels 300 and 400 series
- Inconel
- Pyrosil D
- Hastelloy X
- Many more…

Listed below are properties of common sheath materials.

Sheath Order Code	Sheath Material	Melting Temp.	Continuous Max. Temp.	Application Notes
2	Stainless Steel 310	1400° C	1150° C	High temperature strength and scale resistance. Good resistance to carburizing and reducing environments. Withstands sulfurous gas at elevated temperatures.
3	Stainless Steel 316	1370° C	925° C	Good corrosion resistance and creep strength at elevated temperatures. Resists tendency to pit in phosphoric and acetic acids. Withstands sulfuric acid compounds. Most common general purpose sheath.
6	Stainless Steel 446	1480° C	1100° C	Good high temperature oxidation resistance. Resists attack by sulfur gas. Good in oxidizing and reducing atmospheres.
7	Inconel 600	1400° C	1150° C	High corrosion resistance at elevated temperatures. High hot strength. Used in sulfur-free environments. Resists oxidizing and reducing atmospheres.
8	Pyrosil D	1400° C	1150° C	Exceptional mechanical strength, oxidation and corrosion resistance at temperatures up to 1150°C. Minimizes element contamination.
9	Hastelloy X	1285° C	1150° C	Good temperature strength and exceptional resistance to oxidation. Good for reducing conditions. Resists attack by sulfur compounds at high temperature.

2.4 Manufacturing Tolerances

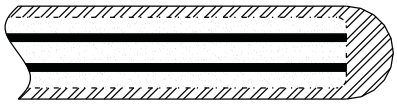
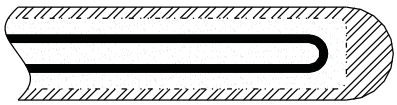
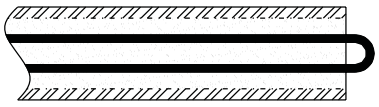
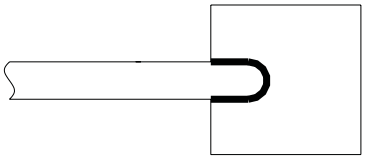
The table below lists manufacturing tolerances for 100 Series thermocouples.

Material	Range	Tolerance
Metal Sheath	Up To 24″	± 0.125″
Metal Sheath	Over 24″	± 0.5%
Leadwire	Up To 120″	+ 6″
Leadwire	Over 120″	+ 5%
Mounting Hardware	Up To 6″	± 0.5″
Mounting Hardware	Over 6″	± 10%

Instrumentation Dynatherm inc
4127 Cousens Montreal QC H4S 1V6 Tel: (514) 636-7800 / (866) 460-7739 Fax: (514) 636-7801

2.5 Junction Form Information

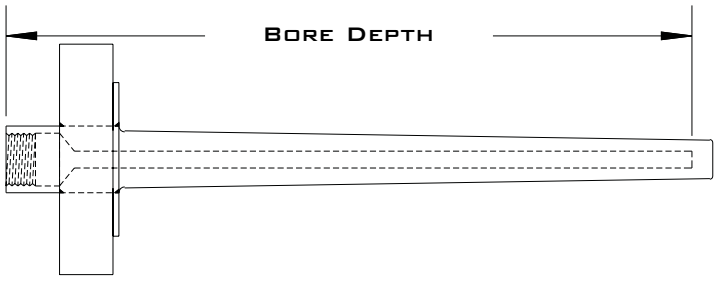
The table below illustrates different styles of junctions available for the 100 Series thermocouples.

Illustration	Junction Type	Application Notes
	Grounded	Conductors are welded to the sheath and are protected against process conditions. To avoid current leakage, this type of junction should be used with an isolated transmitter or instrument with isolated input.
	Ungrounded	Conductors are insulated from the sheath and are protected against process conditions. Response time is slightly longer than grounded junction. Multiple elements can be common or insulated from each other.
	Exposed	Conductors are exposed to process conditions and insulation is sealed against liquid and gas penetration. To be used when fast response time is required.
	Weldpad	Weldpads are used to attach thermocouple to surface or pipe. When ordering weldpad, specify size, material and bend radius if necessary. Standard thickness is 0.125", other sizes available optional.

2.6 Calculating Sensor Length

When specifying sensor length for use in thermowell use the following table to calculate the "X" dimension. Spring loaded probe action is suggested for use with thermowell since the probe is assured to be in contact with the bottom of the thermowell.

Probe Action	Probe Length "X" Dimension
Spring Loaded	Bore
Fixed	Bore - 0.5"



Instrumentation Dynatherm inc
4127 Cousens Montreal QC H4S 1V6 Tel: (514) 636-7800 / (866) 460-7739 Fax: (514) 636-7801

Dynatherm

3.1 Sheath Order Codes

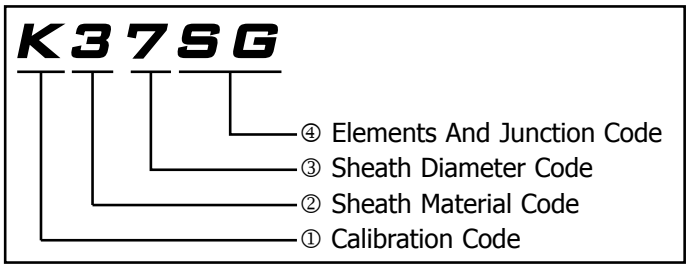
Sheaths come in a wide variety, when ordering 100 Series thermocouples the following information must be specified;

- Probe calibration and limits of error
- Sheath material
- Sheath diameter
- Number of elements
- Junction configuration

Using the example and the tables below, build your sheath order code in ***4 easy steps***.

Example : The code "***K37SG***" specifies;

① Type K probe calibration, standard limits
② SST 316 sheath material
③ 0.250" probe O.D.
④ Simplex element with grounded junction



① Calibration Code

Specify calibration and limits of error.

Calibration	Limits Of Error	
	Standard	Special
K	**K**	**KK**
J	**J**	**JJ**
T	**T**	**TT**
E	**E**	**EE**
N	**N**	**NN**

② Sheath Material Code

Specify sheath alloy.

Sheath Material	Order Code
SST 310	**2**
SST 316	**3**
SST 446	**6**
Inconel 600	**7**
Pyrosil D	**8**
Hastelloy X	**9**

③ Sheath DiA. Code

Specify probe diameter.

Sheath Diameter	Order Code
0.020"	**2**
0.040"	**3**
0.063"	**4**
0.125"	**5**
0.188"	**6**
0.250"	**7**
0.313"	**8**
0.375"	**9**
0.500"	**A**

④ Elements And Junction Form Code

Specify number of elements and junction form.

Element	Junction Forms						
	Grounded	Ungrounded	Exposed	Ungrounded Common	Grounded Weldpad	Ungrounded Weldpad	Ungrounded Common Weldpad
Simplex	**SG**	**SU**	**SE**	**-**	**SX**	**SY**	**-**
Duplex	**DG**	**DU**	**DE**	**DC**	**DX**	**DY**	**DZ**
Triplex	**TG**	**TU**	**TE**	**TC**	**TX**	**TY**	**TZ**

3.2 Hardware Order Codes

Mounting hardware is available in fixed or spring loaded configuration. In a fixed mounting hardware, the mounting hardware is welded to the metal sheath forming a pressure tight seal, this type of configuration is typically used when the sensor is inserted directly into the process. Spring loaded configurations allow the probe to travel back and forth (travel is approximately 1/2”), this configuration is typically used with thermowell, ensuring a contact with the bottom of the thermowell. Use the information below to select hardware mountings.

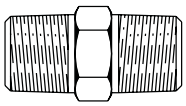
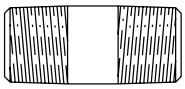
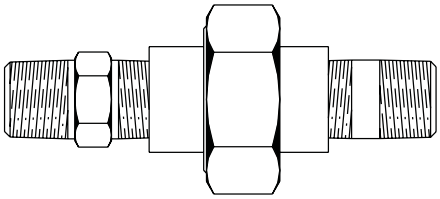
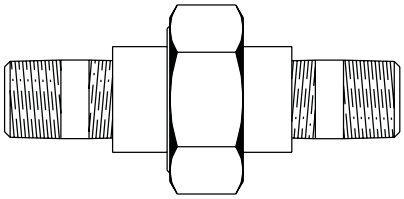
Illustration	Hardware Type
	Bushing Standard Length 1.5”
	Nipple Standard Length 1.5” to 6”

Illustration	Hardware Type
	Bushing-Union-Nipple BUN Standard Length 3.0” to 6”
	Nipple-Union-Nipple NUN Standard Length 3.0” to 6”

Hardware Order Codes

Material And Action	Hardware Type			
	Bushing	Nipple	Bushing-Union Nipple (BUN)	Nipple-Union-Nipple (NUN)
1/2” Galvanized Steel Fixed	-	**A**	-	**B**
1/2” Galvanized Steel Spring Loaded	-	**C**	-	**D**
1/2” Stainless Steel Fixed	**E**	**F**	**G**	**H**
1/2” Stainless Steel Spring Loaded	**I**	**J**	**K**	**L**
3/4” Galvanized Steel Fixed	-	**M**	-	**N**
3/4” Galvanized Steel Spring Loaded	-	**O**	-	**P**
3/4” Stainless Steel Fixed	-	**Q**	-	**R**
3/4” Stainless Steel Spring Loaded	-	**S**	-	**T**

Instrumentation Dynatherm inc
4127 Cousens Montreal QC H4S 1V6 Tel: (514) 636-7800 / (866) 460-7739 Fax: (514) 636-7801

3.3 Connection Head & Transmitter Order Codes

A wide variety of connection heads and transmitters are available. Use the tables below to select a connection head and transmitter if required. When ordering with in head transmitter, specify calibration parameters (low scale, high scale and burnout mode).

Material	Rating	Application Notes
Aluminum	NEMA 4	Lightweight, general purpose and economical. Not recommended for hot environments.
Cast Iron	NEMA 4	Suitable for hot environments and heavy industrial applications.
Stainless Steel 316	NEMA 4X	Excellent corrosion and chemical resistance. Can withstand extremely harsh environments. Good for sanitary application in food and pharmaceutical.
Polypropylene	NEMA 4X	Lightweight head with excellent resistance to acids, alkalies and most process chemicals. FDA compliant for use in sanitary applications.

Transmitter And Connection Head Order Codes

Transmitter	Connection Head Material			
	Aluminum	Cast Iron	Stainless Steel 316	Polypropylene
None (Terminal Block)	**AN**	**BN**	**CN**	**DN**
Isolated	**AA**	**BA**	**CA**	**DA**
Non-Isolated	**AB**	**BB**	**CB**	**DB**

3.4 Leadwire Order Codes

Use the table below to select leadwire insulation and protection. Conductors are available in solid or stranded construction. Standard wire is 20 AWG, other gauges available on demand. Refer to our wire brochure for more detailed specifications.

Leadwire Order Codes

Protection	Leadwire insulation and conductor type					
	PVC Solid	Teflon Solid	Fiberglass Solid	PVC Stranded	Teflon Stranded	Fiberglass Stranded
None	**A7**	**D7**	**G7**	**A8**	**D8**	**G8**
Stainless Steel Overbraid	**B7**	**E7**	**H7**	**B8**	**E8**	**H8**
Stainless Steel Armor	**C7**	**F7**	**I7**	**C8**	**F8**	**I8**

Instrumentation Dynatherm inc
4127 Cousens Montreal QC H4S 1V6 Tel: (514) 636-7800 / (866) 460-7739 Fax: (514) 636-7801

3.5 Connector Termination Order Codes

Use the table below to select connector termination. Connectors come in standard (200°C) or high temperature (**HT** 425°C). Refer to connector brochure for more detailed specifications.

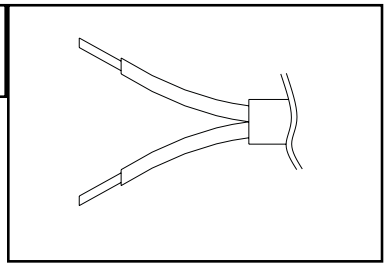
Connector Termination Order Codes

Mounting Adapter	Connector Type							
	Standard Male	Standard Female	Standard Male HT	Standard Female HT	Mini Male	Mini Female	Mini Male HT	Mini Female HT
Hex-Crimp	**AA**	**BA**	**CA**	**DA**	**EA**	**FA**	**GA**	**HA**
Crimp	**AB**	**BB**	**CB**	**DB**	**EB**	**FB**	**GB**	**HB**
Braze	**AC**	**BC**	**CC**	**DC**	**EC**	**FC**	**GC**	**HC**
Compression	**AD**	**BD**	**CD**	**DD**	-	-	-	-
Wire Clamp	**AE**	**BE**	**CE**	**DE**	**EE**	**FE**	**GE**	**HE**

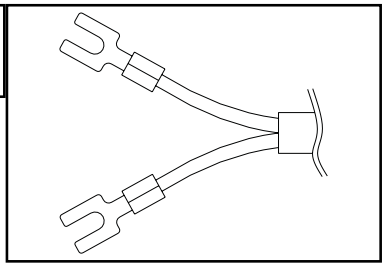
3.6 Leadwire Termination Order Codes

For 2" tails or spade lug terminations, use the order codes below. Standard maximum ambient temperature for these terminations is 90° C, specify if higher operational temperature is required.

Use code **00** for 2" tails



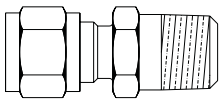
Use code **01** for spade lugs



3.7 Compression Adapter Order Codes

If a compression adapter is required to mount the thermocouple it must be ordered separately, use the tables below to select the right adapter.

CF-SD-M7
① ②

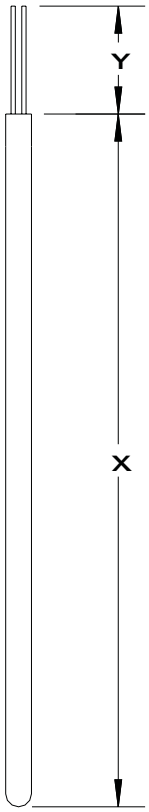


Compression Adapters Order Codes

① Material	Mounting Threads NPT				
	1/8"	1/4"	3/8"	1/2"	3/4"
Stainless Steel	**SA**	**SB**	**SC**	**SD**	**SE**
Brass	**BA**	**BB**	**BC**	**BD**	**BE**

② Ferrule Material	Sheath Diameter						
	0.063"	0.125"	0.188"	0.250"	0.313"	0.375"	0.500"
Metal	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**MA**
Teflon	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**TA**

Instrumentation Dynatherm inc
4127 Cousens Montreal QC H4S 1V6 Tel: (514) 636-7800 / (866) 460-7739 Fax: (514) 636-7801



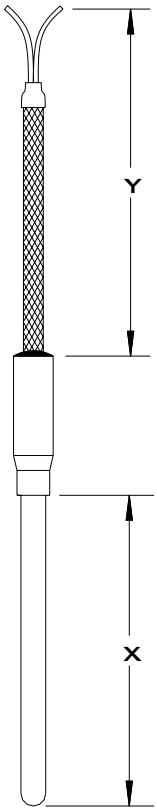
110-K37SG-12-2
1 2 3

1 Sheath Order Code *(See Section 3.1)*

2 Sheath Length In Inches "X"

3 Strip Length In Inches "Y"

Features
- Cold end epoxy sealed.
- Standard strip length is 2".



120-K37SG-12-B7-72-00
1 2 3 4 5

1 Sheath Order Code *(See Section 3.1)*

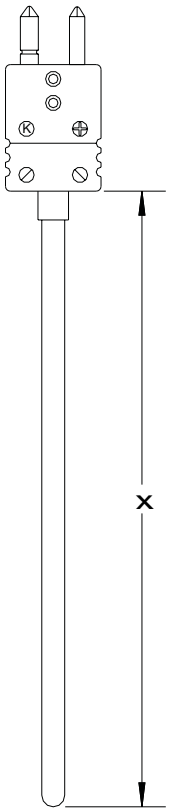
2 Sheath Length In Inches "X"

3 Leadwire Order Code *(See Section 3.4)*

4 Leadwire Length In Inches "Y"

5 Termination Order Code *(See Section 3.5 & 3.6)*

Features
- Metal transition.
- Standard potting epoxy max. 200°C, higher temperatures available optional.
- For connector termination, use wire clamp mounting adapter *(See Section 3.5)*



130-K37SG-12-AA

1 2 3

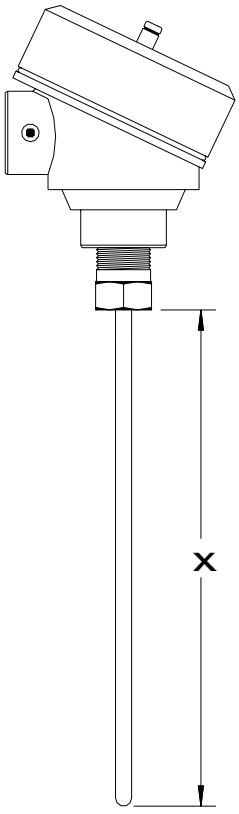
1 Sheath Order Code *(See Section 3.1)*

2 Sheath Length In Inches "X"

3 Termination Order Code *(See Section 3.5)*

Features

- Standard size connector available in simplex or duplex, sheath diameter max. 0.375".
- Miniature size connector available in simplex, sheath diameter max. 0.125".
- Duplex only available with compression adapter mounting *(See Section 3.5)*.



140-K37SG-12-AN

1 2 3

1 Sheath Order Code *(See Section 3.1)*

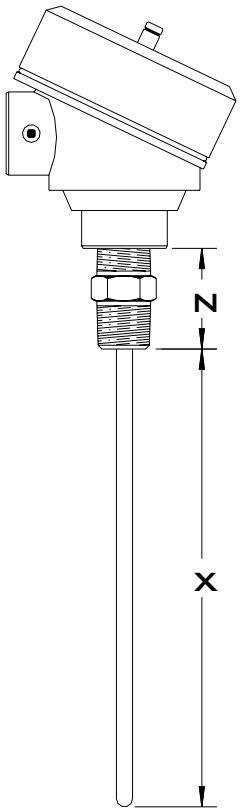
2 Sheath Length In Inches "X"

3 Connection Head Order Code *(See Section 3.3)*

Features

- Sheath welded to bushing.

Instrumentation Dynatherm inc
4127 Cousens Montreal QC H4S 1V6 Tel: (514) 636-7800 / (866) 460-7739 Fax: (514) 636-7801



150-K37SG-12-I-1,5-AN
1 2 3 4 5

1 Sheath Order Code *(See Section 3.1)*

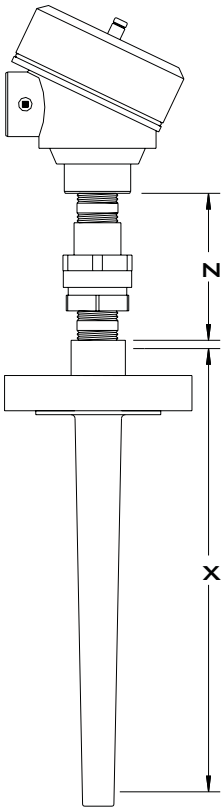
2 Sheath Length In Inches "X"

3 Hardware Order Code *(See Section 3.2)*

4 Hardware Length In Inches "N"

5 Connection Head Order Code *(See Section 3.3)*

Features
- Available spring loaded or fixed.



160-K37SG-12-L-1,5-AN
1 2 3 4 5

1 Sheath Order Code *(See Section 3.1)*

2 Sheath Length In Inches "X" *(See Section 2.6)*

3 Hardware Order Code *(See Section 3.2)*

4 Hardware Length In Inches "N"

5 Connection Head Order Code *(See Section 3.3)*

Features
- Specify thermowell part number when ordering.
- Sheath diameter standard 0.250".