Thermostatic balancing valves in hot water circulation systems

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Introduction

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Contractor for MEP installations in commercial buildings.

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Thermostatic balancing valves

in hot water circulation systems

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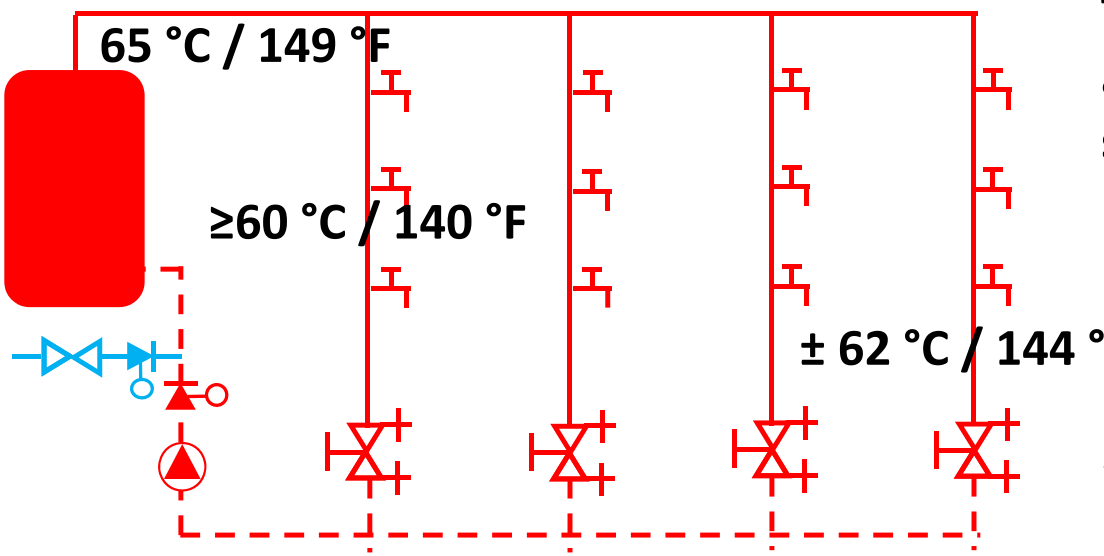
1. Backgrounds

Hot drinking water system in hotels, hospitals etc.

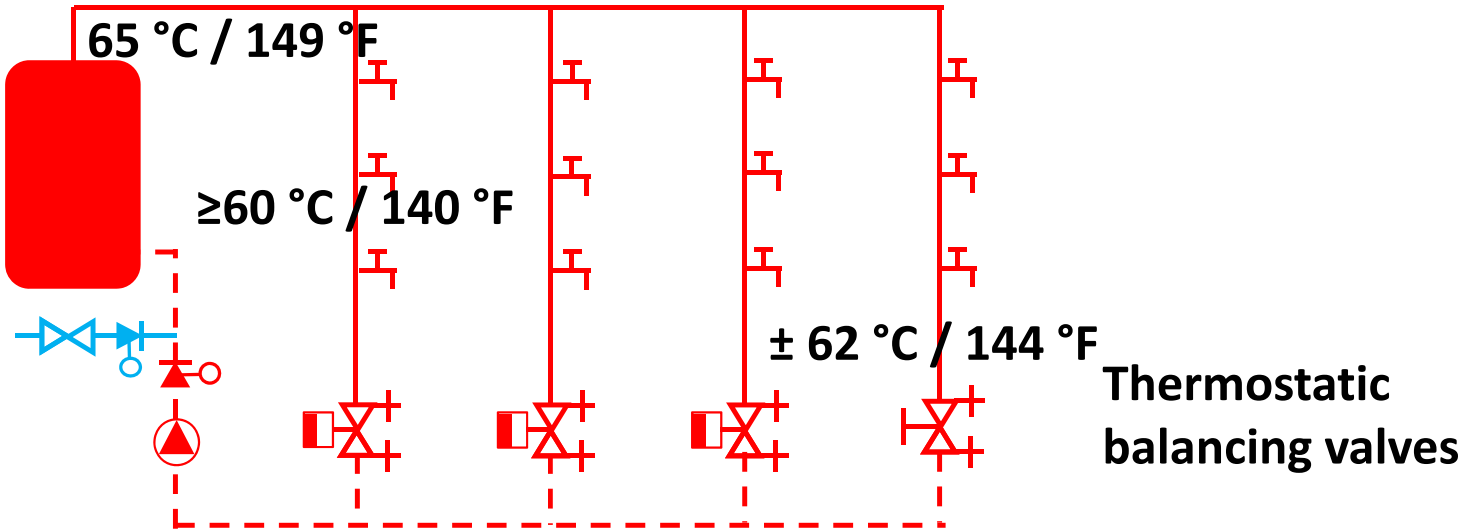


Temperatures according Dutch standard

Static balancing valves

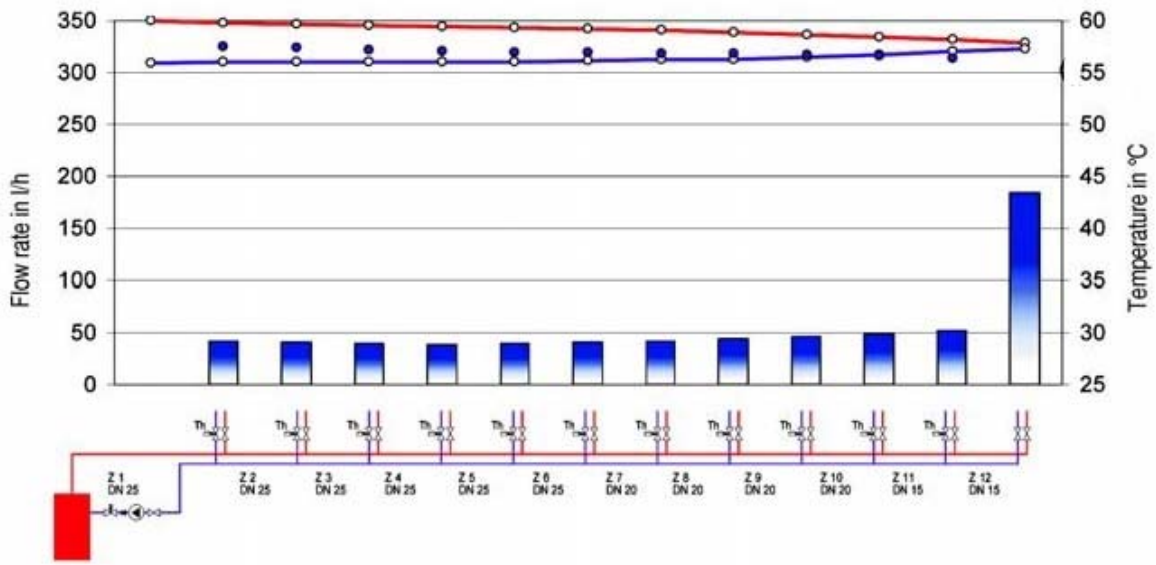
1. Backgrounds

Hot drinking water system in hotels, hospitals etc.



1. Backgrounds

Flow rates thermostatically regulated circulation system



Top curve
Temperature begin circulation loop

Pink curve
Temperature end circulation loop

Source: Kemper, Hochschule Münster

1. Backgrounds

Experiences in practice:

- **60 °C at inlet hot water producer is not reached**
- **62 °C at the end of the circulation loops is not reached**
- **High heat loss**
- **Bad quality thermal insulation**

1. Backgrounds

Questions:

- **Appropriate calculation available?**
- **Is the circulation system balanced?**
- **Lack of knowledge?**
- **Gap between theoretical approach and practice?**
- **Other causes?**

These questions made us decide to do an investigation.

How can we improve the performance of the TBV in HWS?

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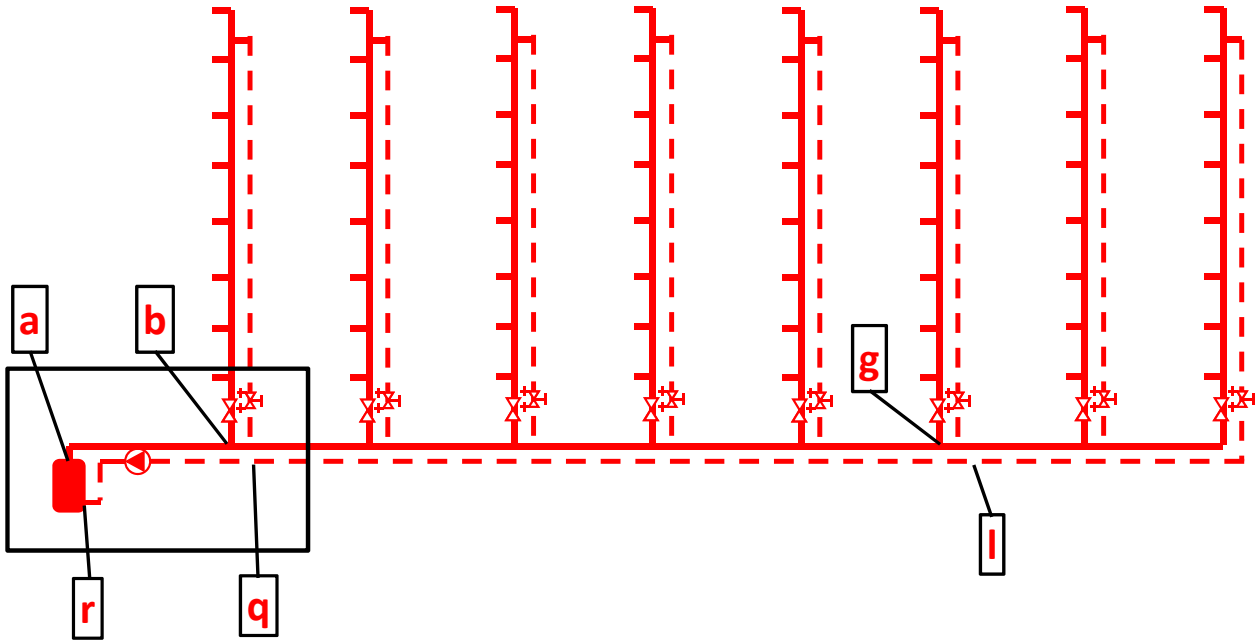
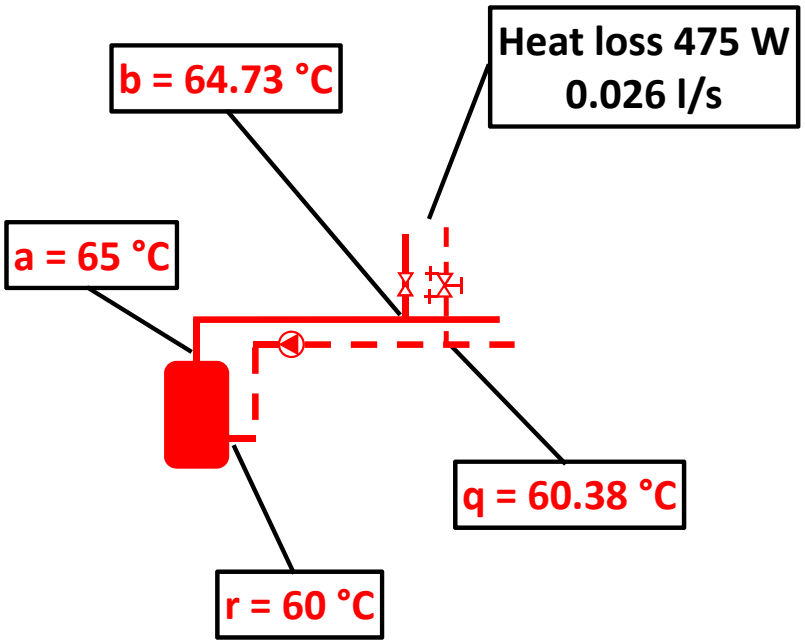
2. Calculations



2. Calculations



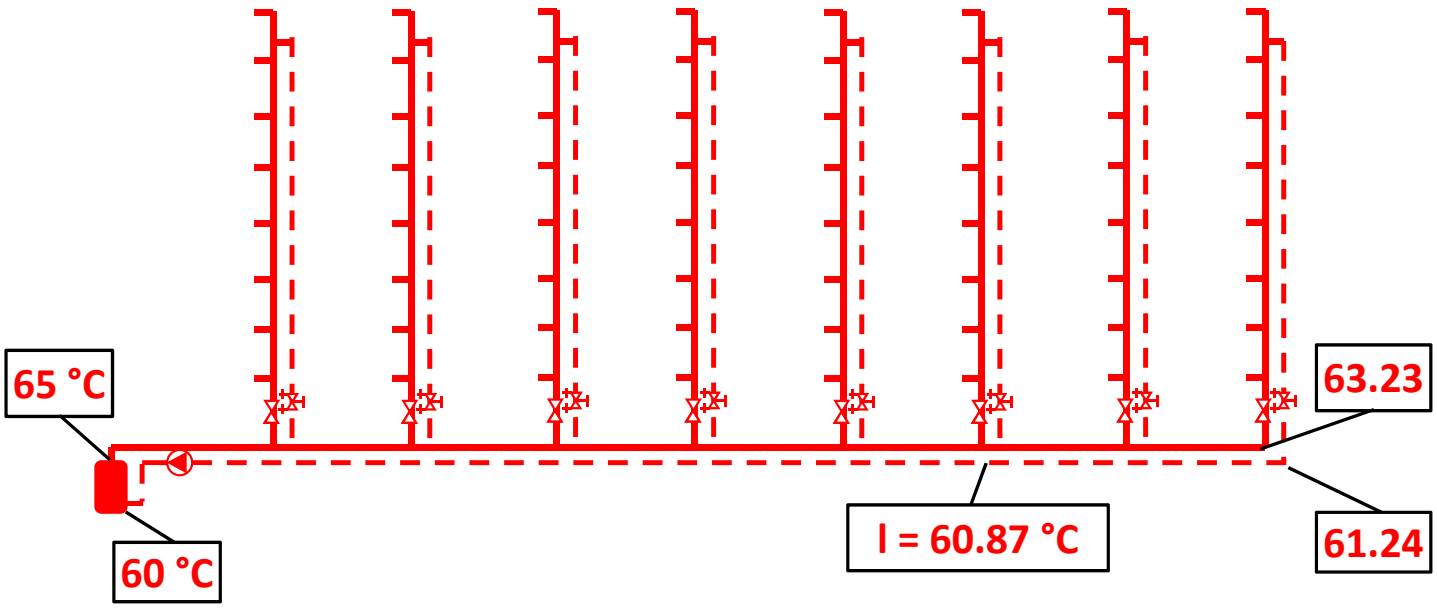
The heat loss depends on:

- **Pipe size**
- **Length**
- **Thermal insulation**

ΔT:

- **Supply** **a – b = 0.27 K**
- **Circulation** **q – r = 0.38 K**
- **Loop** **b -q**

2. Calculations



ΔT supply 1.8 K → 0.22 K / 8 m
ΔT circulation 1.2 K → 0.15 K / 8 m

3. Thermostatic balancing valves in practice

Several manufacturers on the market.

A random selection for the purpose of TVVL investigation.

KEMPER

Multi-Therm
fig. 141 OG
Thermostatic

oventrop

Aquastrom
T-plusThermostatic

NO disapproval of
the products or suppliers!

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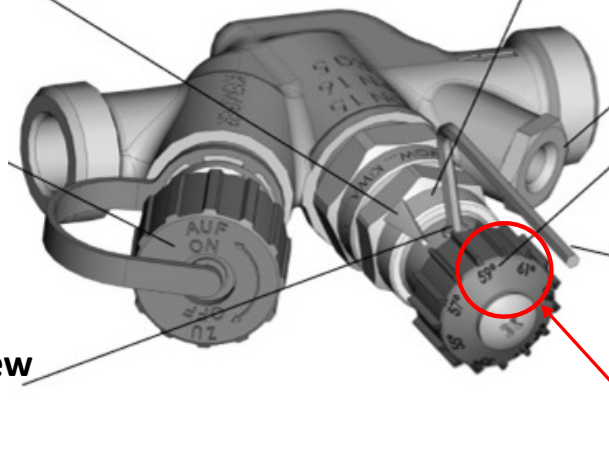
3. Thermostatic balancing valves in practice

Kemper

- **Accuracy ± 2 K**
- **Adjustable range 50 – 65 °C**
- **Factory pre-set 58 °C (German value)**
  - **Be aware of the required set-point!**
- **Sizes DN 15 (½”) , 20 (¾”)and 25 (1”)**

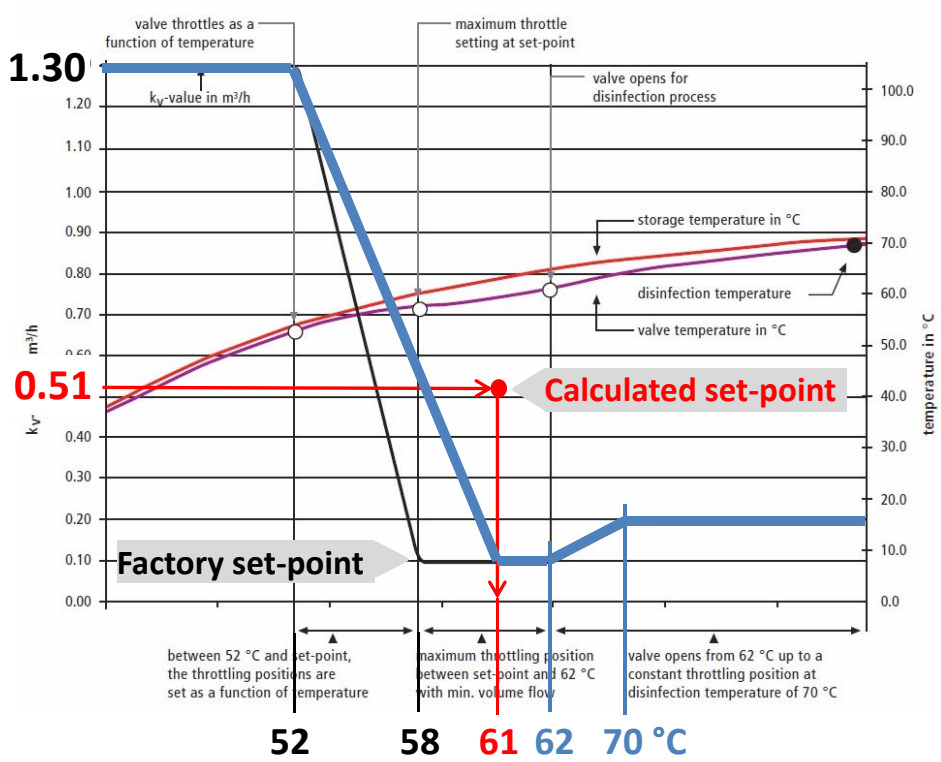
3. Thermostatic balancing valves in practice



Step 59 – 61 °C

Challenge to adjust on 60.87 °C!

3. Thermostatic balancing valves in practice



Example loop g - l

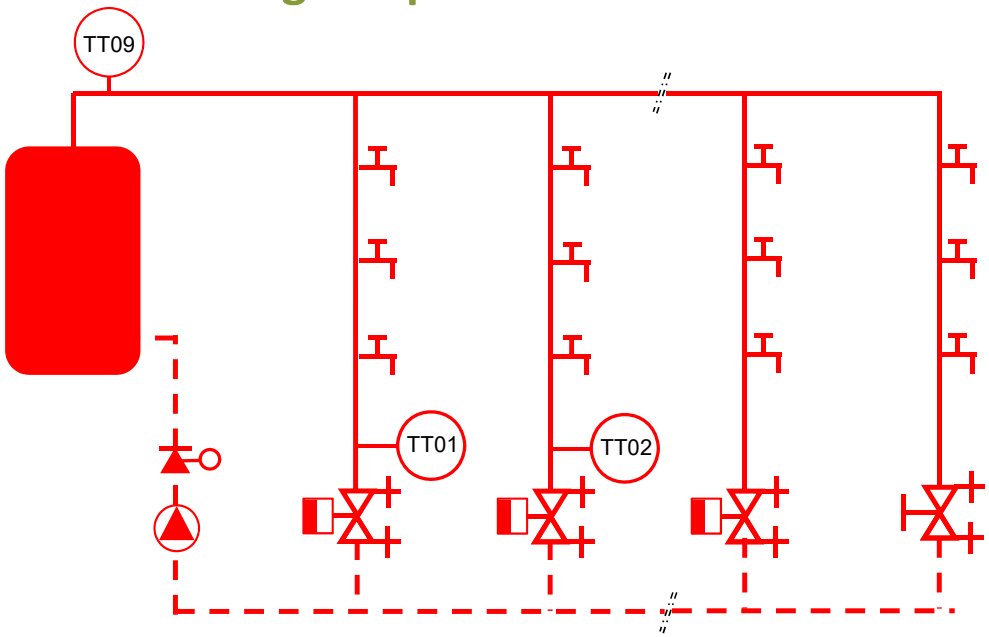
l = 60.87 → 61 °C
Accuracy ± 2 K

Calculated
Kv-value 0.51 m³/h

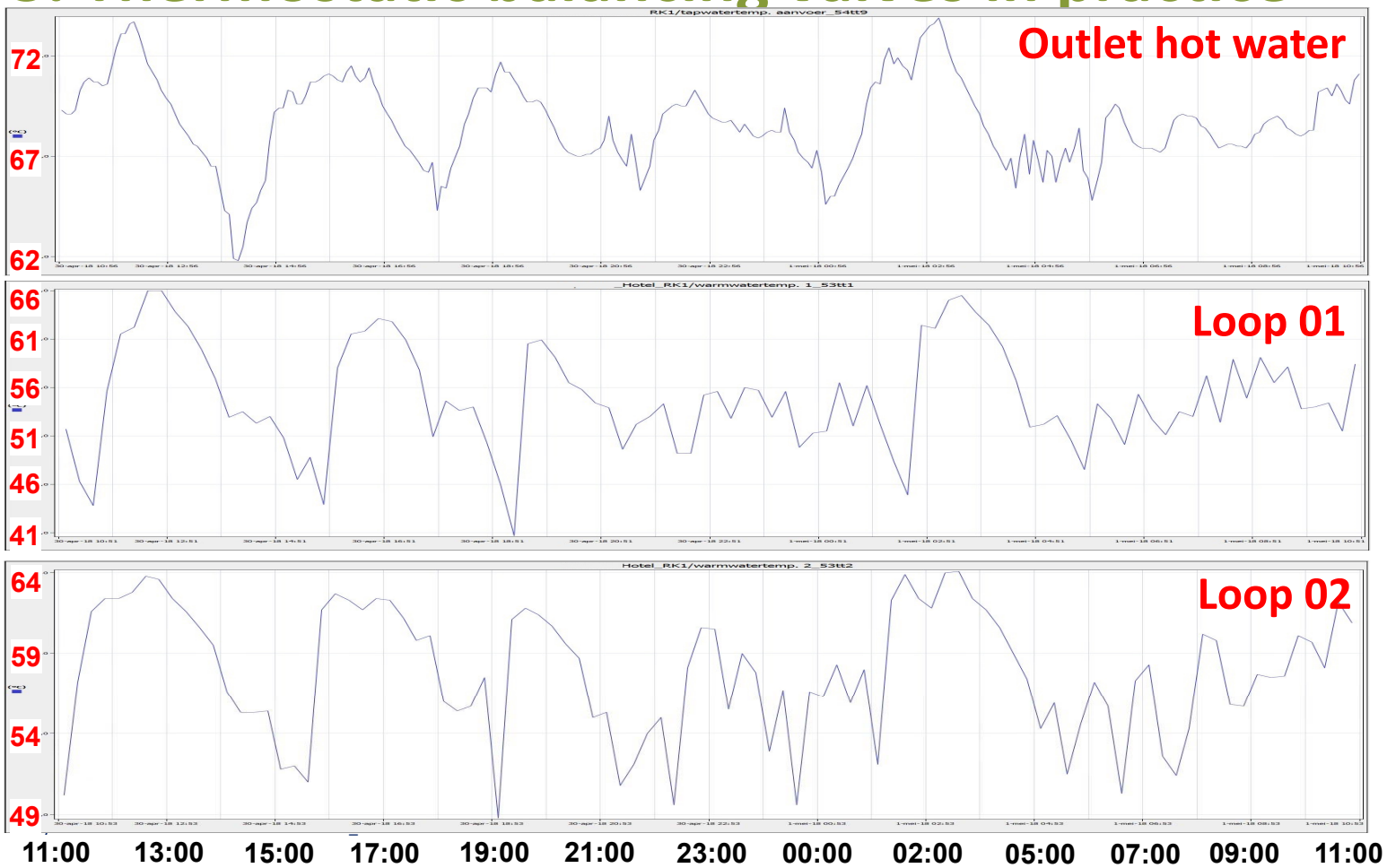
≤ 52 °C
Kv-value → 1.3 m³/h

3. Thermostatic balancing valves in practice

Measuring temperatures in a hotel



3. Thermostatic balancing valves in practice



3. Thermostatic balancing valves in practice

Oventrop Aquastrom T-plus.

Aquastrom
T-plusThermostatic

Result:

- **Changes in larger diameters**
  - **Higher heat loss**
  - **Higher flow rates**
  - **Larger balancing valves**
- **Calculation according German standard**
  - **Velocity 0.7 instead of 1.5 m/s → larger pipe sizes**
  - **Dutch technician isn't aware about this**
  - **He expects reliable calculations**

4. Conclusions and discussion

Conclusions:

- **Start with an accurate calculation.**
- **Use thermal insulation, thickness 35 mm.**
- **Check and adjust set-point temperature.**
- **TBV requires a proper design (Static BV as well).**
- **TBV can't substitute a bad design.**
- **TBV can't substitute a badly constructed HWS.**

4. Conclusions and discussion

Conclusions:

- **The manufacturers:**
  - **Offer to make calculations**
  - **Use their own software**
  - **The results differ from the basic assumptions**
  - **They can't provide Kv-values**
- **Technicians aren't aware about it**
- **Around the performance of TBV question marks still exist.**

What experiences do you have with TBV?

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Personal biography

Walter van der Schee BSc is an employee of Croonwolter&dros based in Amersfoort the Netherlands. He is responsible for mechanical and plumbing design and construction in commercial buildings.

As member of the Dutch Technical Association for Building Installations (TVVL). He is one of the experts consulting for Plumbing technologies. For his work within the TVVL he was awarded the BJ Max award in 2006.

For further information about Walter's employer or the TVVL association consult their websites.
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