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# IP protection

BOPLA Gehäuse Systeme GmbH

**Your strong partner  
for a successful future!**

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# IP protection

- 1. Explanation of the IP protection categories in acc. with DIN EN 60529**
- 2. Demonstration of the need for a pressure compensation element for use in situations with temperature variations and moisture**
- 3. Our services**

# Protection classifications to DIN EN 60529 (VDE 0470)



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## BOPLA IP Test Chamber:



# Protection classifications to DIN EN 60529 (VDE 0470)



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**IP categories which can be checked at BOPLA:**

**IP X3 to X7**

# Protection classifications to DIN EN 60529



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The protection classification offered by an enclosure is shown by the letters IP (Ingress Protection) and two digits.

The first digit indicates two factors (protection for persons and equipment), the second digit indicates only one factor (protection against water).

Example: IP 54

- first digit: protection against dust and wire contact with dangerous parts
- second digit: protection against splash water

# Protection classifications to DIN EN 60529



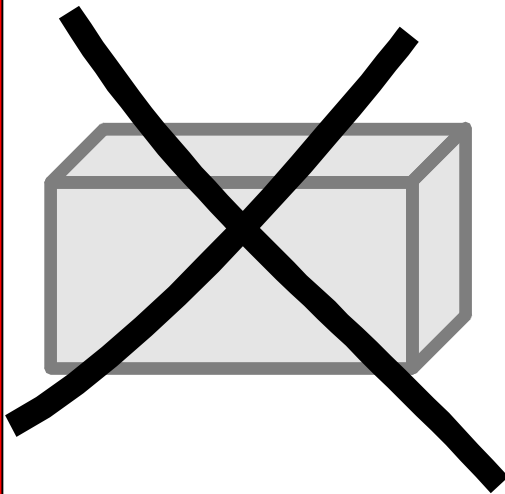
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**First digit: 0 (IP 0X)**

**Protection for persons and equipment**

Persons:

- Not protected



Equipment:

- Not protected

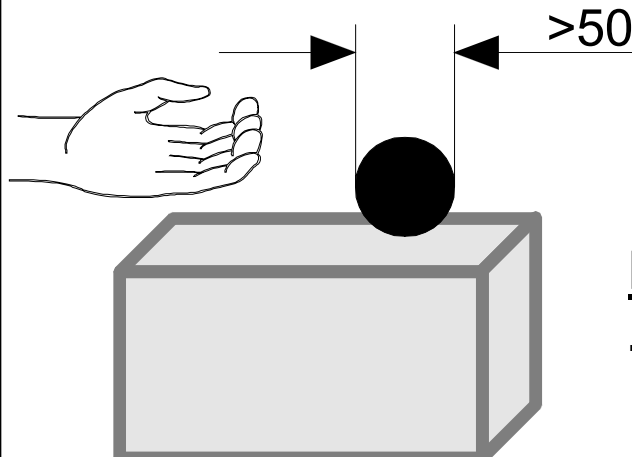
# Protection classifications to DIN EN 60529

## First digit: 1 (IP 1X)

### Protection for persons and equipment

#### Persons:

- Protection against the back of the hand touching dangerous parts.



A round body, 50 mm in diameter, must be at sufficient distance from dangerous parts.

#### Equipment:

- Protected against a solid foreign body of 50 mm or more in diameter.

A round body, 50 mm in diameter, must not fully penetrate.

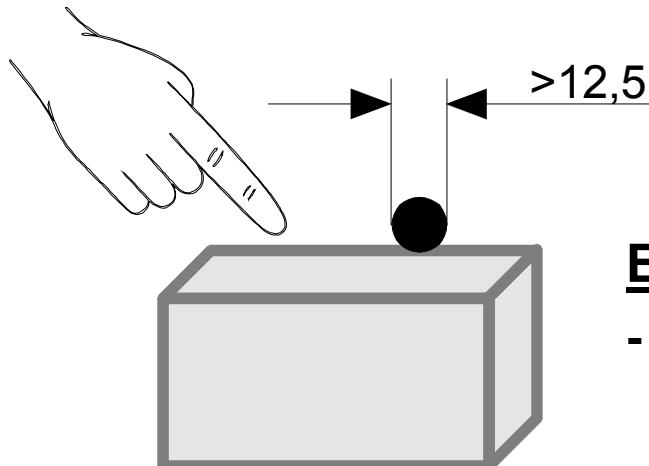
# Protection classifications to DIN EN 60529

## First digit: 2 (IP 2X)

### Protection for persons and equipment

#### Persons:

- Protected against a finger touching dangerous parts.



The test finger, jointed, 12 mm in diameter and 80 mm long, must be at a sufficient distance from dangerous parts.

#### Equipment:

- Protected against a solid foreign body of 12.5 mm or more in diameter.

A round body, 12.5 mm in diameter, must not penetrate at all.



# Protection classifications to DIN EN 60529

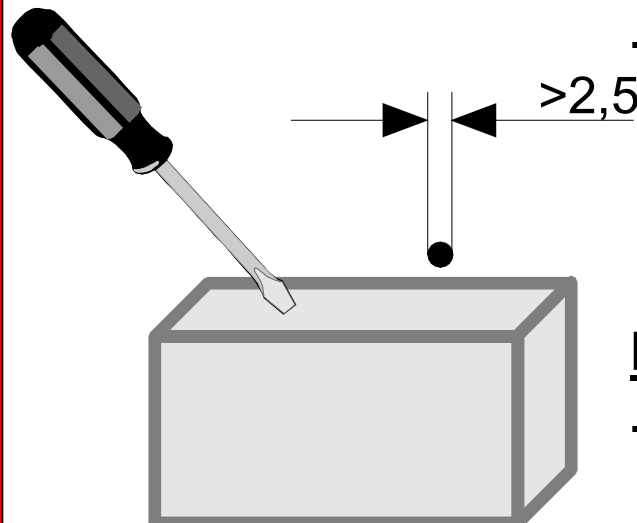
## First digit: 3 (IP 3X)

### Protection for persons and equipment

#### Persons:

- Protection against a tool touching dangerous parts.

A body, 2.5 mm in diameter, must not be able to penetrate.



#### Equipment:

- Protected against a solid foreign body of 2.5 mm or more in diameter.

A round body, 2.5 mm in diameter, must not penetrate at all.

# Protection classifications to DIN EN 60529



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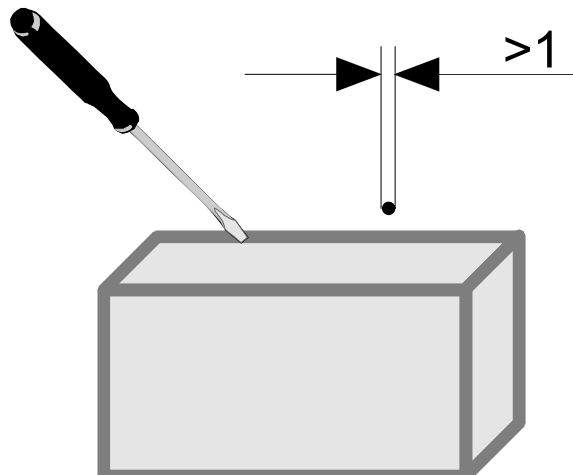
## First digit: 4 (IP 4X)

### Protection for persons and equipment

#### Persons:

- Protection against a wire touching dangerous parts.

A body, 1.0 mm in diameter, must not be able to penetrate.



#### Equipment:

- Protected against a solid foreign body of 1.0 mm or more in diameter.

A round body, 1.0 mm in diameter, must not penetrate at all.

# Protection classifications to DIN EN 60529



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## First digit: 5 (IP 5X)

### Protection for persons and equipment

#### Persons:

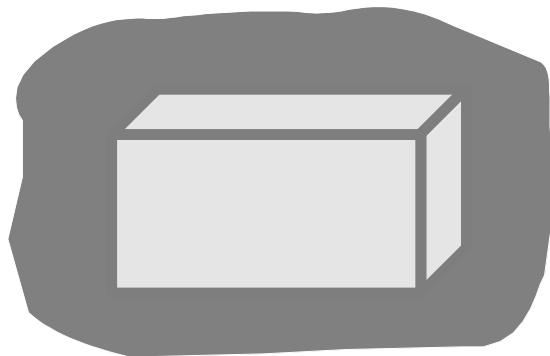
- Protection against a wire touching dangerous parts.

A body, 1.0 mm in diameter, must not be able to penetrate.

#### Equipment:

- Protection against dust

Dust penetration is not completely prevented. Dust must not penetrate in sufficient quantities to prevent the equipment from operating satisfactorily, or to impair safety.



# Protection classifications to DIN EN 60529



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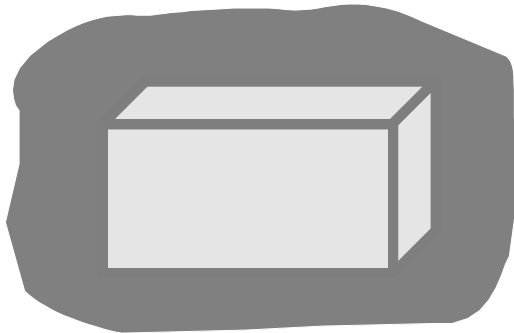
## First digit: 6 (IP 6X)

### Protection for persons and equipment

#### Persons:

- Protection against a wire touching dangerous parts.

A body, 1.0 mm in diameter, must not be able to penetrate.



#### Equipment:

- Sealed against dust
- No dust penetration

# Protection classifications to DIN EN 60529

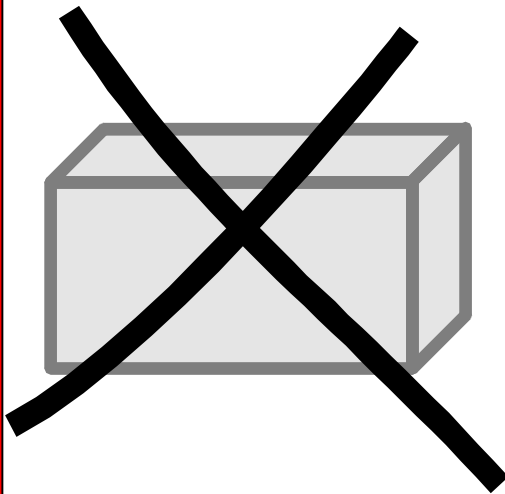


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## Second digit: 0 (IP X0)

Protection against water

- Not protected



# Protection classifications to DIN EN 60529



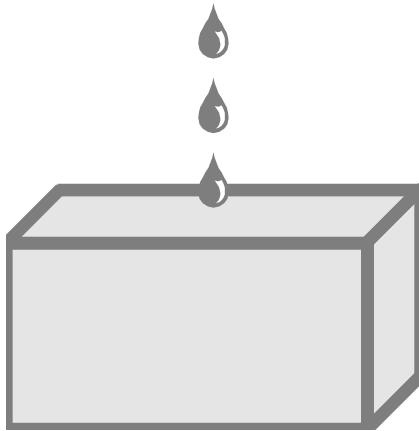
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## Second digit: 1 (IP X1)

Protection against water

- Protected against vertical water drops

**Drops of water falling vertically onto the enclosure must not have any harmful effects.**



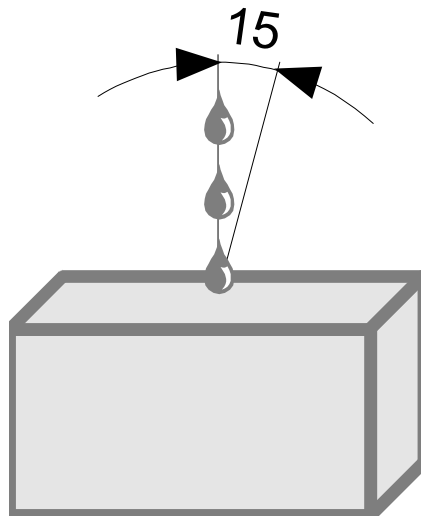
# Protection classifications to DIN EN 60529



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## Second digit: 2 (IP X2)

Protection against water



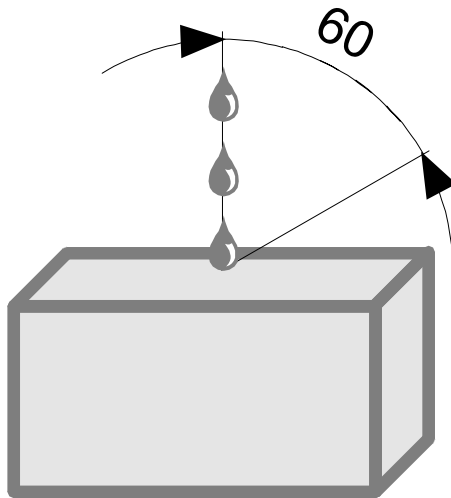
- Protected against vertical water when the enclosure is inclined at 15°.

Drops of water falling vertically onto the enclosure must not have any harmful effects if the enclosure is inclined by up to 15° on both sides of the vertical.

# Protection classifications to DIN EN 60529

## Second digit: 3 (IP X3)

### Protection against water



- Protected against water spray

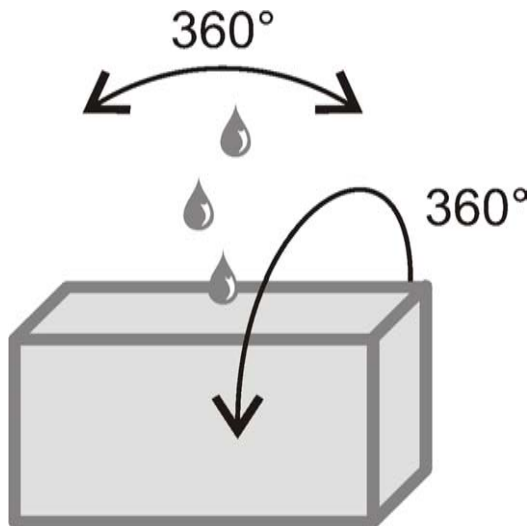
Water sprayed onto the enclosure at up to 60° on both sides of the vertical must not have any harmful effects.



# Protection classifications to DIN EN 60529

## Second digit: 4 (IP X4)

### Protection against water



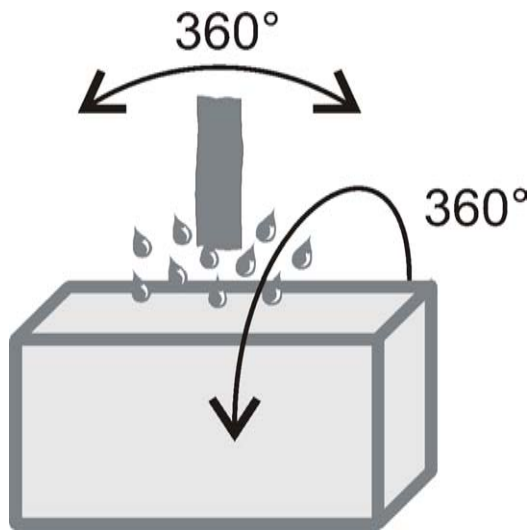
- Protected against splash water

**Water splashed onto the enclosure from any direction must not have any harmful effects.**

# Protection classifications to DIN EN 60529

## Second digit: 5 (IP X5)

Protection against water



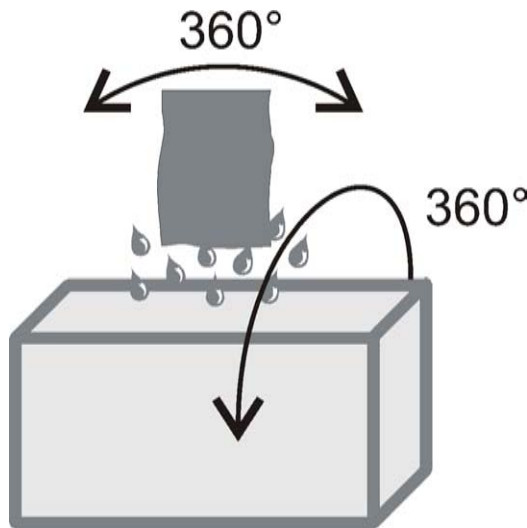
- Protected against water jet

**Water jet directed at the enclosure from any direction must not have any harmful effects.**

# Protection classifications to DIN EN 60529

## Second digit: 6 (IP X6)

### Protection against water



- Protected against powerful water jet  
A strong water jet directed at the enclosure from any direction must not have any harmful effects.

# Protection classifications to DIN EN 60529



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## A frequent misunderstanding:

Up to digit 6, the **second digit** (protection against water) must only be used for an enclosure if it also meets all lower degrees of protection. However, an enclosure which is only designated with the second digit 7, 8 (protection against immersion) or 9K (protection against a jet of steam) is considered to be unsuitable for use with a jet of water (digit 5 or 6). This means that it does not need to meet the requirements indicated by digits 5 or 6. Only an enclosure with a double designation meets the requirements regarding resistance to a jet of water and to immersion/jet of steam.

# Protection classifications to DIN EN 60529

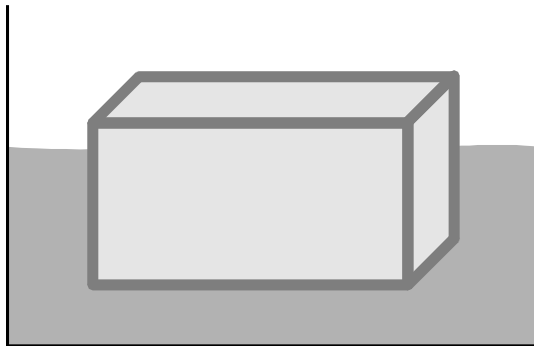


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## Second digit: 7 (IP X7)

### Protection against water

- Protection against the effects of temporary immersion in water.



**Water must not enter in a quantity that could have harmful effects if the enclosure is temporarily immersed in water under standardized pressure and time conditions.**

# Protection classifications to DIN EN 60529

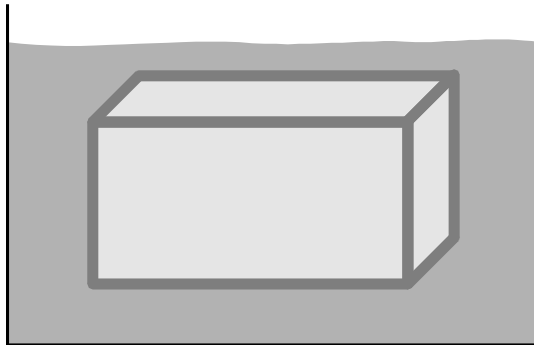


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## Second digit: 8 (IP X8)

### Protection against water

- Protection against the effects of constant submersion in water.

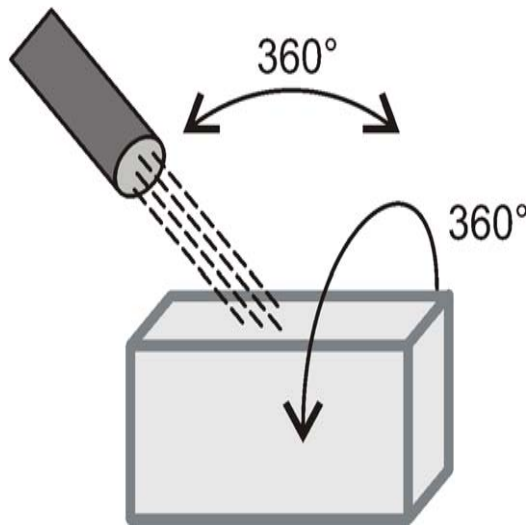


Water must not enter in a quantity that could have harmful effects if the enclosure is kept permanently under water under conditions agreed between the manufacturer and the user; however, these must be more severe than those under fig. 7.

# Protection classifications to DIN EN 60529

## Second digit: 9K (IP X**9K**)

### Protection against water



- Protected against water during high-pressure and steam jet cleaning.

Water which is directed from all sides against the enclosure under greatly increased pressure must not cause any damage (acc. to DIN 40050 part 9, this applies only to road vehicles).

# Protection classifications to DIN EN 60529



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## **Important note:**

The protection classifications given for the BOPLA enclosures refer to unmachined enclosures as supplied. In the case of protection against water in particular (second digit), the test conditions will be met if during the given time for the experiment no water has penetrated, or not in harmful quantities. As the tests to show protection classifications take no account of ageing, the maintenance of the protection classification throughout the lifetime of the equipment is not guaranteed. Similarly, changes in temperature which may occur for example in the open air are not taken into account. Such changes in temperature may cause a loss of pressure in the enclosure, and moisture may be absorbed through the seal area.



Demonstration of the need for a pressure compensation element for use in situations with temperature variations and moisture



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## BOPLA IP test chamber:



Demonstration of the need for a pressure compensation element for use in situations with temperature variations and moisture



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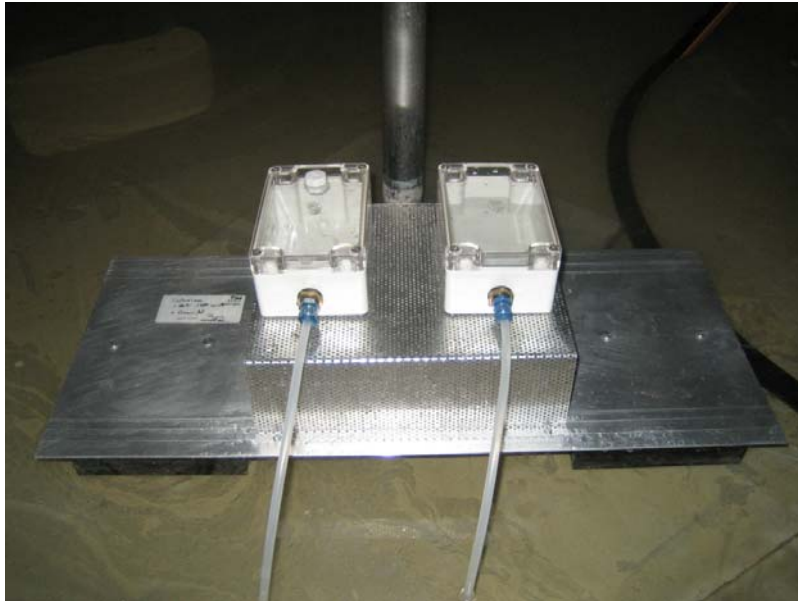
**IP test chamber at  
BOPLA**

**Equipment for  
simulating a rain  
shower (nozzle  
acc. to IP X4)**

# Demonstration of the need for a pressure compensation element for use in situations with temperature variations and moisture



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## Initial test situation:

- 2 enclosures (M 215 G), one fitted with a pressure compensation element and one without this element in the lid
- Screwed enclosure lid

## Test sequence:

- Connection of hoses to the enclosures; the other end of each hose is placed in a water basin
- Both enclosures are heated to 80°C (this temperature is approximately that which results from direct exposure to the sun's rays outdoors)

# Demonstration of the need for a pressure compensation element for use in situations with temperature variations and moisture



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## Next stage of test:

- Simulated rainfall onto the hot enclosures
- Water temperature: 15-20°C



# Demonstration of the need for a pressure compensation element for use in situations with temperature variations and moisture



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## Next stage in test:

- The simulated rainfall cools the enclosures to approx. 20°C (ambient temperature).

# Demonstration of the need for a pressure compensation element for use in situations with temperature variations and moisture



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## Results of the test:

As a result of the cooling process, the enclosure without the pressure compensation element was almost half full of water after the test. The enclosure with the element did not contain any water.

## Explanation:

During cooling, air creates a vacuum in the enclosure, so water - or other material - is sucked into the enclosure through the seal (in this test, through the hose).

## Demonstration of the need for a pressure compensation element for use in situations with temperature variations and moisture



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In order to compensate for the variations in pressure as shown in the test, BOPLA includes the pressure compensation element in its product range. The element is available in light grey (similar to RAL 7035) and black (similar to RAL 9005).

When fitted, the element meets ingress protection category IP 69K.

If there are large volumes of air in the enclosure and/or very short-term temperature changes, it may be necessary to use more than one pressure compensation element. BOPLA will make recommendations after receiving details of the ambient conditions.



# Our services



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Our trained QA personnel can check the following IP protection categories for you:

- **At BOPLA:**  
**IP 3X / 4X**  
**IP X3 / X4 / X5 / X6 / X7 / “X8”**
- **At a partner company:**  
**IP 5X / 6X /**  
**IP “X8” / X9K**



# Our services



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Following a successful IP test, our trained QA personnel can issue the following certificates:

- **BOPLA test record (EN 10204 - 3.1)**
- **BOPLA test record, TÜV-audited**
- **TÜV certificate (organisation / carrying out of external tests)**



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**Thanks for watching!**