

Data sheet H₂-burner system NEO305

Product description:

System for flameless hydrogen combustion in a wide concentration range, outside the ignition limits (Only permitted in non-explosive areas). Emission-free conversion of hydrogen into usable thermal energy and water by catalytic reaction with oxygen.

Typical application:

- Catalytic, flameless, thermal combustion of H₂/air gas mixtures for heat recovery and/or exhaust gas purification on an industrial scale
- Fine purification of gases by removing minimal impurities
- Combustion of hydrocarbon-gas mixtures (at elevated starting temperature)
- Catalytic post-combustion of fuel cell exhaust gases or electrolysis gas
- Removal of oxygen or hydrogen residues from electrolysis gas
e.g. purification of air or helium
- Depletion of oxygen or hydrogen in chemical processes
- Safety engineering, explosion prevention, fire prevention (through O₂ removal)

Setup:



Figure 1: H₂-burner version NEO305 with heating cable

Properties:

- Suitable for the generation of process heat or conversion of large quantities of hydrogen with a non-hazardous gas composition
- Exhaust gas free of pollutants compared to flame combustion, contains no NO_x, CO, CO₂
- High efficiency in H₂ conversion, H₂ residue <500 ppm (>99.95% efficiency), also with gassing with H₂ up to 39.000 ppm, total conversion tested up to 8.000 l/h H₂, with dry gas start of catalysis possible at room temperature
- Suitable for use with simple low-pressure fans due to low flow resistance (example: back pressure 0.05 mbar for cat. D27 mm and 600 l/h gas flow rate)
- Control of concentration, pressure and gas flow velocity not absolutely necessary
- High humidity tolerance, condensing humidity at elevated temperature and 100 % RH can be processed with the appropriate structure
- Corrosion-resistant substrate, no carbon corrosion, due to elastic support grid not as mechanically sensitive as aluminium oxide (no shrinkage or breakage)
- Dust-free disassembly/assembly possible for easy maintenance or cleaning
- Removal of deposits usually easy
- Suitable for the removal of hydrocarbons (99.9 %), methane, CO (efficiency dependent on temperature)
- Cost-effective and environmentally friendly production
- Low use of precious metals
- Recycling or regeneration usually possible
- Modular design for easy adaptation to different systems

Security advice:

4.0 vol% H₂ in air (under standard conditions) is the lower explosion limit, 77 vol% H₂ in air is the upper explosion limit. These depend, among other things, on temperature, oxygen content, humidity and pressure (e.g. 2.9 vol% at 200 °C / 1 bar - 2.1 vol% at 300 °C / 1 bar). The temperature increase due to the reaction must be taken into account. Operation near the explosion limit is not recommended.



There is a risk of burns on the catalyst housing, installation is only permitted with sufficiently temperature-resistant materials!

System characteristics:

Type of construction:	1" tube, material 1.4435, TP316/TP316L
Catalytic converter:	Titanium support lattice with nanostructured metal oxide-platinum-Coating
Weight:	<350 g
Outer diameter:	25.4 mm
Inner diameter:	21.18 mm
Length:	150 mm
Connection:	plain tubes for Swagelok compression fitting
¹ H ₂ range :	0 - 4.0 % by volume H ₂
Response time ² :	1 - 900 seconds
Operating temperature ³ :	20°C - 400°C
Pressure range:	0 - 100 bar
Humidity:	0 - 100 % r.h.
Carrier gas ⁴ :	oxygen-containing gas
ATEX:	not applicable, device only permitted outside Ex-area
CE mark	not available as pressure equipment directive 2014/68/EU

This article is not a hazardous substance and does not contain any hazardous components or substances with Community European occupational exposure limit values or specific substances of very high concern (SVHC) above their respective legal limits. It is therefore not a safety data sheet according to Regulation (EC) No 1907/2006 (REACH) necessary and in this case not available.

¹ under standard conditions, with a conversion corresponding to the O₂ content; at < 6% O₂ any H₂ concentration is possible

² depending on temperature, concentration, density, humidity and volume flow

³ higher temperature (up to 400°C) possible, note the strength of the housing

⁴ Oxygen is needed for the catalytic reaction with hydrogen

Example typical operating data:

The values are dependent on temperature, pressure, humidity, concentration and flow!

Flow velocity:	6 m/s
Total volume flow:	7500 l/h
Volume fraction H ₂ at 4 vol.%	300 l/h (27g/h)
Formation enthalpy of liquid H ₂ O:	1.06 kWh
Thermal energy:	~0.8 kWh
Exhaust gas temperature at T _{start} = 20 °C and with complete heat transfer into exhaust gas	~330 °C
Amount of water formed:	0.2 l/h
Catalyst counter pressure at 7.500 l/h:	up to 20 mbar

Handling instructions:

- Store dry and closed when not in use
- Avoid contamination by long-chain hydrocarbons, fats, oils, hand perspiration, sulphur compounds, halogens, silicones, phosphorus and heavy metal compounds, formation of deposits by aerosols or particles
- Cleaning with oil-free compressed air, brush, do not use solvents, if necessary consult the manufacturer
- Water accumulation in the catalyst must be prevented by suitable pipe routing
- The ignition of a hydrogen mixture and the formation of a flame must be avoided

In order to ensure safety, please observe the Pressure Equipment Directive 2014/68EU, German Statutory Accident Insurance (DGUV), Technical Rules for Operational Safety (TRBS), Technical Rules for Hazardous Substances (TRGS), Technical Regulations for Pipeline Construction and other safety regulations before commissioning. As the catalytic converter can be used under a wide variety of operating conditions, the decision on its suitability for a particular application must only be made after detailed analysis and/or tests to verify that the specific requirements are met. Commissioning of the components is prohibited until it has been established that the machine or plant into which the components are installed complies with the regulations. Hydrogen can be dangerous if an operator is not familiar with its use. Installation, commissioning and maintenance of the catalyst should only be carried out by properly trained and experienced personnel.

Please contact neo hydrogen sensors GmbH if the product is to be used under one of the following conditions:

- Operating or ambient conditions that deviate from the technical data given or when the product is used outdoors.
- Installation within machinery and equipment used in connection with nuclear energy, railways, aviation, motor vehicles, medical equipment, food and drink, leisure and recreational equipment, emergency stop circuits or safety equipment.
- Applications where there is a possibility of damage to persons, property or animals and which require a special safety analysis.

Operation with additional heating

The hydrophilic catalyst may have moisture deposits on it, which must be removed for a safe start. Preheating by means of the supplied jacket heater should ensure a reliable start of the reaction even under unfavourable conditions. If the corresponding amounts of hydrogen are converted, a temperature increase can be measured after the catalyst has been started. In case of sufficient hydrogen conversion, the temperature continues to rise, the heating band can be optionally switched off. A continuous operation of the heater with reduced voltage increases the lifetime compared to frequent switching on and off.

During continuous operation of the heater the maximum permissible temperature of 400 °C in the heating element must be maintained! Continuous operation without sufficient heat dissipation leads to damage to the heating element.

Technical data of the cylinder heating band as additional heating

Diameter:	25.4 mm
Width:	50 mm
Power:	225 W
Operating voltage:	0 - 230 V AC/DC
Connection:	radial/45°/centre
Cable length:	1000 mm
Miscellaneous:	brass version
Temperature measurement:	not included
Allowable temperature:	350 – 400 °C
Tightening torque:	3 - 3.5 Nm, retighten after the first heating

The specified operating temperature of the heating elements does not apply to the connecting cable. If necessary, the connecting cable must be adapted to the application. This product is an electrical equipment. Faultless functioning and operational safety can only be guaranteed if the general safety regulations for electrical installations and the special safety and installation instructions in this manual are observed during installation will be. The heating element may only be used in accordance with the instructions. neo hydrogen sensors GmbH accepts no liability for damage caused by failure to observe the instructions.

Safety instructions of the auxiliary heater

The heating element is not intended for use in Ex-installations. Please observe the following when handling electrical equipment:

Installation, maintenance and servicing of the heating element is the responsibility of a qualified electrician. In the event of power supply faults and/or damage to the electrical equipment, the heating element must be switched off immediately. Safety devices must not be bypassed, dismantled, altered in their function or bypassed in any other way. Whenever work is carried out on the heating element, it must be disconnected from the power supply and secured against being switched on again. The accident prevention regulations in the user's company must be observed. Persons who are not authorised or who are under the influence of alcohol, other drugs or medicines which influence the reaction time must not operate or maintain heating elements.

Installation - Assembly

The heating element may only be used in a technically perfect condition and in accordance with the intended use, safety and risk awareness. As the heat transfer of the heating elements to the body to be heated is effected by contact heat, the heating element must lie firmly and evenly against the body to be heated. If the heat loss is too low, a heat accumulation is created in the heating element, which can lead to the destruction of the heating element.

The following points must be observed:

- The entire inner surface of the heating element must lie firmly against the body to be heated
- The clamping screws must be tightened firmly and evenly
One-piece cylinder heating elements without hinge with 3 to maximum 3.5 Nm
- Cables with sufficient heat resistance of the conductor and the insulation must be provided for the electrical supply line.

Commissioning - Operation

The heating element may only be handled by instructed and authorised persons. The heating element may only be put into operation after complete installation. During the initial commissioning until the operating temperature is reached, the firm seating of the heating element must be checked at several intervals. If necessary the clamping screws have to be retightened.

Maintenance

Regular inspection by a qualified electrician is mandatory. The period depends on the operational conditions and is to be determined and carried out by the user on his own responsibility.

In addition to these instructions and the binding accident prevention regulations applicable in the country of use and at the place of use, the recognised technical regulations for safe and professional work must also be observed.

We reserve the right to make changes in the interest of technical progress.

Connection dimensions:

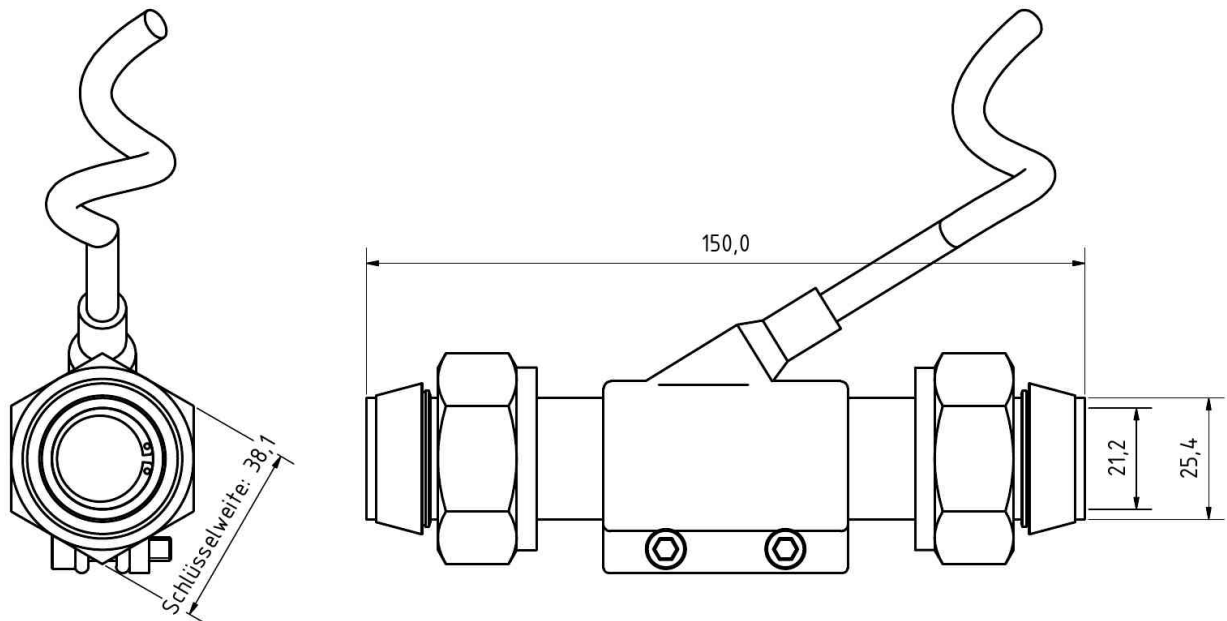


Figure 2: Connection dimensions of the housing with heater and Swagelok compression fitting