Thermowells

Thermowell are provided to protect the basic sensor from mechanical damage and corrosion. An extremely sturdy design may increase the life of the sensor but may lead to a poor response. Similarly, a delicate design will have poor life but will improve the response time. Therefore, a proper balance needs to be struck.

For given process parameters, we can arrive at an optimum Thermowell design considering aspects such as temperature, pressure, fluid velocity and corrosion. Such designs will conform to ASTM PTC 19.3.

The Thermowell material can be brass, SS304, SS316, SS316L, SS310, Inconel® 600, Incoloy® 800, Monel®, Hastelloy® depending upon the process parameters and type of fluid. For proper selection of Thermowell material, expert advice is available from our design department.

Various Types of Thermowells

- Bar Stock Threaded (BT)
  (Process threads NPT, BSP or Metric)
- Bar Stock Flanged (BF)
  (Flanges as per ANSI, BS or DIN)
- Bar Stock Weld In (BW)
- Fabricated Threaded (FT)
- Fabricated Flanged (FF)
- Fabricated Weld In (FW)

Barstock Thermowell is normally offered up to an insertion length of 600mm. Fabricated Thermowells are recommended above 600mm. If required, insertion length can be determined by performing wake frequency calculations, in accordance with PTC 19.3.

Welding (tig welding process) of the Thermowell is performed by professional and approved welders following practice laid down in the ASME code and weld joints can be tested up to 600 kg/ cm^2.

Bore concentricity within 10% of wall thickness can be checked by radiography or ultrasonic method. Special material tests such as ultrasonic test for flaw detection are also available. For steam/ feed water service, an IBR certificate in form IIIC can be issued.

Routine Tests:	Type Tests:
■ Chemical Analysis ■ Dimensional ■ Hydro Test ■ Dye Penetration ■ Bore Concentricity ■ Physical ■ Microstructure ■ Post Weld H/T (if specified)	■ NACE Compliance ■ Radiography ■ Ultrasonic ■ Physical Testing

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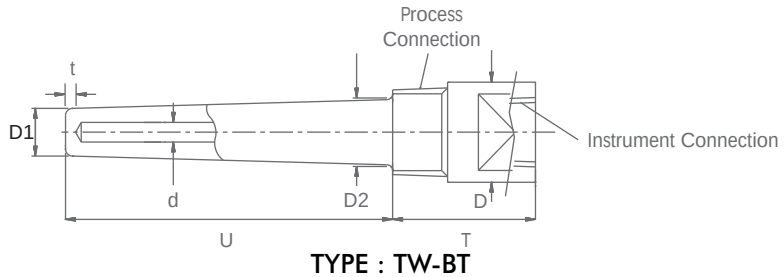
Bar Stock Threaded Thermowell
How to Order



TYPE : TW-BT

WELL MATERIAL*

S4-SS304	I825- Incoloy® 825
S6-SS316	I6-Inconel® 600
S3-SS310	I8-Incoloy® 800
SH-SS446	S2-SS321
4L-SS304L	K-Kanthal
6L-SS316L	HC-Hastelloy® C-276
C-CS to A105	HB-Hastelloy® B
S1-SS410	M-Monel® 400
S7-SS317	T-Ti-II
7L-SS317L	N-Nickel 200

DIA OF BARSTOCK In mm (D)

INSTRUMENT / PROCESS CONNECTION

Size	Type	Male / Female
6-1/4"	NT - NPT	M - Male
10- 3/8"	BP - BSP	F - Female
15-1/2"	BT - BSPT	
20-3/4"	PF - PF	
25-1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		
Metric Threads		
18 M - M 18 x 1.5		
20 M - M 20 x 1.5		
24 M - M 24 x 1.5		
27 M - M 27 x 2		
33 M - M 33 x 2		
X X - Any other		

BORE in mm (d)

COLD END DIAMETER IN mm (D2)

HOT END DIAMETER IN mm (D1)

INSERTION LENGTH IN mm (U)

SPECIAL REQUIREMENT

U-Ultrasonic Test
X1-X Ray for Bore Concentricity
X2-X Ray for weld joints
FP-Full penetration weld
D-Dye Penetration Test
I- IBR
W-PWHT
H-H2 Service
N-NACE to MR- 01-75
R-RF portion in material same as thermowell
C1-Companion flange in CS to A105
C2-Companion flange in same material as that of thermowell flange
F-Studs / Nuts & Gasket
Z1-Nozzle / Stub in CS to A106 or A105
Z2-Nozzle / Stub in same material as that of flange
ST-1 mm Ti sleeve
SN-1 mm Ni sleeve
SH-1 mm HaC sleeve
Sta -0.4 mm Ta sleeve
QP-1 mm PTFE coating
QZ-1 mm zirconium oxide coating
Qt05 - 0.5 mm Tungsten carbide coating
Qt10- 1 mm Tungsten carbide coating
QS-1 mm stellite coating
EN - Extension Nipple specify length x size, material
eg. 100mm, 1/2" NPT(M) x M20x1.5(F), Cd plated CS.

Tip thickness in mm (t)

EXTENSION LENGTH IN mm (T)

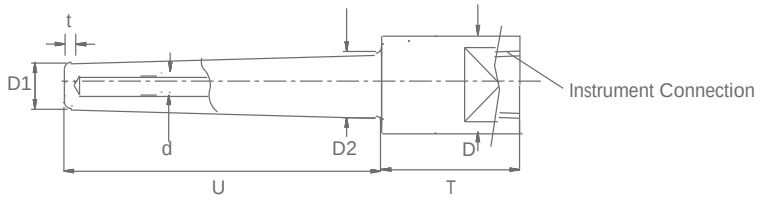
*Exotic material if required as forged, please mention F in the bracket after mentioning the code e.g. M (F) or SH (F) etc.

Note: 1. Wherever coating / lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2 mm)
2. Wherever sleeve is required, thermowell shall be straight & not tapered.

Typical Model No.: TW-BT-S6-28-15 NT F-20 NT M-7-21-16-200-50-4-0

TW-BT	S6	28	15 NT F	20 NT M	7	21	16	200	50	4	0
Construction Type	Well Material	Dia of Bar-stock (mm) (D)	Instrument Connection	Process Connection	Bore ID (mm) (d)	Cold end Diameter (mm) (D2)	Hot end Diammeter (D1)	Insertion Length (mm) (U)	Extension Length (mm) (T)	Tip Thickness (mm) (t)	Special requirement

Bar Stock Weld In Thermowell
How to Order



TYPE : TW-BW

WELL MATERIAL*

S4-SS304	I825- Incoloy® 825
S6-SS316	I6-Inconel® 600
S3-SS310	I8-Incoloy® 800
SH-SS446	S2-SS321
4L-SS304L	K-Kanthal
6L-SS316L	HC-Hastelloy® C-276
C-CS to A105	HB-Hastelloy® B
S1-SS410	M-Monel® 400
S7-SS317	T-Ti-II
7L-SS317L	N-Nickel 200

DIA OF BARSTOCK In mm (D)

INSTRUMENT / PROCESS CONNECTION

Size	Type	Male / Female
6-1/4"	NT - NPT	M - Male
10- 3/8"	BP - BSP	F - Female
15-1/2"	BT - BSPT	
20-3/4"	PF - PF	
25-1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		
Metric Threads		
18 M - M 18 x 1.5		
20 M - M 20 x 1.5		
24 M - M 24 x 1.5		
27 M - M 27 x 2		
33 M - M 33 x 2		
X X - Any other		

Weld in diameter in mm

BORE in mm (d)

SPECIAL REQUIREMENT

U-Ultrasonic Test
X1-X Ray for Bore Concentricity
X2-X Ray for weld joints
FP-Full penetration weld
D-Dye Penetration Test
I- IBR
W-PWHT
H-H2 Service
N-NACE to MR- 01-75
R-RF portion in material same as thermowell
C1-Companion flange in CS to A105
C2-Companion flange in same material as that of thermowell flange
F-Studs / Nuts & Gasket
Z1-Nozzle / Stub in CS to A106 or A105
Z2-Nozzle / Stub in same material as that of flange
ST-1 mm Ti sleeve
SN-1 mm Ni sleeve
SH-1 mm HaC sleeve
Sta -0.4 mm Ta sleeve
QP-1 mm PTFE coating
QZ-1 mm zirconium oxide coating
Qt05 - 0.5 mm Tungsten carbide coating
Qt10- 1 mm Tungsten carbide coating
QS-1 mm stellite coating

(t) Tip thickness in mm (t)

(T) Extension length in mm (T)

(U) Insertion length in mm

HOT END DIAMETER IN mm (D1)

COLD END DIAMETER IN mm (D2)

*Exotic material if required as forged, please mention F in the bracket after mentioning the code e.g. M (F) or SH (F) etc.

Note: 1. Wherever coating / lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2 mm)

2. Wherever sleeve is required, thermowell shall be straight & not tapered.

Typical Model No.: TW-BW-S4-30-20 NT F-7-22-18-100-50-4-I

TW-BW	S4	30	20 NT F	7	22	18	100	50	4	I
Construction Type	Well Material	Dia of Bar-stock (mm) (D)	Instrument Connection	Bore ID (mm) (d)	Cold end Diameter (mm) (D2)	Hot end Diameter (D1)	Insertion Length (mm) (U)	Extension Length (mm) (T)	Tip Thickness (mm) (t)	Special requirement

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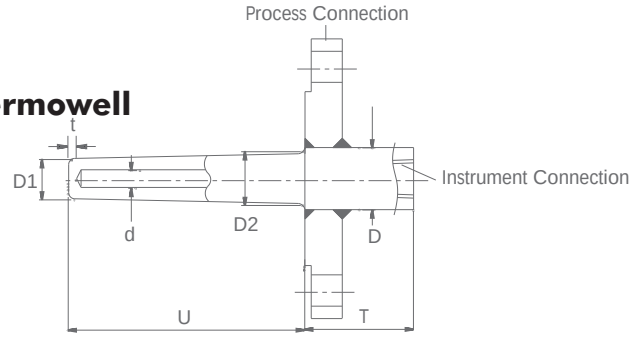
Bar Stock Flanged Thermowell
How to Order



TYPE : TW-BF

WELL MATERIAL*	
S4-SS304	I825- Incoloy® 825
S6-SS316	I6-Inconel® 600
S3-SS310	I8-Incoloy® 800
SH-SS446	S2-SS321
4L-SS304L	K-Kanthal
6L-SS316L	HC-Hastelloy® C-276
C-CS to A105	HB-Hastelloy® B
S1-SS410	M-Monel® 400
S7-SS317	T-Ti-II
7L-SS317L	N-Nickel 200

Dia of Bar Stock in mm

INSTRUMENT / PROCESS CONNECTION

Size	Type	Male / Female
6-1/4"	NT - NPT	M - Male
10- 3/8"	BP - BSP	F - Female
15-1/2"	BT - BSPT	
20-3/4"	PF - PF	
25-1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		

Metric Threads
18 M - M 18 x 1.5
20 M - M 20 x 1.5
24 M - M 24 x 1.5
27 M - M 27 x 2
33 M - M 33 x 2
X X - Any other

INSTRUMENT / PROCESS CONNECTION

Size	Code	Rating	Code	Facing	Code
½"	15	150#	A	RF	RF
¾"	20	300#	B	FF	FF
1"	25	600#	C	RTJ	RTJ
1½"	40	900#	D	LT	LT
2"	50	1500#	E	LG	LG
3"	80	2500	F		

SPECIAL REQUIREMENT
U-Ultrasonic Test
X1-X Ray for Bore Concentricity
X2-X Ray for weld joints
FP-Full penetration weld
D-Dye Penetration Test
I- IBR
W-PWHT
H-H2 Service
N-NACE to MR- 01-75
R-RF portion in material same as thermowell
B-Tail portion in bar stock**
C1-Companion flange in CS to A105
C2-Companion flange in same material as that of thermowell flange
F-Studs / Nuts & Gasket
Z1-Nozzle / Stub in CS to A106 or A105
Z2-Nozzle / Stub in same material as that of flange
ST-1 mm Ti sleeve
SN-1 mm Ni sleeve
SH-1 mm HaC sleeve
Sta -0.4 mm Ta sleeve
QP-1 mm PTFE coating
QZ-1 mm zirconium oxide coating
Qt05-0.5 mm Tungsten carbide coating
Qt10-1 mm Tungsten carbide coating
QS-1 mm stellite coating
TP150-Tapered for tail portion of 150mm

(t) Tip thickness in mm

(T) Extension length in mm

(U) Insertion length in mm

Hot end diameter in mm (D1)

Cold end diameter in mm (D2)

Bore in mm

*****Flange Material**

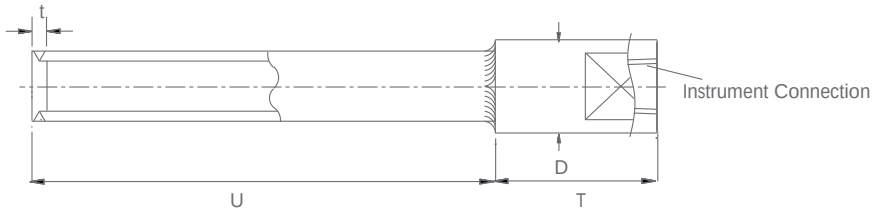
*Exotic material if required as forged, please mention F in the bracket after mentioning the code e.g. M (F) or SH (F) etc. ***For flange material refer the same code as that of well material.
If the flange is with 'HUB' specify the same in the bracket e.g. 20 BRF (HUB).

Note: 1. Wherever coating / lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2 mm) 2. Wherever sleeve is required, thermowell shall be straight & not tapered.

Typical Model No.: TW-BF-S6-30-15 NT F-25 A RF-S6-7-21-16-200-50-4-N

TW-BF	S6	30	15 NT F	25 A RF	S6	7	21	16	200	50	4	N
Construction Type	Well Material	Dia of Bar-stock (mm) (D)	Instrument Connection	Process Connection	Flange Material	Bore ID (mm) (d)	Cold end Diameter (mm) (D2)	Hot end Diameter (D1)	Insertion Length (mm) (U)	Extension Length (mm) (T)	Tip Thickness (mm) (t)	Special requirement

Fabricated Weld In Thermowell
How to Order



TYPE : TW-FW

WELL MATERIAL*

S4-SS304	I825- Incoloy® 825
S6-SS316	I6-Inconel® 600
S3-SS310	I8-Incoloy® 800
SH-SS446	S2-SS321
4L-SS304L	K-Kanthal
6L-SS316L	HC-Hastelloy® C-276
C-CS to A105	HB-Hastelloy® B
S1-SS410	M-Monel® 400
S7-SS317	T-Ti-II
7L-SS317L	N-Nickel 200

Pipe size & schedule

½" Sch 40	- 15A
½" Sch 80	- 15B
½" Sch 160	- 15C
¾" Sch 40	- 20A
¾" Sch 80	- 20B
10x7	- 10x7
14x9	- 14x9

INSTRUMENT / PROCESS CONNECTION

Size	Type	Male / Female
6-1/4"	NT - NPT	M - Male
10- 3/8"	BP - BSP	F - Female
15-1/2"	BT - BSPT	
20-3/4"	PF - PF	
25-1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		

Metric Threads

18 M - M 18 x 1.5
20 M - M 20 x 1.5
24 M - M 24 x 1.5
27 M - M 27 x 2
33 M - M 33 x 2
X X - Any other

SPECIAL REQUIREMENT

U-Ultrasonic Test
X1-X Ray for Bore Concentricity
X2-X Ray for weld joints
FP-Full penetration weld
D-Dye Penetration Test
I- IBR
W-PWHT
H-H2 Service
N-NACE to MR- 01-75
R-RF portion in material same as thermowell
B-Tail portion in bar stock**
C1-Companion flange in CS to A105
C2-Companion flange in same material as that of thermowell flange
F-Studs / Nuts & Gasket
Z1-Nozzle / Stub in CS to A106 or A105
Z2-Nozzle / Stub in same material as that of flange
ST-1 mm Ti sleeve
SN-1 mm Ni sleeve
SH-1 mm HaC sleeve
Sta -0.4 mm Ta sleeve
QP-1 mm PTFE coating
QZ-1 mm zirconium oxide coating
Qt05 - 0.5 mm Tungsten carbide coating
Qt10- 1 mm Tungsten carbide coating
QS-1 mm stellite coating

(t) Tip thickness in mm

(T) Extension length in mm

Weld in diameter in mm

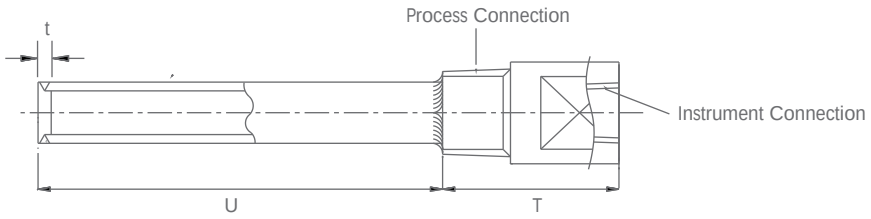
(U) Insertion length in mm

Note:
1. Wherever coating / lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2 mm)
2. ** Tail portion of 100 mm / 150 mm in bar stock to be mentioned as 100 B or 150 B etc.

Typical Model No.: TW-FW-S3-15A-10 NT F-28-150-50-4-0

TW-FW	S3	15A	10 NT F	28	150	50	4	0
Construction Type	Well Material	Pipe size & schedule	Instrument Connection	Dia of Bar-stock (mm) (D)	Insertion Length (mm) (U)	Extension Length (mm) (T)	Tip Thickness (mm) (t)	Special requirement

Fabricated Threaded Thermowell
How to Order



TYPE : TW-FT

WELL MATERIAL*

S4-SS304	I825- Incoloy® 825
S6-SS316	I6-Inconel® 600
S3-SS310	I8-Incoloy® 800
SH-SS446	S2-SS321
4L-SS304L	K-Kanthal
6L-SS316L	HC-Hastelloy® C-276
C-CS to A105	HB-Hastelloy® B
S1-SS410	M-Monel® 400
S7-SS317	T-Ti-II
7L-SS317L	N-Nickel 200

Pipe size & schedule

½" Sch 40	- 15A
½" Sch 80	- 15B
½" Sch 160	- 15C
¾" Sch 40	- 20A
¾" Sch 80	- 20B
10x7	- 10x7
14x9	- 14x9

INSTRUMENT / PROCESS CONNECTION

Size	Type	Male / Female
6-1/4"	NT - NPT	M - Male
10- 3/8"	BP - BSP	F - Female
15-1/2"	BT - BSPT	
20-3/4"	PF - PF	
25-1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		

Metric Threads

18 M - M 18 x 1.5
20 M - M 20 x 1.5
24 M - M 24 x 1.5
27 M - M 27 x 2
33 M - M 33 x 2
X X - Any other

(U) Insertion length in mm

SPECIAL REQUIREMENT

U-Ultrasonic Test
X1-X Ray for Bore Concentricity
X2-X Ray for weld joints
FP-Full penetration weld
D-Dye Penetration Test
I- IBR
W-PWHT
H-H2 Service
N-NACE to MR- 01-75
R-RF portion in material same as thermowell
B-Tail portion in bar stock**
C1-Companion flange in CS to A105
C2-Companion flange in same material as that of thermowell flange
F-Studs / Nuts & Gasket
Z1-Nozzle / Stub in CS to A106 or A105
Z2-Nozzle / Stub in same material as that of flange
ST-1 mm Ti sleeve
SN-1 mm Ni sleeve
SH-1 mm HaC sleeve
Sta -0.4 mm Ta sleeve
QP-1 mm PTFE coating
QZ-1 mm zirconium oxide coating
Qt05 - 0.5 mm Tungsten carbide coating
Qt10- 1 mm Tungsten carbide coating
QS-1 mm stellite coating

(t) Tip thickness in mm

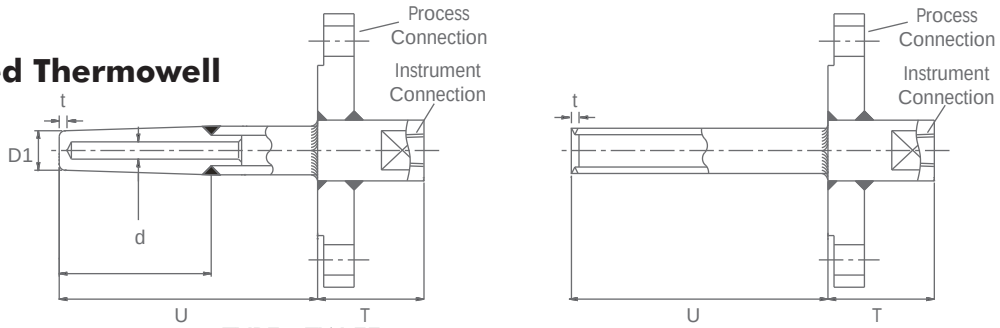
(T) Extension length in mm

Note: 1. Wherever coating / lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2 mm)
2. ** Tail portion of 100 mm / 150 mm in bar stock to be mentioned as 100 B or 150 B etc.

Typical Model No.: TW-FT-S6-15B-15 NT F-20 BP M-125-50-4-QP(1mm)

TW-FT	S6	15B	15 NT F	20 BP M	125	50	4	QP (1mm)
Construction Type	Well Material	Pipe size & schedule	Instrument Connection	Process Connection	Insertion Length (mm) (U)	Extension Length (mm) (T)	Tip Thickness (mm) (t)	Special requirement

Fabricated Flanged Thermowell
How to Order



TYPE : TW-FF

WELL MATERIAL*

S4-SS304	I825- Incoloy® 825
S6-SS316	I6-Inconel® 600
S3-SS310	I8-Incoloy® 800
SH-SS446	S2-SS321
4L-SS304L	K-Kanthal
6L-SS316L	HC-Hastelloy® C-276
C-CS to A105	HB-Hastelloy® B
S1-SS410	M-Monel® 400
S7-SS317	T-Ti-II
7L-SS317L	N-Nickel 200

Pipe size & schedule

½" Sch 40	- 15A
½" Sch 80	- 15B
½" Sch 160	- 15C
¾" Sch 40	- 20A
¾" Sch 80	- 20B
10x7	- 10x7
14x9	- 14x9

INSTRUMENT / PROCESS CONNECTION

Size	Type	Male / Female
6-1/4"	NT - NPT	M - Male
10- 3/8"	BP - BSP	F - Female
15-1/2"	BT - BSPT	
20-3/4"	PF - PF	
25-1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		

Metric Threads

18 M - M 18 x 1.5
20 M - M 20 x 1.5
24 M - M 24 x 1.5
27 M - M 27 x 2
33 M - M 33 x 2
X X - Any other

SPECIAL REQUIREMENT

U-Ultrasonic Test
X1-X Ray for Bore Concentricity
X2-X Ray for weld joints
FP-Full penetration weld
D-Dye Penetration Test
I- IBR
W-PWHT
H-H2 Service
N-NACE to MR- 01-75
R-RF portion in material same as thermowell
B-Tail portion in bar stock**
C1-Companion flange in CS to A105
C2-Companion flange in same material as that of thermowell flange
F-Studs / Nuts & Gasket
Z1-Nozzle / Stub in CS to A106 or A105
Z2-Nozzle / Stub in same material as that of flange
ST-1 mm Ti sleeve
SN-1 mm Ni sleeve
SH-1 mm HaC sleeve
Sta -0.4 mm Ta sleeve
QP-1 mm PTFE coating
QZ-1 mm zirconium oxide coating
Qt05 - 0.5 mm Tungsten carbide coating
Qt10- 1 mm Tungsten carbide coating
QS-1 mm stellite coating

(t) Tip thickness in mm

(T) Extension length in mm

(U) Insertion length in mm

***** Flange Material**

PROCESS CONNECTION

Size	Code	Rating	Code	Facing	Code
½"	15	150#	A	RF	RF
¾"	20	300#	B	FF	FF
1"	25	600#	C	RTJ	RTJ
1½"	40	900#	D	LT	LT
2"	50	1500#	E	LG	LG
3"	80	2500	F		

***For flange material refer the same code as that of well material. If the flange is with 'HUB' specify the same in the bracket e.g. 20 BRF (HUB).

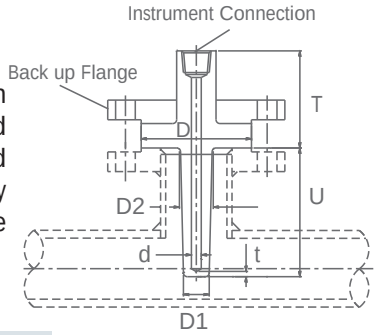
Note: 1. Wherever coating/lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2 mm).
2. Wherever sleeve is required, thermowell shall be straight & not tapered.
3. ** Tail portion of 100 mm / 150 mm in bar stock to be mentioned as 100 B or 150 B etc.

Typical Model No.: TW-FF-S6-15A-15 NT F-40 C RTJ-S6-175-70-3-N

TW-FF	S6	15A	15 NT F	40 C RTJ	S6	175	70	3	N
Construction Type	Well Material	Pipe size & schedule	Instrument Connection	Process Connection	Flange Material	Insertion Length (mm) (U)	Extension Length (mm) (T)	Tip Thickness (mm) (t)	Special requirement

PRISMA Instruments & Gauge Bourdon France

Van Stone Type Thermowell



For high pressure applications and where welding is to be avoided, Van Stone design thermowells are used. These are machined from a single barstock, sandwiched between the nozzle flange and cover (companion) flange. The OD of the machined portion corresponding the raised face portion of the flange. Wake frequency calculations (in accordance with PTC 19.3) are performed where ever data is made available and are essential in order to suggest appropriate dimensions of thermowell.

How to Order

TYPE : TW-V

WELL MATERIAL*

S4-SS304	I825- Incoloy® 825
S6-SS316	I6-Inconel® 600
S3-SS310	I8-Incoloy® 800
SH-SS446	S2-SS321
4L-SS304L	K-Kanthal
6L-SS316L	HC-Hastelloy® C-276
C-CS to A105	HB-Hastelloy® B
S1-SS410	M-Monel® 400
S7-SS317	T-Ti-II
7L-SS317L	N-Nickel 200

(D) Dia of barstock portion to be sandwitched in mm

INSTRUMENT CONNECTION

Size	Type	Male / Female
6-1/4"	NT - NPT	M - Male
10- 3/8"	BP - BSP	F - Female
15-1/2"	BT - BSPT	
20-3/4"	PF - PF	
25-1"	GS - Gas	
32 - 1.1/4"	NS - NPSM	
40 - 1.1/2"		

Metric Threads

18 M - M 18 x 1.5
20 M - M 20 x 1.5
24 M - M 24 x 1.5
27 M - M 27 x 2
33 M - M 33 x 2
X X - Any other

Back-up flange size, rating & facing

Size	Code	Rating	Code	Facing	Code
½"	15	150#	A	RF	RF
¾"	20	300#	B	FF	FF
1"	25	600#	C	RTJ	RTJ
1½"	40	900#	D	LT	LT
2"	50	1500#	E	LG	LG
3"	80	2500	F		

SPECIAL REQUIREMENT

U-Ultrasonic Test
X1-X Ray for Bore Concentricity
X2-X Ray for weld joints
FP-Full penetration weld
D-Dye Penetration Test
I- IBR
W-PWHT
H-H2 Service
N-NACE to MR- 01-75
R-RF portion in material same as thermowell
B-Tail portion in bar stock**
C1-Companion flange in CS to A105
C2-Companion flange in same material as that of thermowell flange
F-Studs / Nuts & Gasket
Z1-Nozzle / Stub in CS to A106 or A105
Z2-Nozzle / Stub in same material as that of flange
ST-1 mm Ti sleeve
SN-1 mm Ni sleeve
SH-1 mm HaC sleeve
Sta -0.4 mm Ta sleeve
QP-1 mm PTFE coating
QZ-1 mm zirconium oxide coating
Qt05 - 0.5 mm Tungsten carbide coating
Qt10- 1 mm Tungsten carbide coating
QS-1 mm stellite coating

(t) Tip thickness in mm

(T) Extension length in mm

(U) Insertion length in mm

(D1) HOT END DIAMETER IN mm

(D2) COLD END DIAMETER IN mm

(d) BORE in mm

***Back-up Flange Material**

Note: 1. Wherever coating / lining (sleeve) thickness varies than what is specified, specify the required thickness in the bracket e.g. QP (2 mm)
2. ** Tail portion of 100 mm / 150 mm in bar stock to be mentioned as 100 B or 150 B etc.

Typical Model No.: TW-V-S6-73-15 NT F-40 A RF-S6-7-30-16-150-75-6-0

TW-V	S6	73	15 NT F	40 A RF	S6	7	30	16	150	75	6	0
Construction Type	Well Material	Dia of Bar-stock (mm) (D)	Instrument Connection	Back-up Flange, Size & Rating	Back-up Flange Material	Bore ID (mm) (d)	Cold end Diameter (mm) (D2)	Hot end Diameter (D1)	Insertion Length (mm) (U)	Extension Length (mm) (T)	Tip Thickness (mm) (t)	Special requirement

Welding Operation

Thermowells are often with welded design. Welding is the most critical operation as improper welding can cause failure of welding in process in form of corrosion & crack. This is particularly serious when thermowell is being used for critical application such as Hydrogen, H2S or explosive media.

We have approved welder specification for several combinations of material. The applicable standard is ASME SEC IX. We maintain complete record of all the welding procedure specification (WPS) and procedures qualification record (PQR).

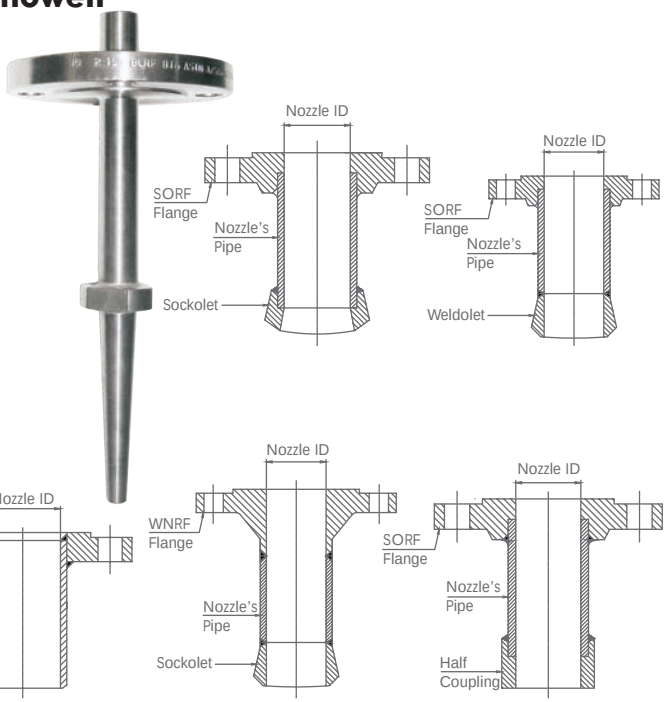
WPS NO.	PQR No.	Material – I		Material – II	
		Specification	P No.	Specification	P No.
WPS029	PQR029	SS446	P7	SS446	P7
WPS1001	PQR1001	SS316L	P8	SS316L	P8
WPS028	PQR028	F44	P8	F44	P8
WPS027	PQR027	P91	5B Gr.2	P91	5B Gr.2
WPS009	PQR009	Monel®	P42	Monel®	P42
WPS019	PQR019	A106	P1	A106	P1
WPS008	PQR008	SS316L	P8	A105	P1
WPS4012	PQR4012	A105	P1	Monel® Cladding	P42
WPS006	PQR006	SS316L	P8	F-11	P4
WPS007	PQR007	F-11	P4	F-11	P4
WPS1013	PQR1013	F-11	P4	SS321 Cladding	P8
WPS023	PQR023	LF2	P1	LF2	P1
WPS018	PQR018	A105	P1	A105	P1
WPS041	PQR041	Hastelloy®	P44	Hastelloy®	P44
WPS042	PQR042	Duplex SS	P10H	Duplex SS	P10H
WPS043	PQR043	Inconel® 600	P43	Inconel® 600	P43

Nozzle suitable for Collar Design Thermowell

Customers many times face lot of problems in installing collar design thermowells at site due to the following reasons:

a) Nozzle ID is inconsistant.
b) Some weld material penetrates inside Nozzle blocking entry of collar.

To solve these problems we supply collar design thermowells along with the matching nozzle. Client only has to weld the weldolet at site.



Special Thermowells

One of the most difficult problems in temperature measurement of process parameters has been the rapid wearing out of Thermowells made out of conventional stainless steel. Various factors could casue the failure of the thermowells, the most difficult, have been the erosion due to severe particle impigement. The corrosion due to chemically agressive fluids; the combination of high temperature, high velocity fluids & the thermal shock faced by the sensor protective sheaths in the glass & metallurgical industries.

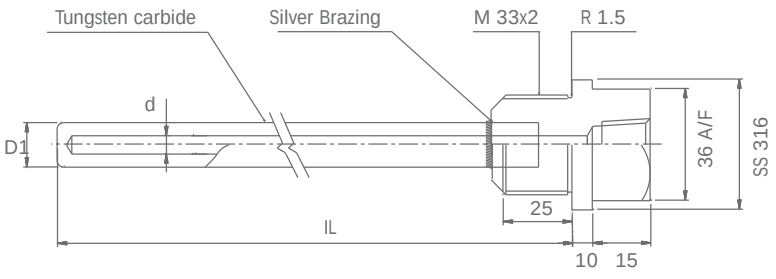
With an experience of over three decades, General is in a position to offer some solutions to most of these problems. Some of the standard designs are described and illustrated in this literature.

Solid Sintered Tungsten Carbide Thermowell

These thermowells are ideally suited for use in very abrasive environment such as in air preheaters & coal mills of coal based power plants (mill classifier or pulveriser outlet) or steam generation units, for temperature measurement of coal and air mixture.

Typical Specifications

Type	:	Built-up threaded
Material	:	Solid Sintered Tungsten Carbide brazed to 316 SS threaded bushing.
Process connection	:	M33 x 2 or as required
Bore	:	7 mm, 10.5 mm
Outer diameter	:	16 mm, 20 mm as standard or else to be specified
Immersion length	:	IL - 160, 200, 250, 320, 400
Extension length	:	EL - 100, 160 in the form of ½" schedule 80 nipple generally
Note	:	When the length are longer, it is recommended to use tungsten carbide only for the tail portion of say 200 to 250 mm.



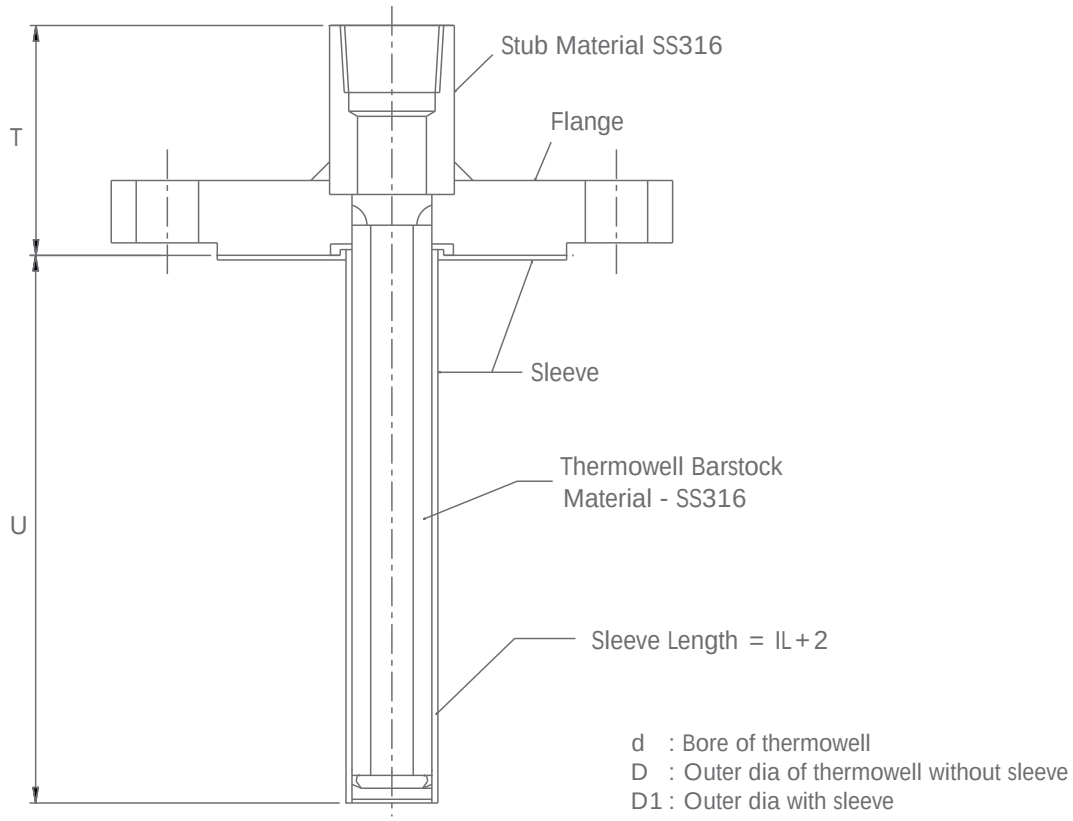
Sensor & Bulb dia (mm)	d	D1	IL
MI TC 6 mm dia	6.5	16	160, 200, 250, 320, 350
MI RTD 6 mm dia	6.5	16	160, 200, 250, 320, 350
Temp Gauge or Switch 10 mm dia	10.5	20	160, 200, 250, 320, 350

Lined (Sleeved) Thermowell

One of the most economical solutions to protect the thermowells from chemically agressive fluids is to provide a bar-stock flanged thermowell made out of conventional stainless steel with loose lining in the form of a sleeve on the entire wetted portion. This will provide strength from stainless steel & corrosion resistance from the lining.

Specifications

Type	:	Bar-stock flanged
Well Material	:	SS316
Lining Material	:	Hastelloy® C, Nickel, Titanium, Tantalum, Silver
Lining thickness	:	0.4 mm for Tantalum & Silver, 1 to 1.5 mm for other materials as standard. Other thicknesses can be provided on request.
Process Connection	:	Flanged 1" (DN25) to 3" (DN80) as per ANSI or DIN as standard. Other on request.
Insertion length	:	To be specified.
Note	:	Sometimes even the conventional stainless steel flanged thermowells can be provided with carbon steel flange corresponding to ASTMA105, with a lining of 3 mm thick stainless steel plate on the RF portion of the flange. This construction offers a very economical solution without having to surrender corrosion resistant characteristics of stainless steels for wetted parts.



Basic Well	Lining	d	D	D1	Insertion Length (U)
316 SS	Haselloy® 'C' Ni, Ti	6.25	13.8	16	200, 250, 300, 400, 500
316 SS	Tantalum, Silver	6.25	14.1	15	200, 250, 300, 400, 500

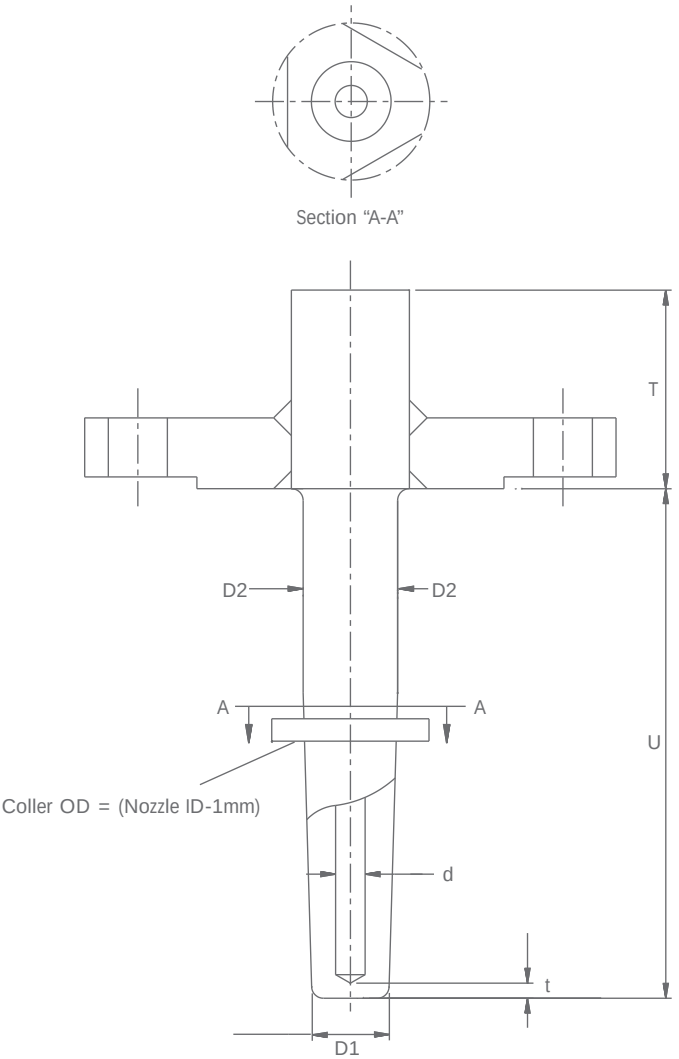
Thermowells for use in high temperature applications

For use in Chemical Plants for installing on Flue Gas areas of Boilers, Furnaces, Kilns, Heat Recovery Units, Incinerators, Reformers & Gasifiers, Material of Construction is recommended based on the working Temperature, Pressure & Other process parameters. The general guide line for selection of materials for Protecting tubes can be regarded as given in the table below.

Working Temperature	Material of Construction
Upto 800^{0}C	Conventional Stainless Steels 321 SS, 316 SS
800^{0}C to 1100^{0}C	Heat resistant Stainless Steels, 310 SS, 446 SS & high alloy steels such as Incoloy® 800 & Inconel® 600
1100^{0}C to 1500^{0}C	Ceramic Material grade 610 & 710

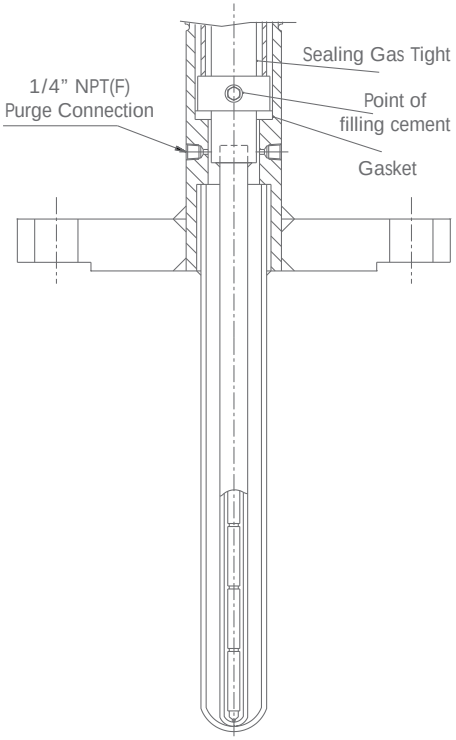
The length, diameter & the thickness will depend on the process parameters. However, as a general guide line we would recommend a minimum thickness of 3.5 mm for metalic tubes.

The wake frequency calculations can be performed in accordance with PTC 19.3, in order to ascertain exact insertion length and outer dimension like OD to save it from breakage due to high velocity service.



Thermowells for use in high temperature applications

For high temperature appications, generally, Ceramic protecting tubes are used in different industries such as Iron & Steel, glass, cement etc. It has high resistance to thermal shocks. It is inert to most chemicals and has a high dielectric strength. These are primariliy used to protect noble metal thermocouples (like R, S & B type) They are available in variety of sizes. Normally it is cemented (by high temperature withstanding cement) to metal tubes (which are termed as holding tubes) The process connection slides or is welded to this metallic portion of the tube. For double protection, inner ceramic tube is also used. Mainly two grades of ceramic are used. Ceramic 610 (also termed as Mullite) & Ceramic 710 (recrystallised Alumina-99.5% purity) can withstand up to 1500^{0}C & 1800^{0}C respectively. It should be remembered that it has poor mechanical shock resistance. It is impervious to gases at high temperatures.



Silicon Carbide protecting tubes are also used generally as a secondary protection for applications such as Kilns, Furnaces, Stove Dome etc. Recrystallised silicon carbide has a very high abrasion resistance. Also used for flue gas application or incinerators in waste management system. It can withstand 1600^{0}C & direct flame impingement. It is extremely hard & chemically inert. It resists most of the acids, molten salts. Generally used in conjunction with ceramic tube.

Cermet (LT-1) which is metal ceramic composite (combination of chromium & aluminium oxide) is stable in oxidising atomospheres upto 1300^{0}C. Cermet tubes are stronger & more resistant to thermal & mechanical shocks than ceramic protecting tubes. Main area of usage is in molten copper, open hearth furnace, blast furnace. Ceramic primary tube is recommended when Cermet is used.

Thermowell material selection guide

APPLICATION		MATERIAL
IRON AND STEEL	Blast furnaces	
	Stove dome	Silicon Carbide
	Hot blast main	Inconel® 600
	Open Hearth	
	Flues and Stack	Inconel® 600, SS 446
	Waste heat Boiler	Inconel® 600, SS 446
CEMENT	Exit Flue Gas	Inconel® 600, SS 446
	Kilns, Heating Zone	Inconel® 600
CERAMIC	Kilns	Ceramic and silicon carbide
	Dryers	Silicon carbide
POWER	Coal-air mixtures	Solid sintered tungsten carbide
	Flue Gas	SS 446
	Preheater	SS 446
	Boiler Tube	SS 304, SS 316, SS 310
INCINERATOR	Up to 1050°C	Inconel® 600, SS 446
	Over 1050°C	Ceramic 610/710 (Primary), Silicon Carbide (Secondary)
CHEMICAL	Acetic Acid	
	10 to 50% 20°C	SS 304, Hastelloy® C, Monel® 400
	50 % 100°C	SS 316, Hastelloy® C, Monel® 400
	99% 21 to 100°C	Hastelloy® C, Monel®
	Alcohol, Ethyl, Methyl	
	20 to 100°C	SS 304
	Ammonia	
	All concentrations 20°C	SS 304, SS 316
	Ammonium Chloride	
	All Concentration 100°C	SS 316, Monel®
	Brine	Monel® 400
	Bromine	Tantalum, Monel® 400
	Butyl Acetate	Monel® 400
	Calcium Hydroxide	SS 304
	Upto 50% 100°C	SS 304, Hastelloy® C
	Chlorine Gas	
	Moist - 7 to 100°C	Hastelloy® C, Tantalum
	Chromic Acid 10 to 50% 100°C	SS 316, Hastelloy® C (all concentrations)
	Ethyl Acetate	SS 304, Monel® 400
	Ethyl Chloride 20°C	SS 304, low carbon steel
	Ethyl Sulphate 20°C	Monel® 400
	Ferric Chloride 5% 20°C to boiling	Tantalum, Hastelloy® C
	Formaldehyde	SS 304, SS 316
	Formic Acid 5% 20 to 66°C	SS 316
	Hydrochloric Acid	
	Upto 5% 20°C	Hastelloy® C
	Upto 25% 100°C	Hastelloy® B
	Hydrofluoric Acid 60% 100°C	Hastelloy® C, Monel®
	Hydrogen peroxide	SS 304, SS 316
	Hydrogen Sulphide wet and dry	SS 316
	Phosphoric Acid	
	Upto 10% 20°C	SS 316
	10% 100°C	Hastelloy® C
	30% to 85% 100°C	Hastelloy® B
	Sodium Hydroxide	Nickel 200
	Sulphuric Acid Upto 90% 20°C	Hastelloy® B

In-House Testing facilities for Thermowells

1. Dimensional : As per approved drawing & data sheet.
2. Hydro Test : For barstock threaded 100 Kg/cm^2 (internal as standard) and more as per customer requirement.
   : External if applicable
   : Flanged Thermowells - Internal / external - 1.5 times the operating pressure
   : Internal - 100 kg/cm^2 for ratings below 600# & 200 kg/cm^2 above 600# rating
   : External - In accordance with flange rating.
3. Bore Concentricity : By using "D" meter (Ultrasonic thickness tester) - Wall thickness measurement - Sample 5% at two different points & each at 180^0 angle to each other.
   : Radiography test by external lab (X-Ray) for immersion length portion (optional)
4. Dye Penetration Test : For weld joints of thermowell / protecting tube
5. Threading Check : Process thread & instrument thread - Check by thread gauge.
6. PMI Test

Optional Tests

1. Hardness Test
2. PWHT - Post weld heat treatment
3. Intra Granular Corrosion Test
4. Corrosion test as per A293 Method C
5. Ferrite No. Test
6. Impact test
7. Radiography for bore concentricity & weld joint as applicable
8. Physical, Chemical & Micro Analysis as applicable
9. PMI test (Positive Material Identification)
10. IBR Test

Ultrasonic Cleaning Process