Texas Thermowell

Thermowells, Protection Tubes, and Sample Probes

Introduction

Thermowells are recommended for temperature instruments in process systems where pressure, velocity, or viscous, abrasive, and corrosive materials are present individually or in combination. A properly selected thermowell will protect the temperature instrument from damage resulting from these process variables. Additionally, a thermowell enables removal of the temperature instrument for replacement, repair, or testing without affecting the process system.

Parker Texas Thermowell specializes in the design and manufacture of all types of thermowells. The 21 Series thermowell designs shown in this guide are styles that are popular throughout industry. Special designs, as well as modifications of our standard offerings, are also available.

Parker Texas Thermowell is dedicated to unsurpassed quality, on-time delivery, and competitive pricing. This commitment has been recognized by the International Standards Organization (ISO). Our ISO 9001:2015 certification is additional assurance to our customers that their buying decisions can be made every day with a higher level of supplier confidence, and affirms our ongoing commitment to our quality policy. This product guide is intended to provide technical data to deal with most applications. For severe applications not adequately covered here, please contact the factory for assistance.

21 Series Thermowells

Materials

Parker thermowells are available in virtually any material to fit your application. Contact the factory regarding availability of materials not listed in the “Ordering Information” guide on pages 8 and 9.

Strength

The strength of a thermowell depends on several parameters that relate thermowell construction to the installation environment. For most industrial applications, standard Parker thermowells provide the necessary strength if the material, style, and length are correctly specified for the application parameters: fluid type, temperature, pressure, and fluid velocity. It is important to note that most thermowell failures are caused by vibration that is induced by fluid flow.

In addition to providing this selection guide, Parker offers assistance in correctly selecting thermowells, given the application parameters. This service is available for a nominal charge. Contact the factory for more information.

Construction

All 21 Series thermowell bodies are machined from bar stock. Flange mounts are welded to the thermowell body. The serial number and material are etched on each thermowell. Additional tagging for specific customer requirements is available.

Manufacturing Standards

Bar Stock: Mill Standard +0.000" to -1/32"
Shank Outside Diameter (O.D.): ±0.010"
“U” Dimension: ±0.050"
Overall Length: ±0.050"
Tip Thickness: 1/4" ±0.050" *(unless otherwise specified)*
Shank Surface Finish: Polished to 16 RMS

Bore: ±0.030"

Thermowell Terminology

Process Connection: External means to connect thermowell to process system. Wells can be threaded, bolted (to matching flange), clamped, or welded in place.

Instrument Connection: Internal threads to connect temperature instrument to thermowell.

“U” Dimension: Length of thermowell immersed into process system. Measured from the base of the process connection to the tip of the well.

“T” Dimension: Also called “lag length” or “lagging extension.” Extends length between the instrument and process connections to accommodate vessel or piping insulation.

“A” Dimension: Instrument insertion length into thermowell. Equal to bore length.

“D” Dimension: Also called “tip diameter.” Diameter of thermowell shank at the tip of the thermowell. This dimension may vary with process connection, shank design, or bore diameter.

“Q” Dimension: Also called “root diameter.” Diameter of thermowell shank below the process connection. This dimension may vary with process connection, shank design, or bore diameter.

Bore Diameter: Dimension of internal bore sized to fit the diameter of the instrument inserted into the thermowell.

Stepped Shank: Also called “reduced tip.” The shank O.D. is reduced over the last 2-1/2" of the “U” dimension from the standard root diameter to 1/2" O.D. in most cases

Straight Shank: Shank O.D. is the same from the root diameter (“Q” dimension) to the tip diameter (“D” dimension). The straight shank is generally used with a 0.385" or larger bore diameter, but is also available with a 0.260" bore.

Tapered Shank: Shank O.D. is gradually reduced from the root diameter (“Q” dimension) to the tip diameter (“D” dimension). The tapered shank is recommended for heavy duty applications characterized by high vibration, pressure, temperature, and/or velocity.

21 Series Thermowells: Selection Considerations

Immersion Length ("U" Dimension):

For best temperature measurement accuracy, the "U" dimension should be long enough to permit the entire temperature-sensitive section of the measuring instrument to project into the medium being measured.

Liquid temperature measurement: A properly designed thermowell will extend into the fluid an amount equal to the length of the temperature-sensitive zone plus one inch or greater.

Gas temperature measurement: A properly designed thermowell will extend into the gas stream an amount equal to the length of the temperature-sensitive zone plus three inches or greater.

The temperature-sensitive zone for thermocouples and thermistors is short (right at the tip of the device), enabling measurement accuracy with limited immersion into the process fluid.

Bi-metal thermometers, resistance temperature detectors (RTDs), and liquid-in-glass thermometers have bulbs with temperature-sensitive zones between one and two inches long.

Filled-system thermometer bulbs may have temperature-sensitive zones from one to several inches in length.

Bore Diameter:

While Parker offers thermowells with bore diameters up to 1.0", the most common are as follows:

0.260" bore:
- Bi-metal Thermometers (1/4" stem)
- Thermocouples (1/4" sheath)
- RTDs (1/4" sheath)
- Liquid-in-glass Test Thermometers (unarmored)
- Other elements having 0.252" maximum diameter

0.385" bore:
- Bi-metal Thermometers (3/8" stem)
- Thermocouples (8 and 14 gage)
- Liquid-in-glass Test Thermometers (armored)
- Other elements having 0.377" maximum diameter

Shank Style:

Tapered shank wells provide greater stiffness for the same sensitivity. The higher strength to weight ratio gives these wells higher natural frequency than for equivalent straight shank wells, thus permitting operation at higher fluid velocities.

Velocity Concerns:

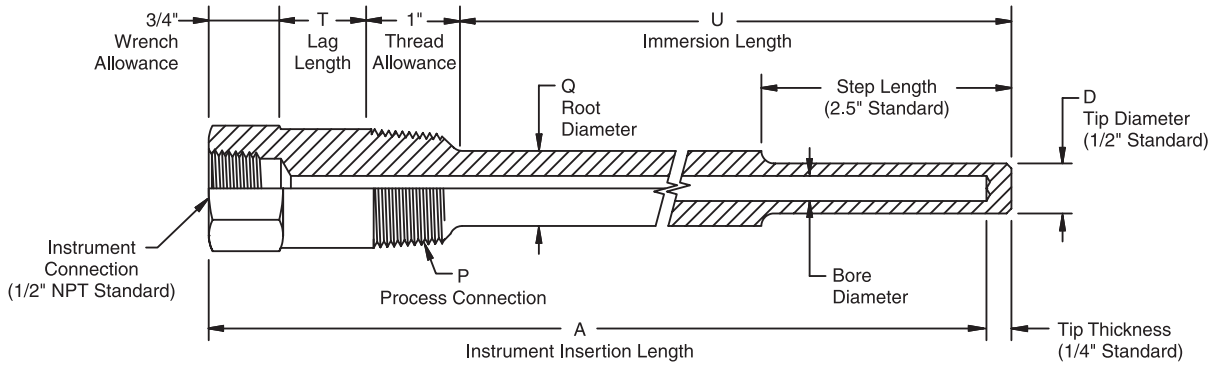
In most cases, thermowell failures are not due to the effects of pressure and temperature. The calculations necessary to provide adequate strength under given conditions are familiar enough to permit proper choice of wall thickness and material.

Less familiar are the vibrational effects to which thermowells are subjected. Fluid flowing past the well forms a turbulent wake (the Von Karman Trail), which has a definite frequency based on the diameter of the well and the velocity of the fluid. The thermowell must have sufficient stiffness so that the wake frequency will never equal the natural frequency of the thermowell itself. If the natural frequency of the well were to coincide with the wake frequency, the well would vibrate to destruction and break off.

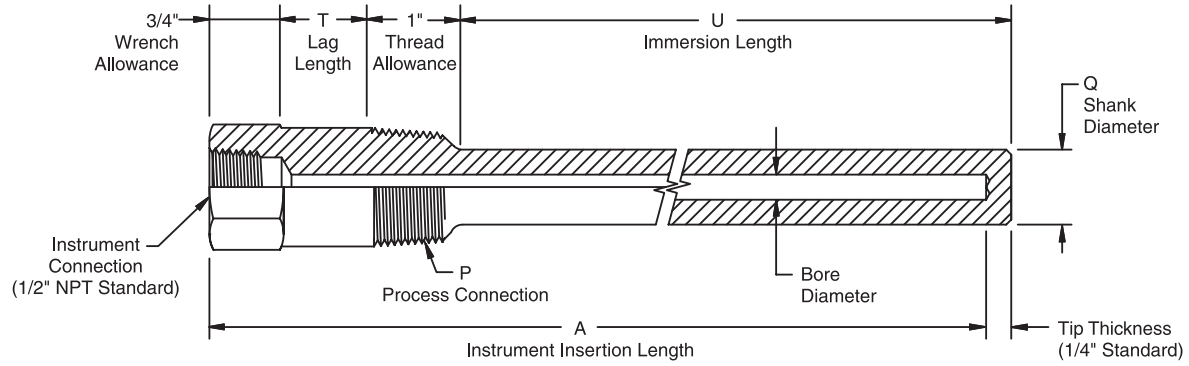
NOTE: Performing wake frequency calculations should be considered in applications where the thermowell U dimension exceeds 2.5" and/or the flow velocity is greater than 50 FPS. Wake calculations are performed per ASME PTC-19.3 TW-2016.

21 Series Thermowells: Threaded Thermowells

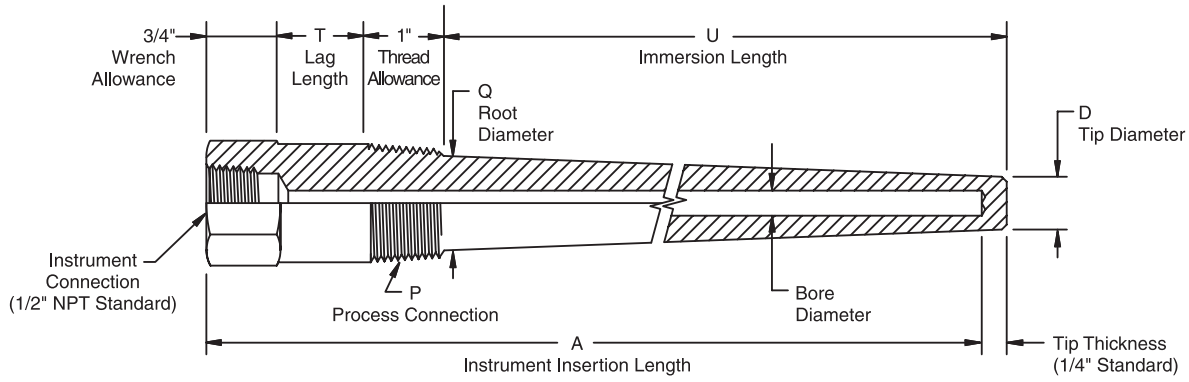
Threaded Stepped



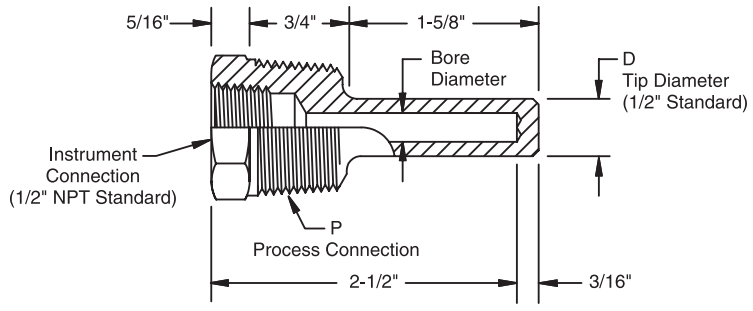
Threaded Straight



Threaded Tapered



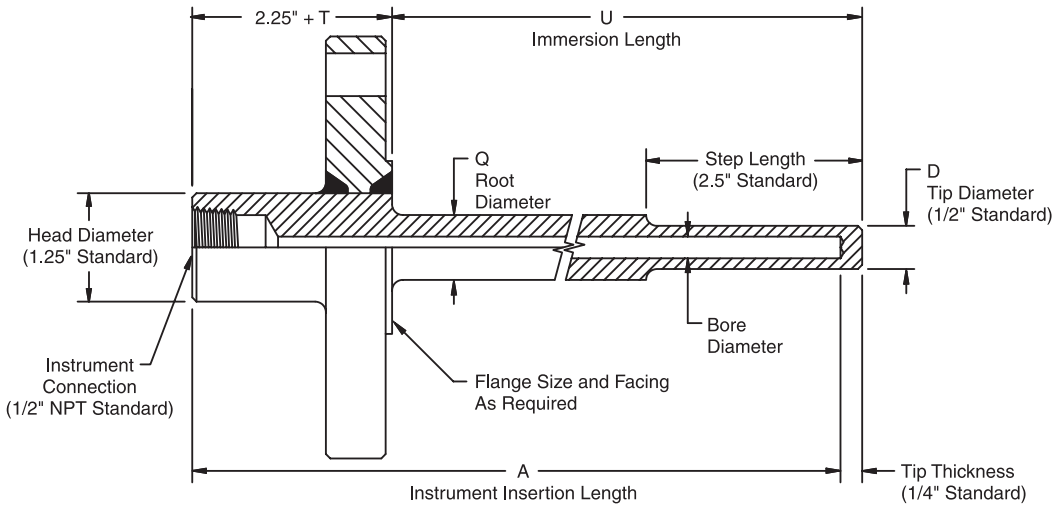
Threaded Limited Space Thermowell



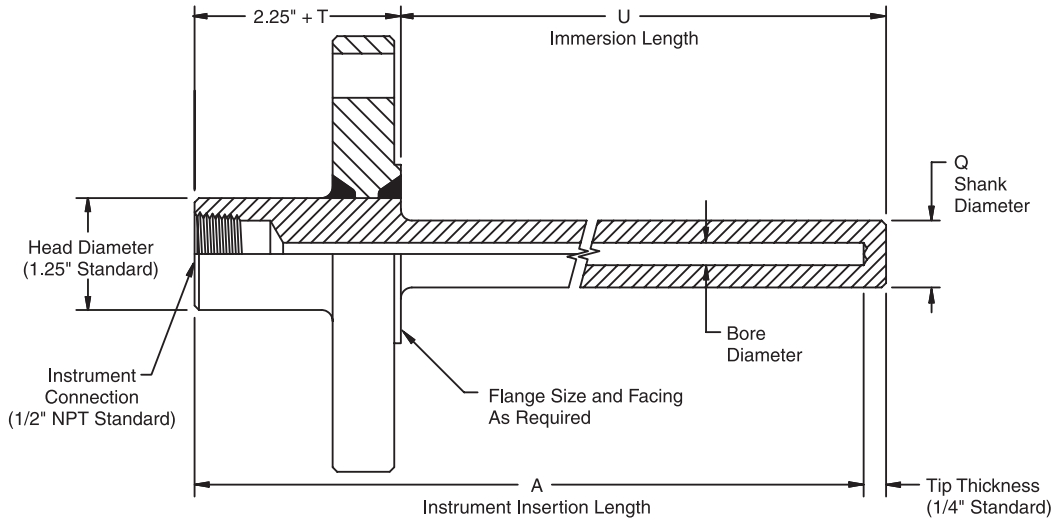
Dimensions in inches are for reference only, subject to change.

21 Series Thermowells: Flanged Thermowells

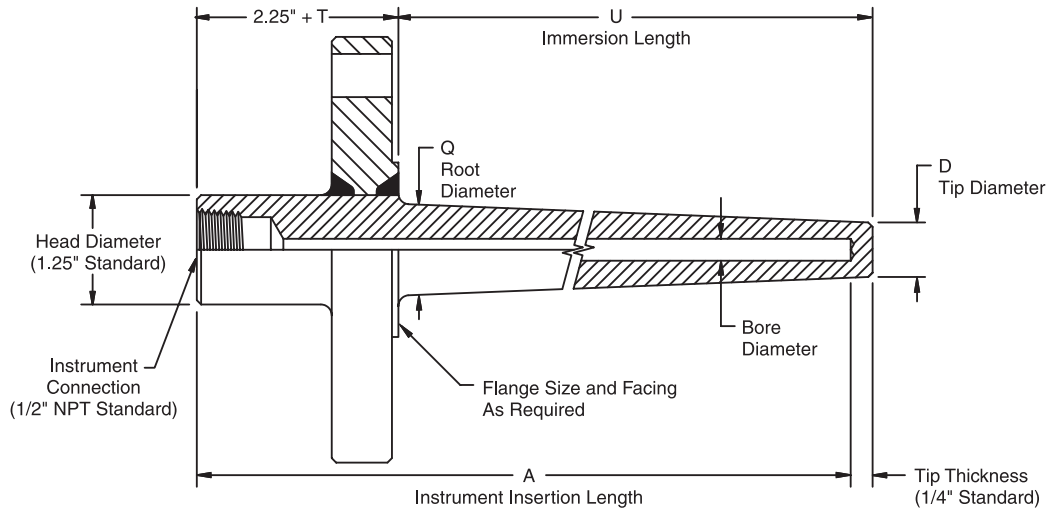
Flanged Stepped



Flanged Straight



Flanged Tapered

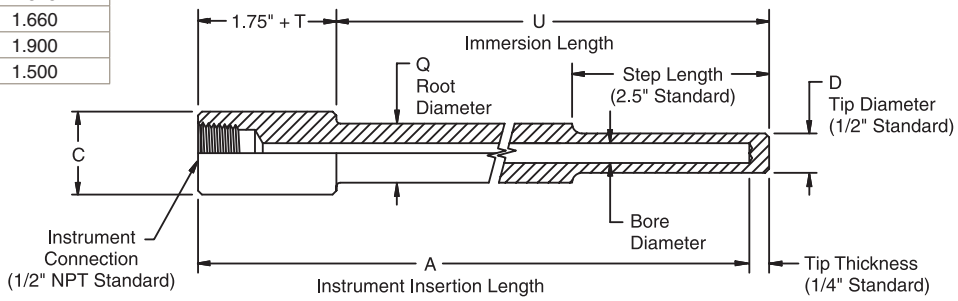


Dimensions in inches are for reference only, subject to change.

21 Series Thermowells: Socket Weld Thermowells

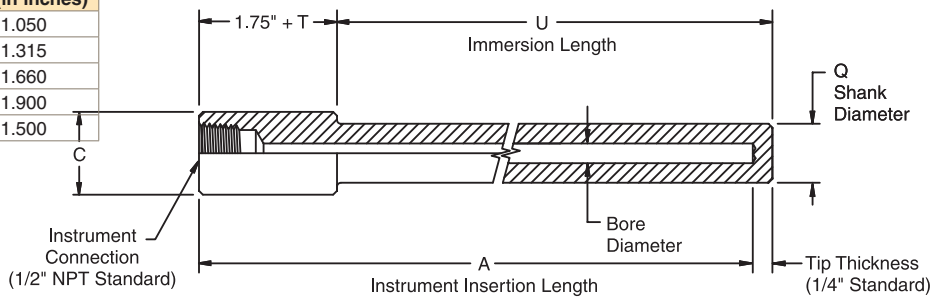
Socket Weld Stepped

Size (in inches)	Head Diameter "C" (in inches)
3/4	1.050
1	1.315
1-1/4	1.660
1-1/2	1.900
1-1/2 Actual	1.500



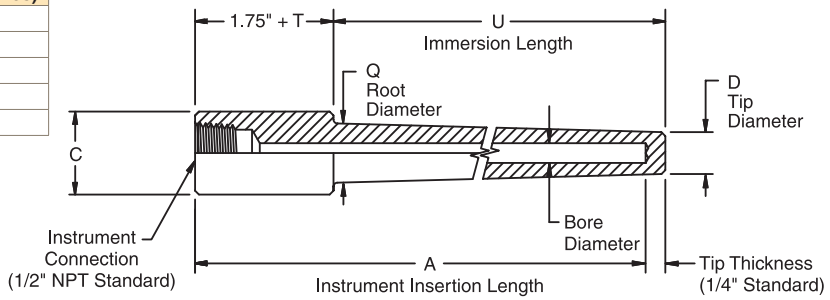
Socket Weld Straight

Size (in inches)	Head Diameter "C" (in inches)
3/4	1.050
1	1.315
1-1/4	1.660
1-1/2	1.900
1-1/2 Actual	1.500



Socket Weld Tapered

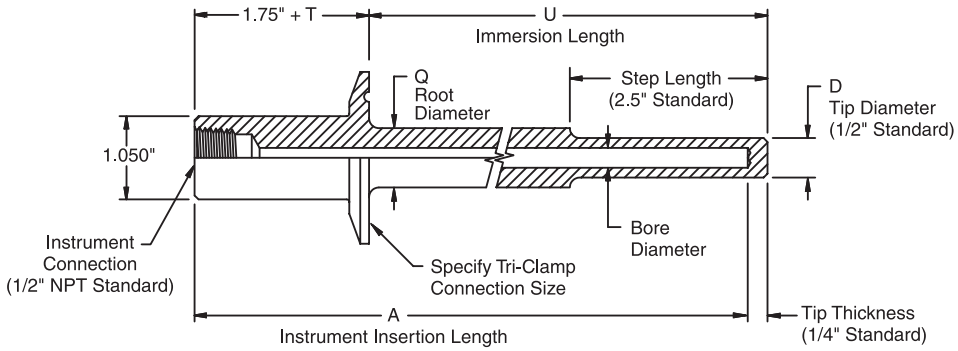
Size (in inches)	Head Diameter "C" (in inches)
3/4	1.050
1	1.315
1-1/4	1.660
1-1/2	1.900
1-1/2 Actual	1.500



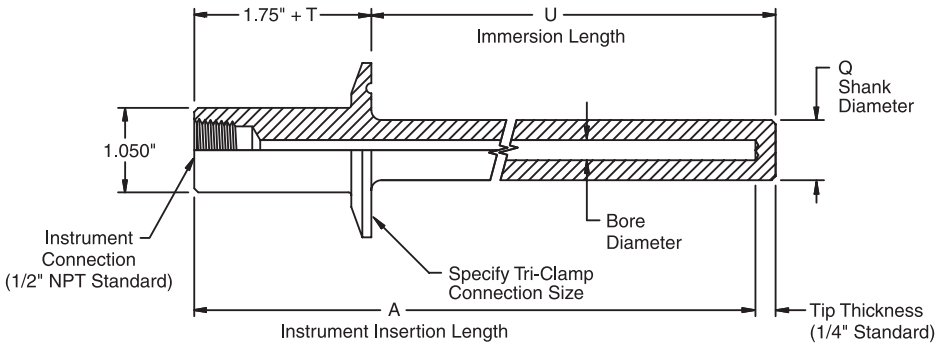
Dimensions in inches are for reference only, subject to change.

21 Series Thermowells: Sanitary & Weld-In Thermowells

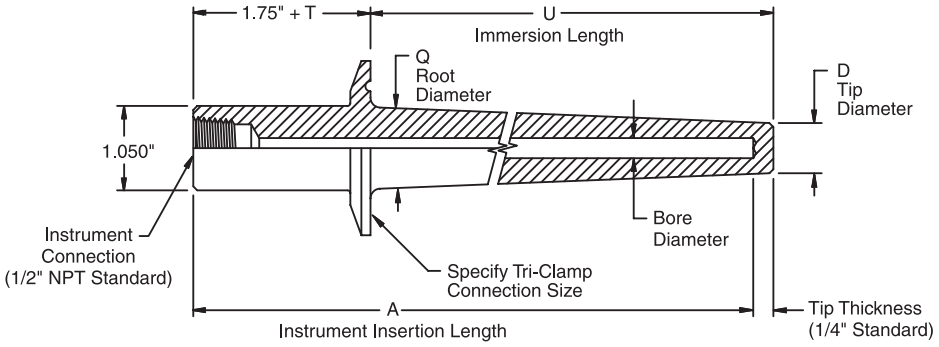
Sanitary Stepped



Sanitary Straight



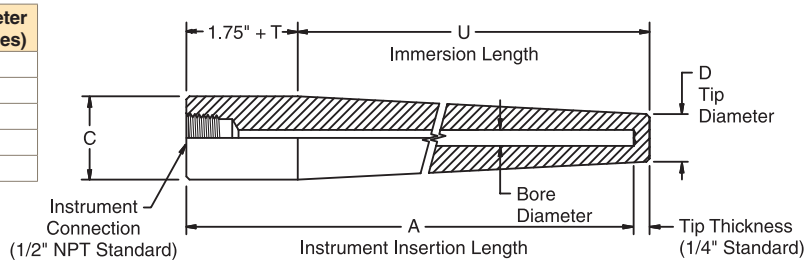
Sanitary Tapered



Dimensions in inches/millimeters are for reference only, subject to change.

Weld-In Tapered

Size (in inches)	Head Diameter "C" (in inches)
3/4	1.050
1	1.315
1-1/4	1.660
1-1/2	1.900
1-1/2 Actual	1.500



Dimensions in inches/millimeters are for reference only, subject to change.

21 Series Thermowells: How to Order

Dimensions in inches are for reference only, subject to change.

Building a Part Number: *Example:* **21A105F43A30ARE-FM**

Example Part Number:	21	A	105	F43	A	30	A	R	E	-FM
Ordering Parameters/ Options:	Series	Material	Immersion Length ("U" Dim.)	Mounting Style	Bore Diameter	Lag. Length ("T" Dim)	Instrument Connection	Root Diameter ("Q" Dim)	Tip Diameter ("D" Dim)	Options
Table Reference: (see below)		A	B	C	D	E	F	G	H	I

A - Material

Code	Material
A	304 SS
C	310 SS
D	316 SS
E	347 SS
F	321 SS
G	Alloy 20
H	CS-1018
I	CS-A105
J	Hastelloy C
K	Hastelloy B
L	Alloy 800
M	Inconel 600
N	F-5
O	F-9
P	Monel 400
Q	F-91
R	F-11
S	F-22
T	Nickel 200
U	Duplex 2205
V	446 SS
Y	Brass
Z	Aluminum
X	Other (please specify)

B - Immersion Length

Code	Length (inches)
016	1.6
020	2.0
025	2.5
030	3.0
035	3.5
040	4.0
045	4.5
050	5.0
055	5.5
060	6.0
065	6.5
070	7.0
075	7.5
080	8.0
085	8.5
090	9.0
095	9.5
100	10.0
105	10.5
110	11.0
115	11.5
120	12.0
...	...
150	15.0
...	...
175	17.5
...	...
240	24.0

Consult factory for "U" length greater than 24.

C - Mounting Style

Mounting Style	
Code	Style
T	Threaded
F	Flanged
R	Ring Joint
K	Socket Weld
W	Weld-in
S	Sanitary
N	Flat Face

Shank Style	
Code	Style
2	Stepped
3	Straight
4	Tapered

Process Connection	
Code	Style
Threaded Only	
1	1/2" NPT
2	3/4" NPT
3	1" NPT
4	1-1/4" NPT

Flanged Only	
1	1" Class 150
2	1-1/2" Class 150
3	2" Class 150
4	1" Class 300
5	1-1/2" Class 300
6	2" Class 300
7	1" Class 600
8	1-1/2" Class 600
9	2" Class 600
A	1" Class 900/1500
B	1-1/2" Class 900/1500
C	2" Class 900/1500
D	1" Class 2500
E	1-1/2" Class 2500
F	2" Class 2500

Socket Weld & Weld-In	
1	3/4" pipe (1.050 O.D.)
2	1" pipe (1.315 O.D.)
3	1-1/4" pipe (1.660 O.D.)
4	1-1/2" pipe (1.900 O.D.)
5	1-1/2" Actual (1.500 O.D.)

Sanitary Only	
1	1-1/2" Tri-Clamp
2	2" Tri-Clamp
3	2-1/2" Tri-Clamp
4	3" Tri-Clamp

Other	
X	(please specify)

21 Series Thermowells: How to Order - con't

Dimensions in inches are for reference only, subject to change.

Building a Part Number: *Example:* 21A105F43A30ARE-FM

Example Part Number:	21	A	105	F43	A	30	A	R	E	-FM
Ordering Parameters/ Options:	Series	Material	Immersion Length ("U" Dim.)	Mounting Style	Bore Diameter	Lag. Length ("T" Dim)	Instrument Connection	Root Diameter ("Q" Dim)	Tip Diameter ("D" Dim)	Options
Table Reference: (see below)		A	B	C	D	E	F	G	H	I

D - Bore Diameter

Code	Bore
A	0.260
B	0.385
C	0.437
D	0.515
E	0.656
F	0.718
X	Other (please specify)

E - Lag Length

Code	Length (inches)
00	0.0
05	0.5
10	1.0
15	1.5
20	2.0
25	2.5
30	3.0
35	3.5
40	4.0
45	4.5
50	5.0
55	5.5
60	6.0
65	6.5
70	7.0
75	7.5
80	8.0
85	8.5
90	9.0
95	9.5
XX	Other (please specify)

F - Instrument Connection

Code	Length (inches)
C	1/4" NPT
A	1/2" NPT
D	3/4" NPT
F	1" NPT
H	1/4" NPSM
B	1/2" NPSM
E	3/4" NPSM
G	1" NPSM
I	1/4" CMP*
J	3/8" CMP*
K	1/2" CMP*
XX	Other (please specify)

* CMP (compression)

G & H - Root & Tip Diameter

Code	Length (inches)
A	0.375
B	0.400
C	0.500
D	0.562
E	0.625
F	0.680
G	0.735
H	0.750
J	0.766
K	0.781
L	0.860
M	0.875
N	0.900
P	1.000
Q	1.050
R	1.063
S	1.125
T	1.250
U	1.315
V	1.375
W	1.500
Y	1.625
Z	1.900
X	Other

* Thermowells with a .500" or less stem diameter and a "U" diameter longer than 4.5" should be avoided. They should be replaced with a larger diameter and a stepped tip to maintain rigidity of well.

I - Options

Code	Option
A	Stainless Plug and Chain
B	Brass Plug and Chain
C	Chrome Plating
D	Dye Penetration Testing
E	External Hydro Pressure Test
F	Full Penetration Weld
I	Internal Hydro Pressure Test
M	Special Markings
N	Special Head Lengths and Diameter
O	Oxygen Cleaning
P	Positive Material ID (PMI)
Q	Special Surface Finish
R	Electropolishing
S	Stellite Overlay
T	PTFE Coating
W	Wake Frequency Calculation (Data Sheet Required)
X	X-ray of Weldment
Y	Tantalum Sheath
Z	Titanium Sheath

NOTE:

Special documents available upon request: COC / MTR / COO / CRN / NACE

22 Series Protection Tubes

Materials

In compliance with ASTM specifications or other applicable national standard (i.e., ASME, AWS, etc.)

Process Connection

Flange:	In compliance with ANSI B16.5 prior to fabrication
Bushing:	Welded in place
Welded:	Bare tube

Instrument Connection

Male pipe thread in compliance with ANSI B1.20.1-92

"U" Dimension

±0.50" for immersion lengths <60"
±0.75" for immersion lengths 60" to 96"
±1.00" for immersion lengths >96"

Tip Dimension

1/4" ±0.050 (unless otherwise specified)

Welding

- Flange to Base Metal
- Bushing to Base Metal
- Barstock for Closed-end
- Pipe Cap for Closed-end

Terminology

Process Connection: External means to connect protection tube to process system. Tubes can be threaded, bolted (to matching flange), or welded in place.

Instrument Connection: Means to connect temperature instrument to protection tube. Typically male pipe threaded.

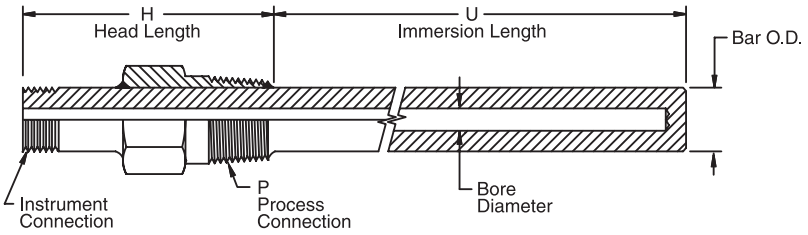
"U" Dimension: Length of protection tube immersed into process system. Measured from the base of the process connection to the tip of the tube.

"H" Dimension: Also called "head length." Measured from the base of the process connection to the face of the instrument connection.

"A" Dimension: Instrument insertion length into protection tube.

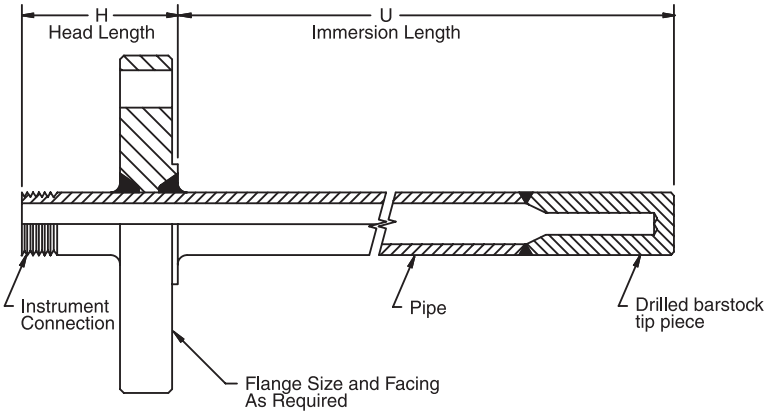
22 Series Protection Tubes: Drilled Barstock

Threaded (Bushing)



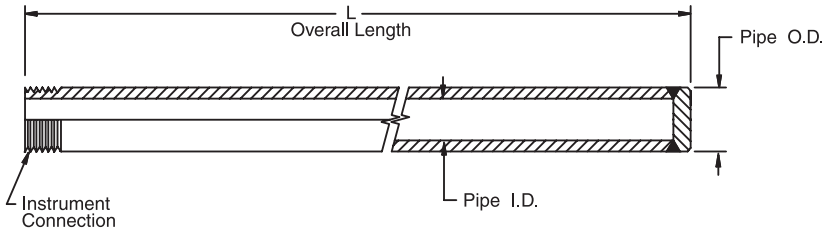
Available in pipe, drilled barstock, or combination (drilled barstock shown here)

Flanged



Available in pipe, drilled barstock, or combination (combination shown here)

Weld-In



Available in pipe, drilled barstock, or combination (pipe shown here)

22 Series Protection Tubes: How to Order

Dimensions in inches are for reference only, subject to change.

Building a Part Number: *Example:* 22A240E09A30A-MP

Example Part Number:	22	A	240	E	09	A	30	A	-MP
Ordering Parameters/ Options:	Series	Material	Immersion Length (“U” Dim.)	Tube Style	Process Connection	Bore Diameter	Head Length (“H” Dim)	Instrument Connection	Options
Table Reference: (see below)		A	B	C	D	E	F	G	H

A - Material

Code	Material
A	304 SS
C	310 SS
D	316 SS
F	321 SS
G	Alloy 20
H	CS-1018
I	CS-A105
J	Hastelloy C
K	Hastelloy B
M	Inconel 600
P	Monel 400
T	Nickel 200
V	446 SS
Y	Brass
X	Other (please specify)

B - Immersion Length

Code	Length (inches)
120	12
150	15
180	18
210	21
240	24
270	27
300	30
320	32
340	34
360	36
380	38
400	40
420	42
440	44
460	46
480	48
500	50
520	52
540	54
560	56
580	58
600	60
620	62
640	64
660	66
680	68
700	70
720	72
740	74
760	76
780	78
800	80
820	82
840	84
860	86
880	88
900	90
920	92
940	94
960	96
980	98

* A U DIMENSION OF GREATER THAN 24” AVAILABLE ON ‘PIPE’ CONFIGURATION ONLY

C - Tube Style

Drilled Barstock

Code	Size	Schedule
A	1/2" O.D.	-
B	5/8" O.D.	-
C	3/4" O.D.	-
D	7/8" O.D.	-
E	1" O.D.	-
F	1-1/8" O.D.	-
G	1-1/4" O.D.	-

Pipe

Code	Schedule	Size
H	40	1/4" O.D.
J	80	
K	160	
L	XX Heavy	
M	40	1/2" O.D.
N	80	
P	160	
Q	XX Heavy	
R	40	3/4" O.D.
T	80	
U	160	
V	XX Heavy	
W	40	1" O.D.
X	80	
Y	160	
Z	XX Heavy	

D - Process Connection

Code	Size
01	3/4" NPT
02	1" NPT
03	1-1/2" NPT
04	2" NPT
05	Welded
06	1" Class 150
07	1-1/2" Class 150
08	2" Class 150
09	3" Class 150
10	4" Class 150
11	1" Class 300
12	1-1/2" Class 300
13	2" Class 300
14	3" Class 300
15	4" Class 300
16	1" Class 600
17	1-1/2" Class 600
18	2" Class 600
19	3" Class 600
20	4" Class 600
XX	Other (please specify)

22 Series Protection Tubes: How to Order- Con't

Dimensions in inches are for reference only, subject to change.

Building a Part Number: *Example:* 22A240E09A30A-MP

Example Part Number:	21	A	240	E	09	A	30	A	-MP
Ordering Parameters/ Options:	Series	Material	Immersion Length ("U" Dim.)	Tube Style	Process Connection	Bore Diameter	Head Length ("H" Dim)	Instrument Connection	Options
Table Reference: (see below)		A	B	C	D	E	F	G	H

E - Bore Diameter

Code	Bore
A	0.260
B	0.385
P	N/A (Pipe Construction)
X	Other (please specify)

F - Length: "H" in inch.

Code	Length (inches)
20	2.0
25	2.5
30	3.0
35	3.5
40	4.0
45	4.5
50	5.0
55	5.5
60	6.0
65	6.5
70	7.0
75	7.5
80	8.0
85	8.5
90	9.0
95	9.5
XX	Other (please specify)

G - Instrument Connection

Code	Thread
C	1/4" NPT
A	1/2" NPT
D	3/4" NPT
F	1" NPT
H	1/4" NPSM
B	1/2" NPSM
E	3/4" NPSM
G	1" NPSM
I	1/4" CMP*
J	3/8" CMP*
K	1/2" CMP*
X	For Female or other Male Connection (please specify)

* CMP (compression)

H - Options

Code	Option
A	Stainless Plug and Chain
B	Brass Plug and Chain
C	Chrome Plating
D	Dye Penetration Testing
E	External Hydro Pressure Test
F	Full Penetration Weld
I	Internal Hydro Pressure Test
M	Special Markings
N	Special Head Lengths and Diameter
P	Positive Material ID (PMI)
X	X-ray of Weldment

NOTE:

Special documents available upon request: COC / MTR / COO / CRN / NACE

23 Series Sample Probes

Bar Stock
Mill Standard +0.000” / -1/32”

Overall Length
±0.050”

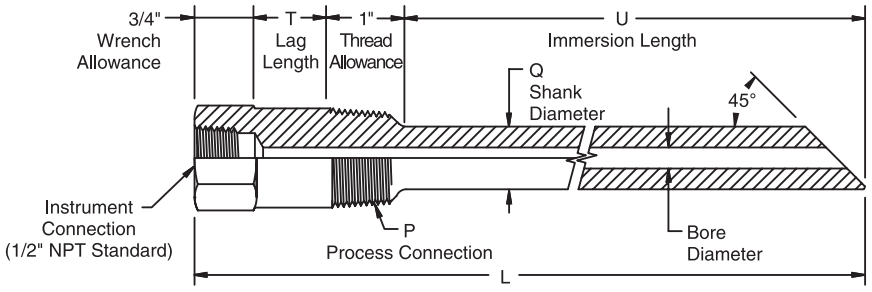
Shank O.D.
±0.010”

Shank Surface Finish
Polished to 16 RMS

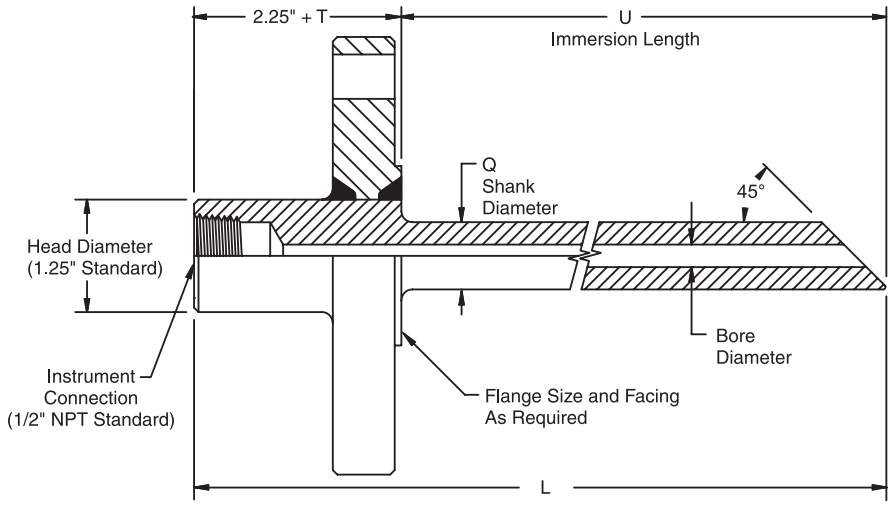
“U” Dimension
±0.050”

Bore
±0.003”

Threaded



Flanged



Dimensions in inches are for reference only, subject to change.

23 Series Sample Probes: How to Order

Dimensions in inches are for reference only, subject to change.

Building a Part Number: *Example:* **23A070T32A30AH-MP**

Example Part Number:	23	A	070	T32	A	30	A	H	-MP
Ordering Parameters/ Options:	Series	Material	Immersion Length (“U” Dim.)	Process Connection	Bore Diameter	Lag. Length (“T” Dim)	Sampler Connection	Shank Diameter (“D” Dim)	Options
Table Reference: (see below)		A	B	C	D	E	F	G	H

A - Material

Code	Material
A	304 SS
C	310 SS
D	316 SS
E	347 SS
F	321 SS
G	Alloy 20
H	CS-1018
I	CS-A105
J	Hastelloy C
K	Hastelloy B
L	Alloy 800
M	Inconel 600
N	F-5
O	F-9
P	Monel 400
Q	F-91
R	F-11
S	F-22
T	Nickel 200
U	Duplex 2205
V	446 SS
Y	Brass
Z	Aluminum
X	Other (please specify)

B - Immersion Length

Code	Length (inches)
016	1.6
020	2.0
025	2.5
030	3.0
035	3.5
040	4.0
045	4.5
050	5.0
055	5.5
060	6.0
065	6.5
070	7.0
075	7.5
080	8.0
085	8.5
090	9.0
095	9.5
100	10.0
105	10.5
110	11.0
115	11.5
120	12.0
...	...
150	15.0
...	...
175	17.5
...	...
240	24.0

Consult factory for “U” length greater than 24.

C - Process Connection

Mount Style		Shank Style	
Code	Style	Code	Style
T	Threaded	3	Straight
F	Flanged		
R	Ring Joint		
K	Socket Weld		
S	Sanitary		
N	Flat Face		

Process Connection	
Code	Style
Threaded Only	
1	1/2" NPT
2	3/4" NPT
3	1" NPT
4	1-1/4” NPT
5	1-1/2” NPT

Flanged Only	
1	1" Class 150
2	1-1/2" Class 150
3	2" Class 150
4	1" Class 300
5	1-1/2" Class 300
6	2" Class 300
7	1" Class 600
8	1-1/2” Class 600
9	2" Class 600
A	1" Class 900/1500
B	1-1/2” Class 900/1500
C	2" Class 900/1500
D	1" Class 2500
E	1-1/2” Class 2500
F	2" Class 2500

Socket Weld	
1	3/4" pipe (1.050 O.D.)
2	1” pipe (1.315 O.D.)
3	1-1/4" pipe (1.660 O.D.)
4	1-1/2" pipe (1.900 O.D.)
5	1-1/2" actual (1.500 O.D.)

Sanitary Only	
1	1-1/2" Tri-Camp
2	2” Tri-Camp
3	2-1/2" Tri-Camp
4	3" Tri-Camp)

Other	
X	(please specify)

NOTE:

Special documents available upon request: COC / MTR / COO / CRN / NACE

23 Series Sample Probes: How to Order- Con't

Dimensions in inches are for reference only, subject to change.

Building a Part Number: *Example:* 23A070T32A30AH-MP

Example Part Number:	23	A	070	T32	A	30	A	H	-MP
Ordering Parameters/ Options:	Series	Material	Immersion Length ("U" Dim.)	Tube Style	Bore Diameter	Lag. Length ("T" Dim)	Sampler Connection	Shank Diameter ("D" Dim)	Options
Table Reference: (see below)		A	B	C	D	E	F	G	H

D - Bore Diameter

Code	Bore
A	0.260
B	0.385
X	Other (please specify)

E - Lag. Length

Code	Length (inches)
20	2.0
25	2.5
30	3.0
35	3.5
40	4.0
45	4.5
50	5.0
55	5.5
60	6.0
65	6.5
70	7.0
75	7.5
80	8.0
85	8.5
90	9.0
95	9.5
XX	Other (please specify)

F -Sample Connection

Code	Length (inches)
C	1/4" NPT
A	1/2" NPT
D	3/4" NPT
F	1" NPT
H	1/4" NPSM
B	1/2" NPSM
E	3/4" NPSM
G	1" NPSM
I	1/4" CMP*
J	3/8" CMP*
K	1/2" CMP*
X	Other (please specify)

* CMP (compression)

G -Shank Diameter

Code	Length (inches)
A	0.375
B	0.400
C	0.500
D	0.562
E	0.625
F	0.680
G	0.735
H	0.750
J	.0766
K	0.781
L	0.860
M	0.875
N	0.900
P	1.000
Q	1.050
R	1.063
S	1.125
T	1.250
U	1.315
V	1.375
W	1.500
Y	1.625
Z	1.900
X	Other (please specify)

G - Options

Code	Option
A	Stainless Plug and Chain
B	Brass Plug and Chain
C	Chrome Plating
D	Dye Penetration Testing
E	External Hydro Pressure Test
F	Full Penetration Weld
M	Special Markings
N	Special Head Lengths and Diameter
O	Oxygen Cleaning
P	Positive Material ID (PMI)
Q	Special Surface Finish
R	Electroploshing
T	PTFE Coating
X	X-ray of Weldment

NOTE:

Special documents available upon request: COC / MTR / COO / CRN / NACE

NOTES:

NOTES:

Parker's Motion & Control Technologies

At Parker, we're guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements. It means looking at customer applications from many angles to find new ways to create value. Whatever the motion and control technology need, Parker has the experience, breadth of product and global reach to consistently deliver. No company knows more about motion and control technology than Parker. For further information call 1-800-C-Parker.

MARKET	KEY MARKETS		KEY PRODUCTS	
 **AEROSPACE**	Aircraft Engines Commercial Commercial Transports Military Aircraft Regional Transports	Business and General Aviation Land-Based Weapons Systems Missiles and Launch Vehicles Unmanned Aerial Vehicles	Flight Control Systems & Components Fluid Conveyance Systems Fluid Metering Delivery & Atomization Devices Fuel Systems & Components	Hydraulic Systems & Components Inert Nitrogen Generating Systems Pneumatic Systems & Components Wheels & Brakes
 **CLIMATE CONTROL**	Agriculture Food, Beverage and Dairy Precision Cooling Transportation	Air Conditioning Life Sciences & Medical Processing	Co2 Controls Electronic Controllers Filter Driers Hand Shut-Off Valves Hose & Fittings	Pressure Regulating Valves Refrigerant Distributors Safety Relief Valves Solenoid Valves Thermostatic Expansion Valves
 **ELECTRO-MECHANICAL**	Aerospace Life Science & Medical Packaging Machinery Plastics Machinery & Converting Semiconductor & Electronics Factory Automation	Machine Tools Paper Machinery Primary Metals Textile Wire & Cable	AC/DC Drives & Systems Electric Actuators, Gantry Robots & Slides Electrohydrostatic Actuation Systems Electromechanical Actuation Systems Human Machine Interface	Linear Motors Stepper Motors, Servo Motors Drives & Controls Structural Extrusions
 **FILTRATION**	Food & Beverage Life Sciences Mobile Equipment Power Generation Transportation	Industrial Machinery Marine Oil & Gas Process	Analytical Gas Generators Compressed Air & Gas Filters Condition Monitoring Engine Air, Fuel & Oil Filtration & Systems	Hydraulic, Lubrication & Coolant Filters Process, Chemical, Water Microfiltration Filters Nitrogen, Hydrogen & Zero Air Generators
 **FLUID and GAS HANDLING**	Aerospace Agriculture Bulk Chemical Handling Construction Machinery Food & Beverage Fuel & Gas Delivery	Industrial Machinery Mobile Oil & Gas Transportation Welding	Brass Fittings & Valves Diagnostic Equipment Fluid Conveyance Systems Industrial Hose	PTFE & PFA Hose, Tubing & Plastic Fittings Rubber & Thermoplastic Hose & Couplings Tube Fittings & Adapters Quick Disconnects
 **HYDRAULICS**	Aerospace Aerial lift Agriculture Construction Machinery Forestry	Industrial Machinery Mining Oil & Gas Power Generation & Energy Truck Hydraulics	Diagnostic Equipment Hydraulic Cylinders & Accumulators Hydraulic Motors & Pumps Hydraulic Systems Hydraulic Valves & Controls	Power Take-Offs Rubber & Thermoplastic Hose & Couplings Tube Fittings & Adapters Quick Disconnects
 **PNEUMATICS**	Aerospace Conveyor & Material Handling Factory Automation Life Science & Medical	Machine Tools Packaging Machinery Transportation & Automotive	Air Preparation Brass Fittings & Valves Manifolds Pneumatic Accessories Pneumatic Actuators & Grippers Pneumatic Valves & Controls	Quick Disconnects Rotary Actuators Rubber & Thermoplastic Hose & Couplings Structural Extrusions Thermoplastic Tubing & Fittings Vacuum Generators, Cups & Sensors
 **PROCESS CONTROL**	Chemical & Refining Food, Beverage & Dairy Medical & Dental	Microelectronics Oil & Gas Power Generation	Analytical Sample Conditioning Products & Systems Fluoropolymer Chemical Delivery Fittings, Valves & Pumps High Purity Gas Delivery Fittings, & Valves & Regulators	Instrumentation Fittings, Valves Regulators Medium Pressure Fittings & Valves Process Control Manifolds
 **SEALING and SHIELDING**	Aerospace Chemical Processing Consumer Energy, Oil & Gas Fluid Power General Industrial	Information Technology Life Sciences Military Semiconductor Transportation	Dynamic Seals Elastomeric O-Rings Emi Shielding Extruded & Precision-Cut, Fabricated Elastomeric Seals	Homogeneous & Inserted Elastomeric Shapes High Temperature Metal Seals Metal & Plastic Retained Composite Seals Thermal Management

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