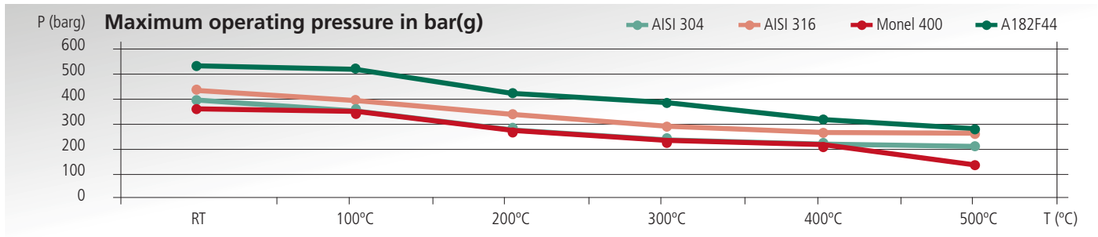
Material Selections

The following table provides an overview of the many materials used for thermowells as informative character.

Max. Temp. in°C	Material no	Material properties	Application range
Unalloyed, Heat and High Heat Resistant Steel			
400	1.0305 (ASTM 105)	Unalloyed steel	Welded and threaded thermowells in steam pipelines
500	1.5415 (AISI A204 Gr.A)	Low alloy heat resistant with Molybdenum additive	Welded and threaded thermowells
540	1.7335 (AISI A182 F11)	Low alloy heat resistant steel with Chromium & Molybdenum additives	Welded and threaded thermowells
570	1.7380 (AISI A182 F22)	Low alloy heat resistant steel with Chromium & Molybdenum additives	Welded and threaded thermowells
Rust and Acid Resistance Steel			
550	1.4301 (AISI 304)	Good resistance against organic acids at moderate temperatures, salt solutions, e.g. sulfates, sulfides, alkaline solutions at moderate temperatures	Food and beverage industry, medical system engineering
550	1.4404 (AISI 316L)	Through the addition of Molybdenum higher corrosion resistance in non-oxidizing acids, such as acetic acid, tartaric acid, phosphoric acid, sulphuric acid and others. Increased resistance against intercrystalline and pitting corrosion due to reduced Carbon content	Chemical and paper industries, nuclear technology, textile, dye, fatty acid, soap and pharmaceutical industries as well as dairies and breweries
550	1.4435 (AISI 316L)	Higher corrosion resistance than 1.4404, lower Delta-ferrite content	Pharmaceutical industry
550	1.4541 (AISI 321)	Good intercrystalline corrosion resistance. Good resistance against heavy oil products, steam and combustion gases. Good oxidation resistance	Chemical, nuclear power plants, textile, dye, fatty acid and soap industries
550	1.4571 (AISI 316 Ti)	Increased corrosion resistance against certain acids due to addition of Titanium Resistant to pitting, salt water and aggressive industrial influences	Pharmaceutical industry and dairies and breweries
Refractory steel			
1200	1.4762 (AISI 446)	High resistance to Sulphur containing gases due to high Chromium content (Minimum resistance to Nitrogen containing gases)	Use in flue and combustion gases, industrial furnaces
1150	1.4841 (AISI 314)	High resistance to Nitrogen containing and Oxygen poor gases. Continuous use not between 700°C and 900°C due to embrittlement	Poser plant construction, petroleum and petrochemical, industrial furnaces
1100	2.4816 (Inconel 600)	Good general corrosion resistance, resistant to stress crack corrosion. Exceptional Oxidation resistance. Not recommended for CO2 and Sulphur containing gases above 550°C and Sodium above 750°C.	Pressurized water reactor, nuclear power, industrial furnaces, steam boilers, turbines
1100	1.4876 (Incoloy 800)	Due to addition of Titanium and Aluminum the material has especially good heat resistance. Suitable for applications, where in addition to scale resistance, highest toughness is required. Exceptional resistance to carburizing and nitration	Pressurized water reactor, nuclear power construction, petroleum and petrochemical, industrial furnaces



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Certified System swissTS ISO 9001

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Thermo-WELL

Manufacturing range

MR TW-E 02.2014

A wide range of reliable Thermo-WELL

RÜEGER thermowells protect industrial thermometers or sensors, RTD's and / or thermocouples.
They allow the replacement of these instruments without interrupting the process. These thermowells can be supplied in several materials, they are welded, threaded or flanged to the process connection. The design of such thermowells for reliable service could be tapered, straight or stepped shank for a wide range of applications.

Industries and plant

- Oil & gas
- Chemical
- Powergen
- Pulp & Paper
- Food and beverage
- Machine
- Heating, ventilation, air, climatisation
- Etc…

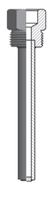
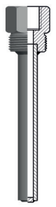
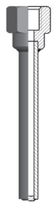
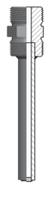
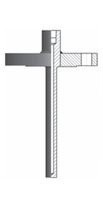
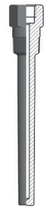
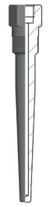
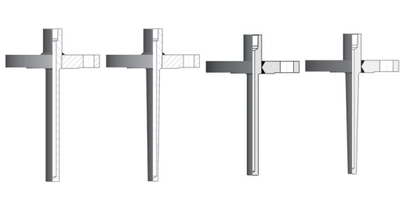
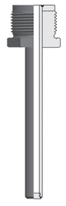
Standard Material

- Stainless steels AISI 304, 316, 316L, 316Ti & 321
- Refractory steels AISI 446 & 310
- High temperature alloys Inconel, Hastelloy, ceramic
- Carbon steel (A105)
- Brass
- Other material on request

Design

- ANSI/ASME standard bar stock straight, tapered or stepped
- DIN bar stock and built-up
- DIN weld-in
- DIN hammered
- Shell-type

Certified System swissTS ISO 9001

	POCKET				BAR STOCK										BUILT-UP								
Application with	HVAC				INDUSTRIAL																		
	DAE	DIE	DIA	DEE	TW10 120	TW10 210	TW10 412	TW10 522	TW50 310	TW50 320	TW50 412	TW50 422	TW50 612	TW50 622	TW10 160	TW10 170	TW10 180	TW10 260	TW10 270	TW10 280	TW10 562	TW10 572	TW10 582
					DIN 43772				ANSI / ASME / ISA						DIN 43772								
																							
Form					4	6	6F	4F	ISA 121	ISA 115/117/ 125/127	ISA 131	ISA 133	ISA 131	ISA 133	2	3	Stepped Rüeger	2G	3G	Stepped Rüeger	2F	3F	Stepped Rüeger
Process connection – Without thread			✓		✓										✓	✓	✓						
Process connection – Threaded	✓	✓		✓		✓			✓	✓								✓	✓	✓			
Process connection – Flange							✓	✓			✓	✓	✓	✓							✓	✓	✓
Maximum length (mm)	2000	2000	2000	2000	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	6000	1100	2000	6000	1100	2000	6000	1100	2000
Minimal external diameter (mm)	8	8	10	10	18/9	17	17	18/9	17	18/9	19	15	19	15	9	12/9	9/5	9	12/9	9/5	9	12/9	9/5
Maximal external diameter (mm)	17	17	13	13	32/17	50	50	32/17		32/17	50	50	50	50	14	14	14	14	14	14	14	14	14
Minimal insider diameter (mm)	5	5	6.5	6.5	3.5	7	7	3.5	7	3.5	6.6	6.6	6.6	6.6	7	6.1	3.2	7	6.1	3.2	7	6.1	3.2
Maximal insider diameter (mm)	14	14	10	10	14	9	9	9	9	9	9	9	9	9	9	8.1	4	9	8.1	4	9	8.1	4
Material	**AISI 316 Brass**	**AISI 316 Brass**	**AISI 316 Brass**	**AISI 316 Brass**	**AISI 304 AISI 316/ AISI 316L,… other on request**										**AISI 304 AISI 316L AISI 316Ti**	**AISI 316L AISI 316Ti**	**AISI 304 AISI 316L AISI 316Ti**	**AISI 304 AISI 316L AISI316Ti**	**AISI 316L AISI 316Ti**	**AISI 304 AISI 316L AISI 316Ti**	**AISI 304 AISI 316L AISI 316Ti**	**AISI 316L AISI 316Ti**	**AISI 304 AISI 316L AISI 316Ti**
															other on request								

General information

1. Ordering a thermowell

For the execution of a thermowell the following information are necessary:

- Process connection unthreaded, threaded or flanged
- Instrument connection
- Type of execution (straight, tapered or stepped)
- Material
- Total length
- Insertion length
- Outside diameter
- Bore diameter
- Tip thickness

Remark:
Generally the tip of thermowell should be placed in the middle third of the pipe, exceptions are made in special cases. The measuring element Pt100, thermocouple, bimetal or gas etc… shall be completely immersed into the medium.

Stress Calculation according to ASME PTC 19.3-2010

If a Karman Stress Calculation (KSC) according to ASME/ANSI PTC19.3 is required, the following additional information are requested:

- Max. operating temperature
- Max. operating pressure
- Density or molecular weight of medium
- Mass flow
- Line size in mm or in inch with SCHED
- Fluid velocity
- Nozzle length
- Inside Ø of nozzle

The stress calculation according to ASME PTC 19.3 – 2010 is used for bar stock thermowells in straight, tapered or stepped designs. Safety factors are included according to design of process connections, if welded, threaded or flanged.

The innovation to previous calculations is the superimposed oscillation of the thermowell perpendicular to the flow direction of the fluid (lift or transverse oscillation) and the in-line (parallel) in the flow direction (drag oscillation).
The frequency ratio (wake frequency / natural frequency) which limits the insertion length U of the thermowell is still max. r = 0.8 for gaseous media, but for liquid media it is the new limit frequency of max. r = 0.4 for in-line resonance. The results are the max. allowed process, pressure depending on the max. process temperature, the geometry and the bending stress in the root of thermowell due to the impact of flow on the immersion length of thermowell.

The following tests and certificates can be executed:

- Hydrostatic internal and / or external
- Dye penetrant
- Radiographic
- Ultrasonic
- PMI
- Material certificate 3.1, option NACE
- Helium
- Karman Stress Calculation ASME PTC 19.3-2010
- Other on request