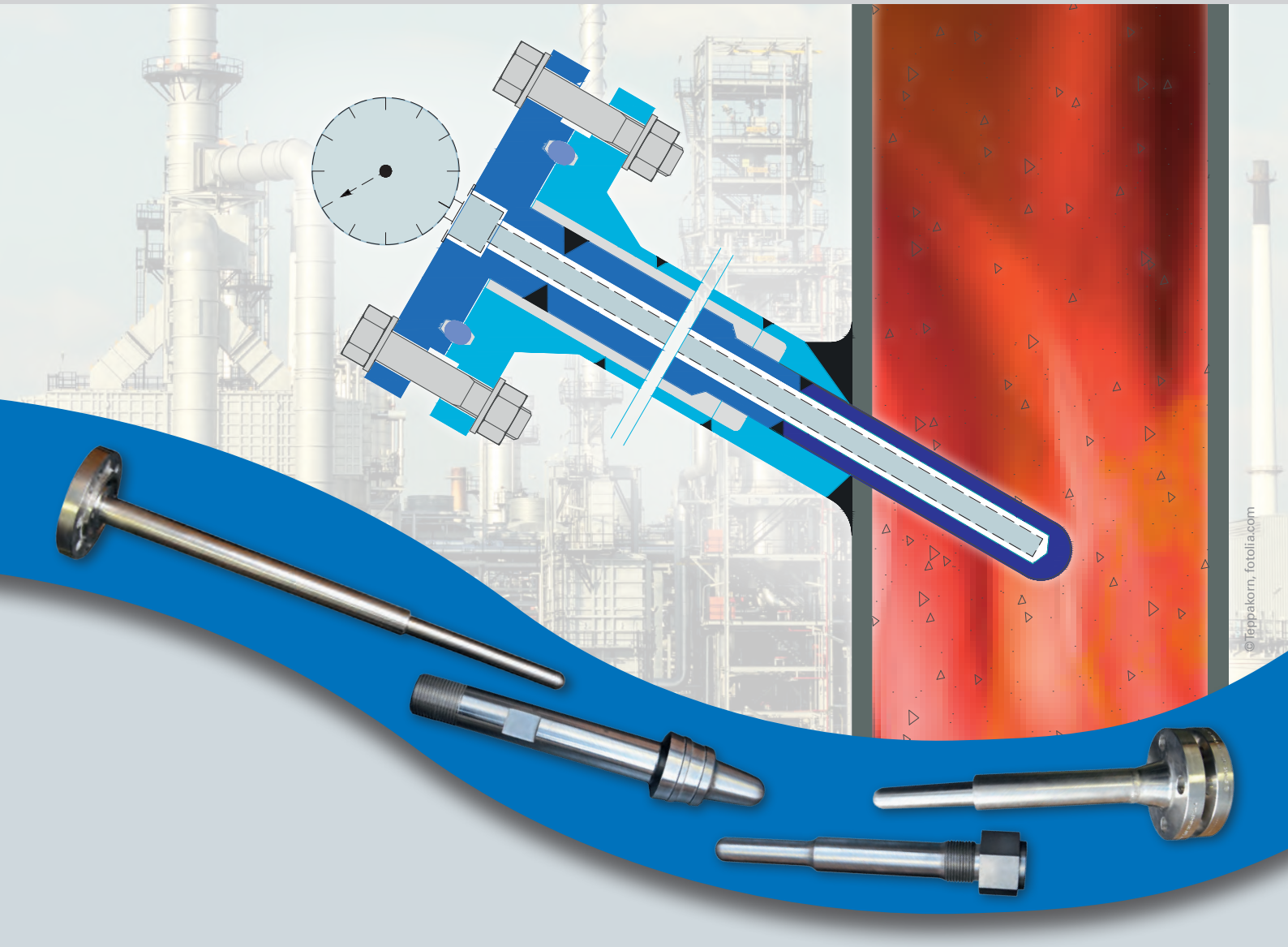
THERMOWELL AND PIPE FITTINGS

For most extreme requirements in the chemical and petrochemical industries



Schumacher
Verfahrenstechnik GmbH
Ein Unternehmen der Schumacher Gruppe

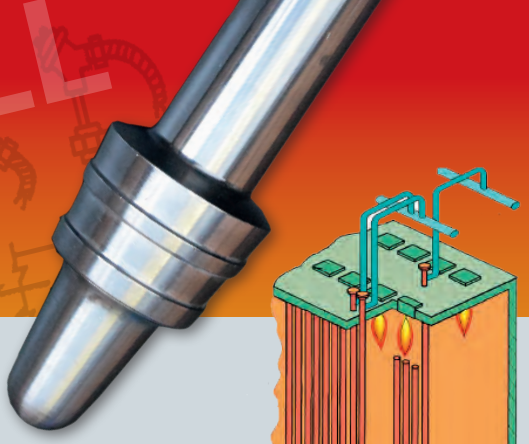
Thermowells – General Information

Temperatures must be measured in all industrial areas. In most cases, however, the thermometer can ot be fed directly into the appropriate medium but must be protected against the following conditions:

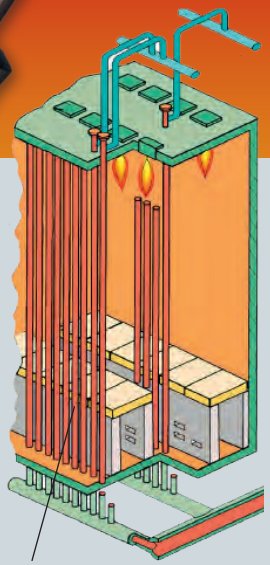
- Extremely high temperatures
- Highly aggressive media
- Extreme pressures
- Extreme flow velocities
- High particle loading (abrasion / erosion)

In order to ensure as precise a measurement accuracy as possible with correspondingly short response times, the thermal protection tube material must have an optimum thermal conductivity with simultaneous resistance to the stated conditions.

In this design, as well as its implementation, you will find one of our core competences.



Thermowell tip made of cobald based material



Schematic drawing of a reformer furnace. In order to use the thermocouples from the outside and to place the sensitive measuring electronics as far as possible from the extreme conditions in the furnace interior, thermal protection tubes made of several individual components welded together are used.

Such conditions (temperature, abrasion, pressure and chemical corrosion) make extreme demands on the thermowell, the service life of which is of enormous importance. Steamcrackers and similar systems are among the most complex and expensive installations. In the petrochemical industry, therefore, the thermowell must be designed with a service life such that it is absolutely necessary to avoid any unscheduled shutdown (downtime) of the furnace.
Thermowells for this purpose are our main area of application.

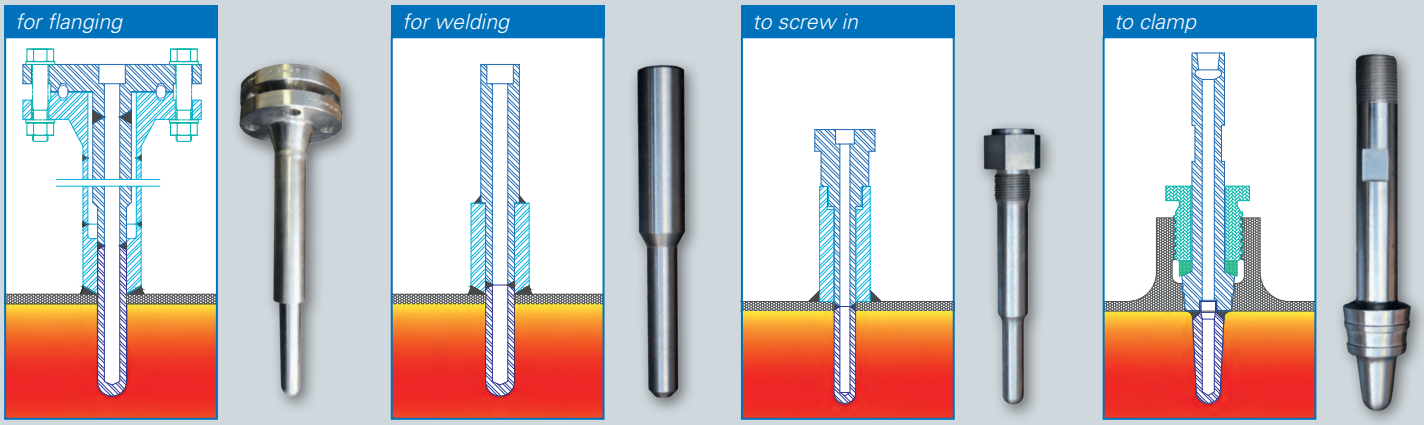
Thermowells in petrochemical cracking plants

For more than 25 years, we have been one of the leading manufacturers in the field of thermowells for extreme process conditions, such as those found in petrochemical steam facilities (steam crackers, steam reformers, etc.).

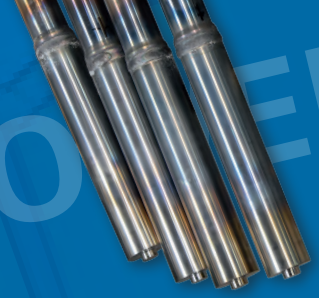
The temperatures inside such plants can each up to 1,400°C. The reformer tubes in the furnace are also flowed through with synthetic gases at velocities close to the speed of sound. In addition, they are enriched with solid particles.

View into the interior of a „cracker“ or „steam reformer“, which is required for petrochemical vaporization. On the right and left are the reformer tubes, which are filled with a catalyst and flowed from top to bottom through the synthesis gas at high speed with the addition of water vapor. With this, the basic materials for many plastics are produced, among other things. In this process, the temperatures must be measured. High performance thermowells, as manufactured by us, are indispensable for this purpose.

Thermowells:



MULTI-PART THERMOWELLS

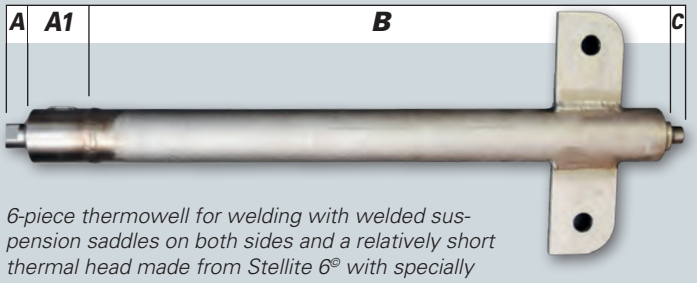


Multi-part thermowells made from various special materials

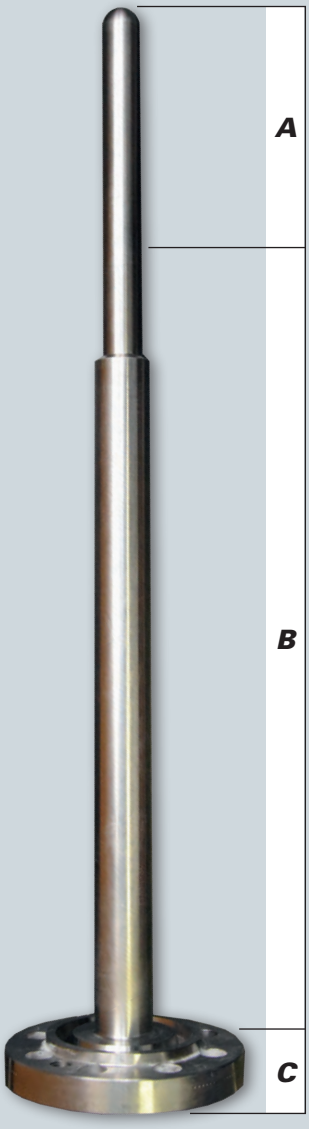
Since extreme conditions are primarily only present in the actual process, it makes sense to design only this area in the corresponding high-performance materials.

The often long way to the flange or threaded connection can be implemented in many cases from other materials. Different temperature zones and chemical-physical boundary conditions of the application areas require the use of different, suitable materials. The actual design of the thermowell is a result of the individual conditions on site: immersion depth, medium, temperature, measuring principle, flow velocity, etc.

We take over the design and calculation, and the construction as well as the complete production on our own machines up to final acceptance.



6-piece thermowell for welding with welded suspension saddles on both sides and a relatively short thermal head made from Stellite 6© with specially designed flow geometry (only this part is involved in the actual process). A short transition piece made of high temperature material 1.4852, the thermowell tube made of Alloy800© as well as a threaded connection from 1.4571 / 316Ti. The wire pin serves as a marking for the correct mounting position.



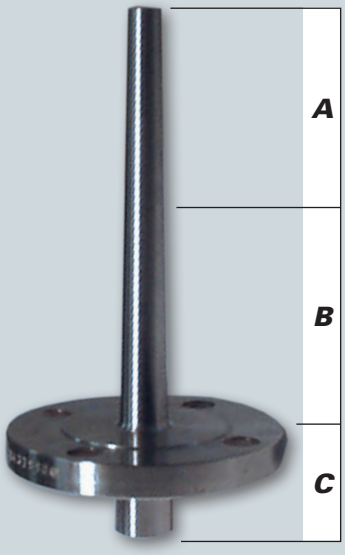
A *Thermowell tip made of cobald based material (Stellite© 1, 6, 12 or similar)*

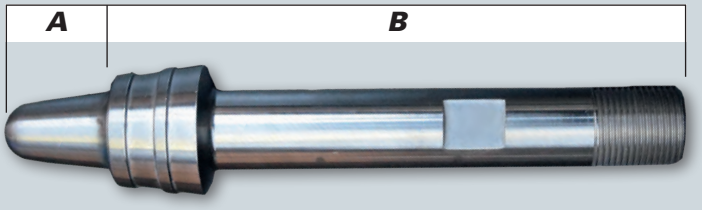
A1 *Transition piece made of high temperature material (1.4852 or similar)*

B *Thermowell pipe (shaft) made of nickel based material (Alloy800H©/HT© or similar)*

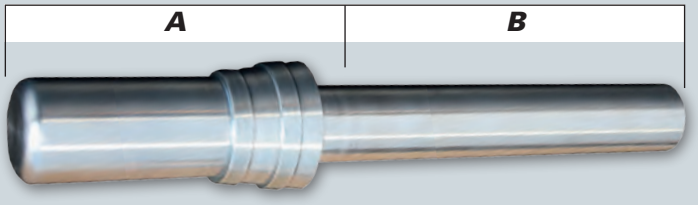
C *Flange, thread connection or similar made of CrNiMo steel (304(H/L), 310(H/L), 316(L/Ti), 321(H/L) or similar)*

Three-piece thermowell with welded, conical probe tip from Stellite 6©.





Two-part thermowell, welded thermal tip made from Stellite 6 ©. It is sealed by a cone and pressed into a corresponding cone with a pressure screw.

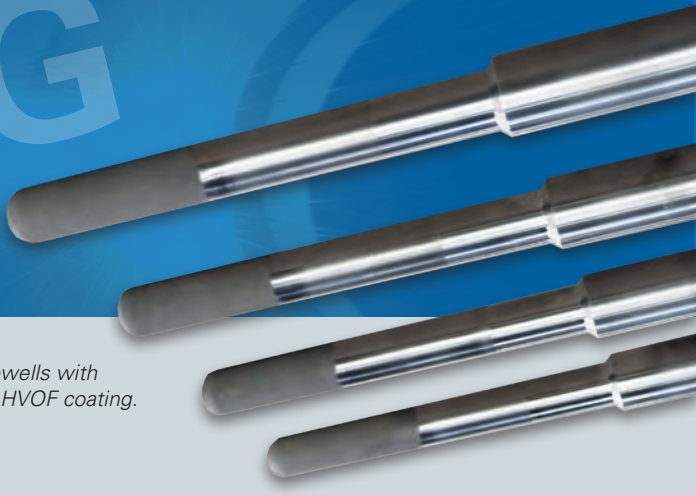


wo-part thermowell, complete thermal tip made from Stellite 12 ©. This allows a further increase in the service life at even higher application temperatures.

Of course, we also manufacture spare parts or re-orders according to customer specifications. Thermal protection tubes can consist, for example, of six or more mutually welded individual components of different materials and have a total length of up to 3,000 mm.

Our protective tubes / thermowells are designed and manufactured to meet your individual needs and requirements.

COATING



Thermowells with applied HVOF coating.

Coated thermowells

Coatings are used in many areas of the chemical and petrochemical industry. The most important distinction here is whether the coating is intended primarily to counteract wear protection, ie abrasion by particles, or to have the highest possible chemical resistance.

Coatings as wear protection / protection against abrasion:

If a coating is intended primarily to counteract the effect of abrasion, high velocity oxygen fuel (HVOF) spraying is used nowadays - as is the case in our company.

The layers produced with this method have a substantially lower porosity as well as higher adhesive strengths than in conventional powder flame spraying / plasma spraying.

Coating by means of plating / welding (WIG - GTAW)

A further possibility of applying coatings to increase the service life is reinforcement by means of deposition welding.

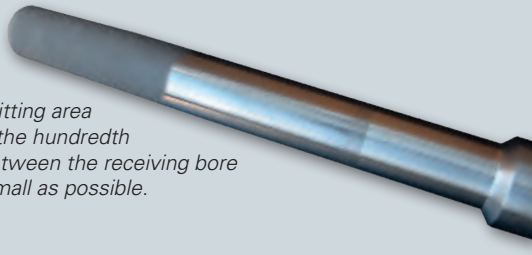
In this case, the desired material is applied by means of a welding filler material (for example, stellites) to the thermal tip involved in the process. As a result, much larger layer thicknesses can be applied and worn out thermal tips can be once again made serviceable.

After the plating, the plate layer is mechanically finished (stripped) and polished, so that the finished surface no longer differs from a new, uncoated tip.

HQV - flame spraying process: here a flame with a high temperature and an extreme exit velocity is generated with a special HQV burner. By means of the injection principle, the corresponding coating material is „sucked", heated and brought to the correspondingly prepared surface of the thermowell at this high speed. As a result, the coating material immediately establishes a firm bonding with the base material.

Thermowell tip with applied plating (GTAW) Stellite 1 © before processing.

The same thermowell tip after processing. There is no difference to a new, uncoated tip.



Thermowell tip with applied coating after the cylindrical grinding. The fitting area is ground to precision in the hundredth range to keep the gap between the receiving bore and the thermowell as small as possible.

Excerpt of the most common coatings for both processes:

Procedures	Base	Brandname	Co	Ni	Cr	W	C	Hardness	Thickness
HVOF	Chromcarbide	JK 7184©		20%	Base		9,70%	58-65 HRC	App. 0,30 mm
HVOF	Tungstencarbide	JK 7125©		6%	20%	Base	9,70%	58-65 HRC	App. 0,30 mm
HVOF	Cobalt	JK 7201© - Stellite 1©	Base		30%	12%	2,50%	53-55 HRC	App. 0,30 mm
HVOF	Cobalt	JK 7212© - Stellite 12©	Base		29,5%	8%	1,40%	46-48 HRC	App. 0,30 mm
WIG GTAW	Cobalt	Stellite 1©	Base	<3%	32%	12%	2,50%	51-56 HRC	App. 3,00 mm
WIG GTAW	Cobalt	Stellite 6©	Base	<3%	30%	5%	1,20%	40-45 HRC	App. 3,00 mm
WIG GTAW	Cobalt	Stellite 12©	Base	<3%	30%	8%	1,55%	46-51 HRC	App. 3,00 mm

SPECIAL DESIGNS

Coatings to increase chemical resistance:

With many highly aggressive media, such as acids, alkalis, salt solutions, organic solvents or similar, whose chemical aggressiveness is generally enhanced by elevated temperatures and temperature changes, even highly alloyed special materials can reach their limits. Here, a coating with correspondingly stable materials, such as PTFE, is the first choice. PTFE (polytetrafluoroethylene) is a fully fluorinated polymer (known under the trade name Teflon®) which is extremely reactive. This means that even the most aggressive acids cannot attack this coating. The reason for this is the particularly strong atomic bonding between carbon and fluorine. Add to this the well-known, excellent gliding properties. PTFE is almost completely unwettable, as a result of which – as in the case of the soldering effect – liquids slide off this coating. Compared to other plastics, PTFE also has a very high temperature resistance. For example, the temperature application range is from -200 °C to + 260 °C (even up to 300 °C for shorter durations).

PTFE is available in various designs and alloys, which also influence the electrical conductivity. This makes PTFE the most widely used coating in the chemical industry.

We are able to coat all protective tubes with special materials to improve certain chemical or physical properties and to extend their service life.

Protection tube made of normal CS steel, with a protective cover (liner) made from PTFE.

Tantalum thermal protection tubes or other high temperature materials

A further example of special designs are protective tubes with a thermal tip made of tantalum. Tantalum has an extremely high resistance to chemical substances of all kinds, since it is naturally coated with a dense layer of oxide. There are very few inorganic substances with which tantalum reacts at room temperature. Due to the extremely high cost of tantalum, entire protective tubes made of tantalum are almost never produced, instead only the immersion area. It is also possible to coat only specific areas or to coat or make a protective tube / liner.

Thermocouples / Temperature Pads

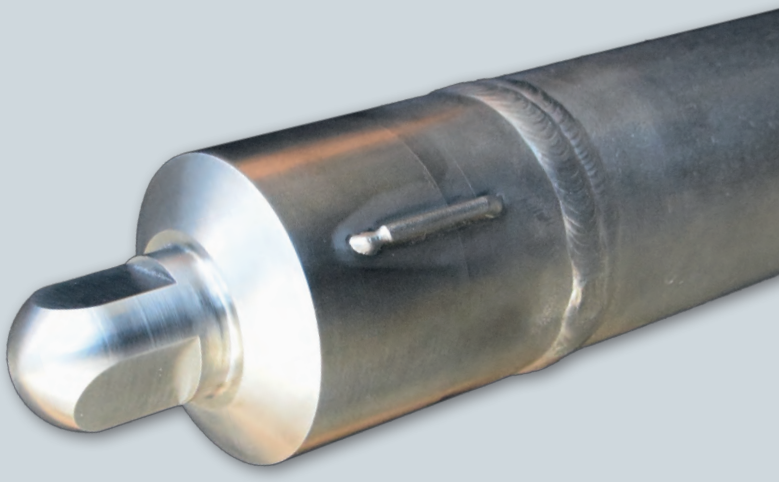
These special thermosensitive elements for indirectly operating temperature sensors are welded onto the outer surface of the pipe.

By means of this type of temperature measurement, conclusions can be drawn about the internal state of the process tubes.

Thus, for example, coking can be determined early.

Special flow geometries

The higher the flow velocities in a pipeline, the more quickly undesired turbulence occurs. Since turbulence cannot be precisely calculated, predicted, and is difficult to avoid, it is often necessary to construct the correspondingly necessary fittings in pipelines in such a way that they counteract the undesirable turbulence, or at least produce no additional turbulence. Since the turbulence and the accompanying abrasion damage not only the pipe wall but also the built-in components - in this case the thermowell - these special geometries are of course also intended to help reduce damage.



Complete lower section of a thermowell with a special flow geometry. The welded wire pin is only used as a marking for installation. Thermowells in this version may only be used in the pipeline in a certain direction. A „service life extension" by turning through 180° in the direction of flow is not possible with this design.

Schumacher Verfahrenstechnik GmbH

Ein Unternehmen der Schumacher Gruppe

One of our production centers with administrative building in Wiehl.

We are not a trading company, but a manufacturer with all the necessary certification and qualified technical design personnel as well as an enormous production capability using our own production facilities.

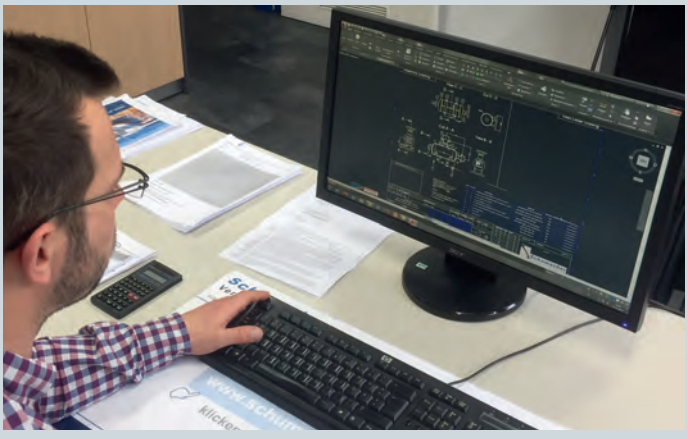
We also stock finished parts and fittings such as flanges, tubes, weldolets, latrolets, sockolets, screw joints, seals and similar parts in various materials.

Entrance with reception on the first floor

A view into our mechanical manufacturing.

If so desired, we undertake the design, calculation, construction and the complete production using our own machines at our site in Wiehl.

Parts which we do not have in stock, we procure at short notice or make them quickly and with minimal compli-catios from raw stock parts on our machines. Due to the immediate proximity to several stockists of special materials, we can also procure the most exotic of special materials very quickly, meaning the shortest possible delivery times can be achieved.
We stock most raw materials in the most common standard and special materials, such as Alloy 800H / HT©, Hastelloy©, Inconel©, Stellite©, Superduplex steels, high temperature materials, as well as plastics such as PTFE, PVDF, ETFE.



A construction engineer at work

One of our extensive raw material storage areas.

Design, construction and manufacture

In manufacturing, we use a wide range of our own raw material stock with rod material, pipes, sheets, etc. from all common stainless steels and special materials.

TESTS ACCEPTANCE

Tests, acceptance and approval

We ensure the full traceability of all protective tubes from our company, via batch and serial numbers, as well as drawing and article number.

Postmarking certificates as well as supporting documents for tests and material proofing are part of our standard documentation.

Piping part during pressure testing.

We perform the following tests:

- Hydrostatic pressure tests up to 1000 bar internal + external pressure testing
- Ultrasonic examination (UT testing)
- PT (FE) test (color penetration testing)
- Magnetic powder test (MT testing)
- Leak testing (LT testing helium / leak testing)
- X-ray examination / transmission test (RT test / X-Ray)
- PMI (Positive Material Identification) testing (Material Interchange Test)
- Visual examination / endoscopy (VT examination)
- Hardness test according to Brinell, Vickers or Rockwell

We are certified for:

- QM system acc. EN ISO 9001
- Welding compartment operation acc. EN 729-1
- Pressure equipment approval acc. DGRL AD 2000 HP0
- Manufacturer approval acc. DGRL Cat .: II – Module A2
- Weighing technology approval acc. DIN 2303
- Transfer authorization according to EN 10204 3.1
- ASME Code Section VIII Div. 1 / U - Stamp - currently still in the auditing phase *

** The auditing and approval of the ASME (American Society of Mechanical Engineers) acc. Section VIII, Div. 1, 2 and 3 has been proposed and planned for September 2017. After successful completion, we then, as one of very few manufacturers, have the right to design and manufacture pressure vessels and pressure-conducting pipeline parts according to this standard, and to stamp them with the corresponding U-stamp: U or U2.*

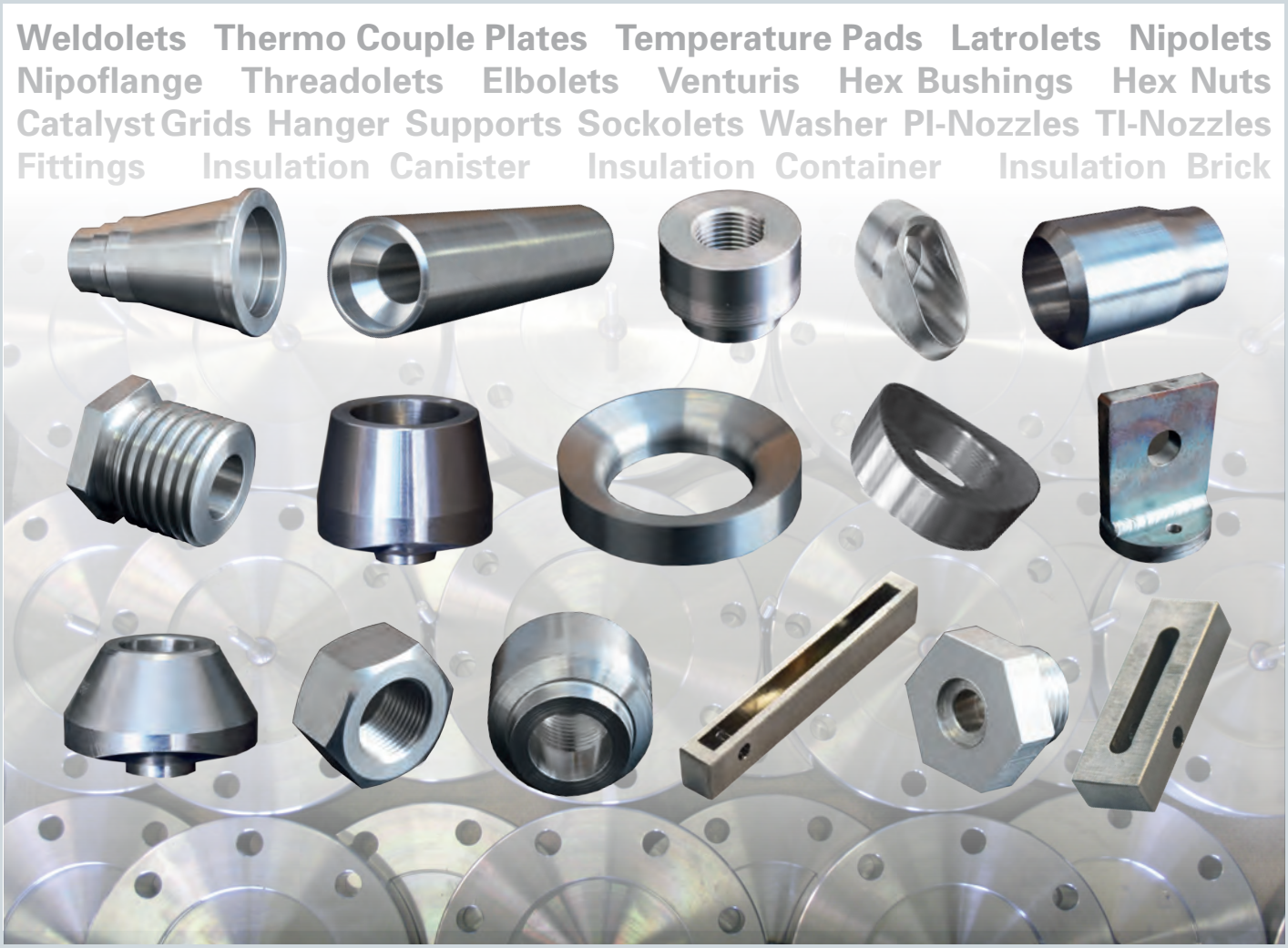
The following certificates can be obtained from us:

- WAZ EN 10204 3.1
- WAZ EN 10204 3.2 (TÜV / Lloyds, LRS, Germanischer Lloyds etc.)
- Restamping certificate
- Pressure test certificate acc. EN or ASME
- X-ray reports acc. EN or ASME
- Certificates acc. NACE MR0175, etc.
- Test certificates on all the test methods referred to
- Certificates / documentation on WPS, WPQR, WPQS, etc.

ACCESSORIES FOR THE DISCERNING PIPELINE CONSTRUCTION

Accessories

It goes without saying that you'll get not only the thermowell, but also all the components and fittings related to the apparatus and pipeline construction of the chemical and petrochemical industries. Due to our production capability, we can produce almost any required component from the desired material at short notice and even from scratch. In particular, pipeline parts for extremely critical areas, such as reformers and crackers, are part of our core business. Here are some examples and products which we can stock, manufacture at short notice or procure.



Schumacher
Verfahrenstechnik GmbH
Ein Unternehmen der Schumacher Gruppe

Schumacher Verfahrenstechnik GmbH I Albert-Einstein-Straße 4 I 51674 Wiehl I GERMANY
Tel.: +49 (0) 22 61 - 5 46 62-0 I Fax: +49 (0) 22 61 - 5 46 62-10 I E-Mail: info@schumacher-vt.de I www.schumacher-vt.de