CHILLVENTA eSPECIAL

Refrigeration | AC & Ventilation | Heat Pumps

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CONNECTING EXPERTS.

NÜRNBERG MESSE

How to optimize heat pump testing with closed loop design

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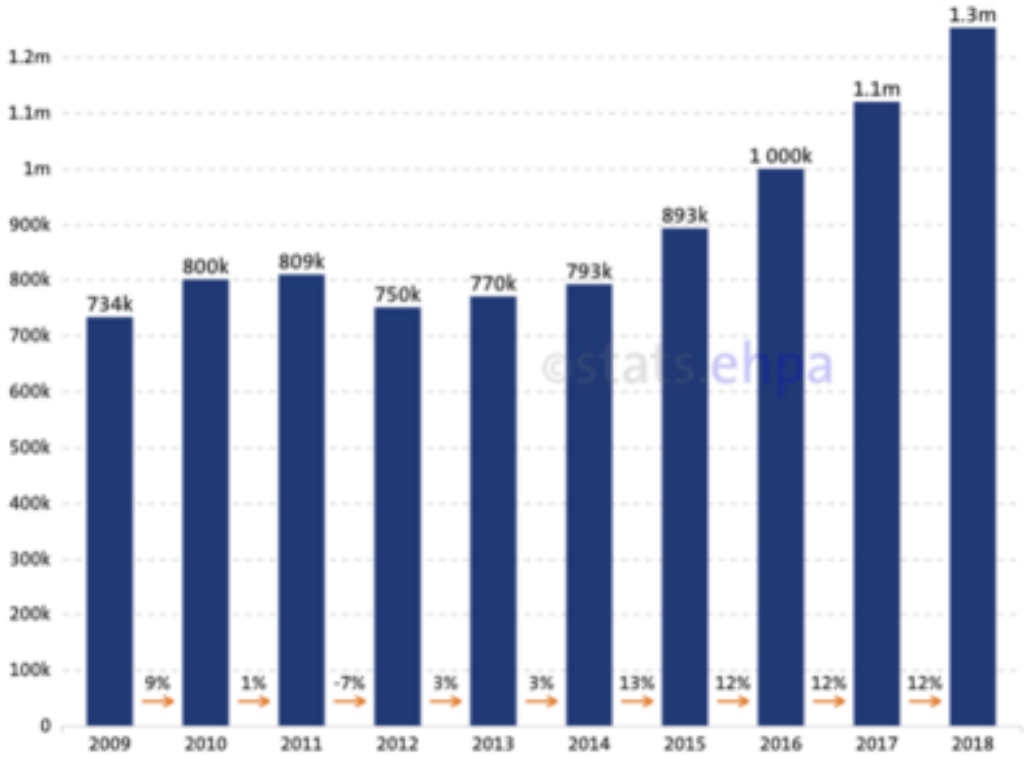
Features & benefits of heat pumps

Energy-efficiency as a decisive quality criterion



Sales development heat pumps in Europe
(source: https://www.ehpa.org/market-data/)

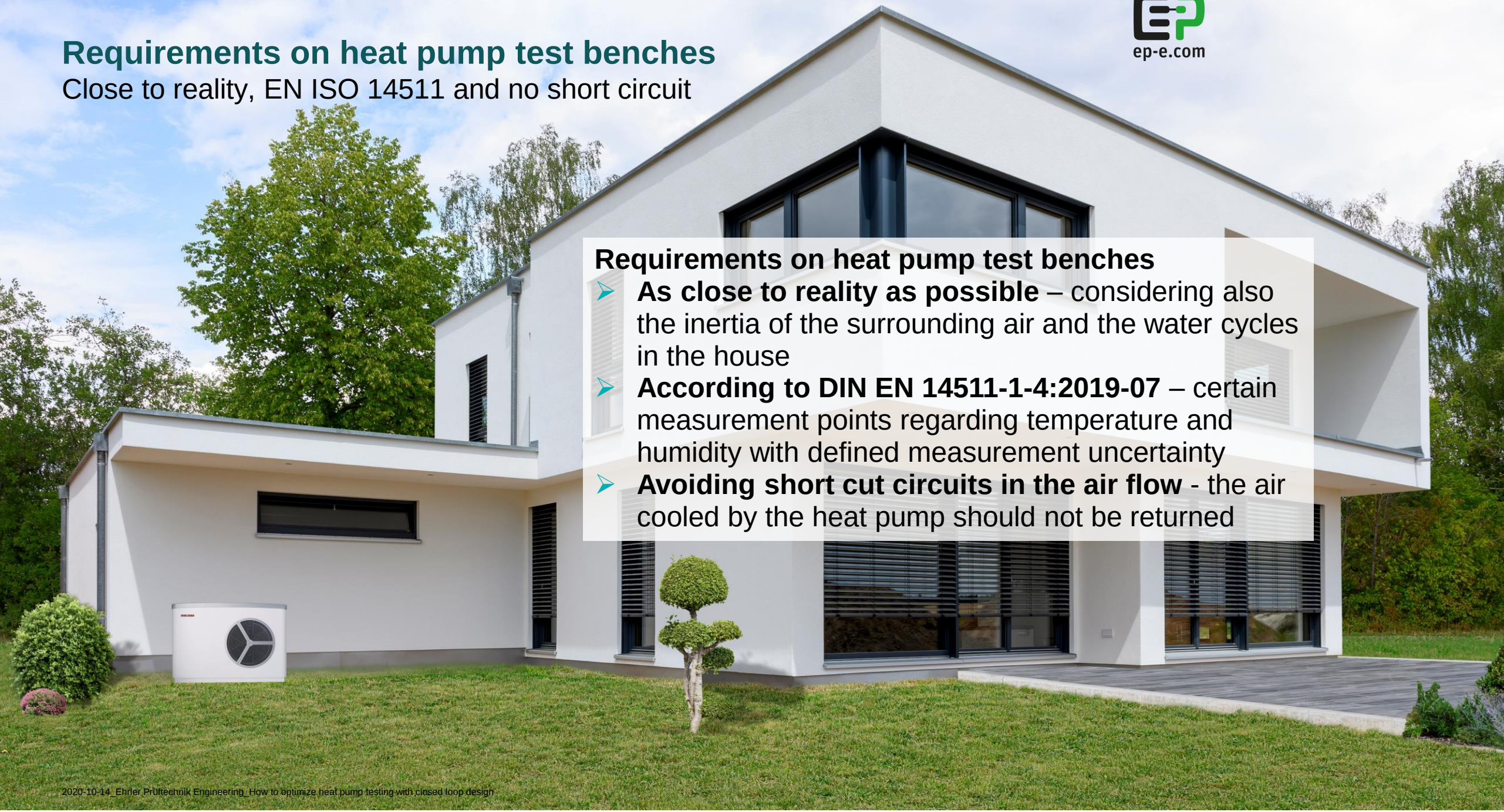
Features & benefits of heat pumps:

- Emission-free
- Independency from resources
- Space-saving design
- Easy and automatic operation
- Low maintenance and operating costs
- Reliable operation
- **Energy-efficiency**

Energy-efficiency as a decisive quality criterion

Requirements on heat pump test benches

Close to reality, EN ISO 14511 and no short circuit



Requirements on heat pump test benches

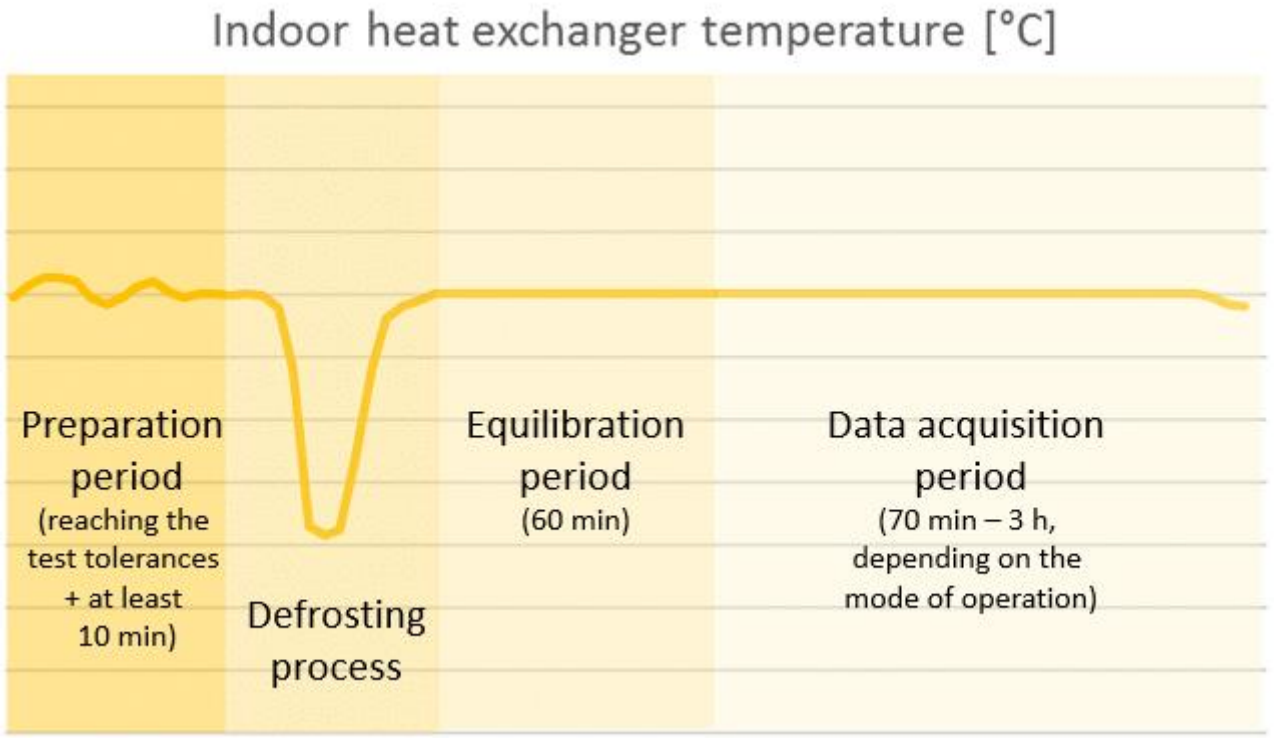
- **As close to reality as possible** – considering also the inertia of the surrounding air and the water cycles in the house
- **According to DIN EN 14511-1-4:2019-07** – certain measurement points regarding temperature and humidity with defined measurement uncertainty
- **Avoiding short cut circuits in the air flow** - the air cooled by the heat pump should not be returned

DIN EN 14511-1-4:2019-07

Measurement points, deviations and test procedure

External heat exchanger: air	
Temperature	**Wet-bulb temperature**
Measurement points	
-15 °C	---
- 7 °C	- 8 °C
2 °C	1 °C
7 °C	6 °C
12 °C	11 °C
20 °C	12 °C
Permissible deviation of the individual values	
± 1 K	± 1 K
Permissible deviation of the arithmetic mean	
± 0.3 K	± 0.4 K

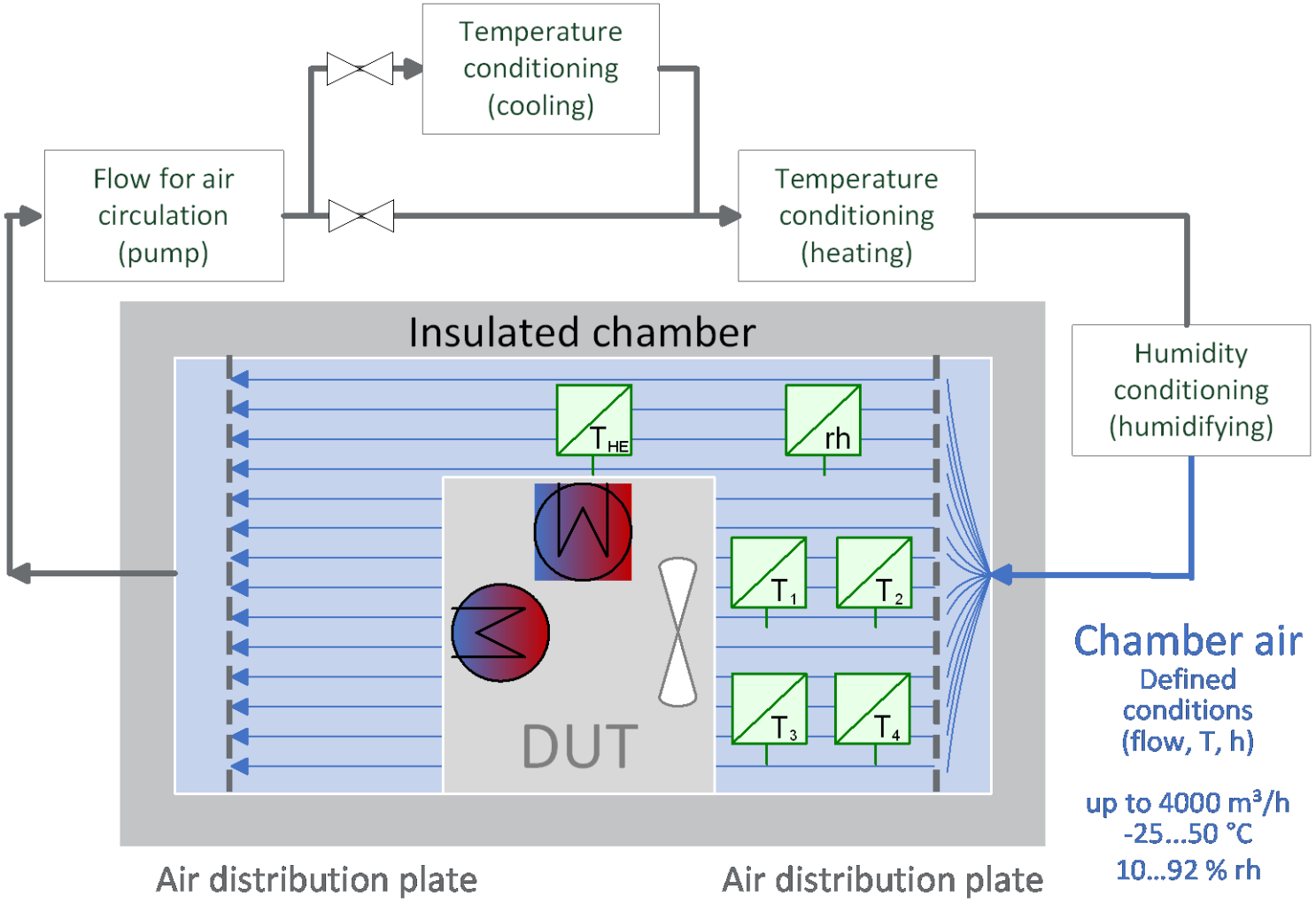
Extract from the standard with the points to be tested (14511-2:2019-7 table12) and the permissible deviations to be met (14511-3:2019-7, table 1, 4)



Test procedure according to the standard (14511-3:2019-7; 4.4.4)

Test set-up: Ehrler Closed-Loop Design

Optimized test set-up for heat pump testing



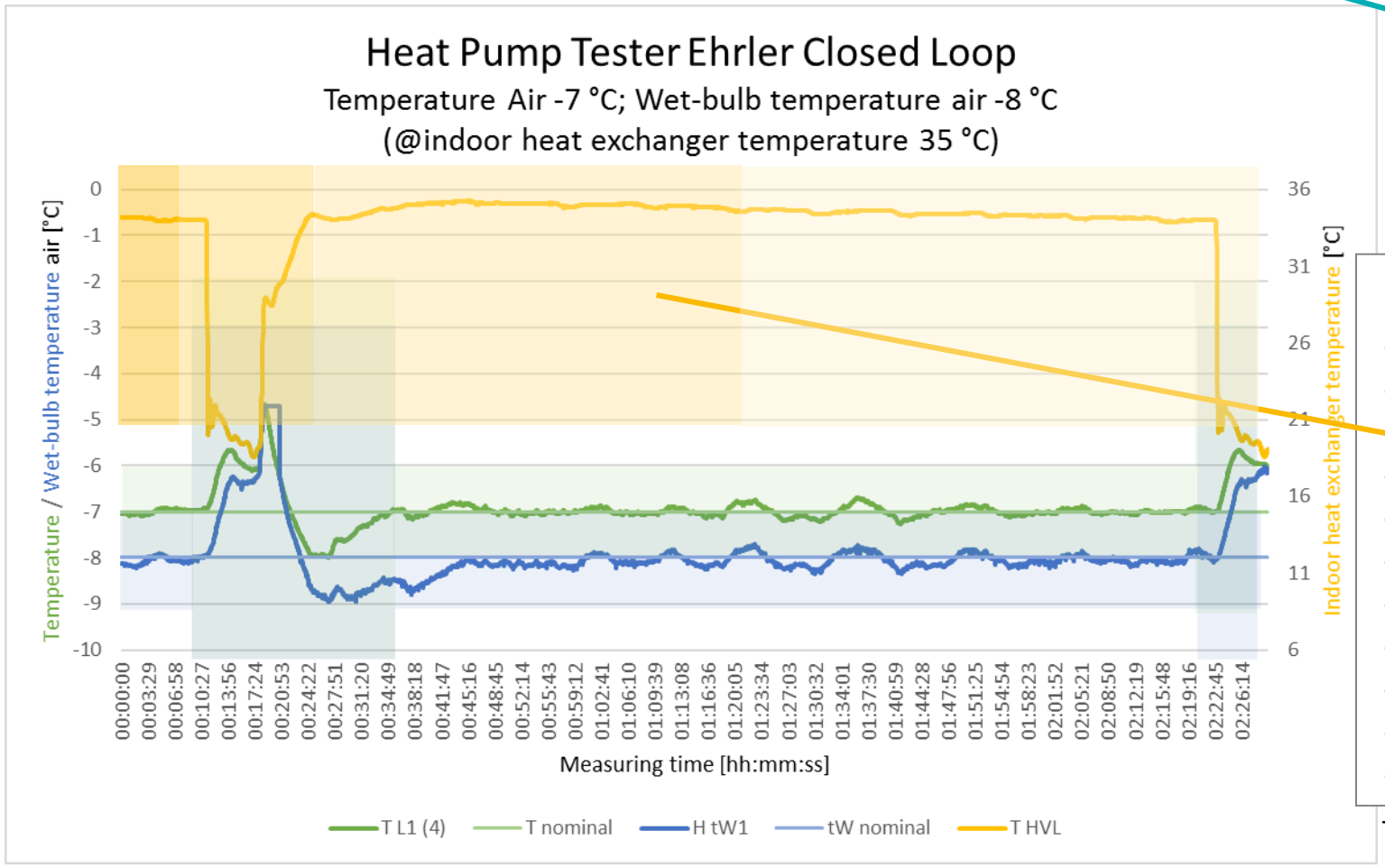
Advantages of the closed-loop design

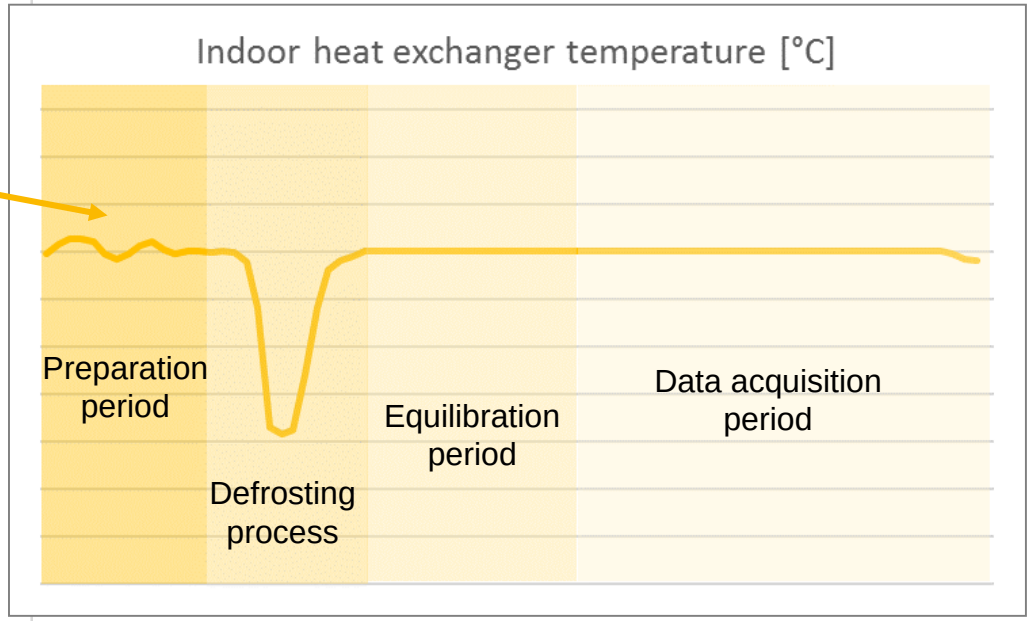
- Uniform air flow
- Accurate temperature and humidity control with fast and dynamic response to disturbances
- ATEX zone 2 security concept

Test procedure according to the standard

Real measurement values at A-7W35

A-7W35:
Temperature air -7°C
Wet-bulb temperature air: -8 °C
Indoor heat exchanger temperature: 35 °C

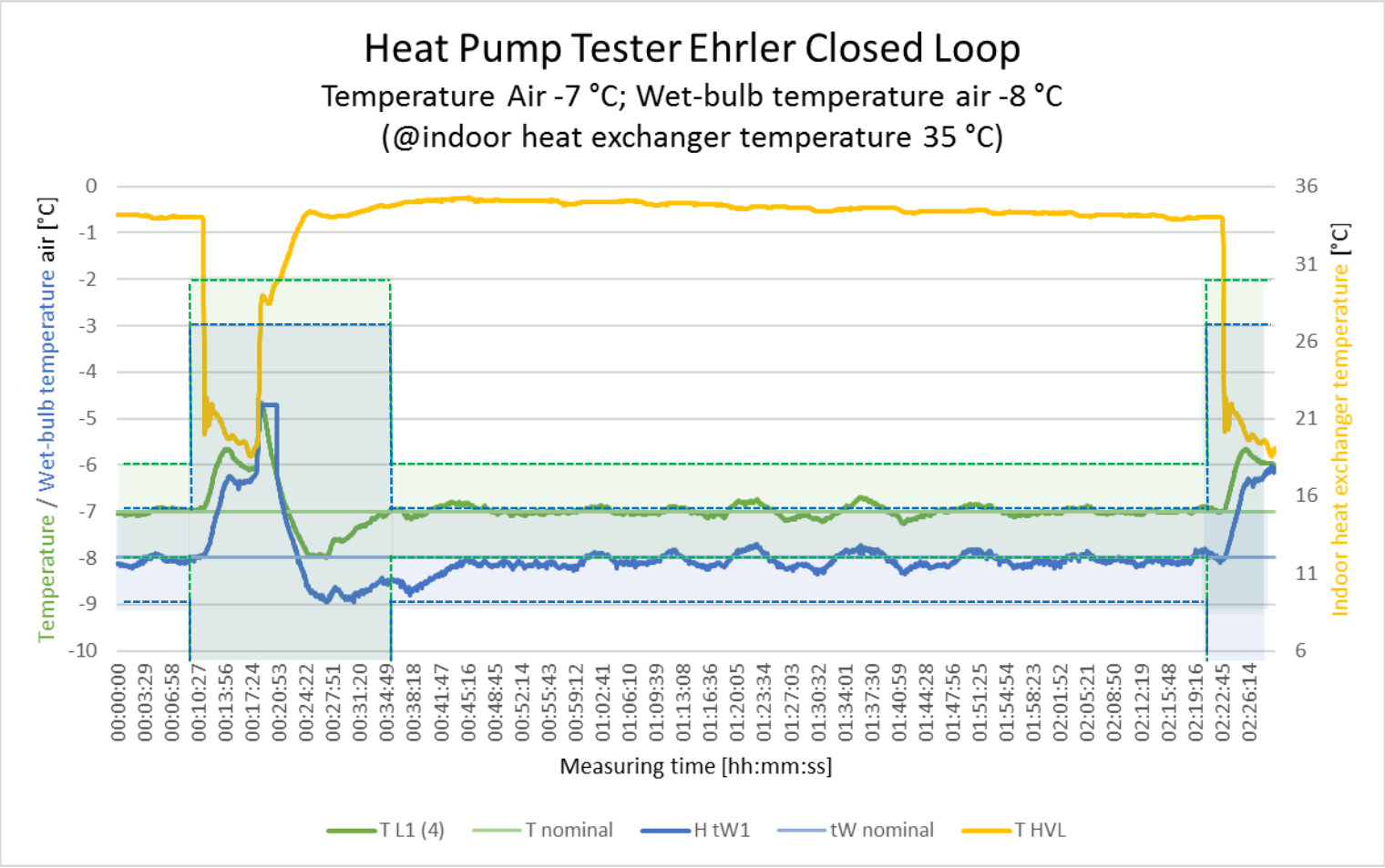




Test procedure according to the standard (14511-3:2019-7; 4.4.4)

Accurate control and dynamic response

Accurate and fast control with closed-loop design *** A-7W35

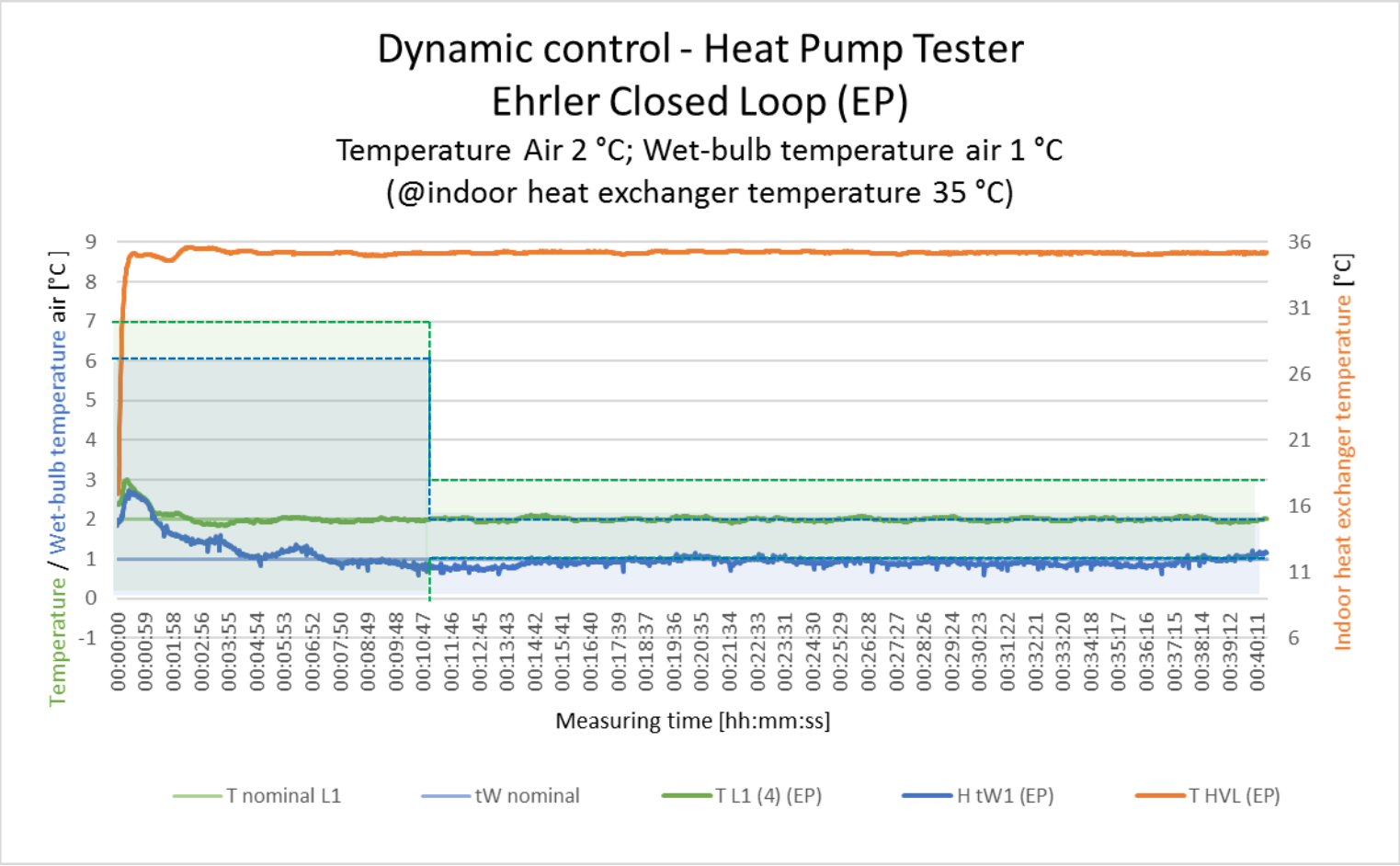


✓**Exact and dynamic temperature and humidity control:**
For realistic simulation of real operating conditions

✓**Precise humidity control:**
even at sub-zero temperatures!

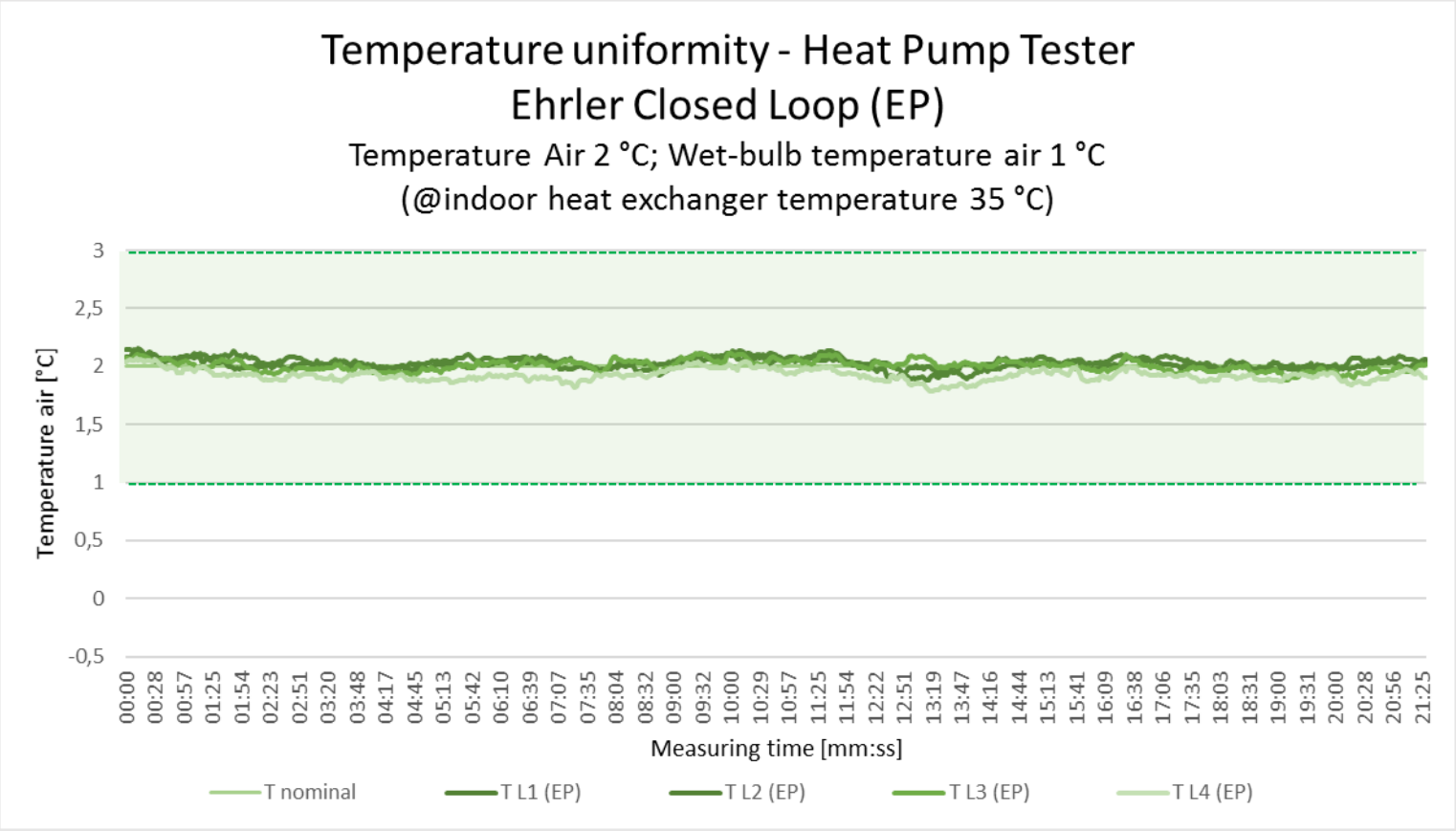
Accurate control and dynamic response

Accurate and fast control with closed-loop design *** A2W35



Temperature uniformity - uniform air flow

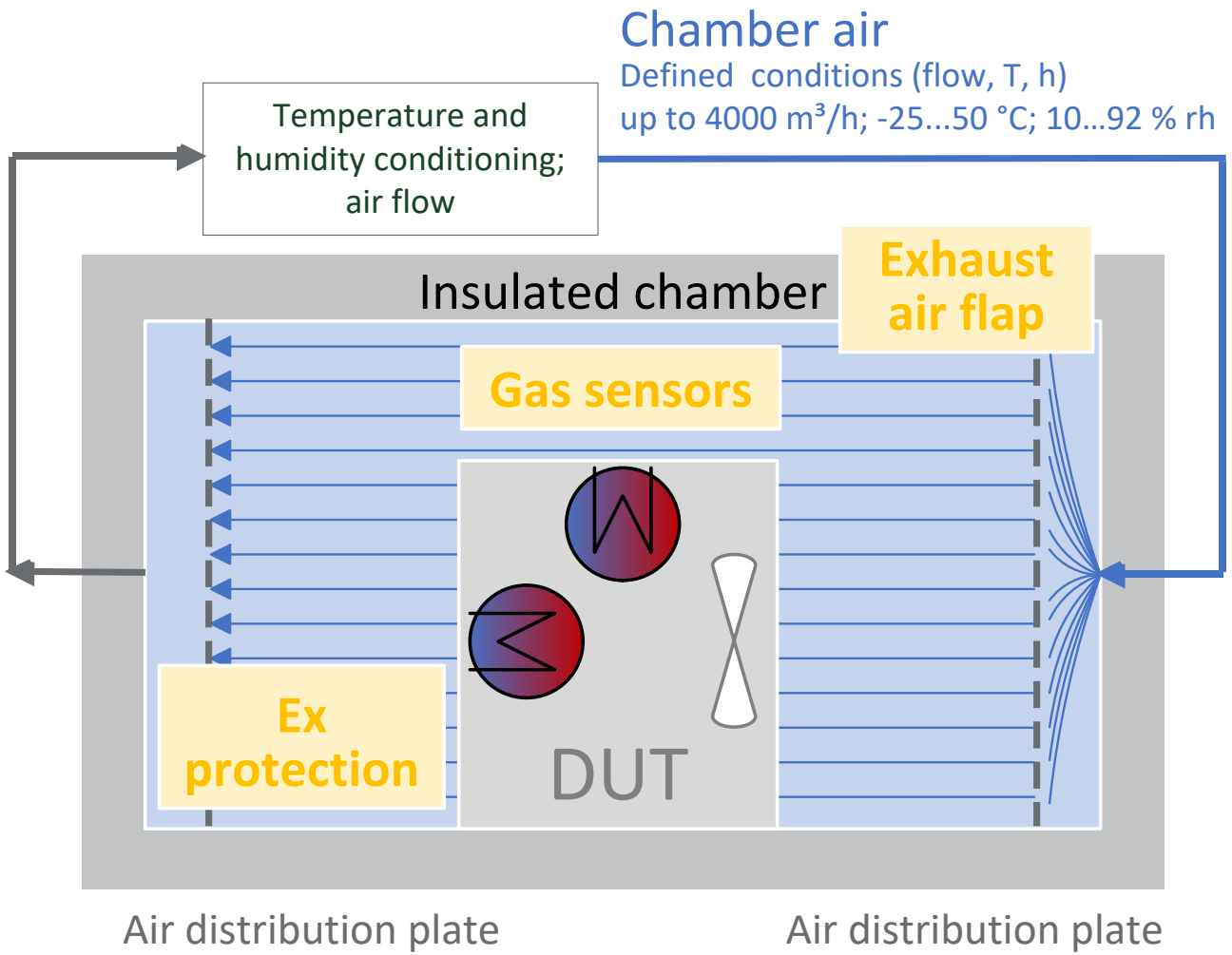
Uniform airflow with closed-loop design



✓**Laminar flow through the test chamber:**
For optimum temperature and humidity uniformity

ATEX zone 2 security concept

Considering the use of flammable refrigerants

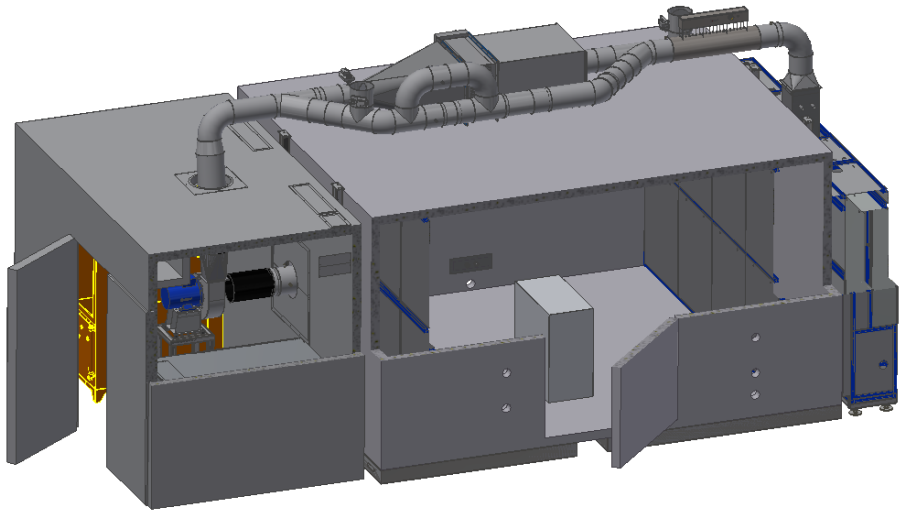


- **Integrated gas sensors**
- **Exhaust air flap**
- **Ex protection**

✓**Optimized security concept (ATEX zone 2):**
for safe test with low GWP refrigerants

Reference project

EP Heat pump test bench for STIEBEL ELTRON



Technical specifications

Conditioning measurement chamber

- Temperature: - 25 … + 50 °C
- Rel. humidity: 10 … 92 % rh
- Wet-bulb temp.: - 8 … 48 °C
- Flow: 1000 … 4000 m³/h

Conditioning heating water

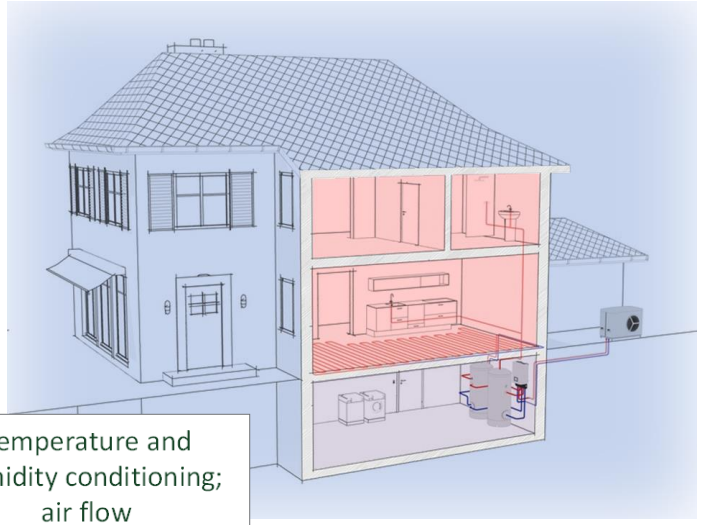
- Temperature: 7 … 70 °C
- Flow: 3 … 55 l/min

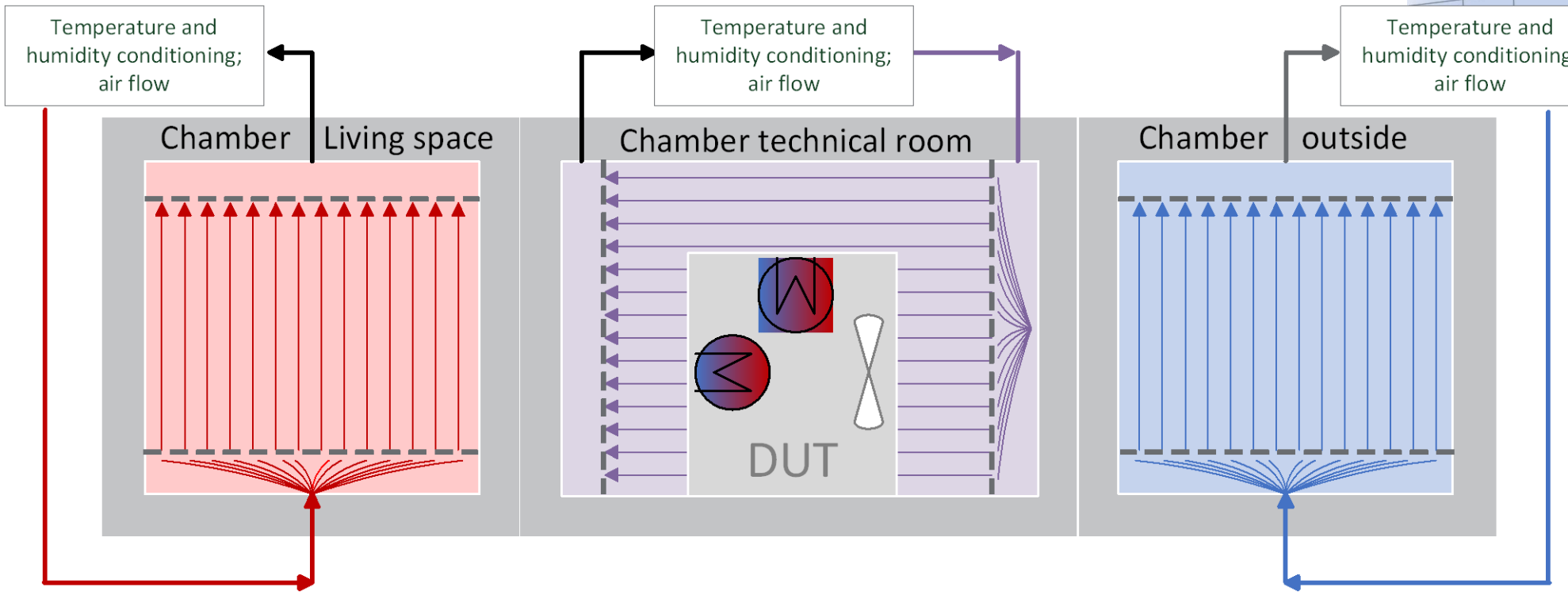
Conditioning process water

- Temperature: 6 … 10 °C
- Flow: 2 … 48 l/min

Further options

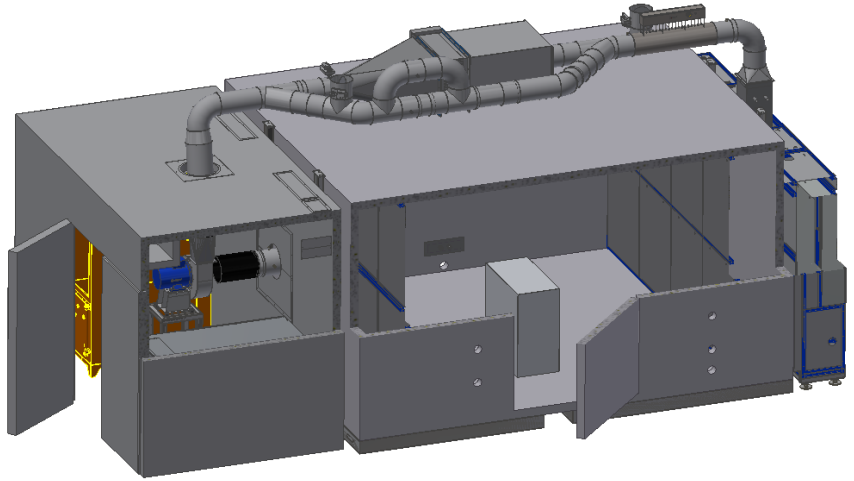
Multi-chamber test bench with EP closed-loop design





Summary: Ehrler Closed-Loop-Design

Optimized test setup for heat pump testing

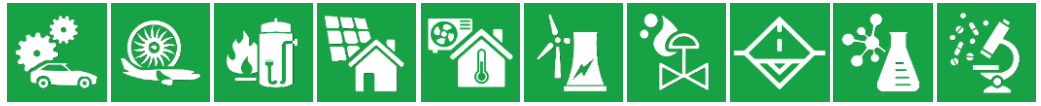


- ✓ **Performance test of heat pumps:**
  According to DIN EN 14511
- ✓ **Exact and dynamic temperature and humidity control:**
  For realistic simulation of real operating conditions
- ✓ **Laminar flow through the test chamber:**
  For optimum temperature and humidity uniformity
- ✓ **ATEX zone 2 security concept:**
  For safe tests with low GWP refrigerants
- ✓ ***Option***
  Heating water and process water conditioning:
  To simulate a complete realistic test set-up
- ✓ ***Option***
  Multi-chamber test benches:
  For the separate simulation of different rooms (outside, technical room and living space)

EP Ehrler Prüftechnik Engineering

We are specialists in high-precision flow measurement technology

- **More than 3500 completed projects –**
  for customers in Automotive, Aviation, Gas and flow measurement, HVAC technology, etc.



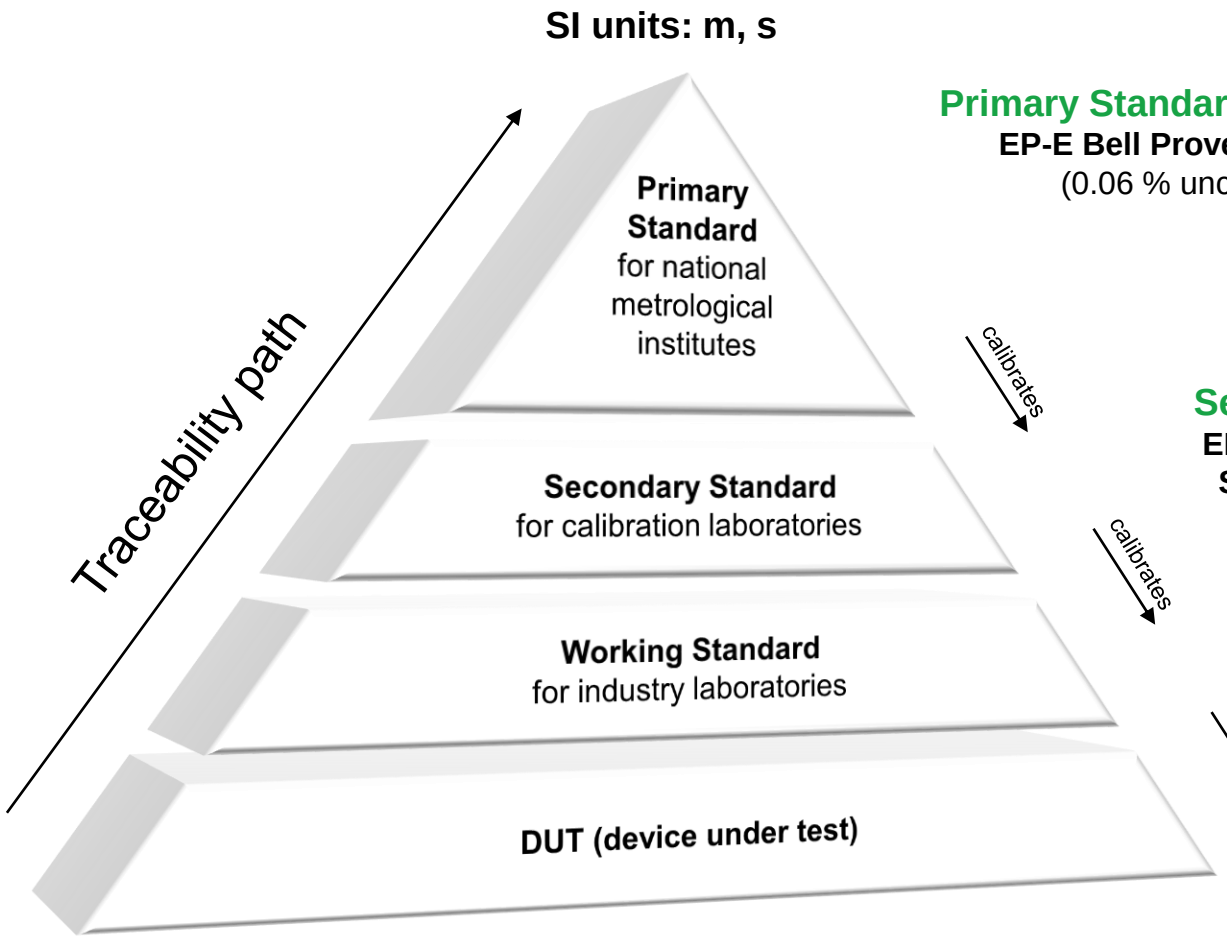
- **High application competence in conditioning of air (T, rh, p)** –
  e.g. testing intercoolers for automotive customers

- **Expertise in test benches for Ex area –**
  e.g. endurance test benches for gas water heaters up to 1000 kW; HPPP High Pressure Piston Prover

- **High precision flow measurement –**
  own DAkkS calibration laboratory for air flow / primary standards for national metrological institutes (PTB Germany, NIM China, INM Colombia, etc.)

Bell calibration pyramid

Experienced in working, secondary and primary standard



Primary Standard
EP-E Bell Prover
(0.06 % unc.)

Secondary Standard
EP-E Nozzle test bench
SMF4000 (0.15 % unc.)

Working Standard
EP-E Blower test bench
(0.5 % unc.)

DUT
Blower
(1…x % acc.)

Thank you for your attention.

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