FLOWSERVE GESTRA

GESTRA Steam Systems

NRG 21-11
NRG 21-51

GB

Installation Instructions 818841-00

Level electrode
NRG 21-11, NRG 21-51

Contents

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Important Notes

Usage for the intended purpose

Use level electrodes NRG 21-11 and NRG 21-51 in conjunction with level switches NRR 2..., NRS 2... or NRT 2... only for signalling liquid levels.

Do not use the equipment in explosion risk areas!

Safety note

The equipment must only be installed and commissioned by qualified and competent staff.
Retrofitting and maintenance work must only be performed by qualified staff who – through adequate training – have achieved a recognised level of competence.

Danger

When loosening the electrode steam or hot water might escape.
This presents the danger of severe scalding.
It is therefore essential not to remove the electrode unless the boiler pressure is verified to be 0 barg.

The electrode is hot during operation.
This presents the danger of severe burns to hands and arms.
Installation and maintenance work should only be carried out when the system is cold.

Attention

The name plate specifies the technical features of the equipment. Note that any item of equipment without its specific name plate must neither be commissioned nor operated.

ATEX (Atmosphère Explosible)

According to the European Directive 94/9/EC the equipment must not be used in potentially explosive areas.

Explanatory Notes

Scope of supply

NRG 21-11
1 Level electrode NRG 21-11 with joint ring D 27 x 32 DIN 7603 1.4301, bright annealed
1 Installation manual

NRG 21-51
1 Level electrode NRG 21-51 with joint ring D 49 x 55 DIN 7603 1.4301, bright annealed
1 Installation manual

Description

The operation of the level electrodes NRG 21-11 and NRG 21-51 is based on the capacitance measuring principle. The NRG 21-11 and NRG 21-51 are designed to signal liquid levels in conductive and non-conductive liquids.

■ Liquid level maintained within the defined control band (measuring range) of the electrode

The pre-amplifier NRV 2-29 is integrated in the terminal box of the level electrode.

The level electrode NRG 21-11 features a rigid plastic-sheathed electrode rod.

The level electrode NRG 21-51 features a flexible plastic-sheathed wire rope electrode.
The level electrode is also available with a wire rope electrode without plastic sheath.

Function

The principle of capacitance measurement is applied to determine the level. The electrode rod and the vessel wall form a capacitor. If the level of the dielectric located between the two capacitor plates changes, the current which flows through the plates changes proportionally to the level. A dielectric is defined as an insulating substance, which excludes many liquids such as water. In order to receive a useful measuring result the measuring rod, which is completely submerged in the liquid, must be completely insulated. After calibration of the control unit (0 % – 100 %), the level can be read off from a remote display unit. The level measuring range can be changed during operation.

Design

NRG 21-11
Screwed ¾" to DIN ISO 228-1. **Fig. 3**

NRG 21-51
Screwed 1½" to DIN ISO 228-1. **Fig. 4**

Technical Data

NRG 21-11

Service pressure
6 bar g at 164 °C

Mechanical connection
Screwed ¾", DIN ISO 228-1

Materials

Terminal box	PPO (Noryl®)
Stem	1 .4571 CrNiMoTi17-12-2
Measuring electrode	1 .4571 CrNiMoTi17-12-2
Electrode insulation	PTFE

Supply voltage
12 V

Overall length / measuring range
⓮ Max. length of installation at 164 °C
⓯ Measuring range

⓮	⓯
349	300
454	400
559	500
663	600
768	700
873	800
978	900
1083	1000
1607	1500
2130	2000

Sensitivity
Range 1: Water ≥ 0.5 µS/cm
Range 2: Water ≥ 20 µS/cm
Range 3: Fuel oil EL ε_r 2.3

Cable entry
Cable gland with integral cable clamp M 16

Protection
IP 65 to DIN EN 60529

Max. admissible ambient temperature
70 °C

Weight
approx. 1.8 kg

Technical Data - continued -

NRG 21-51

Service pressure
6 bar g at 164 °C

Mechanical connection
Screwed 1½", DIN ISO 228-1

Materials

Terminal box	PPO (Noryl®)
Stem	1 .4571 X6 CrNiMoTi17-12-2
Electrode rope	1 .4401 X5 CrNiMo17-12-2
Earth wire rope (optional)	1.4401 X5 CrNiMo17-12-2
Electrode insulation	PTFE

O-ring system FKM e. g. mineral oil, lye, dyebaths up to160 °C, water up to 100 °C.
O-ring system EPDM e. g. water up to 140 °C.

Supply voltage
12 V

Overall length / measuring range
⓯ Measuring range max. 20 m

Weight
approx. 2.1 kg

Corrosion resistance

If the equipment is used for the intended purpose, its safety is not impaired by corrosion.

Sizing

The body is not designed for pulsating loads. Welds and flanges are designed to withstand dynamic-loading (bending and alternative stress). The dimensional allowances for corrosion and anti-corrosive additives reflect the latest state of the art.

Technical Data - continued -

Name plate / marking

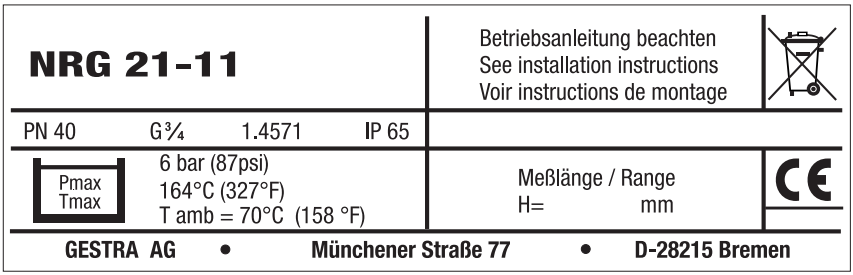

Fig. 1

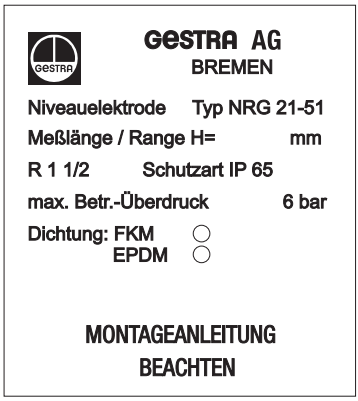

Fig. 2

Technical Data - continued -

Dimensions NRG 21-11

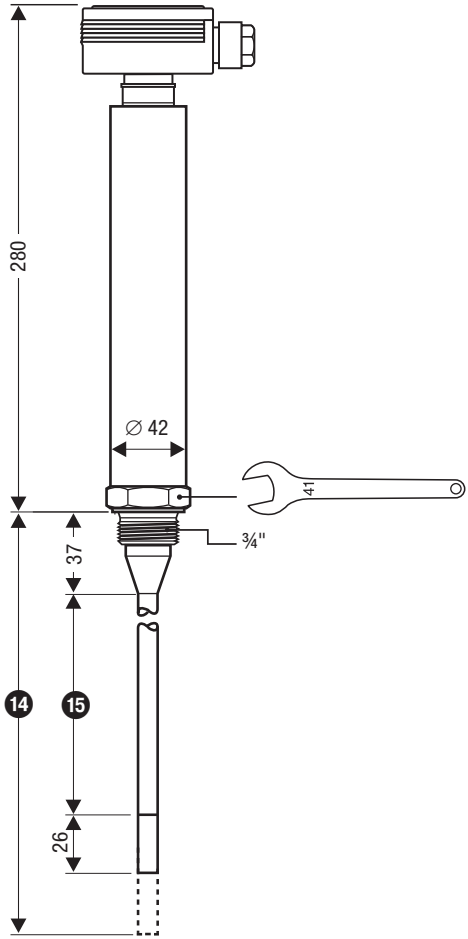

Fig. 3

⓯ constant, no linear expansion

Dimensions NRG 21-51

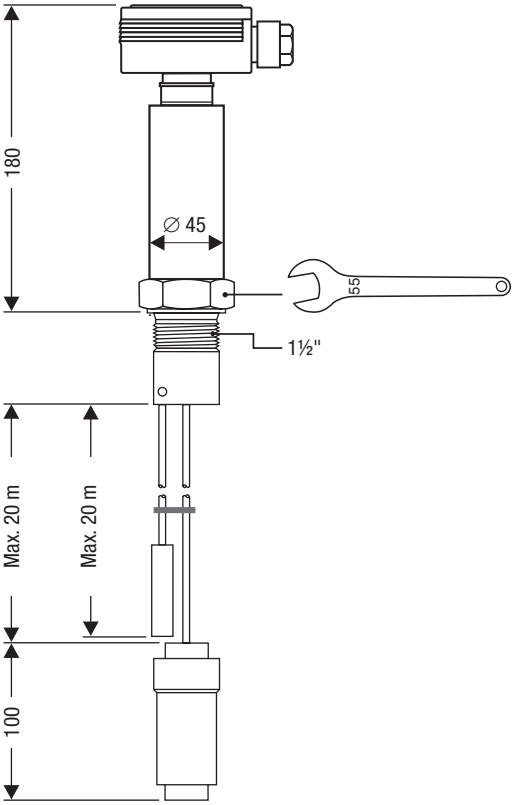

Fig. 4

NRG 21-51 with earth rope (special design)

Design

NRG 21-11

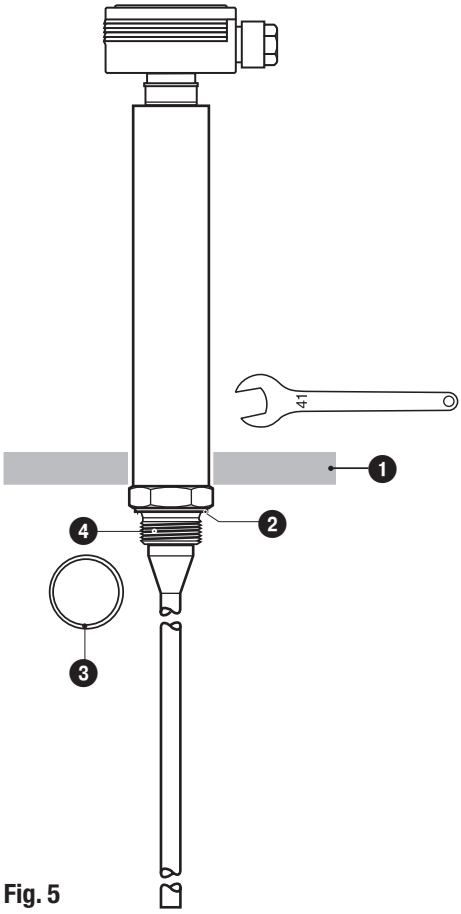

Fig. 5

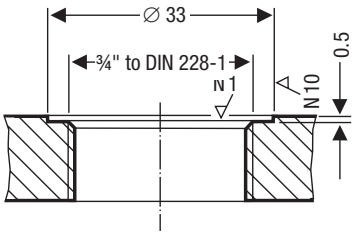

Fig. 6

NRG 21-51

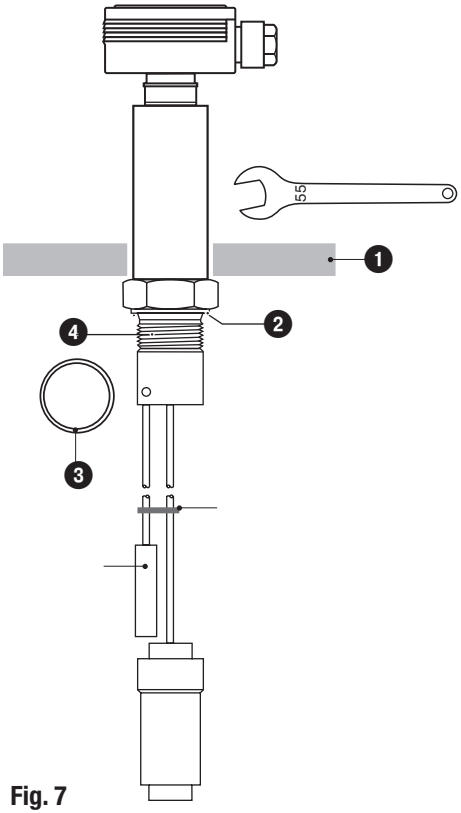

Fig. 7

NRG 21-51 with earth rope (special design)

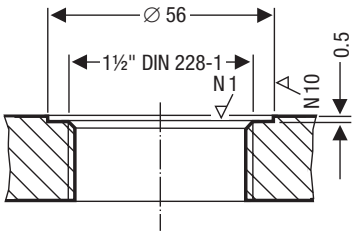

Fig. 8

Functional Elements

NRG 21-11, NRG 21-51

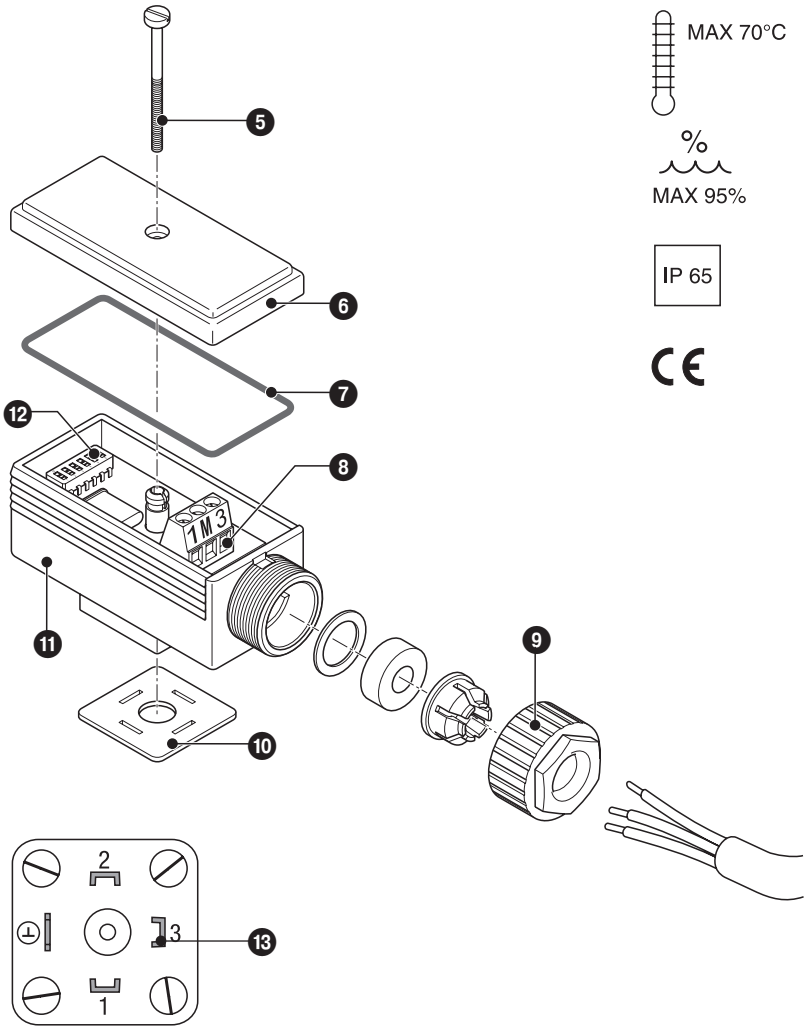

Fig. 9

Pre-amplifier NRV 2-29 integrated in terminal box

Design / Functional Elements

Key

1. Thermal insulation, provided on site, d = 20 mm (outside of thermal insulation of steam boiler)
2. Seating surface
3. Joint ring D 27 x 32 DIN 7603 -1.4301 (NRG 21-11) / D 49 x 55 DIN 7603-1.4301 (NRG 21-51)
4. Electrode thread ¾", DIN ISO 228-1 (NRG 21-11) / 1½", DIN ISO 228-1 (NRG 21-51)
5. Screw M4
6. Cover
7. Seal
8. Terminal strip
9. Cable gland M 16 (PG 9)
10. Insulating plate
11. Terminal box (preamplifier NRV 2-29)
12. Code switch
13. Contact plate
14. Max. length of installation at 238 °C
15. Measuring range

Installation

NRG 21-11, NRG 21-51

1. Check seating surfaces of threads or flange provided on vessel or boiler standpipe. **Fig. 6, Fig. 8**
2. Place joint ring ❸ onto seating surface ❷ of the electrode. **Fig. 5, Fig. 7**
   Use only the supplied joint ring D 27 x 32 DIN 7603-1.4301 (for NRG 21-11) or
   D 49 x 55 DIN 7603-1.4301 (for NRG 21-51)!
3. Apply a light smear of silicone grease (e. g. DOW Corning 111 Compound) to electrode thread ❹.
4. Screw level electrode into threads or flange provided on vessel and tighten with a 41 mm open-end spanner. The torque required when cold is **160 Nm**.

Attention

- The seating surfaces of the standpipe or the flange provided on the vessel must be accurately machined, see **Fig. 6, Fig. 8**.
- Do not bend electrode tip when mounting
- Do not lag electrode body above the hexgonal section.
- Do not insulate electrode thread with hemp or PTFE tape!

Note

- For the approval of the boiler standpipe the relevant regulations must be considered.
- Refer to page 16 for four typical installation examples.

Tools

- Open-end spanner A. F. 41 mm
- Open-end spanner A. F. 55 mm

Examples of Installation

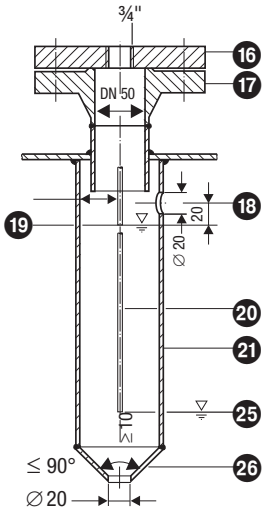

Fig. 10

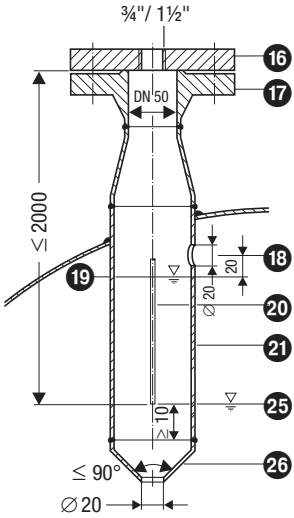

Fig. 11

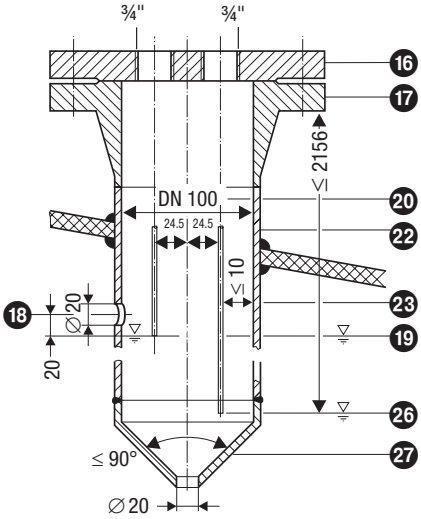

Fig. 12

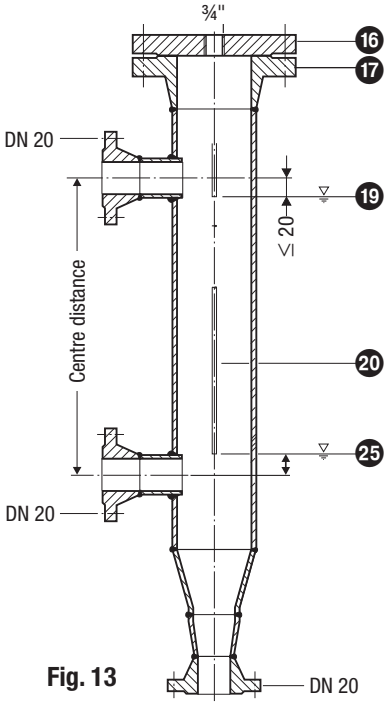

Fig. 13

Key

16 Flange PN 40, DN 50, DIN 2527
Flange PN 40, DN 100, DIN 2527

17 For the approval of the boiler standpipe with connecting flange the relevant regulations must be considered.

18 Vent hole

19 High water HW

20 Electrode rod d = 15 mm

21 Protection tube DN 80

22 Protection tube DN 100

23 Electrode distance ≥ 14 mm (LW)

24 Electrode distance ≥ 40 mm (LW)

25 Low water LW

26 Reducer DIN 2616-2, part 2 K 88.9 x 3.2 - 2 42.4 x 2.6 W

27 Reducer DIN 2616-2, part 2 K 114.3 x 3.6 - 48.3 x 2.9 W

Electrical Connection

NRG 21-11, NRG 21-51

Electrical connection with four-pole connector.

Note that screened four-core cable, e. g. I-Y(St)Y 2 x 2 x 0.8 or LIYCY 4 x 0.5 mm² is required for wiring the electrode.

Max. length 100 m for conductivity from 10 µS/cm.
Max. length 30 m for conductivity from 0.5 µS/cm.

1. Undo screw ❺. **Fig. 9**
2. Take terminal box off the electrode but leave insulating plate ❿ on contact plate ⓭.
3. Remove cover ❻ and seal ❼.
4. Detach cable gland ❾ from terminal box ⓫.
5. Run cable through cable gland ❾ of terminal box ⓫ and wire terminal strip ❽ according to the wiring diagram.
6. Re-attach cover ❻ and insert screw ❺.
7. Put terminal box onto the level electrode and fix it with screw ❺.

Wiring diagram

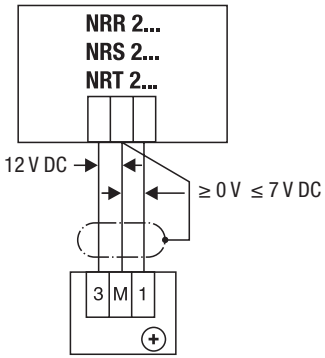

Fig. 14

Setting measuring range

Before the level electrode is ready for operation the pre-amplifier NRV 2-29 inegrated in the terminal box ⓫ must be adapted to the operating conditions of your installation. Before commissioning the equipment determine the measuring range of the electrode rod for your application and check whether the fluid to be measured is electrically conductive or not.

Tools

- Screwdriver for cross head screws, size 1
- Screwdriver for slotted screws, size 2.5, completely insulated according to VDE 0680
- Open-end spanner A. F. 17 mm

Basic Settings

Factory setting

The code switch ⓬ is set at our factory so that the max. measuring range for water (conductivity ≥ 20 µS/cm) is activated. The max. measuring range is found as follows: lower end plus 26 mm up to top measuring point of the electrode rod. **Fig. 15, Fig. 16**

The level electrode NRG 21-11 features the following factory set default values:

- Measuring range up to 350 mm: Code switch ⓬ position 4, 5 ON, 1, 2, 3, 6 OFF
- Measuring range 350 mm up to 750 mm: Code switch ⓬ position 4 ON, 1, 2, 3, 5, 6 OFF
- Measuring range 750 mm up to 1500 mm: Code switch ⓬ position 3 ON, 1, 2, 3, 4, 6 OFF
- Measuring range 1500 mm up to 2500 mm: Code switch ⓬ position 2 ON, 1, 3, 4, 5, 6 OFF

The level electrode NRG 21-51 features the following factory set default values:

Settings for use in conductive fluids

- Measuring range 500 mm: Code switch ⓬ position 4, 5 ON, 1, 2, 3, 6 OFF
- Measuring range 500 mm up to 1,000 mm: Code switch ⓬ position 4 ON, 1, 2, 3, 5, 6 OFF
- Measuring range 1,000 mm up to 2,000 mm: Code switch ⓬ position 3 ON, 1, 2, 4, 5, 6 OFF
- Measuring range 2,000 mm up to 3,800 mm: Code switch ⓬ position 2 ON, 1, 3, 4, 5, 6 OFF
- Measuring range 3,800 mm up to 7,500 mm: Code switch ⓬ position 1 ON, 2, 3, 4, 5, 6 OFF

Settings for use in non-conductive fluids

- Measuring range up to 1,000 mm: Code switch ⓬ position 4, 5, 6 ON, 1, 2, 3 OFF
- Measuring range 1,000 mm up to 2,000 mm: Code switch ⓬ position 4, 5 ON, 1, 2, 3, 6 OFF
- Measuring range 2,000 mm up to 3,800 mm: Code switch ⓬ position 4 ON, 1, 2, 3, 5, 6 OFF
- Measuring range 3,800 mm up to 7,500 mm: Code switch ⓬ position 3 ON, 1, 2, 4, 5, 6 OFF
- Measuring range 7,500 mm up to 14,000 mm: Code switch ⓬ position 2 ON, 1, 3, 4, 5, 6 OFF
- Measuring range 14,000 mm up to 20,000 mm: Code switch ⓬ position 1 ON, 1, 2, 3, 4, 5, 6 OFF

Basic Settings

Establishing active measuring range

Within the measuring range of the electrode you can establish the active measuring range.
Use code switch ⑫ to establish the active measuring range. Code switch ⑫ see **Fig. 9, Fig. 15**.

- Ⓧ Selected (active) measuring range [mm]
- ⑮ Max. measuring range 25 °C
- ㉘ Chart for water, conductivity ≥ 20 µS/cm
- ㉙ Chart for water, conductivity ≥ 5 µS/cm
- ㉚ Chart for fuel oil EL, dielectric constant ε_r 2.3

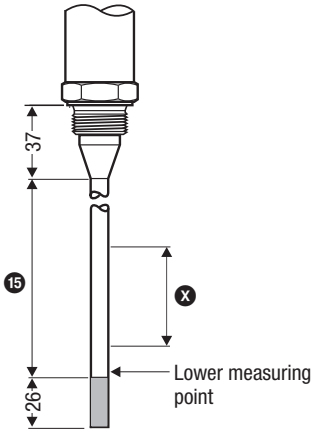

Fig. 15

⑫

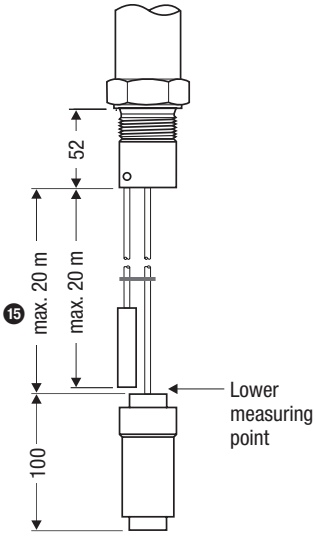

Fig. 16

NRG 21-51 with earth rope (special design)

Attention

- If Ⓧ is clearly below ⑮ change the code switch settings according to the charts ㉘, ㉙ and ㉚ for the fluid to be measured.

Establishing active measuring range - continued -

Ascertain the type of fluid that will be measured. Determine the active measuring range (control range) in mm. Refer to charts ㉘, ㉙ oder ㉚ for the required settings of the code switch for water and fuel oil EL.

Example: Max. measuring range at 25 °C: 1500 mm, selected active measuring range: 1000 mm, toggle switch 3 of the code switch must be set to ON, all other toggle switches to OFF.

If a fluid other than water or fuel oil EL is to be measured, the position of the code switches must be determined by measuring the voltage. For this purpose switch on the mains switch of the associated level switch NRR 2..., NRS 2... oder NRT 2...

1. Open the cover ❻ of the terminal box ⓫.
2. Fill vessel to required maximum level and connect a voltmeter between terminals “1” (+) and “M” (–). Before starting the measurement set all toggle switches of the code switch to OFF.
3. Now operate each individual switch in turn: only switch 1 to ON, only 2 to ON, only 3 to ON, only 4 to ON, only 4 + 5 to ON and only 4 + 5 + 6 to ON. As soon as with one of the switch positions the value measured by the voltmeter exceeds 7 V, stop operating switches, and select the preceding switch position.
4. After having set the code switch, place cover ❻ onto the terminal box ⓫ and fasten with screw ❺.

㉘ Chart for water, conductivity ≥ 20 µS/cm

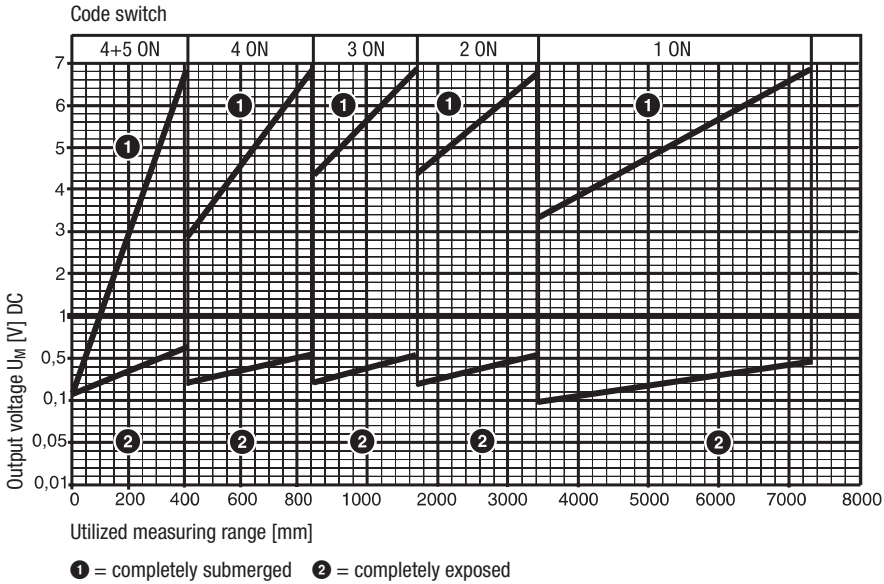

Fig. 17

Establishing active measuring range - continued -

29 **Chart for water, conductivity ≥ 25 µS/cm**

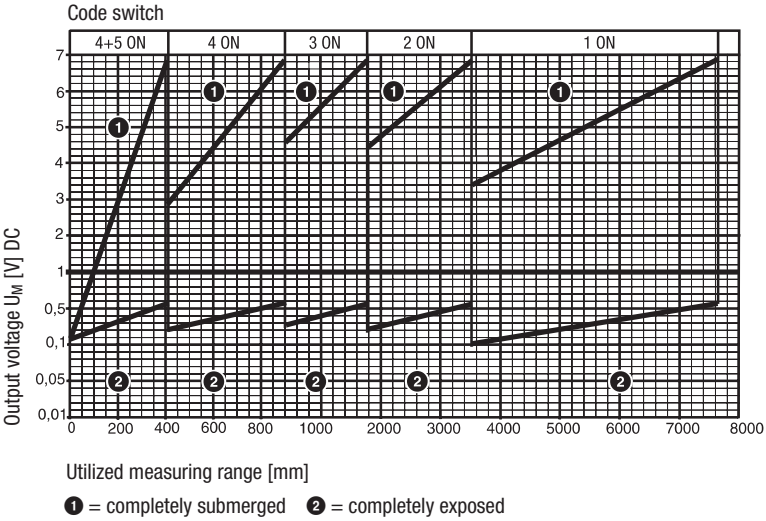

Fig. 18

30 **Chart for fuel oil EL, dielectric constant ε_r 2.3**

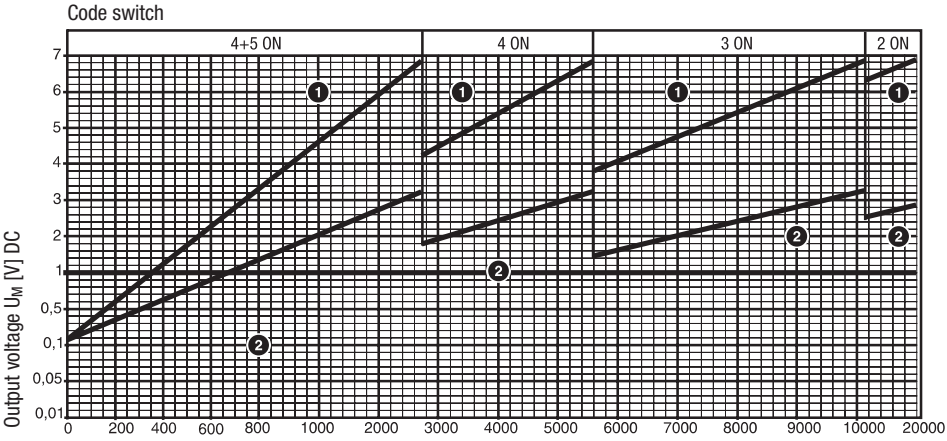

Fig. 19

Basic Settings - continued -

Note

- Note that if the measuring points of the electrde are set when the system is **cold**, the measuring points will shift due to linear expansion when the system gets hot. In this case the settting must be corrected.

Commissioning

Checking electrical connection

1. Make sure that the equipment NRG 21-11 / NRG 21-51 is wired according to the wiring diagram. **Fig. 14**
2. Make sure that the mains voltage of the associated level switch agrees with the specification on the name plate.

Checking measuring voltages

The supply voltage can be measured between terminals “3” and “M” in the terminal box ⓫. The voltage should be 12 V DC. If this voltage is not measured, the equipment has to be checked at our works or by a works official.

The level-proportional voltage U_M can be measured between terminals “1” (+) and “M” (–). Raise level in vessel to the maximum value of the utilized measuring range (e. g. 1000 mm) and measure the voltage.

Compare the value measured with the value of the corresponding chart (in chart ㉘ U_M for 1000 mm is 5.6 V). The following values must be obtained in any case: Level electrode completely exposed: $U_M \geq 0$ V, level electrode completely submerged: $U_M \leq 7$ V DC

If the electrode is submerged and $U_M = 0$ V or $U_M > 7$ V DC is measured, the equipment must be checked at our works or by a works official.

Operation

NRG 21-11, NRG 21-51

For operation in (pressurized) hot-water or steam boilers to TRD 401, TRD 602, TRD 604, EN 12952, EN 12953 or according to national directives or regulations of the classification society.

Note

- To analyse and eliminate malfunctions refer to section “Fault finding list for trouble-shooting” on page 24.

Operation Malfunctions

Fault-finding list for troubleshooting

Equipment does not work

Fault 018: The electrode body does not have earth connection to the vessel.
Remedy: Clean seating surfaces and insert metal joint ring D 27 x 32 to DIN 7603-1.4301.
Do **not** insulate the equipment with hemp or PTFE!

Fault 029: Mains voltage not applied.
Remedy: Apply mains voltage. Connect equipment according to wiring diagram.

Equipment does not work correctly

Fault 019: The vent hole in the protection tube does not exist, is obstructed or flooded.
Remedy: Check protection tube and, if necessary, provide vent hole.

Fault 020: The isolating valves of the external measuring pot (optional extra) are closed.
Remedy: Open isolating valves.

Fault 024: The electrode was installed without a protection tube. The protection tube serves as reference electrode.
Remedy: Install a protection tube.

Fault 025: The desired zero point of the control range is outside of the measuring range of the electrode. The electrode is too short.
Remedy: Replace equipment. Select suitable electrode length.

Fault 026: The electrode rod is covered with dirt deposits.
Remedy: Remove equipment and clean the electrode tip with a wet cloth.

Fault 030: The setting of the measuring range is incorrect.
Remedy: Correct code switch ⓬ setting. **See chapter "Basic Settings".**

If faults occur that are not listed above or cannot be corrected, please contact our service centre or authorized agency in your country.

Decommissioning

Danger

Risk of severe burns and scalds to the whole body!
Before installing the level electrode make sure that the vessel or the external pot are depressurised (0 bar) and cooled down to room temperature (20 °C).

Disposal

Dismantle the equipment and separate the waste materials, using the material specification as a reference.
Electronic component parts such as the circuit board must be disposed of separately!
For the disposal of the equipment observe the pertinent legal regulations concerning waste disposal.

Annex

Declaration of Conformity CE

We hereby declare that the equipment **NRG 21-11** and **NRG 21-51** conforms to the following European directives:

- Low Voltage Directive 73/23/eec version 93/68/eec
- EMC Directive 89/336/eec version 93/68/eec
- LV Standard EN 50 178
- EMC Standard EN 50 081-2, EN 50 082-2

This declaration is no longer valid if modifications are made to the equipment without consultation with us.

Bremen, 3rd January 2005
GESTRA AG

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Dipl.-Ing. Uwe Bledschun
Head of Design Dept.

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Dipl.-.Ing. Lars Bohl
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818841-00/908cm · 2008 GESTRA AG · Bremen · Printed in Germany