WIKA

Part of your business

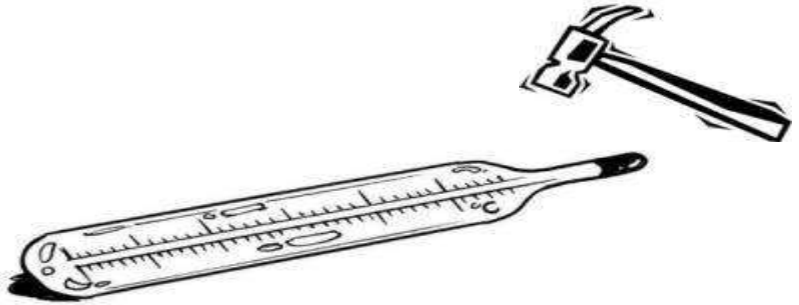
THERMOWELL BASIC TRAINING

PURPOSE OF TRAINING

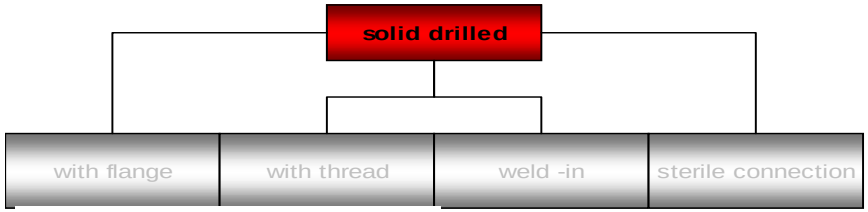
- WHY
- CONSTRUCTION
- TESTING
- INSTALLATION HOW
- INSTALATION CONSEQUENCES
- OVERVIEW OF POSSIBLE MODELS

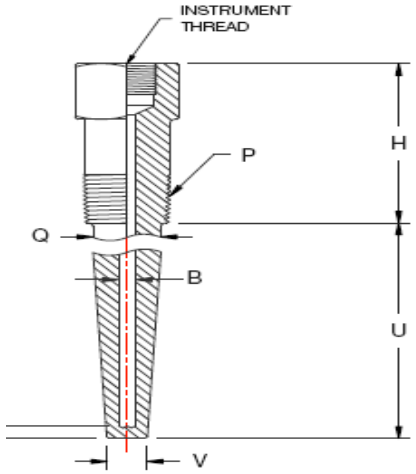
Why to use thermowells?

- Protection of the temperature sensor
- Protection of the workers and the environment
- Ability to replace the sensor during running process



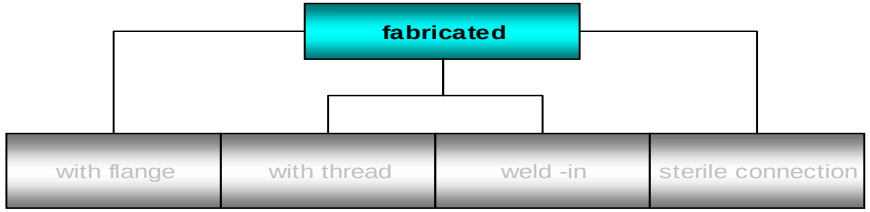
Construction of Thermowells

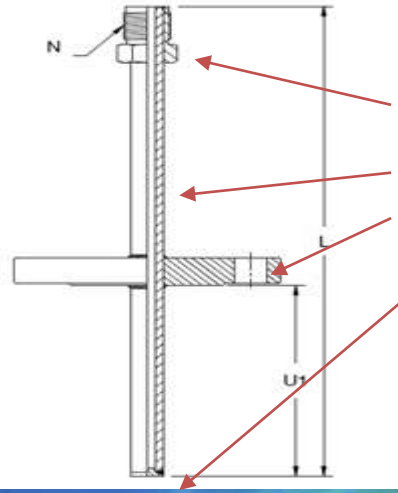




characteristics

- **made of bar material (round or hexagon bar**
- **without welding connection at the thermowell body**

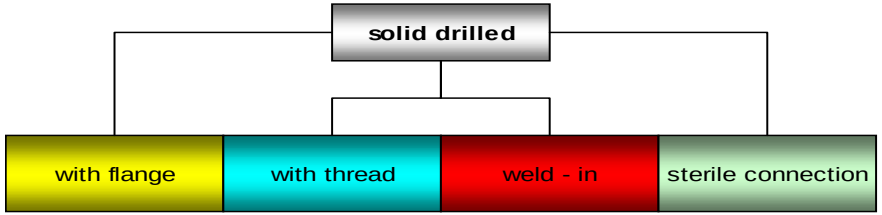


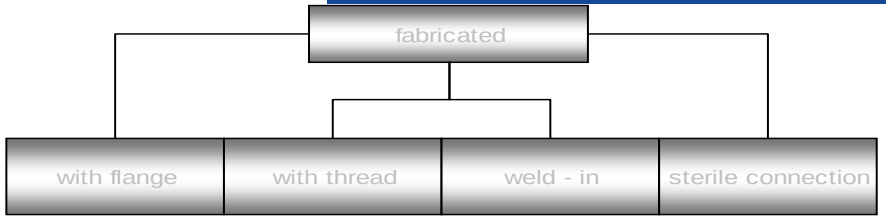


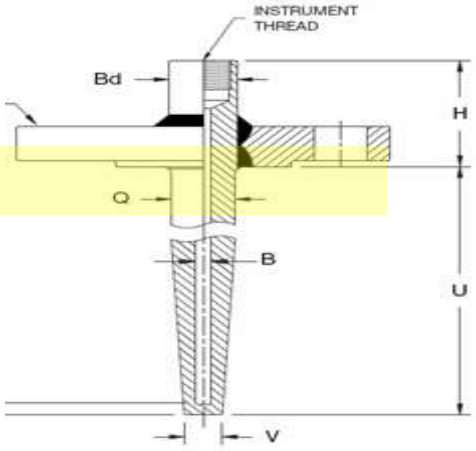
characteristics:

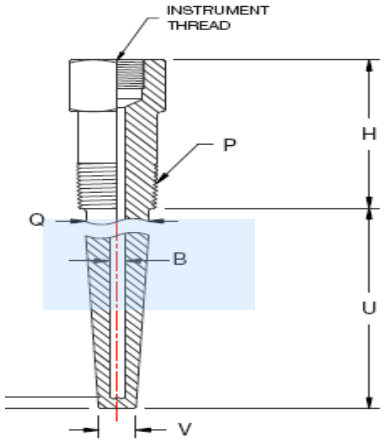
- **separate thermometer connection**
- **made of tube or pipe**
- **separate process connection**
- **closed with welded end cap**

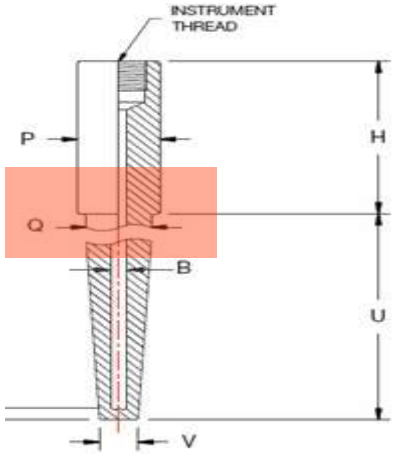
Process Connections

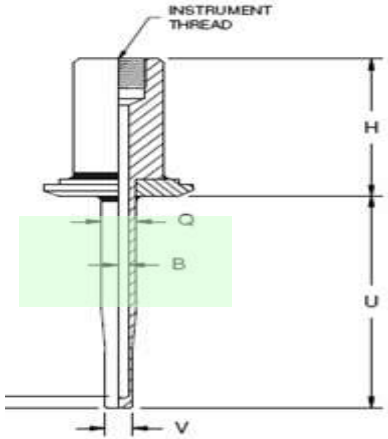




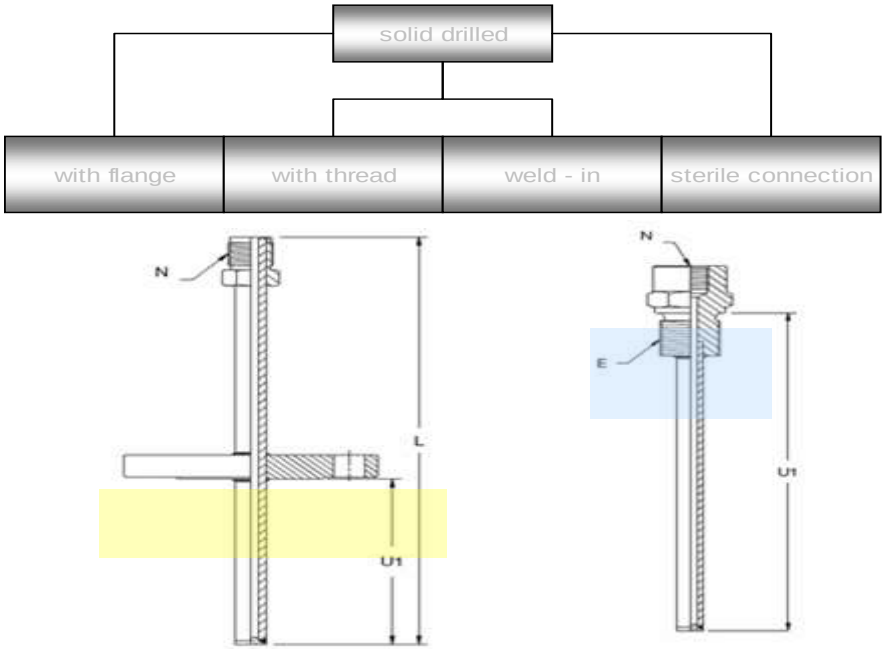


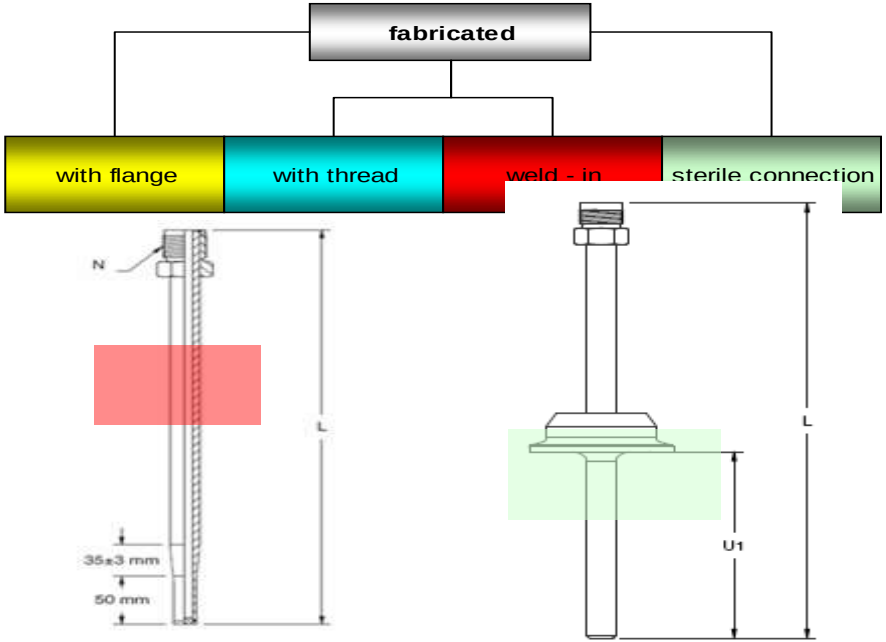






Process Connections





Construction of Thermowells

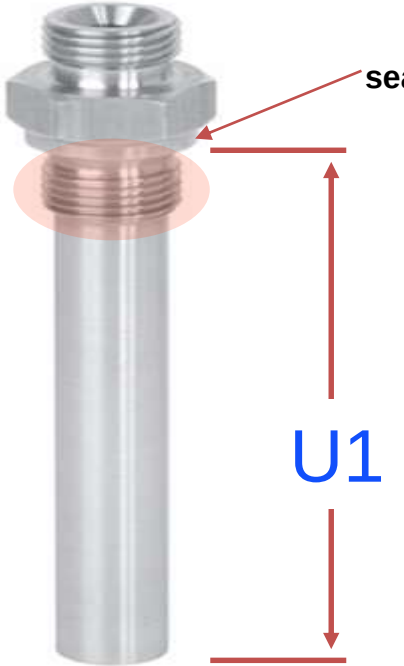
Shank design of solid drilled thermowells

- Tapered: strong root and fast respone time
- Straight: for highest pressure loads
- Stepped: fast response time

Shank design of fabricated thermowells

- Straight tube (standard)
- Tapered tube 12x2,5 mm to 9 mm for fast response time

Construction of Thermowells

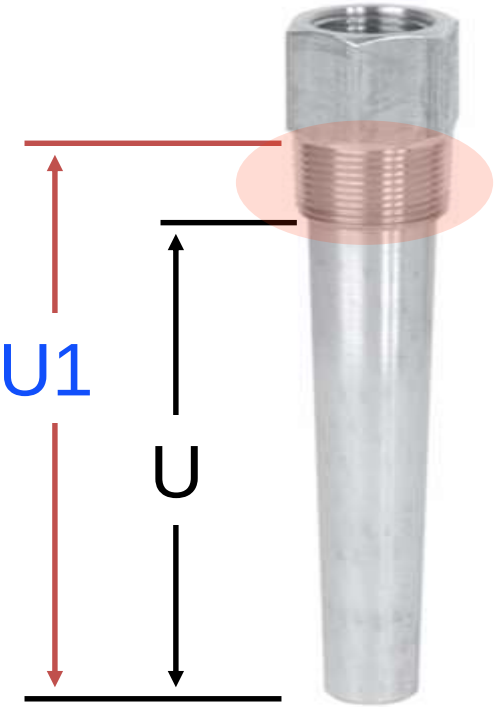


Cylindrical thread

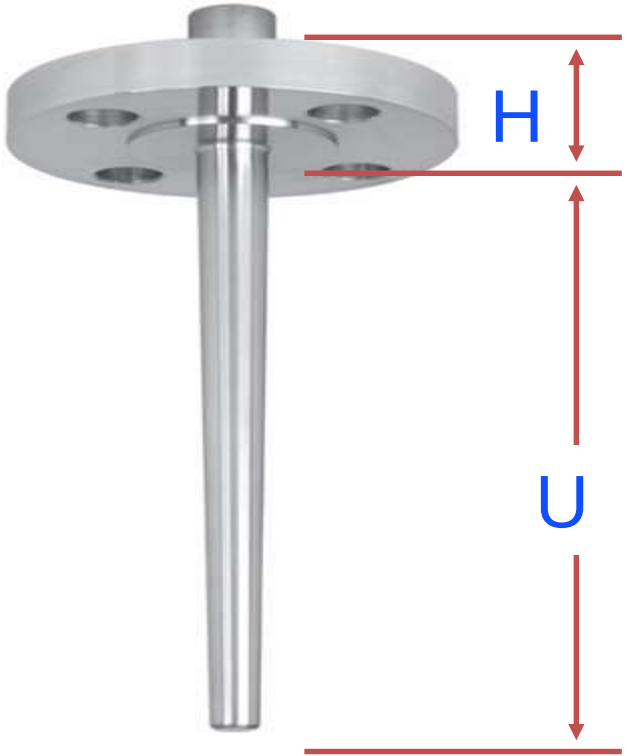
- Insertion lenght U1 inclusive thread
- Sealing face as measuring plane
- e.g. G½B or M20x1,5 mm

Tapered thread

- Insertion lenght U below thread
- Insertion lenght U1 inclusive thread
- No sealing face existing
- e.g. 1“NPT or R½ ISO7



Construction of Thermowells

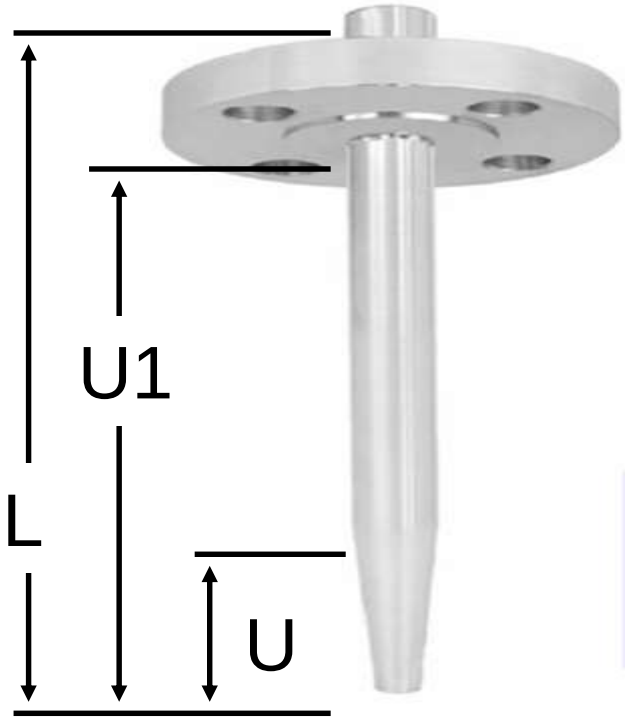


International design

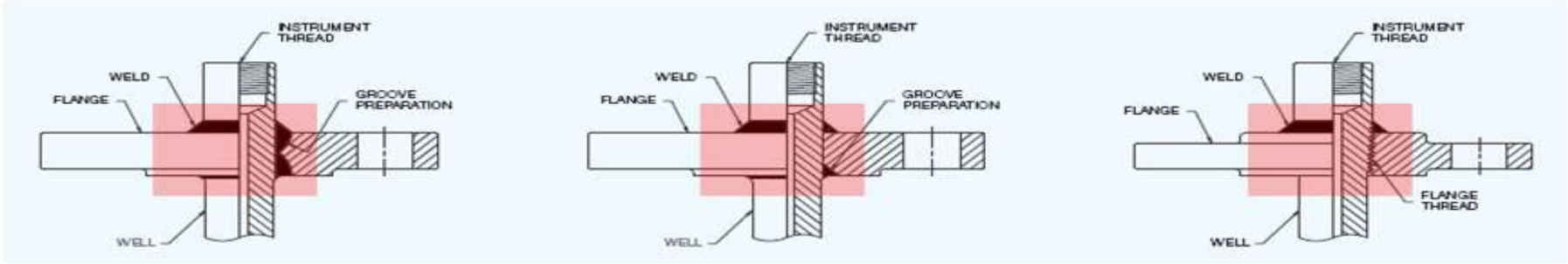
- Head lenght „H“
- Insertion length „U“

DIN 43772 Form 4F

- Total length „L“
- Insertion length „U1“
- Tapered length „U“



Construction of Thermowells



Full Penetration Welding

- global acceptance
- use of blind flanges

Partial Penetration Welding

- use in Europe / Germany
- use of blind flange

Screwed & Welded construction

- roots in asian market
- threaded flange with hub

Construction of Thermowells

Blind Flange

- most common flange for thermowells
- Standards to ASME B16.5 / EN 1092-1 / DIN 2527
- Basis for full and partial penetration welding

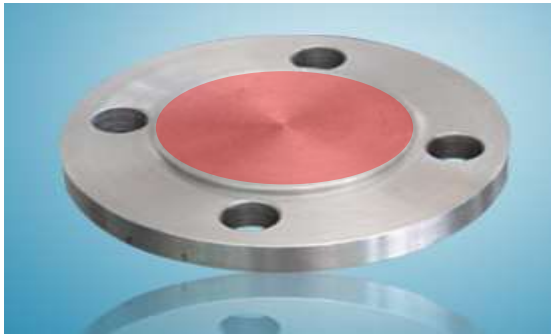
Threaded Flange

- With 1NPT thread for screwed&welded thermowells
- ASME B16.5

Lap Flange

- Used for Van Stone thermowells
- ASME B16.5

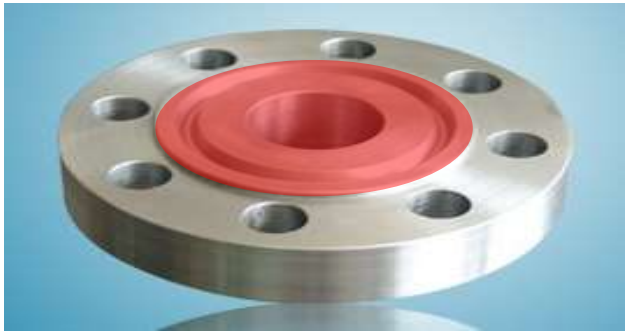
Flange sealing faces



Sealing faces

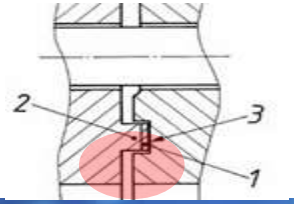
- EN 1092: Form B1 or B2
- DIN 2526: Form C or E
- - ASME B16.5: RF (Raised Face)
- - stock finish or smooth finish

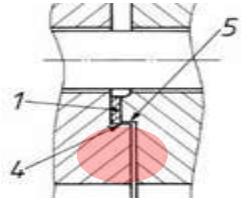
ASME: RTJ (Ring Joint Groove)



Additional sealing faces with :

- tongue/groove or male/female





Non Destructive Testing

Standard

Special

Hydrostatic pressure test:
- outside pressure for flanged thermowells
- inside pressure for screwed and weld-in thermowells

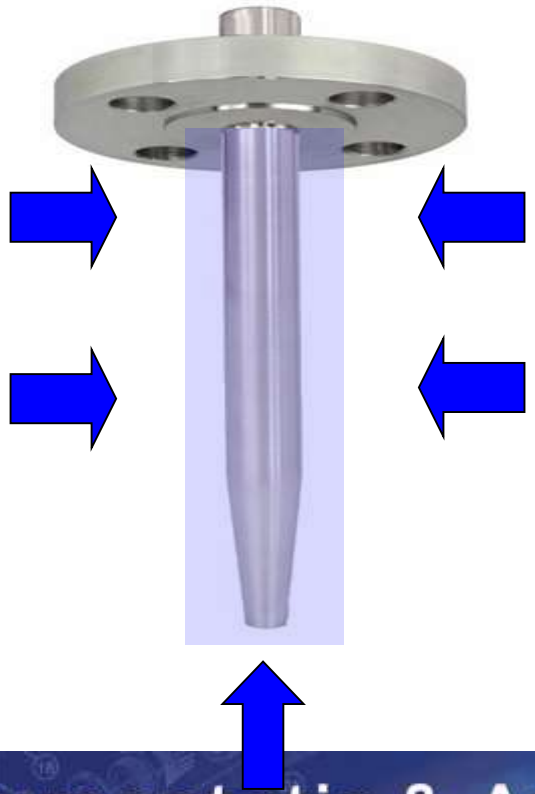
Dye penetration test / Liquide penetration test:
- surface defects of welding connections

Positive material identification (PMI):
- verification of alloy content
- spectral analysis (OES) oder X-ray Fluorescence (XRF)

Ultrasonic testing and X-ray :
- defect inside welding connections
- check of bore concentricity

Helium leak test:
- leak test of themowells

Outside pressure testing



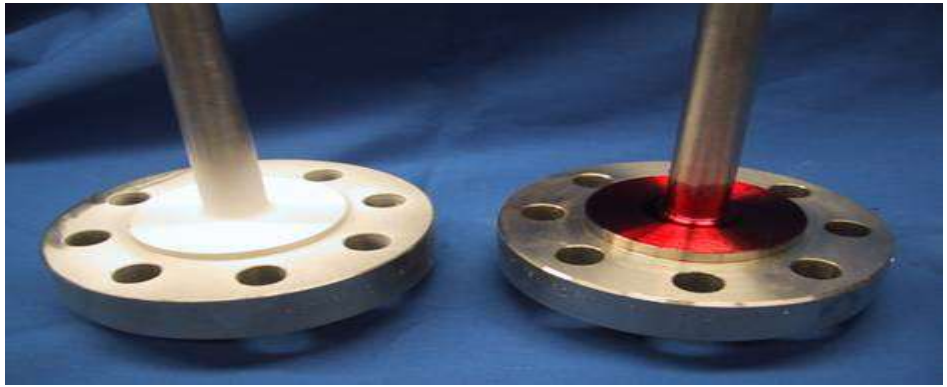
Flange to ASME B16.5:	
pressure rating	test pressure in bar
150#	30
300#	85
600#	160
1500#	390

Flange to DIN / EN:	
pressure rating	test pressure in bar
PN 16-40	60
PN 63/64	100
PN 100	150

inside pressure testing

- Standard test for threaded and weld-in thermowells
- Special for flanged thermowells
- Testing time: 3 min
- Testing pressure: 400 bar

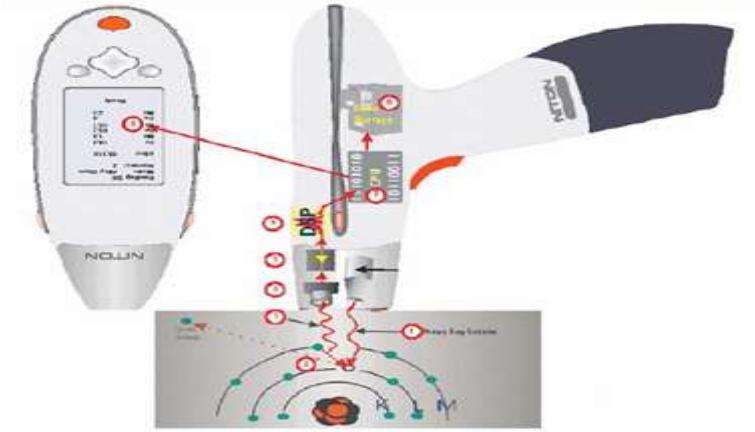
Dye Penetration Test (DPI)
Liquide Penetration Test (LPI)



Surface defect on welding connections

- Methode red/white („Mat'l Check“)
- Methode with ultraviolet light

X-ray Fluorescence (RFA)

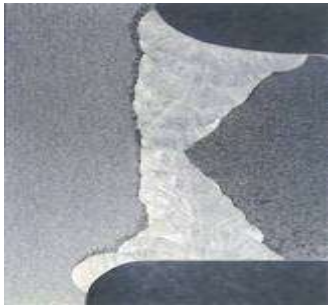


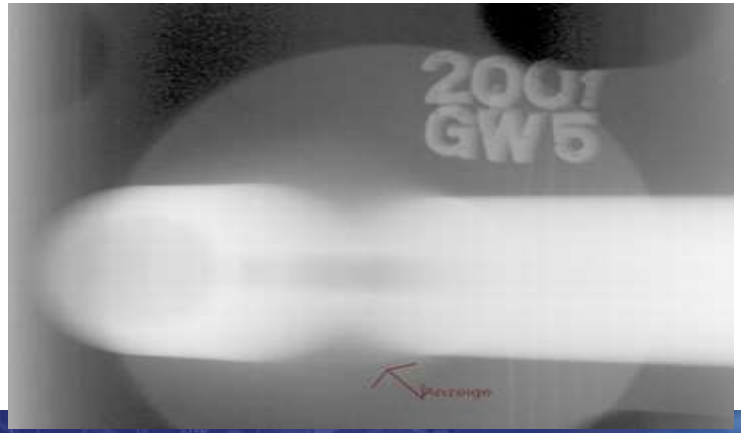
- X-Ray = high energy radiation
- Energy of X-ray stimulate atomes
- Atome radiate a specific radiation
- Specific radiation = Indicator about alloy element in probe

Optical emission spectrometry (OES)

- Spark between tungsen electrode and probe
- Spectral analyse of spark
- Wave lenght characteriasic for alloy elemants
- Intensity shows amount of alloy elements

X-Ray examination

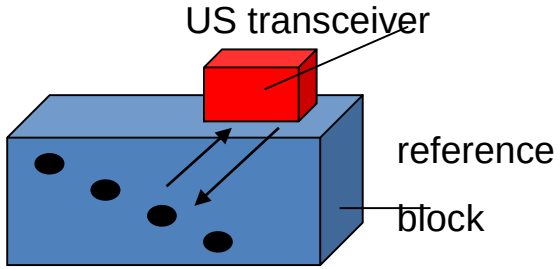


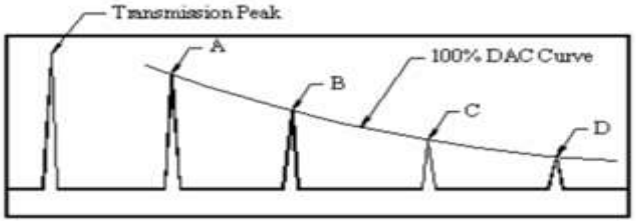


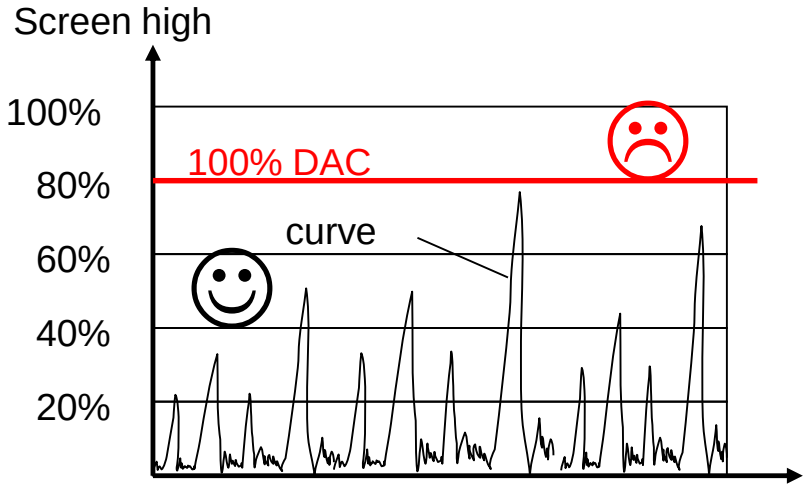
- Internal defect of welding connections
- Full Penetration Welding
- Welds of end caps of fabricated thermowells
- Concentricity of bore

Ultrasonic examination

- Determination of DAC curve (Distance Amplitude Correction)
- Comparison of measuring signal vs. DAC curve

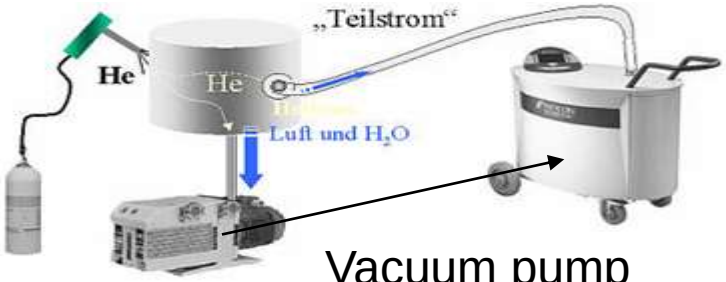






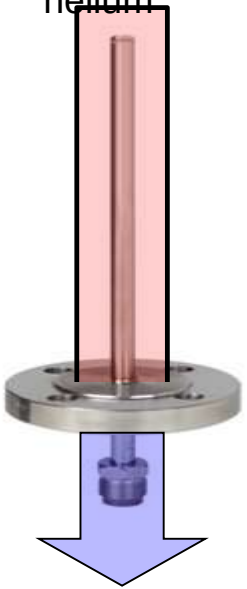
Outside pressure testing

- Evacuationof thermowell
- Local testing: spraying of helium on testing area
- Integrale methode: Flushing with helium inside the housing



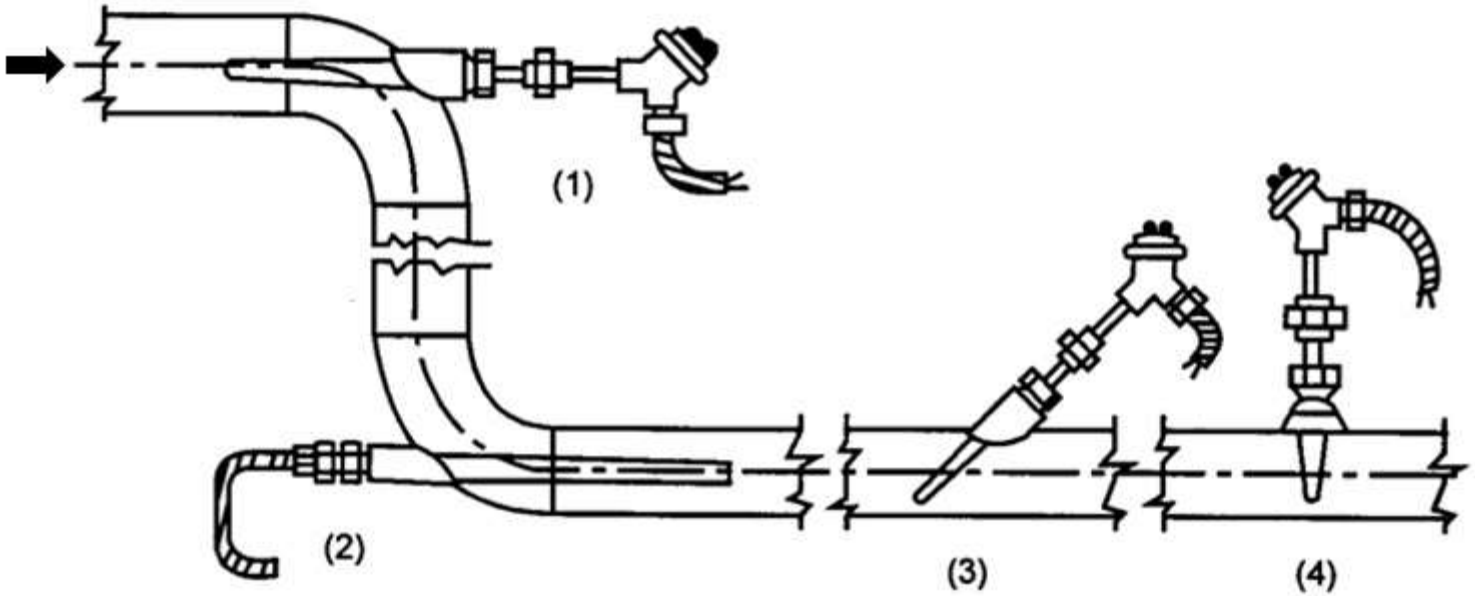
Vacuum pump inside testing equipment

Spraying or flushing with helium

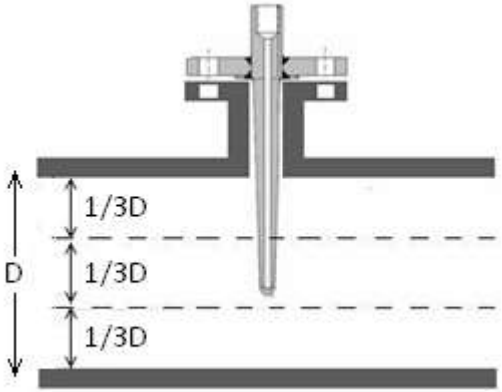


vacuum

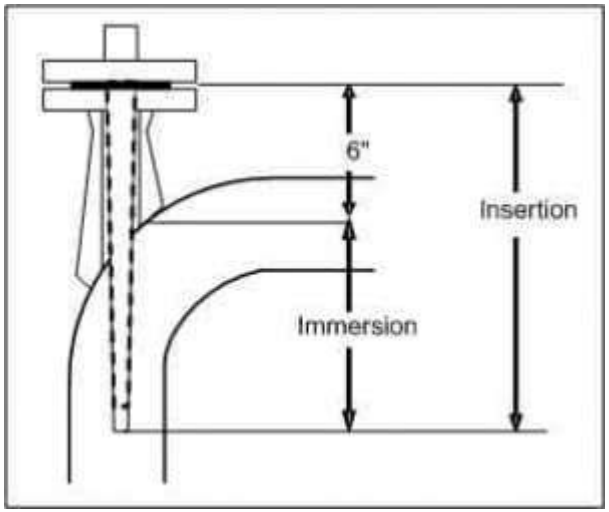
HOW TO INSTALL

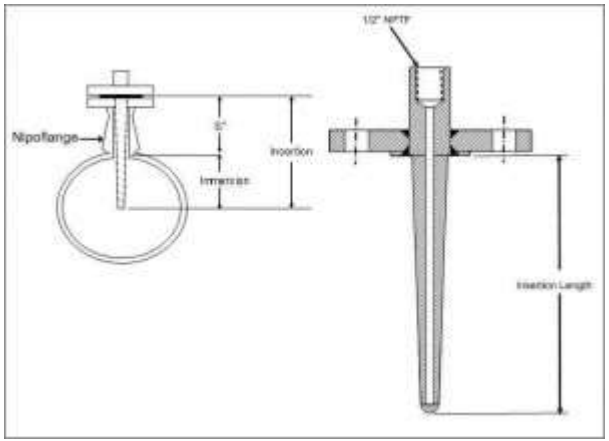


IMMERSION DEPT

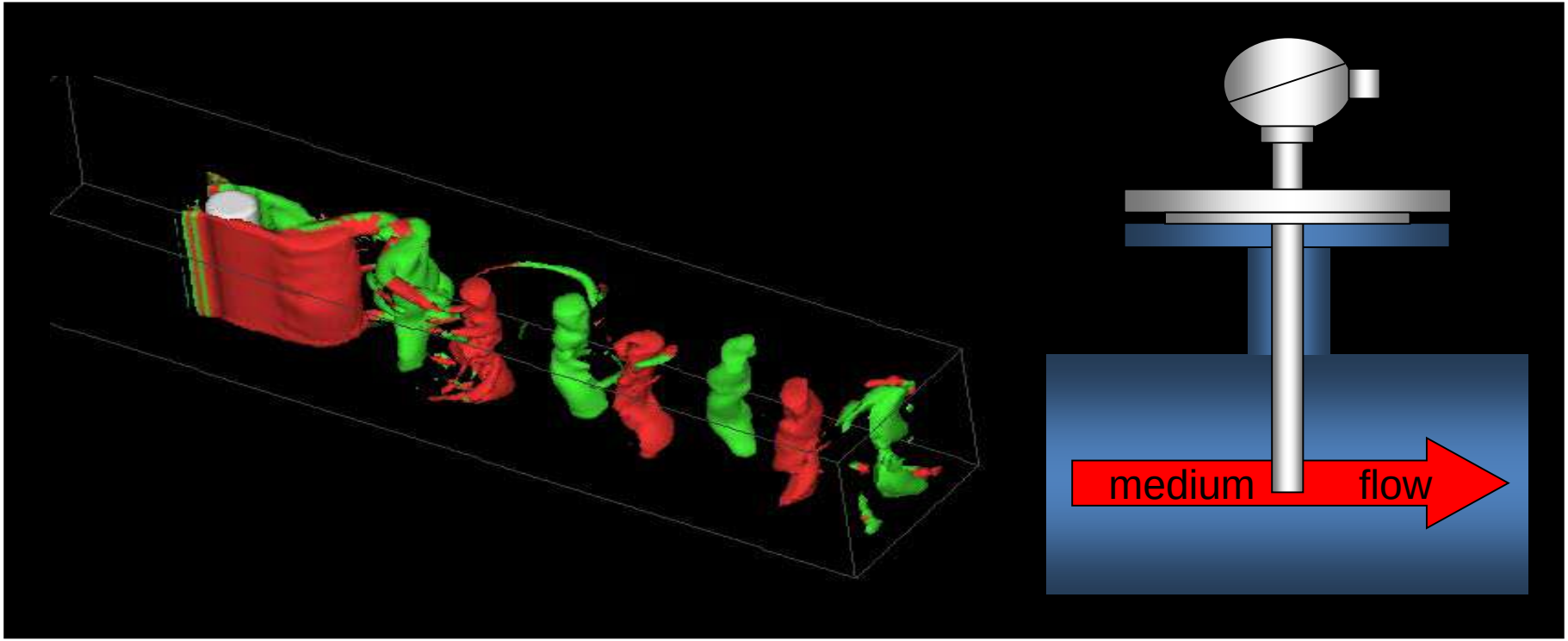


WHICH LENGTH

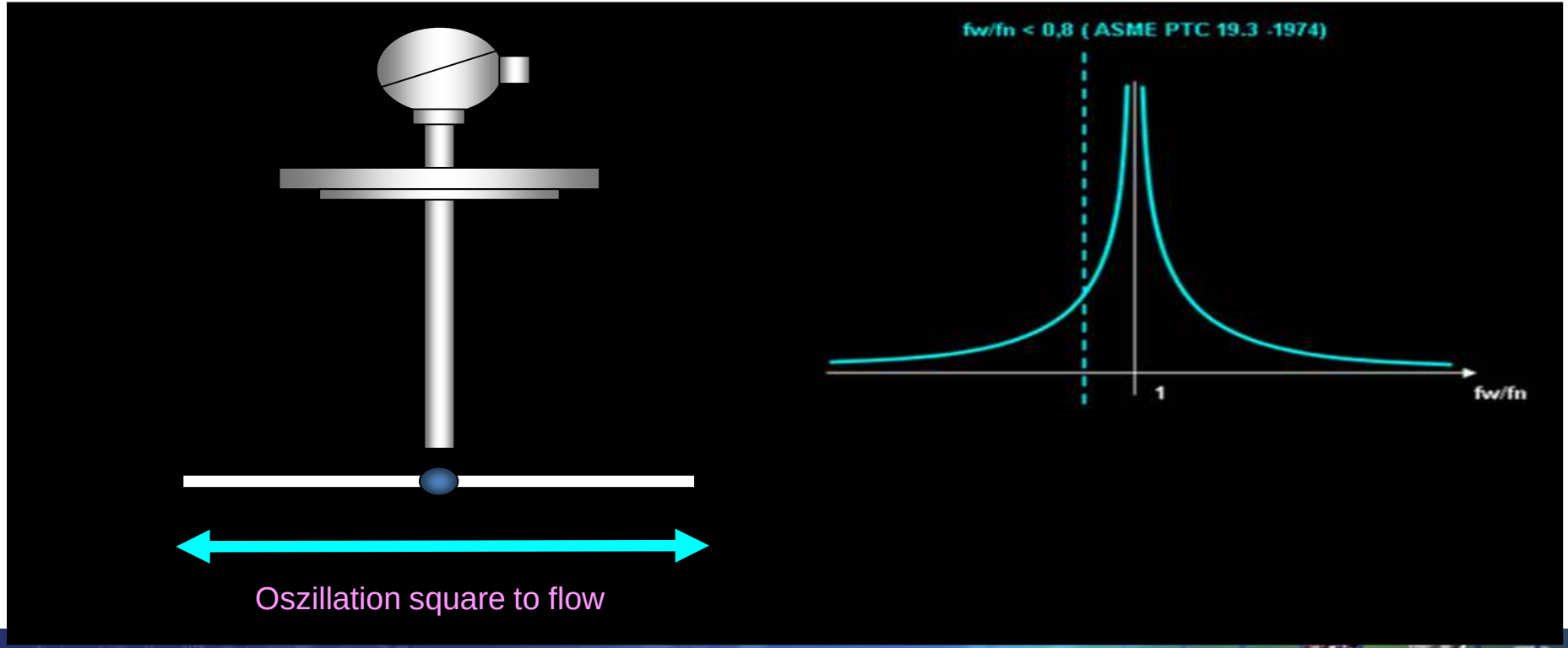




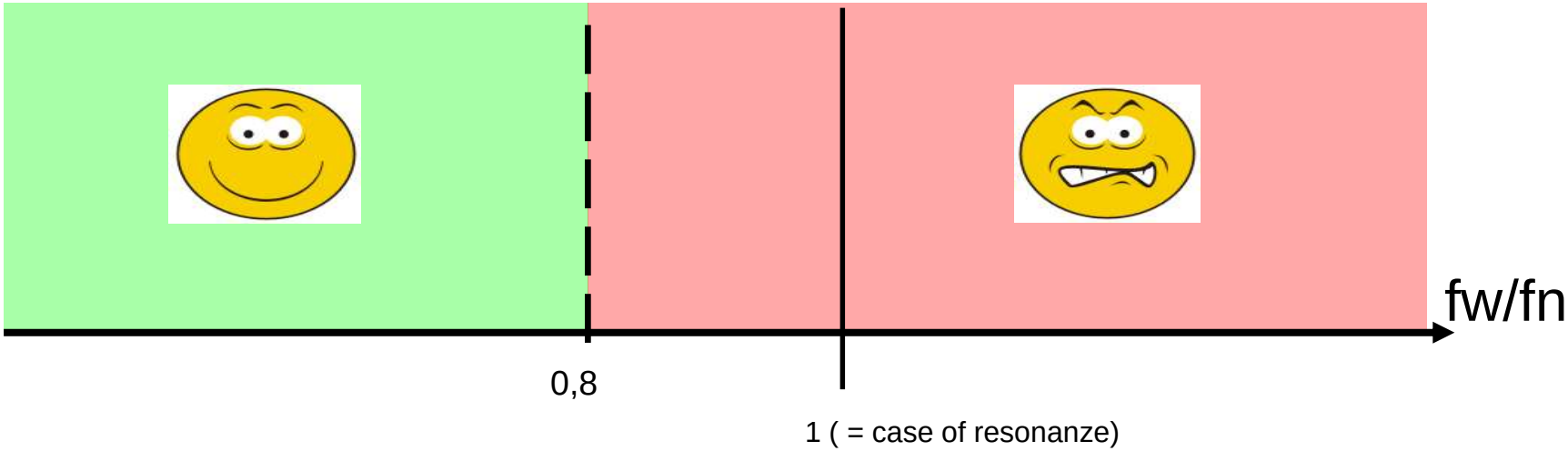
Principle of VORTEX shedding



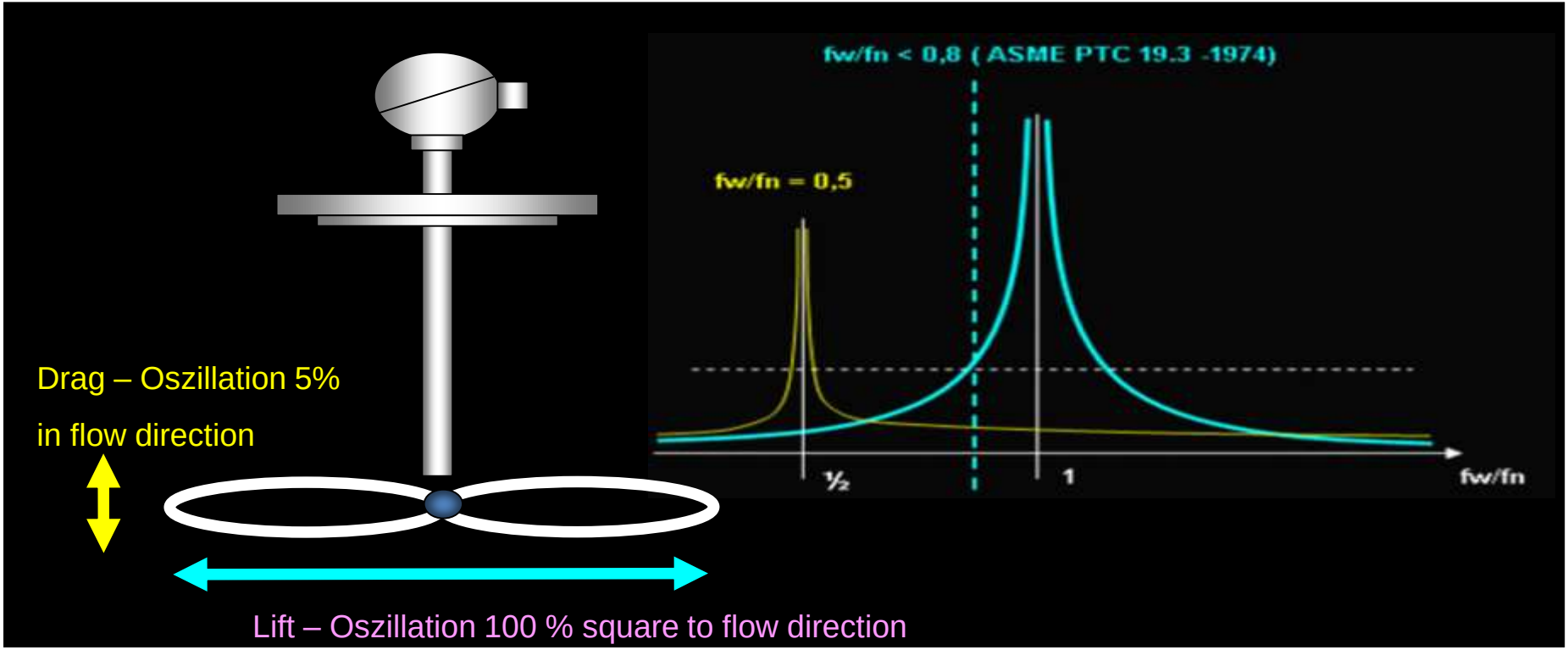
Oszillation to ASME PTC 19.3-1974



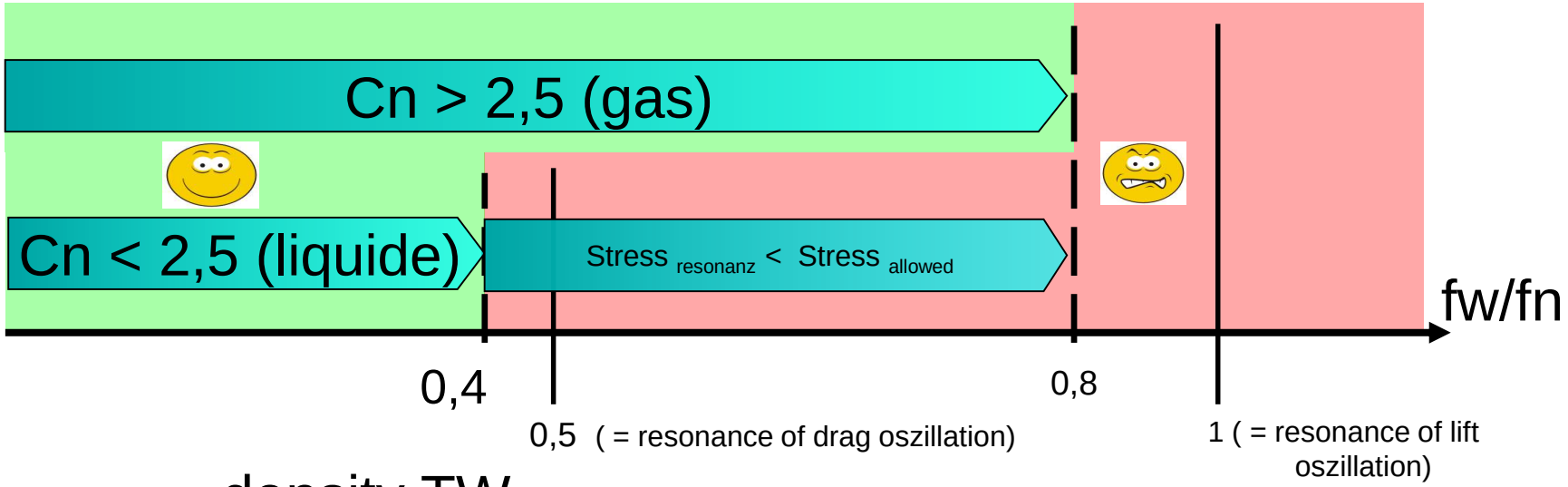
Frequency ratio limits to PTC 19.3-1974



Oszillation to ASME PTC 19.3-2010



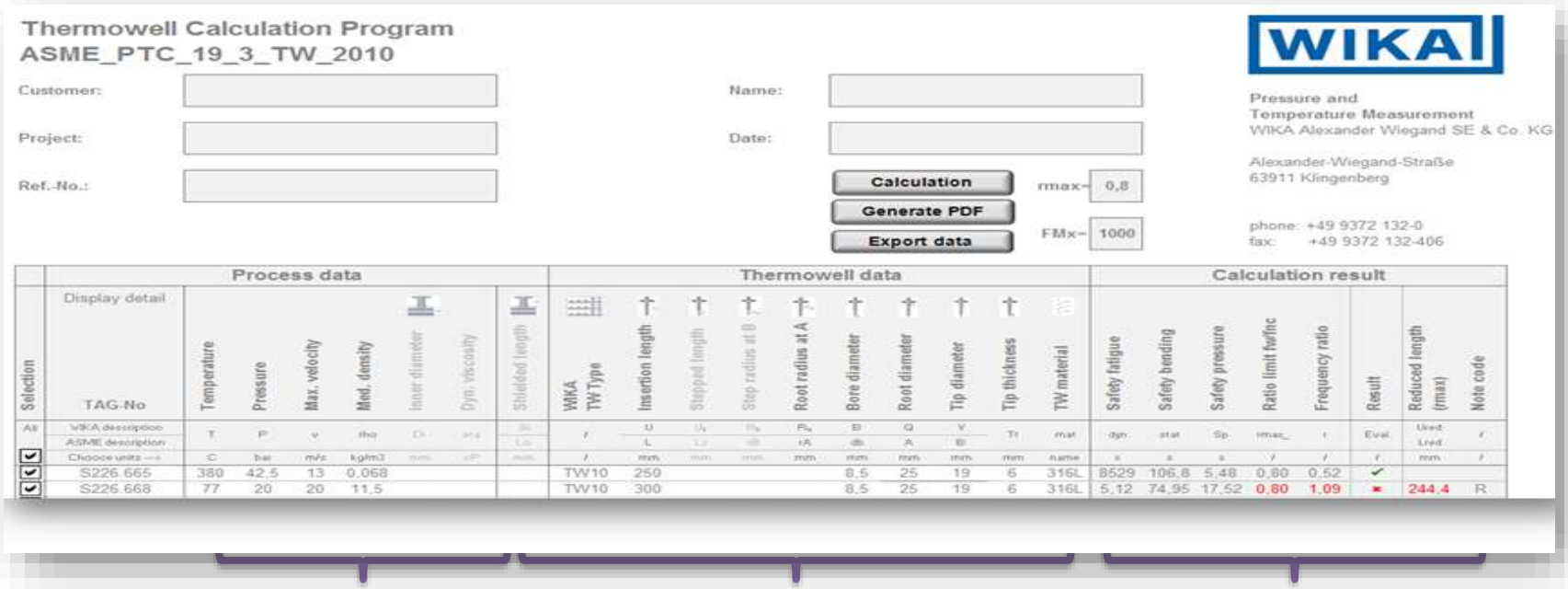
Frequency ratio limits to PTC 19.3-2010



$$Cn = \frac{\text{density TW}}{\text{density medium}} \times \text{TW design x factor (static)}$$

Cn = scruton number - mass damping parameter

Wake Frequency Calculation program PTC 19.3- TW2010



Thermowell Calculation Program
ASME_PTC_19_3_TW_2010

Customer: | Name: | Date: | Project: | Ref.-No.:

Calculation | Generate PDF | Export data | rmax= 0,8 | FMx= 1000

WIKA
Pressure and Temperature Measurement
WIKA Alexander Wiegand SE & Co. KG
Alexander-Wiegand-Straße
63911 Klingenberg
phone: +49 9372 132-0
fax: +49 9372 132-406

	Process data							Thermowell data									Calculation result							
Selection	Display detail / TAG-No	Temperature	Pressure	Max. velocity	Med. density	Inner diameter	Dyn. viscosity	Shielded length	WIKA TW Type	Insertion length	Stepped length	Step radius at B	Root radius at A	Bore diameter	Root diameter	Tip diameter	Tip thickness	TW material	Safety fatigue	Safety bending	Safety pressure	Ratio limit fw/fnc	Frequency ratio	Result	Reduced length (rmax)	Note code
All	WIKA description	T	P	v	rho	Di	eta	Ls	/	U	U_1	R_B	R_A	B	Q	V	Tt	mat	dyn	stat	Sp	rmax_	r	Eval.	Used / Lred	/
	ASME description									L	L_1	dB	rA	db	A	B										
	Choose units →	C	bar	m/s	kg/m3	mm	cP	mm	/	mm	mm	mm	mm	mm	mm	mm	mm	name	x	x	x	/	/	/	mm	/
☑	S226.665	380	42,5	13	0,068				TW10	250				8,5	25	19	6	316L	8529	106,8	5,48	0,80	0,52	✓		
☑	S226.668	77	20	20	11,5				TW10	300				8,5	25	19	6	316L	5,12	74,95	17,52	0,80	1,09	✗	244,4	R

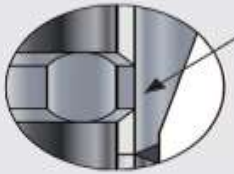
- Process data
- Thermowell data
- results

Failed results .. How to handle?

	Process data							Thermowell data										Calculation result							
Selection	Display detail TAG-No	Temperature	Pressure	Max. velocity	Med. density	Inner diameter	Dyn. viscosity	Shielded length	WIKA TW Type	Insertion length	Stepped length	Step radius at B	Root radius at A	Bore diameter	Root diameter	Tip diameter	Tip thickness	TW material	Safety fatigue	Safety bending	Safety pressure	Ratio limit fw/fmc	Frequency ratio	Result	Reduced length (rmax)	Note code
All	WIKA description ASME description	T	P	v	rho	Di	eta	B Le	/	U L	Us Ls	Rs rB	Rk rA	B db	D A	V B	Tc	mat	dyn	stat	Sp	rmax_	r	Eval.	Ured Lred	/
	Choose units ==>	C	bar	m/s	kg/m3	mm	cP	mm	/	mm	mm	mm	mm	mm	mm	mm	mm	name	=	=	=	/	/	/	mm	/
☑ ☑	Test1	80	20	25	1,2			150	TW10	250				8,5	25	19	6	316L	36,3	323	17,36	0,80	0,95	✖	217	R
☑ ☑	Test2	80	20	26	1,2			150	TW10	250				8,5	25	19	6	316L	5,76	321	17,36	0,80	0,99	✖	213	R
☑ ☑	Test3	80	20	27	1,2			150	TW10	250				8,5	25	19	6	316L	21,4	318	17,36	0,80	1,03	✖	209	R
☑ ☑	Test4	80	20	28	1,2			150	TW10	250				8,5	25	19	6	316L	45,7	315	17,36	0,80	1,07	✖	205	R
☑ ☑	Test5	80	20	29	1,2			150	TW10	250				8,5	25	19	6	316L	67,5	312	17,36	0,80	1,11	✖	202	R
☑ ☑	Test6	80	20	30	1,2			150	TW10	250				8,5	25	19	6	316L	87,2	309	17,36	0,80	1,14	✖	199	R
☑ ☑	Check 1	80	20	25	1,2			150	TW10	199				8,5	25	19	6	316L	595	335	17,36	0,80	0,62	✔		
☑ ☑	Check 2	80	20	26	1,2			150	TW10	199				8,5	25	19	6	316L	524	335	17,36	0,80	0,64	✔		
☑ ☑	Check 3	80	20	27	1,2			150	TW10	199				8,5	25	19	6	316L	460	334	17,36	0,80	0,66	✔		
☑ ☑	Check 4	80	20	28	1,2			150	TW10	199				8,5	25	19	6	316L	403	334	17,4	0,8	0,69	✔		
☑ ☑	Check 5	80	20	29	1,2			150	TW10	199				8,5	25	19	6	316L	351	333	17,4	0,8	0,71	✔		
☑ ☑	Check 6	80	20	30	1,2			150	TW10	199				8,5	25	19	6	316L	304	332	17,4	0,8	0,74	✔		

Support collar design to IN00.15

Detail



interference fit between support collar and inside diameter of nozzle

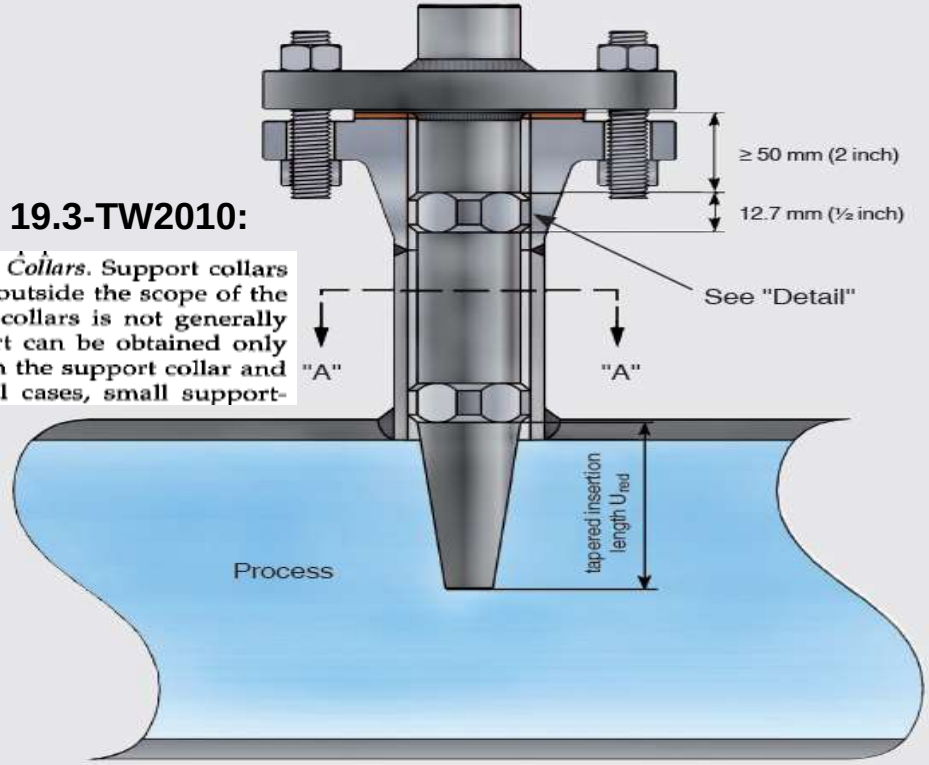
4-point support collar

Section "A"-"A"

Part of the ASME PTC 19.3-TW2010:

(e) Thermowells With Support Collars. Support collars or other means of support are outside the scope of the Standard. The use of support collars is not generally recommended, as rigid support can be obtained only with an interference fit between the support collar and the installed piping. In special cases, small support-

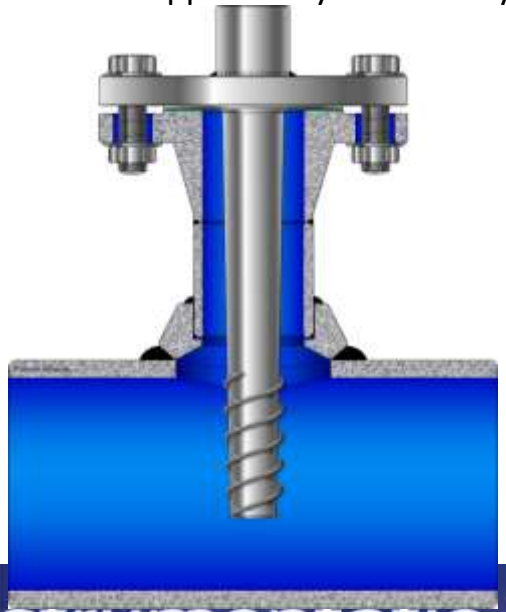
Typical installation through a nozzle



Thermowells with support collar are out of the scope of the ASME PTC 19.3-TW2010

ScrutonWell design

Thermowells with specially designed surface structures (e.g., a knurled surface or a surface with spiral ridges) are beyound the scope of this Standard, due to the difficulty of providing design rules with board applicability for these types of thermowells.



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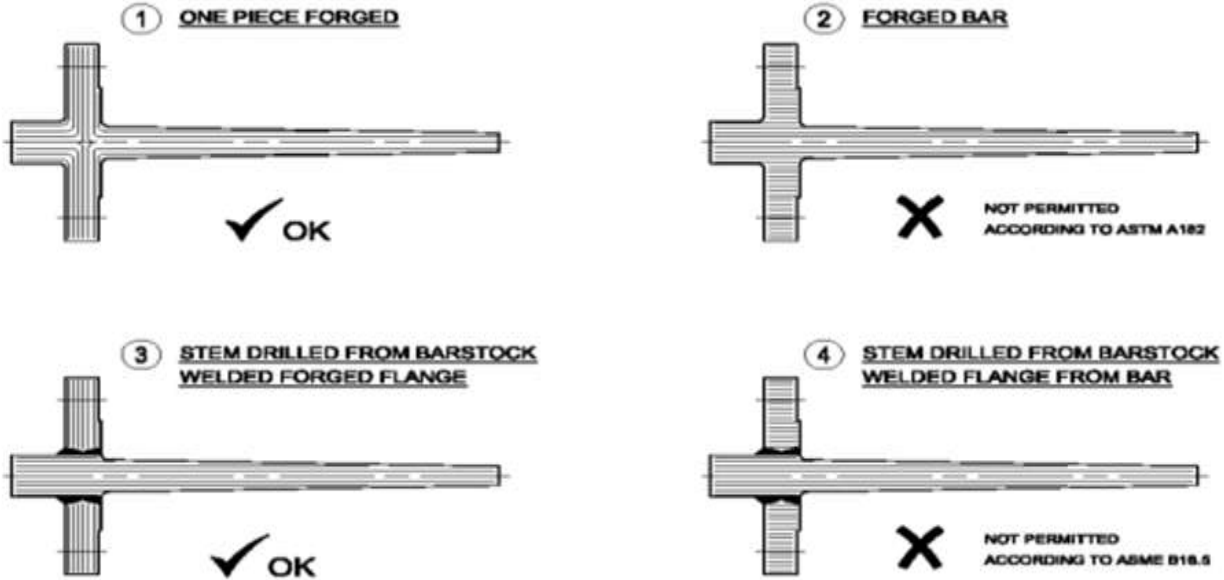
TW10: Thermowell solid machined with flange

- TW 95.10 (PPW + FPW)
- TW 95.11 (screwed & welded)
- TW 95.12 (washer disc construction

- all welding connections (FPW / PPW / S&W)
- all flanges and flange facings
- all materials
- washer disc construction for exotic materials
- all female and male threads to the thermometer
- all shank designs and bore diameters

TW10X-forged: Thermowell
One piece forged design



TW15: Thermowell solid machined with thread

- all head designs
- all materials
- all shank designs and bore diameters

- Data sheet: TW 95.15

TW20: Thermowell
solid machined for socked welding

- all materials
- standard welding diameters:
- 26.7 mm, 33.4 mm, 48.3 mm
- all shank designs and bore diameters

- Data sheet: TW 95.20

TW25: Thermowell
solid machined for direct welding

- all materials
- all head diameters between 25.4 mm … 49.5 mm
- all shank designs and bore diameters

- Data sheet: TW 95.25

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Why „TW20 versus TW25“ ?

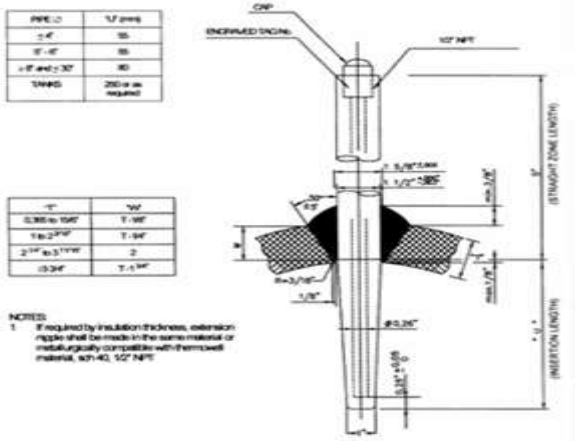


Figura nº 1

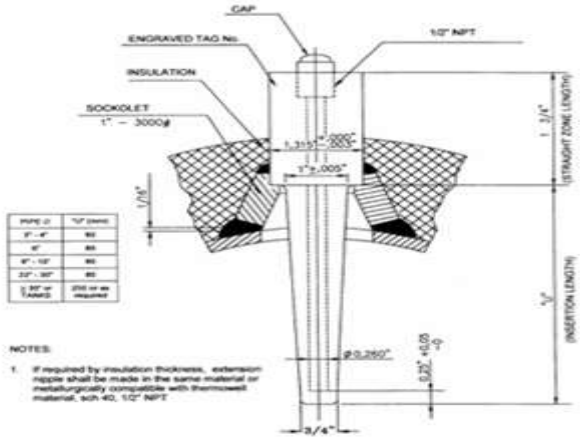
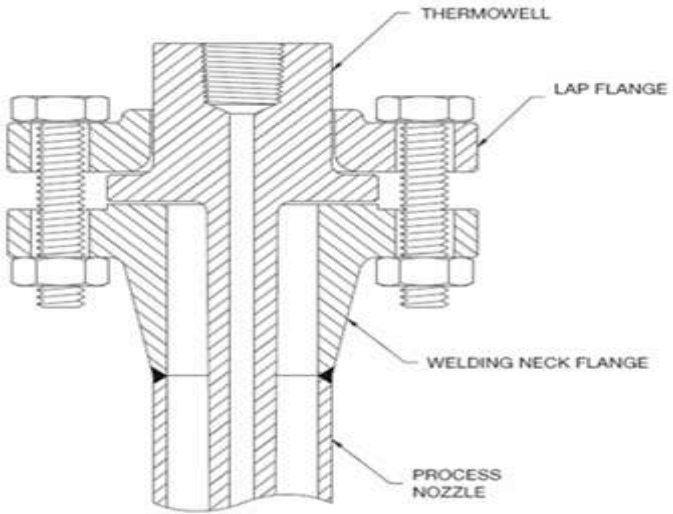


Figura nº 2

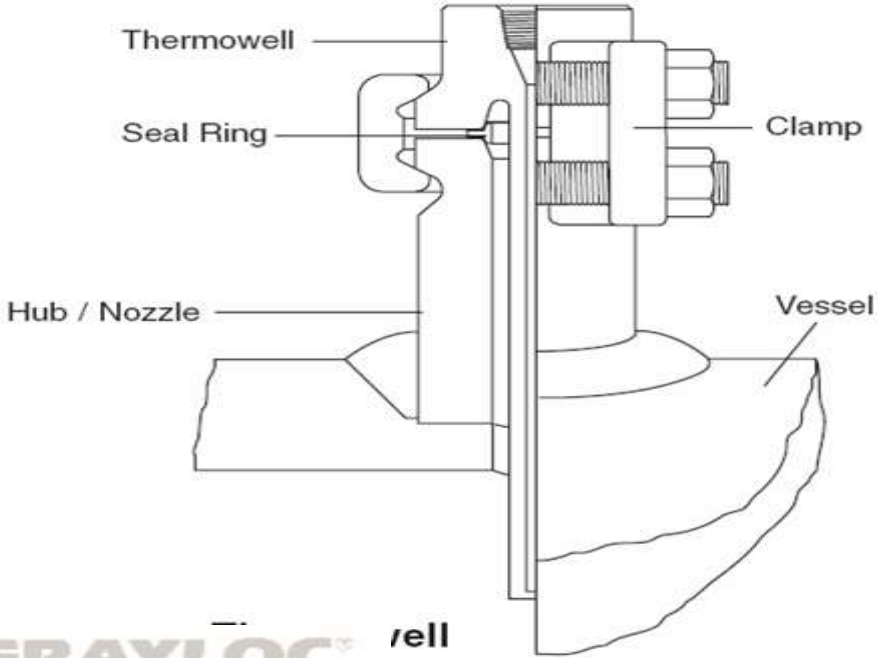
TW30: Thermowell
solid machined in Van-stone construction

- Note: the lap flange is not included in standard delivery



- all materials
- all dimensions fitting for ASME lap flanges
- all shank designs and bore diameters
- A special customer design for the TW30 are thermowells acc.

- Data sheet: TW 95.30

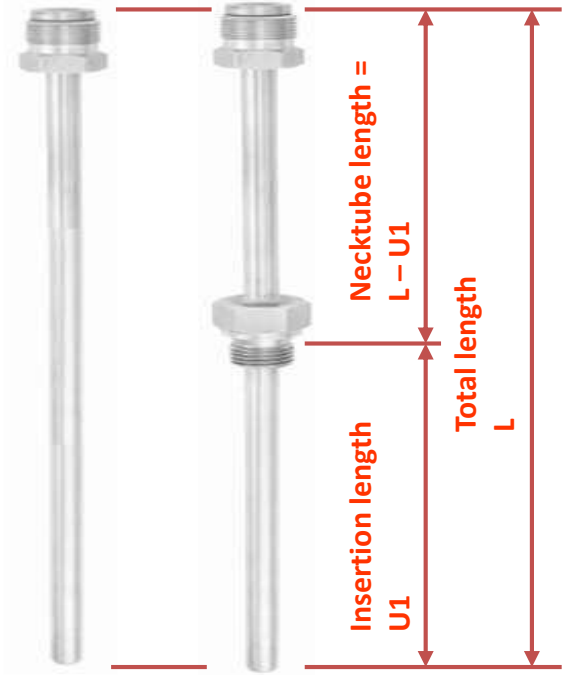


GRAYLOC® PRODUCTS
www.grayloc.com

Thermowells

Grayloc® thermowell one-piece, solid construction assemblies are smaller and lighter than flanged thermowell assemblies. Metal-to-metal sealing makes Grayloc thermowell assemblies capable of higher pressures and temperatures.

TW35: Thermowell, fabricated acc. to DIN 43772 (form 2, 3, 2G, 3G)



- all tube dimensions
- design with or without process threads
- all thread dimensions
- straight and tapered tubes
- all length acc. to DIN 43772 and customer specifications

Necktube length:
Direct coding is not possible. The neck tube length is calculated by: total length L minus insertion length U1.

- Form 2G (straight tube) = 145 mm (minimum 60 mm)
- Form 3G (tapered tube) = 147 mm (minimum 60 mm)

TW40: Thermowell, fabricated acc. to DIN 43772 (form 2F, 3F)

- all tube dimensions
- male and female thread as a connection to the thermometer
- all flange dimensions
- straight and tapered tubes
- all length acc. to DIN 43772 and customer specifications

TW40: Special construction for exotic materials

TANTALUM:

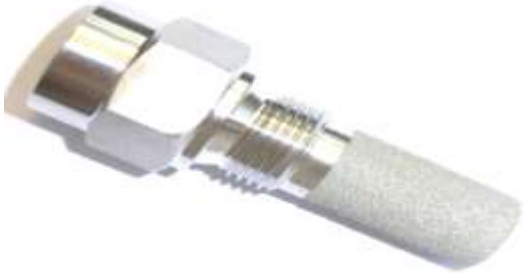
- removeable cover
- 12 x 0,4 mm with tube 11 x 2 mm
- 16 x 0,4 mm with tube 15 x 3 mm

EXOTIC MATERIAL

- Washer disc construction (also TW10)
- Wetted parts made of exotic material
- Flange body made of stainless steel

Coatings for Thermowells

- PFA
- E-CTFE
- Stellite SF6
- Tantalum (Tantaline)



TW45: Thermowell, fabricated to DIN 43772 (form 5, 8)

- male and female thread as a connection to the thermometer
- straight and tapered threads (NPT) as process connection
- many different tube dimensions

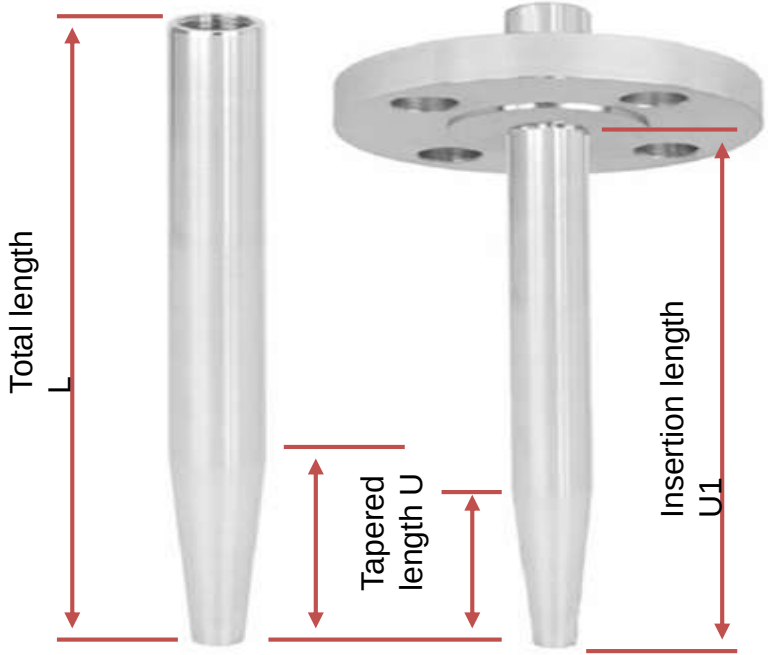
- Data sheet: TW 95.45

TW50: Thermowell, solid drilled to DIN 43772 (form 6, 7, 9)

- all materials and bore dimensions
- male and female thread as a connection to the thermometer
- straight and tapered threads (NPT) as process connection

- Data sheet: TW 95.50

TW55: Thermowell, solid machined to DIN 43772 (form 4, 4F)



- thermowells with flange or to weld-in
- all flanges and flange faces
- all length (U, U1, L) and thermowell dimension to DIN 43772

- Data sheet: TW 95.55

TW60: Thermowell, solid machined with sterile connection

- all materials
- all shank designs and bore diameters
- all sterile connections

TW70: Thermowell, fabricated
International design (protection tube)

- Materials: SS304 / SS316 / Inconel 600
- Different process connections
  - Flange
  - Thread
  - Weld-In
- Dimensions:
  - ¼“, ½“, ¾“, 1“
  - Schedule 40 / 80 / 160 / XXH

TW22: Thermowell, fabricated with sanitary connection

- all tube dimensions and length
- female, male and male nut M24x1.5 as connection to the thermometer
- all common sanitary connections available

- Data sheet: TW 95.22

TW61: Thermowell for hygienic applications

- Suitable for CIP (cleaning in place)
- Possibility of SIP (Sterilization-In-Place)
- Calibration without opening the process
- Designed for orbital welding process
- Elastomer free process connection
- Suitable for DIN, ISO and ASME BPE pipe dimensions
- Patent for dead space minimized design
  Patent number: DE 10 2009 048 559

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