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.
N	0°C to 1250°C	Nicrosil	Nisil	Better stability and resistance to oxidation than Type K.
R & S	0°C to 1600°C	R: Pt/13% Rh S: Pt/10% Rh	Platinum	Recommended for high temperature applications. High resistance to oxidation and corrosion. Can be contaminated by metal vapors.
B	500°C to 1700°C	Pt/30% Rh	Pt/6% Rh	Same as Type R & S except higher temperature range and lower emf output.

2.2 Calibration Tolerances

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 N	0° C to 1260° C	± 0.75% 0r 2.2° C	± 0.4% 0r 1.1° C
Type R	0° C to 1480° C	± 0.25% 0r 1.5° C	± 0.1% 0r 0.6° C
Type S	0° C to 1480° C	± 0.25% 0r 1.5° C	± 0.1% 0r 0.6° C
Type B	870° C to 1700° C	± 0.5%	-

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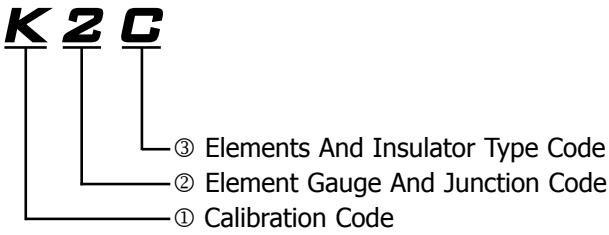
3.1 Base Metal Element Order Codes

When ordering 200 Series thermocouples with base metal element, the following information must be specified;

- Element calibration and limits of error
- Element gauge
- Junction form
- Number of elements
- Insulator type

Using the example and the tables below, build your base element order code in ***3 easy steps***.

Example : The code "***K2C***" specifies;
① Type K probe calibration, standard limits
② 8 AWG element, twist weld junction
③ Single element, Oval 3" long insulator

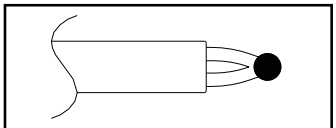


① Calibration Code
Specify calibration and limits of error.

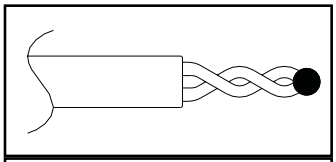
Calibration	Limits Of Error	
	Standard	Special
K	**K**	**KK**
J	**J**	**JJ**
N	**N**	**NN**

② Element Gauge And Junction Code
Specify element gauge & junction form.

Gauge	Junction Form	
	Parallel Weld	Twist Weld
8 AWG	**1**	**2**
14 AWG	**4**	**5**



Parallel Weld Junction



Twist Weld Junction

③ Elements And Insulator Type Code
Specify number of elements and insulator type.

Element	Insulator Type					
	None	1" Oval	3" Oval	1" Round	3" Round	Fish Spine
Single	**A**	**B**	**C**	**D**	**E**	**F**
Dual	**-**	**G**	**H**	**I**	**J**	**-**

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3.2 Noble Metal Element Order Codes

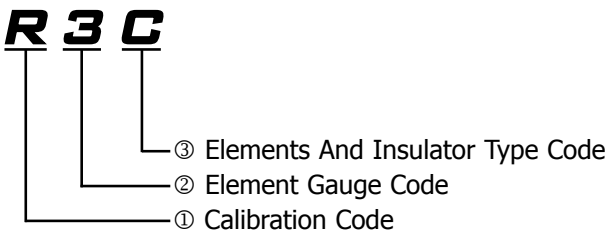
When ordering 200 Series thermocouples with noble metal element, the following information must be specified;

- Element calibration and limits of error
- Element gauge
- Number of elements
- Insulator type

Using the example and the tables below, build your noble element order code in ***3 easy steps***.

Example : The code "***R3C***" specifies;

① Type R probe calibration, standard limits
② 24 AWG element
③ Single element, alumina insulator & collar

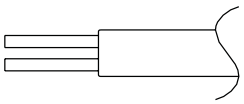


① Calibration Code
Specify calibration and limits of error.

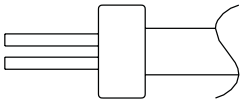
Calibration	Limits Of Error	
	Standard	Special
R	**R**	**RR**
S	**S**	**SS**
B	**B**	**-**

② Element Gauge Code
Specify element gauge.

Wire Gauge	Order Code
20 AWG	**1**
24 AWG	**3**
26 AWG	**5**



Without Support Collar



With Support Collar

③ Elements And Insulator Type Code
Specify number of elements and insulator type.

Element	Insulator Type		
	None	Alumina	Alumina With Collar
Single	**A**	**B**	**C**
Dual	**-**	**G**	**H**

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3.3 Metal Protection Tube Order Codes

Listed below are order codes for metal protection tubes in schedule 40, for schedule 80 pipe, replace last digit (***3***) by ***4***. More detailed information can be found in the ***Series 400*** brochure.

Metal Protection Tube Order Codes

Pipe Size	Pipe Material					
	Carbon Steel	SST 304	SST 310	SST 316	SST 446	Inconel 601
1/2″	**4D3**	**1D3**	**2D3**	**3D3**	**5D3**	**6D3**
3/4″	**4E3**	**1E3**	**2E3**	**3E3**	**5E3**	**6E3**

3.4 Ceramic Protection Tube Order Codes

Listed below are order codes for ceramic protection tubes. More detailed information can be found in the ***Series 400*** brochure.

Ceramic Protection Tube Order Codes

Code	Material	Size O.D. X I.D.	Process Connection NPT Male
1BE	Mullite	3/8″ X 1/4″	3/4″
1DE	Mullite	11/16″ X 7/16″	3/4″
1DF	Mullite	11/16″ X 7/16″	1″ NPT
1GG	Mullite	1″ X 3/4″	1.25″ NPT
2BE	Alumina	3/8″ X 1/4″	3/4″
2DE	Alumina	11/16″ X 7/16″	3/4″

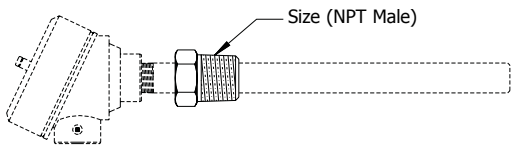
Code	Material	Size O.D. X I.D.	Process Connection NPT Male
2DF	Alumina	11/16″ X 7/16″	1″ NPT
2GG	Alumina	1″ X 3/4″	1.25″ NPT
5BE	Hexoloy	3/8″ X 1/4″	3/4″
5EF	Hexoloy	3/4″ X 1/2″	1″ NPT
5HG	Hexoloy	1″ X 1/2″	1.25″ NPT
3IZ	SiC	1.75″ X 1″	-

3.5 Weld Bushing Order Codes

A weld bushing is used to connect the probe to the process. Use the table below to specify weld bushing material and size, if the weld bushing is not required, use code ***0***.

Weld Bushing Order Codes

Material	Size (NPT Male)					
	1/2″	3/4″	1″	1.25″	1.5″	2″
Carbon Steel	**A**	**B**	**C**	**D**	**E**	**F**
Stainless Steel	**H**	**I**	**J**	**K**	**L**	**M**



3.6 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.

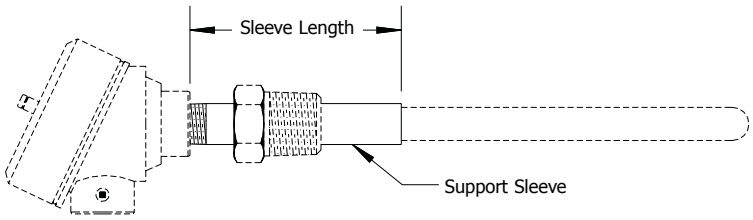
Transmitter And Connection Head Order Codes

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

3.7 Support Sleeve Order Codes

A support sleeve can be added to a ceramic protection tube to add strength or to position a weld bushing. Use the table below to select sleeve material. The sleeve size is determined at our factory depending on ceramic protection tube O.D.

Order Code	Support Sleeve Material
4	Carbon Steel
3	Stainless Steel 316
5	Stainless Steel 446
6	Inconel 601



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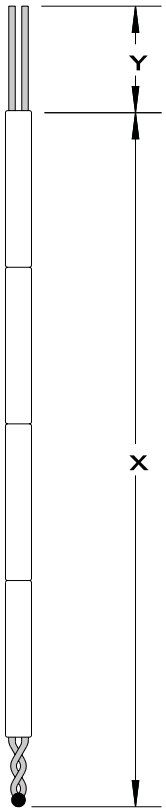
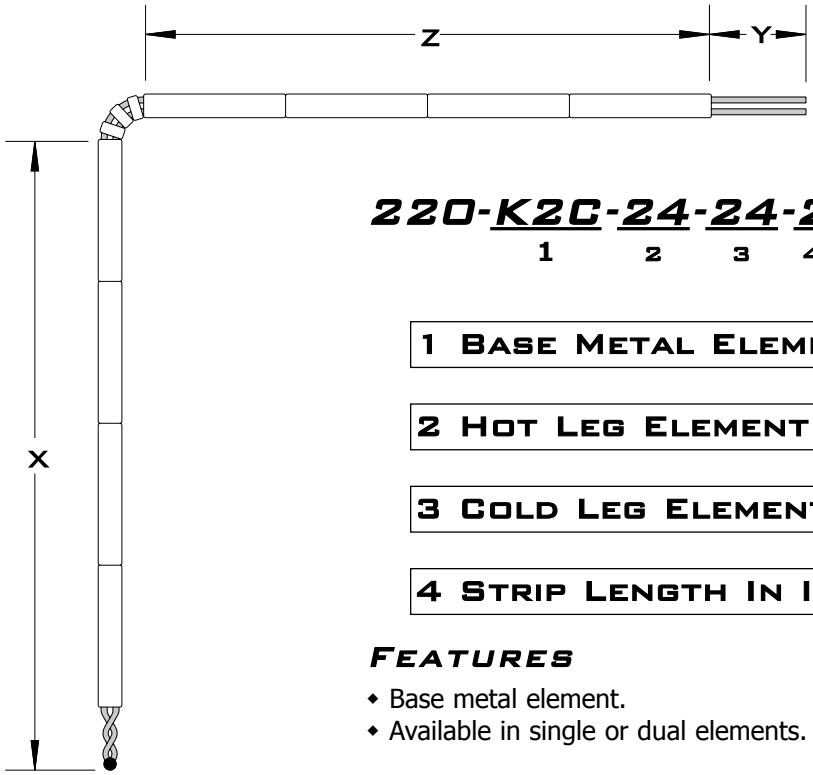


210-K2C-24-2
1 2 3

1 Base Metal Element Order Code *(Sec. 3.1)*
2 Element Length In Inches "X"
3 Strip Length In Inches "Y"

Features
- Base metal element.
- Available in single or dual elements.



220-K2C-24-24-2
1 2 3 4

1 Base Metal Element Order Code *(Sec. 3.1)*
2 Hot Leg Element Length In Inches "X"
3 Cold Leg Element Length In Inches "Z"
4 Strip Length In Inches "Y"

Features
- Base metal element.
- Available in single or dual elements.

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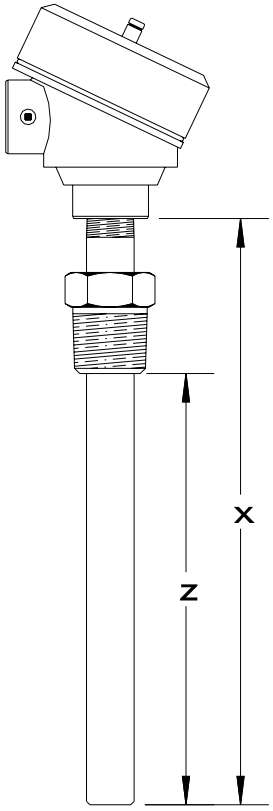


230-K2C-3D3-24-BN-K20

1 2 3 4 5 6

1 Base Metal Element Order Code *(Sec. 3.1)*

2 Metal Protection Tube Order Code *(Sec. 3.3)*

3 Probe Length In Inches "X"

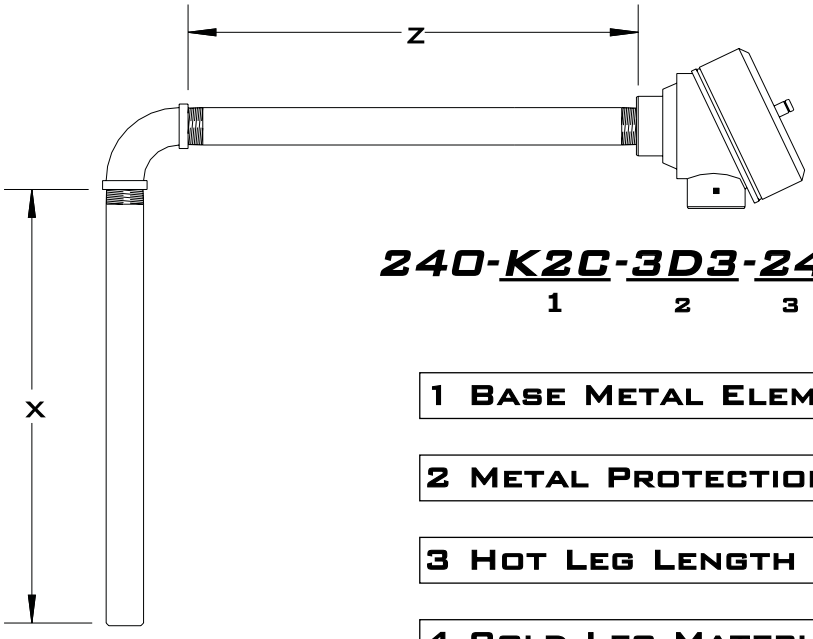
4 Connection Head Order Code *(Sec. 3.6)*

5 Weld Bushing Order Code *(Sec. 3.5)*

6 Weld Bushing Distance In Inches "Z"

Features

- Metal protection tube.
- Base metal element.
- Use Order Code ***0*** if weld bushing not required.



240-K2C-3D3-24-3D3-24-BN

1 2 3 4 5 6

1 Base Metal Element Order Code *(Sec. 3.1)*

2 Metal Protection Tube Order Code *(Sec. 3.3)*

3 Hot Leg Length In Inches "X"

4 Cold Leg Material Order Code *(Sec. 3.3)*

5 Cold Leg Length In Inches "Z"

6 Connection Head Order Code *(Sec. 3.6)*

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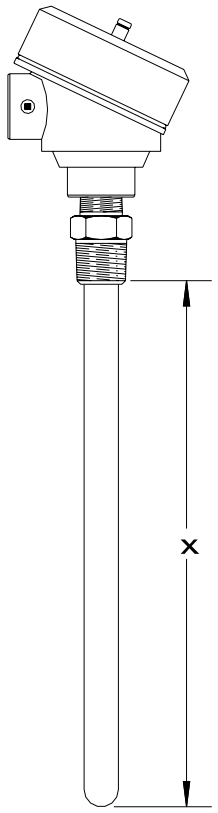


250-K2C-1DE-24-BN
1 2 3 4

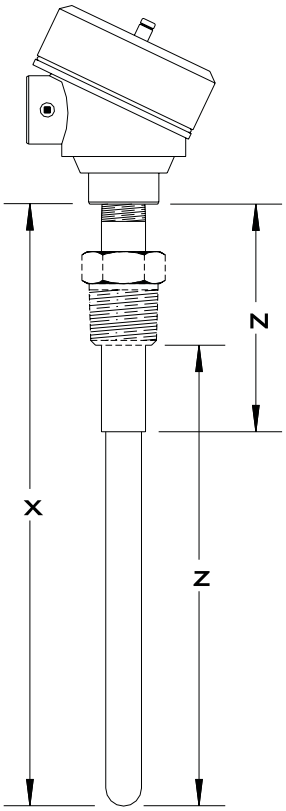
1 Base Metal Element Order Code *(Sec. 3.1)*

2 Ceramic Protection Tube Order Code *(Sec. 3.4)*

3 Probe Length In Inches "X"

4 Connection Head Order Code *(Sec. 3.6)*

Features
- Ceramic protection tube.
- Base metal element.



260-K2C-1DE-24-BN-36-K20
1 2 3 4 5 6 7 8

1 Base Metal Element Order Code *(Sec. 3.1)*

2 Ceramic Protection Tube Order Code *(Sec. 3.4*

3 Probe Length In Inches "X"

4 Connection Head Order Code *(Sec. 3.6)*

5 Support Sleeve Order Code *(Sec. 3.7)*

6 Support Sleeve Length In Inches "N"

7 Weld Bushing Order Code *(Sec. 3.5)*

8 Weld Bushing Distance In Inches "Z"

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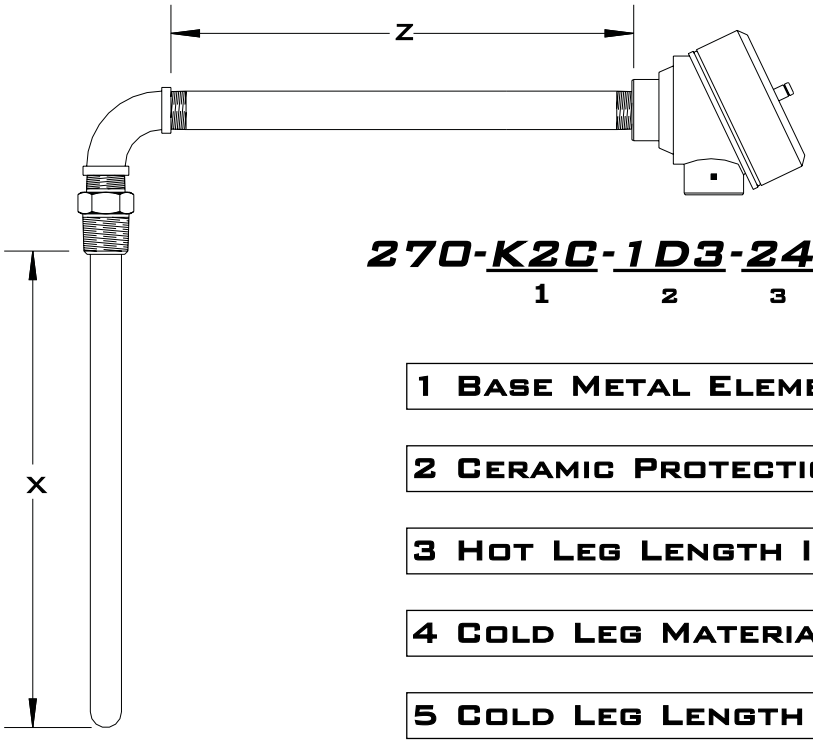
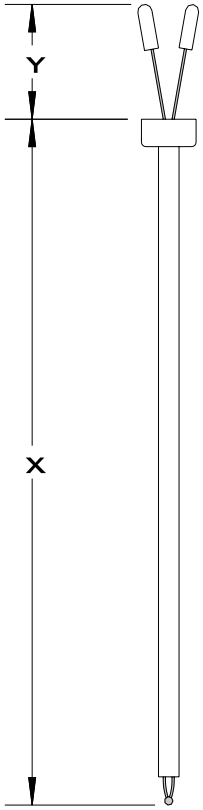


270-K2C-1D3-24-3D3-24-BN

1 2 3 4 5 6

1	Base Metal Element Order Code *(Sec. 3.1)*
2	Ceramic Protection Tube Order Code *(Sec. 3.4)*
3	Hot Leg Length In Inches "X"
4	Cold Leg Material Order Code *(Sec. 3.3)*
5	Cold Leg Length In Inches "Z"
6	Connection Head Order Code *(Sec. 3.6)*



205-R3C-12-2

1 2 3

1	Noble Metal Element Order Code *(Sec. 3.2)*
2	Element Length In Inches "X"
3	Strip Length In Inches "Y"

Features

- Noble metal element.
- Available in single or dual elements.
- Terminated with copper lugs.

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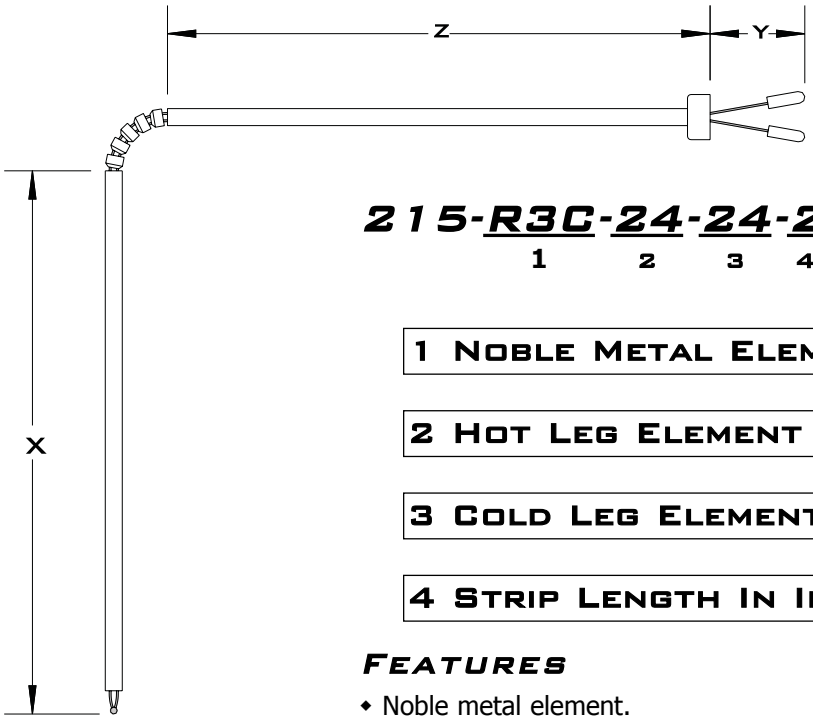


215-R3C-24-24-2
1 2 3 4

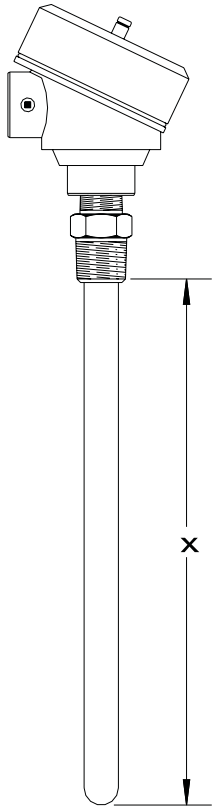
1 Noble Metal Element Order Code *(Sec. 3.2)*

2 Hot Leg Element Length In Inches "X"

3 Cold Leg Element Length In Inches "Z"

4 Strip Length In Inches "Y"

Features
- Noble metal element.
- Available in single or dual elements.
- Terminated with copper lugs.



225-R3C-1DE-24-BN
1 2 3 4

1 Noble Metal Element Order Code *(Sec. 3.2)*

2 Ceramic Protection Tube Order Code *(Sec. 3.4)*

3 Probe Length In Inches "X"

4 Connection Head Order Code *(Sec. 3.6)*

Features
- Ceramic protection tube.
- Noble metal element.

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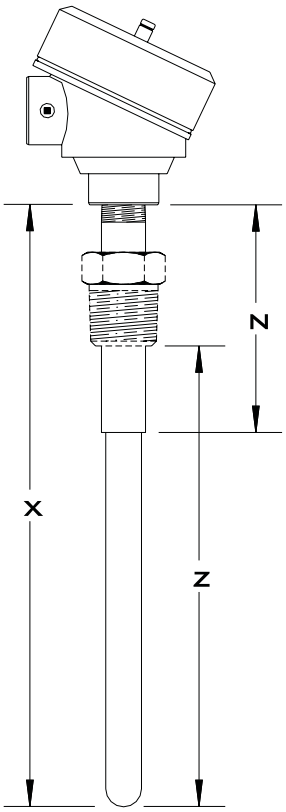


235-R3C-1DE-24-BN-36-K20

1 2 3 4 5 6 7 8

1 Noble Metal Element Order Code *(Sec. 3.2)*

2 Ceramic Protection Tube Order Code *(Sec. 3.4*

3 Probe Length In Inches "X"

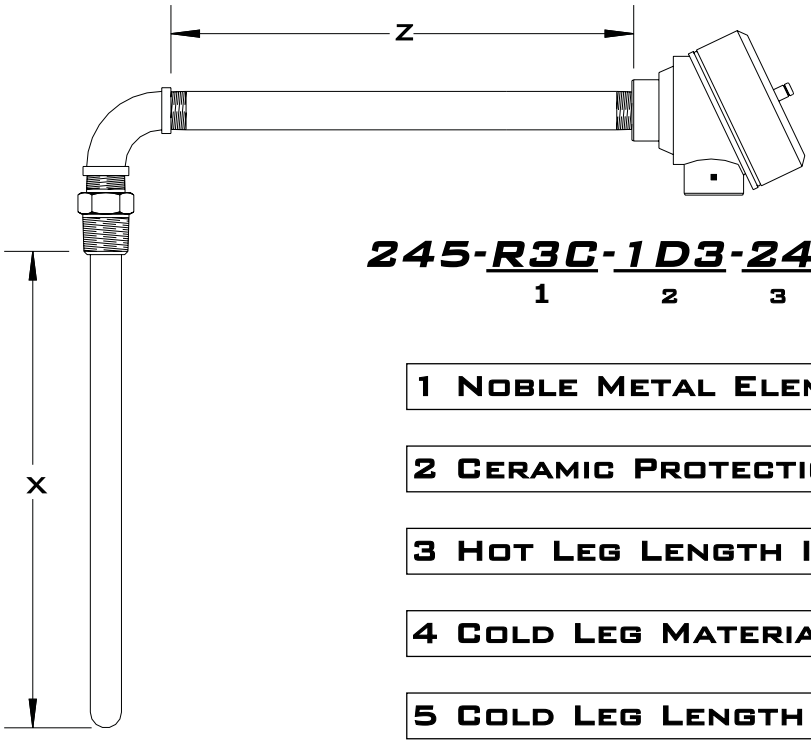
4 Connection Head Order Code *(Sec. 3.6)*

5 Support Sleeve Order Code *(Sec. 3.7)*

6 Support Sleeve Length In Inches "N"

7 Weld Bushing Order Code *(Sec. 3.5)*

8 Weld Bushing Distance In Inches "Z"



245-R3C-1D3-24-3D3-24-BN

1 2 3 4 5 6

1 Noble Metal Element Order Code *(Sec. 3.2)*

2 Ceramic Protection Tube Order Code *(Sec. 3.4)*

3 Hot Leg Length In Inches "X"

4 Cold Leg Material Order Code *(Sec. 3.3)*

5 Cold Leg Length In Inches "Z"

6 Connection Head Order Code *(Sec. 3.6)*

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