

Pressure | Temperature | Level | Flow | Calibration

# Nuclear power generation





# About us

As a family-run business acting globally, with over 9,300 highly qualified employees, the WIKA group of companies is a worldwide leader in pressure and temperature measurement. The company also sets the standard in the measurement of level and flow, and in calibration technology.

Founded in 1946, WIKA is today a strong and reliable partner for all the requirements of industrial measurement technology, thanks to a broad portfolio of high-precision instruments and comprehensive services.

With manufacturing locations around the globe, WIKA ensures flexibility and the highest delivery performance. Every year, over 50 million quality products, both standard and customer-specific solutions, are delivered in batches of 1 to over 10,000 units.

With numerous wholly owned subsidiaries and partners, WIKA competently and reliably supports its customers worldwide. Our experienced engineers and sales experts are your competent and dependable contacts locally.

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# WIKA – Your partner in nuclear power generation

In many systems within a nuclear power plant, both in the primary and also the secondary circuits, not only are pressure, temperature and level measuring instruments from WIKA used, but also their primary flow elements are too.

Due to the extremely strict safety standards, the demands on measurement technology are very high. Electronic, mechatronic and mechanical measuring instruments for pressure, temperature, level and flow must prove themselves in many different tests (vibration, radioactivity, ageing, ...) before they can be installed in nuclear plants. Our instruments conform to even the highest demands of safety and functionality (1E, K1, LOCA).

WIKA offers you a large selection of field instrumentation which specifically meets your requirements.

Individually tailored advice and proposals, to match solutions to your needs, supplement our extensive offering of services and products.

Our expertise and dependability, in addition to our worldwide sales and service network, has made WIKA a global contracting partner with many large international projects in the area of new builds of nuclear power plants or the refurbishment of existing plants.

# All around the world – Close to the customer

With manufacturing locations around the globe, we ensure the highest flexibility and delivery performance. Some WIKA manufacturing locations:

Germany (HQ), Australia, Brazil, Canada, China, India, Italy, Korea, Malaysia, Poland, Russia, Singapore, Switzerland, South Africa and USA











Proximity to our customers is essential for efficient solutions. Whether standard products or custom designs: Working with you we'll find the right concepts for your requirements.

To meet this demand wherever it arises, we are a strong group of companies with a worldwide presence through our wholly-owned subsidiaries. Our experienced engineers and sales specialists are your competent and reliable contacts locally. They know the country-specific conditions, standards and applications, and will dedicate the time for your individual requirements.

Thus, around the world you have access to our unique know-how and product range. Whether you have a need for a sensor qualified in accordance with KTA, IEEE or RCC, whether you require specific vibration or radiation testing, whether you want to measure up to 0.5 mbar or up to 700 bar, whether you want to monitor a continuous level in a spent fuel pool or monitor a limit level, or record a flow through an orifice plate, Venturi or a pitot tube:

For each application and requirement, we offer the right solution for you.



# Safety in the event of failure

After the Fukushima reactor disaster, the safety procedures in nuclear plants have once again been questioned the world over, particularly whether their resistance to natural disasters is sufficient.

As a result of this, the whole safety infrastructure of nuclear power plants and their design have been reevaluated. The analyses have, among other things, shown that the monitoring systems for cooling ponds for beyond-design events must be improved. Through the consideration of new failure scenarios, the safety standards and, with that, the requirements on the measurement technology have been increased.

Thanks to some new developments and enhancements, very high manufacturing standards and proven measurement technology know-how, many products from the WIKA portfolio meet these requirements and can today be used in all new-build projects, and also for the modernisation of existing plants.

# Tailor-made solutions and the highest demands on quality

Measuring instruments for the monitoring of levels and temperatures in the processes of a nuclear power plant are used before, during and after a severe accident. These therefore deliver essential information on the actual status of the parameters in the containment – even if other sensors in the vicinity have failed.

#### **Continuous level measurement**

#### **Normal operation**

Operating temperature: 70 °C

Operating pressure: atm.

■ Humidity: 100 %

■ Operational radiation dose: ≤ 160 kGy

#### Operation in the event of failure

- Temperature in the event of failure: 208 °C (short-term temperature rise to 250 °C possible)
- Pressure in the event of failure: to 10 bar abs.
- Operation under failure conditions: 1 year
- Radiation dose in the event of failure: 5.05 MGy cumulative
- Seismic acceleration: to 5 g

# **Applications**

- Reactor cooling systems
- Reactor containment vessels
- Safety cooling systems
- Leak monitoring



#### Qualification

- KTA 3505 (severe accident conditions up to 5 MGy)
- НП-001-97 2НУ
- HΠ-031-01 Cat. 1
- NP-001-97-2NU
- NP-031-01 category 1

- Olkiluoto 3 (Finland)
- Goesgen (Switzerland)
- Hamaoka 4 (Japan)
- Ostrovets 1 (Belarus)



# **Temperature probes**

#### **Normal operation**

- Operating temperature: 0 ... 450 °C
- Humidity: 75 %
- Operational radiation dose: ≤ 50 kGy
- Response time without thermowell: from ≤ 3.6 sec.

#### Operation in the event of failure

- Temperature in the event of failure: 156 °C
- Humidity: 100 %
- Radiation dose in the event of failure: up to 400 kGy cumulative
- Seismic acceleration: to 5 g

# Applications Primary coolant pipes Emergency cooling and residual heat removal systems Cooling pond cooling systems

#### Qualification

KTA 3505

- Trillo (Spain)
- Taishan (China)
- Tianwan (China)
- Olkiluoto 1&2 (Finland)



# **Classified instrumentation**

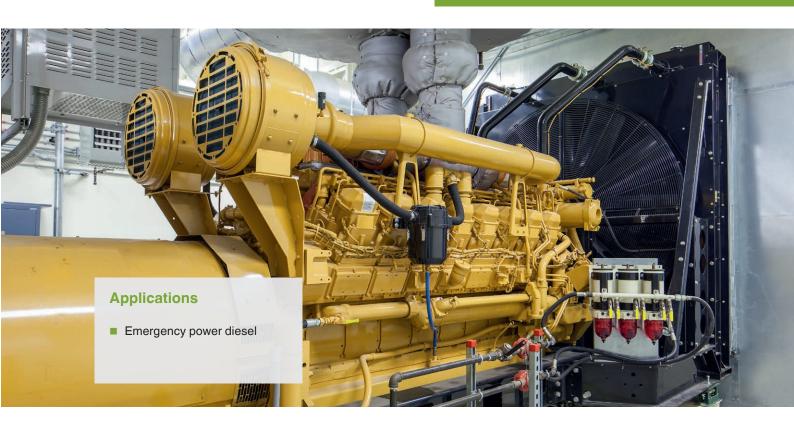
As a result of the reevaluation of the accident scenarios, modification measures on the components of the safety systems (e.g. the emergency power diesel generators) and also on systems in the secondary circuit in the power house could be required.

Here the name of WIKA also stands for reliability and competence; in product manufacture as well as in the consultancy, planning and design of measuring requirements.









# Temperature measuring instruments, temperature switches and thermowells







# Pressure measuring instruments and pressure switches









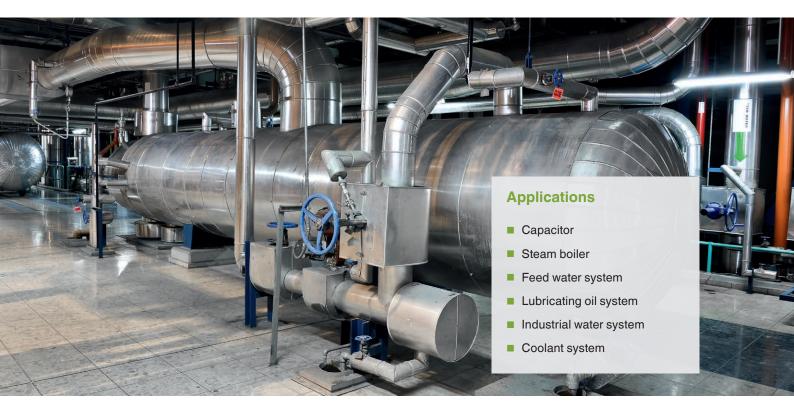




#### Qualification

■ IEEE 323/344 – 1E

- Leningrad 2 (Russia)
- Olkiluoto 1 and 2 (Finland)



# **Level measuring instruments**

- Bypass level indicators
- Reed sensors
- Magnetic switches



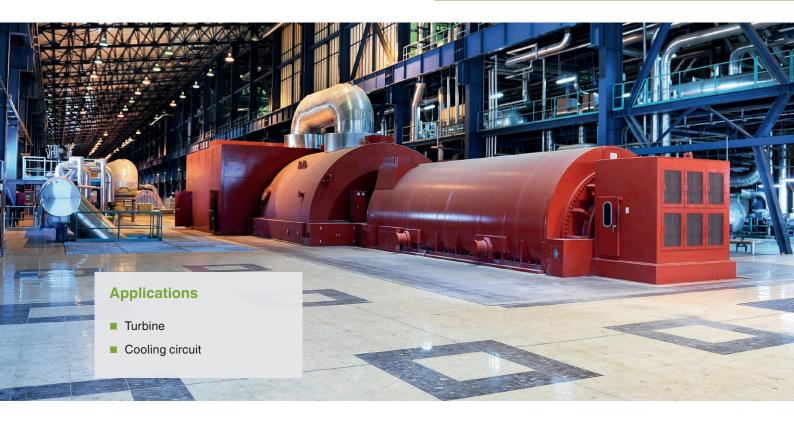
■ Magnetic float switches



# Qualification

- IEEE 323/344 1E
- RCC-E

- Leningrad II (Russia)
- Taishan I+II (China)
- Mochovce 3+4 (Slovakia)
- Olkiluoto 1 and 2 (Finland)



# **Pressure measuring instruments**









# **Surface temperature probes**



#### Qualification

- RCC NC
- SC1 (I)
- IEEE 323/344 –1E

# Reference

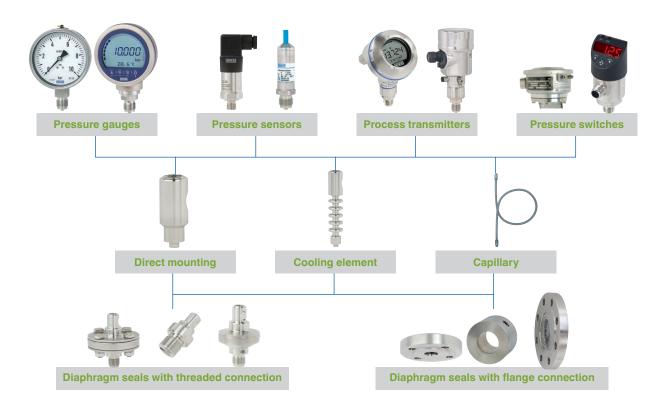
- Yangjiang 5+6 (China)
- Fangchenggang 3&4 (China)
- Fuqing 5&6 (China)
- Hongyanhe 5&6 (China)

- Olkiluoto 1&2 (Finland)
- Olkiluoto 3 (Finland)
- Tihange 1,2,3 (Belgium)
- Leningrad II (Russia)

#### **Diaphragm seal systems**

By using diaphragm seals, it is possible to adapt pressure gauges, , process transmitters, pressure switches or pressure sensors to even the most difficult of conditions in the nuclear power industry. A diaphragm made of the appropriate material separates the medium from the measuring instrument. Mounting may be made via a direct connection, a cooling element or a capillary.

The internal space between the diaphragm and the pressure measuring instrument is completely filled with a system fill fluid matched to the process. In order to be able to cope with a wide variety of radiation loads, there are various system fill fluids to choose from. For the diaphragm seals, test certificates and approvals for special applications can be supplied.

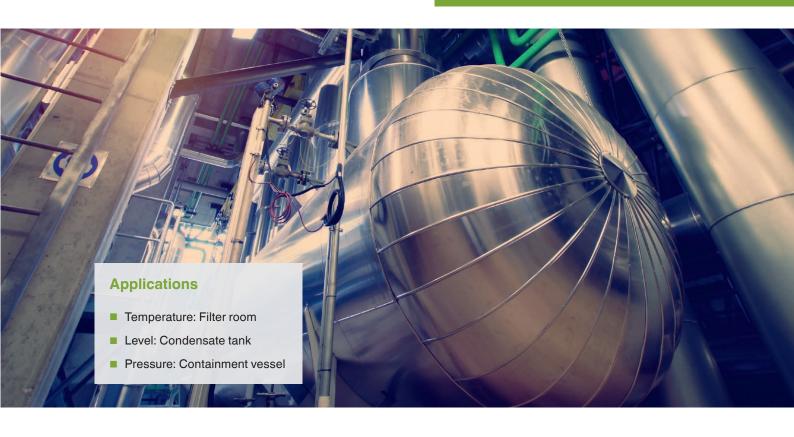


# The realisation of your individual solution



Create your perfect diaphragm seal solution together with us. From the wide variety of realisable combinations, our technology experts will find a proven solution for your application. As required, we will adapt our systems to your individual application.

Talk to us – we are happy to provide you with advice!



# Filtered containment pressure relief

A core meltdown may cause damage to the reactor containment vessel due to overpressure. This overpressure is caused by the decay heat in the containment vessel and must be limited.

To achieve this, "filtered containment pressure relief systems" are used. Specifically for these applications, different diaphragm seal systems are used.









#### Qualification

■ SC 1 (F)

#### Reference

■ Tractebel (Belgium)



# Unclassified instrumentation

Our portfolio for primary flow elements includes orifice plates, meter runs, flow nozzles, Venturi tubes and averaging pitot tubes. With our extensive product range we are in a position to cover almost all applications within power plants.

As a result of our many years of experience, we can develop customised solutions to meet your specific needs.





#### **Calibration**

For many customers, the accuracy of the measurement is a key criterion. Often, a best-in-class measurement is required in terms of the accuracy, the precision and the reproducibility. With this we will support you during the entire planning and manufacturing – our focus is the best solution for your project, the guarantee of high quality and a calibration certificate in accordance with ASME PTC6, ISPESL and IBR standards.

# Venturi tubes



# Orifice plates



# **Meter runs**



# **Averaging pitot tubes**



# Flow nozzles



## Reference

■ EDF Heysham (UK)



#### Instrumentation valves and accessories

Very often, pressure measuring instruments are installed in combination with valves to enable an easy separation from the process for recalibration or replacement.

WIKA offers a wide range of valves, valve manifolds and monoflanges, which can perform shut-off, venting and compensating functions.

A variety of sizes and connection types, such as NPT, G and IEC connection, and also mounting brackets for wall or pipe mounting are available.

#### **Instrumentation valves**







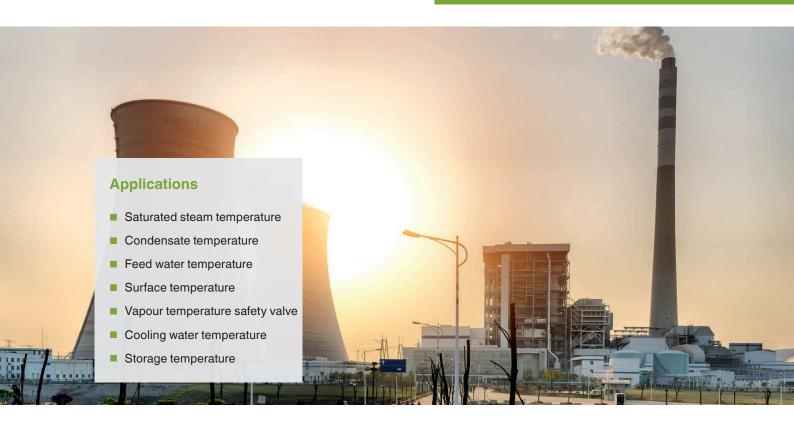


## **Protective devices**









## **Electrical temperature monitoring**

Within the nuclear power plant industry, the monitoring of temperature plays an important role. This measurement technology is used in all systems, whether for conventional industries or also for the nuclear industry. Alongside the safety-relevant applications, WIKA can cover almost any application with its sensors and transmitters.



## **Temperature transmitters**





# References



#### **References in Europe**

- Brunsbüttel project (Germany)
- Brokdorf project (Germany)
- Biblis project (Germany)
- Loviisa project (Finland)
- Olkiluoto project (Finland)
- Oskarsham project (Sweden)
- Ringhals project (Sweden)
- Forsmark project (Sweden)
- Gösgen project (Switzerland)
- Mochovce project (Slovakia)
- Bohunice project (Slovakia)
- Leningrad project (Russia)
- Dukovany project (Czech Republic)
- Temelin project (Czech Republic)
- Paks project (Hungary)
- Borssele project (Netherlands)
- Trillo project (Spain)
- Tihange project (Belgium)
- Ostrovets project (Belarus)

# References in America



- Vogtle project (USA)
- VC Summer project (USA)
- Atucha project (Argentina)
- Angra project (Brazil)

## **References in Asia**



- Qinshan project (China)
- Ling Ao project (China)
- Ningde project (China)
- Hongyanhe project (China)
- Fuging project (China)
- Yangijang project (China)
- Fangchenggang project (China)
- Taishan project (China)
- Tianwan project (China)
- Hamaoka project (Japan)

#### **References in Africa**

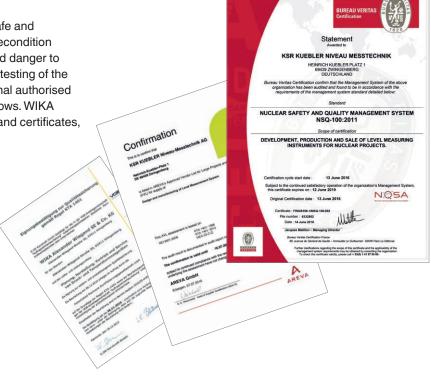


■ Koeberg project (South Africa)

# Global safety requirements

#### International approvals/certificates

High-quality components are essential for safe and reliable production processes. They are a precondition for highly efficient processes, helping to avoid danger to people, environment and property. Rigorous testing of the instruments used, by national and international authorised bodies, results in reliability and stable workflows. WIKA instruments offer a wide range of approvals and certificates, worldwide.



#### **IEEE 323/344**

In this standard, the demands on the measurement technology and its interfaces for a qualification of class 1E in nuclear power plants are defined and specified.

#### **NSQ-100**

NSQ-100 is an international standard with demands on quality management for suppliers to nuclear power plants. This is based on ISO 9001:2008, however, with consideration also to the relevant requirements of IAEA (GS-R-3:2006) and ASME (NQA-1-2008).

#### **KTA 3505**

This regulation is to be used for the type testing of measuring instruments of safety control technology in accordance with KTA 3501, which carry out measurement and control functions in accordance with class A DIN IEC 61226.

#### **RCC**

RCC includes the regulations for the design and engineering of mechanical and electrical components for the nuclear elements of power plants with pressurised-water reactors. This is based on international standards and conforms to the requirements of the IAEA.

# **Services**





Customer support

Feasibility studies, engineering, customer-specific solutions and training, qualification and documentation, support during installation, tools and assemblies for transport, installation and maintenance of the instruments – all from one source.

# Comprehensive in-house testing or in co-operation with certified laboratories

- Liquid penetrant inspection
- Magnetic particle inspection
- Radiographic testing
- Hydrostatic pressure test
- Ultrasonic test
- Positive material test
- Calibration



LOCA test (loss-of-coolant accident test)



Seismic test



Functional check

# Replacement service for diaphragm seal systems

WIKA diaphragm seal systems mounted with process transmitters from WIKA and all well-known manufacturers are recognised and valued internationally. The optimal diaphragm seal designs, materials and filling media are available for the most difficult measuring requirements and for each application.

By using diaphragm seals, the measuring instruments can be used at extreme temperatures from -90 to +400  $^{\circ}$ C and with aggressive, corrosive, heterogeneous, abrasive, highly viscous or toxic media.

The special materials and coatings employed by WIKA ensure a long service life for the diaphragm seal. However, we do recommend having regular service intervals, depending on the media used, at which the diaphragm seal can be replaced.

In this way, in addition to cost savings, you also create the certainty of being able to continue producing with the latest technology. With a preventative replacement, scheduled in line with planned shut-downs to your plant, you can reduce downtimes.



# Advantages of our replacement service

Only in rare cases must defective diaphragm seal systems be replaced completely. With the testing and replacement, WIKA offers you a service package with clear cost savings through the further utilisation of your existing process transmitter.

# **Further advantages**

- New calibration of the system
- Hydrostatic pressure test for differential pressure
- Current material certificate
- Current approvals, e.g. for power plants
- State-of-the-art weld seam at the system (AD 2000)



# Calibration technology

#### From individual components ...

WIKA is the ideal partner for solutions in calibration technology, whether a single service instrument is required quickly on site, or whether a fully automated calibration system needs to be designed for the laboratory or production.

We are able to offer an appropriate solution for each application. In relation to the measuring task and the measurands, the following product matrix will assist you.



# Portable pressure generation

Test pumps serve as pressure generators for the testing of mechanical and electronic pressure measuring instruments through comparative measurements. These pressure tests can take place in the laboratory or workshop, or on site at the measuring point.



#### **Measuring components**

High-accuracy pressure sensors and very stable standard thermometers are ideal for applications as references in industrial laboratories. Due to their analogue or digital interfaces, they can be connected to existing evaluation instruments.



#### Hand-helds, calibrators

Our hand-held measuring instruments (process tools) offer a simple capability for measurement or simulation of all established measurands on site. They can be operated with a wide variety of pressure sensors or thermometers.





#### Digitally indicating precision measuring instruments

High-accuracy digital precision measuring instruments are ideal for applications as reference standards in industrial laboratories, enabling high-accuracy calibration. They feature exceptionally simple handling and an extensive range of functionality.



#### Digital precision instruments and controllers

Due to their integrated controller, these instruments offer exceptional convenience. Typically, a fully automated setting of the required value can be done via the interface.



# Fully automated calibration systems as complete solu-

Fully automated calibration systems are customer-specific, turnkey installations which can be fitted in laboratories as well as in the production environment. With integrated reference instruments and calibration software, calibration certificates can be generated and archived in a simple and reproducible way.

■ Pressure ■ Temperature

■ Current, voltage, resistance



# **Calibration services**

Our calibration laboratories have been calibrated for pressure and temperature for over 30 years. Since 2014, our calibration laboratory has also been accredited for the electrical measurands DC current, DC voltage and DC resistance. Since 2017, the factory calibration for length measuring instruments has been expanding our portfolio.

- ISO 9001 certified
- DKD/DAkkS accredited (in accordance with DIN EN ISO/ IEC 17025)
- Co-operation in the DKD/DAkkS working groups
- Over 60 years of experience in pressure and temperature measurement
- Highly qualified, individually trained personnel
- Latest reference instruments with the highest accuracy

#### Manufacturer-independent calibration – fast and precise for ...

#### **Pressure**



- -1 bar ... +8,000 bar (to +9,500 bar possible with factory calibration)
- Calibration using working standards (precise electrical pressure measuring instruments) or high-accuracy reference standards (pressure balances)
- With an accuracy of 0.003 % ... 0.01 % of reading
- In accordance with the directives DIN EN 837, DAkkS-DKD-R 6-1 or EURAMET cg-3

#### **Temperature**



- -196 °C ... +1,200 °C
- Comparison calibration in calibration baths and tube furnaces with an accuracy of down to 1.5 mK
- Calibration at fixed points of ITS90 with the smallest possible measurement uncertainties
  - Triple point of mercury (-38.8344 °C)
  - Triple point of water (0.01 °C)
  - Melting point of gallium (29.7646 °C)
  - Solidification point of tin (231.928 °C)
  - Solidification point of zinc (419.527 °C)
  - Solidification point of aluminium (660.323 °C)
- In accordance with the appropriate DKD/DAkkS directives

#### Current, voltage, resistance



- DC current from 0 mA ... 100 mA
- DC voltage from 0 V ... 100 V
- $\blacksquare$  DC resistance from 0  $\Omega$  ... 10  $k\Omega$
- In accordance with the directives VDI/VDE/ DGO/DKD 2622

## Length



- Factory calibration within 10 working days
- Replacement of the measuring device if required
- Calibration of special-purpose gauges according to customer drawings
- Calibratable measuring devices
  - Caliper gauges to 800 mm
  - Testing pins to 100 mm
  - Ring gauges and plug gauges to 150 mm
  - Tapered thread gauges to 150 mm
  - Gauge blocks to 170 mm (also possible as a set)
  - others on request

## On site (pressure and temperature



In order to have the least possible impact on the production process, we offer you a time-saving, on-site DAkkS calibration throughout Germany.

- In our calibration van or on your workbench
- With a DAkkS accreditation for pressure from -1 bar ... +8,000 bar
  - with accuracies between 0.025 % and 0.1
     % of full scale for the standard used
- With a DAkkS accreditation for temperature from -55 °C ... +1,100 °C

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You can find further information here!

