DAILY
THERMETRICS

Thermowells & Protection Tubes

Catalog

DAILY THERMETRICS

DAILY THERMETRICS is a single source provider of superior temperature measurement systems and field services to make projects flow seamlessly from feasibility to construction. This unique capability allows **Daily** to provide design and technical support, as well as control the fabrication and testing schedule to ensure timely, consistent delivery.

Since 1973, Daily Thermetrics Corporation has provided the process industries with the tools for process optimization through precise temperature measurement instrumentation. We are known for the highest quality equipment, turnkey services, and emergency delivery services to meet the demands of our customers. Daily Thermetrics owns multiple patents in the field of temperature sensing instrumentation and is committed to pushing the limits of conventional temperature control through constant research and development. Our patented CatTracker® catalyst tracking system leads the industry in vessel temperature profiling and is the first flexible thermocouple system certified as SIL 3 capable. Proprietary CatTracker® manufacturing techniques have provided the building blocks for other Daily Thermetrics exclusive products, including Daily Premium™ Line and EZPad™ replaceable skin thermocouples. Whatever the situation, from common thermocouple issues to complex hydrocracker catalyst profiling and fired heater issues, Daily Thermetrics' technical team is qualified to provide essential expertise and best-practice solutions. Throughout the refining, petrochemical, and power industries, Daily Thermetrics has provided thousands of plant operators with key process control data all over the world.

CERTIFIED NMSDC MBE 2018

certified WBENC WOMEN'S BUSINESS ENTERPRISE

CERTIFIED ISO 9001 UKAS MANAGEMENT SYSTEMS 001

CERTIFIED ISO 9001 ANAB ACCREDITED MANAGEMENT SYSTEMS CERTIFICATION BODY

Manufacturing Headquarters
Houston TX, USA

1. Daily Thermetrics' U.S. and worldwide patents include USPN 8,870,455; USPN 6,599,011; USPN 6,550,963; CA 2,848,398; and CA 2,449,074. Additional patents are pending.

The **Daily** Advantage

Comprehensive Solutions for Your Temperature Needs

PRODUCT LINES

- Thermocouples and RTDs
- Surface Temperature Measurement
- Vessel Thermometry
- Thermowells

EXPERTISE

- Refinery-Wide Application Specialists
- Process Unit Specific Approach
- Proprietary Wake Frequency Analysis Software per ASME PTC 19.3 TW-2016 (available online)

INSPECTION AND CERTIFICATION

Full Documentation and Traceability of In-House Testing including (but not limited to):

- Ultrasonic Inspection of Full Penetration Welds
- Radiographic Inspection of all Sensors
- Positive Material Identification (raw materials and finished products)
- Calibration Test (including cryogenic temperatures)
- ATEX and IEC Flameproof and Intrinsically Safe Certified Assemblies

QUALITY CONTROL

- ISO 9001:2008 Certified
- Thermowell Serialization for Complete Traceability
- Climate and Contaminant Controlled Manufacturing Facility
- Level II Inspectors
- ASME Section IX Qualified Welders

SERVICE

- Turnkey and Supervisory Installation Services
- Site Turnaround (STAR™) Services
- Field Diagnostics & Application Consultation

Cat Tracker®

THERMOWELLS
THERMOCOUPLES AND RTDs

SURFACE TEMPERATURE MEASUREMENT
A DIVISION OF DAILY THERMETRICS

DAILY
Premium Line

STAR SERVICES
A DIVISION OF DAILY THERMETRICS

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Thermowells
General Information

Every thermowell and pipewell purchased from Daily Thermetrics is designed and manufactured by Daily Thermetrics, an ISO 9001:2008 Certified company. This enables Daily Thermetrics to offer same-day shipping, while at the same time ensuring consistent quality to a recognized international standard. Thermowells are designed to protect the contained sensor, provide an effective seal against service conditions, and allow for sensor replacement during unit operation. Proper design of these assemblies directly correlates to sensor reliability and the overall safety of the process unit. Daily Thermetrics has developed comprehensive calculation software in strict accordance with ASME PTC 19.3 TW-2016 to ensure all thermowells designed are suitable for the process conditions to which they will be exposed.

With over 40 years of experience, Daily Thermetrics' technical team can assist and provide industry best practice solutions for even the most challenging process units and environments. Daily Thermetrics leads the industry in providing our clients with the most advanced manufacturing and NDT (Non-Destructive Testing) techniques to ensure maximum safety, service life, and performance.

For more information regarding material availability, please contact sales@dailyinst.com or your local Daily Thermetrics representative.

Around-the-Clock Service

Emergency delivery situations commonly arise as a result of discovery during turnarounds. Daily Thermetrics is structured to support your turnaround needs by offering immediate service 24 hours a day, 7 days a week. No matter what time of day or night, a product specialist is always ready to assist you.

For all inquiries, please e-mail us at sales@dailyinst.com
For emergency assistance, please call at +1 713.780.8600

Thermowells

Unique Features and Advantages

ULTRASONIC TESTING FOR ALL FULL PENETRATION WELDS

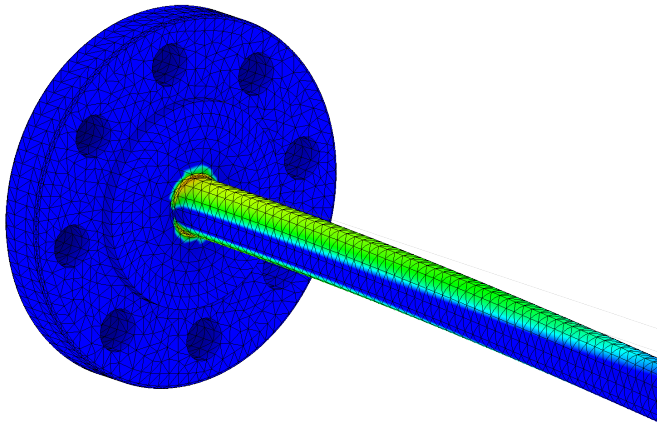
Comprehensive examination of full penetration welds for flanged thermowells is critical to prevent thermowell failure. Daily Thermetrics utilizes ***Shear Wave*** and/or ***Phased-Array*** ultrasonic testing to inspect 100% of full penetration welds.

CORROSION RESISTANT FINISH

Every thermowell is manufactured to a high polish finish of ***8 AARH or better*** which minimizes corrosion and pitting during service.

SERIALIZATION

Each thermowell is individually laser etched with a unique serial number. This links all design and testing information to the ***Daily Thermetrics database***, allowing for easy information retrieval in the absence of a data sheet.



COMPLETE WAKE FREQUENCY ANALYSIS

Complete Wake Frequency Analysis (per ***ASME PTC 19.3 TW-2016***) is offered at no extra cost for every thermowell ordered through Daily Thermetrics.

PMI (POSITIVE MATERIAL IDENTIFICATION)

Daily Thermetrics performs both fluorescent and spectrograph PMI on incoming and outgoing materials and assemblies to ensure ***all materials are PMI verified*** (and PMIV stamped) prior to shipment.

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Thermowell Selection Guide

Styles and Configurations

MODEL 110

MODEL 110 THREADED THERMOWELL

See pages 7 - 8 for options and configurations

MODEL 130

MODEL 130 FLANGED THERMOWELL

See pages 9 - 10 for options and configurations

MODEL 140

MODEL 140 VAN STONE THERMOWELL

See pages 11 - 12 for options and configurations

Thermowell Selection Guide

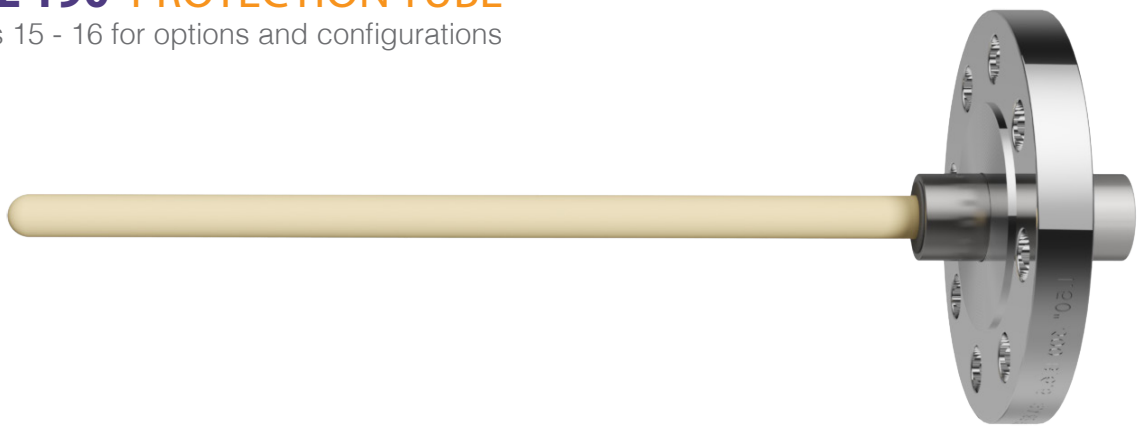
Styles and Configurations

MODEL 150 SOCKET WELD AND WELD-IN THERMOWELL

See pages 13 - 14 for options and configurations

MODEL 190 PROTECTION TUBE

See pages 15 - 16 for options and configurations



MODEL 800 PIPEWELL

See pages 17 - 18 for options and configurations

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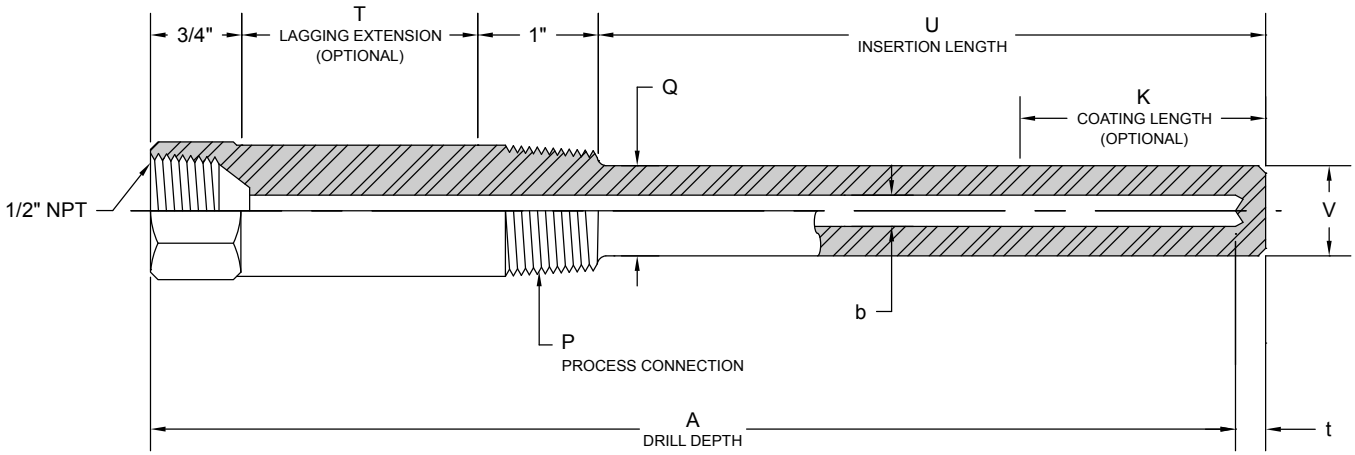
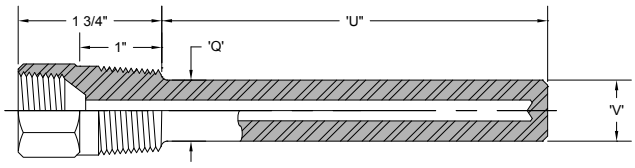
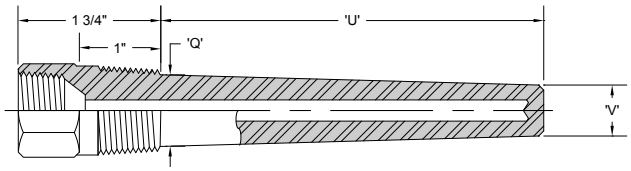
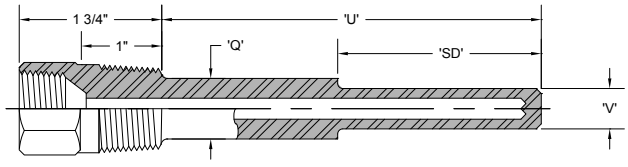
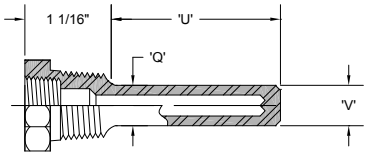
Model 110
Threaded Thermowell



Daily Thermetrics' Model 110 Threaded Thermowells are manufactured from a single piece of solid bar stock and can be utilized with thermocouples, RTDs, bimetallic thermometers, and other instrumentation devices (see Daily Thermetrics' Sensor Catalog). All aspects of the thermowell are customizable.

B	Shank Style
ST Straight	
TP Tapered	
SD Step Down	
LS Limited Space	

** Lagging extension is shown as T = 0 on table above.*

Model 110 How to Order

EXAMPLE:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
110	SD	P.75	U7.5	T0	SD2.5	b260	t25	Q.750	V.500	347	NA	NA	NA	NA	NA	AB	13

• INDICATES COMMON SELECTION

A	Model	
110	Threaded Thermowell	•

B	Shank Style	
ST	Straight	•
TP	Tapered	•
SD	Step Down	
LS	Limited Space	

C	P Size *(Process Connection)*	
P.75	3/4" NPT	•
P1.00	1" NPT	•
PX.XX	Custom	

D	U Dimension *(Insertion Length)*	
ULS	1.63" *(Limited Space Design)*	
U2.5	2.50"	•
U4.5	4.50"	•
U7.5	7.50"	
U10.5	10.50"	
U13.5	13.50"	
U19.5	19.50"	
UXX.XX	Custom	

E	T Dimension *(Optional Lagging Extension)*	
T2	2.00"	
T3	3.00"	•
TX.XX	Custom	
T0	No Lagging Extension	•

F	SD Dimension *(Step Down Length)*	
SD2.5	2.50"	•
SDX.X	Custom	
NA	Not Applicable for Shank Style Straight or Tapered	•

G	b Dimension *(Bore)*	
b260	.260"	•
b385	.385"	
bXXX	Custom	

H	t Dimension *(Tip Thickness)*	
t25	.25"	•
t38	.38"	
t31	.31"	
tXX	Custom	

Minimum Tip Thickness is .120"

I	Q Dimension *(Root Diameter)*	
Q.750	.750"	
Q.875	.875" *	•
Q1.063	1.063" **	•
QX.XXX	Custom	

** For 3/4" NPT, Max Q = .875"*
*** For 1" NPT, Max Q = 1.063"*

J	V Dimension *(Tip Diameter)*	
V.500	.500" *	
V.625	.625" **	•
V.750	.750"	
VX.XXX	Custom	

** For Step Down or .260" Bore, Min V = .500"*
*** For Tapered or .385" Bore, Min V = .625"*

K	Thermowell Material Code	
316	316/316L SS	•
347	347/347H SS	
M400	Monel® 400	
I600	Inconel® 600	
I800	Incoloy® 800	

See Page 19 for Additional Materials

L	Coating	
S6	Stellite® 6	•
S1	Stellite® 1	
C88	Colmonoy® 88	
NA	No Coating	•

M	Coating Thickness[1]	
A	1/16" Per Side	•
B	1/8" Per Side	
NA	No Coating	•

N	K Dimension *(Coating Length)*	
KU	Entire U Dimension	•
K3	3" From Tip	
KXX	Custom Length From Tip	
NA	No Coating	•

O	Coating Process	
W	Welded / Hardface Overlay *(Stellite® 6 only)*	•
SF	Spray and Fuse	
NA	No Coating	•

P	Plug and Chain	
304PC	304SS	
316PC	316SS	
BRPC	Brass	
NA	None	•

Q	Optional Testing[2] *(String Letters Together for Multiple)*	
A	Internal Hydrostatic Test with Report	
B	External Hydrostatic Test with Report	
C	Hardness Test with Report	
D	Ferrite Test with Report	
NA	No Additional Testing	•

R	Optional Test Reports[2] *(String Numbers Together for Multiple)*	
1	Positive Material Identification Report	
2	Positive Material Identification Certificate	
3	NACE MR0103 Compliance Certificate	
4	Material Test Reports	
NA	No Additional Reports	•

1. Q and V dimensions are final after coating. Base material will be undercut accordingly. Minimum wall thickness before coating shall be .120".
2. See Page 25 for more information on testing and reports.
3. Unique and simplified item number will be generated and issued to every customized thermowell for ease of reordering.
4. The majority of options are customizable. Please contact sales if your requirements are not met by this catalog.

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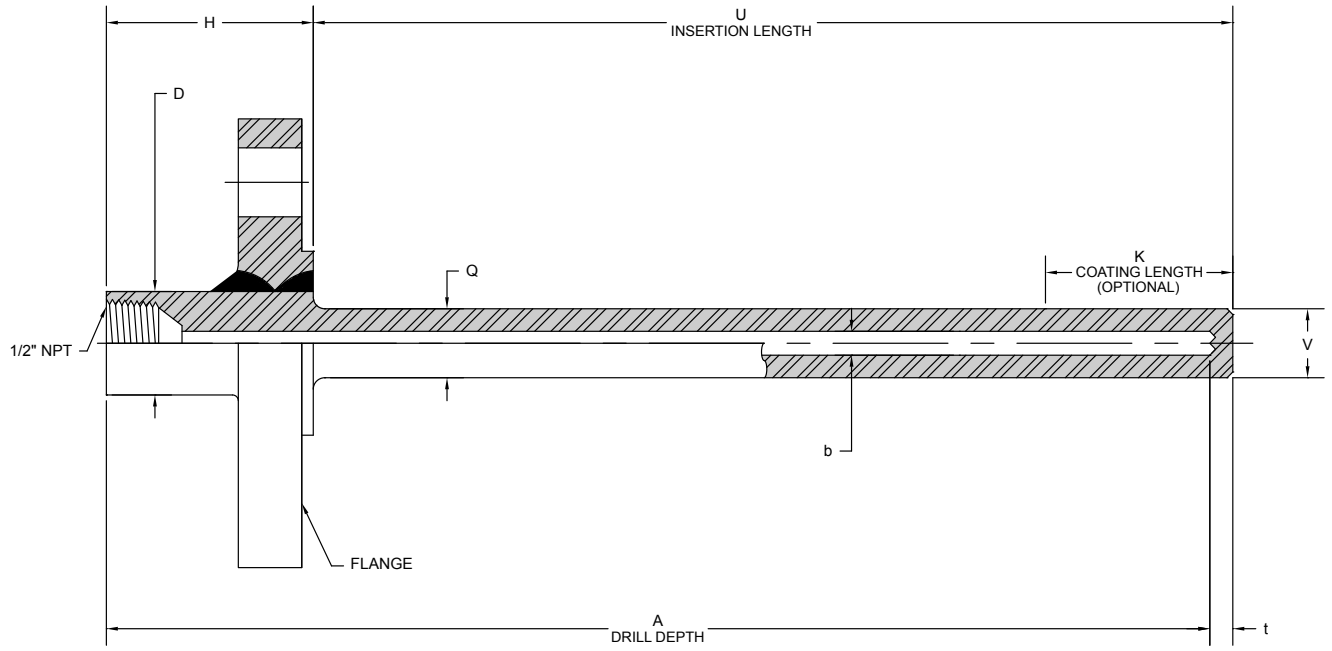
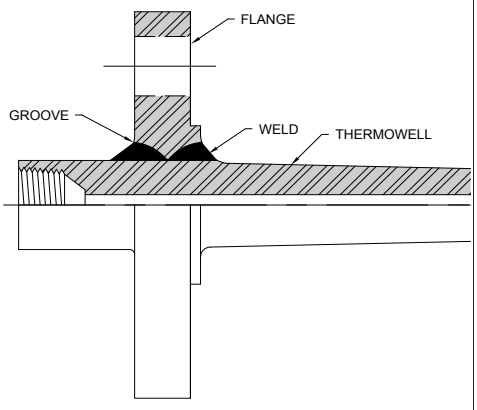
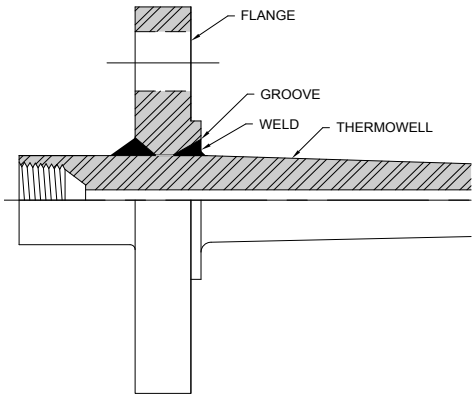
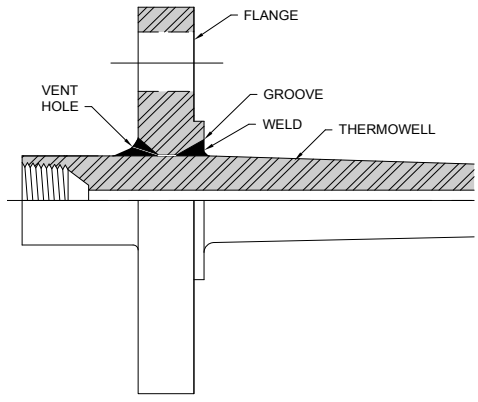
Model 130
Flanged Thermowell



Daily Thermetrics' Model 130 Flanged Thermowells consist of a thermowell shank made from a single piece of solid bar stock welded to a flange. Raised face and ring type joint flange connections are available, and gaskets must be used during installation. Designed for use with thermocouples, RTDs, bimetallic thermometers, and other instrumentation devices (see Daily Thermetrics' Sensor Catalog). All aspects of the thermowell are customizable.

O	Weld Type		
	Full Penetration FP	Partial Penetration PP	Partial Penetration with Vent Hole PV
			

Model 130 How to Order

EXAMPLE:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
130	SD	U13	H3.25	SD2.5	b260	t25	D1.125	Q.750	V.500	347	3RF	900	347	FP	NA	NA	NA	NA	NA	AB	13

• INDICATES COMMON SELECTION

A	Model	
130	Flanged Thermowell	•

B	Shank Style	
ST	Straight	•
TP	Tapered	•
SD	Step Down	

C	U Dimension *(Insertion Length)*	
U4	4.00"	
U7	7.00"	•
U10	10.00"	•
U13	13.00"	
U16	16.00"	
U22	22.00"	
UXX.XX	Custom	•

D	H Dimension *(Head Length)*	
H2.25	2.25"	•
H3.25	3.25"	
HX.XX	Custom	

For a flange rating 600# or greater, a minimum H of 3.25" may be required.

E	SD Dimension *(Step Down Length)*	
SD2.5	2.50"	•
SDX.X	Custom	
NA	Not Applicable for Shank Style Straight or Tapered	•

F	b Dimension *(Bore)*	
b260	.260"	•
b385	.385"	
bXXX	Custom	

G	t Dimension *(Tip Thickness)*	
t25	.25"	•
t38	.38"	
t31	.31"	
tXX	Custom	

Minimum Tip Thickness is .120"

H	D Dimension *(Bar Diameter)*	
D1.125	1.125"	•
D1.250	1.250"	
D1.375	1.375"	
DX.XXX	Custom	

I	Q Dimension *(Root Diameter)*	
Q.750	.750"	
Q.875	.875"	•
Q1.063	1.063"	•
QX.XXX	Custom	

J	V Dimension *(Tip Diameter)*	
V.500	.500" *	
V.625	.625" **	•
V.750	.750"	
VX.XXX	Custom	

** For Step Down or .260" Bore, Min V = .500"*
*** For Tapered or .385" Bore, Min V = .625"*

K	Thermowell Material Code	
316	316/316L SS	•
347	347/347H SS	
M400	Monel® 400	
I600	Inconel® 600	
I800	Incoloy® 800	

See Page 19 for Additional Materials

L	Flange Size and Type [5]	
1RF	1" RF	•
1.5RF	1-1/2" RF	•
2RF	2" RF	•
3RF	3" RF	•
1.5RTJ	1-1/2" RTJ	•
2RTJ	2" RTJ	•
XRF	Custom Size RF	
XRTJ	Custom Size RTJ	

For 1" flanges, verify Q will fit in nozzle

M	Flange Rating [5]	
150	150#	•
300	300#	•
600	600#	•
900	900# [6]	
1500	1500#	
2500	2500#	

N	Flange Material Code	
316	316/316L SS	•
347	347/347H SS	
M400	Monel® 400	
I600	Inconel® 600	
I800	Incoloy® 800	

See Page 19 for Additional Materials

O	Weld Type	
FP	Full Penetration	•
PP	Partial Penetration	
PV	Partial Penetration w/ Vent	

P	Coating	
S6	Stellite® 6	•
S1	Stellite® 1	
C88	Colmonoy® 88	
NA	No Coating	•

Q	Coating Thickness [1]	
A	1/16" Per Side	•
B	1/8" Per Side	
NA	No Coating	•

R	K Dimension *(Coating Length)*	
KU	Entire U Dimension	•
K3	3" From Tip	
KXX	Custom Length From Tip	
NA	No Coating	•

S	Coating Process	
W	Welded / Hardface Overlay *(Stellite® 6 only)*	•
SF	Spray and Fuse	
NA	No Coating	•

T	Plug and Chain	
304PC	304SS	
316PC	316SS	
BRPC	Brass	
NA	None	•

U	Optional Testing [2] *(String Letters Together for Multiple)*	
A	Internal Hydrostatic Test with Report	
B	External Hydrostatic Test with Report	
C	Hardness Test with Report	
D	Ferrite Test with Report	
E	Dye Penetrant Test with Report	
F	Radiographic Test with Report	
NA	No Additional Testing	•

V	Optional Test Reports [2] *(String Numbers Together for Multiple)*	
1	Positive Material Identification Report	
2	Positive Material Identification Certificate	
3	NACE MR0103 Compliance Certificate	
4	Material Test Reports	
5	Ultrasonic Test Report *(Full Penetration Welds Only)*	
NA	No Additional Reports	•

1. Q and V dimensions are final after coating. Base material will be undercut accordingly. Minimum wall thickness before coating shall be .120".
2. See Page 25 for more information on testing and reports.
3. Unique and simplified item number will be generated and issued to every customized thermowell for ease of re-ordering.
4. The majority of options are customizable. Please contact sales if your requirements are not met by this catalog.
5. Flange face finish is 125-250 RMS for raised face and 63 AARH for RTJ sealing surface.
6. Per ASME B16.5, 900# flanges have the same dimensions as 1500# flanges for flanges 2-1/2" and smaller. For those sizes, 1500# will be provided.

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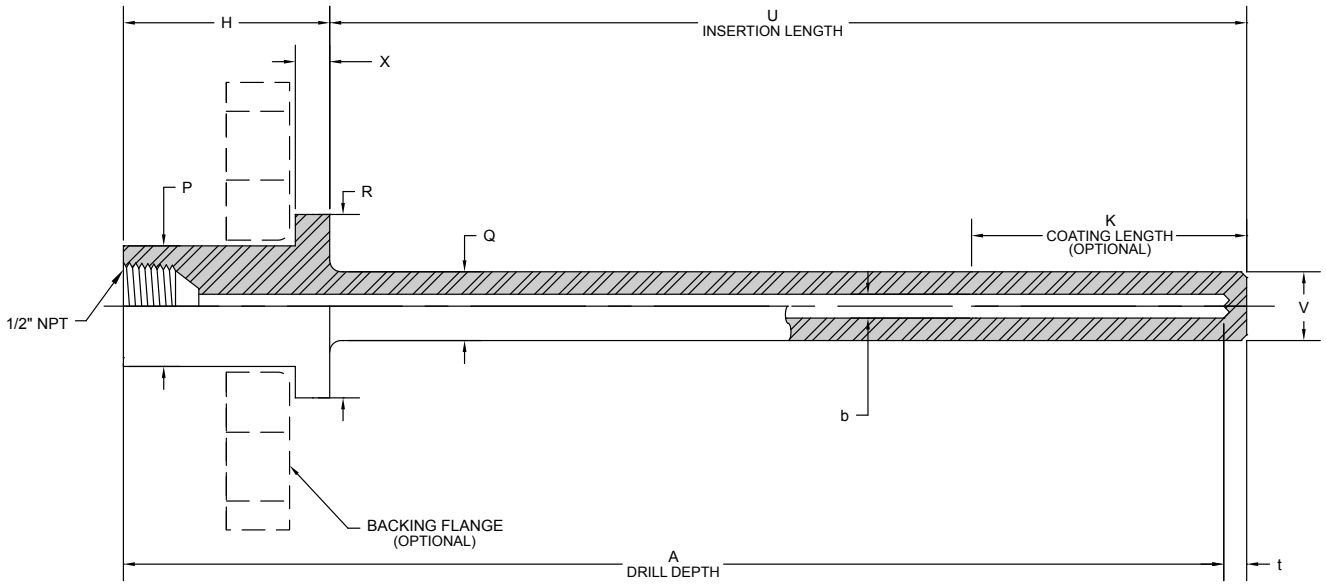
Model 140
Van Stone Thermowell



Daily Thermetrics' Model 140 Van Stone Thermowells are constructed from a single piece of solid bar stock and are designed to be in direct contact with the process. Raised face and ring type joint flange connections are available and gaskets must be used during installation. Designed for use with thermocouples, RTDs, bimetallic thermometers, and other instrumentation devices (see Daily Thermetrics' Sensor Catalog). All aspects of the thermowell are customizable.

H / I	**Standard P, R, & X Dimension Chart**					
RF Raised Face	R Dimension *Raised Face Diameter*				P Dimension *Offset Diameter*	X Dimension *Face Thickness*
	150#	300-600#	900-1500#	2500#		
1"	2"	2"	2"	2"	1.315"	.375"
1-1/2"	2.875"	2.875"	2.875"	2.875"	1.9"	
2"	3.625"	3.625"	3.625"	3.625"	2.375"	
2-1/2"	4.125"	4.125"	4.125"	4.125"	2.875"	.500"
3"	5"	5"	5"	5"	3.5"	
RTJ Ring Type Joint	R Dimension *Ring-Type Joint Diameter*				P Dimension *Offset Diameter*	X Dimension *Face Thickness*
	150#	300-600#	900-1500#	2500#		
1"	2.5"	2.75"	2.813"	3.25"	1.315"	.500"
1-1/2"	3.25"	3.563"	3.625"	4.5"	1.9"	
2"	4"	4.25"	4.875"	5.25"	2.375"	
2-1/2"	4.75"	5"	5.375"	5.875"	2.875"	.625"

Model 140 How to Order

EXAMPLE:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
140	TP	U13	H2.25	NA	b260	t25	3RF	900	Q.875	V.750	347	NA	NA	NA	NA	CS	NA	AB	13

• INDICATES COMMON SELECTION

A	Model	
140	Van Stone Thermowell	•

B	Shank Style	
ST	Straight	•
TP	Tapered	•
SD	Step Down	

C	U Dimension *(Insertion Length)*	
U4	4.00”	
U7	7.00”	•
U10	10.00”	•
U13	13.00”	
U16	16.00”	
U22	22.00”	
UXX.XX	Custom	•

D	H Dimension *(Head Length)*	
H2.25	2.25”	•
H3.25	3.25”	
HX.XX	Custom	

E	SD Dimension *(Step Down Length)*	
SD2.5	2.50”	•
SDX.X	Custom	
NA	Not Applicable for Shank Style Straight or Tapered	•

F	b Dimension *(Bore)*	
b260	.260”	•
b385	.385”	
bXXX	Custom	

G	t Dimension *(Tip Thickness)*	
t25	.25”	•
t38	.38”	
t31	.31”	
tXX	Custom	

Minimum Tip Thickness is .120”

H	Connection Size and Type [5]	
1RF	1” RF	•
1.5RF	1-1/2” RF	•
2RF	2” RF	•
3RF	3” RF	•
1.5RTJ	1-1/2” RTJ	•
2RTJ	2” RTJ	•
XRF	Custom RF	
XRTJ	Custom RTJ	

For 1” flanges, verify Q will fit in nozzle

I	Flange Rating [5]	
150	150#	•
300	300#	•
600	600#	•
900	900# [7]	
1500	1500#	
2500	2500#	

J	Q Dimension *(Root Diameter)*	
Q.750	.750”	
Q.875	.875”	•
Q1.063	1.063”	•
QX.XXX	Custom	

K	V Dimension *(Tip Diameter)*	
V.500	.500” *	
V.625	.625” **	•
V.750	.750”	
VX.XXX	Custom	

* For Step Down or .260” Bore, Min V = .500”
** For Tapered or .385” Bore, Min V = .625”

L	Thermowell Material Code	
316	316/316L SS	•
347	347/347H SS	
M400	Monel® 400	
I600	Inconel® 600	
I800	Incoloy® 800	

See Page 19 for Additional Materials

M	Coating	
S6	Stellite® 6	•
S1	Stellite® 1	
C88	Colmonoy® 88	
NA	No Coating	•

N	Coating Thickness [1]	
A	1/16” Per Side	•
B	1/8” Per Side	
NA	No Coating	•

O	K Dimension *(Coating Length)*	
KU	Entire U Dimension	•
K3	3” From Tip	
KXX	Custom Length	
NA	No Coating	•

P	Coating Process	
W	Welded / Hardface Overlay *(Stellite® 6 only)*	•
SF	Spray and Fuse	
NA	No Coating	•

Q	Backing Flange [6]	
A105	A105	•
304	304SS	
316	316SS	
NA	None	•

See Page 19 for Additional Materials

R	Plug and Chain	
304PC	304SS	
316PC	316SS	
BRPC	Brass	
NA	None	•

S	Optional Testing [2] *(String Letters Together for Multiple)*	
A	Internal Hydrostatic Test with Report	
B	External Hydrostatic Test with Report	
C	Hardness Test with Report	
D	Ferrite Test with Report	
NA	No Additional Testing	•

T	Optional Test Reports [2] *(String Numbers Together for Multiple)*	
1	Positive Material Identification Report	
2	Positive Material Identification Certificate	
3	NACE MR0103 Compliance Certificate	
4	Material Test Reports	
NA	No Additional Reports	•

1. Q and V dimensions are final after coating. Base material will be undercut accordingly. Minimum wall thickness before coating shall be .120”.
2. See Page 25 for more information on testing and reports.
3. Unique and simplified item number will be generated and issued to every customized thermowell for ease of reordering.
4. The majority of options are customizable. Please contact sales if your requirements are not met by this catalog.
5. Flange face finish is 125-250 RMS for raised face and 63 AARH for RTJ sealing surface.
6. Backing flange is lap joint style. For slip on style contact sales.
7. Per ASME B16.5, 900# flanges have the same dimensions as 1500# flanges for flanges 2-1/2” and smaller. For those sizes, 1500# will be provided.

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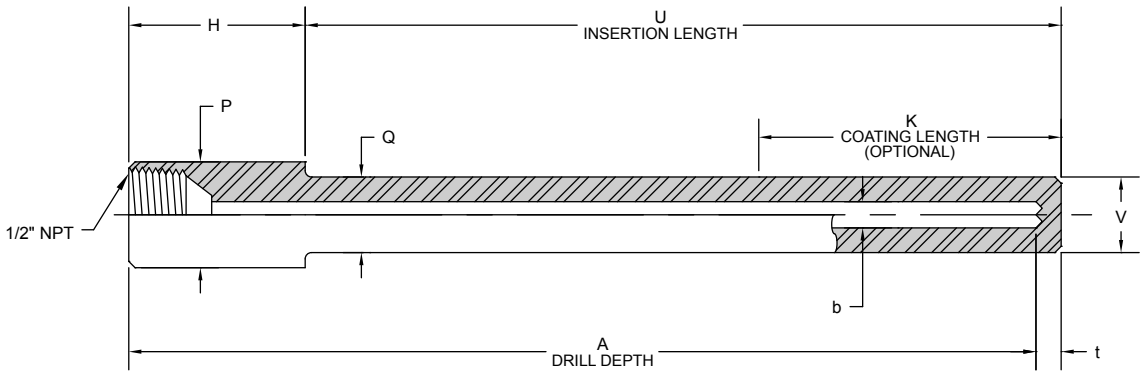
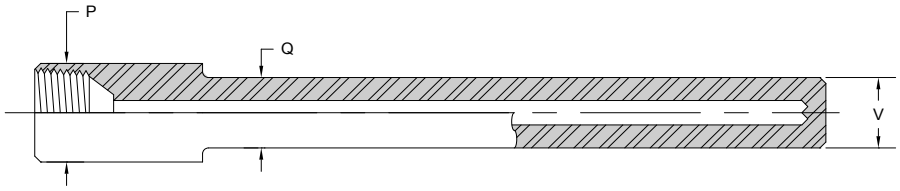
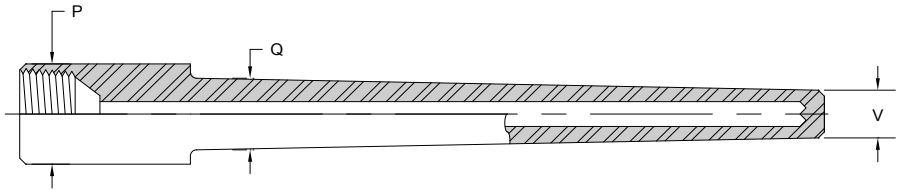
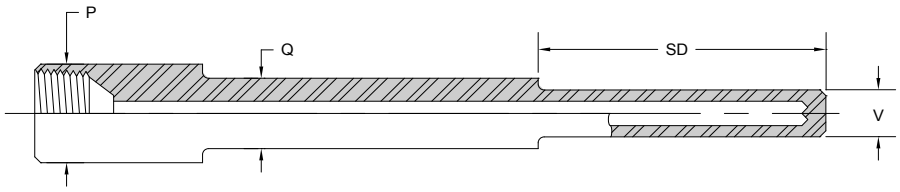
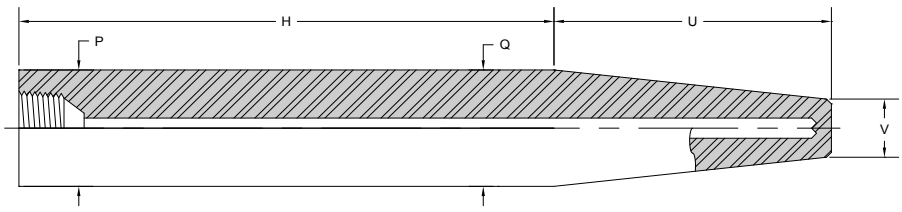
Model 150

Socket Weld and Weld-In Thermowell



Daily Thermetrics' Model 150 Socket Weld and Weld-In Thermowells are constructed from a single piece of solid bar stock and are designed to be in direct contact with the process. They require field welding and are best suited for permanent installations. The thermowell diameter is designed to fit standard socket weld connections. Designed for use with thermocouples, RTDs, bimetallic thermometers, and other instrumentation devices (see Daily Thermetrics' Sensor Catalog). All aspects of the thermowell are customizable.

B	Shank Style
ST Straight	
TP Tapered	
SD Step Down	
WI Weld-in	

Socket Weld Dimension Chart					
Pipe Size *(Nominal)*	3/4"	1"	1-1/4"	1-1/2"	2"
P Dimension *(Offset Diameter)*	1.050"	1.315"	1.660"	1.900"	2.375"

Model 150 How to Order

EXAMPLE:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
150	SD	U7	H1.75	SD2.5	b260	t25	P1.315	Q.750	V.500	316	NA	NA	NA	NA	NA	AB	13

• INDICATES COMMON SELECTION

A	Model	
150	Socket Weld or Weld-In Thermowell	•

B	Shank Style	
ST	Straight	•
TP	Tapered	•
SD	Step Down	
WI	Weld-In	

C	U Dimension *(Insertion Length)*	
U4	4.00"	•
U7	7.00"	•
U10	10.00"	
U13	13.00"	
U16	16.00"	
U22	22.00"	
UXX.XX	Custom	

D	H Dimension *(Head Length)*	
H1.75	1.75"	•
H6.75	6.75" Weld-In	•
HX.XX	Custom	

E	SD Dimension *(Step Down Length)*	
SD2.5	2.50"	•
SDX.X	Custom	
NA	Not Applicable for Shank Style Straight or Tapered	•

F	b Dimension *(Bore)*	
b260	.260"	•
b385	.385"	
bXXX	Custom	

G	t Dimension *(Tip Thickness)*	
t25	.25"	•
t38	.38"	
t31	.31"	
tXX	Custom	

Minimum Tip Thickness is .120"

H	P Dimension *(Offset Diameter)*	
P1.315	1.315" 1" Sock Weld	•
P1.050	1.050" 3/4" Sock Weld	•
P1.500	1.500" Weld-In	•
PX.XXX	Custom	

I	Q Dimension *(Root Diameter)*	
Q.750	.750"	
Q.875	.875"	•
Q1.063	1.063"	•
QX.XXX	Custom	

J	V Dimension *(Tip Diameter)*	
V.500	.500" *	
V.625	.625" **	•
V.750	.750"	
VX.XXX	Custom	

** For Step Down or .260" Bore, Min V = .500"*
*** For Tapered or .385" Bore, Min V = .625"*

K	Thermowell Material Code	
316	316/316L SS	•
347	347/347H SS	
M400	Monel® 400	
I600	Inconel® 600	
I800	Incoloy® 800	

See Page 19 for Additional Materials

L	Coating	
S6	Stellite® 6	•
S1	Stellite® 1	
C88	Colmonoy® 88	
NA	No Coating	•

M	Coating Thickness[1]	
A	1/16" Per Side	•
B	1/8" Per Side	
NA	No Coating	•

N	K Dimension *(Coating Length)*	
KU	Entire U Dimension	•
K3	3" From Tip	
KXX	Custom Length	
NA	No Coating	•

O	Coating Process	
W	Welded / Hardface Overlay *(Stellite® 6 only)*	•
SF	Spray and Fuse	
NA	No Coating	•

P	Plug and Chain	
304PC	304SS	
316PC	316SS	
BRPC	Brass	
NA	None	•

Q	Optional Testing[2] *(String Letters Together for Multiple)*	
A	Internal Hydrostatic Test with Report	
C	Hardness Test with Report	
D	Ferrite Test with Report	
NA	No Additional Testing	•

R	Optional Test Reports[2] *(String Numbers Together for Multiple)*	
1	Positive Material Identification Report	
2	Positive Material Identification Certificate	
3	NACE MR0103 Compliance Certificate	
4	Material Test Reports	
NA	No Additional Reports	•

1. Q and V dimensions are final after coating. Base material will be undercut accordingly. Minimum wall thickness before coating shall be .120".
2. See Page 25 for more information on testing and reports.
3. Unique and simplified item number will be generated and issued to every customized thermowell for ease of reordering.
4. The majority of options are customizable. Please contact sales if your requirements are not met by this catalog.

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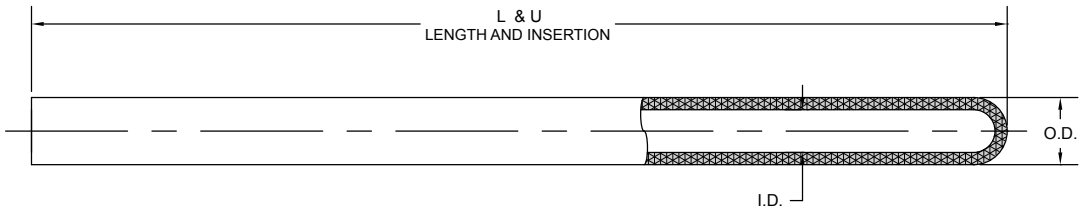
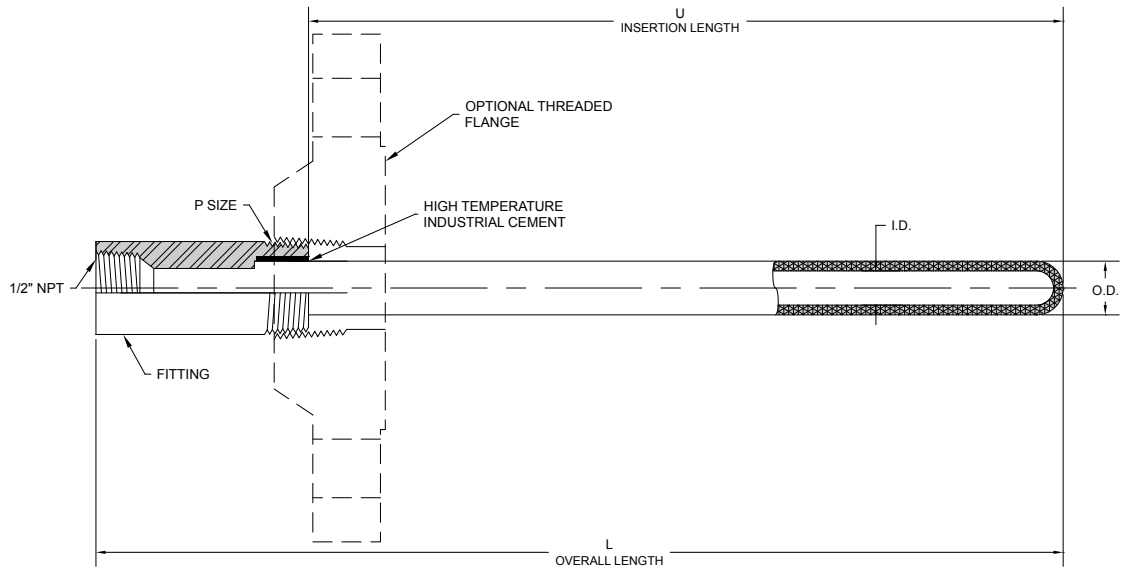
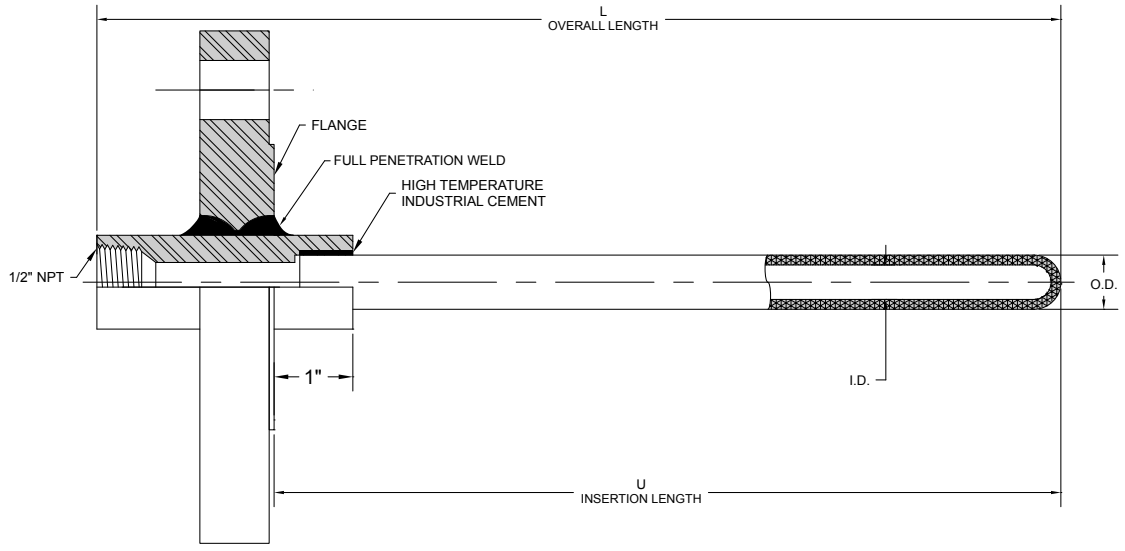
Model 190
Protection Tube

Daily Thermetrics' Model 190 Protection Tubes are constructed from ceramic or metal/ceramic composites and offer much higher temperature limits and better chemical resistance than metal alternatives. They are designed to be in direct contact with process and can be built with either threaded or flanged connection types. Designed for use with thermocouples, RTDs, and other instrumentation devices (see Daily Thermetrics' Sensor Catalog).

B	Type
PL Plain	
TF Threaded Fitting	
FF Fitting & Flange	

Model 190 How to Order

EXAMPLE:

A	B	C	D	E	F	G	H	I	J	K
190	TF	L18	U12	P1	AL	NA	NA	NA	A	12

• INDICATES COMMON SELECTION

A	Model	
190	Protection Tube	•

B	Type	
PL	Plain	•
TF	Threaded Fitting *(Flange is threaded and shipped separately)*	•
FF	Fitting & Flange	•

C	L Dimension *(Overall Length)*	
L12	12”	•
L18	18”	•
L24	24”	•
L36	36”	
L48	48”	
L72	72”	
LXX	Custom	

Metal Ceramic Tubes have 48” max length

D	U Dimension *(Inseration Length)*	
U12	12”	•
U18	18”	•
U24	24”	•
U30	30”	
U36	36”	
U48	48”	
U60	60”	
U72	72”	
UXX	Custom	

Metal Ceramic Tubes have 48” max length

E	P Size *(Process Connection)*	
P.75	3/4” NPT	•
P1.00	1” NPT	•
P1.50	1-1/2” NPT	•
NA	Non-Threaded Connection *(Plain or Fitting & Flange)*	

Metal Ceramic Tubes only come in 1” or greater

F	Ceramic Material Code	
AL	Alumina	•
ML	Mullite	•
HX	Hexoloy®	•
MC	Metal Ceramic	

G	Flange Size and Type [4]	
1RF	1” RF	•
1.5RF	1-1/2” RF	•
2RF	2” RF	•
3RF	3” RF	•
1.5RTJ	1-1/2” RTJ	•
2RTJ	2” RTJ	•
XRF	Custom RF	
XRTJ	Custom RTJ	
NA	No Flange	•

H	Flange Rating [4]	
150	150#	•
300	300#	•
600	600#	•
900	900# [6]	
1500	1500#	
2500	2500#	
NA	No Flange or Fitting	•

I	Flange or Fitting Material Code	
316	316/316L SS	•
347	347/347H SS	
M400	Monel® 400	
I600	Inconel® 600	
I800	Incoloy® 800	
NA	No Flange	•

See Page 19 for Additional Materials

J	OD/ID	
A	OD = 3/8” ; ID = 1/4” *Alumina, Mullite or Hexoloy®*	•
B	OD = 11/16” ; ID = 7/16” *Alumina, Mullite or Hexoloy®*	
C	OD = 1” ; ID = 3/4” *Alumina, Mullite or Hexoloy®*	
D	OD = 7/8” ; ID = 5/8” *Metal Ceramic*	

Contact Sales for Other Options

K	Optional Test Reports [1] *(String Numbers Together for Multiple)*	
1	Positive Material Identification Report [5]	
2	Positive Material Identification Certificate [5]	
4	Material Test Reports	
5	Ultrasonic Test Report *(Full Penetration Welds Only)*	
NA	No Additional Reports	•

1. See Page 25 for more information on testing and reports.
2. Unique and simplified item number will be generated and issued to every customized thermowell for ease of reordering.
3. The majority of options are customizable. Please contact sales if your requirements are not met by this catalog.
4. Flange face finish is 125-250 RMS for raised face and 63 AARH for RTJ sealing surface.
5. Positive Material Identification for flange and fitting only.
6. Per ASME B16.5, 900# flanges have the same dimensions as 1500# flanges for flanges 2-1/2” and smaller. For those sizes, 1500# will be provided.

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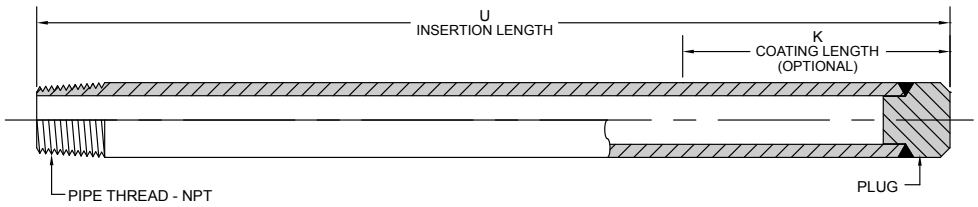
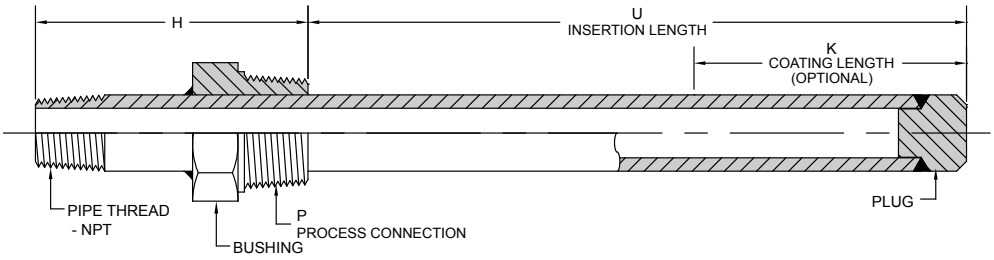
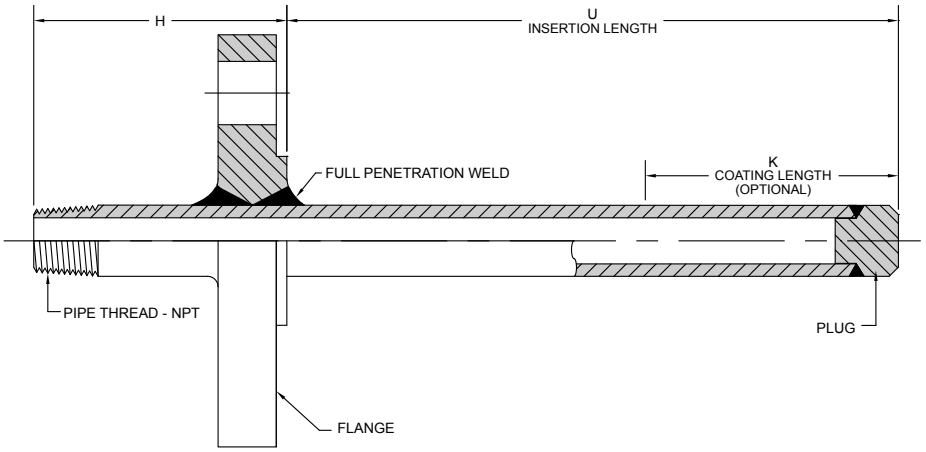
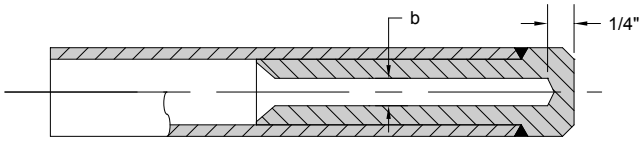
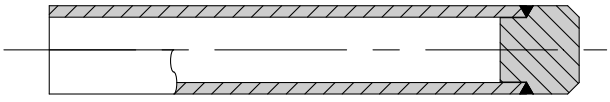
Model 800
Pipewell

Daily Thermetrics' Model 800 Pipewells are built from industrial grade pipe (as opposed to bar stock) to accommodate longer lengths which might not be practical for traditional thermowells. Additionally, Pipewell assemblies can accommodate multiple sensing probes to provide a more thorough temperature profile along the length of the pipe. These multipoint systems can be paired with secondary containment chambers and localized junction boxes for vessel profiling. Connection types can be threaded (NPT), flanged, or other.

B	Type
PL Plain	
PB Pipe with Bushing	
PF Pipe with Flange	

C	Tip Style
ST Sensitive Tip	
EP End Plug	

Model 800 How to Order

EXAMPLE:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
800	PF	ST	U12	H3	316	b281	P1	SCH40	2RF	300	316	NA	NA	AD	13

• INDICATES COMMON SELECTION

A	Model	
800	Pipewell	•

B	Type	
PL	Plain	•
PB	Pipe with Bushing	•
PF	Pipe with Flange	•

C	Tip Style	
EP	End Plug	•
ST	Sensitive Tip	•

D	U Dimension *(Insertion Length)*	
U12	12"	
U18	18"	
U24	24"	
U30	30"	
U36	36"	•
U48	48"	•
U60	60"	
U72	72"	
UXX	Custom	

E	H Dimension *(Head Length)*	
H3	3"	•
HXX	Custom	
HN	None *(For Plain Model)*	•

F	Pipewell Material Code	
304	304SS	•
316	316SS	•
347	347SS	•
I600	Inconel® 600	

See Page 19 for Additional Materials

G	b Dimension *(Bore for Sensitive Tip)*	
b281	.281"	•
bXXX	Custom	
NA	No Bore (End Plug)	

H	Pipe Size	
P1/2	1/2"	•
P3/4	3/4"	•
P1	1"	•
PXXX	Custom	•

I	Pipe Schedule	
SCH40	Sch 40	•
SCH80	Sch 80	•
SCH160	Sch 160	•
SCHXXH	Sch XXH	

J	Process Connection [4]	
1RF	1" RF	•
1.5RF	1-1/2" RF	•
2RF	2" RF	•
3RF	3" RF	•
1.5RTJ	1-1/2" RTJ	•
2RTJ	2" RTJ	•
XRF	Custom RF	
XRTJ	Custom RTJ	
B.75	3/4" NPT Bushing	•
B1	1" NPT Bushing	•
B1.25	1-1/4" NPT Bushing	
B1.5	1-1/2" NPT Bushing	
B2	2" NPT Bushing	
NA	No Process Connection	•

K	Flange Rating [4]	
150	150#	•
300	300#	•
600	600#	•
900	900# [5]	
1500	1500#	
2500	2500#	
NA	No Flange	•

L	Bushing and/or Flange Material Code	
316	316/316L SS	•
347	347/347H SS	
M400	Monel® 400	
I600	Inconel® 600	
I800	Incoloy® 800	
A105	A105 CS	•
NA	No Flange	

See Page 19 for Additional Materials

M	Coating Spray and Fuse - 1/16" Thick	
S6	Stellite® 6	•
S1	Stellite® 1	
C88	Colmonoy® 88	
NA	No Coating	•

N	K Dimension *(Coating Length)*	
KU	Entire U Dimension	•
KXX	Custom Length From Tip	
NA	No Coating	•

O	Optional Testing [2] *(String Letters Together for Multiple)*	
A	Internal Hydrostatic Test with Report	
B	External Hydrostatic Test with Report	
C	Hardness Test with Report	
D	Ferrite Test with Report	
E	Dye Penetrant Test with Report	
F	Radiographic Test with Report	
NA	No Additional Testing	•

P	Optional Test Reports [2] *(String Numbers Together for Multiple)*	
1	Positive Material Identification Report	
2	Positive Material Identification Certificate	
3	NACE MR0103 Compliance Certificate	
4	Material Test Reports	
5	Ultrasonic Test Report *(Full Penetration Welds Only)*	
NA	No Additional Reports	•

1. See Page 25 for more information on testing and reports.
2. Unique and simplified item number will be generated and issued to every customized thermowell for ease of reordering.
3. The majority of options are customizable. Please contact sales if your requirements are not met by this catalog.
4. Flange face finish is 125-250 RMS for raised face and 63 AARH for RTJ sealing surface.
5. Per ASME B16.5, 900# flanges have the same dimensions as 1500# flanges for flanges 2-1/2" and smaller. For those sizes, 1500# will be provided.

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Thermowell Material Reference Guide

INFORMATION FROM ASME SECTION II-D (FOR APPLICATION SPECIFIC INFORMATION PLEASE CONTACT SALES).
Information is for reference only.

Ordering Code	Material	UNS Number	Welding P-Number	Recommended Maximum Operating Temperature	Tensile Strength (PSI)	Yield Strength (PSI) (0.2% Offset)	Allowable Stress Values (PSI)						
							0°F	300°F	500°F	700°F	900°F	1100°F	1300°F
304	304/304L SS	S30400 S30403	8	1500° F (816°C)	75,000	30,000	20,000	18,900	17,500	15,800	14,600	9,800	3,700
304H	304H SS	S30409	8	1500° F (816°C)	75,000	30,000	20,000	17,700	16,900	15,800	14,600	9,800	3,700
310	310SS	S31000	8	1500° F (816°C)	75,000	30,000	20,000	20,000	19,300	17,900	16,900	5,000	800
316	316/316L SS	S31600 S31603	8	1500° F (816°C)	75,000	30,000	20,000	20,000	18,000	16,300	15,600	12,400	4,100
316H	316H SS	S31609	8	1500° F (816°C)	75,000	30,000	20,000	20,000	18,000	16,300	15,600	12,400	4,100
321	321SS	S32100	8	1500° F (816°C)	75,000	30,000	20,000	19,100	18,700	17,500	16,500	6,900	1,700
347	347/347H SS	S34700 S34709	8	1500° F (816°C)	75,000	30,000	20,000	18,800	17,200	16,800	16,700	16,000	2,200
A105	A105 CS	K03504	1	1000° F (538°C)	70,000	36,000	20,000	20,000	19,600	17,200	6,700	-	-
F5	A182-F5 (5Cr-1/2Mo)	K41545	5B	1200° F (649°C)	70,000	40,000	20,000	19,400	19,200	18,200	10,900	2,900	-
F9	A182-F9 (9Cr-1Mo)	K90941	5B	1200° F (649°C)	85,000	55,000	24,300	23,500	23,300	22,100	16,400	3,300	-
F11	A182-F11 Cl 2 (1-1/4Cr-1/2Mo-Si)	K11572	4	1200° F (649°C)	70,000	40,000	20,000	20,000	20,000	20,000	13,700	2,800	-
F22	A182-F22 Cl 3 (2-1/4Cr-1Mo)	K21590	5A	1200° F (649°C)	75,000	45,000	21,400	20,900	20,500	20,000	15,800	3,200	-
F91	A182-F91 (9Cr-1Mo-V)	K90901	15E	1200° F (649°C)	85,000	60,000	24,300	24,300	24,100	22,900	19,100	10,300	-
A20	Alloy 20 (20Cb-3)	N08020	45	800° F (427°C)	80,000	35,000	22,900	22,600	22,100	21,900	-	-	-
I600	Inconel® 600	N06600	43	1200° F (649°C)	80,000	35,000	22,900	20,800	20,200	19,600	16,000	3,000	-
I625	Inconel® 625	N06625	43	1200° F (649°C)	120,000	60,000	34,300	34,300	32,900	31,800	30,600	29,000	-
I800	Incoloy® 800	N08800	45	1500° F (816°C)	75,000	30,000	20,000	20,000	20,000	20,000	20,000	13,000	2,000
I800H	Incoloy® 800H	N08810	45	1650° F (899°C)	65,000	25,000	16,700	14,400	12,900	11,600	10,700	10,000	4,700
I800HT	Incoloy® 800HT	N08811	45	1650° F (899°C)	65,000	25,000	16,700	16,700	16,700	15,700	14,500	12,900	5,400
I825	Incoloy® 825	N08825	45	1000° F (538°C)	85,000	35,000	23,300	23,300	23,300	23,300	22,800	-	-
C276	Hastelloy® C-276	N10276	43	1250° F (677°C)	100,000	41,000	27,300	27,300	26,900	24,000	22,600	15,000	-
HASTX	Hastelloy® X	N06002	43	1650° F (899°C)	95,000	35,000	23,300	23,300	22,300	20,300	19,600	17,500	7,700
M400	Monel® 400	N04400	42	900° F (482°C)	70,000	25,000	16,700	13,600	13,100	13,000	8,000	-	-

Thermowell Material Selection Guide

This recommended material list is to only be used as a guide, since variations in temperature, pressure, concentration, and impurities in the corrosive medium may affect actual performance. Contact Daily Thermetrics for recommendations for special applications.

CORROSION RESISTANCE MATERIAL GUIDE

Information is for reference only.

Corrodent	Temp. °F	Conc. %	Recommended Material
Acetic Acid	212	ALL	Monel
Acetic Anhydrite	300		Nickel
Acetone	212	ALL	304SS
Acetylene	400		304SS
Alcohols	212	ALL	304SS
Alum. (Potassium or Sodium)	300	ALL	Hast C
Aluminum Chloride	212	ALL	Hast C
Aluminum Sulfate	212	ALL	316SS
Ammonia Dry	212	ALL	304/316SS
Ammonia Hydroxide (Ammonia Aqua)	212	ALL	304/316SS
Ammonium Chloride	300	50	Monel
Ammonium Nitrate	300	ALL	304SS
Ammonium Sulfate	212	ALL	316SS
Amyl Acetate	300	ALL	304SS
Aniline	25		Monel
Asphalt	250		304SS
Atmosphere (Industrial & Marine)			304SS
Barium Compounds	See Calcium		
Beer	70		304SS
Benzene (Benzol)	212		Steel
Benzoic Acid	212	ALL	316SS
Bleaching Powder	70	15	Monel
Borax	212	ALL	Brass
Bordeaux Mixture	200		304SS
Boric Acid	400	ALL	316SS
Bromine	125	DRY	Monel
Butane	400	ALL	Steel
Butyl Alcohol	See Alcohols		
Butyric Acid	212		Hast C
Calcium Bisulfite	75	ALL	Hast C
Calcium Chloride	212	ALL	Hast C
Calcium Hydroxide	300	20	Hast C
Calcium Hypochlorite	See Bleaching Powder		
Carbolic Acid	See Phenol		
Carbon Dioxide Dry	800	ALL	Brass
Carbonated Water	212	ALL	304SS
Carbonated Beverages	212		304SS
Carbon Disulfide	200		304SS
Carbon Tetrachloride	125	ALL	Monel
Chlorine Dry	100		Monel
Chlorine Moist	100	ALL	Monel
Chloraceptic Acid	212	ALL	Monel
Chloroform Dry	212		Monel
Chromic Acid	300	ALL	Hast C
Cider	300	ALL	304SS
Citric Acid	212	ALL	Hast C
Copper (10) Chloride	212	ALL	Hast C
Copper (10) Nitrate	300	ALL	316SS
Copper (10) Sulfate	300	ALL	316SS

Corrodent	Temp. °F	Conc. %	Recommended Material
Copper Plating Solution (Cyanide)	180		304SS
Copper Plating Solution (Acid)	75		304SS
Corn Acid	200		304SS
Creosote	200	ALL	304SS
Crude Oil	300		Monel
Ethel Acetate	See Laquer Thinner		
Ethyl Chloride Dry	500		Steel
Ethanol	See Alcohols		
Ethylene Glycol (Uninhibited)	212	ALL	304SS
Ethylene Oxide	75		Steel
Fatty Acids	500	ALL	316SS
Ferric Chloride	75	ALL	Hast C
Ferric Sulfate	300	ALL	304SS
Formaldehyde	212	40	316SS
Formic Acid	300	ALL	316SS
Freon	300		Steel
Fluorine, Anhydrous	100		304SS
Furfural	450		316SS
Gasoline	300		Steel
Glucose	300		304SS
Glue ph 6-8	300	ALL	304SS
Glycerine	212	ALL	Brass
Hydrobromic Acid	212	ALL	Hast C
Hydrochloric Acid (37-38%)	225	ALL	Hast C
Hydrogen Chloride Dry	500		304SS
Hydrocyanic Acid	212	ALL	304SS
Hydrofluoric Acid	212	60	Monel
Hydrogen Fluoride Dry	175		Steel
Hydrofluogilicic Acid	212	40	Monel
Hydrogen Peroxide	125	10-100	304SS
Kerosene	300	ALL	Steel
Laquers & Thinners	300	ALL	304SS
Lactic Acid	300	ALL	316SS
Lime	212	ALL	316SS
Linseed Oil	75		Steel
Magnesium Chloride	212	50	Nickel
Magnesium Hydroxide (or Oxide)	75	ALL	304SS
Magnesium Sulfate	212	40	304SS
Mercuric Chloride	75	10	Hast C
Mercury	700	100	Steel
Methylene Chloride	212	ALL	304SS
Methyl Chloride	Dry	75	Steel
Milk, fresh or sour	180		304SS
Molasses	See Glucose		
Natural Gas	70		304SS
Nitric Acid	75	ALL	304SS
Oxygen	75	ALL	Steel
Oleic Acid	See Fatty Acid		

Corrodent	Temp. °F	Conc. %	Recommended Material
Oxalic Acid	212	ALL	304SS
Photographic Bleaching	100	ALL	304SS
Palmitic Acid	See Fatty Acids		
Phosphoric Acid	212	ALL	316SS
Phenol	212	ALL	316SS
Potassium Compounds	See Sodium Compound		
Propane	300		Steel
Rosin	700	100	316SS
Sea Water	75		Monel
Soap & Detergents	212	ALL	304SS
Sodium Bicarbonate	212	20	316SS
Sodium Bisulfite	212	20	304SS
Sodium Bisulfate	212	40	304SS
Sodium Carbonate	212	30	316SS
Sodium Chloride	300	ALL	Monel
Sodium Chromate	212	ALL	316SS
Salt or Brine	See Sodium Chlorine		
Sodium Cyanide	212	ALL	304SS
Sodium Hydroxide	212	30	316SS
Sodium Hypochlorite	75	10	Hast C
Sodium Nitrate	212	40	304SS
Sodium Nitrite	75	20	304SS
Sodium Phosphate	212	10	Steel
Sodium Silicate	212	10	Steel
Sodium Sulfide	212	10	316SS
Sodium Sulfite	212	10	316SS
Sodium Sulfate	212	30	316SS
Sodium Thiosulfate	212	ALL	304SS
Steam			304SS
Steamic Acid	See Fatty Acids		
Sugar Solution	See Glucose		
Sulfur	500		304SS
Sulfur Chloride	75	DRY	316SS
Sulfur Dioxide	500	DRY	316SS
Sulfur Trioxide	500	DRY	316SS
Sulfuric Acid	212	0-10	Monel
Sulfuric Acid	212	0-100	Hast C
Sulfuric Acid	180-190	90-100	316SS
Sulfuric Acid, Fuming	175		Hast C
Sulfurous Acid	75	20	316SS
Titanium Tetrachloride	75	ALL	316SS
Tannic Acid	75	40	Hast C
Toluene	75		Steel
Trichloracetic Acid	75	ALL	Hast C
Trichlorethylene	300	DRY	Monel
Turpentine	75		316SS
Varnish	150		Steel
Zinc Chloride	212	ALL	Hast C
Zinc Sulfate	212	ALL	316SS

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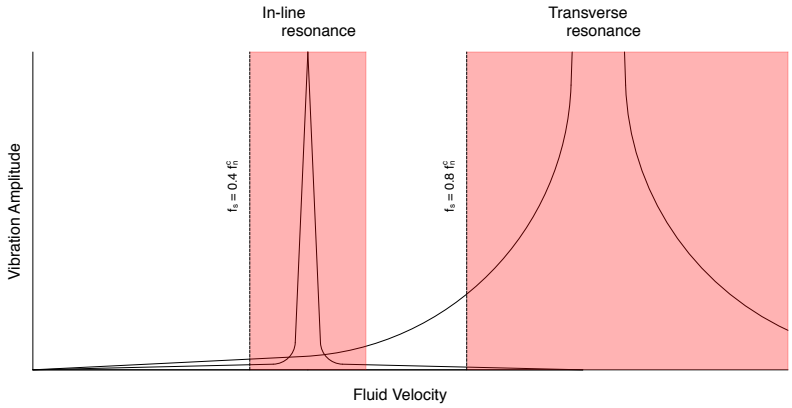
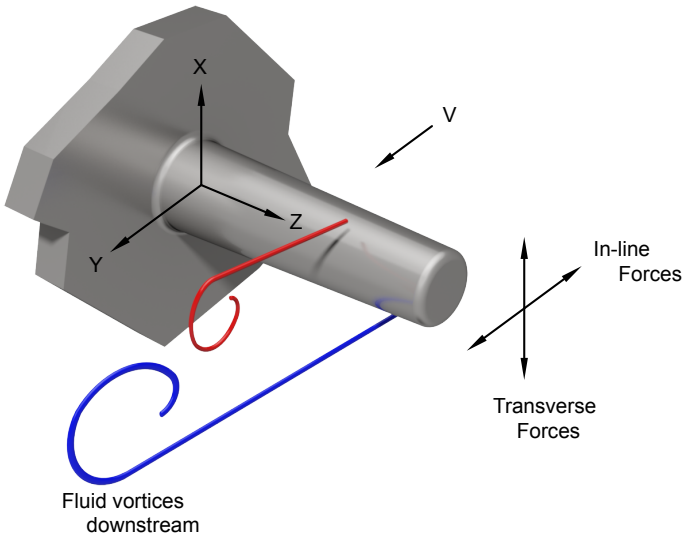
Wake Frequency Analysis

Daily Thermetrics provides Wake Frequency Calculations free of charge on all orders in accordance with ***ASME PTC 19.3 TW-2016****.*

Frequency Ratio / Vortex Shedding

Fluid flow around a traditional cylindrical thermowell generates vortices that are produced at a calculable frequency. Stresses created from thermowell oscillations are greatly amplified when the vortex shedding frequency reaches the natural frequency of the thermowell, which can lead to thermowell failure. The wake and natural frequencies are calculated and the ratio compared to requirements set by the ASME code.



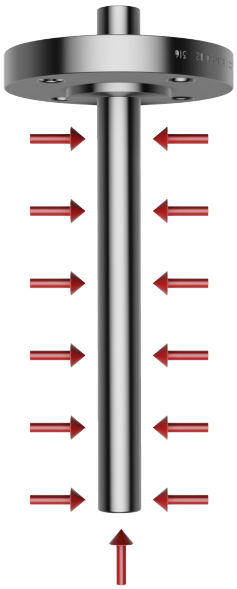


Steady State / Dynamic Stress

Steady state and dynamic stress must not exceed the thermowell's calculated maximum allowable stress. Steady state stress is found by the Von Mises Calculation, while dynamic stress is calculated from the transverse and in-line forces along the thermowell.

Pressure

The final check ensures that process design pressure does not exceed the allowable pressure of the thermowell at the design temperature. Maximum allowable pressure is calculated for the flanged/threaded connection, shank wall thickness, and tip thickness. Required minimum tip and wall thicknesses can be calculated per ASME Section VIII Div 1 Paragraph UG-28.

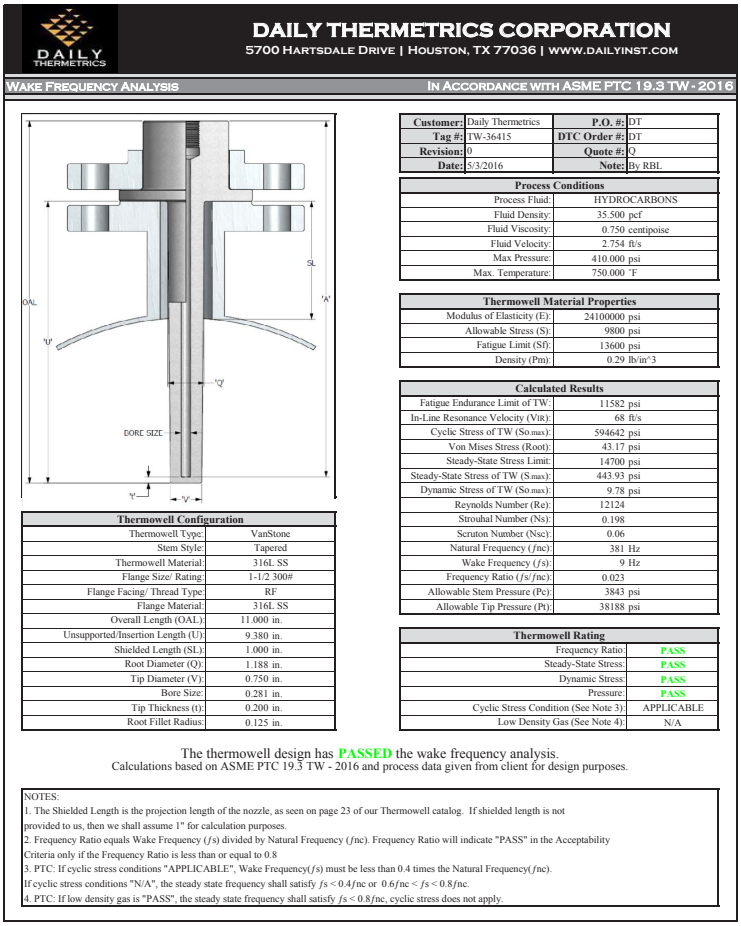


Wake Frequency Analysis

Wake Frequency Analysis

Daily Thermetrics offers the most thorough *Wake Frequency Analysis* (commonly referred to as thermowell vibration and/or velocity calculations) in the industry free of charge with every thermowell order.

Over the years, the refining industry has been steadily increasing unit throughput. Since today's process velocities are increasingly higher than in the past, it is imperative to verify that thermowell designs are suitable for every service and application.



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WAKE FREQUENCY ANALYSIS — IN ACCORDANCE WITH ASME PTC 19.3 TW - 2016

Customer:	Daily Thermetrics	**P.O. #:**	DT
Tag #:	TW-36415	**DTC Order #:**	DT
Revision:	0	**Quote #:**	Q
Date:	5/3/2016	**Note:**	By RBL

Process Conditions	
Process Fluid:	HYDROCARBONS
Fluid Density:	35.500 pcf
Fluid Viscosity:	0.750 centipoise
Fluid Velocity:	2.754 ft/s
Max Pressure:	410.000 psi
Max. Temperature:	750.000 °F

Thermowell Material Properties	
Modulus of Elasticity (E):	24100000 psi
Allowable Stress (S):	9800 psi
Fatigue Limit (Sf):	13600 psi
Density (Pm):	0.29 lb/in^3

Thermowell Configuration	
Thermowell Type:	VanStone
Stem Style:	Tapered
Thermowell Material:	316L SS
Flange Size/ Rating:	1-1/2 300#
Flange Facing/ Thread Type:	RF
Flange Material:	316L SS
Overall Length (OAL):	11.000 in.
Unsupported/Insertion Length (U):	9.380 in.
Shielded Length (SL):	1.000 in.
Root Diameter (Q):	1.188 in.
Tip Diameter (V):	0.750 in.
Bore Size:	0.281 in.
Tip Thickness (t):	0.200 in.
Root Fillet Radius:	0.125 in.

Calculated Results	
Fatigue Endurance Limit of TW:	11582 psi
In-Line Resonance Velocity (VIR):	68 ft/s
Cyclic Stress of TW ($S_{O\,max}$):	594642 psi
Von Mises Stress (Root):	43.17 psi
Steady-State Stress Limit:	14700 psi
Steady-State Stress of TW (S_{max}):	443.93 psi
Dynamic Stress of TW ($S_{O\,max}$):	9.78 psi
Reynolds Number (Re):	12124
Strouhal Number (Ns):	0.198
Scruton Number (Nsc):	0.06
Natural Frequency (fnc):	381 Hz
Wake Frequency (fs):	9 Hz
Frequency Ratio (fs/fnc):	0.023
Allowable Stem Pressure (Pe):	3843 psi
Allowable Tip Pressure (Pt):	38188 psi

Thermowell Rating	
Frequency Ratio:	PASS
Steady-State Stress:	PASS
Dynamic Stress:	PASS
Pressure:	PASS
Cyclic Stress Condition (See Note 3):	APPLICABLE
Low Density Gas (See Note 4):	N/A

The thermowell design has **PASSED** the wake frequency analysis.
Calculations based on ASME PTC 19.3 TW - 2016 and process data given from client for design purposes.

NOTES:
1. The Shielded Length is the projection length of the nozzle, as seen on page 23 of our Thermowell catalog. If shielded length is not provided to us, then we shall assume 1" for calculation purposes.
2. Frequency Ratio equals Wake Frequency (fs) divided by Natural Frequency (fnc). Frequency Ratio will indicate "PASS" in the Acceptability Criteria only if the Frequency Ratio is less than or equal to 0.8
3. PTC: If cyclic stress conditions "APPLICABLE", Wake Frequency(fs) must be less than 0.4 times the Natural Frequency(fnc). If cyclic stress conditions "N/A", the steady state frequency shall satisfy $fs < 0.4fnc$ or $0.6fnc < fs < 0.8fnc$.
4. PTC: If low density gas is "PASS", the steady state frequency shall satisfy $fs < 0.8fnc$, cyclic stress does not apply.

Online Calculator

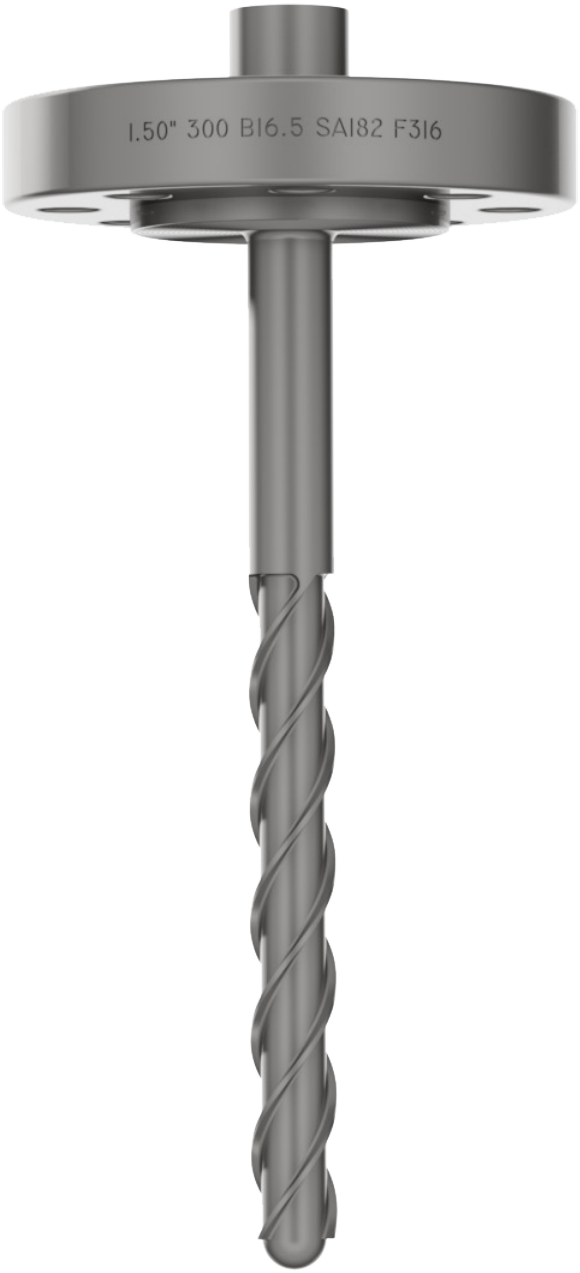
Daily Thermetrics now offers Wake Frequency Analysis per the ASME PTC 19.3 TW-2016 code online and free of charge. Qualified customers will be given login credentials to generate more thorough reports of the calculations. You may access the online calculator at: www.dailyinst.com/velocityCalc/PublicCalc.aspx

CASE STUDY:

In a recent multi-billion dollar refinery expansion project, Daily Thermetrics found that approximately *25% of all of the thermowells designed by a major EPC firm failed* to meet the design criteria set forth by the process conditions. Daily Thermetrics' expertise was called upon to correct this situation, redesigning the thermowells while saving the EPC and customer countless engineering hours in design and field installations. Daily Thermetrics' assistance in the original thermowell design could have avoided this costly mistake.

Daily Helix Thermowell (DHTW™) utilizing VE Technology®

US PATENT 8424396B2, US PATENT APPLICATION 13/858,056, AND WORLDWIDE PATENTS AND APPLICATIONS PENDING



INTRODUCTION

Flow past cylindrical thermowells creates alternating vortices which induce thermowell vibration at the vortex shedding frequency. Mechanical resonance occurs when the vortex shedding frequency reaches the natural frequency of the thermowell and causes a dramatic increase in dynamic stress. ASME PTC 19.3 TW recommends standards based upon calculated results to prevent several different thermowell failure modes. Often, the conservative formulas and assumptions in the ASME code tend to be very prohibitive for high velocity applications. Traditional measures to mitigate these effects include using a collar, creating a bulkier thermowell, or shortening the nozzle length. Although these methods can prevent thermowell failure, they also have significant shortcomings. Larger diameter thermowells reduce temperature sensing accuracy, delay response times, and transfers a larger drag force to the nozzle. Collars require an interference fit which is difficult to achieve and is not recommended by the ASME PTC code due to the inconsistent nature of installation. The clear solution to high velocity applications is the Daily Helix Thermowell (DHTW™) utilizing VE technology®.

VE TECHNOLOGY®

Daily Thermetrics is the exclusive supplier of the Daily Helix Thermowell (DHTW™) utilizing the patented VE Technology®. VE technology® combines helical strakes with a hemispherical tip which results in a special geometry that change the characteristics of the vortices created and prevents vibration induced failures. Multiple industries utilize the helical strake design and have proven its effectiveness in preventing vibrational failure through thousands of hours of service life.

DAILY THERMETRICS

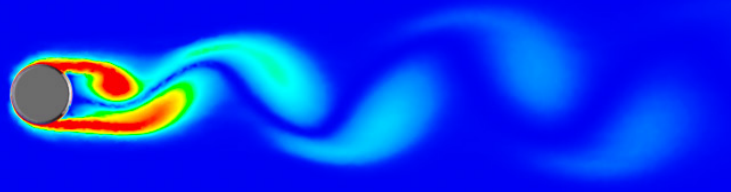
VE Technology

Daily Helix Thermowell (DHTW™) utilizing VE Technology®

Benefits and Features

- ***Vortex-Induced Vibration Dampening***
  The DHTW™ breaks up flow and reduces transverse forces caused by the wake frequency approaching the natural frequency of the thermowell. These vibrations, which would cause reduced life and failure due to metal fatigue in standard thermowells, no longer pose an issue with VE Technology®.
- ***Solid Construction***
  The DHTW™ is machined from a single piece of solid bar stock and has better geometry than welded strakes.
- ***Hemispherical Tip***
  The hemispherical tip meets all the required thickness specifications from ASME PTC 19.3 TW-2016 and minimizes flow disturbances.

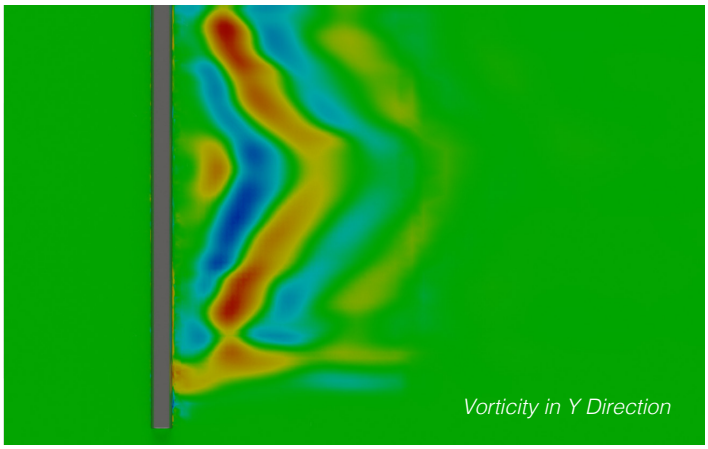
*Daily Thermetrics is the exclusive supplier of the **Daily Helix Thermowell (DHTW™) utilizing the patented VE Technology®**. Helical strakes prevent a common failure mechanism in thermowells - **vortex induced vibrations**. Contact Sales to understand how the Daily Helix Thermowell can help overcome your difficult process conditions.*



Vorticity Magnitude

Standard Cylinder

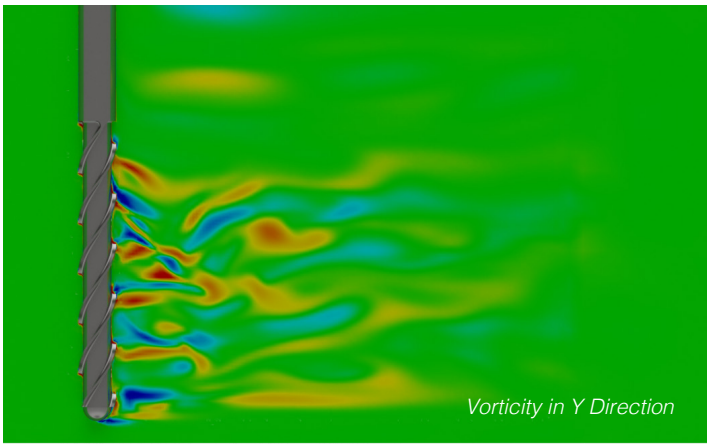
A standard cylinder (normal thermowell) obstructs the flow, causing large vortices in the wake and increasing the amplitude of the vibrations.



Vorticity in Y Direction

Standard Cylindrical Thermowell

The wake produces large vortices that extend the length of the portion of the thermowell that is exposed to the flow. The oscillation of these vortices is what causes the vortex induced vibrations. If the frequency of the vortex shedding approaches the natural frequency of the thermowell, then failure can occur.



Vorticity in Y Direction

Daily Helix Thermowell (DHTW™)

The vortices produced by the wake of the helical strake are much smaller and non-uniform. The combinations of these smaller vortices, in contrast with a standard thermowell, are negligible when assessing vortex induced vibrations. Since the smaller vortices are shed non-uniformly, the vortex shedding will not cause resonation at the thermowell's natural frequency.

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Testing and Reports

STANDARD TESTING FOR ALL THERMOWELLS

- Positive Material Identification (PMI) per ASTM E 1085 and ASTM E 1086
- Ultrasonic Volumetric Test of Full Penetration Welds per ASME Section V, Article 4

ADDITIONAL TESTING AVAILABLE

- Hydrostatic Test (Internal or External)
- Hardness Test per ASTM E 384
- Ferrite Test per API 582
- Magnetic Particle Test per ASME Section V Article 7
- Dye Penetrant Test per ASME Section V Article 6
- Eddy Current Test per ASME Section V Article 8
- Leak Testing per ASME Section V Article 10

OPTIONAL TEST REPORTS / CERTIFICATES

Reports available for tests:

- Positive Material Identification (PMI) Report per ASTM E 1085 and ASTM E 1086
- Positive Material Identification (PMI) Certificate per ASTM E 1085 and ASTM E 1086
- NACE Compliant Certificate per MR0103
- Material Test Reports
- Test Reports reviewed by NDT Level II Inspectors
- Test Procedures reviewed and approved by ASNT NDT Level III

QUALITY SYSTEM

- ISO 9001:2008 Certified
- Thermowell Serialization for Complete Traceability
- Climate and Contaminant Controlled Manufacturing Facility
- NDT Level II Inspectors
- ASME Section IX Qualified Welders
- ATEX 94/9/EC Quality Assurance
- PED 2014/68/EU Compliant
- IECEx Quality Assessment Report
- INMETRO Quality Assessment
- ASME U Stamp Certificate Holder
- Multiple Worldwide Certificates (See Sales for More Information)
- Canadian Registration Numbers for All Provinces

Daily Thermetrics Site Turnaround (STAR™) Services

Daily Thermetrics *STAR™ Service* programs complement and leverage our technical and production capabilities to meet turnaround instrumentation demands. A STAR™ Specialist is a graduate engineer that is experienced with all Daily Thermetrics product lines and plant process temperature measurement requirements.

Pre-TAR Planning

STAR™ Specialists conduct thorough pre-TAR field verifications and create inspection and replacement plans that drastically reduce the number of ***discovery items*** during TAR.

Execution

STAR™ Specialists are highly experienced in supervising turnkey TAR temperature instrumentation inspection and replacement programs. In addition to ensuring proper inspection procedures and redesign as necessary, they also manage production and shipping to ensure no replacement items become ***critical path***. STAR™ Specialists provide a direct link to all divisions of Daily Thermetrics' in order to quickly provide estimates and arrange timely delivery.

Inspection

Daily Thermetrics provides dedicated Level II inspectors who are specially trained in inspection of temperature measurement equipment. We offer turnkey inspection and recertification of existing temperature measurement equipment, including visual testing, PT, PMI, UT, eddy current, hydrostatic testing, and others upon request.

Post-TAR Close Out

STAR™ Specialists manage all necessary documentation – from inspection reports and wake frequency analysis to full data sheets for each item inspected, redesigned, and/or replaced.

From on-site technical service and turnaround support to thermowell inspection services, STAR™ Services can be customized to suit refinery TAR requirements.

- PRE-TURNAROUND PLANNING
- INVENTORY EVALUATION & STANDARDIZATION
- FIELD VERIFICATION / SURVEY
- ON-SITE TECHNICAL SUPPORT
  - Troubleshooting and Field Diagnostics
  - Design and Drawings
  - Wake Frequency Analysis
- ON-SITE SALES SUPPORT
  - Estimates
  - Rush Delivery
- INSTALLATION SUPERVISION
- INSPECTION SERVICES

STAR SERVICES

A DIVISION OF DAILY THERMETRICS

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