



Workshop

IEA HPP Annex 28: “Test Procedures and Seasonal Performance Calculation Methods”

Las Vegas, 2005-05-30



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IEA HPP Annex 28: “Test Procedures and Seasonal Performance Calculation Methods”

- Test guideline
- Measurements points
- 3 steps for a complete thermal test

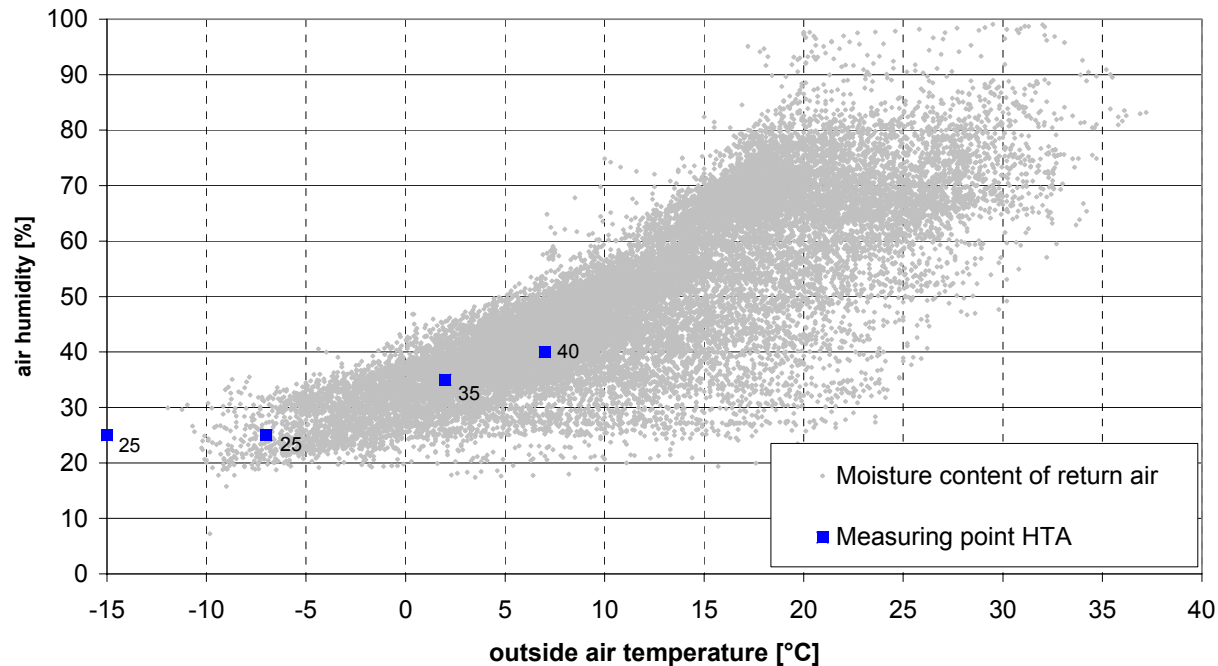
Test procedure for compact units (Test guideline)



- Leakage (prEN 13141-7)
- Filter bypass leakage (EN 1886:1998)
- Air flow / pressure curve (DIN 24163)
- Acoustic tests (ISO 9614/1-3)
- Handling / Maintenance / Safety
- Hygienic examinations (SWKI 2003-5)
- Thermal testing
(EN 14511, EN 308, EN 255-3, M/324)

Measurement points for heat pump compact unit in accordance with EN 14511:2004

Moisture content of exhaust air inlet
from measurements pilot plants Rapperswil and Stans

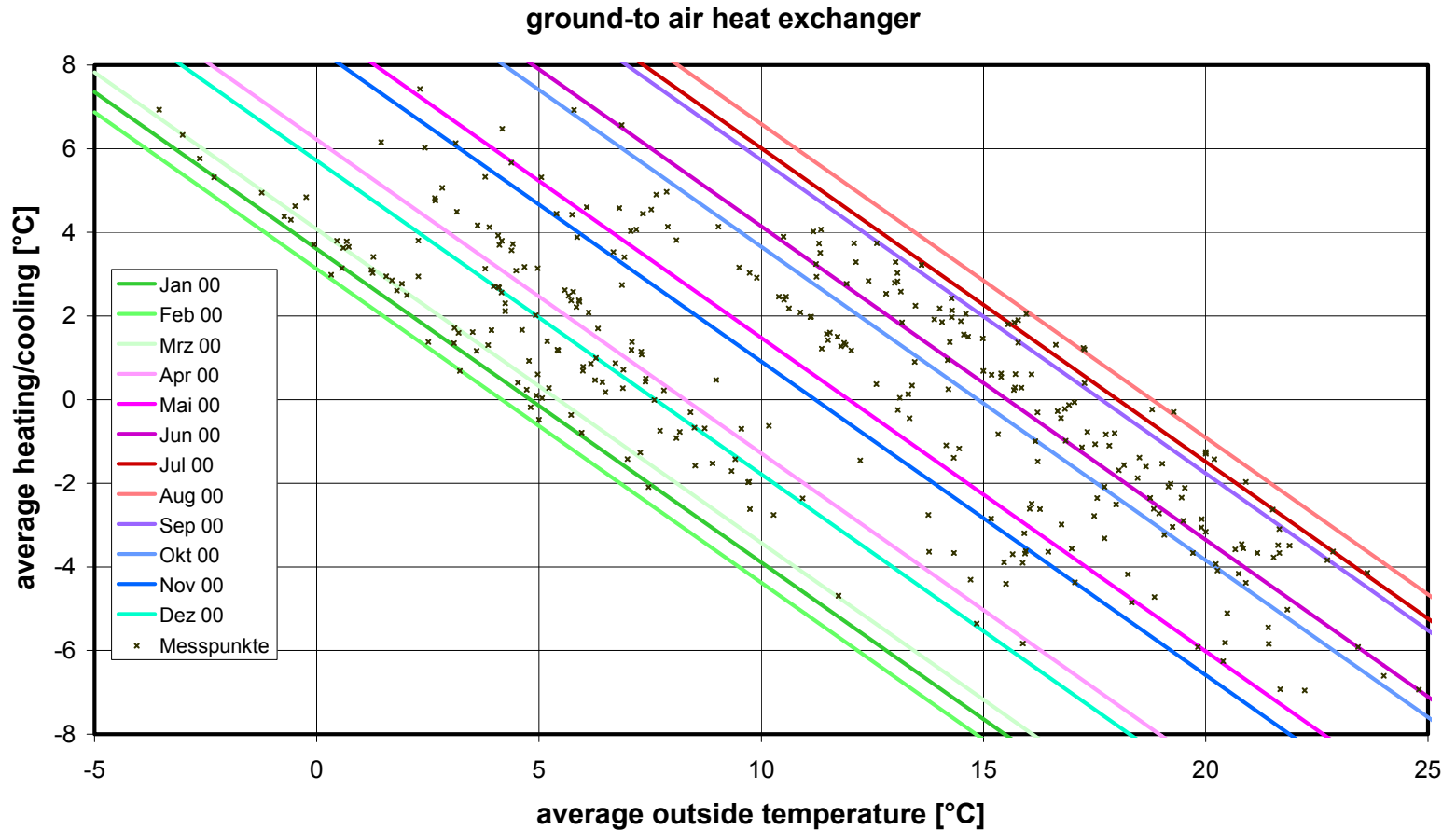


- exhaust air inlet temperature **21°C**
- space heating temperature **35°C or 45°C**
- domestic hot water reference temperature **60°C**

Measurement points for heat pump compact unit in accordance with EN 14511:2004

| description | Outdoor air | | Exhaust air | | Heating | DHW |
|--------------------------|---------------------|---------------------|---------------------|---------------------|----------------|----------------|
| | Temperature [°C] | air humidity [%] | Temperature [°C] | air humidity [%] | outlet [°C] | outlet [°C] |
| Option | -15 | 80 | 21 | 25 | 35/45 | 60 |
| Measuring point 1 | -7 | 80 | 21 | 25 | 35/45 | 60 |
| Measuring point 2 | +2 | 80 | 21 | 35 | 35/45 | 60 |
| Measuring point 3 | +7 | 80 | 21 | 40 | 35/45 | 60 |
| Option | +15 | ... | 21 | 55 | 35/55 | 60 |
| Only DHW | (+10) | | 21 | 45 | - | 60 |

Measurements ground-to-air heat exchanger in Swiss Midland



Measurement points for heat pump compact unit with ground-to-air heat exchanger in accordance with EN 14511:2004

| Description | Outdoor air | | | Exhaust air | | Heating | DHW |
|------------------------------|---------------------|------------------------|--|---------------------|------------------------|----------------|----------------|
| | Temperature [°C] | air humidity [%] | Temperature after ground- to-air HX [°C] | Temperature [°C] | air humidity [%] | outlet [°C] | outlet [°C] |
| Option | -15 | 80 | -7 | 21 | 25 | 35/45 | 60 |
| Measuring point 1 | -7 | 80 | 2 | 21 | 25 | 35/45 | 60 |
| Measuring point 2 | +2 | 80 | 5 | 21 | 35 | 35/45 | 60 |
| Measuring point 3 | +7 | 80 | 7 | 21 | 40 | 35/45 | 60 |
| Option | +15 | 80 | ... | 21 | 55 | 35/55 | 60 |
| Only DHW | (+10) | | | 21 | 45 | - | 60 |

The temperature of the air flow leaving the ground-to-air heat exchanger corresponds to the typical ground-to-air heat exchanger in the Swiss Midland.

In other regions, temperature can be defined by the manufacturer

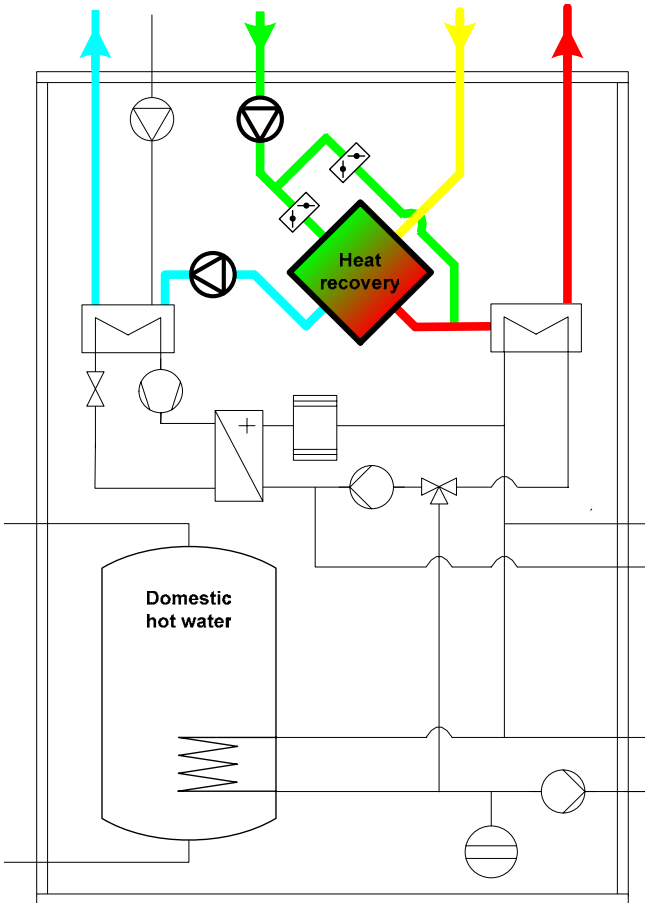
Thermal testing (EN 308, EN 14511, EN 255-3)

3 steps for a complete thermal test:

- 1. Heat recovery for the temperature change coefficient and electro-thermal amplification factor**
- 2. Heat recovery and heat pump for COP space heating**
- 3. Heat recovery and heat pump for COP domestic hot water in accordance with EN 255-3, M/324**

Thermal testing (EN 308, EN 14511, EN 255-3)

1. Heat recovery for the temperature change coefficient and electro-thermal amplification factor



Temperature change coefficient

$$\phi_{OA} = \frac{\text{temperature difference outside-supply air}}{\text{temperature difference exhaust-outside air}}$$

$$\phi_{OA} > 0.5$$

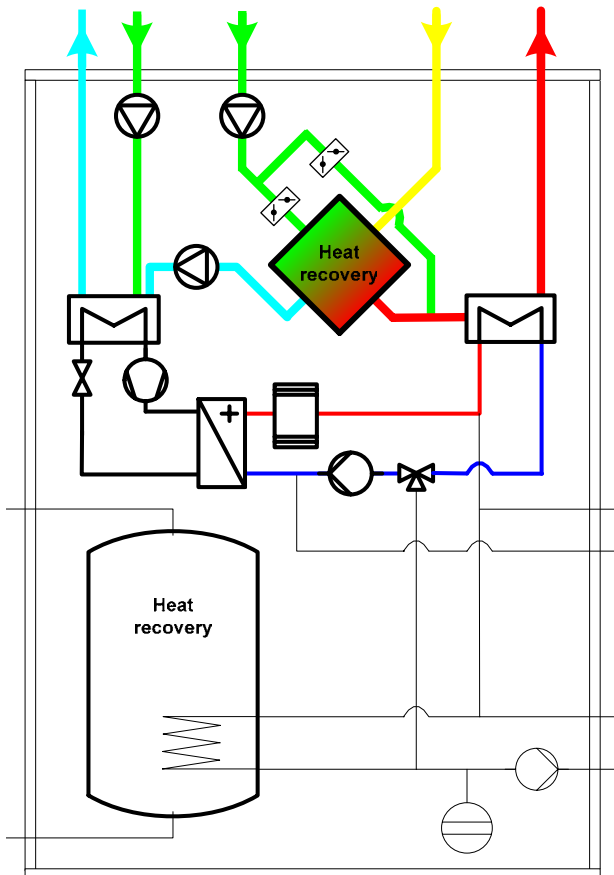
Electro-thermal amplification factor

$$ETV_{HRO} = \frac{\text{recovered heat from outside air to supply air}}{\text{electricity consumption for fans}}$$

$$ETV_{HRO} > 5.0$$

Thermal testing (EN 308, EN 14511, EN 255-3)

2. Heat recovery and heat pump for COP space heating



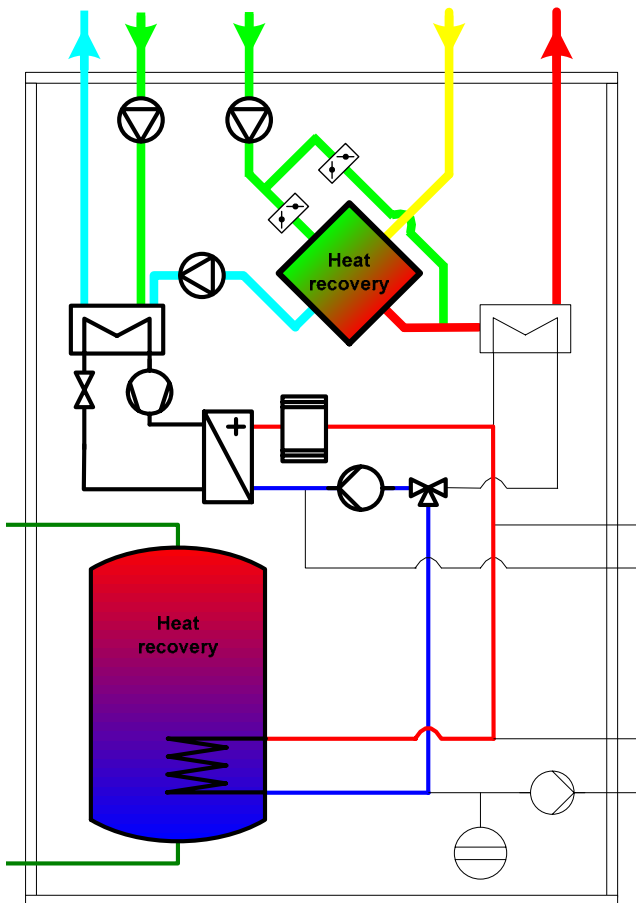
COP for space heating

$$\text{COP} = \frac{\text{Produced heat from the heat pump}}{\text{electricity input of the heat pump}}$$

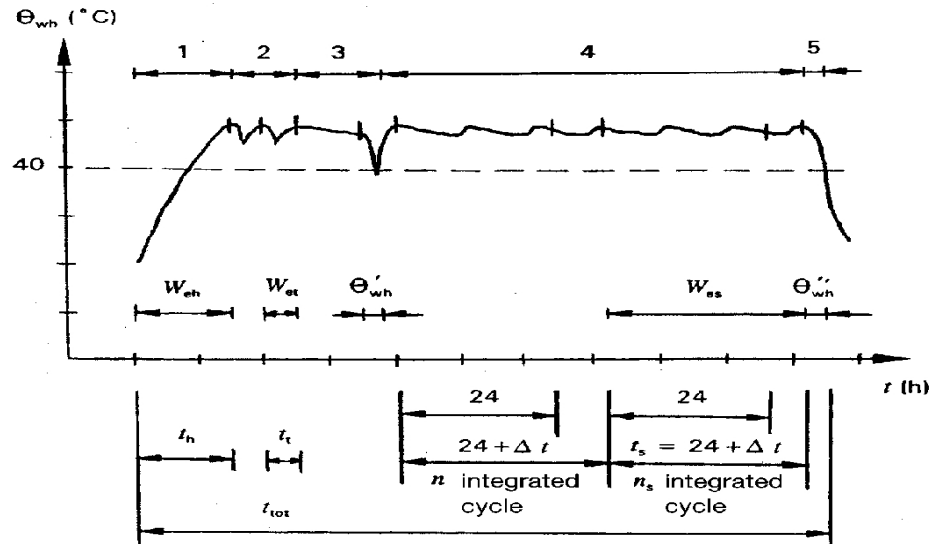
COP > 2.0

Thermal testing (EN 308, EN 14511, EN 255-3, M/324)

3. Heat recovery and heat pump for COP domestic hot water in accordance with EN 255-3



Tapping pattern



- COP from the tapping cycle
- Determine the stand-by losses from the storage
- Tapping cycle in accordance with Mandate M/324 ?