BARTEC BENKE

Freeze/Cloud Point Process Analyzer FRP-4.2/CPA-4.2

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12/2016

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Contents

1 General Information

Amongst other things, this section contains information on this operating manual, the symbols used, liability restrictions and contact persons in customer service.

1.1 Information on the operating manual

This operating manual provides important information on handling the analyzer. Adherence to all safety and operating instructions given is prerequisite for work safety.

☞ Furthermore, the locally applicable accident prevention regulations and general safety instructions for the area of application of the analyzer must be observed.

☞ Read the operating manual prior to beginning any work! It is a component part of the product and must be stored in the immediate vicinity of the analyzer and must be accessible for operating personnel at all times.

If the analyzer is handed over to a third party, the operating manual must also be handed over.

For the purposes of clarity, the figures in this operating manual are not necessarily illustrated to scale and may deviate slightly from the actual analyzer model.

NOTICE	
	This operating manual is supplemented by the *software manual.* It provides a detailed explanation of the operation of the *software* for controlling the analyzer. It also contains information on the measuring process.

In addition to the operating manual and the software handbook, all other documents contained in the customer folder are applicable.

Observe the safety instructions listed there! An overview can be found in the table of contents in the customer folder.

1.2 Explanation of symbols

Warnings

Warnings are indicated in this operating manual by symbols. The warnings are introduced with signal words indicating the degree of danger at hand.

Observe the instructions under all circumstances and work with care to avoid accidents, injuries to personnel and damage to property.

DANGER	
	… indicates an immediate hazard which, if not avoided, will result in serious injury or death.

WARNING	
	… indicates a possible hazard which, if not avoided, could result in serious injury or death.

CAUTION	
	… indicates a possible hazard which, if not avoided, could result in minor injuries.

NOTICE
… indicates a possible hazard which, if not avoided, could result in damage to equipment or property.

Symbols used in the manual and on the analyzer

The safety warnings on the analyzer are also highlighted with warning symbols. The following section explains the warning symbols used on the analyzer and in the operating manual.


Warning of a danger area


Warning about poisonous substances


Warning about flammable substances

Warning about potentially explosive atmospheres


Warning about dangerous electrical current


Warning about potential hand injuries


Warning about hot surfaces


Warning about automatic start-up
(in use with some analyzers only)


Warning about cold
(in use with some analyzers only)

Examples of special warning signs

DANGER	
	**Danger of death due to electrical current!** ... indicates life-threatening situations due to electrical current. Failure to observe the safety instruction could result in serious injuries or death. FOR THIS REASON: ☞ The work to be performed may only be carried out by an electrician.

WARNING	
	**Risk of death due to unavailable explosion protection!** ... indicates life-threatening situations in potentially explosive atmospheres. Failure to observe the safety instruction could result in serious injuries or death. FOR THIS REASON: ☞ Work may only be performed by a specialist for potentially explosive atmospheres.

Tips and recommendations

NOTICE	
	… indicates useful tips and recommendations as well as information for efficient and trouble-free operation.

1.3 Duties of the operator

The analyzer is used in commercial enterprises. The operator of the analyzer is therefore under legal obligation to ensure work safety. The applicable national standards and laws must be observed.

In addition to the work safety instructions in this operating manual, the safety, accident prevention and environmental protection regulations applicable in the area of application of the analyzer must be observed.

Further to this, the operator is responsible for ensuring that the analyzer is always in a technically perfect working condition. Therefore the following applies:

- The operator must ensure that all maintenance intervals specified in this operating manual are adhered to.
- The operator must have all safety equipment inspected regularly to ensure it is fully functional and complete.

The operator must make the necessary safety equipment available to personnel.

1.4 Limitation of liability

All specifications and instructions in this operating manual have been compiled under consideration of the applicable norms and regulations, the latest technological standards as well as our many years of experience and expertise.

The manufacturer assumes no liability for damages due to the following:

- Failure to observe the instructions in the operating manual
- Improper use
- Deployment of untrained personnel
- Structural modifications made without prior consent
- Technical modifications
- Use of non-approved replacement parts

The actual scope of delivery of special models can differ from the explanations and diagrams used in this manual if additional options are ordered or due to the latest technical changes.

Otherwise, the obligations agreed upon in the delivery contract, the general terms and conditions and the delivery terms of the manufacturer apply, as well as any legal regulations valid at the time the contract was concluded.

1.5 Copyright

The operating manual is to be treated confidentially. It is intended exclusively for personnel engaged to work with the analyzer. Making the operating manual available to third parties is not permitted without the manufacturer's written consent.

NOTICE	
	The information, texts, diagrams, images and other illustrations of the contents are copyright protected and subject to commercial protective rights. Every instance of misuse may result in prosecution.

Reproductions of any type - including excerpts - as well as the application and/or imparting of the content is prohibited without a written statement from the manufacturer. Infringements will be met with a claim for compensatory damages. The right to make further claims is reserved.

1.6 Replacement parts

WARNING	
	**Risk of injury due to incorrect replacement parts!** Incorrect or defective replacement parts can result in damages, faults or total failures as well as impairments to safety. FOR THIS REASON: ☞ Only use replacement parts from BARTEC BENKE.

Obtain replacement parts from authorised dealers or directly from BARTEC BENKE. For the address, see *Section 1.7 "Customer service" on page 7*.

WARNING	
	**No explosion protection due to using incorrect replacement parts!** Some optionally used replacement parts are modified by BARTEC BENKE for a particular purpose. The use of non-modified original replacement parts of the relative manufacturer can cause loss of explosion protection. FOR THIS REASON: ☞ Only use replacement parts from BARTEC BENKE.

The replacement parts list can be found in the customer folder.

1.7 Customer service

Should you require any technical information, our customer service department will be happy to help you.

You can find information on the responsible contact partner at any time by telephone, fax, e-mail or on the Internet.

Furthermore, our employees are always eager to receive any new information and experiences arising from use and which could be valuable for the improvement of our analyzers.

Service-address

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2 Safety

This section provides an overview of all important safety aspects for optimal protection of personnel as well as safe and trouble-free operation.

Failure to observe the operating and safety instructions in this manual can result in considerable dangers.

This chapter describes all the safety and warning signs in line with the risk assessment of the analyzer. The measures for avoiding the respective dangers are described in detail in this chapter. The following chapter will only present the safety and warning signs in shortened form.

Example of shortened safety or warning message

DANGER	
	**Danger of death due to electrical current!** Touching voltage-conducting parts poses an immediate life-threatening hazard. Damage to the insulation or to individual components can cause fatal injury. ☞ Avoidance measures see *chapter 2 “Safety”*.

2.1 Intended use

The analyzer is designed exclusively as a process analyzer for the fully automatic measurement of fossil and regenerating energy sources and/or petrochemical products (hereafter referred to as product). The analyzer is only to be used for stationary operation. It is suitable for use in potentially explosive atmospheres.

Do not make any modifications to the analyzer. Only use spare parts from BARTEC BENKE. Otherwise additional hazard may arise for which the safety fittings cannot provide sufficient protection.

A more precise definition of the use of the products and the device-specific function can be found in *Chapter 4 “Design and function” on page 53*.

2.1.1 Improper use

The following uses of the device are prohibited.

- Feeding other liquids, vapors, or gases into the device; in particular this applies to an external vent drain system. Adding oxygen or hydrogen can result in the risk of explosions.
- Rinsing with steam. High temperatures and pressures damage device components.
- Feeding liquid gas into the device.

WARNING	
	**Danger from improper use!** Any use which goes beyond and/or differs from the intended use of the unit can lead to dangerous situations. FOR THIS REASON: ☞ The Analyzer is to be used only as intended. ☞ Strict compliance with all specifications in this operating manual is mandatory.

Claims of any type for damages due to improper use are disallowed.

The operating company is solely responsible for all damages arising from improper use.

2.2 Dangers and risks

The following section names residual risks that have been established in a risk analysis.

☞ Adhere to the safety instructions and observe the warnings in the following sections of this operating manual to reduce health risks and avoid dangerous situations.

Electrical current

DANGER

Danger of death due to electrical current!

Touching voltage-conducting parts poses an immediate life-threatening hazard. Damage to the insulation or to individual components can cause fatal injury.

FOR THIS REASON:

- ☞ If the insulation is damaged, immediately disconnect the power supply and have the damage repaired.
- ☞ Have work on the electrical systems performed only by electricians.
- ☞ For all work on the electrical systems, switch off the voltage and test that the circuit is voltage-free.
- ☞ In addition to the analyzer's power supply, all external voltages of signal and control lines must also be free of voltage.
- ☞ Prior to any maintenance, cleaning and repair work, switch off the power supply and secure it against being switched back on again.
- ☞ Do not bypass or disable any fuses. When exchanging fuses, observe the correct amperage.
- ☞ Keep moisture away from voltage-conducting parts. This could otherwise result in a short-circuit.

Liquids and gases under overpressure

WARNING

Danger of injury due to liquids or gases under pressure!

Lines are under overpressure even when switched off. In the case of defective or leaky lines, escaping liquids or gases could cause serious injuries.

FOR THIS REASON:

- ☞ Before performing any work, switch off the supply lines and depressurize them.
- ☞ Wear suitable protective goggles and gloves.

Hot operating materials

WARNING

Danger of burns due to hot operating materials

Operating materials can reach high temperatures during operation and cause burns upon contact.

FOR THIS REASON:

- ☞ Before handling operating materials, check whether they are hot. Allow them to cool down if necessary.

Hot surfaces

WARNING

Danger of burns due to hot surfaces!

Contact with hot components can cause burns.

FOR THIS REASON:

☞ Always wear protective clothing and gloves during all work in the vicinity of hot components.

☞ Check that all components have cooled to ambient temperature before beginning any work.

Cold operating materials

WARNING

Danger of burns due to cold operating materials!

Operating materials can reach low temperatures during operation and cause burns upon contact.

FOR THIS REASON:

☞ Before handling operating materials, check whether they are cold. Allow them to warm up if necessary.

Cold surfaces

WARNING

Danger of burns due to cold surfaces!

Contact with cold components can cause burns.

FOR THIS REASON:

☞ Always wear protective clothing and gloves during all work in the vicinity of cold components.

☞ Check that all components have warmed up to ambient temperature before beginning any work.

Transporting the analyzer

CAUTION

Damage due to improper transport!

Improper transport can result in considerable material damage.

FOR THIS REASON:

☞ When unloading the packaged items during delivery or during in-house transport, exercise caution and observe the symbols and instructions on the packaging.

☞ Only use the intended suspension points.

☞ Remove the packaging only immediately prior to assembly.

WARNING	
	**Danger of death due to suspended loads!** When loads are being lifted, falling or uncontrollably swinging components pose a danger to life and limb. FOR THIS REASON: ☞ Never step beneath suspended loads. ☞ Observe the specifications regarding the provided suspension points. ☞ Do not suspend by protruding machine parts or by the eyebolts of attached components. ☞ Make sure suspension equipment is attached securely. ☞ Only use approved lifting devices and lifting accessories with sufficient load-bearing capacity. ☞ Do not use cracked or chafed cables or belts. ☞ Do not attach cables and belts to sharp edges or corners and do not knot or twist. ☞ Only move loads under supervision. ☞ Set down the load before exiting the workplace.

WARNING	
	**Danger of injury from transport item swinging out!** The suspension point is not directly over the center of gravity of the analyzer. The item swings out when transported with a crane and can cause injury to personnel or material damage if adequate space to maneuver is not provided. FOR THIS REASON: ☞ Make sure that neither persons nor obstacles are in the swing range.

Tipping over of the analyzer

WARNING	
	**Danger of injury from transport item tipping over!** If it is set down on an uneven surface or surface with an insufficient load-bearing capacity, the load will tip over. This can result in injuries to personnel or material damage. FOR THIS REASON: ☞ Make sure that the surface is even and has a sufficient load-bearing capacity.

WARNING	
	**Danger of injury due to analyzer tipping over!** Due to the high center of gravity, the analyzer could tip over if transported incorrectly, which can lead to severe injuries and material damage. FOR THIS REASON: ☞ Secure the analyzer against tipping over and use a suitable means of transport.

Dirt and objects left lying around

CAUTION	
	**Danger of tripping due to dirt and objects left lying around!** Dirt deposits and objects left lying around constitute slipping and stumbling hazards and can cause injuries. FOR THIS REASON: ☞ Always maintain a clean and orderly work area. ☞ Remove objects that are no longer required. ☞ Draw attention to stumbling hazards with yellow and black marking tape.

Handling packaging materials

CAUTION	
	**Environmental damage due to incorrect disposal!** Packaging materials are valuable raw materials and can in many cases be reused or expediently processed and recycled. FOR THIS REASON: ☞ Dispose of packaging materials in an environmentally sound manner. ☞ Observe the locally applicable disposal regulations. Have a specialist company handle the disposal if needed.

Incorrect installation and commissioning

WARNING	
	**Danger due to incorrect installation and commissioning!** Installation and commissioning must be conducted by trained specialist personnel who have adequate experience. Errors in installation and commissioning can lead to life-threatening situations or considerable material damage. FOR THIS REASON: ☞ Have installation and preparations for commissioning conducted solely by specialists for potentially explosive atmospheres or by qualified electricians. ☞ If the location of the device is to be changed later, consult the manufacturer. ☞ Do not install or relocate the device yourself. ☞ Before starting work, ensure there is adequate space for the work. ☞ Use caution when handling open, sharp-edged components. ☞ Assemble the components professionally. Comply with the specified screw-tightening torques. ☞ Secure components so that they cannot fall down or tip over.

Improper operation

WARNING	
	**Danger of injury due to improper operation!** Improper operation can lead to serious personal injury and material damage. FOR THIS REASON: ☞ All operating steps are to be conducted in accordance with the instructions contained in this operating manual. ☞ Before starting work, make sure that all safety equipment is installed and working properly. ☞ Never disable safety equipment during operation.

Improper fault rectification

WARNING	
	**Danger of injury due to improper fault rectification** Improper fault rectification can lead to serious personal injury and material damage. FOR THIS REASON: ☞ Before starting work, ensure there is adequate space for the work. ☞ Make sure the work area is clean and orderly! Components or tools that are loosely stacked or left lying around are a source of accidents. ☞ If components were removed, make sure they are re-mounted correctly, reinstall all fastening elements and observe the specified screw-tightening torques.

Improperly performed maintenance

WARNING	
	**Danger of injury due to improperly performed maintenance work** Improper maintenance can lead to serious personal injury and material damage. FOR THIS REASON: ☞ Before starting work, ensure there is adequate space for the work. ☞ If components were removed, make sure they are re-mounted correctly, reinstall all fastening elements and observe the specified screw tightening torques.

Incorrect dismantling work

WARNING	
	**Danger of injury due to incorrect dismantling work** Stored residual energy, components with sharp edges, points and corners in and around the analyzer or on the required tools can cause injuries. FOR THIS REASON: ☞ Before starting work, ensure there is adequate space for the work. ☞ Use caution when handling open, sharp-edged components. ☞ Dismantle the components in a professional manner. Remember that some components may be very heavy. Use lifting gear if necessary. ☞ Secure components so that they cannot fall down or tip over. ☞ Should you have any questions, contact the manufacturer.

2.3 Hazardous materials

The notices given here only provide a general overview of the possible dangers that could arise from materials to be analyzed by the analyzer. For the precise material-specific requirements for personal protective equipment, safety notices at the workplace, cleaning and disposal, please refer to the data sheet pertaining to the material in use.

In addition to the hazardous materials used in the system, other substances requiring further safety measures may also be in use at the location of the analyzer. It is the responsibility of the operator to ensure compliance with the pertinent regulations and legislation (for example the Ordinance on Hazardous Substances).

Highly flammable substances

Substance marking "Flammable"

WARNING	
	**Danger of fire due to highly flammable materials!** Highly flammable liquids or gases can start fires which can cause severe or fatal injuries. FOR THIS REASON: ☞ Do not use open flames or ignition sources. ☞ Make a fire extinguisher available. ☞ In the event of fire, immediately stop work, initiate fire-fighting and, if appropriate, leave the danger zone until the all clear signal is given.

Poisonous substances

Substance marking "Poisonous"

WARNING
Danger of injury from toxic substances! Swallowing, inhaling or contact with skin or eyes can lead to serious, permanent health damage or death. FOR THIS REASON: ☞ Avoid direct contact. ☞ Do not inhale vapours. ☞ If unknown concentrations or concentrations above the threshold values for the particular substance are present in the air, wear suitable breathing protection. ☞ Wear appropriate protective clothing, gloves and eye protection when working. ☞ In the event of accident, consult a physician at once. ☞ Do not consume or store any food, drink or tobacco in the work area. ☞ Observe the notes in the safety data sheet.

Nitrogen

In use with some analyzers only.

WARNING
Danger of suffocation due to nitrogen! Nitrogen can escape. High concentration in the air leads to oxygen deficiency. Inhalation can cause loss of consciousness or death. FOR THIS REASON: ☞ Ensure adequate ventilation. ☞ When working on nitrogen-conducting lines, wear suitable respiratory protection or shut off the lines. ☞ If unknown concentrations or concentrations above the threshold values are present in the air, wear suitable breathing protection.

Environmentally hazardous substances

Substance marking "Hazardous to water"

NOTICE	
	**Environmentally hazardous substances!** Hazardous materials escaping during a malfunction are hazardous to the environment. FOR THIS REASON: ☞ Prevent them from entering bodies of water, the sewerage system or the ground, and/or install the analyzer in a ground that is leak-proof against the hazardous materials occurring in the system. ☞ Use suitable resistant materials for the collecting tray or sealing. ☞ Dispose of residues and waste product professionally. ☞ If pollutant substances are released, take immediate measures to limit the damage.

2.4 Explosion protection

The analyzer is designed for use in potentially explosive atmospheres. This section describes the marking, types of protection and certificates as well as special conditions.

2.4.1 Marking

Depending on the required approval, the analyzer is equipped with marking in line with

- ATEX Directive 94/9/EC (valid to April, 19th 2016)
  as from April, 20th 2016: ATEX Directive 2014/34/EU
- National Electrical Code NEC 500/505 of the USA or the Canadian Electrical Code CEC annex 18 or section 18
- CSEx System from TRTC (Russia)

Marking according to ATEX
e.g. II 2 G IIC T4 Gb (see type plate respectively technical data)

Meaning of the marking according to ATEX

Marking	**Meaning**
Device group II	The device may be used in potentially explosive atmospheres, excepting those of mining activities.
Category 2	A potentially explosive atmosphere may occasionally occur. The device ensures a high degree of safety and can be used in Zone 1 and Zone 2.
G	Materials which form a potentially explosive atmosphere and are gases, mist or vapors (not dust).
IIC	Classification of gases and vapors into the subgroups IIA, IIB and IIC depending on their potential to ignite. The explosion protection of the device permits use with subgroup IIC.
T4	Classification of gases and vapors depending on their igniting temperature into the classes T1 to T6 in accordance with IEC 60079-4). The device is designed for gases and vapors in temperature class: **T4:** 135 °C < igniting temperature < 200 °C
Gb	The device guarantees a high level of safety. It can be operated in zone 1 and in zone 2. A potentially explosive atmosphere may occasionally occur.

Meaning of the marking according to NEC 500 / CEC annex 18

Marking	Meaning
Class I	Classification of potentially explosive atmospheres in classes I (combustible gases, vapors and mist), II (dusts) and III (fibers and lint). The device may be used in class I potentially explosive areas.
Div. 2	Classification of potentially explosive areas in divisions 1 and 2 according to the frequency in which potentially explosive atmospheres arise. In division 2, hazardous concentrations of combustible gases, vapors and mist do not usually occur under normal operating conditions. The device may be used in such areas.
Groups B, C, D	Classification of gases, vapors and mists into the groups A (acetylene), B (hydrogen), C (ethylene) and D (propane). The device provides explosion protection for groups B, C and D.
T4	Classification of gases and vapors depending on their ignition temperature into the classes T1 to T6 (in accordance with IEC 60079-4). The device has been designed for use with gases and vapors of temperature class: **T4**: 135 °C < ignition temperature < 200 °C

Meaning of the marking according to NEC 505 / CEC section 18

Marking	Meaning
Class I	Classification of potentially explosive atmospheres in classes I (combustible gases, vapors and mist), II (dusts) and III (fibers and lint). The device may be used in class I potentially explosive areas.
Zone 1	Classification of areas with explosive gas atmospheres in the following zones: ■ **zone 0**: explosive gas atmosphere is **continuously** present or present for a long periods of time. ■ **zone 1**: explosive gas atmosphere is **likely to occur** in normal operation or can be expected to be present frequently ■ **zone 2**: explosive gas atmosphere is **not likely to occur** and if it does, it will only exist for a short period of time

Marking	Meaning
AEx Ex	AEx designates built to a US ANSI standard. Ex designates built to a Canadian standard.
d, e, p, i, m	Methods of protection.
IIC	Apparatus Group: ■ I: mining - underground (methane) ■ II: surface industries ■ A (propane) ■ B (ethylene) ■ C (hydrogen)
T4	Classification of gases and vapors depending on their ignition temperature into the classes T1 to T6 (in accordance with IEC 60079-4). The device has been designed for use with gases and vapors of temperature class: **T4**: 135 °C < ignition temperature < 200 °C

2.4.2 Types of protection and certificates

The analyzer and its components provide explosion protection through various types of ignition protection. The principles of these will be briefly described in the following section:

Pressurization (Ex p)

The penetration of an external, potentially explosive atmosphere into the housing of electrical components is prevented by a protective gas (in this case, air) maintained in the housing interior under overpressure in relation to the surrounding atmosphere. The maintenance of the pressure is monitored.

Pressure-resistant enclosure Ex d

Parts which could be ignited by a potentially explosive atmosphere are kept inside a housing. The housing is constructed in such a way that in the event of an explosion in the interior, the pressure is maintained and thereby prevents the spread of the explosion to the explosive atmosphere surrounding the housing.

Increased safety Ex e

For electrical components, for which ignition sources are not present during normal operation, impermissible high temperatures, sparks and electric arcs are prevented by additional measures.

Encapsulation Ex m

Parts which could ignite a potentially explosive atmosphere by sparks or heat are embedded in a grouting so that this cannot occur.

Intrinsic safety Ex i

Intrinsically safe electrical circuits cause no sparks or thermal effects that might ignite a potentially explosive atmosphere of the subgroups IIA, IIB or IIC.

The analyzer basically consists of main subassemblies installed in the following housings:

Housing

Housing	Ignition protection type
Control box	p
Measuring unit box	■ d ■ none: in case of the exclusive use of components with intrinsically safe circuits and of components with their own permitted explosion protection (applies to some analyzers only)
Power supply box	e
Signal junction box	e

The housings with their installations have been approved as individual subassemblies in line with ATEX. All explosion-protection-relevant components outside the housings and in the junction boxes are explosion-protected by their own type of protection. In addition, electric operating materials such as the thermostat for the *chiller for liquids* option (*chiller* for short) can be operated from the control box in intrinsically safe circuits.

NOTICE	
	You will find the list of explosion-protected components and subassemblies used, as well as the corresponding certificates, in the customer folder under *Manufacturer Data Record Book section 5 "Certificates"*.

The risk assessment shows that the combination of explosion-proof components and subassemblies does not create additional ignition hazards. Therefore the analyzer does not require an assessment as an electrical device in line with ATEX. During the procedure for assessing conformity, the technical documents were stored in a nominated location.

2.4.3 Special conditions

The measuring unit box provides explosion protection due to the Ex d type of protection.

WARNING	
	**Addition of carbon disulfide.** Loss of explosion protection. FOR THIS REASON: ☞ Do not feed carbon disulfide into the measuring unit box. ☞ The product may not contain carbon disulfide.

2.5 Safety devices

WARNING	
	**Danger of death due to non-functioning safety devices!** Safety is only guaranteed if the safety devices are intact. FOR THIS REASON: ☞ Before starting work, check whether the safety devices are correctly installed and fully functional. ☞ Never disable safety devices. ☞ Make sure that safety devices such as emergency stop buttons, pullcords etc. are always accessible (installed by the operator).

NOTICE	
	Test the functioning of the safety devices on a regular basis (see *chapter 10.6 “Checking the safety equipment” on page 113*).

2.5.1 Overview of the safety equipment on the analyzer

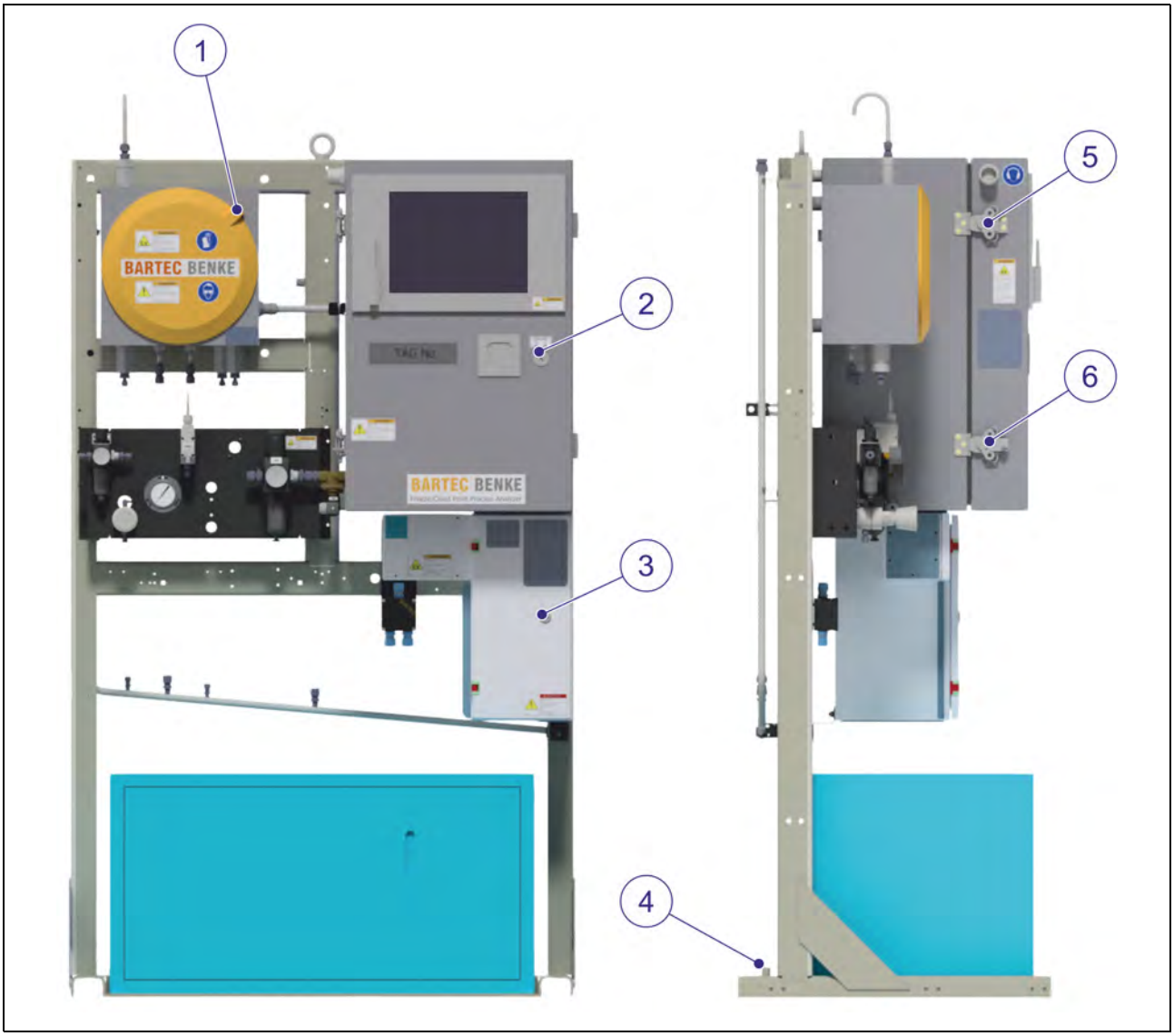


Figure 2.1: Locations of the safety equipment

1. Lock for measuring unit box cover
2. Key switch
3. Lock on the power supply box
4. Ground
5. Catch
6. Catch with safety bolt

2.5.2 Control box (Ex p)

Figure 2.2: Control box (front view)

The **control box (Ex p)** contains operating equipment without its own ignition protection type and therefore contains potential ignition sources.

Explosion protection is provided for the control box by the pressurization type of protection (Ex p).

To prevent potentially explosive atmospheres from entering, overpressure is created with the aid of instrument air in the interior of the control box. The overpressure is monitored by a pressure monitor. The housing protects against contact and foreign bodies as well as against splash water.

Even after switching off the voltage supply, components on the inside can still have electrical charges or high temperatures which form potential ignition sources.

Figure 2.3: Control box key switch

The key switch is used to switch pressure monitoring in the control box on and off.

To switch on the pressure monitor on:

☞ Close the door of the control box.

☞ Turn the key anticlockwise to its stop limit (see figure). Pull the key out.

The control box pressure monitor is switched on. This provides explosion protection **only** in this operating mode.

If the pressure inside the control box drops below a specified threshold value, the pressure monitor switches off the voltage supply for the analyzer.

NOTICE	
	You will find more information on the pressure monitoring in the manual for the *APEX pressurization system*.

☞ Make sure that only responsible persons have access to the key.

WARNING	
	**Explosion protection is not provided when the pressure monitor is switched off!** The control box contains ignition sources. Operating the device when the pressure monitor of the control box is switched off can result in explosions in potentially explosive atmospheres. FOR THIS REASON: ☞ Never deactivate the explosion protection during normal operation. Leave the key switch in the explosion protection on position. ☞ The option of switching off the explosion protection (position: explosion protection off) is designed only for service work. No potentially explosive atmosphere may be present during this time. ☞ After performing service work, close the control box carefully with the aid of the two catches and switch on the pressure monitor again using the key switch.

The pressure monitor can be switched off for servicing or maintenance work.

☞ Place the key in the key switch.

☞ Turn the key clockwise to its stop limit.

The control box pressure monitor is switched off. **The housing is no longer protected against explosions.**

Even when the control box is open, all electrical components are still supplied with a voltage.

The lower **catch** (**1**) of the control box is secured with a safety bolt.

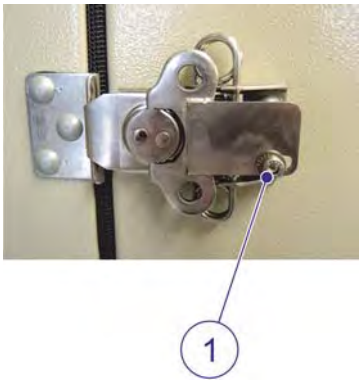


Figure 2.4: Door catch (secured)

WARNING	
	**Danger of explosion due to open sources of ignition!** The control box contains ignition sources. Opening in potentially explosive atmospheres can cause explosions. FOR THIS REASON: ☞ If there is a potentially explosive atmosphere present, disconnect the voltage supply of the analyzer and wait 5 minutes before opening. ☞ After completing work, close the housing securely.

2.5.3 Measuring unit box (Ex d)

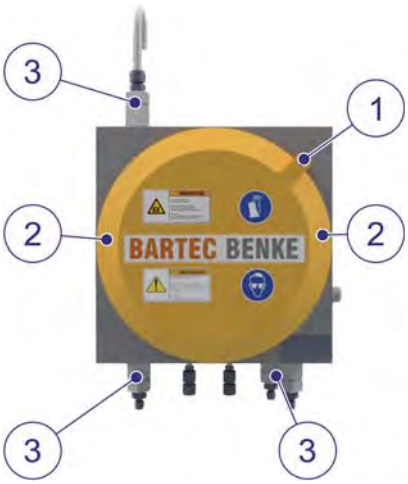


Figure 2.5: Measuring unit box

The **measuring unit box (Ex d)** contains operating equipment without an own type of protection and therefore potential sources of ignition. In addition, the housing contains fail-safe and non-fail-safe pipeline systems for product and auxiliary media. Non-fail-safe pipeline systems are always conducted to the outside via flame arresters.

The measuring unit box in combination with the flame arresters and the cable ducts provides explosion protection of the pressure-resistant enclosure (Ex d) type of protection.

The cover is fastened with a locking screw (**1**). To turn the cover, socket keys (see *Figure 2.6 on page 29*) can be inserted in the boreholes (**2**).

The housing is constructed in such a way that in the event of an explosion in the interior, the pressure is maintained and thereby prevents the spread of the explosion to the explosive atmosphere surrounding the housing.

Flame arresters prevent potential flashbacks to the outside via the pipelines. In fail-safe pipeline systems, flashbacks to the outside are precluded.

The analyzer has flame arresters with flame filters (**3**) (thread M32 x 1.5).

In the event that an explosion has taken place inside, the entire analyzer must be checked and all flame arresters replaced!

If the temperature on the surface of the flame arrester is more than 60°C, explosion protection is compromised.

Cable ducts

Only cable bushings with metric threads M25 x 1.5 or M32 x 1.5 are permitted. All other thread types damage the threads in the housing. With faulty threads, the housing no longer provides explosion protection even with suitable cable bushings and may no longer be used.

Electric charges and high temperatures

Even after switching off the voltage supply, components on the inside can still have electrical charges or high temperatures which form potential ignition sources.

☞ Keep the cover of the measuring unit box closed during operation and up to 5 minutes after the voltage has been switched off, so that electric charges and high temperatures can be safely reduced.

Opening the housing

WARNING	
	**Danger of explosion due to ignitions sources within!** Hot surfaces on the inside can ignite a potentially explosive atmosphere. FOR THIS REASON: ☞ Before opening, switch off the power supply and wait 5 minutes.

The measuring unit box can be opened for the purpose of service and maintenance work:

- Release the locking screw (pos. **1** in *Figure 2.5 on page 28*) in the housing cover.

  NOTICE! The housing cover is secured against falling by means of a hinge.

- Turn the housing cover in anti-clockwise direction to remove it from the housing. Use the two socket keys to do so.

Figure 2.6: Socket key. A socket key is equipped with a hexagon for releasing the locking screw. The socket keys are provided in the supplied tool box.

Closing the housing

- Ensure that the threads in the housing and the housing cover are undamaged. If the threads are damaged, the flame-proof gap is no longer ensured.
- Turn the housing cover clockwise into the housing as far as it will go.
- Fix the housing cover with the locking screw (**1**).

The box cover is completely inserted in the box. The housing is protected against explosions.

2.5.4 Junction boxes (Ex e)

Figure 2.7: Signal junction box (1) and power supply box (2)

The **signal junction box** (**1**) contains terminals for connecting the signal lines.

Caution! The covered terminal connections are live even when switched off.

The signal junction box only offers explosion protection in closed condition through the increased safety protection type (Ex e).
For this reason:

- ☞ Check that all seals are flawless.
- ☞ Check whether the ground cable is screwed in.
  If not, screw it in.
- ☞ Keep the cover of the signal junction box closed with all fastening bolts during normal operation.

The **power supply box** (**2**) contains terminals for connecting the supply voltages, contactors and the APEX control unit. It is required for the pressurization of the control box. The control unit regulates and monitors the flow of the protective gas and the pressure inside the housing during the rinsing phase. During the operating phase, it monitors only the pressure inside the housing (compensation for leakage rates). During the operating phase, the control unit uses the contactors to release the voltages.

Caution! The covered terminal connections are live even when switched off.

The power supply box is opened and closed with a double-bit key.

The power supply box only offers permanent explosion protection in closed condition through the increased safety protection type (Ex e).
For this reason:

- ☞ Check that all seals are flawless.
- ☞ Keep the cover of the power supply box closed during normal operation.

2.5.5 Potential matching

After the installation, the rack and all parts of the housing has to be connected to the local potential matching rails.

- ☞ Connect the analyzer to the local potential matching rail before initial commissioning.
- ☞ Check the complete local potential matching system.

Location of the potential matching connections see *chapter 2.5.1 “Overview of the safety equipment on the analyzer” on page 25*.

2.5.6 Main switch and emergency off equipment

Main switch and integration in an emergency off concept required

The analyzer has neither its own main switch nor its own emergency off device.

For this reason, before commissioning the analyzer:

☞ Install a main switch which disconnects all poles from the current supply.

☞ Install an emergency off device for the analyzer and integrate it in the safety chain of the system control during operation as part of a system.

When installing, make sure that:

- The main switch and the emergency off device can be secured against being switched on again.
- For example, it must be possible to secure the main switch with a lock to prevent it from being switched on without authorisation.

☞ The emergency off device must be connected in such a way that once the power supple or the activation of the power supply has been interrupted no situations can arise that endanger persons or property.

☞ Install the main switch and emergency off device in an easily accessible location close the analyzer.

☞ Label the main switch and emergency off device so that they can be clearly associated with the analyzer.

2.5.7 Signs and safety warnings

The signs and safety warnings on and around the device are components of the safety equipment. They are described in *Chapter 2.6 "Signs" on page 33*.

- In accordance with the maintenance plan (see *page 108*), their presence and legibility should be checked regularly.
- Replace them if damaged or missing.

2.5.8 Leakage sensor inside the measuring unit box

Figure 2.8: Leakage sensor

The leakage sensor (**1**) in the measuring unit box triggers when liquids accumulate on the base of the housing. The sensor is evaluated by the control and generates an alarm when a leak has been detected.

☞ For more information on alarms, see the *PACS software manual*.

☞ Check the function regularly in line with the maintenance plan.

☞ Replace the leakage sensor in case of damage.

2.6 Signs

The following safety instructions and signs giving orders must be attached directly to the device.

They must be attached in the position in which they are delivered and must be clearly legible.

WARNING	
	**Danger of injury resulting from illegible symbols!** Over the course of time, stickers and signs can become dirty or otherwise unrecognizable. FOR THIS REASON: ☞ Always maintain safety, warning, and operating notices in a legible condition. ☞ Replace damaged signs or stickers immediately.

Replacements can be ordered from the manufacturer. For the address to order from, see *chapter 1.7 “Customer service” on page 7*

2.6.1 Overview of signs

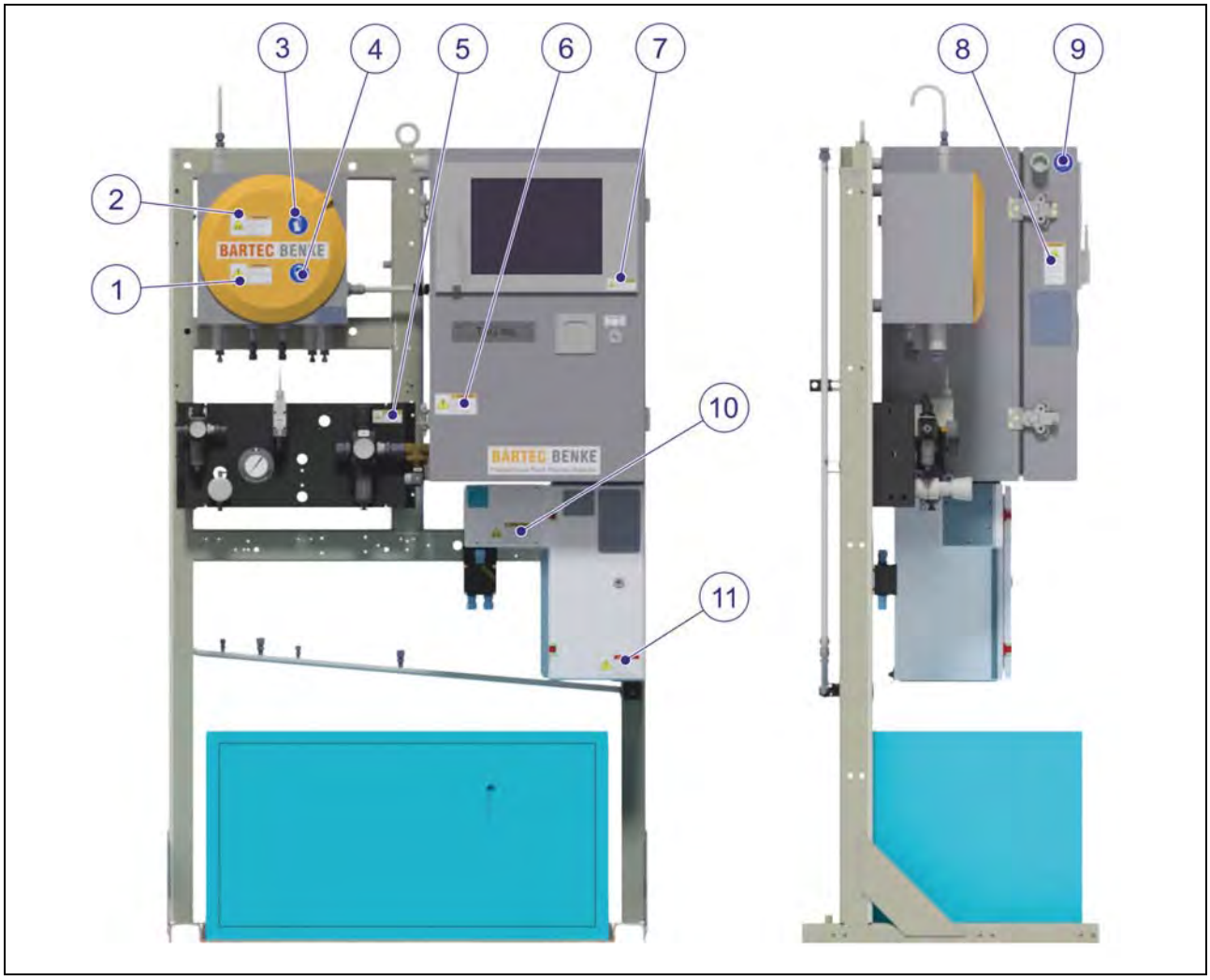


Figure 2.9: Warnings

1. Warning sign: “Danger of injury due to liquids and gases under overpressure”
2. Warning: “Danger of explosion due to ignition sources inside – wait 5 minutes”
3. Command sign: Use hand protection
4. Command sign: Use eye protection
5. Warning sign: “Danger of explosion due to electrostatic charge”
6. Warning sign: “Danger of injury due to analyzer tipping over!”
7. Warning sign: “Danger of explosion due to electrostatic charge”
8. Warning: “Danger of explosion due to ignition sources inside – wait 5 minutes”
9. Command sign: hearing protection (only for option *vortex cooler*)
10. Warning sign: “Danger of explosion due to creation of sparks” (optional)
11. Warning sign: “Danger of death due to electrical current!”

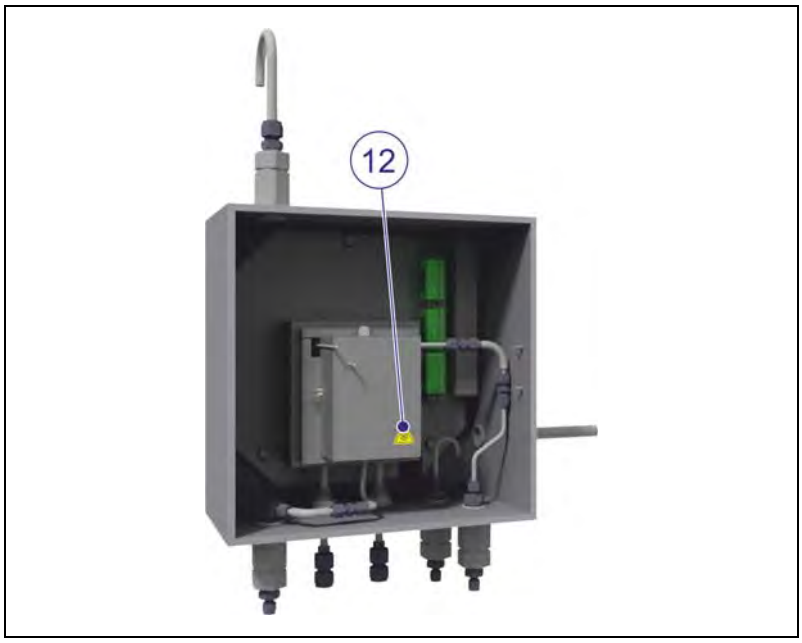


Figure 2.10: Warning inside the measuring unit box

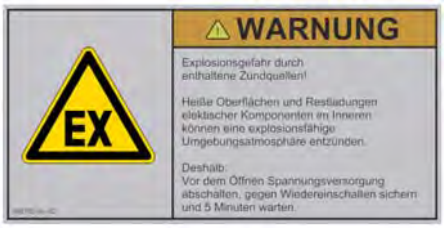
(12) Warning about cold

2.6.2 Warnings

Sticker 1 (see page 34)

WARNING	
	Danger of injury due to liquids or gases under pressure! Lines are under overpressure even when switched off. In the case of defective or leaky lines, escaping liquids or gases could cause serious injuries. FOR THIS REASON: ☞ Before performing any work, switch off the supply lines and depressurize them. ☞ Wear suitable protective goggles and gloves.

Sticker 2 (see page 34)



WARNING	
EX	**Danger of explosion due to ignitions sources within!** Hot surfaces and residual charges of electronic components on the inside can ignite a potentially explosive atmosphere. FOR THIS REASON: ☞ Switch off the power supply, secure it from being switched on again and wait 5 minutes.

Stickers 5 and 7 (see page 34)

WARNING	
EX	**Danger of explosions due to electrostatic discharge (ESD)!** Cleaning plastic surfaces with a dry cloth can result in static discharge. Any sparks could ignite a potentially explosive atmosphere. FOR THIS REASON: ☞ Always clean plastic surfaces with a damp cloth.

Sticker 6 (see page 34)

WARNING	
	Danger of injury due to analyzer tipping over! Due to the high center of gravity, the analyzer could tip over if transported incorrectly, which can lead to severe injuries and material damage. FOR THIS REASON: ☞ Secure the analyzer against tipping over and use a suitable means of transport.

Sticker 8 (see page 34)

WARNING	
EX	**Danger of explosion due to ignitions sources within!** Hot surfaces and residual charges of electronic components inside the control box can ignite a potentially explosive atmosphere. FOR THIS REASON: ☞ Switch off the power supply, secure it from being switched on again and wait 5 minutes to ensure that hot surfaces have cooled and residual charges have discharged before opening.

Sticker 10 (see page 34)

WARNING	
EX	**Danger of explosion due to sparks!** Incorrectly installed intrinsically safe electrical circuits could cause sparks. FOR THIS REASON: ☞ Observe installation regulations on intrinsically safe electrical circuits. Threshold values can be found on the evaluation device installed.

Sticker 11 (see page 34)

DANGER	
	Danger of death due to electrical current! Touching the non-intrinsically safe, voltage-conducting parts can cause potentially fatal current to flow. FOR THIS REASON: ☞ Do not open the box if non-intrinsically safe circuits are live.

Sticker 12 (see page 35)

Warning about cold

2.6.3 Command signs

Sticker 3 (see page 34)

This command sign indicates that suitable gloves must be worn (see *page 44*).

Sticker 4 (see page 34)

This sign indicates that suitable safety goggles must be worn (see *page 44*).

Sticker 9 (optional – see page 34)

This command sign indicates that suitable hearing protection should be worn (see *page 44*) and is located on the control box (if the *control box cooling* option is installed).

2.7 Safety measures at the installation location

Workspace conditions

- ☞ Ensure that the working area is adequately ventilated.
- ☞ Observe the emission limits. Install an exhaust-air cleaning system if necessary.
- ☞ Do not direct suctioned-off air back into the work room.
- ☞ Install washing facilities and eye baths in the workplace.
- ☞ Install a solvent-proof floor.
- ☞ **Creeping vapors can constitute an ignition source.** Seal the room properly to ensure that gases or vapors which could contain ignition sources cannot enter the room.
- ☞ Install equipment for detecting and reporting gas hazards.
- ☞ Install emergency-off equipment in easily accessible locations.

Containers and hoses

- ☞ Label containers and hoses clearly.

- ☞ Only conduct work on containers and hoses when they have been thoroughly rinsed and rendered inert.
- ☞ Protect the analyzer from impermissible external warming.
- ☞ Regularly inspect for leaks.

Vent/drain system

The vent/drain system may not be used to introduce foreign gases, vapors or liquids.

2.8 Safety information on explosion protection

Petrochemical products

WARNING	
	**Danger of explosions due to impermissible petrochemical products!** The explosion protection of the individual analyzer has been exclusively designed for the safety technology characteristics of the petrochemical products specified in the order documentation. FOR THIS REASON: ☞ Before switching on and during analyzer operation, make sure that the supply lines and all other petrochemical product-conveying parts of the analyzer only contain the permitted product (for example by thorough rinsing and bleeding). ☞ Make sure that the product properties correspond with the given specifications.

WARNING	
	**Danger of explosions due to escaping petrochemical products!** Petrochemical products can leak. The liquid evaporates and forms an explosive atmosphere when it mixes with air. Or escaping gas can form an explosive atmosphere with the air. Highly flammable liquids can start fires that can cause severe or fatal injuries. FOR THIS REASON: ☞ Prevent the escape of petrochemical product. ☞ Do not use open flames or ignition sources. ☞ Take measures to prevent electrostatic charging. ☞ Do not use any tools which cause sparks. ☞ Additionally used devices and all electrical connections within the danger area must be protected against explosions in accordance with ATEX. ☞ Written permission (hot work permit) must be obtained for all work with flames or hot materials. ☞ Make a fire extinguisher available. ☞ Halt work at once in the event of fire. Initiate fire-fighting and, if appropriate, leave the danger zone until the all clear signal is given.

Vent and drain

WARNING	
	**Danger of explosions due to uncontrolled chemical reactions!** Supplied/discharged liquids other than the petrochemical product can explode. FOR THIS REASON: ☞ Make sure that the vent/drain system and other lines only convey the petrochemical product and its exhaust gases.

Technical modifications

WARNING

Danger of explosions due to technical modifications!

Every unauthorized modification endangers the safety of the analyzer and can result in the failure of the explosion protection and accidents.

FOR THIS REASON:

☞ Do not make any technical modifications to the analyzer without prior written consent from the manufacturer.

☞ Only use spare parts from BARTEC BENKE.

Ignition sources of operating material outside the analyzer

WARNING

Danger of explosion due to open ignition sources of operating material outside the analyzer

Operating materials operated in intrinsically safe circuits can cause explosions if they are not connected in line with the manufacturer's specifications.

FOR THIS REASON:

☞ The total of all capacities and inductivities of this operating equipment must lie below the threshold values specified in the standards and regulations applicable to explosion protection and in the manufacturer's specifications.

Electrostatic discharge

WARNING

Danger of explosion due to open ignition sources of operating material outside the analyzer

Electrostatic discharges can cause sparks and ignite potentially explosive atmospheres.

FOR THIS REASON:

☞ Always use a damp cloth to clean plastic parts of the analyzer, and the touchscreen in particular.

☞ Always operate the analyzer with a ground connection.

WARNING

Danger of explosions due to electrostatic discharge!

Painting the analyzer increases the risk of electrostatic discharge even on metallic surfaces.

FOR THIS REASON:

☞ Do not paint or coat the analyzer.

Flame arresters for Ex d box

WARNING	
	**Danger of explosion due to incorrectly installed flame arresters!** The Ex d box does not provide protection against explosion if the flame arresters are incorrectly installed! FOR THIS REASON: ☞ Ensure that both or all three flame filters are installed. ☞ Follow the instructions precisely when assembling the flame arresters. ☞ Screw flame arresters correctly

2.9 Personnel requirements

All personnel who may work in potentially explosive atmospheres must be sufficiently trained and familiar with the analyzer or the component. This training must include instruction on the device properties, hazardous substances and environmental conditions that relate to the requirements for explosion protection.

2.9.1 Qualifications

WARNING	
	**Danger of injury due to inadequate qualifications!** Improper handling can lead to considerable personal injury and material damage. FOR THIS REASON: ☞ Have all tasks performed only by qualified personnel.

The operating manual refers to the following qualifications for various task areas:

Instructed person

An instructed person has been instructed by the operator on the assigned tasks and on the potential dangers in case of improper behavior.

Trained specialist

Trained specialists have specialist training, knowledge and experience and are aware of the relevant regulations, meaning that they can perform assigned tasks and detect and avoid any possible dangers.

Electrician

Electricians have specialist training, knowledge and experience and are aware of the relevant standards and regulations, meaning that they can perform work on **electrical systems** and detect and avoid any possible dangers.

Electricians are trained for the special locations in which they work and are aware of the relevant standards and regulations.

They are also familiar with all standards and regulations relevant to explosion protection, in particular, but not limited to, all sections of IEC 60079 [*Explosive atmosphere*].

Specialist for potentially explosive atmospheres

Specialists for potentially explosive atmospheres have specialist training, knowledge and experience and are aware of the relevant standards and regulations, meaning that they can perform work on **systems or components in potentially explosive atmospheres** and detect and avoid any possible dangers.

The specialists have knowledge of the various ignition protection types, installation procedures and area partitions in rooms where potential explosions can arise and has certification for experience of knowledge in this area.

These specialists are aware of the rules and regulations applicable to their duties and for explosion protection, in particular, but not solely the ATEX guideline 94/9/EC (2014/34/EU) and all parts of IEC 60079 [*Explosive atmosphere*].

2.9.2 General requirements

Completed instruction must be logged and confirmed by the persons responsible for instruction and by the persons receiving instruction.

Employees must be persons who can be expected to perform their work reliably. Persons whose reactions are impaired, e.g. by drugs, alcohol or medication, are not permitted.

When selecting employees, observe the age and occupation-specific regulations applicable at the location of deployment.

2.9.3 Unauthorized persons

WARNING	
	**Hazard for unauthorized persons!** Unauthorized persons who do not fulfill the requirements described here are not aware of the hazards posed in the work area. FOR THIS REASON: ☞ Keep unauthorized persons out of the work area. ☞ In case of doubt, address these persons and instruct them to leave the work area. ☞ Interrupt work as long as unauthorized persons are within the work area.

2.9.4 Instruction

The operator must provide instruction to personnel before they are hired, and at least once a year after that. Log the performance of instruction to make it easier to monitor.

Below is an example of an instruction log:

Date	Name	Type of instruction	Instruction provided by	Signature
		First safety instruction for _____		
		Annual safety instruction for _____		

2.10 Personal protective equipment

Wearing personal protective equipment while working is required in order to minimise health hazards.

☞ Always wear the protective equipment required for the corresponding tasks.

☞ Follow the instructions posted in the work area regarding personal protective equipment.

Always wear

Protective work clothing

The following minimum requirements must always be met when performing work.

- Anti-static
- Fire-retardant
- Tight-fitting and closed

Wear no rings, chains or other jewellery.

Safety boots

The following minimum requirements must always be met when performing work.

- Category S3 and closed
- Anti-static
- Fire-retardant

Analyzer with option control box cooling

Use of a vortex cooler causes noise emissions of 85°dB°(A). Wear hearing protection during all work while the device is in operation.

Hearing protection

Protects against hearing damage. Hearing protection must comply with the requirements of EN 352 2002.

For special work, wear

When performing special tasks, special personal protective equipment is required. This equipment is referred to specifically in the individual chapters of this operating manual. These special items of safety equipment are described below:

Respiratory protection, filter devices

Protect against hazardous gases, vapours, dusts and similar materials and media.

If a permissible threshold value is exceeded by a factor of 100, self-contained respiratory protection apparatus must be used.

Respiratory protection may only be used when there is an oxygen content of at least 17% in the air.

Safety goggles

to protect the eyes from flying objects and sprayed liquids.

Note: Some system operators make the wearing of safety goggles mandatory in general.

Protective gloves (hazardous materials)

for protecting the hands against contact with hazardous toxic substances. The glove material must be sufficiently durable and impermeable to the substance in use. Gloves made of fabric or leather are not suitable.

- Before using, check for holes or leaks.
- Clean before removal.

Safety gloves (hot surfaces)

Protect hands against contact with hot surfaces.

2.11 Securing against being switched on again

DANGER	
	**Danger of death due to unauthorised restarting!** During work in danger areas, there is the danger that the power supply can be switched on without authorisation. This poses a life-threatening hazard for the persons in the danger area. FOR THIS REASON: ☞ Adhere to the instructions for securing the device against being switched on again in this operating manual. ☞ Always follow the procedure described for securing the device against being switch on again.

Switch secured with lock
on: _____ at _____ o'clock.

DO NOT SWITCH ON
The lock may only be removed
by: _____
once it has been ascertained that there are no persons in the danger area.

☞ Perform the following steps to prevent restarting:

- Switch off the power supply.
- If possible secure the switch with a lock and attach a corresponding sign (see left) to the switch in a place where it can be easily read.
- Have the employee named on the sign keep the key safe.

Switched off
on: _____ at_____ o'clock.

DO NOT SWITCH ON

The device may only be switched on
by: _____
once it has been ascertained that there are no persons in the danger area.

If it is **not** possible to secure the switch with a lock,

☞ Set up a corresponding sign (see left).

☞ Ensure that no persons are in the danger zone once all work has been completed.

☞ Make sure that all safety equipment is installed and functioning.

☞ Only then should the sign be removed.

3 Technical data

Parameters	Specification	
Device type	**FRP-4.2/CPA-4.2**	
Variable	Freezing point (FP) and cloud point (CP)	
Measuring range	Up to -70°C (-94°F) cloud point optional: up to -80°C (-112°F) cloud point	
Measuring cycle	Cyclic (8 to 20 min.), depending on the product	
Marking according to TRTC	II 2 G IIC T4 Gb (see type plate)	
Method comparable with	**Freezing point:** ASTM D2386 DIN ISO 3013 ASTM D5901 ASTM D1015 IP 16	**Cloud point:** ASTM D2500 ASTM D7153-05 ASTM D7154-05
Repeatability	≤ requirements of DIN/ASTM	
Comparability	≤ requirements of DIN/ASTM	
Product streams	■ 2x product stream ■ 1x validation stream (additional hardware required)	
Special functions	■ Free definition of products (winter/summer quality) ■ Parameterizable measuring procedure ■ Automatic stream switching ■ Automatic validation NOTICE: For some of the above functions, additional hardware, if applicable, is required.	

Parameters	Specification
Sample characteristics	
Inlet pressure P_{rel}	2 to 3 bar (29 to 43.5 psi)
Property	50 µm, without suspended water, bubble-free
Flow rate	5 to 30 l/h
Inlet temperature	5° to 15°C; at least 15 K above the expected CP
Viscosity at inlet	Max. 37 cSt. at inlet temperature
Auxiliary media	
Instrument air (for flushing the control box)	
Primary pressure P_{rel}	2 to 7 bar (29 to 101 psi)
Consumption, normal operation, typical	Approx. 1.0 Nm³/h
Consumption, rinsing phase	8 Nm³/h
Quality	Class 2 in line with ISO 8573-1 or higher
Temperature	Max. 40°C
Instrument air/N2 (for flushing of the measuring unit against the atmosphere)	
Primary pressure P_{rel}	2 to 7 bar (29 to 101 psi)
Consumption	12 Nl/h
Quality	Class 2 in line with ISO 8573-1 or higher
Temperature	Max. 40°C
Coolant	
Type	The water-glycol mixture or temper (variant-dependent)
Primary pressure	1 to 3 bar (15 to 44 psi)
Flow rate	60 to 100 l/h
Quality	Filtered 50 µm, pH value 6 to 8
Inlet temperature	20° bis 40°C (depending on the application)

Parameters	Specification
Power supply	
Rated voltage	See data sheet/type plate
Maximum permissible deviation from rated voltage	± 10%
Frequency	See data sheet/type plate
Rated current	See data sheet/type plate
Pre-fuse	16 A
Protection type	Europe (IEC 60529): IP 54 (splash water protected)
Signal inputs and outputs	
Analog inputs	
Signal	4 to 20 mA
Apparent ohmic resistance, maximum	160 Ω
Reference potential	0 V/ground
Digital inputs	
Voltage	High: 15 to 28 VDC Low: 0 to 4 VDC
Reference potential	0 V/ground
Analog outputs	
Signal	4 to 20 mA
Apparent ohmic resistance, maximum	1000 Ω
Reference potential	0 V/ground
Digital outputs	
Voltage	24 VDC
Current	0.5 A
Total signal currents, max.	0.8 A
Reference potential	0 V/ground
Auxiliary voltage	
Voltage	24 VDC
Current, max.	0.8 A

Parameters	Specification
Operating and storage conditions	
Ambient temperature	Operation: 5 to 40°C (41 to 104°F) Storage: -20 to 60 °C (-4 to 140 °F)
Humidity	Operation: 5 to 80% relative at 25°C, non-corrosive Storage: 5 to 80% relative at 25°C, non-corrosive
Vent and drain	
Version	Shared vent-drain pipe with two connections During normal operation, small quantities of product condensate and vapor escape at the vent connection. In the event of an error, liquid product can escape from the vent connection.
Back-pressure	Atmospheric pressure, others upon request
Emissions	
Basic device	<70 dB(A)
Rinsing phase control box	95 dB(A)
Device with option *vortex cooler*	<85 dB(A)
Liquid	Petrochemical product, discharged via drain
Gaseous	Petrochemical product, discharged via vent and drain
Connections	
Screw pipe vent/drain	Ø12 mm (1/2" on request)
Screw pipe product and purge gas inlet	Ø6 mm (1/4" on request)
Screw pipe coolant inlet and outlet (optional without *chiller*)	Ø12 mm (1/2" on request)
General specifications	
Dimensions (W x H x D) in mm	1,140 x 2,050 x 710
Weight	Analyzer without options: Approx. 380 kg Chiller (optional): Approx. 110 kg

3.1 Type plates

The following figures are **example** type plates in line with ATEXT:

Analyzer

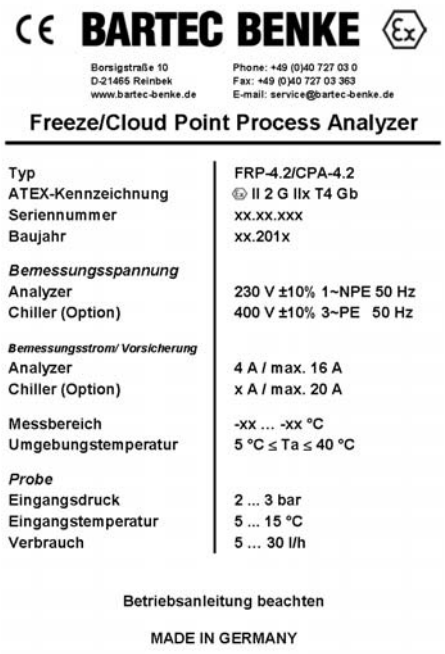


Figure 3.1: Type plate analyzer

The primary type plate is located on the cover of the power supply box and contains the following information:

- Manufacturer
- Type
- Ex marking (explosion protection marking)
- Serial number
- Year of manufacture
- Rated voltage
  - Analyzer
  - Chiller (optional)
- Rated current/pre-fuse
  - Analyzer
  - Chiller (optional)
- Measuring range
- Ambient temperature
- Sample
  - Inlet pressure
  - Inlet temperature
  - Consumption

Measuring unit

Figure 3.2: Type plate, measuring unit FRP-4.2

The type plate for the measuring unit is on the front of the measuring unit box and contains the following information:

- Manufacturer
- Type
- Ex marking (explosion protection marking)
- Certificate number
- Serial number
- Year of manufacture
- Ambient temperature

Control box

Figure 3.3: Type plate control box

The type plate for the control box is on the left side of the control box door and contains the following specifications:

- Manufacturer
- Type
- Ex marking
- Certificate number
- Serial number
- Date of build
- Protective gas
- Supply pressure
- Cut-off pressure
- Purging flow rate
- Purging duration
- Leakage rate

Junction boxes

Figure 3.4: Type plate Junction boxes

The type plate for the junction boxes is on a side of the junction boxes and contains the following specifications:

- Manufacturer
- Type
- Ex marking
- Certificate number
- Serial number
- Date of build
- Rated voltage
- Maximum number of terminals

4 Design and function

This chapter provides an overview of the most important functions and the design of the analyzer.

4.1 Overview

Figure 4.1: Analyzer overview

1. Measuring unit box
2. Touchscreen
3. Control box
4. Signal junction box
5. Power supply box
6. Chiller for liquids
7. Rack
8. Fluid technology

4.2 Brief description

The analyzer is used for continuous, fully automated measurement of the *cloud point* (CP) or *freezing point* (FP) of petrochemical or similar liquids.

Determination of the cloud point

For the determination of the two readings, the sample is steadily cooled down under precisely defined conditions. As soon as the sample temperature has reached a value at which small crystals form that spread in the sample and make it cloudy, this temperature is referred to as *cloud point*.

Determination of the freezing point

If the cooling is terminated, the crystals melt again with increasing temperature. The sample becomes transparent and clear again. The temperature at which the crystals are completely dissolved is referred to as *freezing point*.

Definition and use of the freezing point

The knowledge of the behavior and properties of liquid hydrocarbons at low temperatures is of great importance with regard to their application because the flow behavior is strongly affected, for example, when pumping and filtering.
The *freezing point* is used as measurement value for the regulation/control of the production process and is necessary for releasing the product for sale.

The determination of the *freezing point* (FP) in the laboratory has been specified in several national and international standards:

- ASTM D2386-97
- DIN ISO 3013 (international standard)
- IP 16
- ASTM D5901

Definition and use of the cloud point

The determination of the concentration of paraffin in liquid hydrocarbons is important for the further processing and usability of mineral oil products.
In addition, the determination of the cloud point can be used for internal purposes, i.e. as a parameter to check process optimization or sales standards.

The determination of the *cloud point* (CP) in the laboratory has been specified in several national and international standards:

- DIN EN 23015 (German standard)
- ISO 3015 (international standard)
- IP 219/82 (British standard)
- ASTM D2500 (American standard)

NOTICE	
	The standards for the cloud point listed above limit the scope of application for the measurement of the cloud point in mineral oil products that are transparent at a given layer thickness of 40 mm (IP and ASTM specify 1 1/2" = 38 mm) and whose cloud point is less than 49°C (120°F).

Up to three streams can be connected to the process analyzer. Different versions of the streams are possible. The product streams are selected alternately for measuring in automatic mode.

The measuring values are displayed on the touchscreen and transferred to higher-level systems (e.g. a measuring station) via the integrated interface.

4.3 Measuring principle

The photometric measuring principle of the analyzer allows the detection of a sample becoming cloudy on the basis of diffusion of light and diffuse reflection caused by tiny, finely dispersed particles that emerge during the cooling process of the product in the measuring cell when a specific temperature is undercut. The rate of this crystallization of paraffins in the product correlates with the cooling energy to which the sample is subjected.

The crystals are finely dispersed particles that reflect and absorb the optical radiation between the transmitter and the receiver of the measured distance. The rate of this dispersion and thus the absorption/attenuation of the received light intensity is determined by the number of particles in the optical path; the different refractive indices of liquid and solid components of the sample; as well as the wavelength range of the emitted light.

The measured *cloud point* is the temperature that is determined when, in the optical part, a specific threshold value is undercut for the dispersion. The measured *freezing point* is the temperature at which no diffusion and absorption of light is detected any longer after a threshold value defined beforehand was exceeded once.

The required cooling energy is brought into the product with the aid of Peltier elements or supplied by the *chiller* (optional) or an external cooling system. The sequence of the analysis procedure is controlled, monitored and visualized by the PACS (Process Analyzer Control System) process software.

For more information, *see Software Instructions PACS*.

4.4 Description of subassemblies

4.4.1 Measuring unit

Overview

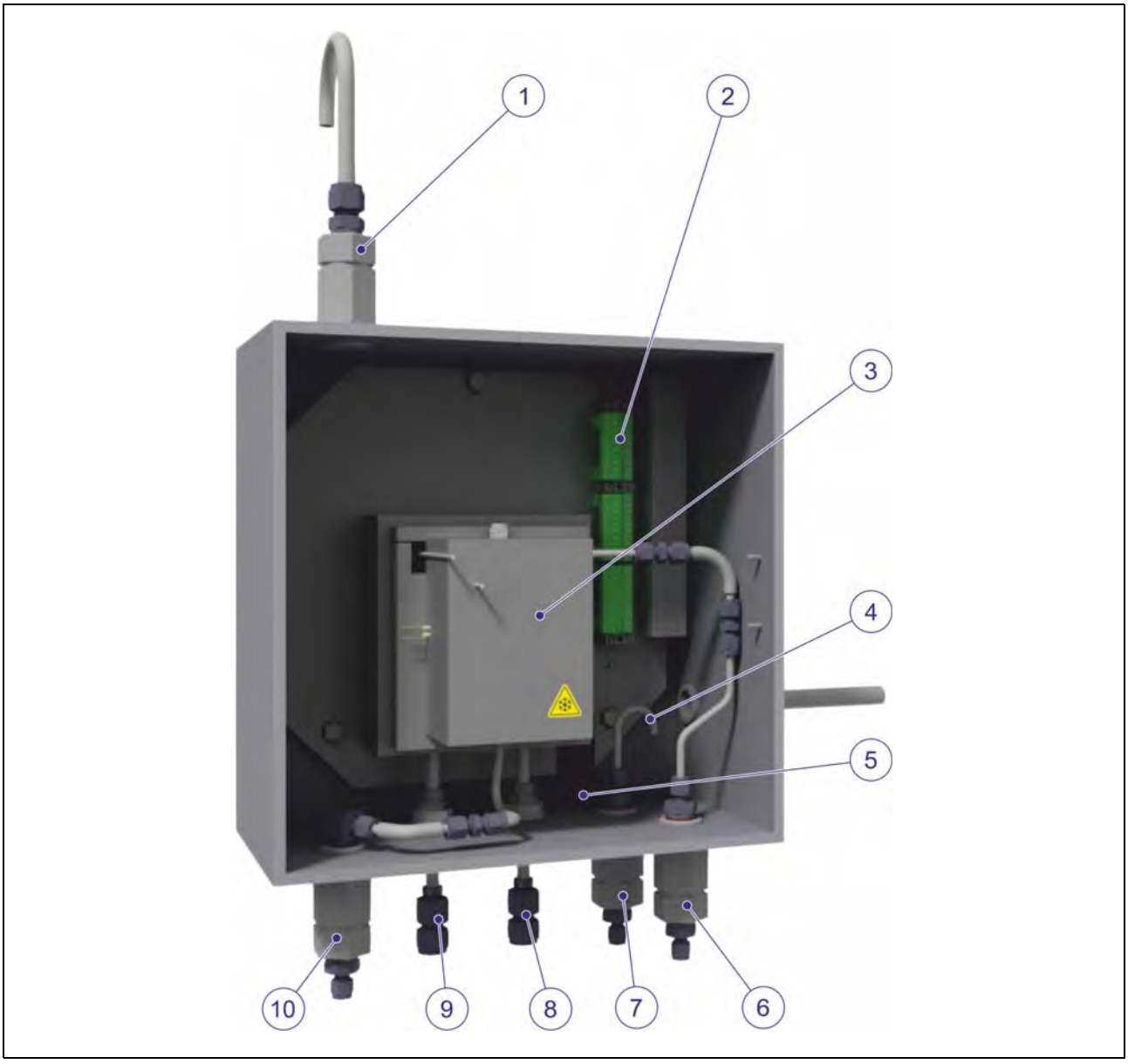


Figure 4.2: Subassemblies inside the measuring unit box

1. Flame arrester
   Outlet for the flushing of the measuring unit box
2. Connecting terminals
3. Measuring unit with insulation
4. Pipe for the flushing of the measuring unit box
5. Leakage sensor
6. Flame arrester, product outlet
7. Flame arrester
   Inlet for the flushing of the measuring unit box
8. Coolant inlet
9. Coolant outlet
10. Flame arrester, product inlet

Measuring unit

The measuring unit (**3**) contains the measuring cell, Peltier elements for temperature control and temperature sensors. The coolant is fed through a heat exchanger and thus provides for the cooling of the Peltier elements. The Peltier elements regulate the temperature and thus the sample inside the measuring cell.

For more information on the design of the measuring cell see *chapter 4.4.2 "Structure of the measuring cell" on page 59*.

Connecting terminals

All electrical components of the measuring unit box are connected at the connecting terminals (**2**).

Flushing of measuring unit box

Flushing the measuring unit box prevents the occurrence of condensation and ice on the cold parts of the measuring unit. The purge gas is fed into the box through the pipe (**4**). Via the flame arrester (**1**), the purge gas is led out again on the top of the box.

Leakage sensor

For more information about the leakage sensor, see *Chapter 2.5.8 "Leakage sensor inside the measuring unit box" on page 32*.

Measuring unit box (Ex d) and flame arresters

The measuring unit box in combination with the flame arresters and the cable ducts provides explosion protection due to the pressure-resistant enclosure (Ex d) type of protection. All supply and discharge lines to non-fail-safe pipeline systems in the Ex d box are equipped with flame arresters.

WARNING	
	**Danger of explosion due to incorrectly installed or operated flame arresters!** Explosion protection is no longer given if the flame arresters are installed incorrectly, as well at temperatures above the maximum allowable product temperature. ☞ Avoidance measures see *chapter 2 "Safety"*.

4.4.2 Structure of the measuring cell

The following figure shows the structure of the measuring cell:

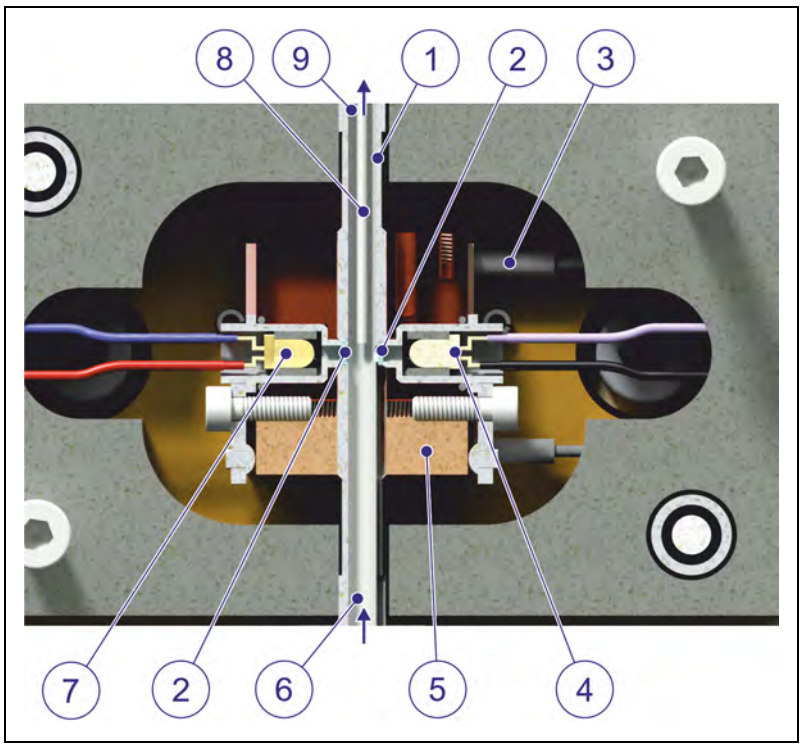


Figure 4.3: Cross-section of the measuring cell

1. Measuring cell pipe
2. Window
3. Peltier element
4. Light barrier, receiver (black and purple cable)
5. Body of the measuring cell
6. Sample inlet
7. Light barrier, emitter (blue/red cable)
8. Temperature sensor, sample
9. Sample outlet

The product sample is in the measuring cell pipe (**1**). The cloudiness of the sample is measured through the window (**2**) with the light barrier (**4**, **7**). The temperature sensor (**8**) measures the temperature of the sample in the measuring cell.

The body of the measuring cell (**5**) makes the thermal connection of the measuring cell pipe (**1**) to the Peltier element (**3**).

4.4.3 Control unit

1. Output instrument air
2. Touchscreen
3. Explosion protection key switch
4. Display overpressure monitor
5. Pressure regulator for overpressure regulation
6. Digital purging gas valve
7. Pen for touchscreen

Figure 4.4: Outside of the control box

The pressurized enclosed control box contains all electrical and electronic components necessary for controlling the analyzer.

The electrical and electronic components are:

- The industry PC that provides the user interface, controls and monitors all processes and performs external communications.
- IO card for processing internal and external digital and analog inputs and outputs.
- Power supply and automatic circuit breakers
- If necessary, transformers (for converting the voltage supply)
- Motor and fault protection switches, filters, contactors
- Measuring transmitter, measuring amplifier, switching repeater

4.4.4 Fluid technology

The fluid technology subassembly contains components for regulating the pressure and filtering the required instrument air and for filtering the coolant if the *cooling unit* option is installed.

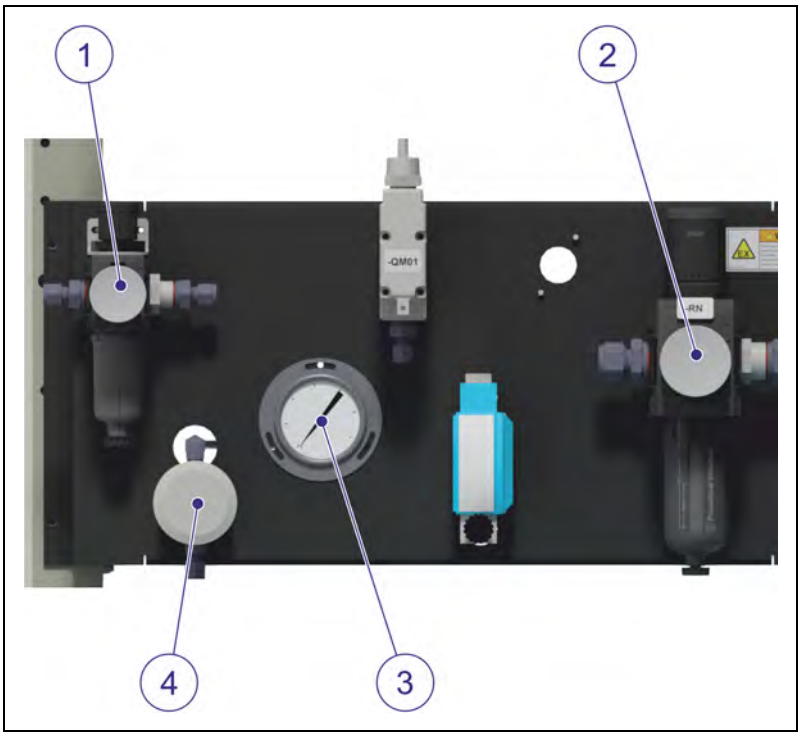


Figure 4.5: Fluid technology (example)

1. Pressure regulator, flushing of measuring unit box
2. Pressure regulator, flushing of control box
3. Manometer, pressure at the product inlet
4. Pressure regulator, product inlet

4.4.5 Junction boxes

The analyzer is connected to the supply and signal voltages via two separate junction boxes:

Figure 4.6 Signal junction box (1) and power supply box (2)

The **signal junction box** (**1**) contains terminals for connecting the signal lines.

The Ex e type of protection of only guaranteed as long as the signal junction box is closed.

The **power supply box** (**2**) contains terminals for connecting the supply voltages, contactors and a control unit. It is required for the pressurization of the control box. The control unit regulates and monitors the flow of the protective gas and the pressure inside the housing during the rinsing phase. During the operating phase, it monitors only the pressure inside the housing. During the operating phase, the control unit uses the contactors to release the voltages.

The Ex e type of protection of only guaranteed as long as the power supply box is closed permanently.

4.5 Optional extensions

Chiller for liquids

The **chiller for liquids** (chiller for short) provides cold cooling medium, e.g. for any heat exchangers or other applications. For more information on the **chiller**, please refer to the accompanying manual.

Control box cooling

The housing can be retrofitted with a vortex cooler. For more information, please refer to the accompanying handbook.

Serial interface

Serial interface for data exchange. Measurement values are output using the MODBUS protocol.

Remote maintenance interface

Interface for remote access to the PACS controller software.

Sample conditioning system

The optional sample treatment system is upstream of the product supply system. The design depends on the application and can be found in the technical documents supplied in the customer folder.

Validation system

As standard, the *validation system* consists of a tank, a pump, one or several valves, and further components. The valves are operated manually or controlled by the PACS control software.

Recovery system

The *recovery system* collects the product that is directed into the drain line of the device. The product can then be pumped to a higher pressure level. The recovery system basically consists of a container, a pump, valves, sensors, and its own control.

4.6 Connections

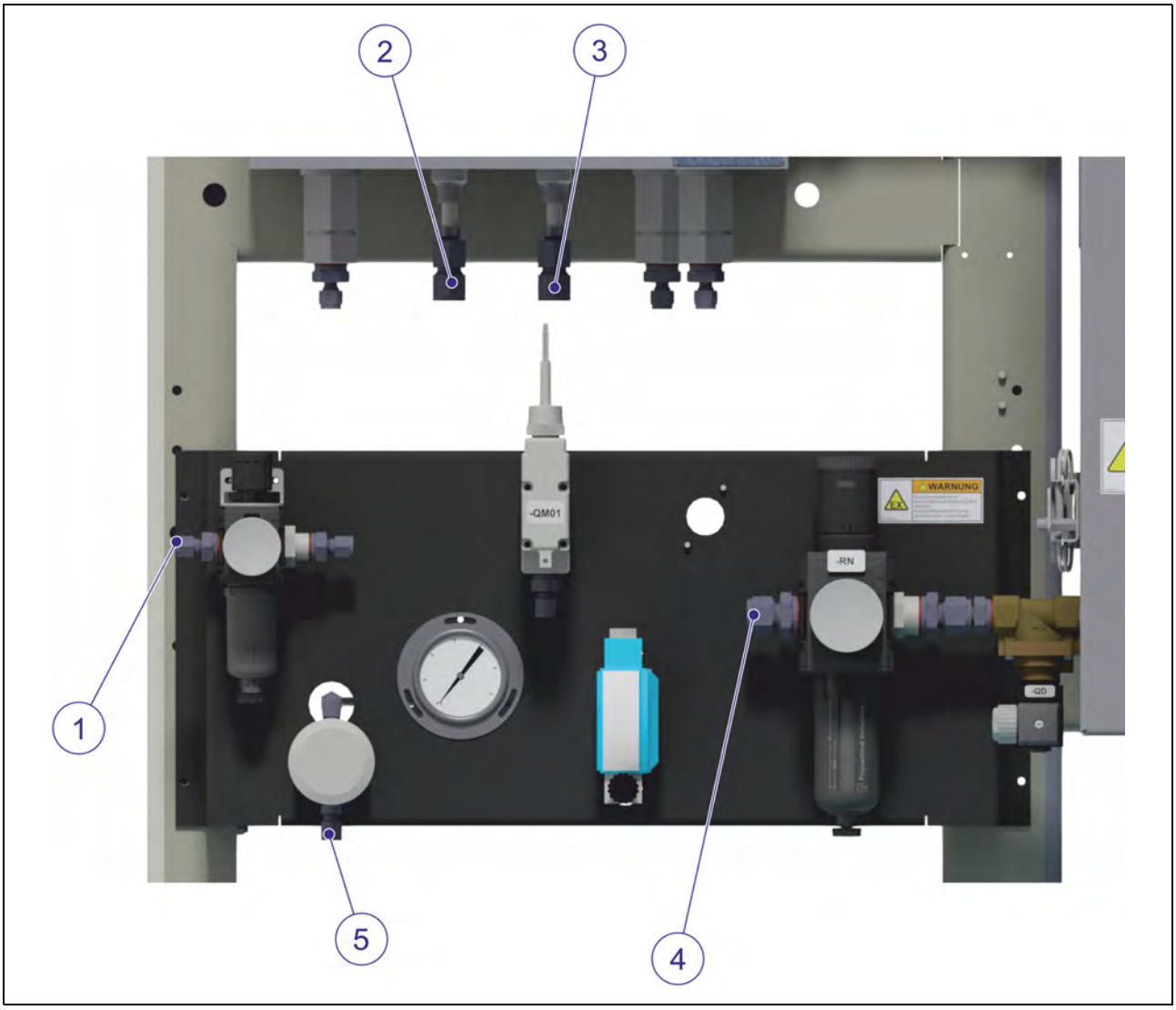


Figure 4.7: Connections

1. Inlet for the flushing of the measuring unit box
2. Coolant inlet
3. Coolant outlet
4. Instrument air inlet, control box
5. Product inlet

4.7 Operating elements

Figure 4.8 Control box key switch

To prevent potentially explosive atmospheres from entering, overpressure is created with the aid of instrument air in the interior of the control box.

The overpressure is monitored by a pressure monitor. For servicing and maintenance work, monitoring can be switched off using the **key switch** on the front side of the control box.

WARNING	
	**Explosion protection is no longer provided when the pressure monitor is switched off!** The control box contains ignition sources. Operating the device when the pressure monitor of the control box is deactivated can result in explosions in potentially explosive atmospheres. ☞ Avoidance measures see *chapter 2 Safety*.

Figure 4.9 Touchscreen with input pen

The **touchscreen** on the front of the control box is used to for making inputs in the user interface. Inputs are made with a pen.

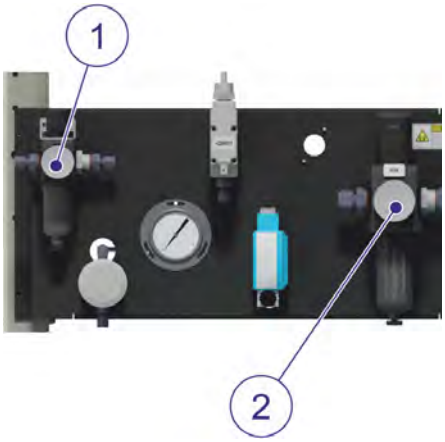


Figure 4.10: Pressure regulator with coalescer and filter unit

Pressure regulator with coalescer and filter unit for adjusting the primary pressure for instrument air. The pressure regulator protects against particles and moisture entering the instrument air in the event of a fault.

The maintenance devices are used for the following, for example (see also *Figure 4.5 on page 61*):

(1) Flushing the measuring unit box

(2) Overpressure monitor, control box

NOTICE	
	For more detailed information on operating, controlling, and configuring the device and on the analyzing process, please refer to the software manual.

5 Transport, packaging and storage

The following transport and storage conditions must be observed.

5.1 Safety

Personnel

The transport work described here may only be performed by trained specialists or by employees of the manufacturer.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 "Safety"* and the following additional protective equipment:

- Protective gloves
- Head protection if necessary

5.2 Safety instructions for transport

Improper transport

CAUTION	
	**Damage due to improper transport.** Improper transport can result in considerable material damage. ☞ Avoidance measures see *chapter 2 "Safety"*.

Suspended loads

WARNING	
	**Danger of death due to suspended loads!** When lifting loads, falling or uncontrollably swinging components pose a danger to life and limb. ☞ Avoidance measures see *chapter 2 "Safety"*.

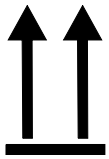
WARNING	
	**Danger of injury from transport item swinging out!** The suspension point is not directly over the centre of gravity of the analyzer. The item swings out when transported with a crane and can cause injury to personnel or material damage if not allowed adequate room to manoeuvre. ☞ Avoidance measures see *chapter 2 "Safety"*.

Tipping over of the analyzer

WARNING	
	**Danger of injury from transport item tipping over!** If it is set down the transport load on an uneven surface or surface with an insufficient load-bearing capacity, the load will tip over. This can result in injuries to personnel or material damage. ☞ Avoidance measures see *chapter 2 "Safety"*.

WARNING	
	**Danger of injury due to analyzer tipping over!** Due to the high centre of gravity, the analyzer could tip over if transported incorrectly, which can lead to severe injuries and material damage. ☞ Avoidance measures see *chapter 2 "Safety"*.

5.3 Symbols on the packaging



This way up
The arrows indicate the top side of the packaged item. They must always point upwards, otherwise the content can be damaged.

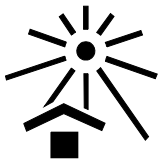
Protect against moisture
Protect the packaged items against moisture and store in a dry place.

Lift here
Lifting equipment (chains, lifting belts) should only be attached to the points indicated with this symbol.

Centre of gravity
Indicates the centre of gravity of packaged items.
Take the centre of gravity into consideration when lifting and transporting.

Weight of suspended load
Indicates the weight of packaged items.

Handle the packaged item in a manner appropriate for the indicated weight.



Protect against heat
Protect packaged items against heat and direct sunlight.

Caution, fragile
Indicates fragile goods.
Handle packages carefully, do not push or strap.

5.4 Transport inspection

☞ Inspect the delivery immediately upon reception for completeness and possible transport damage.

☞ If externally visible transport damage is detected, proceed as follows:

- Do not accept the delivery or only with reservations.
- Note the extent of damage on the transport documents or on the delivery note of the carrier.
- File a claim.

NOTICE	
	File a claim for every defect as soon as it is detected. Damage claims can only be honoured within the applicable claim deadlines.

5.5 Packaging

Packaging

The individual packaged items are appropriately packed for the expected transport conditions. Only environmentally sound materials have been used for the packaging.

The packaging is designed to protect the individual components from transport damage, corrosion and other damage until the time of their assembly. Therefore do not destroy the packaging and only remove it immediately prior to assembly.

Handling packaging materials

Separate packaging materials by type and size and reuse or recycle.

CAUTION	
	**Environmental damage due to incorrect disposal.** Packaging materials are valuable raw materials and can in many cases be reused or expediently processed and recycled. ☞ Avoidance measures see *chapter 2 "Safety"*.

5.6 Center of gravity and suspension

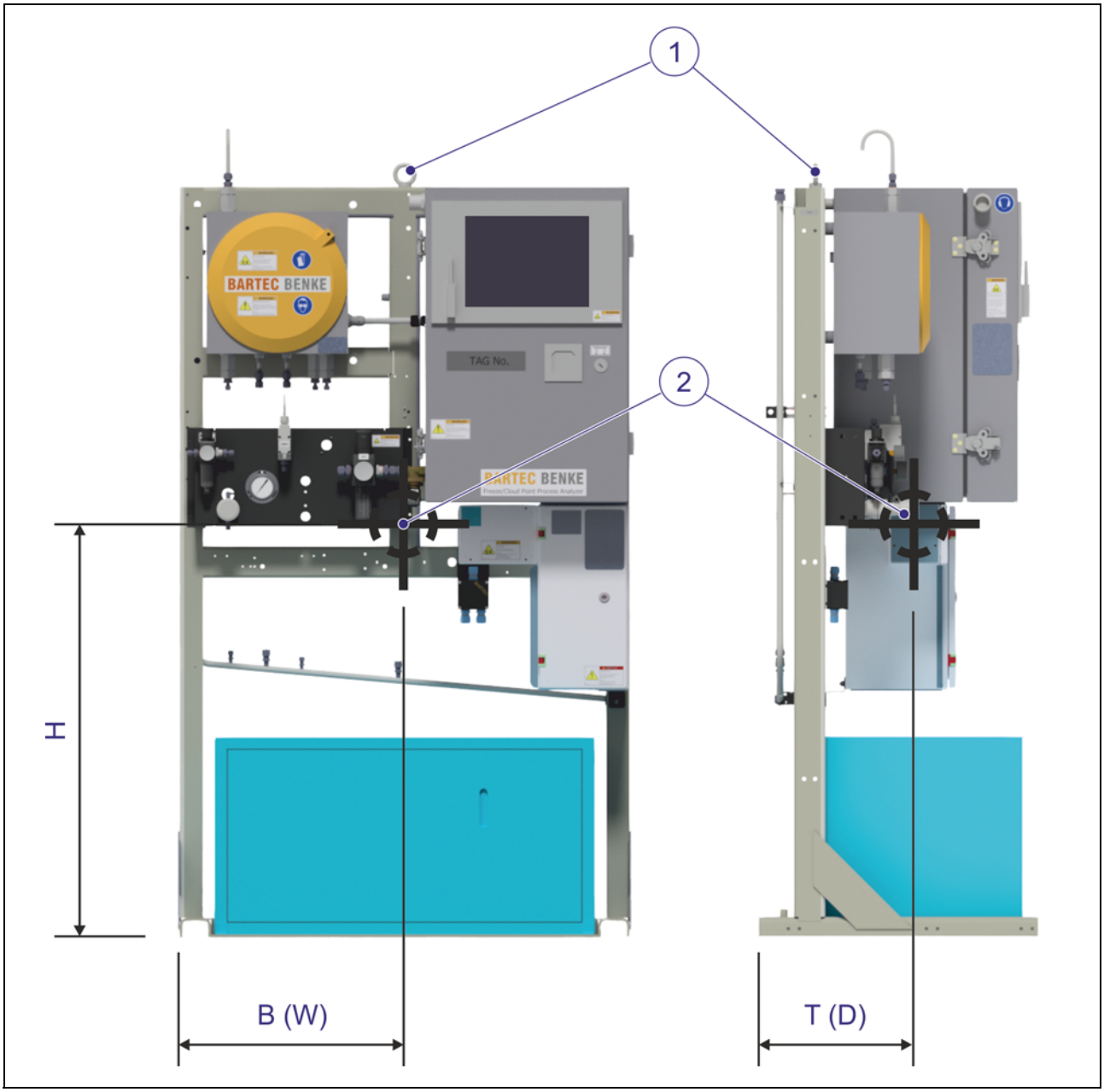


Figure 5.1: Center of gravity

(1) Suspension eyebolt

(2) Center of gravity: (H x W x D): approx. 900 x 500 x 400 mm (without *Chiller*)

5.7 Transport

Transport with a forklift (Analyzer is in its packaging)

The analyzer can be transported with a forklift under the following conditions:

- The analyzer must be in its packaging (wooden box or wooden crate with integrated pallet).
- The forklift must have a sufficient load-bearing capacity to bear the weight of the transport item.
- The driver must be authorised to drive the forklift.

Lifting:

☞ Drive the forks of the forklift between or under the struts of the pallet.

☞ Drive the forks in so that they protrude on the opposite side.

☞ Remember that the centre of gravity is not in the centre! Make sure that the pallet cannot tip over.

☞ Lift the package and begin transport.

Transport with a crane (Analyzer without packaging)

The analyzer can be transported with a crane under the following conditions:

- The crane and lifting equipment must have a sufficient load-bearing capacity for the weight of the analyzer.
- The operator must be authorised to operate the crane.

Lifting:

☞ Make sure that the suspension eyebolt (see section "Centre of gravity and suspension") is professionally assembled.

☞ Attach ropes, belts or suspension gear to the suspension eyebolt.

WARNING	
	**Danger of injury from transport item swinging out!** The suspension point is not directly over the centre of gravity of the analyzer. The item swings out when transported with a crane and can cause injury to personnel or material damage if not allowed adequate room to manoeuvre. ☞ Avoidance measures see *chapter 2 “Safety”*.

☞ Begin transport.

5.8 Storage

☞ Only store the analyzer where the following conditions are fulfilled:

- Only store in the original packaging.
- Do not store outdoors.
- Store in a dry and dust-free location.
- Do not expose to any aggressive media.
- Protect against direct sunlight.
- Avoid mechanical vibrations.
- Storage temperature: -20 to 60 °C
- The storage room may not be subject to large temperature fluctuations. Risk of condensation forming.
- Relative humidity: 5 to 85 %, non-corrosive
- If the device is to be stored for longer than 3 months, check the condition of all parts and the packaging regularly. If necessary, replace or touch up the corrosion protection.

NOTICE	
	Under certain circumstances, individual packaged items may have instructions regarding their storage conditions which exceed the requirements mentioned here. These are to be observed accordingly.

6 Installation and preparation for commissioning

The installation and commissioning of the analyzer must be performed professionally in order to ensure smooth operation. This section describes important steps and conditions as well as the safety instructions that must be observed.

6.1 Safety

Personnel

- The installation and preparation for commissioning may only be performed by specialists for potentially explosive atmospheres.
- Have work on the electrical system performed only by electricians.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 "Safety"* and the following additional protective equipment:

- Safety goggles
- Protective gloves
- Hearing protection if necessary

NOTICE	
	If other safety equipment is required for certain tasks, this will be mentioned in the warnings in this chapter.

Fundamental principles

WARNING	
	**Danger due to incorrect installation and commissioning!** Installation and commissioning must be conducted by trained specialist personnel who have adequate experience. Errors in installation can lead to life-threatening situations or considerable material damage. ☞ Avoidance measures see *chapter 2 "Safety"*.

Escaping petrochemical product

WARNING	
	**Danger of explosions due to escaping petrochemical products!** Petrochemical products can leak. The liquid evaporates and forms an explosive atmosphere when it mixes with air. Or escaping gas can form an explosive atmosphere with the air. Highly flammable liquids can start fires which can cause severe or fatal injuries. ☞ Avoidance measures see *chapter 2 "Safety"*.

Electrical current

GEFAHR	
	**Danger of death due to electrical current!** Touching voltage-conducting parts poses an immediate life-threatening hazard. Damage to the insulation or to individual components can cause fatal injury. ☞ Avoidance measures see *chapter 2 "Safety"*.

Securing against being switched on again

DANGER	
	**Danger of death due to unauthorized restarting!** During work in danger areas, there is the danger that the power supply can be switched on without authorisation. This poses a life-threatening hazard for the persons in the danger area. ☞ Avoidance measures see *chapter 2 "Safety"*.

Liquids and gases under pressure

WARNING	
	**Danger of injury due to liquids or gases under pressure!** Lines are under overpressure even when switched off. In the case of defective or leaky lines, escaping liquids or gases could cause serious injuries. ☞ Avoidance measures see *chapter 2 "Safety"*.

6.2 Requirements for the installation location

Environmental conditions

The analyzer is solely intended for use at a fixed location in an analysis building that provides protection against the elements. The following conditions must be met:

Environment	Condition
Temperature range	5 to 40 °C
Relative humidity, non-corrosive	5 to 80 %

- The operation of the analyzer is only permitted under a low influence of mechanical hazards in the area of the touchscreen, away from the usual traffic routes.

Installation conditions

- The floor at the installation location must be even, level and have sufficient load-bearing capacity.
- The analyzer must be well illuminated.
- The front of the analyzer must be freely accessible.
- The product outlet (drain) of the analyzer must be higher than the next inlet on the drain line of the analyzer house. For information on the dimensions of the analyzer, see the installation plan supplied.
- The analyzer must be set up at atmospheric pressure.
- Atypical vibrations and shocks must be avoided near the analyzer. **The analyzer is in this case to be insulated against vibrations and shocks by vibration dampers, for example.**

  The distance between analyzer and supply lines or components that cause strong mechanical vibrations in the pipe system (e.g. pumps) should be as great as possible.
- The analyzer must not be coated or painted.
- The location of the analyzer must provide protection against the following influences:
  - aggressive media
  - animal and vegetable influences

Notes on hazardous substances

☞ Ensure that the working area is adequately ventilated.

☞ Observe the emission limits. If necessary, install an exhaust air treatment system.

☞ Do not return the extracted air to the work area.

☞ Provide washing facilities and eye baths in the workplace.

☞ Creeping vapors can constitute an ignition source. Seal the room properly to ensure that gases or vapors which could contain ignition sources cannot enter the room.

☞ Install equipment for detecting and reporting gas hazards.

NOTICE	
	**Environmentally hazardous substances!** Hazardous substances, which could leak out as the result of a fault during improperly performed installation, can enter the earth. ☞ Avoidance measures see *chapter 2 Safety*.

Notes on optional Components

NOTICE	
	If the *chiller* is installed, keep a space of 0.5 m free on the right and left so that the ventilation of the *chiller* is not impaired.

NOTICE	
	If a *vortex cooler* is in use for the control box, make sure that at the very most drip water can hit the analyzer in compliance with EN 60529. Make sure that the hot air discharge of the *vortex cooler* is not hindered.

6.3 Fixing to the floor

☞ Align the analyzer in horizontal and vertical direction.

☞ Secure it to the floor with four m 12 bolts (not included in the scope of delivery).

NOTICE	
	For the size of the fastening drill holes, please refer to the *installation plan in the customer folder*.

Mounting optional components

Specify optional components when ordering the analyzer. Possible options are listed in the *Design and function chapter*.

Retrofitting components may only be performed by the manufacturer or by persons authorised by the manufacturer.

6.4 Connecting pipe connections

This activity must be performed by a specialist. Wear the basic protective equipment in line with *chapter 2 "Safety"* and the following additional protective equipment:chapter 2 "Safety"

- Safety goggles
- Protective gloves

NOTICE	
	Observe the regulation for mounting screw pipe connections. Please refer to the *manufacturer's documentation for the corresponding components*.

Liquids and gases under pressure

WARNING
 **Danger of injury due to liquids or gases under pressure!** Lines are under overpressure even when switched off. In the case of defective or leaky lines, escaping liquids or gases could cause serious injuries. ☞ Avoidance measures see *chapter 2 "Safety"*.

Hazardous materials

WARNING
 **Danger of injury from toxic substances!** Swallowing, inhaling or contact with skin or eyes can lead to serious, permanent health damage or death. ☞ Avoidance measures see *chapter 2 "Safety"*.

Hot operating materials

WARNING
 **Danger of burns due to hot operating materials!** Operating materials can reach high temperatures during operation and cause burns upon contact. ☞ Avoidance measures see *chapter 2 "Safety"*.

Hot surfaces

WARNING
 **Danger of burns due to hot surfaces!** Contact with hot components can cause burns. ☞ Avoidance measures see *chapter 2 "Safety"*.

Cold operating materials

WARNING
 **Danger of burns due to cold operating materials!** Operating materials can reach low temperatures during operation and cause burns upon contact. ☞ Avoidance measures see *chapter 2 "Safety"*.

Cold surfaces

WARNING
 **Danger of burns due to cold surfaces!** Contact with cold components can cause burns. ☞ Avoidance measures see *chapter 2 "Safety"*.

General instructions

- ☞ Before connecting the pipe connections, install the product, instrument air and carrier gas supply lines to the analyzer with a manually operated system-side stop valve each.
- ☞ Install the stop valves close to the analyzer in an easily accessible area.
- ☞ Label the pipelines so that the assignment of the respective analyzer and materials is clear.

6.5 Notes on vent and drain

The analyzer must be connected to a vent and drain. If the lines are not depressurised:

- ☞ Before connecting the pipes to the analyzer, install a manually operated system-side shut-off valve in the supply and discharge lines.
- ☞ Maximum back-pressure in vent and drain
  see *Technical data*.

WARNING	
	**Danger of explosions due to uncontrolled chemical reactions!** If connected incorrectly, pipelines can trigger chemical reactions. ☞ Avoidance measures see *chapter 2 "Safety"*.

- ☞ Ensure that the product can flow off without back pressure.
  Select a drain with a cross-section that is large enough.
- ☞ Ensure that the vent is open to the atmosphere and subject to typical pressure fluctuations only. Greater pressure fluctuations affect the measured results. Connect the analyzer to a separate vent if necessary.

Vent/drain system

As standard the analyzer is equipped with a combined vent drain system. Purge gas and evaporated product are conducted into the vent. Liquid product is conducted into the drain. Purge gas flow into the drain with the liquid product.

In the even of a malfunction, liquid product can be pressed into the vent. The connection to the drain allows liquid product to flow from vent to drain. That means that product condensed in the vent can flow to the drain even in normal operation.

Connecting pipelines

- ☞ Observe the regulations regarding assembly of the pipe screw connections. See the documentation of the components used.
- ☞ Before assembly, clean pipelines of dirt and shavings.
- ☞ Do not undershoot the permitted bending radiuses.
- ☞ Connect the pipelines in line with the installation plan in the customer folder.

☞ Check for leaks.

Probenaufbereitungssystem (Option)

NOTICE	
	Bei installiertem Probenaufbereitungssystem folgende zusätzliche Hinweise zum Anschluss der Rohrverbindungen beachten!

- Der Produkteingang ist Teil des Probenaufbereitungssystems. Produktzuleitung dort anschließen und mit manuell bedienbarem, eindeutig zugeordnetem Absperrventil versehen.
- Bei vorhandener Kühloption Kühlmittel-Vor- und Rücklauf an die entsprechend gekennzeichneten Anschlüsse am Probenaufbereitungssystem anschließen.

Kühlung mit Kühlmittel

NOTICE	
	Die am Ausgang Kühlmittel angeschlossene Leitung kann heiß werden. Isolieren Sie daher die Leitung mit geeignetem Wärmedämmmaterial.

6.6 Connecting the power supply and signal lines

- This work should only be performed by a qualified electrician.
- Special tools required:
  - Electrician's equipment

The following tightening torques must be observed:

Cross-section	Tightening torques
2.5 mm²	0.4 - 0.6 Nm
4 mm²	0.5 - 1.0 Nm
6 mm²	0.8 - 1.6 Nm
10 mm²	1.2 - 2.4 Nm
16 mm²	2.0 - 4.0 Nm

Electrical current

GEFAHR	
	**Lebensgefahr durch elektrischen Strom!** Bei Berührung mit spannungsführenden Teilen besteht unmittelbare Lebensgefahr. Beschädigung der Isolation oder einzelner Bauteile kann lebensgefährlich sein. ☞ Maßnahmen zur Vermeidung siehe *Kapitel 2 „Sicherheit"*.

Main switch and integration in an emergency off concept required

The analyzer has neither its own main switch nor its own emergency off device.

Before commissioning the analyzer, you must therefore observe the safety instructions in *chapter 2 Safety* on *Main switch and emergency off device*.

Preparation

WARNING	
	**Danger of explosion due to open ignition sources of operating material outside the analyzer** Operating materials operated in intrinsically safe circuits can cause explosions if they are not connected in line with the manufacturer's specifications. ☞ Avoidance measures see *chapter 2 Safety*.

☞ Install a fuse in line with the technical data for the supply line to the analyzer.

☞ Data important for the installation can be found in the supplied electrotechnical documentation and the terminal diagram.

☞ Before beginning work, make sure that the mains voltage available corresponds with the operating voltage specified on the type plate.

☞ Only use shielded cables for signal lines.

Notes on optical cables

With respect to laying and dimensioning of fiber-optic cables and associated components, it is important to note the following:

- No reduction of cross-sections of optical cables
- The connection of optical cables in a coupler must be performed in such a way that no additional energy can be brought into the fiber-optic cables.
- Light-transmitting components must not be used.
- The notes in the operating instructions for the relevant components must be observed.

Connecting the power supply

☞ Connect the analyzer to the local potential matching with a cable cross-section of at least 16 mm². For the position of the connections on the rack, please refer to the *installation plan in the customer folder*.

☞ Open the power supply box with a double-bit key.

☞ Dismantle the flange plate and drill holes for the cable ducts in line with the supplied connection plan. Ensure that the flange plate is sufficiently stable even with the holes.

☞ Mount suitable cable ducts on the flange plate.

☞ Bolt the flange plate to the power supply box.

☞ Guide the cables through the cable ducts to the power supply box.

- ☞ Connect the protective earthing conductor and supply voltages in line with the terminal plan.
- ☞ Check the polarity of the cables.
- ☞ Tighten the cable ducts.
- ☞ Close unused cable ducts and drill holes for cable ducts in a professional manner.
- ☞ Reattach the contact protection to the terminals.
- ☞ Close the power supply box with a double-bit key.

Connecting electric signal lines

- ☞ Unscrew the cover of the signal junction box.
- ☞ Dismantle the flange plate and drill holes for the cable ducts in line with the supplied connection plan. Ensure that the flange plate is sufficiently stable even with the holes.
- ☞ Mount suitable cable ducts on the flange plate.
- ☞ Bolt the flange plate to the signal junction box.
- ☞ Guide the cables through the cable ducts to the signal junction box.
- ☞ Connect the signal lines in line with the terminal plan.
- ☞ Check the polarity of the signal cables.
- ☞ Tighten the cable ducts.
- ☞ Close unused cable ducts and drill holes for cable ducts in a professional manner.
- ☞ Install a potential matching on the cover.
- ☞ Close the signal junction box and screw tight the cover.

6.7 Preparing for commissioning

- ☞ Rinse all supply lines before commissioning.

Rinsing is intended to remove dirt and air from the supply lines and is only necessary during commissioning or after maintenance or repair work to the supply lines.

6.7.1 Rinsing the instrument air supply lines

- ☞ Close the system-side stop valve in the instrument air supply line.
- ☞ Open the screw connection of the instrument air supply line on the instrument air connection slightly at first. Open it fully when no more air emerges.
- ☞ Carefully open the system-side stop valve in the instrument air supply line.

☞ Rinse the supply line for at least 2 minutes. If dirt is still emerging after this time keep rinsing until dirt stops emerging.

☞ Close the system-side stop valve in the supply line.

☞ Reconnect the instrument air supply line.

Rinsing the nitrogen supply line (optional)

WARNING	
	**Danger of suffocation due to nitrogen!** Nitrogen can escape. High concentration in the air leads to oxygen deficiency. Inhalation can cause loss of consciousness or death. FOR THIS REASON: ☞ Ensure adequate ventilation. ☞ If unknown concentrations or concentrations above the limit values are present in the air, wear suitable respiratory protection.

☞ Purge the nitrogen supply line in the same way as the instrument air supply line (*see above*).

6.7.2 Supply analyzer with instrument air or nitrogen (optional)

Supplying with instrument air

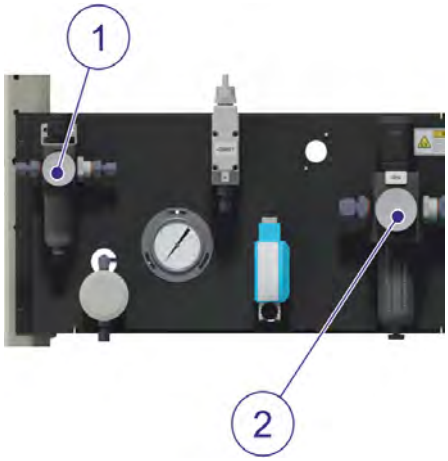


Figure 6.1: Pressure regulator

☞ Ensure that the instrument air is in line with the specification (see *page 48*).

☞ Open the system-side shut-off valve in the instrument air supply line.

☞ Check whether the screw connection on the instrument air connection is sealed tightly.

☞ Set the pressure on the pressure regulators (**1**) and (**2**). The target values can be found on the corresponding operational data plates on the analyzer. A pressure regulator for the vortex cooler may be installed as an option.

The analyzer is now supplied with instrument air.

Supplying with nitrogen

Optionally, nitrogen can be used for flushing the measuring unit box.

NOTICE	
	If the necessary nitrogen is to be generated using the optional nitrogen generator, please also observe the operating manual provided with the nitrogen generator.

☞ Proceed as with instrument air.

6.7.3 Rinsing the product supply lines

All product supply lines must be rinsed. This also applies to the validation product.

NOTICE	
	Observe the regulations for mounting screw pipe connections. Please refer to the manufacturer's documentation for the corresponding components.

Liquids and gases under overpressure

WARNING	
	**Danger of injury due to liquids or gases under pressure!** Lines are under overpressure even when switched off. In the case of defective or leaky lines, escaping liquids or gases could cause serious injuries. ☞ Avoidance measures see *chapter 2 "Safety"*.

Hazardous materials

WARNING	
	**Danger of injury from toxic substances!** Swallowing, inhaling or contact with skin or eyes can lead to serious, permanent health damage or death. ☞ Avoidance measures see *chapter 2 "Safety"*.

Hot operating materials

WARNING	
	**Danger of burns due to hot operating materials!** Operating materials can reach high temperatures during operation and cause burns upon contact. ☞ Avoidance measures see *chapter 2 "Safety"*.

Hot surfaces

WARNING	
	**Danger of burns due to hot surfaces!** Contact with hot components can cause burns. ☞ Avoidance measures see *chapter 2 "Safety"*.

Cold operating materials

WARNING	
	**Danger of burns due to cold operating materials!** Operating materials can reach low temperatures during operation and cause burns upon contact. ☞ Avoidance measures see *chapter 2 "Safety"*.

Cold surfaces

WARNING	
	**Danger of burns due to cold surfaces!** Contact with cold components can cause burns. ☞ Avoidance measures see *chapter 2 "Safety"*.

Rinsing supply line

☞ Close the system-side shut-off valve in the product supply line.

NOTICE	
	The analyzer can be fitted with an optional sample conditioning system (see *chapter 4.5 "Optional extensions" on page 62*). The product inlet is then located on the sample conditioning system.

☞ Open the screw connection of the product supply line at the product inlet slightly at first and then open it completely when petrochemical product no longer emerges.

☞ Install a collection container on the open system-side end of the product supply line.

☞ Carefully open the system-side shut-off valve in the product supply line and make sure that the petrochemical product flows into the collection container.

☞ Rinse the product supply line with petrochemical product until no more air bubbles appear.

☞ Rinse the product supply line for another 2 minutes. Make sure that the collection container does not overflow.

☞ Close the system-side shut-off valve in the product supply line.

☞ Reconnect the product supply line to the product inlet.

☞ Properly dispose of the product in the collection container.

☞ Rinse all product supply lines as described above.

☞ Inspect the connections for tightness (visual inspection).

6.7.4 Rinsing the coolant supply line

Some specific analyzer versions require coolant. Cooling can be performed

- By the chiller option.

- From outside by adding coolant.

If cooling is provided from the outside, the coolant supply lines require rinsing.

☞ Close the system-side stop valve in the coolant supply line.

☞ Open the screw connection of the supply line at the coolant inlet slightly at first and then open it completely when no more coolant emerges.

☞ Install a collection container (with a capacity of at least 5 liters) at the open, system-side end of the supply line for the coolant.

☞ Carefully open the system-side stop valve in the supply line and make sure that the coolant flows into the collection container.

☞ Rinse the supply line with coolant until no more air bubbles appear.

☞ Rinse the supply line for another 2 minutes. Make sure that the collection container does not overflow.

☞ Close the system-side stop valve in the supply line.

☞ Reconnect the supply line to the coolant inlet.

6.7.5 Fill the chiller and provide it with coolant

Analyzers with the chiller option do not require any coolant from the outside (see *page 86*).

NOTICE	
	During commissioning, fill the *chiller* with coolant.

☞ Perform the steps described in the manual supplied for the *Chiller* (section *Switching on*).

Supplying with coolant

Ensure that

- The properties of the coolant, in particular pressure and temperature, correspond to the specifications installation plan and the technical data.
- The coolant supply lines are clean (see *page 86*).

Procedure

☞ Open the system-side stop valve in the coolant supply line.

☞ Check whether the screw connection is sealed tightly.
The coolant flows through the components.

NOTICE	
	In particular the use of a coolant with a low temperature can cause condensation to form. Shut off the coolant supply line if the analyzer is out of operation for a longer period of time.

7 Commissioning

NOTICE	
	BARTEC BENKE recommends that commissioning is performed by employees of the manufacturer and having operating and maintenance personnel trained by the manufacturer.

Make sure that all preparatory work for commissioning has been performed.

NOTICE	
	Installing the analyzer and the necessary preparations for commissioning are described in chapter "Installation and preparations for commissioning".

7.1 Safety

Personnel

Commissioning is only to be performed by specialists for potentially explosive atmospheres.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 "Safety"* and the following additional protective equipment:

- Safety goggles
- Protective gloves
- Hearing protection if necessary

NOTICE	
	If other safety equipment is required for certain tasks, this will be mentioned in the warnings in this chapter.

Liquids and gases under Overpressure

WARNING	
	**Danger of injury due to liquids or gases under pressure!** Lines are under overpressure even when switched off. In the case of defective or leaky lines, escaping liquids or gases could cause serious injuries. ☞ Avoidance measures see *chapter 2 "Safety"*.

Hazardous materials

WARNING	
	**Danger of injury from toxic substances!** Swallowing, inhaling or contact with skin or eyes can lead to serious, permanent health damage or death. ☞ Avoidance measures see *chapter 2 "Safety"*.

Hot operating materials

WARNING	
	**Danger of burns due to hot operating materials!** Operating materials can reach high temperatures during operation and cause burns upon contact. ☞ Avoidance measures see *chapter 2 "Safety"*.

Hot surfaces

WARNING	
	**Danger of burns due to hot surfaces!** Contact with hot components can cause burns. ☞ Avoidance measures see *chapter 2 "Safety"*.

Cold operating materials

WARNING	
	**Danger of burns due to cold operating materials!** Operating materials can reach low temperatures during operation and cause burns upon contact. ☞ Avoidance measures see *chapter 2 "Safety"*.

Cold surfaces

WARNING	
	**Danger of burns due to cold surfaces!** Contact with cold components can cause burns. ☞ Avoidance measures see *chapter 2 "Safety"*.

7.2 Supplying with product

NOTICE	
	The analyzer can be fitted with an optional sample conditioning system (see *chapter 4.5 “Optional extensions” on page 62*).

Preparation

Ensure that

- the pressure and temperature in the product supply line correspond with the specifications in the installation plan and technical data.
- The product is sufficiently filtered in accordance with the technical data.
- The product supply line is clean (see *Section 6.7.3 “Rinsing the product supply lines” on page 85*).
- The vent/drain system and the recovery system that may be installed are ready for operation.

Supplying with product

☞ Open the system-side shut-off valve in the product supply line.

☞ Make sure that the screw connection to the analyzer is sealed tightly.

☞ Set the product pressure on the system-side pressure regulator (for set point, see *Section “Sample characteristics” on page 48*).

☞ Set the product flow rate on the system-side flow controller (for set point, see *Section “Sample characteristics” on page 48*).

The petrochemical product flows through the bypass to the product outlet.

7.3 Switching on the power supply

Preparation

☞ Check all safety equipment.
For more information, see the *Maintenance chapter*.

☞ Check that all electrical terminals have a tight fit.

☞ Check that the mains supply was executed in line with the electrical documentation.

Switching on

☞ Switch on the voltage supply by means of the main switch.

NOTICE	
	**If the residual-current device (RCD) has triggered immediately during commissioning follow the hints in chapter maintenance about the theme „Check the residual-current device (RCD)“.**

- The control box is rinsed with instrument air. This results in considerable noises emissions. The remaining rinsing time is displayed by the pressure monitor.
- During the rinsing phase all electrical operating equipment without its own ignition protection is voltage-free. The analyzer is not ready for operation.
- After the rinsing phase, the controller computer starts and the touchscreen is ready for use shortly afterwards. The optional chiller and optional components are switched on.
- The operating system, the *PACS* process software and other applications start.
- In normal operation the analyzer starts measuring automatically with the configuration and operating mode last set.

7.4 Monitoring and operation

Monitoring

☞ After 2 hours of operation, check all connections for leaks and perform a general visual inspection (see *Maintenance chapter*).

Supplying with product:

☞ Check the settings of the pressure regulator.
Adjust the pressure regulator if necessary.

☞ Check the settings of the flow meter.
Adjust the flow meter if necessary.

☞ If necessary, continue adjusting the pressure regulator and flow meter settings until the target values are reached.

Operation

- In normal operating circumstances, the analyzer works fully automatically.
- The analysis process can be followed in the analyzer's touchscreen.
- The analyzer can be operated with the touchscreen pen.

NOTICE	
	For more detailed information on operating, controlling and configuring the analyzer and on the analyzing process, please refer to the *PACS software manual*.

8 Operation

This chapter provides a brief overview of how to operate the analyzer.
The safety instructions for switching the analyzer on and off and for operating it must be observed.

8.1 Safety

Personnel

The analyzer may only be operated by specialists for potentially explosive atmospheres.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 "Safety"* and the following additional protective equipment:

- Safety goggles
- Protective gloves
- Hearing protection if necessary

Fundamental principles

WARNING	
	**Danger of injury due to improper operation!** Improper operation can lead to serious personal injury and material damage. ☞ Avoidance measures see *chapter 2 "Safety"*.

Explosion protection

WARNING	
	**Explosion protection is no longer provided when the pressure monitor is switched off!** The control box contains ignition sources. Operating the device when the pressure monitor of the control box is deactivated can result in explosions in potentially explosive atmospheres. ☞ Avoidance measures see *chapter 2 "Safety"*.

NOTICE	
	Further safety-relevant notes on explosion protection, hazardous substances and handling the device can be found in the *Safety* chapter.

8.2 Switching on

Preparation

Ensure that

- All safety equipment is installed and fully functional (see *chapter 10.6 “Checking the safety equipment” on page 113*).
- Pressure and flow rates in the supply lines for the instrument air are set correctly.
- The analyzer is adequately supplied with coolant (optional).
- The pressure and flow of the product are set correctly.

NOTICE	
	Specifications on the setting values see *chapter 3 “Technical data” on page 47*.

Procedure

☞ Open the stop valve in the product supply line.

☞ Ensure that the flow of the product is present and if applicable adjust the flow of the product supply line correctly.

☞ Switch on the voltage supply by means of the main switch.

- The control box is rinsed with instrument air. This results in considerable noises emissions. The remaining rinsing time is displayed by the pressure monitor.
- Set the flow rate for the instrument air correctly.
- During the rinsing phase all electrical operating equipment without its own ignition protection is voltage-free. The analyzer is not ready for operation.
- After the rinsing phase, the PC starts and the touchscreen is ready for use shortly afterwards. The optional chiller and auxiliary heaters are switched on.
- The operating system, the PACS process software and other applications start.
- In normal operation the analyzer starts measuring automatically with the configuration and operating mode last set.

8.3 Operation

- In normal operating circumstances, the analyzer works fully automatically.
- The analysis process can be followed in the analyzer's touchscreen.
- The analyzer can be operated with the touchscreen pen.

NOTICE	
	For more detailed information on operating, controlling and configuring the analyzer and on the analyzing process, please refer to the *PACS software manual*.

8.4 Switching off

NOTICE	
	For detailed information on operating the analyzer with the touchscreen and pen, please refer to the *PACS software manual*.

Procedure

☞ With the pen, click the *File* menu item on the touchscreen of the *PACS software*.

☞ Click *Exit*.

☞ Click *Shutdown* in the operating system.

☞ Wait until the computer has shut down.

☞ Switch off the analyzer with the main power switch.

Petrochemical product continues to flow through the bypass to the product outlet.

☞ Close the valves of the product supply line.

☞ Close the valves of the coolant supply and return line (not required with the *chiller* option).

☞ If available, close the valves for the supply of the instrument air and auxiliary media.

The analyzer is switched off.

8.5 Shutting down in an emergency

NOTICE	
	Follow the local safety regulations.

Shutting down

☞ Activate the emergency-off device.
The analyzer is disconnected from the voltage supply.

☞ Close any system-side stop valves in the product supply line.

☞ Close any system-side valves of the coolant supply and return line (not required with the *chiller* option).

☞ If available, close the system-side valves for the supply of the instrument air and auxiliary media.

The analyzer is switched off.

CAUTION	
	**Loss of data due to emergency off.** Switching off the analyzer with the emergency off function can result in data loss in the analyzer. FOR THIS REASON: ☞ Only use the emergency-stop function in an emergency. ☞ In normal opration, shut down the analyzer first by means of the software function.

8.6 Conduct in the event of danger

After the emergency

☞ Depending on the type of fault, have it rectified by the manufacturer or rectify it yourself. Read more on this in *Chapter 9 "Faults" on page 97*.

WARNING	
	**Danger of death due to premature restarting!** If the device is switched on again prematurely, there is a danger of fatal injuries to all persons in the danger area. FOR THIS REASON: ☞ Before switching on again, make sure that there are no persons in the danger area.

☞ Check the analyzer before restarting and ensure that all safety equipment is installed and fully functional.

9 Faults

The following chapter describes the possible causes of faults and the work required to rectify them.

☞ If faults occur frequently, the maintenance intervals must be shortened according to the actual load.

☞ If the faults cannot be remedied with the following instructions, please contact the manufacturer:

See *chapter 1.7 "Customer service" on page 7*.

9.1 Safety

Personnel

- The troubleshooting work described here may only be performed by specialists for potentially explosive atmospheres.
- Work on the electrical systems may only be performed by electricians.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 "Safety"* and the following additional protective equipment:

- Safety goggles
- Protective gloves
- Hearing protection if necessary
- Respiratory protection if necessary

Fundamental principles

WARNING	
	**Danger of injury due to improper fault rectification!** Improper fault rectification can lead to serious personal injury and material damage. ☞ Avoidance measures see *chapter 2 "Safety"*.

Electrical current

GEFAHR	
	**Danger of death due to electrical current!** Touching voltage-conducting parts poses an immediate life-threatening hazard. Damage to the insulation or to individual components can cause fatal injury. ☞ Avoidance measures see *chapter 2 "Safety"*.

Securing against being switched on again

DANGER
 **Danger of death due to unauthorized restarting!** During work in danger areas, there is the danger that the power supply can be switched on without authorisation. This poses a life-threatening hazard for the persons in the danger area. ☞ Avoidance measures see *chapter 2 "Safety"*.

Explosion protection

WARNING
 **Loss of explosion protection in the event of a fault.** The analyzer contains ignition sources. Faults which affect explosion protection can result in a potentially explosive atmosphere being ignited. FOR THIS REASON: ☞ With faults that affect explosion protection, disconnect the analyzer from the current supply using the emergency off and interrupt material flows by closing the valves. ☞ Make sure that no ignition sources are brought into the area to rectify faults.

WARNING
 **Explosion protection is no longer provided when the pressure monitor is switched off!** The control box contains ignition sources. Operating the device when the pressure monitor of the control box is deactivated can result in explosions in potentially explosive atmospheres. ☞ Avoidance measures see *chapter 2 "Safety"*.

Liquids and gases under overpressure

WARNING
 **Danger of injury due to liquids or gases under pressure!** Lines are under overpressure even when switched off. In the case of defective or leaky lines, escaping liquids or gases could cause serious injuries. ☞ Avoidance measures see *chapter 2 "Safety"*.

Hazardous materials

WARNING

Danger of injury from toxic substances!

Swallowing, inhaling or contact with skin or eyes can lead to serious, permanent health damage or death.

☞ Avoidance measures
see *chapter 2 "Safety"*.

Hot operating materials

WARNING

Danger of burns due to hot operating materials!

Operating materials can reach high temperatures during operation and cause burns upon contact.

☞ Avoidance measures
see *chapter 2 "Safety"*.

Hot surfaces

WARNING

Danger of burns due to hot surfaces!

Contact with hot components can cause burns.

☞ Avoidance measures
see *chapter 2 "Safety"*.

Cold operating materials

WARNING

Danger of burns due to cold operating materials!

Operating materials can reach low temperatures during operation and cause burns upon contact.

☞ Avoidance measures
see *chapter 2 "Safety"*.

Cold surfaces

WARNING

Danger of burns due to cold surfaces!

Contact with cold components can cause burns.

☞ Avoidance measures
see *chapter 2 "Safety"*.

NOTICE

Further safety-relevant notes on explosion protection, hazardous substances and handling the device can be found in the *Safety chapter*.

Behaviour in the event of faults

In principle:

☞ If faults arise that pose a direct danger to personnel or property, switch the analyzer off immediately with the emergency off device.

☞ Determine the cause of the fault.

☞ Depending on the type of fault, have it rectified by the manufacturer or rectify it yourself.

☞ If the fault rectification requires work in the danger zone, switch off the analyzer and ensure it cannot be switched on again.

9.2 Fault analysis

Procedure

☞ In the event of an error, determine whether the process software displays an error message.

☞ For causes and solution proposals for errors detected by the software, please refer to the *Analyzer software manual*.

☞ If the process software has not output an error message, continue diagnosis using the following table.

Fault table

Faults not listed here may only be diagnosed and rectified by the manufacturer or specialists authorised by the manufacturer.

WARNING	
	**Risk of injury due to incorrect replacement parts!** Incorrect or defective replacement parts can result in damages, faults or total failures as well as impairments to safety. FOR THIS REASON: ☞ Only use replacement parts from BARTEC BENKE. ☞ See *chapter 2.1 "*Intended use*"*.

Error	Possible cause		Troubleshooting
No ready signal / measuring result for a long time	Analyzer is switched off / will not start a) No display on the overpressure monitor	The power supply of the device has been interrupted (e.g. defective/tripped fuse)	Check the power supply and restore it.
		The pre-fuse of the overpressure monitor (only present on certain models) is defective	Rectify the cause of the fault.
	b) Display present on the overpressure monitor	The pressure monitor has switched off the analyzer / cannot start the analyzer	See *overpressure monitor manual*
		Internal fuses defective / have tripped	Rectify the cause of the fault
		The power supply of the I/O card has been interrupted or the I/O card is defective	
		The instrument air supply has been interrupted	
No ready signal / measuring result for a long time	*PACS* is not running		See *PACS software manual*
	Unsuitable parameter settings		Adjust parameters (see *PACS software manual*)
	Signal connection to analyzer has been interrupted		Rectify the cause of the fault

Error	Possible cause	Troubleshooting
Measurement value outputs show an unusual or implausible value/measuring result reproducibility worsens	Fault in product conditioning (dirt, water, or gas in product, product temperature...)	Make sure that the product is treated in accordance with the technical data specifications
	No product flow	Check/adjust pressure and flow
	Temperature of the coolant too high or no flow	Rectify the cause of the fault
	Light barrier of measuring cell defective	Replace light barrier (see *page 135*)
	Peltier element defective	Replace Peltier elements (see *page 118*)
	Temperature sensor of sample defective	Replace temperature sensor of sample (see *page 141*)
	Window within the measuring cell is dirty	Clean *window* within the measuring cell (see *page 135*)

Error	Possible cause	Troubleshooting
Alarm at digital alarm output	*PACS* has issued an alarm	Rectify the cause of the alarm. Perform reset (see *PACS software manual*)
	The analyzer is switched off	Switch on analyzer
	PACS is not running	Start *PACS* (see *PACS software manual)*
Product flow missing or too low (see display on flow controller, if existent)	■ **Product supply line:** Shut-off valve is closed, primary pressure too low, leakage, product has run out, flame arrester is blocked ■ **Analyzer:** Product has run out, leakage ■ **Drain:** blocked, shut-off valve closed	Rectify cause of fault (e.g. blocked flame arrester) Make sure that the product is treated in accordance with the technical data specifications
Temperature of heat exchanger is too high	Coolant does not flow through the analyzer.	Rectify the cause of the fault.
	The temperature of the coolant is too high.	Make sure that the coolant is treated in accordance with the technical data specifications.
Icing of the measuring cell	Inlet pressure for the flushing of the measuring unit box not present or too low	Adjust the pressure
	Capillary for flushing is blocked	Clean or replace the capillary
Leaks in fluid system components	For components through which coolant flows: condensation water can give the impression of leakages.	Dry the components with a cloth and observe whether there is actually a leak.
	A screw pipe connection is leaking	Tighten the screw pipe connection is accordance with the supplied installation instructions
A flame arrester is leaking	The o-ring of the flame arrester is worn out	Replace o-ring (see *page 148*)

9.3 Starting up after rectifying a fault

After rectifying a fault, conduct the following steps for restarting:

☞ Reset the emergency-off equipment.

☞ Confirm any alarm messages from the process software (see Analyzer *software manual*).

☞ Make sure that nobody can be endangered by switching on the analyzer.

☞ Start analyzer operation again.

10 Maintenance

Carry out maintenance regularly to ensure optimum and disruption-free operation. The following section describes the most important maintenance work and the safety measures to be observed.

10.1 Safety

Personnel

The maintenance work described here may only be performed by **specialists for potentially explosive atmospheres** or **by employees of the manufacturer**.

Work on the electrical systems may only be performed by electricians.

NOTICE	
	BARTEC BENKE recommends that operating and maintenance staff be trained by the manufacturer.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 "Safety"* and the following additional protective equipment:

- Safety goggles
- Protective gloves
- Hearing protection if necessary
- Respiratory protection if necessary

NOTICE	
	If other safety equipment is to be worn for certain tasks, this will be mentioned in the warnings in this chapter.

Fundamental principles

WARNING	
	**Danger of injury due to improperly performed maintenance work!** Improper maintenance can lead to serious personal injury and material damage. ☞ Avoidance measures see *chapter 2 "Safety"*.

Electrical current

GEFAHR

Danger of death due to electrical current!

Touching voltage-conducting parts poses an immediate life-threatening hazard. Damage to the insulation or to individual components can cause fatal injury.

☞ Avoidance measures see *chapter 2 "Safety"*.

Securing against being switched on again

DANGER

Danger of death due to unauthorized restarting!

During work in danger areas, there is the danger that the power supply can be switched on without authorisation. This poses a life-threatening hazard for the persons in the danger area.

☞ Avoidance measures see *chapter 2 "Safety"*.

Replacement parts

WARNING

Risk of injury due to incorrect replacement parts!

Incorrect or defective replacement parts can result in damages, faults or total failures as well as impairments to safety.

FOR THIS REASON:

☞ Only use replacement parts from BARTEC BENKE.

☞ See *chapter 2.1 "Intended use"*.

Liquids and gases under overpressure

WARNING

Danger of injury due to liquids or gases under pressure!

Lines are under overpressure even when switched off. In the case of defective or leaky lines, escaping liquids or gases could cause serious injuries.

☞ Avoidance measures see *chapter 2 "Safety"*.

Hazardous materials

WARNING

Danger of injury from toxic substances!

Swallowing, inhaling or contact with skin or eyes can lead to serious, permanent health damage or death.

☞ Avoidance measures see *chapter 2 "Safety"*.

Hot operating materials

WARNING	
	**Danger of burns due to hot operating materials!** Operating materials can reach high temperatures during operation and cause burns upon contact. ☞ Avoidance measures see *chapter 2 "Safety"*.

Hot surfaces

WARNING	
	**Danger of burns due to cold surfaces!** Contact with cold components can cause burns. ☞ Avoidance measures see *chapter 2 "Safety"*.

Cold operating materials

WARNING	
	**Danger of burns due to cold operating materials!** Operating materials can reach low temperatures during operation and cause burns upon contact. ☞ Avoidance measures see *chapter 2 "Safety"*.

Cold surfaces

WARNING	
	**Danger of burns due to hot surfaces!** Contact with hot components can cause burns. ☞ Avoidance measures see *chapter 2 "Safety"*.

Opening the control box

WARNING	
	**Danger of explosion due to open ignition sources!** The control box contains ignition sources. Opening the control box can cause explosion of potentially explosive atmosphere. ☞ Avoidance measures see *chapter 2 "Safety"*.

Opening the measuring unit box

WARNING	
	**Danger of explosion due to open sources of ignition!** Hot surfaces on the inside can ignite a potentially explosive atmosphere. ☞ Avoidance measures see *chapter 2.4 "Explosion protection"*.

WARNING	
	**Danger of explosions due to electrostatic discharge!** Painting the analyzer increases the risk of electrostatic discharge even on metallic surfaces. ☞ Avoidance measures see *chapter 2.4 "Explosion protection"*.

10.2 Maintenance plan

The maintenance plan provides an overview of the most important maintenance work. The sections below describe the maintenance work in detail.

If increased wear is detected at regular inspections, shorten the required maintenance intervals according to the actual degree of observed wear.

If you have questions on maintenance work and intervals, contact us at our service address (see *page 7*).

WARNING	
	**Risk of injury due to incorrect replacement parts!** Incorrect or defective replacement parts can result in damage, faults or total failures as well as impairments to safety. FOR THIS REASON: ☞ Only use spare parts from BARTEC BENKE. ☞ See *chapter 2 Safety "Intended use"*.

Interval	Maintenance work	To be performed by
Daily	General visual inspection (see *page 111*)	Unless stated otherwise, an expert for potentially explosive atmospheres
Every 6 months	Checking the safety equipment (see *page 113*)	
	Check that all electrical terminals are firmly seated.	
	Check seals, Ex e/p housing	
Annually or when defective	Checking Ex p control (see *page 115*)	
	Clean leakage sensor or replace if defective (see *page 145*)	
Depending on product: annually or at significantly shorter intervals	Check flame arresters and clean if necessary (see *page 148*)	
	Clean the measuring cell (see *page 118*)	
Every 2 years or when a fault occurs	Replace Peltier elements (see *page 118*)	
Every 5 years	Replace lithium battery for PC (see *page 153*)	
In the event of a fault	Replace temperature sensors (see *page 141*)	
	Replace temperature fuses (see *page 142*)	

10.3 Key for figures showing maintenance activities

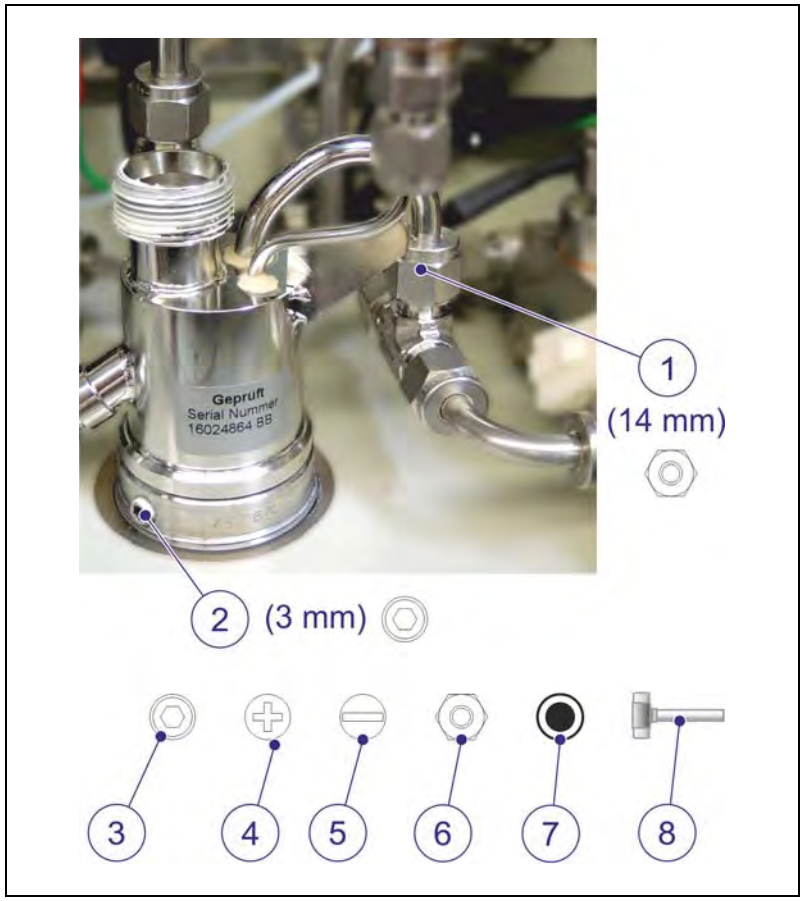


Figure 10.1: Example and key for figures showing maintenance activities

(1) The dimensions specified in brackets near the item number indicate the jaw width of the tool that should be used.

(2) As for 1., only a different tool.

The following symbols are used:

(3) Tool for Allen screws (e.g. Allen key)

(4) Tool for Phillips screws

(5) Tool for slotted screws

(6) Tool for nuts, screw pipe connections such as Swagelok

(7) Cotter pin drive

(8) Rubber hammer, e.g. For Cotter pin drive

Notes on special tools and the tasks to be performed are given in the individual instructions.

10.4 Cleaning the touchscreen and other components

Safety

WARNING	
	**Danger of explosions due to electrostatic discharge!** Cleaning plastic surfaces with a dry cloth can result in static discharge. The sparks can ignite potentially explosive atmospheres. ☞ Avoidance measures see *chapter 2 "Safety"*.

☞ Do not clean the touchscreen window with aggressive solvents or scouring agents and do not clean with instrument air or steam cleaners. The touchscreen is a part of the control box and therefore fulfils a protective function and must not be damaged.

☞ To clean the touchscreen, only use water and detergent or monitor cleaning foam.

Cleaning the touchscreen

☞ Switch the analyzer off:
When touching the touchscreen, functions can be inadvertently triggered.

☞ Dampen a cleaning cloth with water.

☞ Put cleaning agent on the cleaning cloth **not on the touchscreen**.

☞ Clean the touchscreen with the cleaning cloth.

Cleaning of the touchscreen has been concluded.
The analyzer can be switched on again.

Cleaning other components

☞ Do not clean painted or plastic surfaces and seals with aggressive solvents, scouring agents, high pressure cleaners or steam cleaners.

☞ Only use cleaning cloths and soap suds for cleaning. This applies in particular to the control box and the measuring unit box.

☞ Make sure that no moisture can penetrate into voltage-conducting parts.

10.5 General visual inspection

Procedure

The inspection can be performed while the analyzer is in operation.

☞ Inspect the analyzer for externally visible problems in accordance with the following table.

Inspection table

Inspection point	Reaction
Software error message	See *Analyzer software manual*
Leak tightness	Rectify the leakage.
Pressure target/actual values	Set pressures
Flow target/actual values	Set flow rates

NOTICE	
	CAUTION! Changing the pressures and the flows have an effect on the current measurement.

10.6 Checking the safety equipment

Procedure

The external safety signs can be checked while the device is in operation.

Signs and positioning of warning signs and stickers on the analyzer see *page 34*.

To check all other safety equipment, in particular items in the control box and measuring unit box:

☞ Before opening the measuring unit box, please follow the steps in *Chapter 10.8 "Notes on maintenance activities on/in the measuring unit box" on page 116*.

☞ Check the safety equipment using the following table.

WARNING	
	**Danger of injury due to damaged safety equipment.** Missing, damaged or non-functioning safety equipment can pose a risk of injury due to missing warnings and danger of explosion protection failure. FOR THIS REASON: ☞ If safety equipment is missing, damaged or not function, switch off the analyzer immediately. ☞ Only start the analyzer again once all safety equipment has been restored to full working order.

Inspection table

Safety equipment	Target condition
Warning signs	Present, clearly legible
Stickers	Present, clearly legible
Key switch *Explosion protection*	Position *On*
Control box	■ No damage to housing or add-on structures ■ No open drill holes ■ No assembly notches ■ Door closed Catch secured with bolt
Measuring unit box (device-specific housing with explosion protection)	■ Cover secured with locking screw ■ No damage to housing or add-on structures ■ No open drill holes

Safety equipment	Target condition
Measuring unit enclosure (device-specific housing without explosion protection)	■ Door locked (two-way) ■ No damage to housing or add-on structures ■ No open drill holes
Power supply box	■ No damage ■ No open boreholes or screw connections ■ Door locked (two-way)
Signal junction box	■ No damage ■ No open boreholes or screw connections ■ Lid closed with all bolts
Ground	Connected
Leakage sensor (if available)	■ No damage ■ Functioning flawlessly

10.7 Checking the pressure monitor

Should only be performed by a qualified electrician.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 "Safety"* and the following additional protective equipment:

- Safety goggles
- Protective gloves (hazardous materials)

Required material

- Software handbook
- Electrotechnical documents (see customer folder)

Preparation

☞ End all the PACS process software.
For more information, see the *PACS software* manual.

☞ Shut down the control computer.

Procedure

☞ Ensure that the ambient atmosphere is not explosive.

WARNING	
	**Danger of explosion due to open ignition sources!** The control box contains ignition sources. Opening the control box can cause explosion of potentially explosive atmosphere. ☞ Avoidance measures see *chapter 2 "Safety"*.

☞ Open the control box.
The pressure monitor cuts off all currents to electrical consumers.

☞ Check that the device is voltage-free at the output terminals of the pressure monitor and other contactors if necessary. To do so, open the power supply box with a double-bit key.
If no voltage is present then the pressure monitor is working properly.

See electrotechnical documentation for further information.

☞ Connect the power supply box and lock it with both locks.

☞ Close the control box and secure the connections with safety bolts.
The analyzer starts automatically.

Restarting operation

☞ Once you have completed all the maintenance work, perform the steps described in *Chapter 10.17 "Measures after maintenance" on page 154*.

10.8 Notes on maintenance activities on/in the measuring unit box

Before performing any maintenance activities on or in the measuring unit box, you must perform the following steps:

WARNING	
	**Danger of explosion due to open sources of ignition!** Hot surfaces on the inside can ignite a potentially explosive atmosphere. ☞ Avoidance measures see *chapter 2.4 "Explosion protection"*.

☞ Switch off the analyzer (see *page 95*).

☞ Ensure the analyzer cannot be switched on again.

☞ Close all supply lines. Make sure that the supply lines to the analyzer are completely without pressure. Empty them if necessary.

☞ **Leave the analyzer switched off for at least 25 min. in order to avoid ice formation within the measuring unit box.**

☞ Open the measuring unit box (see *page 28*).

NOTICE	
	Observe the regulations regarding assembly of the screw pipe connections. Please refer to the manufacturer's documentation for the corresponding components.

10.9 Overview of components in the measuring unit box

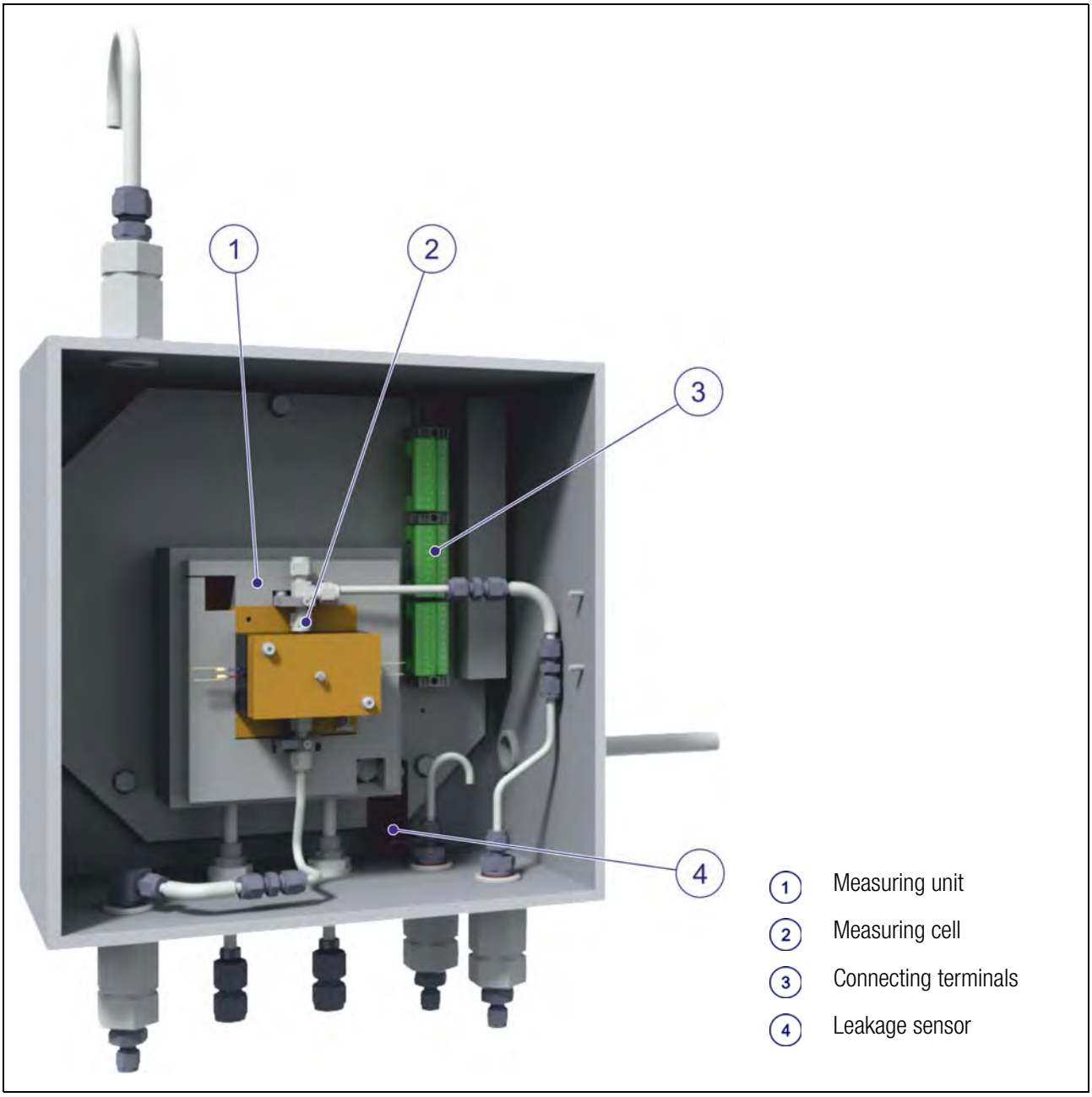


Figure 10.2: Components in the measuring unit box

10.10 Replace Peltier elements

If faulty, Peltier elements must be replaced. The analyzer has two different types of Peltier elements:

- Peltier element for the measuring cell
- Peltier elements for pre-stage

NOTICE	
	During this maintenance work, the measuring cell can also be cleaned and replaced, if defective.

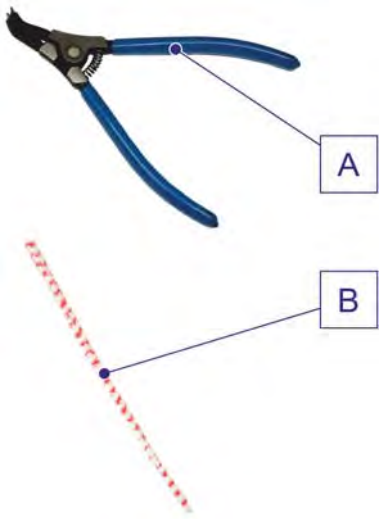
Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 Safety* and the following additional protective equipment:

- Safety goggles
- Protective gloves (hazardous materials)

Required tools

- 15 mm, 19 mm, 22 mm and 1/2" wrenches
- 3 mm and 5 mm Allen keys
- 5 mm torque wrench
- Flat-headed screwdriver
- Special tools



A - Snap-ring pliers
B - Pipe cleaners

Figure 10.3: Snap ring pliers and pipe cleaners

Required auxiliary equipment

- Thermally conductive paste
- Ethanol for cleaning
- Cleaning cloths
- Lint-free cloth

Preparation for maintenance
General

- ☞ Order new Peltier elements from BARTEC BENKE.
  For contact data, see *chapter 1.7 "Customer service" on page 7*.
- ☞ Before opening the measuring unit box, please follow the steps in *Chapter 10.8 "Notes on maintenance activities on/in the measuring unit box" on page 116*.

10.10.1 Remove the measuring unit

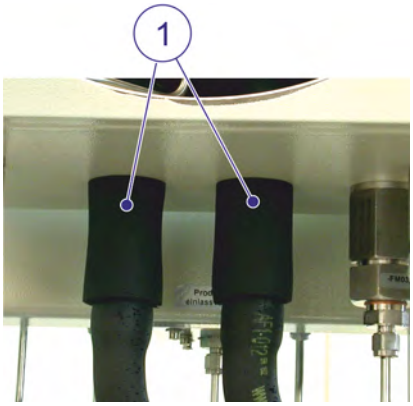


Figure 10.4: Remove insulation of coolant connections

- ☞ Remove the pipes to the coolant connections
- ☞ Remove the insulation (**1**) of the coolant connections so that the Swagelok screw connections are uncovered.
- ☞ Loosen alternately, step by step, the Swagelok screw connections of the pipes to the coolant connections.
- ☞ Secure the upper nut from turning with a suitable wrench (see **(3)** *Figure 10.5 on page 119*).
- ☞ Remove any leaked coolant with a suitable cloth or collect it in a container.

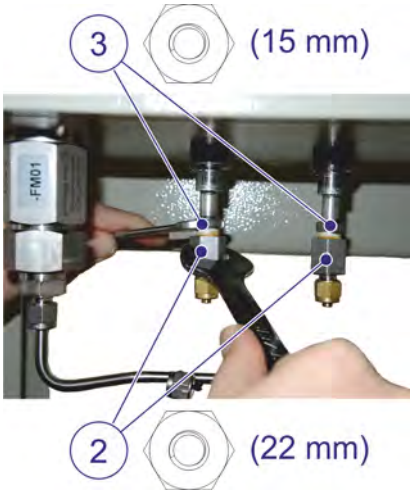


Figure 10.5: Loosen the Swagelok screw connections of the coolant connections

- ☞ Loosen the Swagelok screw connections (**2**) of the coolant connections while you hold the nut up with another suitably sized wrench (**3**).
- ☞ Remove the Swagelok screw connections (**2**).
- ☞ Optionally, you can close the coolant connections with a blind plug.

Figure 10.6: Remove snap rings of coolant connections

☞ Remove the snap ring (**4**) on both coolant connections using a pair of snap ring pliers.

☞ Remove the front insulation of the measuring unit.

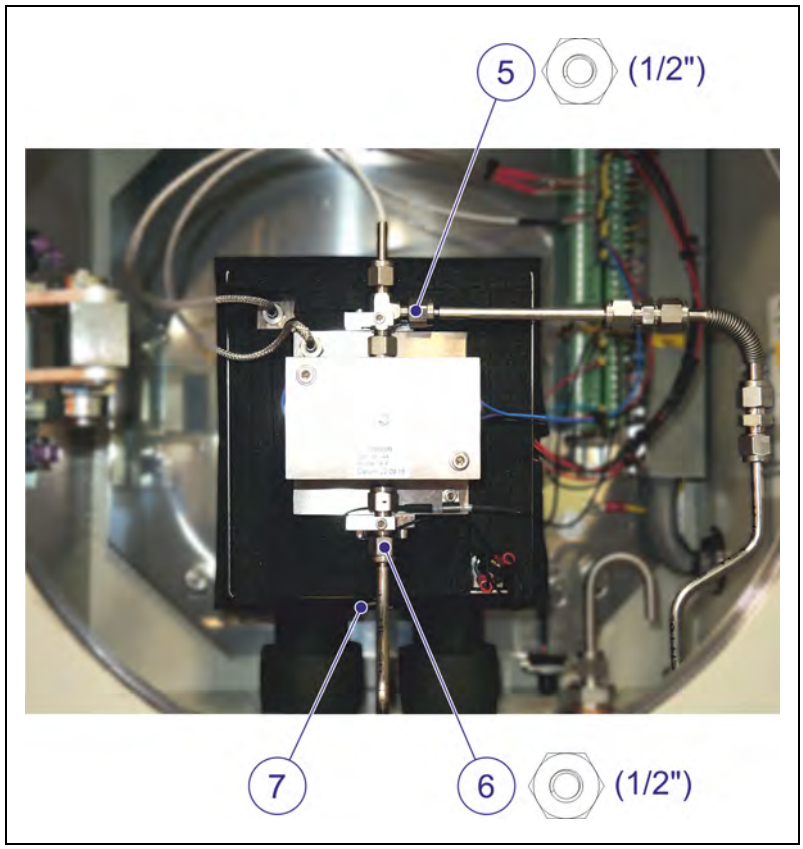


Figure 10.7: Remove pipes on the measuring unit

☞ Release the Swagelok screw connections (**5**) and (**6**) of the piping to the measuring cell.

☞ Make sure that no product from the upper screw connection (**5**) can get downward to the measuring cell.

☞ Remove any escaping product with a suitable cloth.

☞ Loosen the retaining wire of the insulation (**7**) and remove the two halves of the insulation.

Removing the plug

☞ Remove the two plugs (terminals 1-10 and 11-20) from connecting terminal *-XA1*.

☞ Remove the plug from connecting terminal *-XA2*.

Removing measuring unit

☞ Carefully remove the measuring unit from the measuring unit box. **Take care not to damage the cylindrical gap (the circular area) at the input and output of the coolant connections, since otherwise explosion protection no longer exists.**

☞ **Grasp the measurement unit when you remove it also at the heat exchanger and not only on the pipes.**

☞ Remove any escaping coolant with a suitable cloth.

10.10.2 Remove the measuring cell

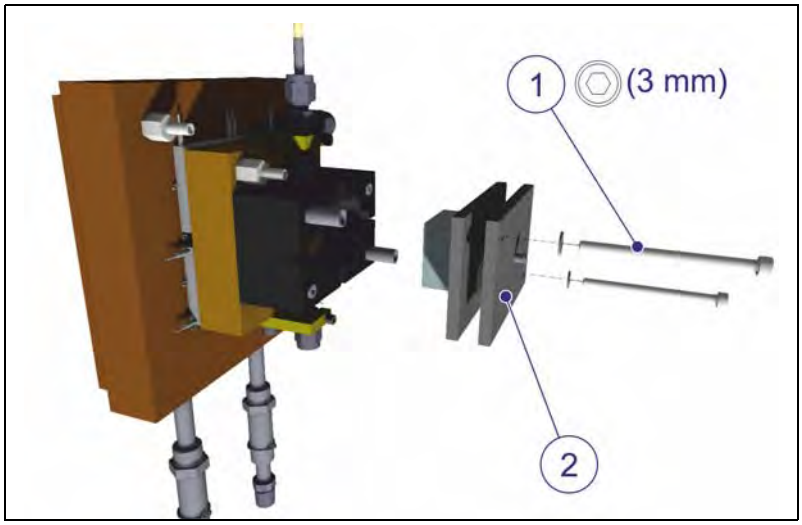


Figure 10.8: Removing end plate of measuring unit

☞ Loosen the two screws (**1**) and remove them, including the washers.

☞ Remove the complete assembly (**2**).

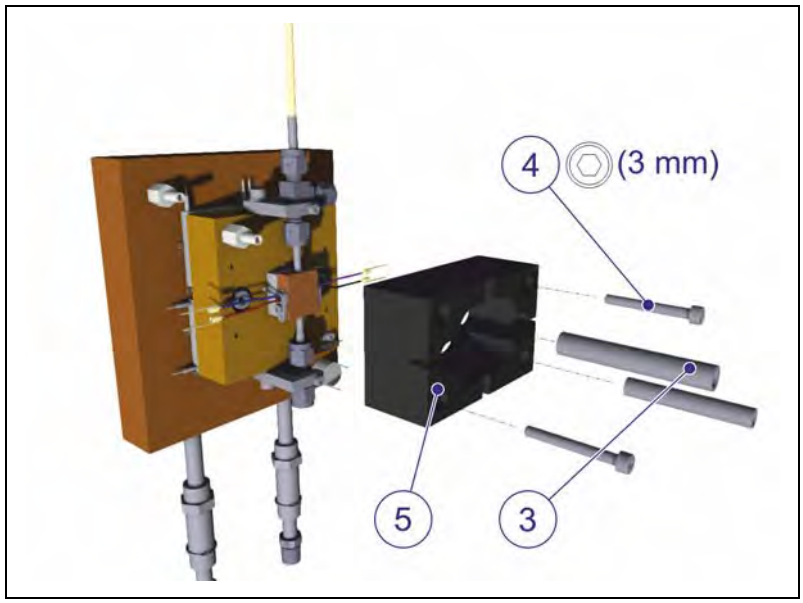


Figure 10.9: Remove measuring cell receptacle

☞ Remove the spacer pipes (**3**) and loosen the screws (**4**).

☞ Remove the measuring cell receptacle (**5**).

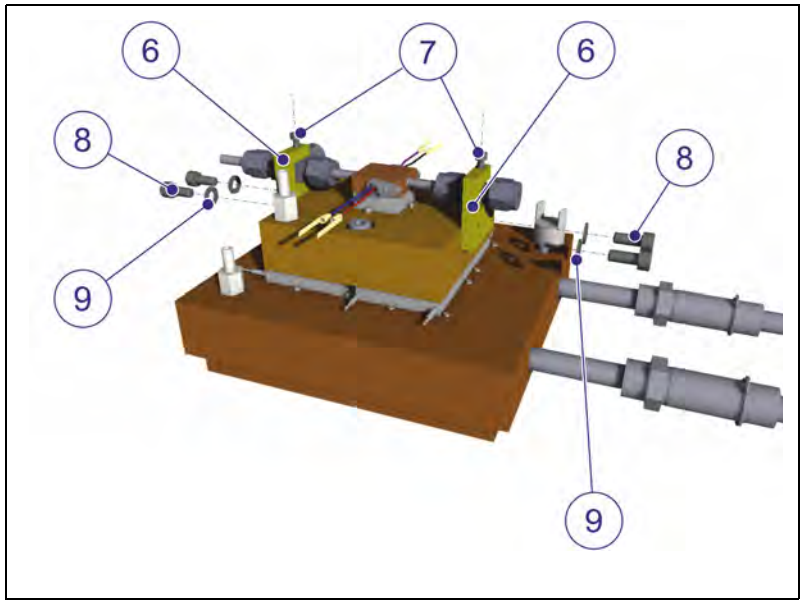


Figure 10.10: Remove the anti-twist protection of the measuring cell

☞ Loosen the two retaining screws (**7**) of the anti-twist protections (**6**) with a few rotations.

☞ Remove the two screws (**8**) and washers (**9**) of the upper and lower anti-twist protection.

☞ Remove the anti-twist protections (**6**).

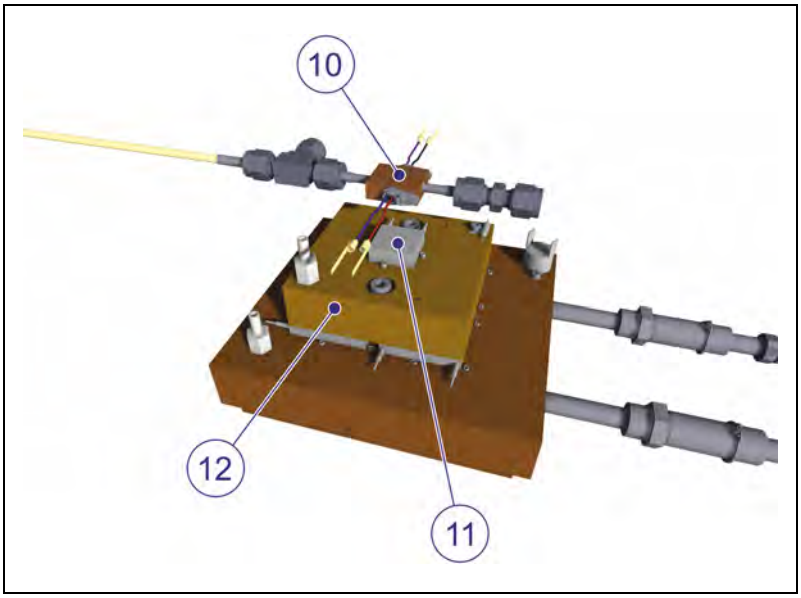


Figure 10.11: Remove measuring cell

☞ Remove the measuring cell (**10**). Due to the thermally conductive paste, the measuring cell body can stick to the Peltier element (**11**) under it. Ensure that the Peltier element remains in its place on the pre-stage (**12**).

NOTICE	
	If the measuring cell is defective or you want to clean it, again follow the steps in *Chapter 10.11 "Clean the measuring cell" on page 135*.

10.10.3 Replacing Peltier element for the measuring cell

Removing Peltier element

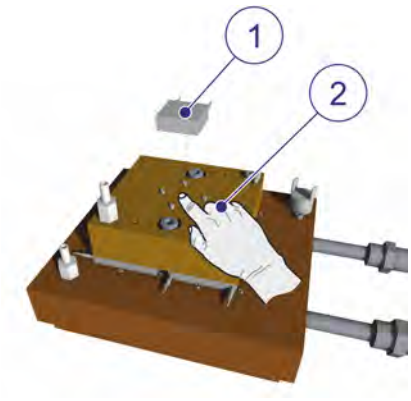


Figure 10.12: Remove Peltier element for the measuring cell

☞ Remove the Peltier element (**1**) from the pre-stage.

☞ Remove the connecting lines *XA1-5* and *XA1-6* of the Peltier elements by releasing the terminal screws (flat-headed screwdriver).

☞ Clean the pre-stage (**2**) with a lint-free cloth and some ethanol until all traces of the thermally conductive paste are removed.

Installing new Peltier element

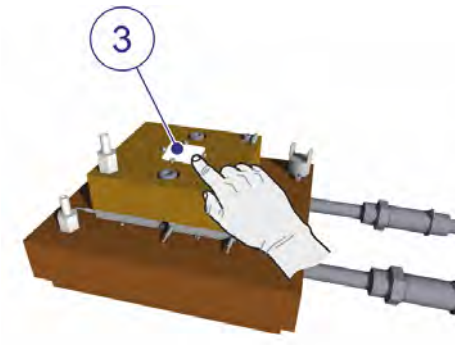


Figure 10.13: Apply thermally conductive paste on the pre-stage

☞ **If you must replace the Peltier elements for the pre-stage, follow the steps in Chapter 10.10.4 “Replace Peltier elements for the pre-stage” on page 125.**

☞ Apply a sufficient amount – but not too much – thermally conductive paste on the pre-stage (**3**). Use a glove, for example, to fill the area between the alignment aids (**5** - *Figure 10.14 on page 124*) of the Peltier element.

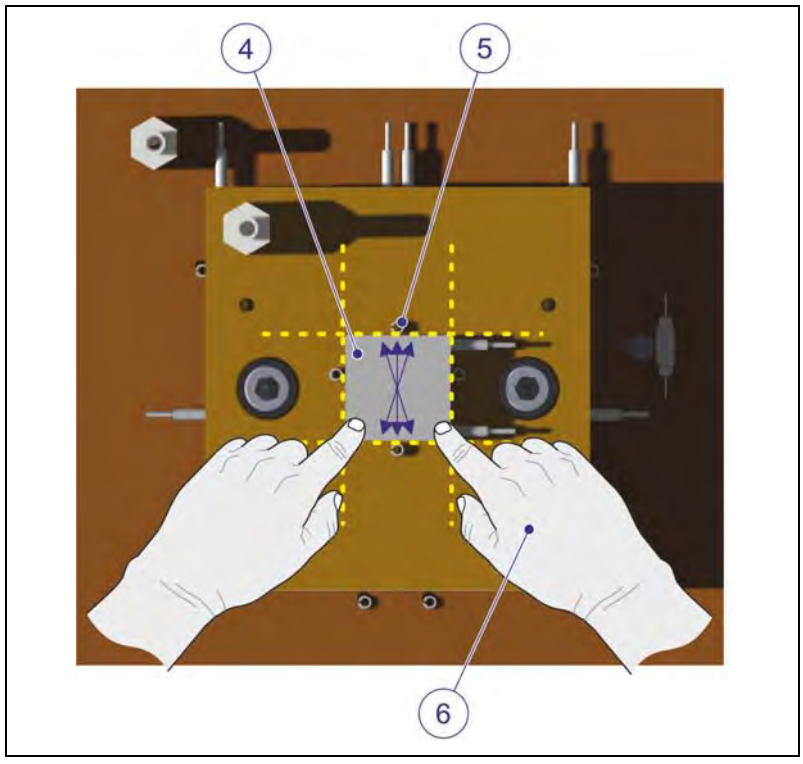


Figure 10.14: Install Peltier element of the measuring cell

☞ Place the Peltier element (**4**) with the warm side (where the cables are soldered) down between the four alignment aids (**5**). **The cables must be on the right side.**

☞ Press the Peltier element slightly onto the pre-stage with the fingers of one hand (**6**) and move it back and forth until the resistance increases significantly.

☞ **Avoid any contact between the Peltier element and the alignment aids.**

☞ Apply the thermally conductive paste sparingly on the surface of the Peltier element so that only a very thin layer of thermally conductive paste remains on the contact surface.

☞ Connect connecting lines *XA1-5* and *XA1-6* of the Peltier element to plug *-XA1* and tighten the terminal screws again (flat-headed screwdriver). **The number on the plug must always match the number of the connecting line!**

10.10.4 Replace Peltier elements for the pre-stage

NOTICE	
	If you don't have to replace the Peltier elements for the pre-stage, continue with *Chapter 10.10.5 "Install measuring cell" on page 131*.

Removing the pre-stage

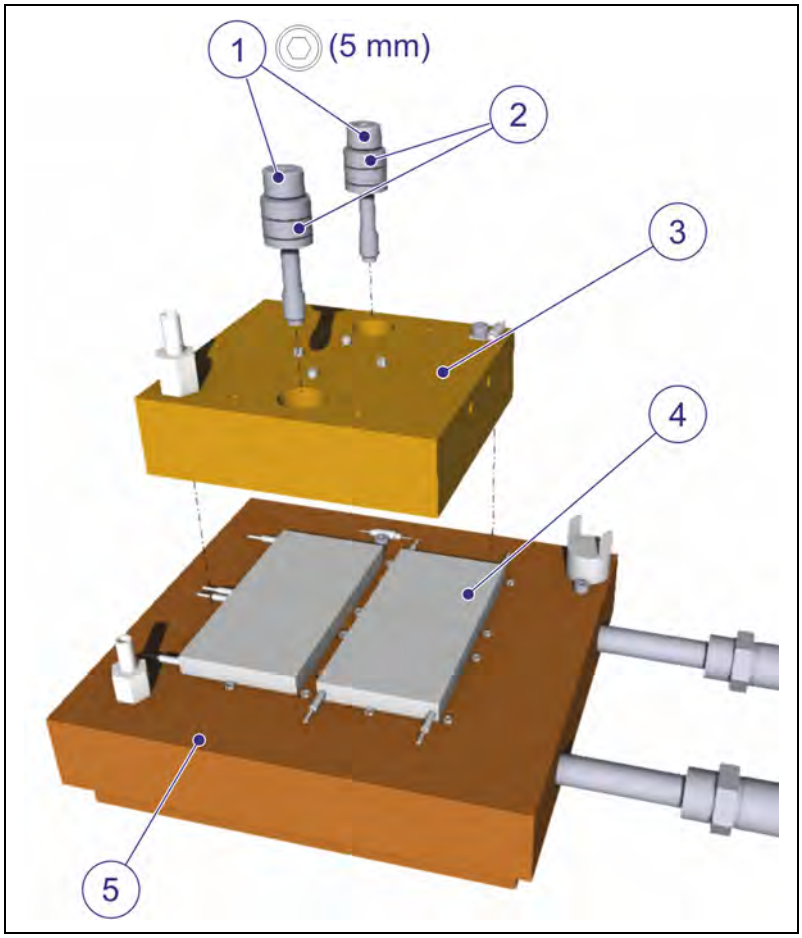


Figure 10.15: Removing the pre-stage

☞ Loosen the screws (**1**). When you remove the screws, ensure that the so-called *spring packs* (**2**) are not lost.
The exact order and direction of installation of the conical springs must be observed.
It is best to leave them on the screws.

☞ Remove the pre-stage (**3**). The thermally conductive paste might cause the pre-stage to stick to the Peltier elements (**4**) under it. Make sure that the Peltier elements remain in their place on the heat exchanger (**5**).

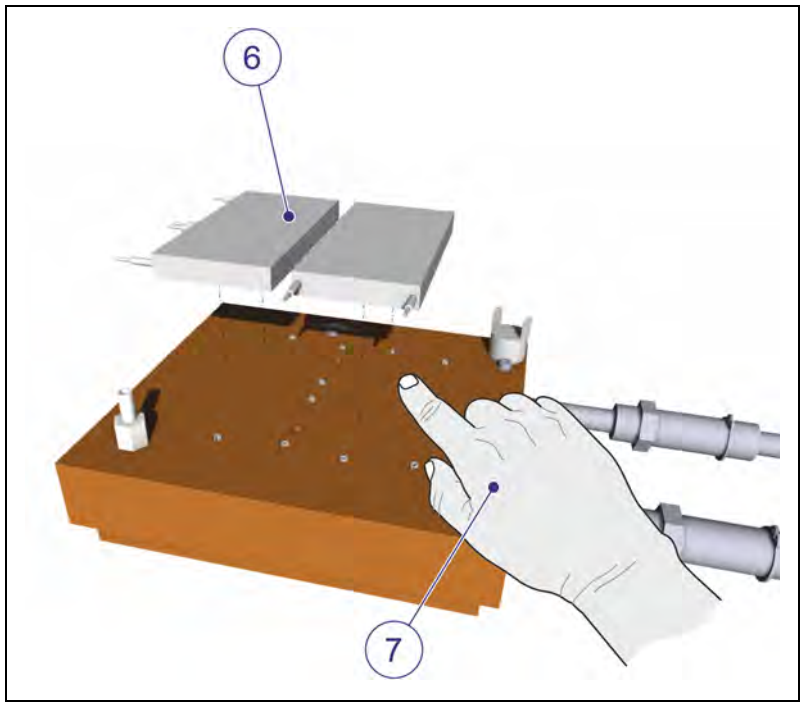


Figure 10.16: Remove the Peltier element for the pre-stage

☞ Remove the four Peltier elements (**6**) from the heat exchanger.

☞ Remove the connecting lines of the Peltier elements *XA1-1* to *XA1-4* by releasing the terminal screws (flat-headed screwdriver).

☞ Clean the heat exchanger (**7**) with a lint-free cloth and some ethanol until all traces of the thermally conductive paste are removed.

Installing new Peltier elements

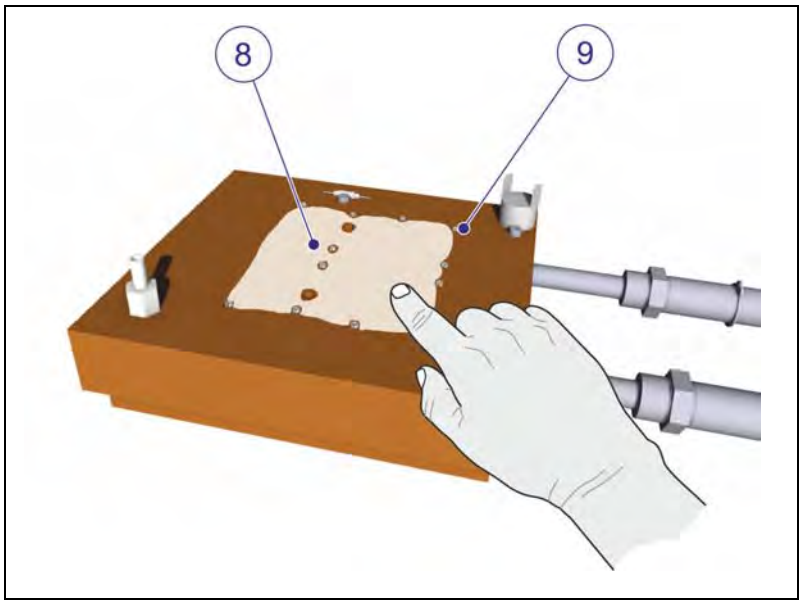


Figure 10.17: Installing Peltier element for the pre-stage

☞ Apply a sufficient amount – but not too much – thermally conductive paste on the heat exchanger (**8**). Use a glove, for example, to fill the area between the alignment aids (**9**) of the Peltier elements.

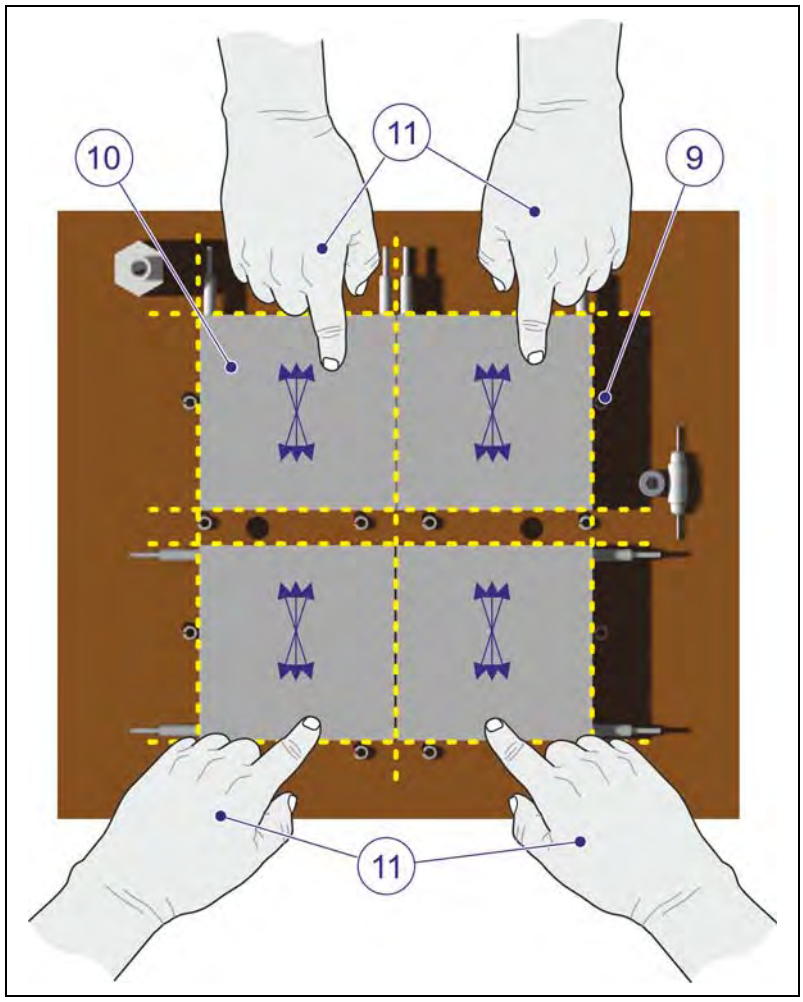


Figure 10.18: Install Peltier element of the measuring cell

☞ Two Peltier elements are always connected in series. Place the four Peltier elements (**10**) with the warm side (where the cables are soldered) down on the heat exchanger between the four alignment aids (**9**).

- The upper Peltier elements with the cables upward.
- The bottom Peltier elements with the cables to the left and right.

☞ Press each Peltier element slightly onto the heat exchanger with the fingers (**11**) and move it back and forth until the resistance increases significantly.

☞ **Avoid any contact between the Peltier elements and the alignment aids.**

☞ **Leave plenty of space to the threaded holes so that the screws for fastening the pre-stage cannot damage the Peltier elements.**

☞ Clean the new Peltier elements with a lint-free cloth and a bit of ethanol.

☞ Connect connecting lines *XA1-1* to *XA1-4* of the Peltier elements to plug *-XA1*and tighten the terminal screws again (flat-headed screwdriver). **The number on the plug must always match the number of the connecting line!**

Installing the pre-stage

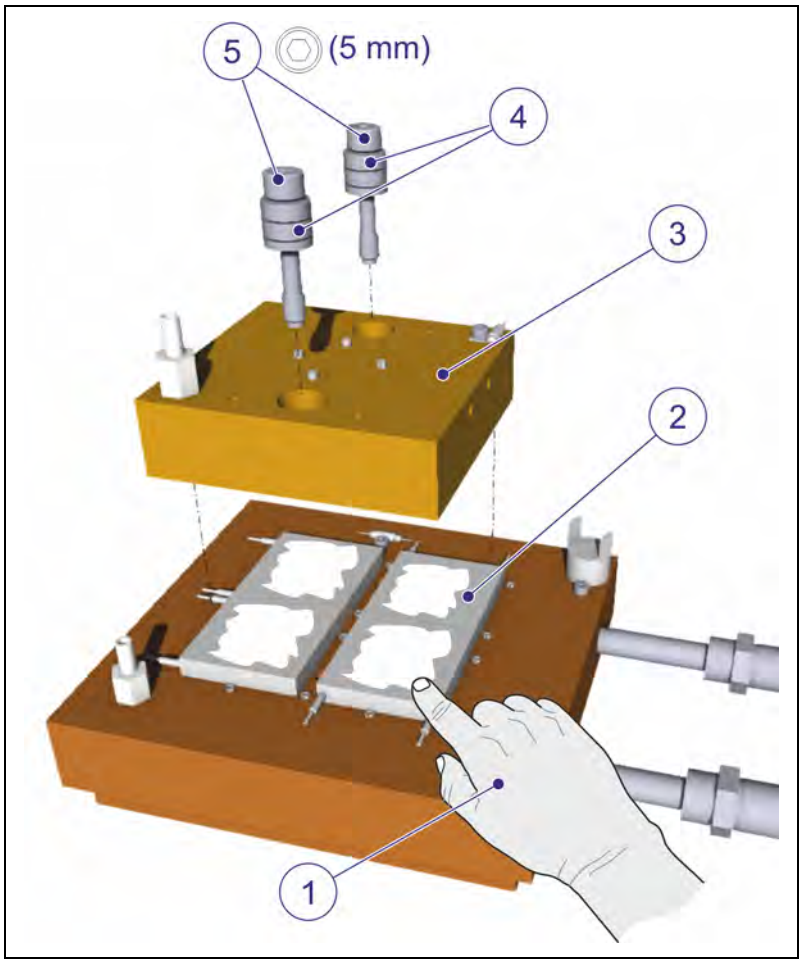


Figure 10.19: Installing the pre-stage

- ☞ Apply the thermally conductive paste (**1**) sparingly on the surface of the Peltier elements (**2**) of the pre-stage (**3**) so that only a very thin layer of thermally conductive paste remains on the contact surfaces.
- ☞ Place the pre-stage (**3**) on the Peltier elements (**2**) in such a way that it is flush with the Peltier elements.
- ☞ Slide the pre-stage back and forth until the resistance increases significantly. Make sure once more that it is flush with the Peltier elements.
- ☞ Make sure that the screws (**5**) do not touch and damage the Peltier elements (**2**).
- ☞ When placing the screws, ensure that the so-called *spring packs* (**4**) are not lost and are installed in the **exact order and direction of installation of the conical springs.**

Order of the conical springs

The following order of the conical springs on the screws must be observed:

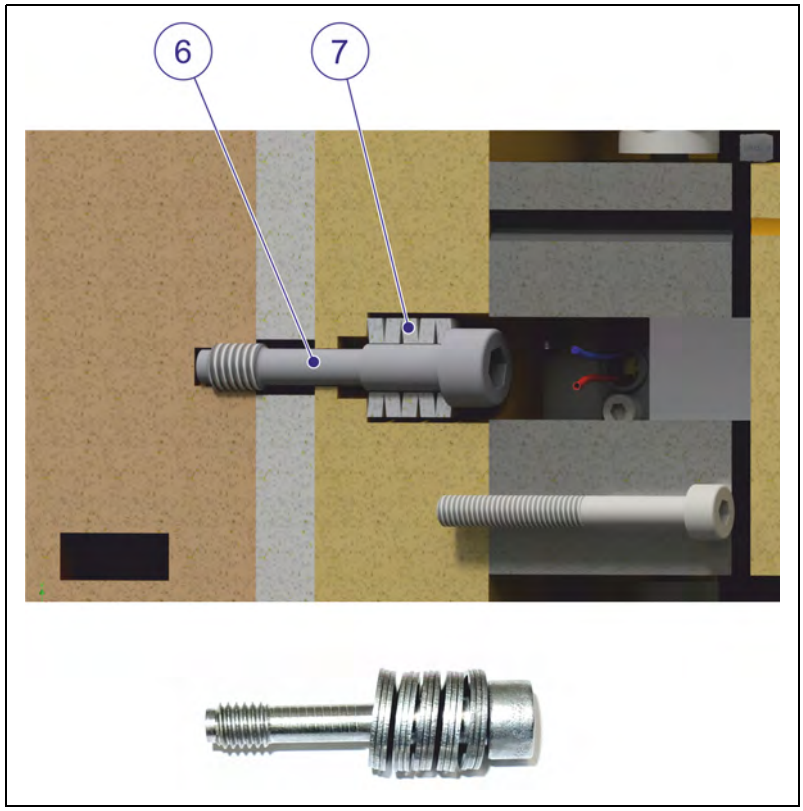


Figure 10.20: Structure of the conical springs of the screws of the pre-stage

Always **3 conical springs** (**7**) together are slipped on the screw, in the same position in alternating directions (**6**), as shown in the figure above. This ensures that when the screws are tightened, the pre-stage is pressed on the Peltier elements beneath with a defined force and does not damage them.

☞ Tighten the screws (**5**) with **a maximum of 5 Nm** using a torque wrench.

10.10.5 Install measuring cell

NOTICE	
	If the measuring cell is defective or you want to clean it, first follow the steps in *Chapter 10.11 "Clean the measuring cell" on page 135*.

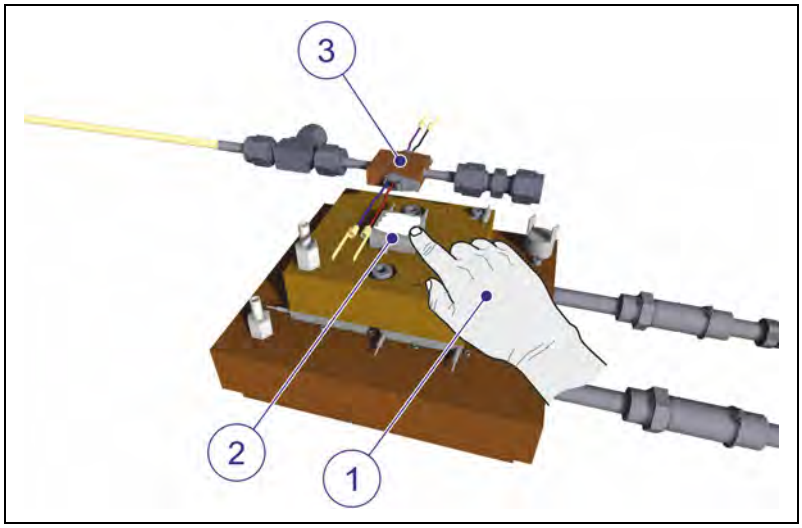


Figure 10.21: Installing measuring cell to pre-stage

☞ Apply the thermally conductive paste (**1**) sparingly on the surface of the Peltier element (**2**) so that only a very thin layer of thermally conductive paste remains on the contact surfaces.

☞ Place the measuring cell (**3**) on the Peltier element (**2**) in such a way that it is flush with the Peltier elements.

☞ Slide the measuring cell back and forth until the resistance increases significantly. Make sure once more that it is flush with the Peltier element.

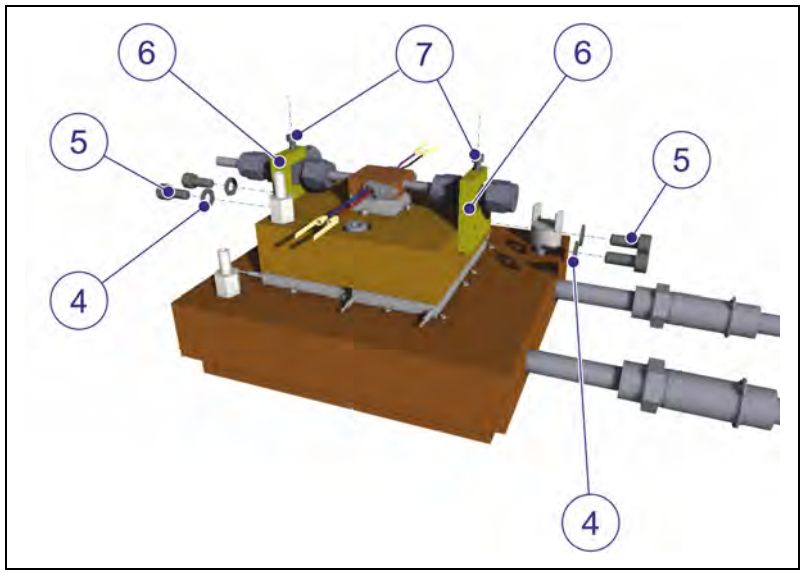


Figure 10.22: Installing the anti-twist protection of the measuring cell

☞ Fasten the anti-twist protections (**6**) at the top and bottom of the measuring cell.

☞ Fasten the two screws (**5**) and washers (**4**) of the upper and lower anti-twist protection and tighten them.

☞ Tighten the two retaining screws (**7**) of the anti-twist protections (**6**) again.

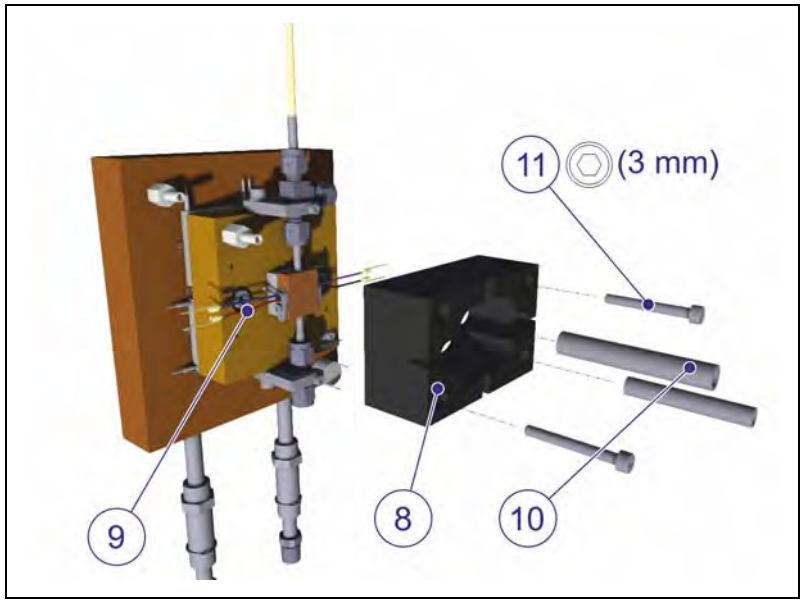


Figure 10.23: Install measuring cell receptacle

☞ Place the measuring cell receptacle (**8**) on the pre-stage.

☞ Guide the cables of the light barrier (**9**) through the lateral slots of the measuring cell receptacle to the outside.

☞ Place the spacer pipes (**10**).

☞ Tighten the screws (**11**) again.

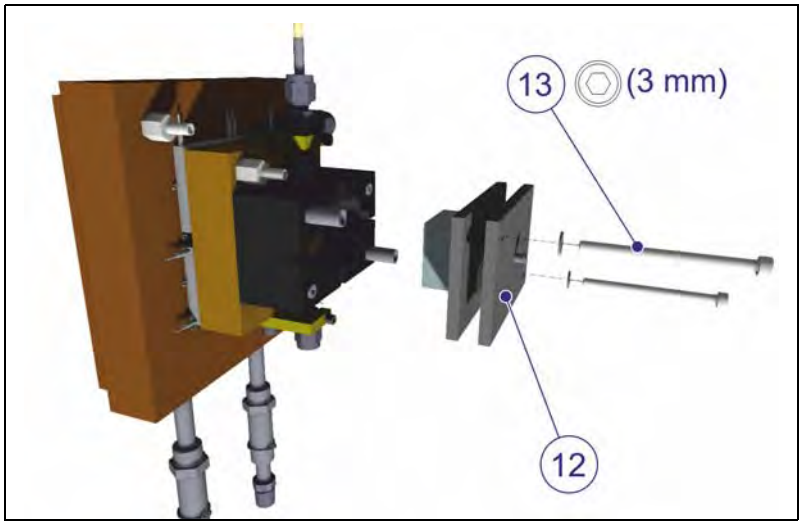


Figure 10.24: Installing end plate of measuring unit

☞ Place the complete assembly (**12**) on the measuring cell receptacle.

☞ Place the screws, including the washers.
Tighten the two screws (**13**).

10.10.6 Installing measuring unit

☞ Carefully mount the measuring unit in the measuring unit box.
Take care not to damage the cylindrical gap (the circular area) at the input and output of the coolant connections, since otherwise explosion protection no longer exists.

☞ **Grasp the measurement unit when you install it also at the heat exchanger and not only on the pipes.**

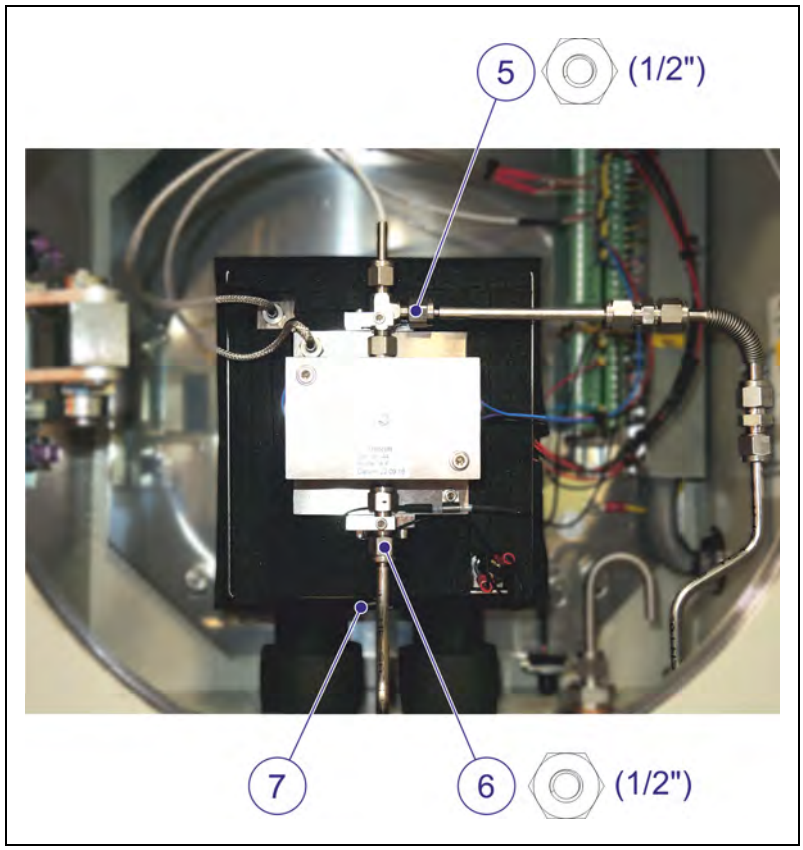


Figure 10.25: Install pipes on the measuring unit

- ☞ Place the insulation and secure the retaining wire of the insulation (**7**).
- ☞ Fasten the Swagelok screw connections (**5**) and (**6**) of the piping to the measuring cell.
- ☞ Place the upper insulation for the measuring unit.

Connecting the plugs

- ☞ Connect the two plugs (terminals 1-10 and 11-20) with connecting terminal *-XA1*.
- ☞ Connect plug *-XA2* with connecting terminal *-XA2*.

Figure 10.26: Fasten snap rings of coolant connections

- ☞ Fasten a new snap ring (**4**) on both coolant connections using a pair of snap ring pliers.
- ☞ Fasten the front insulation of the measuring unit.

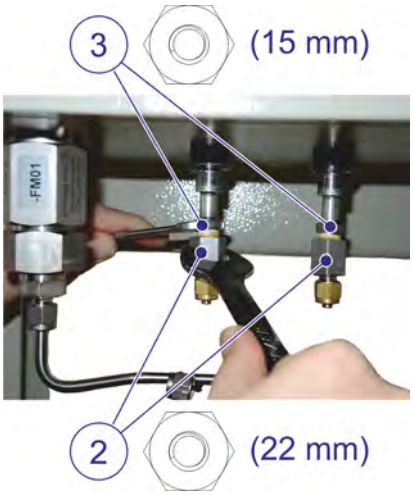


Figure 10.27: Install the Swagelok screw connections of the coolant connections

- ☞ Remove the blind plugs on the coolant connections, if existent.
- ☞ Remove old Teflon tape and wrap new tape on the thread.
- ☞ Fasten the Swagelok screw connections (**2**) of the coolant connections while you hold the nut up with another suitably sized wrench (**3**).

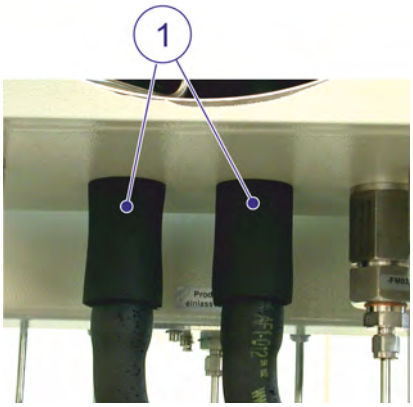


Figure 10.28: Attach insulation of coolant connections

- ☞ Fasten the Swagelok screw connections to the pipes of the coolant connections.
- ☞ Secure the upper nut from turning with a suitable wrench (see **(2)** *Figure 10.27 on page 135*).
- ☞ Fasten the pipes to the coolant connections
- ☞ Attach the insulation (**1**) of the coolant connections.

Restarting operation

- ☞ Once you have completed all the maintenance work, perform the steps described in *Chapter 10.17 "Measures after maintenance" on page 154*.

10.11 Clean the measuring cell

Depending on its condition, the measuring cell may require cleaning.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 Safety* and the following additional protective equipment:

- Safety goggles
- Protective gloves (hazardous materials)

Required tools

- 1/2" wrench
- 2 mm Allen key
- Flat-headed screwdriver

Preparation for maintenance
General

☞ Before opening the measuring unit box, please follow the steps in *Chapter 10.8 "Notes on maintenance activities on/in the measuring unit box" on page 116*.

☞ If you have not already done so, follow the steps in *Chapter 10.10 "Replace Peltier elements" on page 118*, until you have removed the measuring cell.

NOTICE	
	**Perform all the steps on a suitable surface so that no small parts may be lost.**

10.11.1 De-install the measuring cell

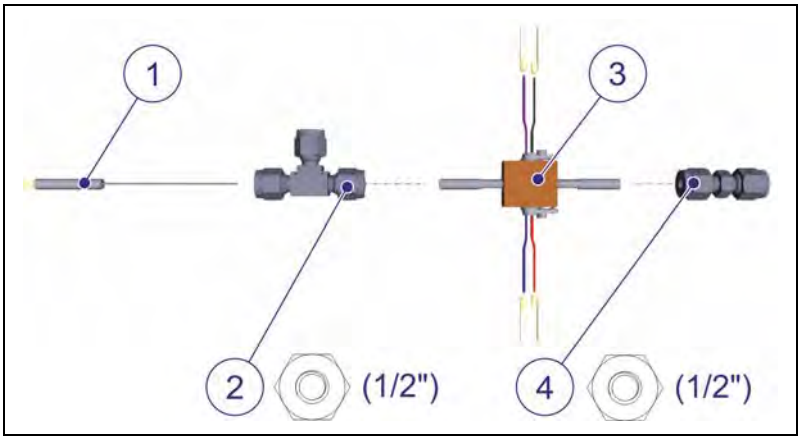


Figure 10.29: Remove Swagelok and temperature sensor of measuring cell

☞ Release the Swagelok screw connections (**2**) and (**4**) of the measuring cell (**3**).

NOTICE	
	The screw connections are fitted with plastic cutting rings. Make sure that they are not lost.

☞ Remove the temperature sensor (**1**).

☞ If the temperature sensor is defective, order a new one at BARTEC BENKE and follow the steps in *Chapter 10.12 "Replace temperature sensors" on page 141*.

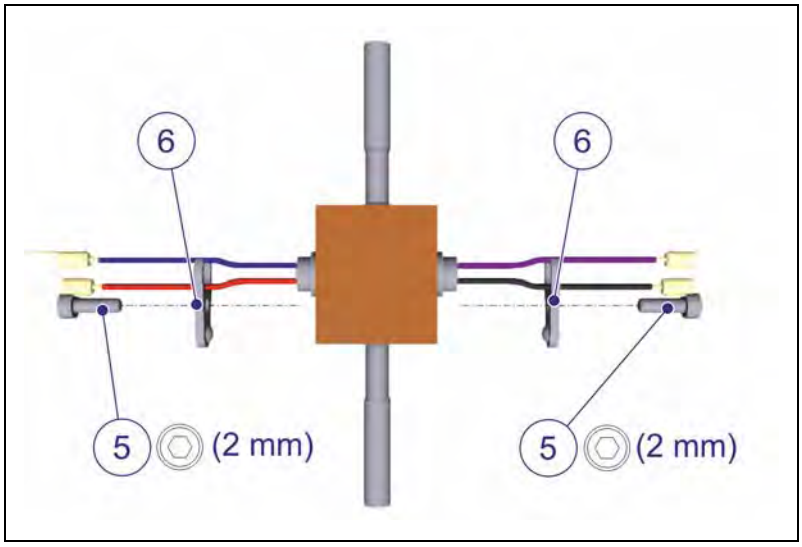


Figure 10.30: Remove the lock washers of the light barrier

☞ Loosen the screws (**5**).

☞ Remove the screws together with the lock washers (**6**).

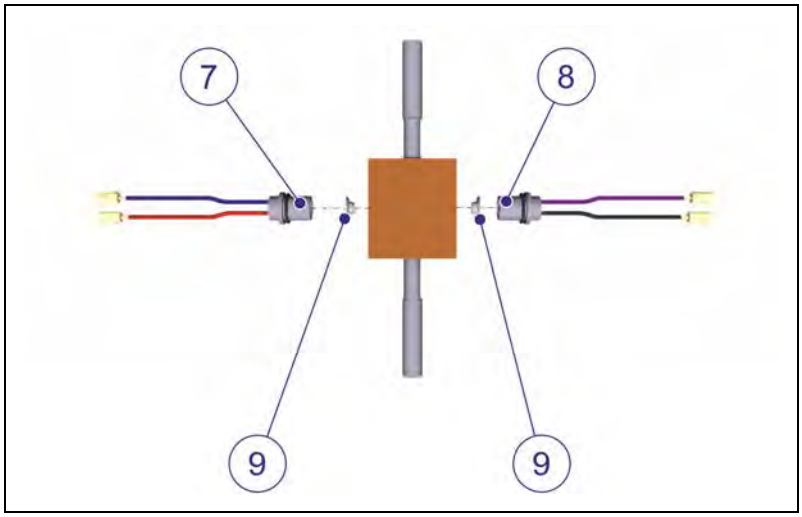


Figure 10.31: Remove light barrier

☞ Carefully remove the sensors of the light barrier (**7**, **8**), including the o-rings.

☞ Carefully remove the thrust washers (**9**).
Don't lose the thrust washers.

☞ If the light barrier is defective, order a new one at BARTEC BENKE. For contact data, see *chapter 1.7 "Customer service" on page 7*.

Remove connecting lines *XA1-13* to *XA1-16* of the sensors of the light barrier by releasing the terminal screws (flat-headed screwdriver).

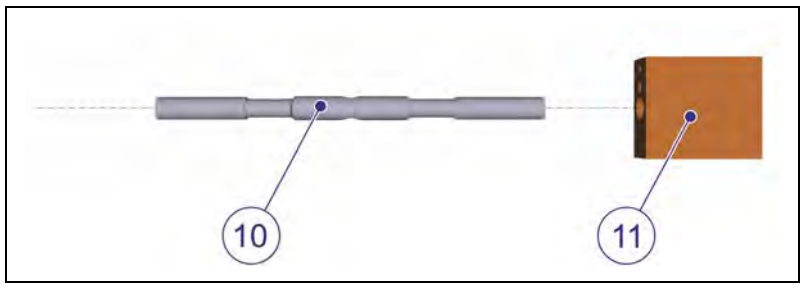


Figure 10.32: Remove measuring cell pipe

☞ Gently pull the pipe of the measuring cell (**10**) out of the measuring cell body (**11**).

Clean measuring cell pipe

☞ Clean the pipe thoroughly inside with a pipe cleaner until all product residues are removed. Use a little ethanol if necessary.

☞ Also clean glass elements inserted in the pipe (*window*) from the outside with a lint-free cloth and, if necessary, some ethanol until all product residues are removed.

10.11.2 Installing the measuring cell

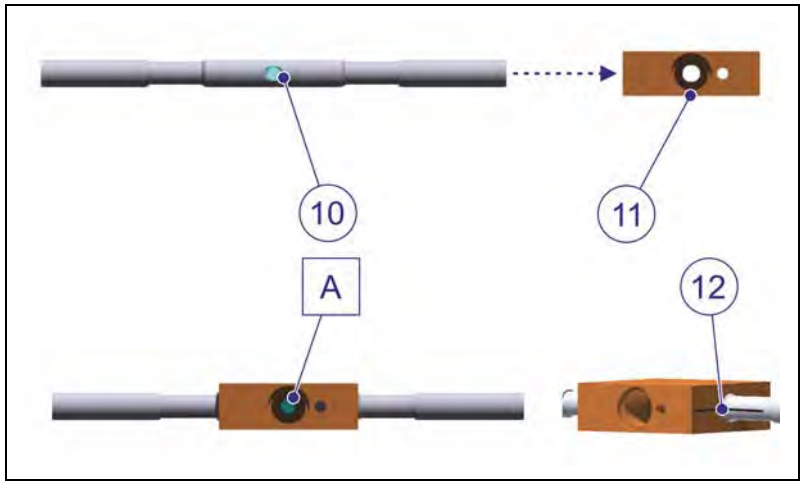


Figure 10.33: Align window of the measuring cell pipe to the measuring cell body

☞ Slide the pipe (**10**) back into the measuring cell body (**11**).

☞ Turn and slide the pipe until the inserted *window* is aligned to the hole and can be seen (**A**).

☞ If necessary, mark the pipe with a pen (**12**) so that the *windows* remain in place.
Make sure the pipe does not turn until the brackets for the light barrier have been fitted and screwed.

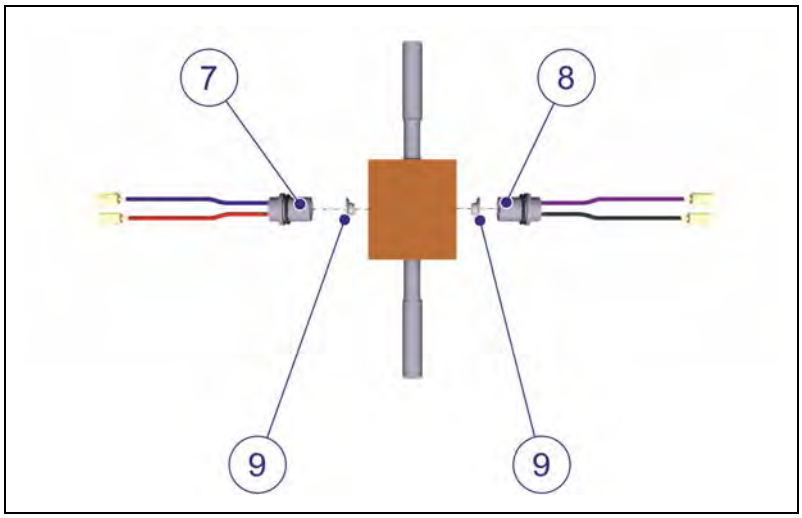


Figure 10.34: Install light barriers

☞ Place the thrust washers (**9**) in the measuring cell body.

☞ Place the sensors of the light barrier in the measuring cell body as follows:

- Emitter (**7**) to the left
- Receiver (**8**) on the right

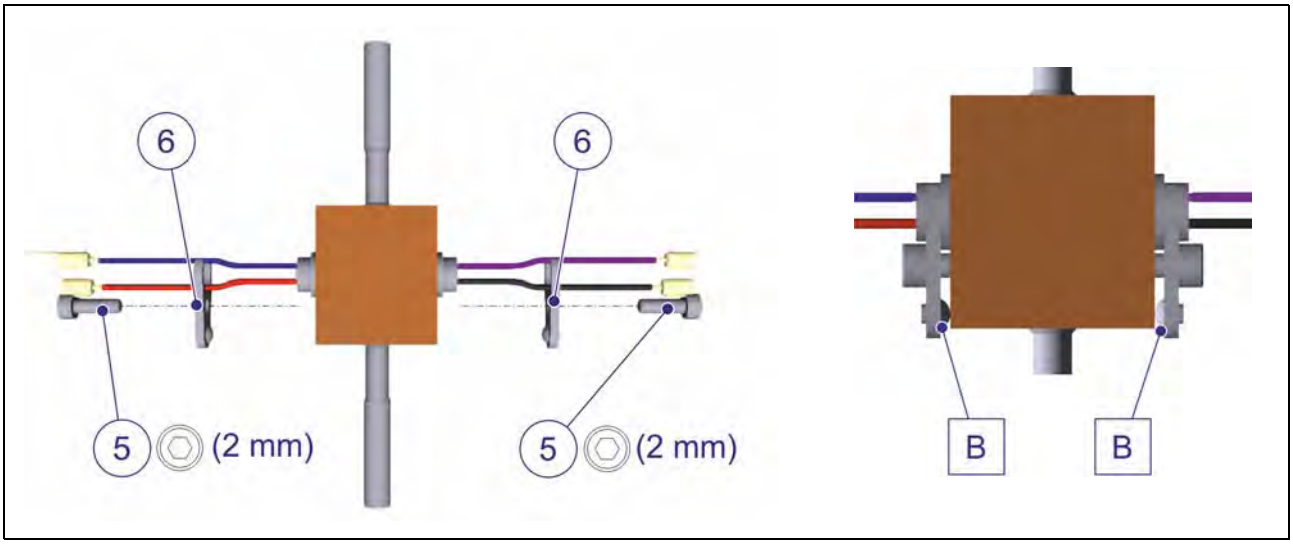


Figure 10.35: Install the lock washers of the light barrier

☞ Place the lock washers (**6**) on the sensors of the light barrier, so that **the blind rivets contact the measuring cell body with the round side (B).**

☞ Ensure that the markings on the pipe and the measuring cell body match.

☞ Tighten the screws (**5**).

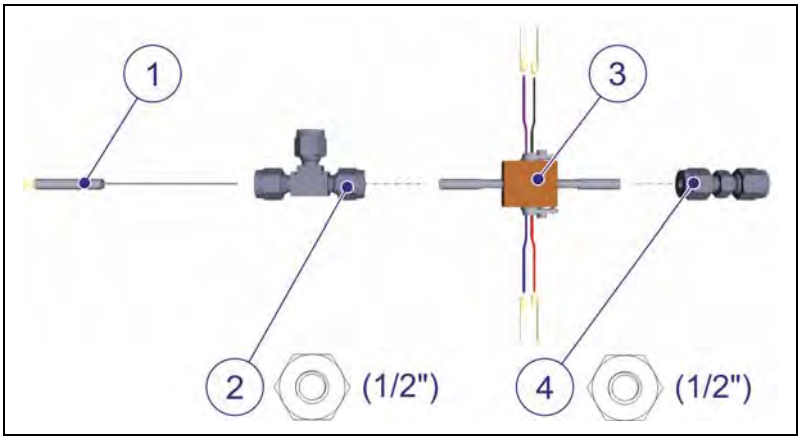


Figure 10.36: Install Swagelok and temperature sensor of measuring cell

☞ If you still need to replace the product temperature sensor, first follow the steps for the product temperature sensor in *Chapter 10.12 "Replace temperature sensors" on page 141*, if you have not already done so.

☞ Install the product temperature sensor (**1**).

☞ Fasten the Swagelok screw connections (**2**) and (**4**) on the measuring cell (**3**).

NOTICE	
	The screw connections are fitted with plastic cutting rings. Should they have been lost, order new ones from BARTEC BENKE. Don't use metal cutting rings so the pipe is not damaged.

☞ Connect connecting lines *XA1-13* to *XA1-16* of the sensors of the light barrier to plug *-XA1* and tighten the terminal screws again (flat-headed screwdriver). **The number on the plug must always match the number of the connecting line!**

☞ If you still need to replace the temperature sensor of the measuring unit, first follow the steps in *Chapter 10.12 "Replace temperature sensors" on page 141*.

☞ If you still need to replace the thermal fuses, first follow the steps in *Chapter 10.13 "Replace thermal fuses" on page 142*.

☞ Once the maintenance activities on the measuring unit have been completed, please follow the steps from *Chapter 10.10.5 "Install measuring cell" on page 131* until the measuring cell and the measurement unit are installed.

Restarting operation

☞ Once you have completed all the maintenance work, perform the steps described in *Chapter 10.17 "Measures after maintenance" on page 154*.

10.12 Replace temperature sensors

If faulty, temperature sensors must be replaced.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 Safety* and the following additional protective equipment:

- Safety goggles
- Protective gloves (hazardous materials)

Required tools

- 10 mm wrench
- Flat-headed screwdriver

Preparation for maintenance
General

☞ Before opening the measuring unit box, please follow the steps in *Chapter 10.8 "Notes on maintenance activities on/in the measuring unit box" on page 116*.

☞ If the measuring unit is still installed, remove the insulation of the measuring unit until the temperature sensors are visible.

10.12.1 Install/uninstall temperature sensors

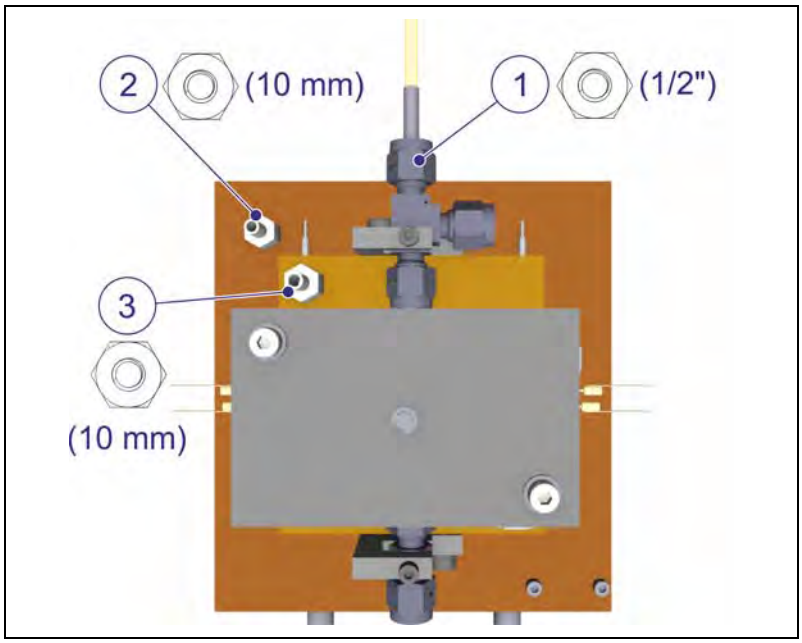


Figure 10.37: Installation location of temperature sensors

(1) Product temperature sensor
(2) Temperature sensor, heat exchanger
(3) Temperature sensor, pre-stage

Terminal classification

Observe the following terminal classification when replacing individual temperature sensors:

Temperature sensor	Terminal
Product temperature sensor	*-XA1-11/12*
Temperature sensor, heat exchanger	*-XA1-7/8*
Temperature sensor, pre-stage	*-XA1-9/10*

☞ Send the faulty temperature sensor(s) to BARTEC BENKE and order the necessary spare parts from us.
For contact data, see *chapter 1.7 "Customer service" on page 7*.

☞ If you still have to replace the thermal fuses, please continue in *Chapter 10.13 "Replace thermal fuses" on page 142*.

☞ If you have removed the measuring unit, follow the steps starting from *Chapter 10.10.6 "Installing measuring unit" on page 133*.

Restarting operation

☞ Once you have completed all the maintenance work, perform the steps described in *Chapter 10.17 "Measures after maintenance" on page 154*.

10.13 Replace thermal fuses

If faulty, thermal fuses must be replaced.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 Safety* and the following additional protective equipment:

- Safety goggles
- Protective gloves (hazardous materials)

Required tools

- 2.5 mm Allen key
- Flat-headed screwdriver

Preparation for maintenance
General

☞ Before opening the measuring unit box, please follow the steps in *Chapter 10.8 "Notes on maintenance activities on/in the measuring unit box" on page 116*.

☞ If the measuring unit is still installed, remove the insulation of the measuring unit until the thermal fuses are visible.

10.13.1 Remove thermal fuses

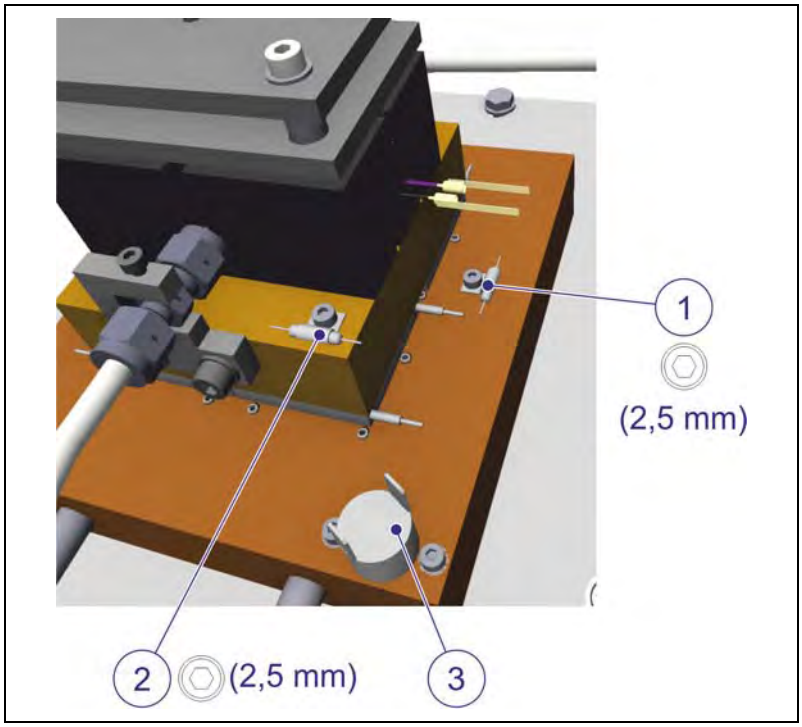


Figure 10.38: Remove thermal fuses

☞ Loosen the brackets (**1**) and (**2**) of the thermal fuses.

☞ Remove connecting lines *XA2-1 and XA2-2* of the fuses by releasing the terminal screws (flat-headed screwdriver).

☞ Remove the connecting cables on the thermo switch (**3**).

☞ Order new thermal fuses from BARTEC BENKE.
For contact data, see *chapter 1.7 “Customer service” on page 7*.

10.13.2 Install thermal fuses

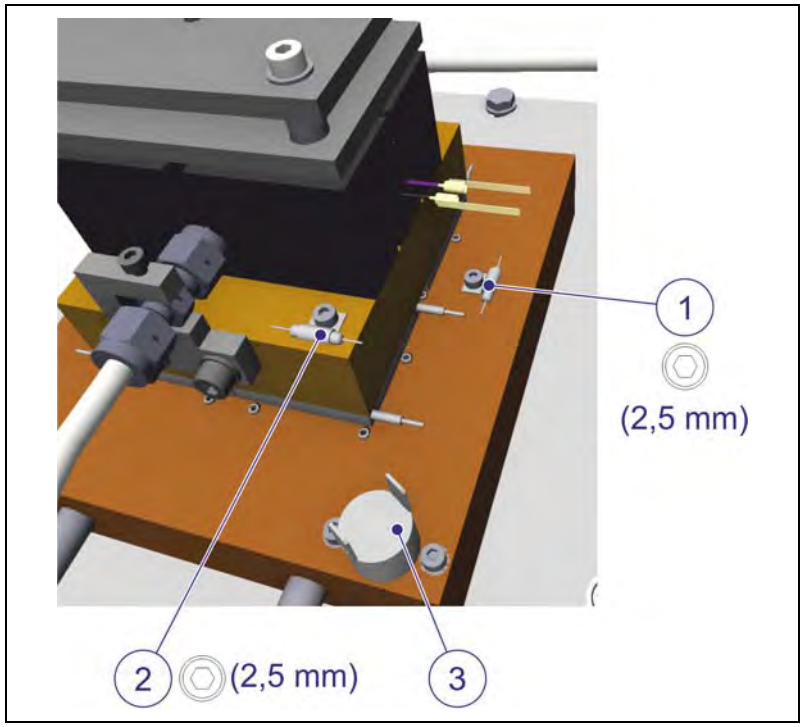


Figure 10.39: Install thermal fuses

☞ Place the new thermal fuses on the measuring unit in (**1**) and (**2**).

☞ Tighten the brackets (**1**) and (**2**).

☞ Connect connecting lines *XA2-1 and XA2-2* of the fuses to plug *-XA2* and tighten the terminal screws again (flat-headed screwdriver).
The number on the plug must always match the number of the connecting line!

☞ Connect each connecting line not yet connected to the thermo switch (**3**).

☞ If you have removed the measuring unit, follow the steps starting from *Chapter 10.10.6 "Installing measuring unit" on page 133*.

Restarting operation

☞ Once you have completed all the maintenance work, perform the steps described in *Chapter 10.17 "Measures after maintenance" on page 154*.

10.14 Clean/replace leakage sensor

Depending on its condition, the leakage sensor has to be cleaned or replaced, if defective.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 Safety* and the following additional protective equipment:

- Safety goggles
- Protective gloves (hazardous materials)

Required tools

- 17 mm and 19 mm wrenches
- 3 mm Allen key

Preparation for maintenance
General

☞ Before opening the measuring unit box, please follow the steps in *Chapter 10.8 "Notes on maintenance activities on/in the measuring unit box" on page 116*.

10.14.1 Cleaning the leakage sensor

☞ Wipe the residue of product/coolant away with a cloth.

☞ Wipe the leakage sensor dry.

☞ Remove the leaks.

10.14.2 Removing the leakage sensor

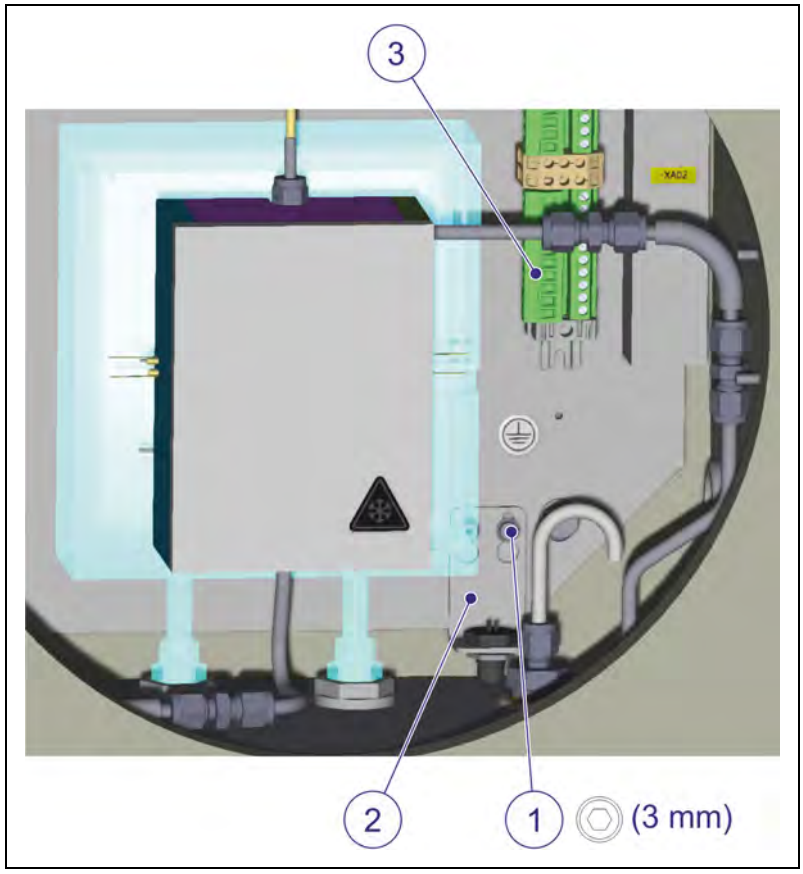


Figure 10.40: Installation location of the leakage sensor

- ☞ Loosen the two Allen screws of the leakage sensor bracket (**1**).
- ☞ Remove the bracket (**2**).
- ☞ Remove the screws of the leakage sensors (17 mm and 19 mm wrenches).
- ☞ Remove plug *-XA2* (**3**).
- ☞ Remove connecting lines *XA2-4*, *XA2-9* and *XA2-10* by releasing the terminal screws (flat-headed screwdriver).
- ☞ If the leakage sensor is defective, order a new one at BARTEC BENKE. For contact data, see *chapter 1.7 "Customer service" on page 7*.

10.14.3 Install leakage sensor

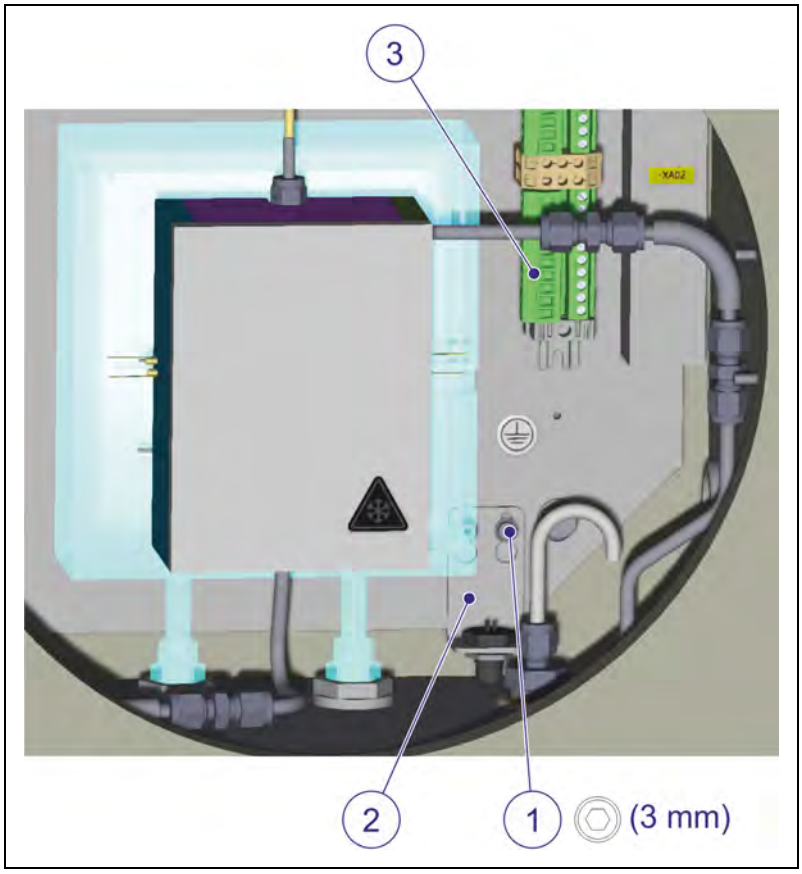


Figure 10.41: Installation location of the leakage sensor

☞ Install the new leakage sensor in the bracket.

☞ Tighten the screws of the leakage sensors (17 mm and 19 mm wrenches).

☞ Tighten the screwed connection.
Caution: Do not damage the plastic thread!

☞ Install the leakage sensor bracket (**2**) with the two Allen screws (**1**).

☞ Check the distance from the ground. Set the distance to approx. 0.5 mm with the aid of the holder.

☞ Connect connecting lines *XA2-4*, *XA2-9* and *XA2-10* of the leakage sensor to plug *-XA2* and tighten the terminal screws again (flat-headed screwdriver). **The number on the plug must always match the number of the connecting line!**

☞ Connect plug *-XA2* (**3**).

Restarting operation

☞ Once you have completed all the maintenance work, perform the steps described in *Chapter 10.17 "Measures after maintenance" on page 154*.

10.15 Cleaning flame arresters

All supply and discharge lines to non-fail-safe pipeline systems in the Ex d box are equipped with flame arresters. Only in combination with flame arrester does the measuring unit box provide explosion protection through the *pressure-resistant enclosure* type of protection (Ex d).

The *explosion group* of the Ex d box is mainly determined by the flame arresters used:

- For *explosion group IIC*, the flame arrester can contain **three or four flame filters**. That depends on the permitted surface temperature of the housing.
- For *explosion group IIB*, the flame arrester contains **two flame filters** and one distancing ring (in some analyzers only).

To function smoothly, the flame arresters require regular inspection and cleaning. The required intervals depend mainly on the liquids and gases flowing through the flame arresters.

NOTICE	
	The maintenance intervals for liquids are generally shorter than for gases.

In particular, flame arresters through which petrochemical product flows must be cleaned regularly. For clean products, cleaning is usually necessary only once a year. Product contamination can make considerably shorter maintenance intervals necessary.

Hot operating materials

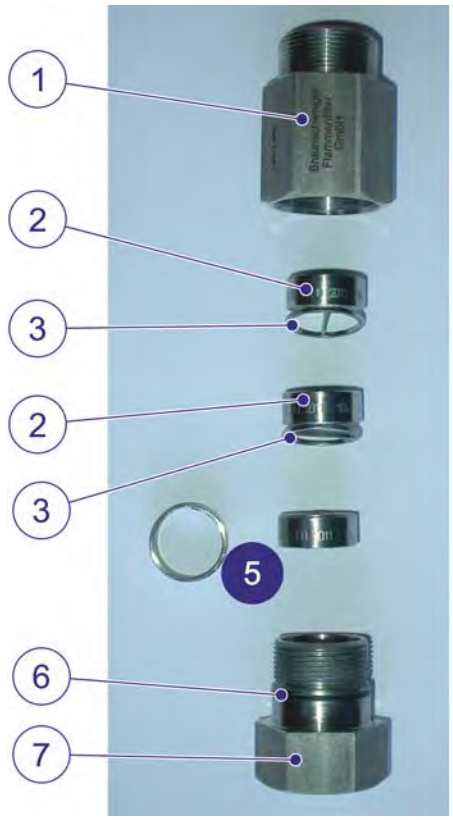
WARNING	
	**Danger of burns due to hot operating materials!** Operating materials can reach high temperatures during operation and cause burns upon contact. ☞ Avoidance measures see *chapter 2 "Safety"*.

Hot surfaces

WARNING	
	**Danger of burns due to hot surfaces!** Contact with hot components can cause burns. ☞ Avoidance measures see *chapter 2 "Safety"*.

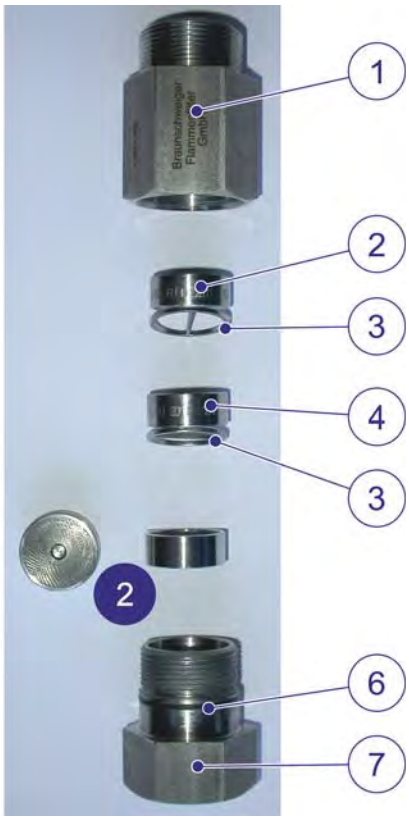
The **FRP-4.2/CPA-4.2** has flame arresters with three flame filters. For more information on flame arresters see *chapter 4.4.1 "Measuring unit" on page 57* and type of protection *pressure-resistant enclosure* (Ex d) see *chapter 2.4.2 "Types of protection and certificates" on page 22*.

10.15.1 Cleaning and/or replacing the flame arrester with inlaid flame filters



Explosion group IIB
(with two flame filters)

1	Outer housing
2	Flame filter, left (L)
3	Intermediate layer
5	Distancing ring
6	O-ring



Explosion group IIC
(with three flame filters)

1	Outer housing
2	Flame filter, left (L)
3	Intermediate layer
4	Flame filter, right (R)
6	O-ring

Figure 10.42: Configuration of flame arrester with flame filter

NOTICE	
	Flame arresters with **three** inlaid flame filters (*explosion group IIC*) are marked as follows: *PROTEGO® VAL-3/8''-X33*. Flame arresters with **two** inlaid flame filters (*explosion group IIB*) are marked as follows: *PROTEGO® VAL-3/8''-X32*. **Ensure that you use the flame arresters specified for the analyzer type.** ☞ Make sure you specify the **correct analyzer type** in your order.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 „Safety"* and the following additional protective equipment:

- Safety goggles
- Protective gloves (hazardous materials)

Required tools

- Spanners in the following sizes:
  - 14 mm, 22 mm, 2x 36 mm
- Plastic die (blunt)
- Plastic hammer
- Assembly paste

Preparation for maintenance
General

☞ Switch the analyzer off:

☞ Ensure the analyzer cannot be restarted.

☞ Depressurise all supply lines. Empty them if necessary

☞ Let the analyzer cool down for at least the specified period.

Removing the flame arrester

To clean the flame arrester, unscrew the inside housing (7) from the outside housing (1). The outer housing remains firmly screwed to the Ex d housing. Proceed as follows:

☞ Open the measuring unit box.

☞ Disconnect the flame arrester from the pipeline. To do so, release the Swagelok screw connection and the pipe screw connection on the inside housing of the flame arrester.

Removing the flame filter

The inside housing (7) contains the flame filters (2) and (4), and, for IIB, the distancing ring (5).

☞ Unscrew the inside housing from the outside housing (1). Use a spanner to prevent the outside housing from turning out of the Ex d housing. Always keep the inside housing upright to prevent the flame filters from falling out.

☞ Remove the flame filter. If applicable, use a blunt object to press it carefully out of the inside housing. Ideally you should use a type of plastic die to prevent damage to the flame filter.

☞ If it is not possible to remove the flame filters, replace the entire flame arrester. Replacements can be obtained from BARTEC BENKE.
Observe the instructions in Section "Assembling and installing flame arresters" on page 152.

Checking

☞ Check that the o-ring (6) is in flawless condition. Replace it if necessary. Replacements can be obtained from BARTEC BENKE.

☞ Check that the flame filters are clean and in flawless condition. If necessary, clean or replace the flame filters:

Cleaning

NOTICE	
	For cleaning at high pressures (air, water, vapor), the flame filters should be placed on a support grid to prevent damage.

☞ For dry dirt particles, it is enough to blast the flame arrester with compressed air.

☞ If heavy soiling has accumulated in the flame filter gaps, place the flame filters in a solution that dissolves soiling but does not attack the filter material. Then blast and dry with compressed air.

Cleaning with vapor is also often effective (maximum permitted temperature: 250 °C).

Before reassembly, all parts must be completely dry!

Replacing flame filters

☞ Replace a flame filter immediately if

- after cleaning the flame filter still contains residual soiling in the flame filter gap that cannot be removed.
- even a small area of the flame filter displays corrosion attacks or tempering colours (possibly from a combustion process), because the smallest changes to the gap width can impair the effectiveness of the analyzer.
- the flame filter has become loose and the bands on the filter disc are easy to move.

New flame filters can be obtained from BARTEC BENKE. When you place your order, you must provide information on the filter gap width, the material and the angle of the gap in the flame filter (right = R, left = L).

Figure 10.43: Flame filter with a right (R) angle in the gap

You will find this information on the outside of the tension bands of the flame filter. The brand label, flame filter material, gap width, angle, type and production year are embossed there.

☞ **Use the embossed information to ensure that replacement flame filters match the original flame filters. Only then can the necessary explosion protection of the Ex°d housing be ensured!**

Assembling and installing flame arresters

WARNING	
EX	**Danger of explosion due to incorrectly installed flame arresters!** The Ex d box does not provide protection against explosion if the flame arresters are incorrectly installed. FOR THIS REASON: ☞ Ensure that both or all three flame filters are installed. ☞ Follow the instructions precisely when assembling the flame arresters. ☞ **If a flame arrester has been replaced completely, place the support disc on the outer thread of the outer housing before screwing the outer housing into the Ex d box, so that the thread of the flame arrester complies with explosion protection regulations.** ☞ Observe the tightening torques.

☞ Make sure that all parts are dry and clean.

☞ Grease the outer thread of the inside housing with assembly paste. For flame arresters for instrument air and nitrogen lines in particular, make sure that no assembly paste can enter the interior area.

☞ Insert the flame filters and intermediate layers in the inside housing (7) (for the sequence, see *Figure 10.42 on page 149*). Please note that flame filter (R) is installed as the second flame filter.

☞ Ensure the o-ring (6) is undamaged.

☞ Screw the inside housing (7) back into the outer housing (1) on the Ex d housing. Tighten the inside housing with 50 - 60°Nm.

☞ Connect the pipe to the flame arrester and tighten the Swagelok screw connection.

Restarting operation

☞ Once you have completed all the maintenance work, perform the steps described in *Chapter 10.17 “Measures after maintenance” on page 154*.

10.16 Replacing the battery on the industry PC

The analyzer is always controlled by an industry PC. It is located in the control unit enclosure. The industry PC is equipped with a lithium battery. Amongst other things, it ensures in the event of power failure that the system clock continues to run. In order to ensure that the industry PC is functional, the battery should be replaced every five years.

Preparation

WARNING	
	**Danger of explosion when replacing the battery in an explosive atmosphere!** Sparks can be generated during the removal and installation of the battery. They can ignite an explosive atmosphere. FOR THIS REASON: ☞ Ensure that there is no explosive atmosphere when carrying out work to change the battery.

You must open the control box to replace the battery.

☞ Switch the analyzer off:

☞ Make sure that the line is voltage supply is switched off.

☞ Open the control box.

Batteries

WARNING	
	**Danger of explosion if unsuitable batteries are used!** Unsuitable batteries can overheat and ignite explosive atmospheres in the event of a fault. FOR THIS REASON: ☞ Only use replacement batteries from BARTEC BENKE.

CAUTION	
	**Damage to the industry PC!** Unsuitable batteries can damage the industry PC FOR THIS REASON: ☞ Only use replacement batteries from BARTEC BENKE.

Procedure

NOTICE	
	For information on replacing the battery, see the manual provided for the industry PC.

☞ Replace the batter of the industry PC.

☞ Close the control box.

☞ Switch the analyzer on.

10.17 Measures after maintenance

After completion of the maintenance work and before switching on, carry out the following:

☞ Check that all previously loosened screw connections have a tight fit.

☞ Make sure that all previously removed protective devices and covers have been properly reinstalled.

☞ Make sure that all tools, materials and other equipment used have been removed again from the work area.

☞ Clean the work area and remove any substances that have leaked, such as liquids, processing material or similar.

☞ Make sure that all protective devices on the system are functioning flawlessly.

☞ Start analyzer operation again.

☞ After 2 hours of operation, check all connections for leaks and make a general visual inspection.

11 Dismantling

At the end of its service life, the analyzer must be dismantled and disposed of in an environmentally friendly manner.

11.1 Safety

Personnel

- Dismantling is only to be performed by specialists for potentially explosive atmospheres.
- Have work on the electrical system performed only by electricians.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 "Safety"* and the following additional protective equipment:

- Safety gloves if necessary
- Safety goggles

Fundamental principles

WARNING	
	**Danger of injury due to incorrect dismantling work.** Stored residual energy, components with sharp edges, points and corners in and around the analyzer or on the required tools can cause injuries. ☞ Avoidance measures see *chapter 2 "Safety"*.

DANGER	
	**Danger of lethally toxic substances!** Leaks can cause toxic substances to accumulate on the inside, which can cause serious or fatal injury if inhaled. FOR THIS REASON: ☞ Avoidance measures see *chapter 2 "Safety"*.

11.2 Preparing for dismantling

- ☞ Clean the analyzer prior to disposal.
- ☞ Empty product-conveying components and rinse them with inert gas.
- ☞ Switch off the analyzer and ensure it cannot be restarted.
- ☞ Unload the remaining residual energies.
- ☞ Remove operating media, auxiliary media and any remaining processing materials in an environmentally friendly manner.

11.3 Disconnecting electrical connections

- This work should only be performed by a qualified electrician.
- Special tools required.
- Electrotechnical specialist equipment

Electrical current

DANGER	
	**Danger of death due to electrical current!** Touching voltage-conducting parts poses an immediate life-threatening hazard. Damage to the insulation or to individual components can cause fatal injury. ☞ Avoidance measures see *chapter 2 Safety*.

Disconnecting electrical connections

- ☞ Disconnect the analyzer completely from the mains.
- ☞ Ensure it cannot be restarted.
- ☞ Open the junction box.
- ☞ Disconnect all cables and pull them out of the junction box.
- ☞ Unscrew the potential matching cable from the rack.
- ☞ Close the junction box.

11.4 Disconnecting pipe connections

Personnel

This work should only be conducted by a specialist for potentially explosive atmospheres.

Personal protective equipment

Wear the basic protective equipment in line with *chapter 2 "Safety"* and the following additional protective equipment:

- Safety goggles
- Protective gloves

Hazardous materials

WARNING	
	**Danger of injury from toxic substances!** Swallowing, inhaling or contact with skin or eyes can lead to serious, permanent health damage or death. ☞ Avoidance measures see *chapter 2 Safety*.

Disconnecting pipe connections

☞ Check that the pressure has been fully released.

☞ Collect any escaping substance residues separately.

☞ Disconnect the pipe connections in accordance with the installation plan in the customer folder.

11.5 Removing fastenings

☞ Remove the four M12 screws from the base.

☞ Remove the analyzer from the base.

WARNING	
	**Danger of injury due to analyzer tipping over!** Due to the high center of gravity, the analyzer could tip over if transported incorrectly, which can lead to severe injuries and material damage. FOR THIS REASON: ☞ Secure the analyzer against tipping over and use a suitable means of transport.

11.6 Disposal

Analyzer

Disassemble the analyzer in accordance with the applicable work safety and environmental protection guidelines. Recycle the dismantled components:

☞ Scrap metals.

☞ Send plastic elements for recycling.

☞ Dispose of the other components according to their material composition.

CAUTION	
	**Environmental damage due to incorrect disposal.** Improper disposal damages the environment. FOR THIS REASON: ☞ Have electric scrap, electronic components, lubricants and other auxiliary media disposed of only by authorised specialist companies. They are subject to the rules on special waste treatment.

Your local authorities or specialist disposal companies can provide you with information on environmentally friendly disposal.

Hazardous materials

Sort the hazardous materials according to their properties and have them disposed of professionally.

CAUTION	
	**Environmental hazard.** Improper disposal of hazardous materials poses a threat to both health and the environment. FOR THIS REASON: ☞ Observe local laws and regulations regarding the disposal of hazardous materials.

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