

	Test methods Water pressure test on components Information in drawings and orders	LHH-N 000.330 Page1 of 5
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1. Scope

This standard applies for Bühler Alzenau as well as all suppliers.

It applies to all assemblies and components that are manufactured according to Bühler's specifications and are water-cooled or heated or are used in cooling or heating water systems up to 60°C. It is used to determine the test procedure and specify it in drawings or orders.

The standard does not replace the relevant general regulations for pressure tests, but merely supplements them.

2. Scope of testing

All parts used to conduct water at a pressure of >1bar must be tested. The test refers to the parts according to the scope of the drawing. Further water lines that are not shown in the drawing are not part of the scope of the test. In general, the result of the test must be documented in a test report.

3. Test specifications

3.1. General

Before each pressure test, all water-conducting parts must be flushed with water.

This does not apply in the case of 3.3 – 3.5.

All tests must be recorded: test pressure, duration, pressure drop or helium leak rate (see below)

3.2. Water pressure test

The test is based on DIN EN 13480-5 (Metal industrial piping).

As standard, it is carried out with **water** at a temperature of 18...25°C at a test pressure of **10bar**.

When filling the system, ensure that it is completely vented. A test with residual air in the system will produce incorrect results and poses a hazard due to the compressible air cushion.

The pressure must be slowly brought to 50% of the test pressure and then increased in 10% steps with short pauses to the final value.

The pressure must be maintained for at least 30 minutes.

A pressure gauge (preferably an electronic pressure gauge) with a measurement uncertainty of 0.1 bar should be used as a measuring device.

The test is successful if there are no visible leaks after the test time and the test pressure has not dropped within the measurement accuracy.

Deviating test pressures are specified on the drawing.

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	Test methods Water pressure test on components Information in drawings and orders	LHH-N 000.330 Page2 of 5
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3.3. Testing with compressed air

If a water pressure test in accordance with 3.2 is not possible or not practicable, the test may alternatively be carried out using compressed air or an inert gas.

Caution: Air or inert gas is compressible and may therefore, in the event of increased pressure and a defect in the system, result in an explosive release of pressure!

For this physical and **safety reasons**, the pressure test must be carried out in accordance with the following rules, which are based on DGUV Information T039 "Pressure testing of pressure vessels and piping".

3.3.1 General safety requirements

Access to the hazard zone:

- A pressure test using air may **only be carried out** if there are **no persons, or at maximum only authorized personnel**, present in the hazard zone. Suitable barrier measures must be ensured.
- In practice, this is preferably carried out **in the evening or at the weekend**.
- Throughout the entire test, **only the qualified personnel responsible for the test** may be present in the hazard zone.

Principles for minimising risk:

- The test must be carried out in such a way that the pressure is increased **in stages**.
- After each pressure stage, the system must be checked for leaks and these must be fixed **before** proceeding to the next pressure stage.
- Testing should be carried out in sensible, manageable sections (for glass coaters, e.g. only the main line)

3.3.2 Procedure

1. The system is **filled with compressed air in stages**. The pressure is increased in **0.5-bar increments**.
2. After each pressure step, the system is checked for leaks (acoustically, by 'feeling' or with a foam-forming leak detection spray).
3. If leaks are detected:
 - Locate and fix the leak
 - Repeat the test at the same pressure level
4. Only when no further abnormalities are present is the pressure increased to the next level.
5. The **maximum test pressure is 3 bar**. Leaks that are not detected at 3 bar air pressure are generally not critical when the system is subsequently pressurized with water.

Standardisation	Edited: Merz	Issued				
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	Test methods Water pressure test on components Information in drawings and orders	LHH-N 000.330 Page3 of 5
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3.4 Special case: Testing of cathodes after target replacement using helium pressurization and helium sniffer testing

Caution: Air, helium and inert gases are compressible and may therefore, under increased pressure and in the event of a system defect, result in an explosive release of pressure!

For this physical and **safety reasons**, the following rules must be followed when carrying out the pressure test

3.4.1 General safety requirements

Access to the hazard zone:

- If the cathode is located on the **cathode turning unit** or at a **service workstation**, the greatest hazard during the pressure test with air or helium arises from the **target clamping mechanism**. This area has the **largest cross-sections and** is subject to **the greatest mechanical stress**.
- The following also applies in this case: During the entire test, **only the qualified personnel responsible for the test** may be present in the hazard zone.
Although the hazard zone is significantly smaller and more easily controlled than when testing a complete media system, suitable barrier measures must nevertheless be ensured.

Principles for minimising risks:

- The test must be carried out in such a way that the pressure is increased **in stages**.
- Before the actual leak test at 3 bar, a stress test is carried out at 3.5 bar. Reducing the pressure from **3.5 bar to 3 bar prior to the test** creates an additional safety margin. The system has already withstood the higher pressure and is subsequently tested under lower stress.

3.4.2 Procedure

1. The system is brought up to **3.5 bar** in **stages of 0.5 bar from a safe distance**.
2. This pressure is **maintained** for approx. **5 minutes** (stress test)
3. If the system remains fault-free, the pressure is then **reduced to 3.0 bar**.
4. This is followed by a **helium leak test** in accordance with factory standard LHH-N 000.320 at the sealing points between the vacuum and water circuits (target clamp, etc.).
5. **Repeat test in the system**
 - The helium pressure test is later repeated with **the cathode installed in the system under vacuum conditions**.
 - Technically speaking, this corresponds to an integral helium test of the water circuit in accordance with factory standard LHH-N 000.320 (helium leak detector connected to the vacuum chamber).
 - In this case, there is no risk from the test pressure, as the cathode is located inside the chamber.

Standardisation	Edited: Merz	Issued				
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	Test methods Water pressure test on components Information in drawings and orders	LHH-N 000.330 Page4 of 5
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3.5 Vacuum test

Components with water-carrying areas that have joints inside the vacuum or come into direct contact with vacuum areas must also be subject to a vacuum leak test in accordance with factory standard LHH-N 000.320 before or after the pressure test.

If the water-carrying part was flushed with water prior to the test, the water channels must be dried beforehand with hot air or in an oven.

The individual leak rates in accordance with factory standard LHH-N 000.320 apply.

4. Specifications in drawings

Standard:

Wasserdruckprüfung nach LHH-N 000.330
water pressure test according to LHH-N 000.330

In the event of a different test pressure (e.g. 6 bar instead of 10 bar):

Wasserdruckprüfung nach LHH-N 000.330
water pressure test according to LHH-N 000.330

Abweichender Prüfdruck: 6bar !
 Deviating test pressure: 6bar !

In the case of an additional vacuum test of the water circuit (e.g. HV1-tight):

Wasserdruckprüfung nach LHH-N 000.330
water pressure test according to LHH-N 000.330

Wasserkreis / Water circuit:

HV1-dicht nach LHH-N 000.320
HV1- (high vacuum) tight according to LHH-N 000.320

The information must be placed near the title block of the drawing.

Standardisation	Edited: Merz	Issued				
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	Test methods Water pressure test on components Information in drawings and orders	LHH-N 000.330 Page5 of 5
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5. Orders to suppliers

In orders that do not include a BLOA drawing, the water pressure test in accordance with LHH-N may also be specified

Specification: **Water pressure test in accordance with LHH-N 000.330**

This specification must be included in the order specification (Windchill description).

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