Avoiding heat transfer from hot water connection to cold water connection at a mixer tap

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1. Introduction

Different terms for „drinking water“

World wide: Drinking water (DW)
EU: Potable water, cold, hot, hot circulation (PWC, PWH, PWH-C)

Different laws / rules / codes / guidelines for drinking water and hygiene:

Worldwide: WHO Guidelines for Drinking-water Quality, 2006

EU: Drinking water directive, 98/83/EG, 1998

Member states EU: National law / guideline
Germany: Trinkwasserverordnung 2001; in acc. to Drinking water directive, 98/83/EG, 1998
Netherland: law / guideline in accordance to Drinking water directive, 98/83/EG, 1998
UK: law / guideline in accordance to Drinking water directive, 98/83/EG, 1998
.....

1. Introduction

Common aims for drinking water worldwide are:

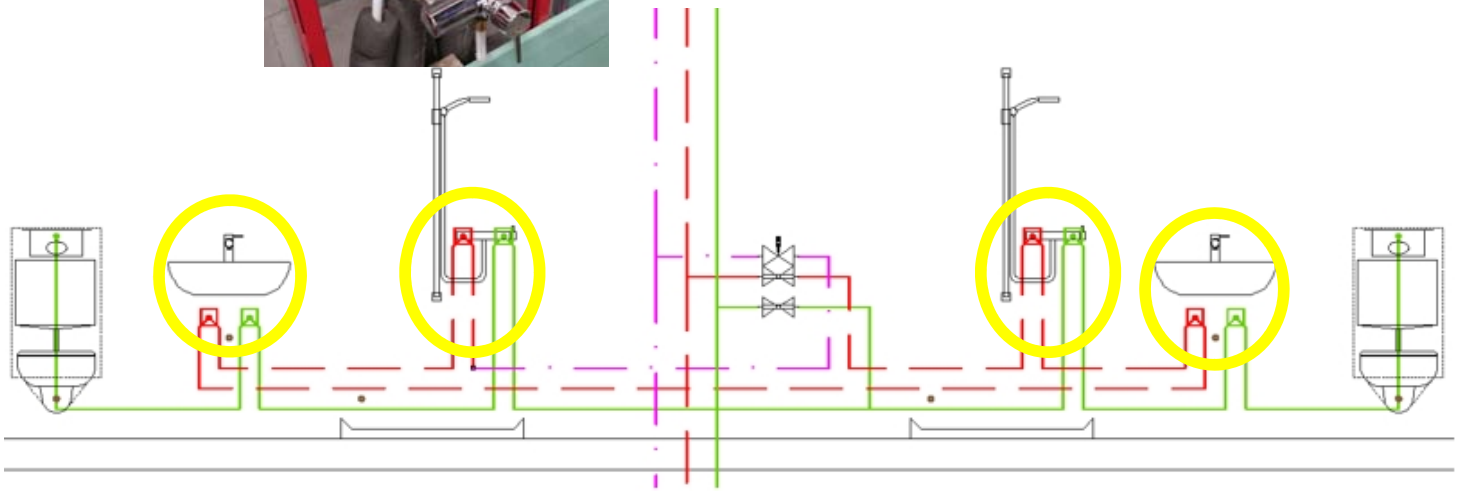
- Human healthcare
- High quality level for drinking water /potable water
- Strict adherence of Drinking water hygiene

Recommendations to reach and retain the quality for drinking water:

- Avoid stagnation in PWC / PWH (change of water quality after hours, days, weeks…of stagnation time)
- Keep cold water cold (t < 25°C) and hot water hot (t >55°C - 60°C; NL: t >60°C - 65°C)
- „Use the water“ as intended, (…consume water as calculated before)
- Keep water in move (like in the old Rome)

2. Installation

Today´s typical principle of installation in PWC and PWH



Effect at the point of use
and at the mixing tap:

Warmth transfer from PWH to PWC!

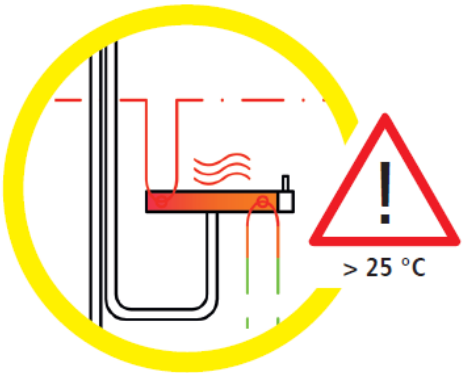
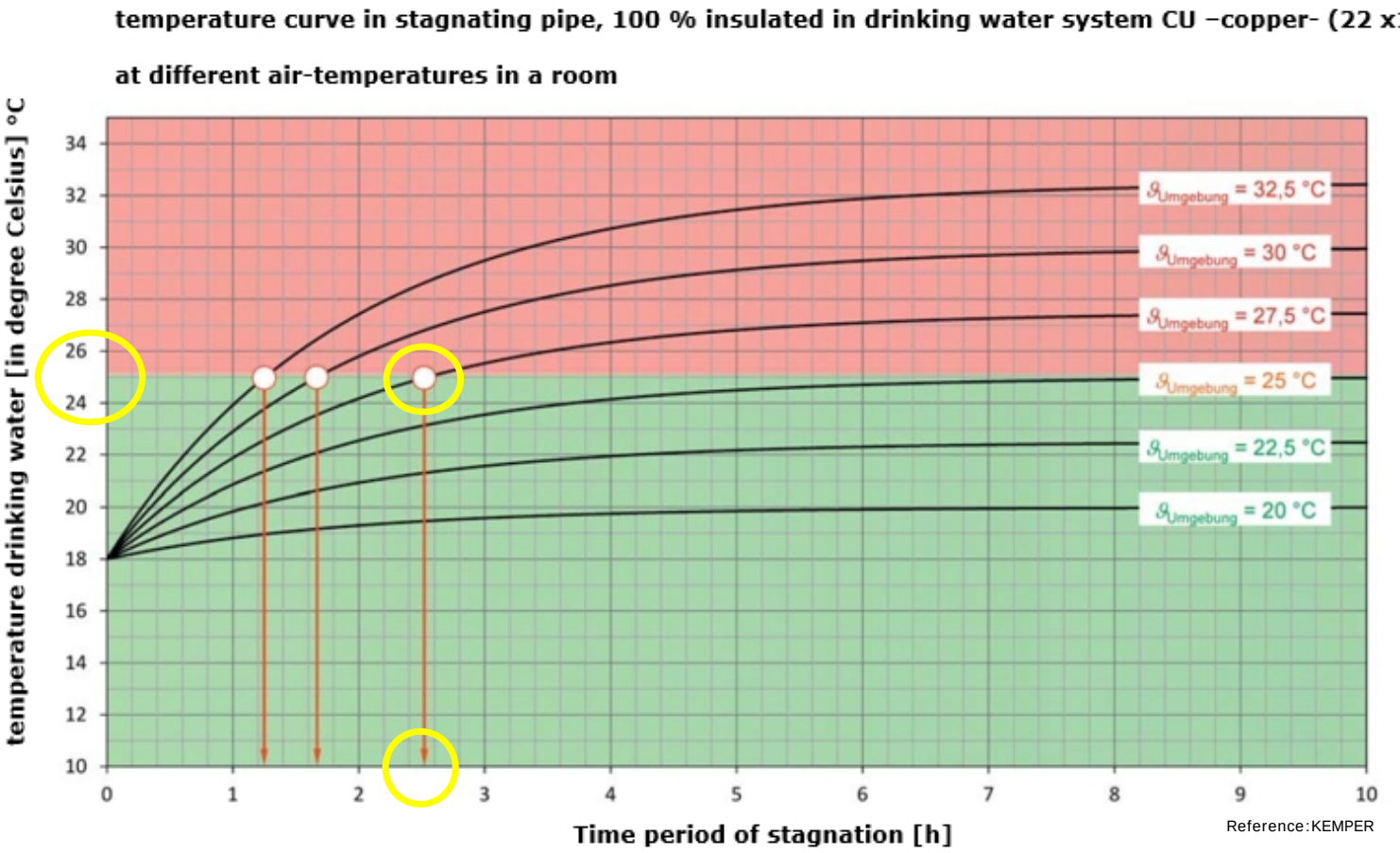


Figure 1: Typical drinking water installation (e.g. hospital / hotel):

Question: How can we keep cold water really cold an hot water really warm?

2. Installation

Stagnation time and influence to water temperature



Explanatory text:

After tapping water (Time 0 with 18°C water temperature), it takes 2,5 hours at ambient temperature 27,5°C until the water in a copper pipe DN 20 reaches the max. allowed temperature of 25°C.

(installation shafts, ceilings in Installation floor

3. Experimental issues cold and warm drinking water system

Temperature at the tap in PWC and PWH

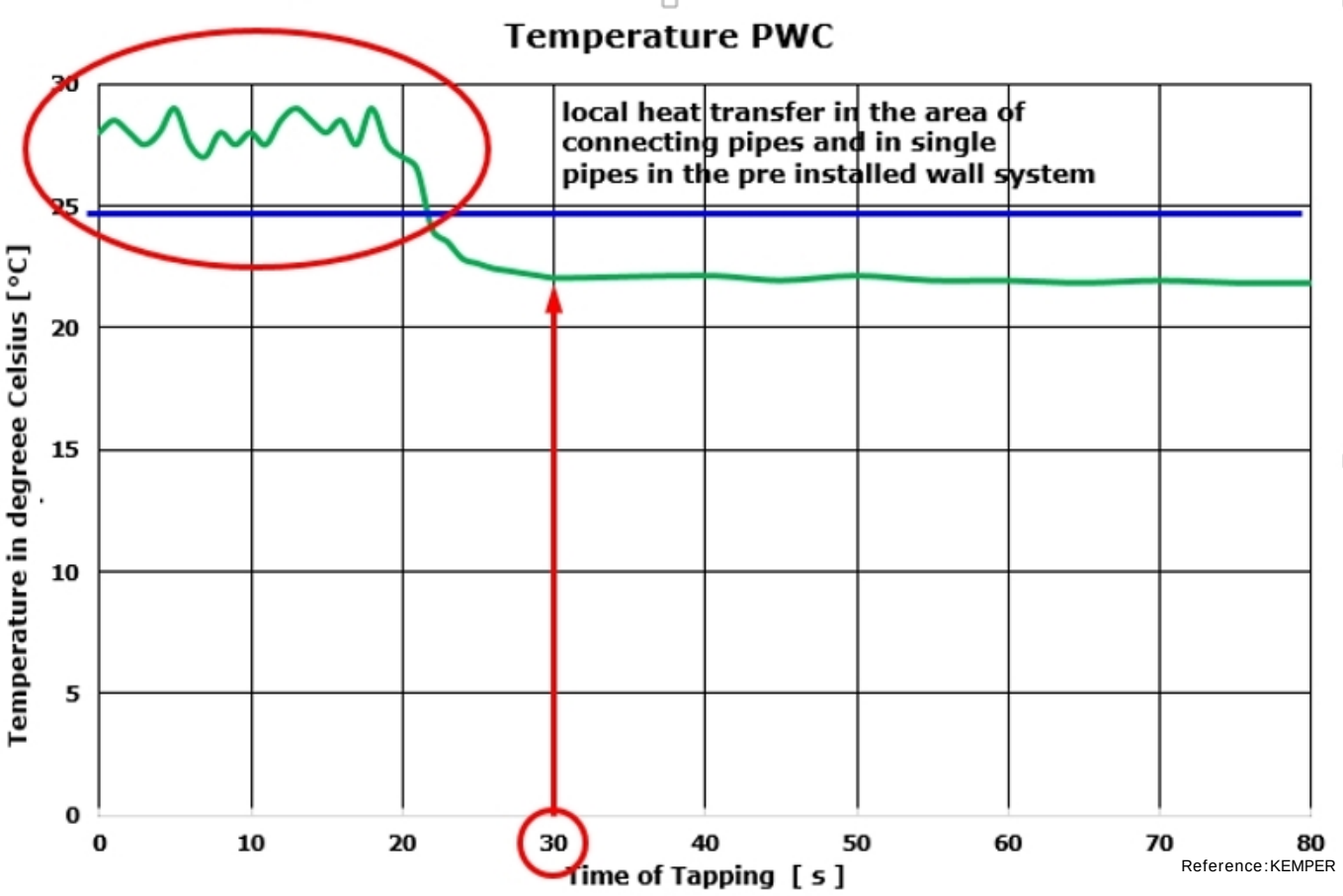


Figure 2:

Temperature measurement at the point of use during phasing out according

EN 806-2:
In 30 sec PWC has to have ≤ 25 °C.

In 30 sec PWH has to have ≥ 55 °C.

3. Experimental issues cold and warm drinking water system

Temperature at the tap, way of installation PWC and PWH

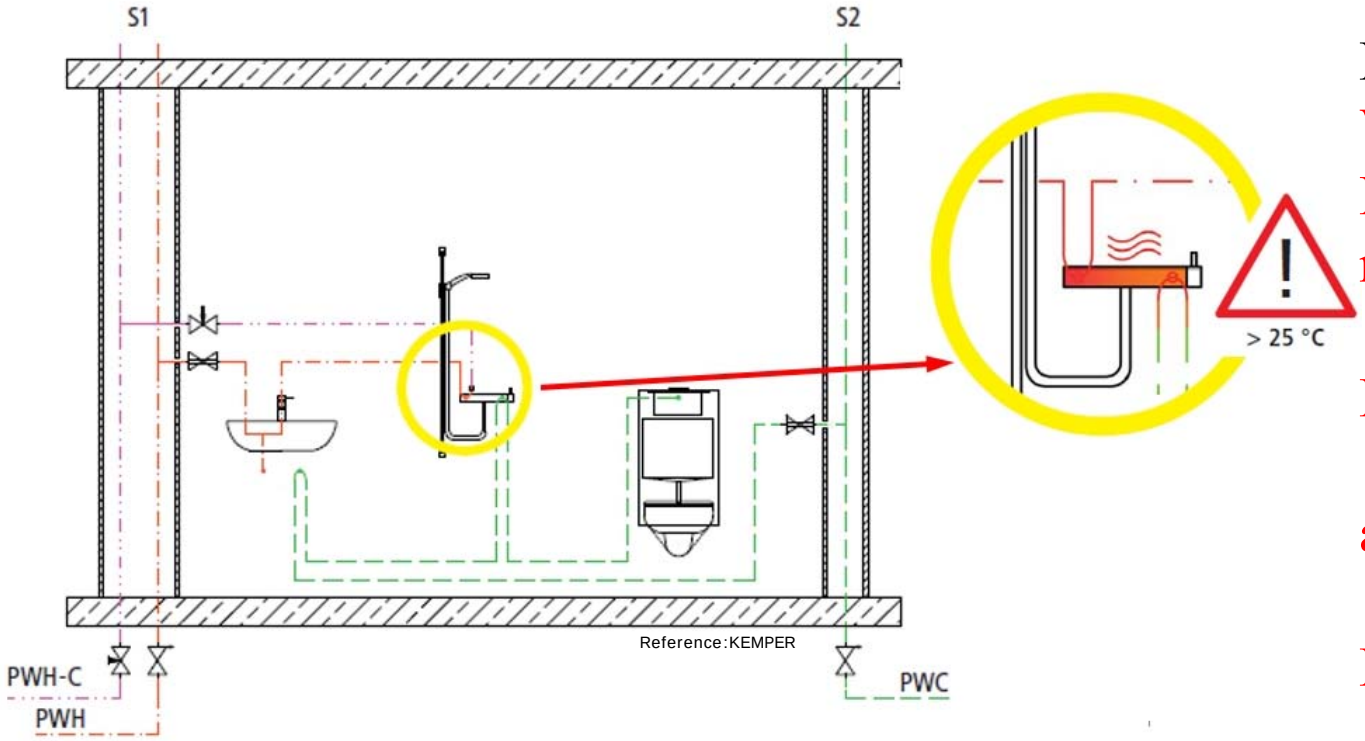


Figure 3:
Warmth transfer from PWH to PWC through the mixing valve, although

PWC is installed from below

and

PWH is installed from above

Reason: PWC and PWH are directly connected to the mixing tap (shower)

3. Experimental issues cold and warm drinking water system

Warmth transfer through the tap PWC to PWH

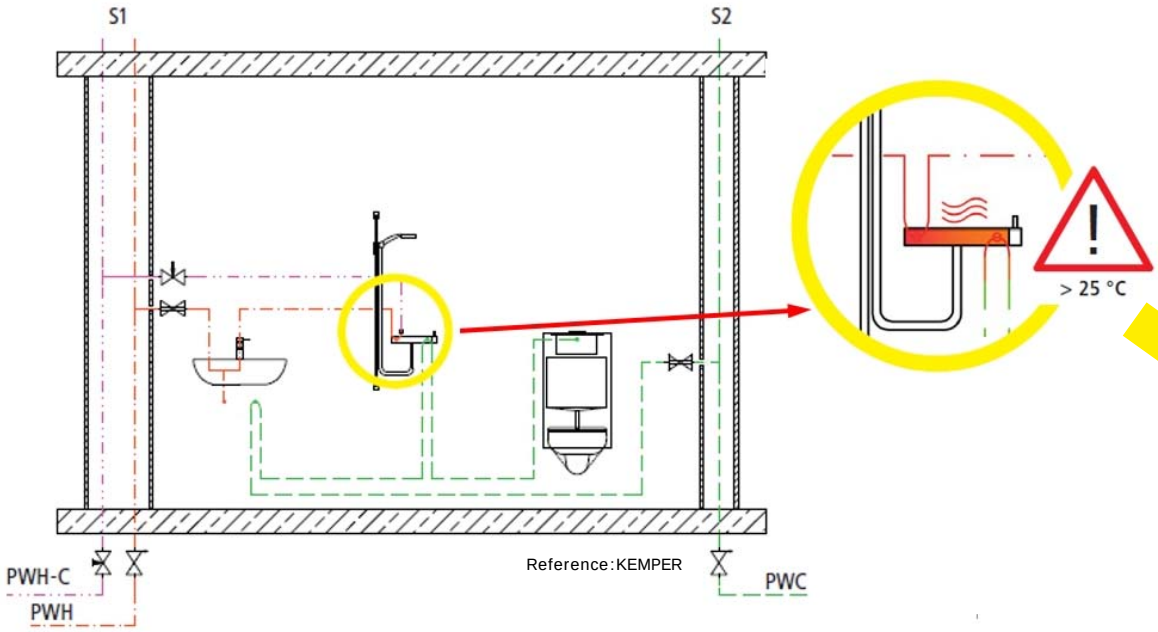
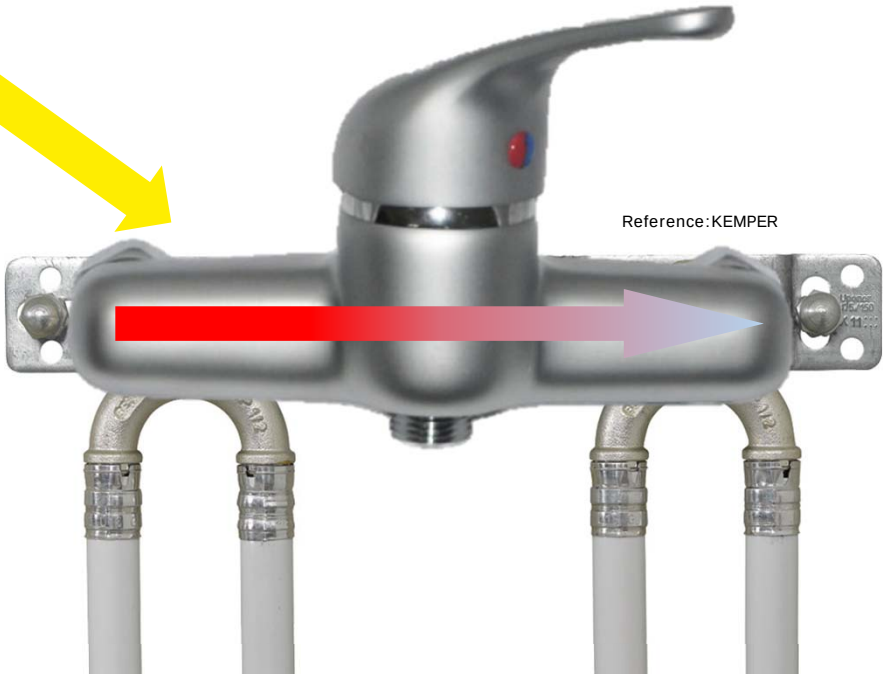


Figure 4:
Warmth transfer through the mixing valve!



Reason:
Double ear elbows at PWH at the connection to the mixing valve!

4. Measurements at test rig

Temperature PWC and PWH at the connectors and surface of the tap

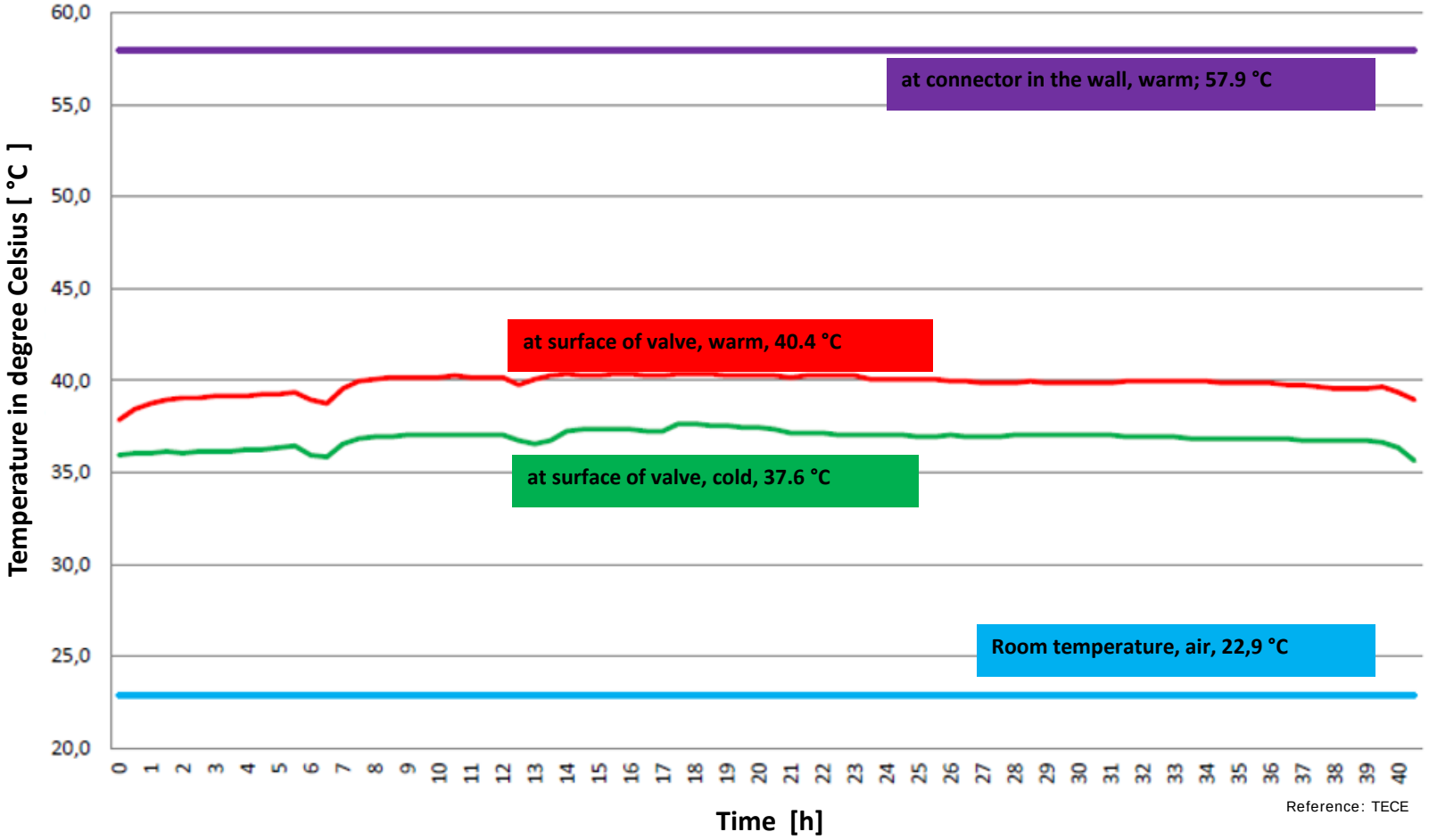


Figure 5:
Temperatures in and at the surface of the mixing valve.

PWC surface of valve

PWH surface of valve
PWH in the connector

4. Measurements at test rig

Temperature at PWC and PWH at the tap

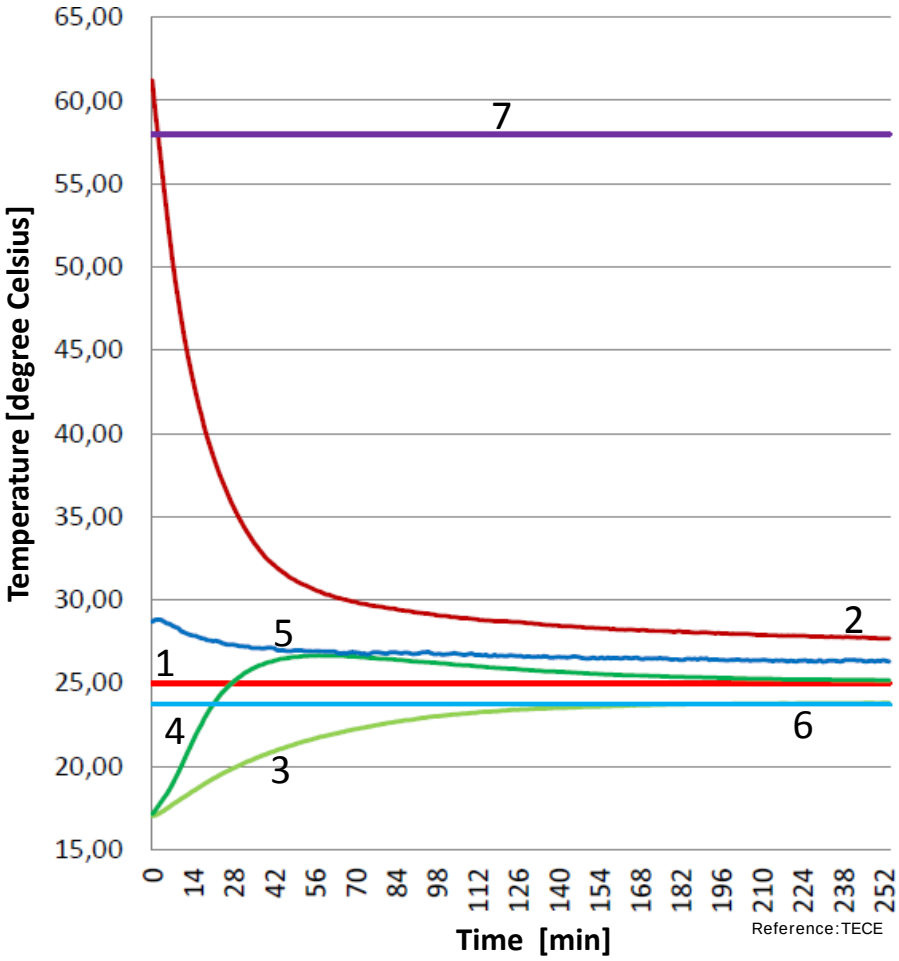


Figure 6:
Temperatures in PWC / PWH after using a shower:

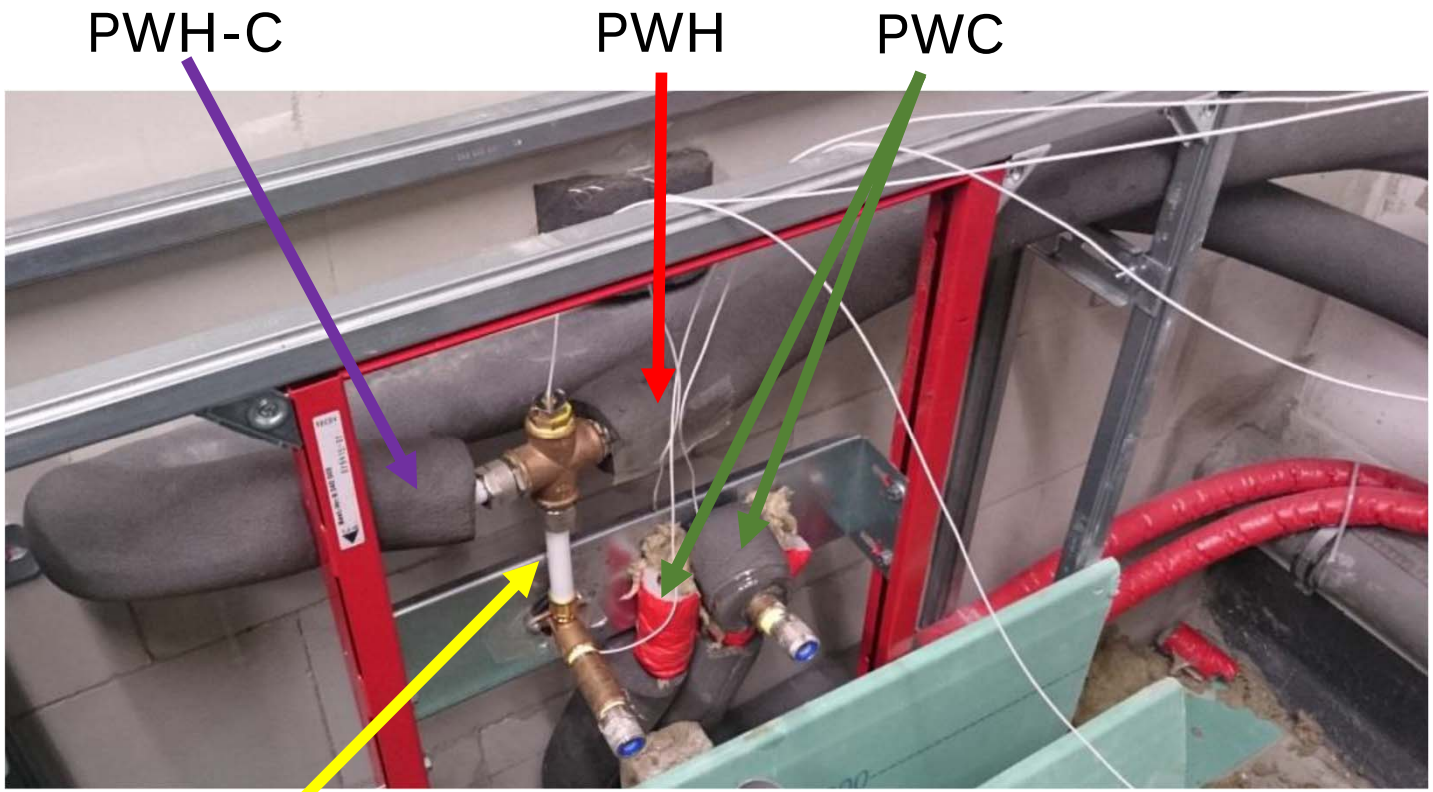
Start: Time 0 with water temperature = 17°C

- 1_limited max. temperature EN 806-2
- 2_temperature at PWH elbow connection valve
- 3_PWC temperature in the wall
- 4_PWC temperature at elbow connection valve
- 5_temperature in the pre wall
- 6_temperature in the room
- 7_PWH-C temperature

High Influence of the directly connected body of the mixing valve to PWC temperature at elbow connection PWC (4).

4. Measurements at test rig

Research & development in thermal separation



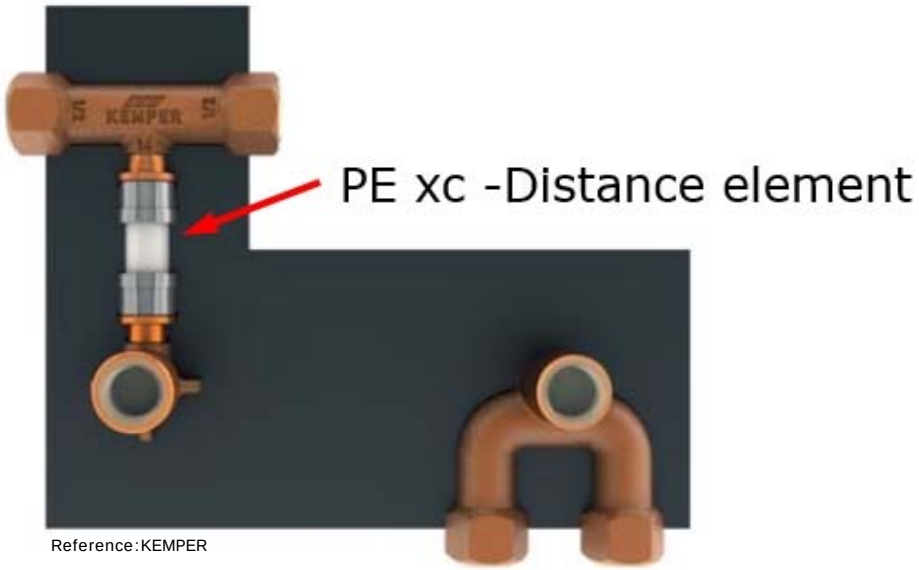
Reference:TECE

Figure 7:
Creating a defined distance element to connect PWH –pipe system with connector PWH of the mixing valve brought the solution for thermal separation.

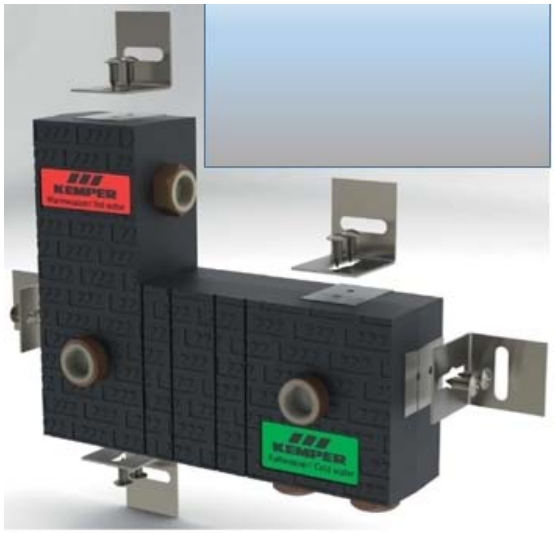
Distance element out of PE-Xc, principle near „thermosiphon“ was found.

5. The result

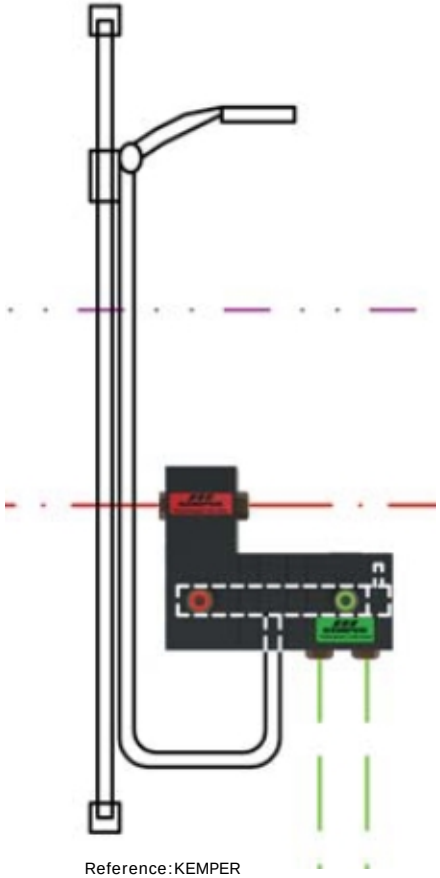
Thermal seperator for mixing valves and tapsavoids influence form PWH to PWC



Reference:KEMPER



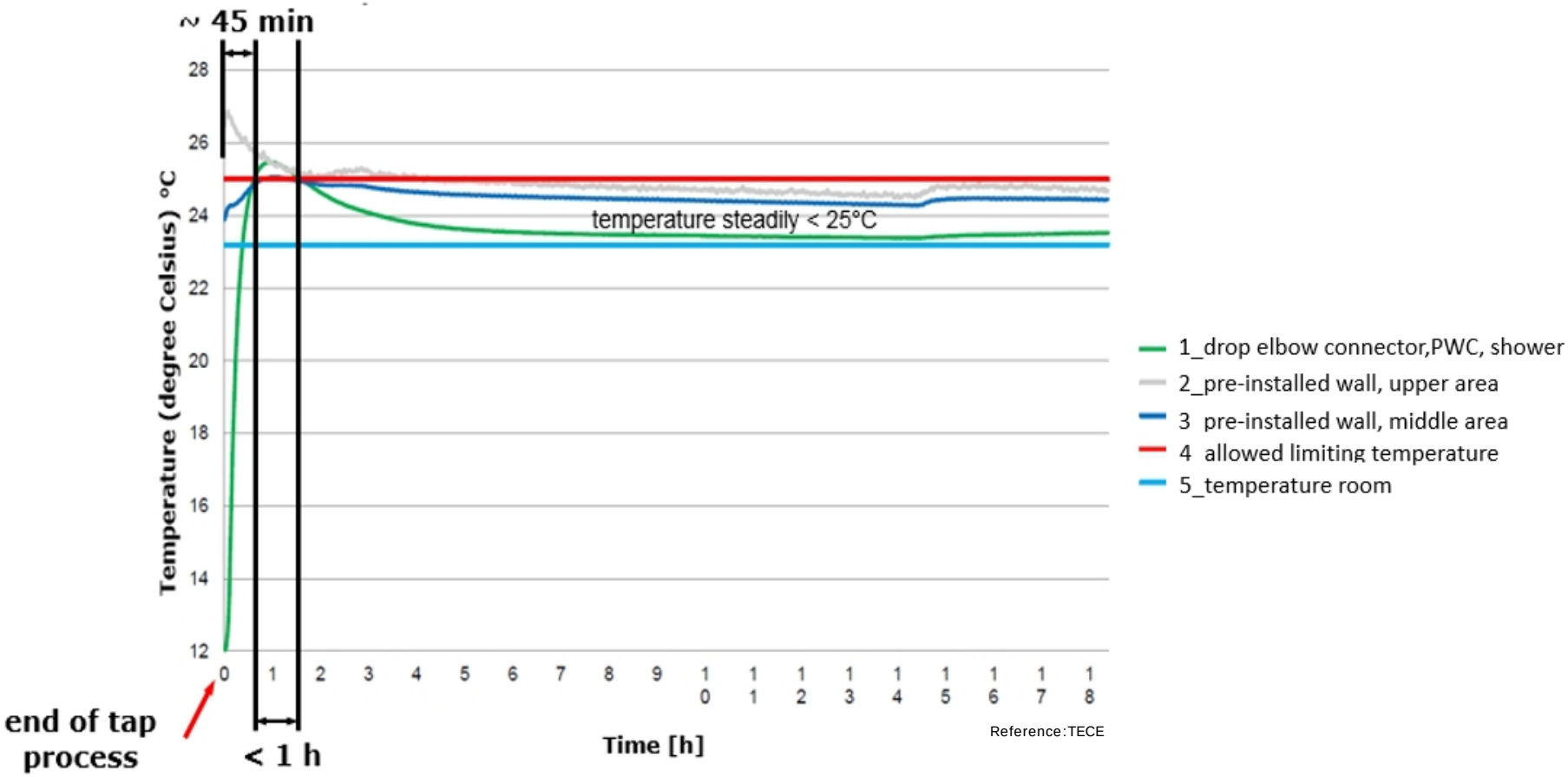
Reference:KEMPER



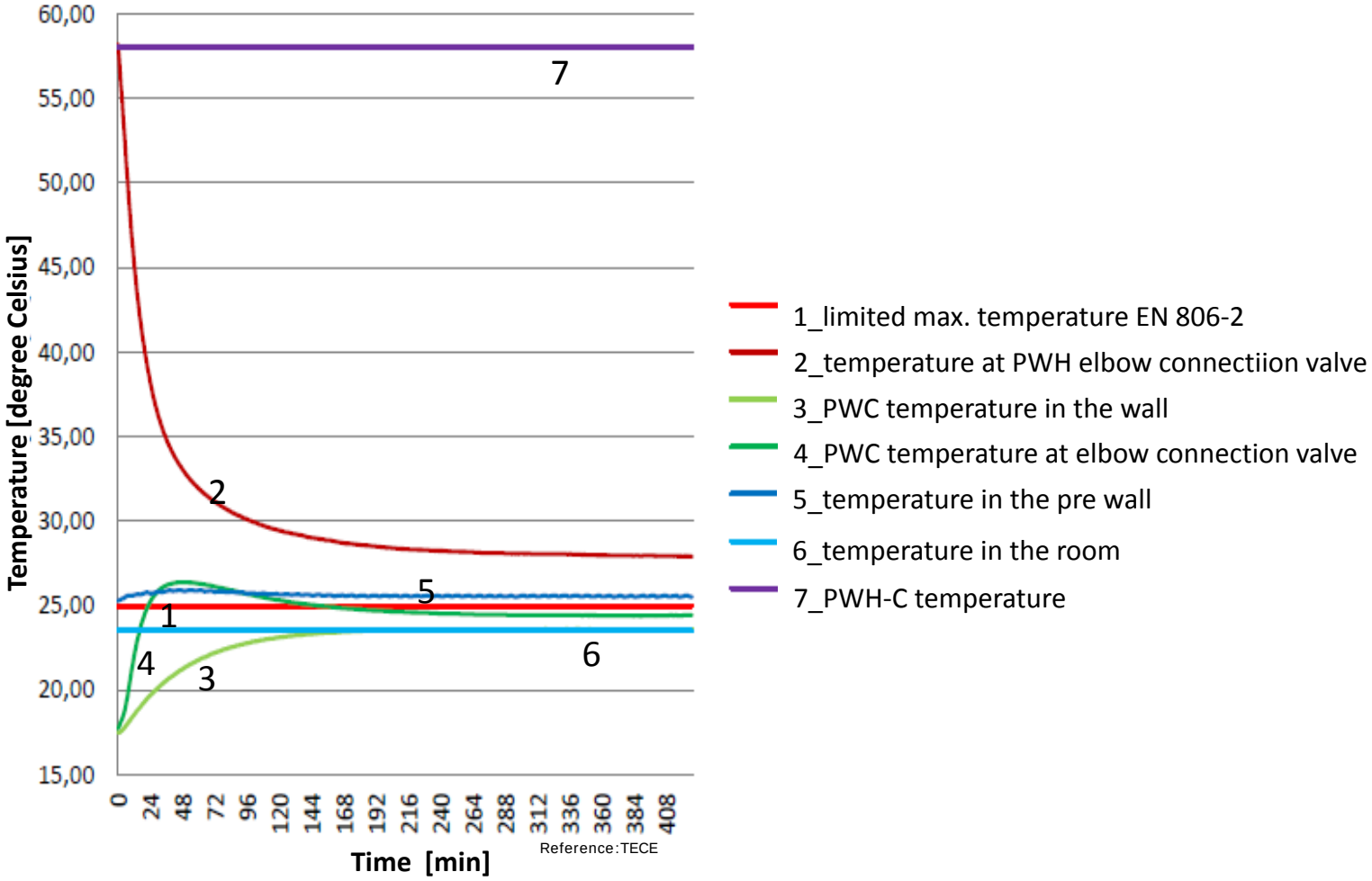
Reference:KEMPER

5. The result

Thermo seperation effect at mixing valve

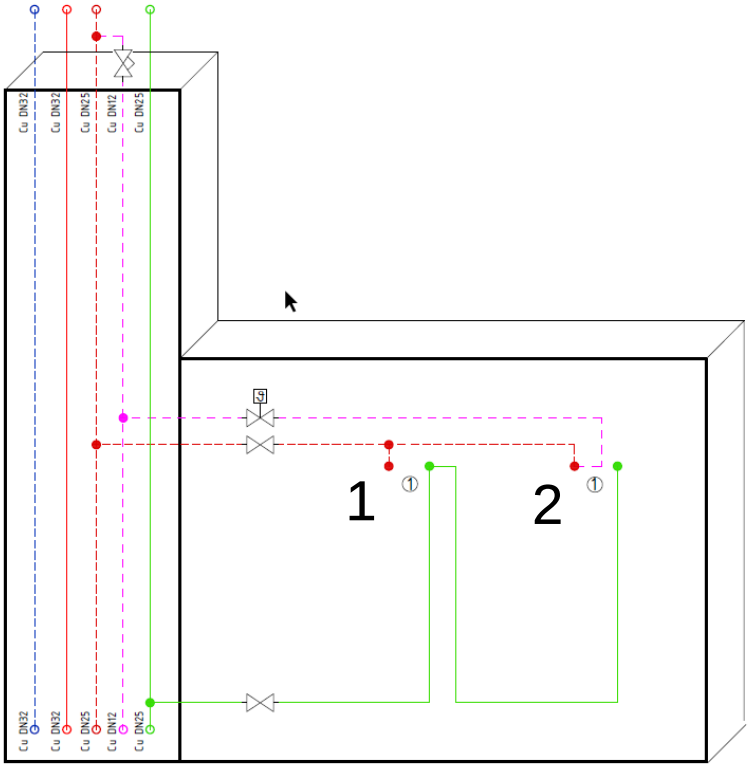


5. The result


60,00
55,00
50,00
45,00
40,00
35,00
30,00
25,00
20,00
15,00
Temperature [degree Celsius]
0
24
48
72
96
120
144
168
192
216
240
264
288
312
336
360
384
408
Time [min]
Reference:TECE
1
2
3
4
5
6
7
1_limited max. temperature EN 806-2
2_temperature at PWH elbow connectiion valve
3_PWC temperature in the wall
4_PWC temperature at elbow connection valve
5_temperature in the pre wall
6_temperature in the room
7_PWH-C temperature

6. Further measurements in pre-wall installation

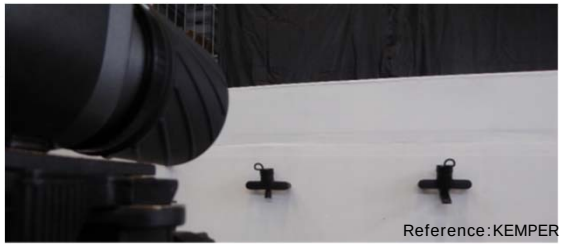
Test of Thermal Seperator in a sanitairy mounting construction



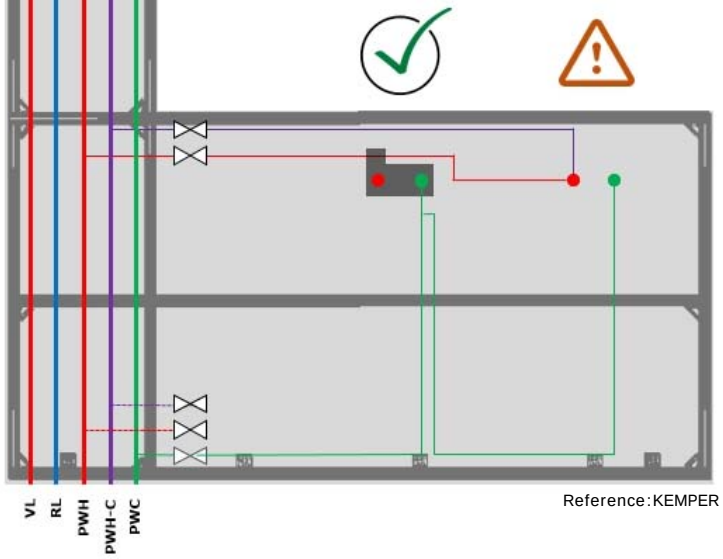
Reference:KEMPER

Construction of pre- wall installation.
Mixing valve with (1) and without (2) Thermal Seperator

Thermo - camera with neutralised surface of the mixing valves (black)



Reference:KEMPER

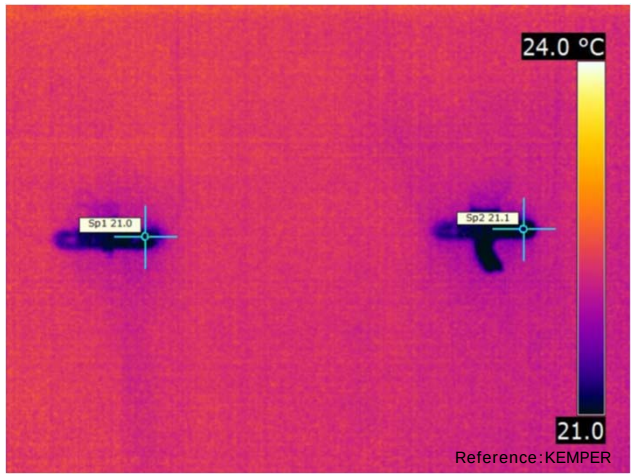


Reference:KEMPER

6. Further measurements

Results of Thermo- camera with and without Thermal Seperator

Thermographic picture:
Same start conditions: Time 0
Room air temperature: 23°C



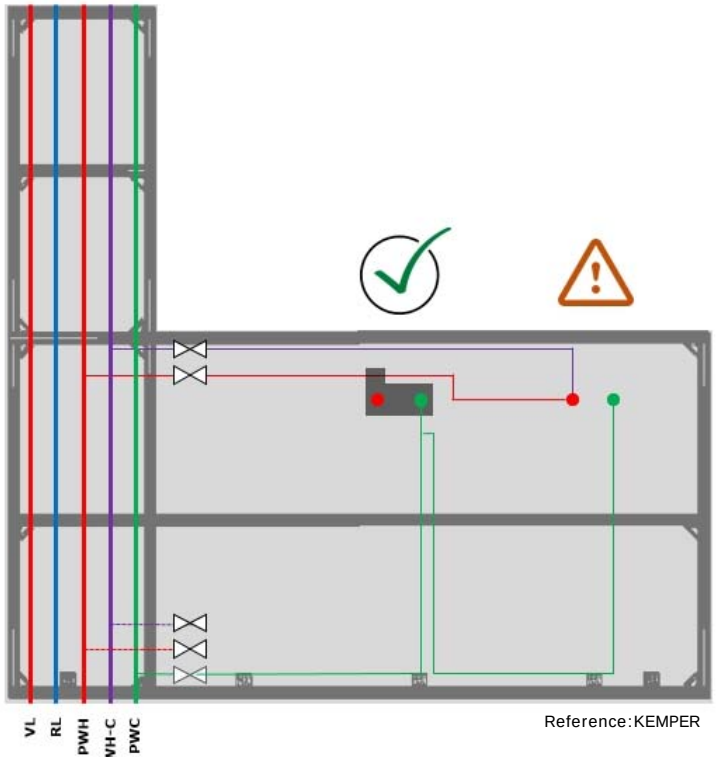
Reference:KEMPER

Left:
Mixing tap with
Thermal Separator

Thermographic picture:
Circulatuion temperature: ≈60°C
Time: after 180 min

Reference:KEMPER

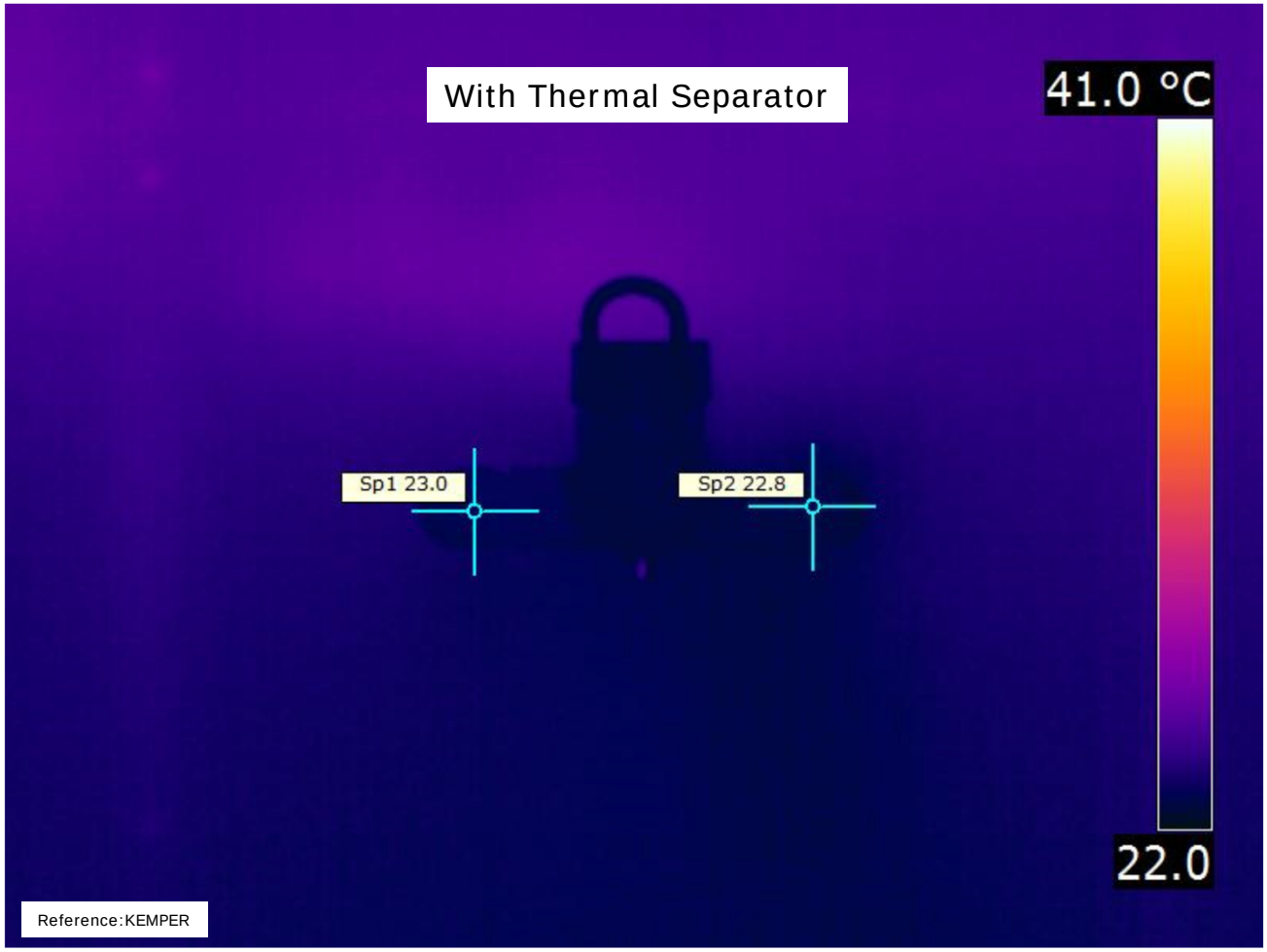
Right:
Mixing tap in
Standard situaton
Without Thermal Seperator

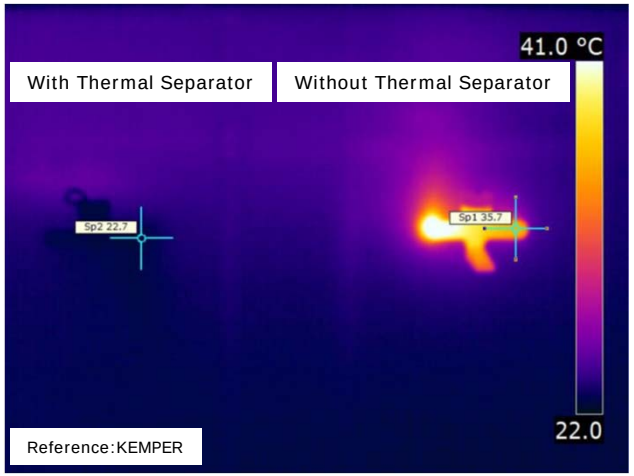


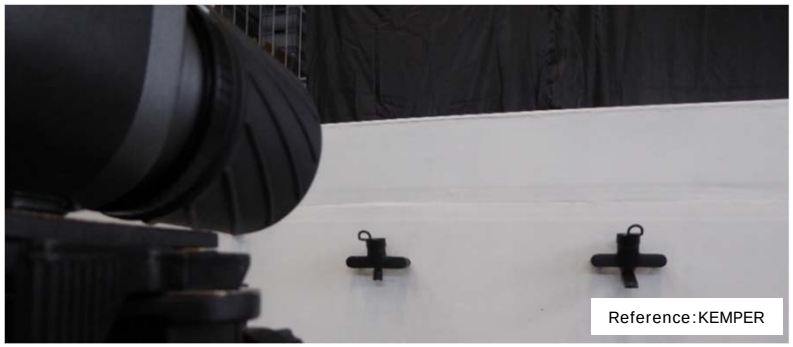
Reference:KEMPER

6. Further measurements

Results: Thermographic pictures mixing valve **with** Thermal Seperator

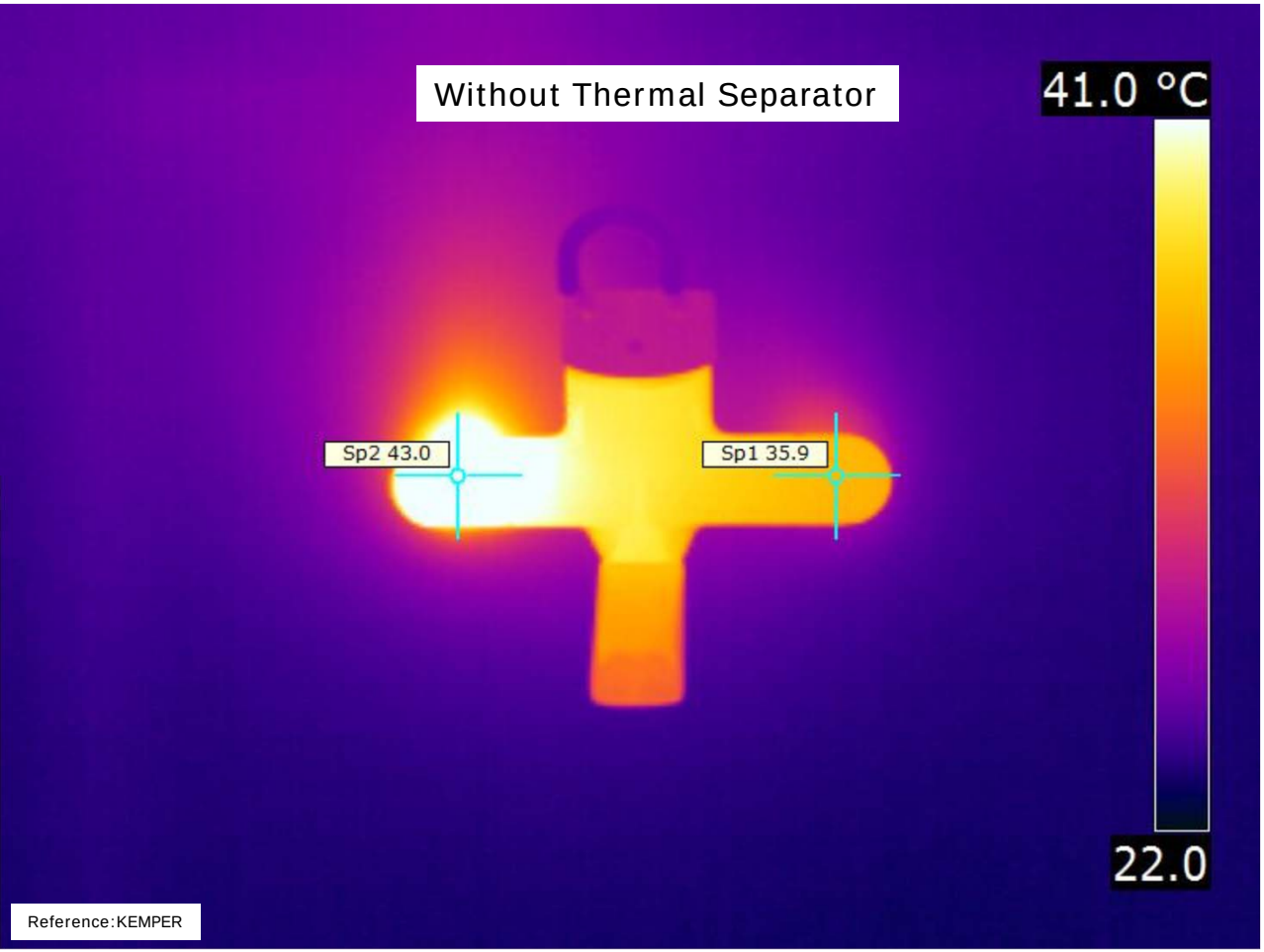


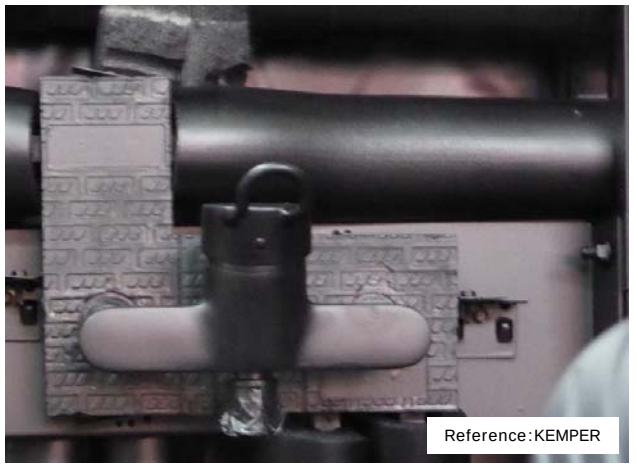




6. Further measurements

Results: Thermographic picture mixing valve **without** Thermal Seperator

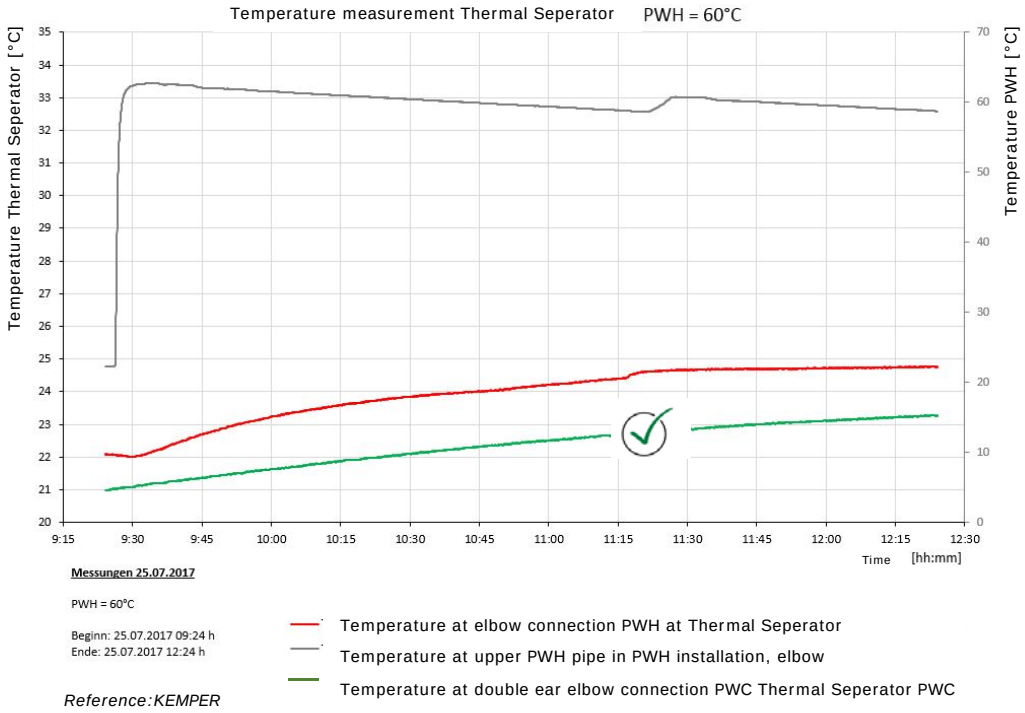




6. Further measurements

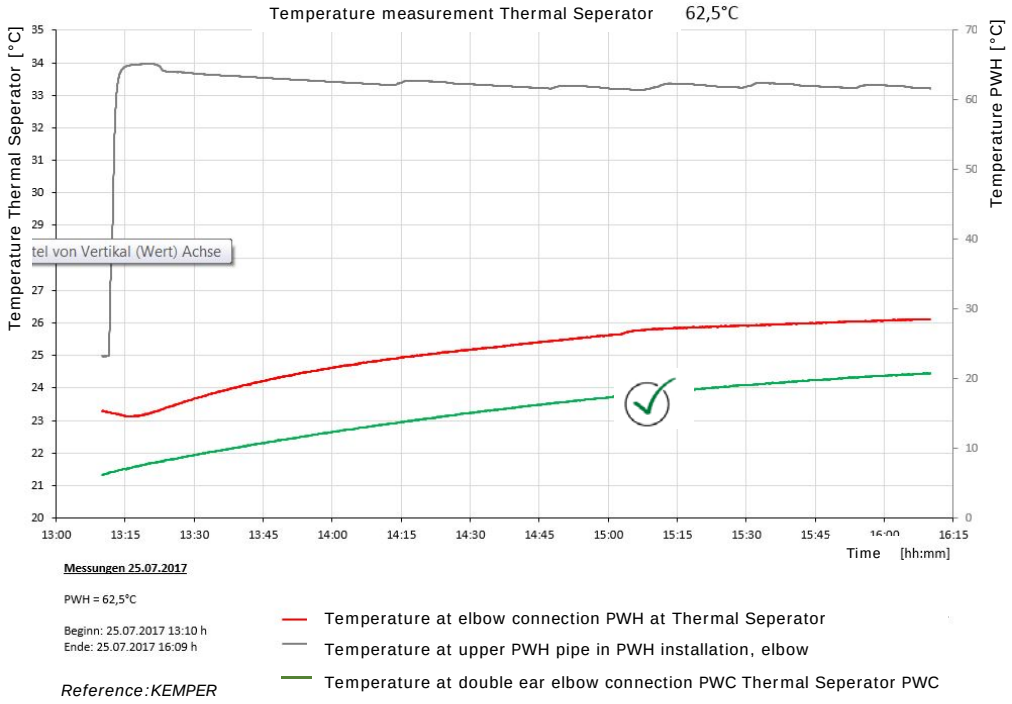
Results: Influence PWH to PWC with Thermal Seperator and mixing valve

PWH-C = 60°C



Reference:KEMPER

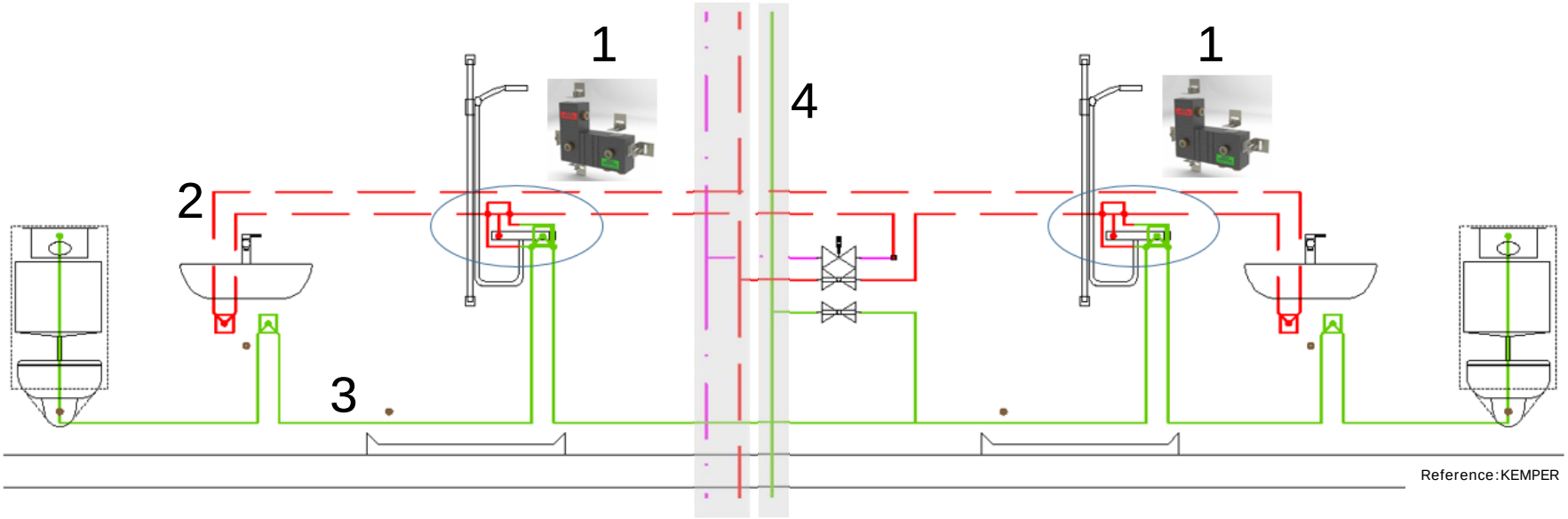
PWH-C = 62,5°C



Reference:KEMPER

7. Consequences for innovative installation

Innovative PWC and PWH installation to keep PWC water cold



- *Mounting of Mixing valves with Thermal Seperator (1)*
- *PWH / PWH-C -installation in the upper area of the pre –wall (2)*
- *PWC -installation coming from below to the tap / mixing valve (3)*
- *Seperated shafts for thermal separation of PWC an PWH/PWH-C (4)*

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