

General information about NACE standards for sour gas applications with WIKA products

WIKA data sheet IN 00.21

General information

This technical information refers to two publications in the area of material requirements. Here MR stands for "Material Requirements".

- NACE ¹⁾ MR0175
"Petroleum and natural gas industries. Material for use in H₂S-containing environments in oil and gas production."
- NACE ¹⁾ MR0103
"Materials resistant to sulphide stress cracking in corrosive petroleum refining environments."
- Only for pressure gauges, pressure transmitters, diaphragm seals and thermowells



Fig. left: Bourdon tube pressure gauge model 232.30
Fig. right: Diaphragm seal, flange connection model 990.27

Description

Natural gas and crude oil, as raw materials, contain greater or lesser high levels of hydrogen sulphide (H₂S). If there is a minimum amount of H₂S and a minimum total pressure, such a mixture is recognised as "sour gas" or "sour oil".

Both standards describe the corrosion properties of metals in the presence of H₂S under different corrosion mechanisms. Firstly, hydrogen-induced stress cracking corrosion is considered. This is greatest at room temperature and is the focus of MR0103. A typical application for this standard is downstream processing in a refinery. Secondly, chlorine-induced stress cracking corrosion under the influence of H₂S is considered. This is aided at higher temperatures and is described by NACE MR0175. A typical application is the production of oil and gas.

The NACE MR0175 standard is represented in the ISO 15156 standard (part 1 - 3) internationally valid. This deals with technical issues regarding corrosion of materials during the extraction and processing of natural gas and crude oil. The ISO 15156 standard, Part 3, describes the use of corrosion-resistant metals and complies with to NACE MR0175.



Application example:
Pressure transmitter models E-10 and E-11



Thermowells in various design

1) The term "NACE" refers to an organisation (National Association of Corrosion Engineers), which primarily deals with any form of corrosion. The results of their work are published in many publications as NACE standards and updated regularly. The headquarters of this organisation is in Houston, Texas/USA.

NACE MR0175

NACE MR0175 (ISO 15156-3) describes, according to the application, for the various material groups, the relevant requirements for each individual material and the maximum permissible temperature limits. WIKA has sorted their products into the application "Instrumentation and control devices" and "Any equipment or component". Unless otherwise specified, this standard applies at WIKA.

NACE MR0103

This standard is similarly constructed and can also be implemented for WIKA products if a customer wishes. It defines the material requirements and temperature limits for applications in refineries.

Material selection

In sour gas applications, the corrosion properties of metals depend on the environmental conditions (pH value, chloride content, H₂S concentration and temperature limits) and the maximum strength of the materials. For different materials there are different strength requirements.

In accordance with the standard, ISO 15156-1/section 5 "General principles", it is the responsibility of the user to specify which material is suitable for the application.

With knowledge of the above-mentioned environmental conditions, WIKA can make recommendations on the selection of materials.

If the details of the environmental conditions are not adequately known, WIKA specifies the operating conditions for ISO 15156-3 under the assumption of critical environmental conditions.

On this basis, therefore, only the lowest maximum process temperature can be confirmed.

Example: For nickel-based alloys such as HC276, in a work-hardened condition, without knowledge of the environment conditions, a maximum temperature of 132 °C will apply, whereby, at a given partial pressure of H₂S of less than 200 kPa, a maximum temperature of 232 °C would be possible.

Generally, with its products, WIKA fulfills the strength requirements (maximum hardness) of materials. Exceptions are the elements of mechanical pressure gauges. Here, due to their elastic properties, higher strength is required. WIKA has demonstrated in detail the suitability of its Bourdon tube measuring system in accordance with ISO 15156-3 through independent laboratory testing up to 120 °C.

The following table gives an example-based overview of the lowest maximum operating temperatures by material and product group per "Any equipment and component" in accordance with ISO 15156-3/NACE MR0175.

Product group	Stainless steel 316L	Monel 400	Duplex 1.4462	Alloy C276	Elgiloy 2.4711
Mechanical pressure measuring instruments	max. 120 °C ¹⁾	no limit	n/a	n/a	n/a
Electronic pressure measuring instruments	n/a	n/a	n/a	n/a	no limit ³⁾
Diaphragm seal	no limit ²⁾	no limit	max. 232 °C	max. 132 °C	n/a
Thermowells	no limit ²⁾	no limit	max. 232 °C	max. 132 °C	n/a

1) Measured using laboratory testing

2) Classified using "Instrumentation and control device": as of 2009

3) Classified using "Diaphragms, pressure diaphragms, pressure measuring devices and pressure seals"

Even if the NACE standard has no temperature limit, the product-specific details, which can limit the maximum operating temperature, should be considered.

General information

Welding

The welding processes (WPS/PQR) are qualified in accordance with the appropriate standards (AD 2000 or ASME). One element of the welding procedure tests is hardness testing of the weld seam. A retrospective verification of the hardness on the welded product is not prescribed by the NACE standards for cracking-resistant alloys.

Heat treatment following welding

Heat treatment (PWHT) is not mandatory. For certain materials (e.g. carbon steel) heat treatment can be required due to technical considerations of the welding.

Hardness values on semifinished product

A proof of the hardness values of the semi-finished products is made via the supplier's 3.1 acceptance test certificate (except for stainless steel Bourdon tubes and Duratherm 600 diaphragm elements).

