BAUER KOMPRESSOREN

Quality. Our DNA

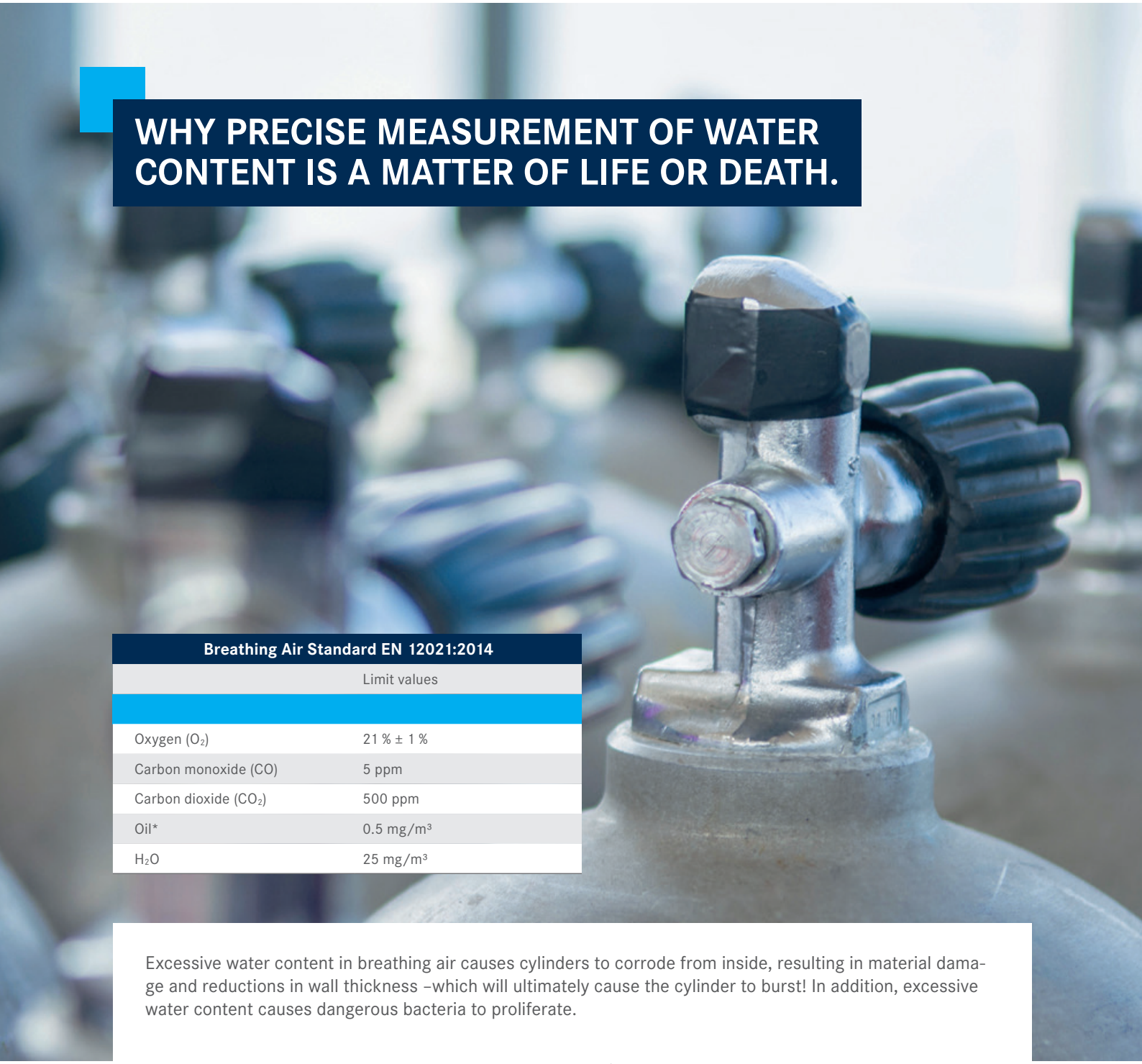
MEASURING WATER CONTENT IN COMPRESSED BREATHING AIR

IN COMPLIANCE WITH EN 12021:2014 – ULTRA-PRECISE AND ULTRA-RELIABLE WITH POLYMER TECHNOLOGY

SPORTS & SAFETY

75 1946 – 2021 BAUER KOMPRESSOREN

WHY PRECISE MEASUREMENT OF WATER CONTENT IS A MATTER OF LIFE OR DEATH.



Breathing Air Standard EN 12021:2014	
	Limit values
Oxygen (O_2)	21 % ± 1 %
Carbon monoxide (CO)	5 ppm
Carbon dioxide (CO_2)	500 ppm
Oil*	0.5 mg/m³
H_2O	25 mg/m³

Excessive water content in breathing air causes cylinders to corrode from inside, resulting in material damage and reductions in wall thickness –which will ultimately cause the cylinder to burst! In addition, excessive water content causes dangerous bacteria to proliferate.

High water content is even hazardous on cold water dives. If the water content is not below the threshold specified in the standard, scuba regulators may freeze during dives in cold waters – a potentially fatal occurrence. The moisture and the cold generated by the expanding air cause the breathing valve to ice up. The resulting uncontrolled air release may cause the air supply to fail altogether.

Highly precise measurement of water content in compressed breathing air is a matter of life or death for firefighters as well as for divers. Because of this, the European Breathing Air Standard **EN 12021:2014** exactly defines limits for the absolute water content. The limit value for water in compressed breathing air coming from the compressor is **25 mg/m³**.

*Limit value for breathing air, the limit value for Nitrox is 0.1 mg/m³

THE CHALLENGE: MEASURING WATER CONTENT IS A COMPLEX TECHNICAL PROCESS.

Measuring water content in compressed breathing air presents a huge technical challenge that must take a wide range of parameters into account.

The European Breathing Air Standard EN 12021:2014 standard defines the limit value for water content in terms of mg/m³ at atmospheric pressure. The physical measurement principles on which humidity sensors are based express either the dew point (in °C) or relative humidity (in %). Conversion of the measure value to the displayed value, expressed as absolute water content (in mg/m³), is pressure-dependent and is only defined for low pressure levels. This conversion is not backed by scientific evidence for higher pressures, so that pressures of > 200 bar involve high levels of inaccuracy.

In addition, the variable parameters of pressure and temperature at the high-pressure outlet impact negatively on measurement precision.

BAUER KOMPRESSOREN therefore chose the atmospheric method for measuring the water content of breathing air, with the aim of achieving measurements of the maximum precision and reliability.

BAUER'S SOLUTION: DEW POINT SENSORS INCORPORATING POLYMER TECHNOLOGY

Polymer sensors have extremely rapid response times. They react within a very short time – unlike the aluminium oxide sensors that are prevalent in compressed-air technology, which have response times of several hours from ambient humidity to dry breathing air.

Low-price mass-market products in this category are unable to measure the extremely low water content levels defined by the Breathing Air Standard. BAUER uses sophisticated add-on technologies, such as automatic offset calibration of polymer sensors, to deliver ultra-precise measurements of even low levels of water content. Only a few manufacturers have this expertise.

BAUER'S QUALITY FACTOR NO. 1

Lower-cost aluminium oxide sensors have extremely long response times, and are thus unsuitable for measuring extremely low water content levels. The dew point sensors with polymer technology used by BAUER KOMPRESSOREN respond extremely rapidly. BAUER's polymer sensors enable even low levels of water content to be measured accurately, based on automatic offset calibration.

THE EXPERT SYSTEM FOR STANDARD-COMPLIANT MEASUREMENT

B-DETECTION PLUS ENSURES THE CORRECT MEASUREMENT ACCORDING TO THE EUROPEAN BREATHING AIR STANDARD EN 12021:2014

1. High-pressure compressor
2. B-DETECTION AIRBOX
3. Data cable
4. Gas hose
5. High-pressure piping
6. B-DETECTION PLUS s
7. External filling panel

Measuring water content in compressed air is a science in itself – even with the right sensors.

The extremely high partial pressure difference between compressed air and air under atmospheric conditions causes ambient moisture to diffuse into pipelines, and thus also into the measurement cell of the dew point sensor. When the compressor is not in operation, the water molecules are deposited in the pipes, the measurement cell and the dew point sensor.

When the compressor is restarted after longer downtimes, the system must first be dried by flushing it with compressed air to ensure compliance with the limits required by the European Breathing Air Standard EN 12021:2014.

It is recommended to refrain from filling breathing air cylinders until the air water content has returned to below the limit stated in the European Breathing Air Standard EN 12021:2014. Instead, the moist air can be released to the outside through a purging valve. We recommend our optional automatic purging system.

NOTE ON FIRST-TIME INSTALLATION OF A B-DETECTION PLUS SYSTEM

During first-time installation, purging times of up to 3 hours may be necessary to remove moisture from the entire piping system. In general, a purging time of 30 minutes must be calculated for first-time installation

RECOMMENDATIONS AND INFORMATION

To keep this drying period and associated purging of moisture-laden air as brief as possible in practice, we recommend the following actions when installing and operating our B-DETECTION PLUS gas measurement systems:

- Ensure the system pressure between the filter housing and the gas extraction unit is as high as possible (> 200bar) while the compressor is inoperative. This means that the piping between the filling panel or storage system should not be vented after filling is complete.
- Use stainless-steel piping to connect the compressor and storage unit or other air extraction devices.
- Keep screw connections and gaskets to a minimum.

The following point must be in addition observed during installation of standalone models:

- The length of piping between the compressor filter housing and the gas extraction unit (AIRBOX) should be as short as possible (max. 3 metres).

When these actions are observed, the following purging times after compressor downtime can be assumed to apply:

Downtime	Purging time
1 days	< 5 min
3 days	< 15 min
7 days	≈ 30 min

Table 1: Purging times for various compressor downtimes

Standalone version: B-DETECTION PLUS s

RECOMMENDATION REGARDING FILTER CARTRIDGE CHANGES

The filter cartridge must be changed if the absolute humidity limit value of 25 mg/m³ or the VOC limit value of 0.5 mg/m³ are exceeded. During the compressor start-up phase, ensure that the water content level falls below the limit value during the purging times given in Table 1. If this does not happen or if the value rises again after the start-up phase, change the filter cartridge. For compressor systems with longer downtimes, we recommend the additional installation of a SECURUS system for direct monitoring of filter cartridge saturation.

BAUER'S QUALITY FACTOR NO. 2

The dew point sensor of the B-DETECTION PLUS guarantees long-term stability, even for low water content levels. Given this, calibration at 2-year intervals is sufficient to ensure high-precision measurement.

ARE YOU INTERESTED IN OUR PRODUCTS?

CONTACT US – WE ARE HAPPY TO PROVIDE INFORMATION AND ASSISTANCE.

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Technische Änderungen vorbehalten