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hydronic balancing

THE guide for the practitioner! Because less is more - factual, logical and understandable!

usable for radiator and underfloor systems

Everything on 2 pages? It will work ...

Dear professionals,

Has this ever happened to you: You read a technical article, a standard, a set of rules and then ask yourself: And what should I actually do now, where can I find the solution to my problem ?

This is exactly how it should NOT be. That's why I took up the challenge and gave my slogan ...

The right amount of water in the right place at the right time

.... is now followed by this guide, which describes the complete subject of hydraulic balancing in existing systems on 2 pages. Not possible ? Yes ... it can! Of course, there are several additional pages of description with the elementary components 1 2 and 3 but the two modules 4 and 5 are the red optimisation thread for you - suitable for millions of existing buildings.

Yes, hydraulic balancing is complex, but it doesn't have to be complicated. Just try it out - it works!

Best regards

Bernd Scheithauer

5 blocks for hydronic balancing

1 The room-by-room heating load calculation

- A simplified room-by-room heating load calculation (transmission and ventilation heat demand, e.g. DIN EN 12831-1 section 7, e.g. assumption of U-values) is the basis for each further calculation step.

2 The zoning into consumer units

- By dividing the heating system into as many small consumer units as possible with pressure-independent fittings, the target water quantities are maintained in every load case

3 The type of transmission surface

- The type of transfer surface (heating surface or underfloor heating) determines step by step the sequence of the replanning.

4 Define the function and the process

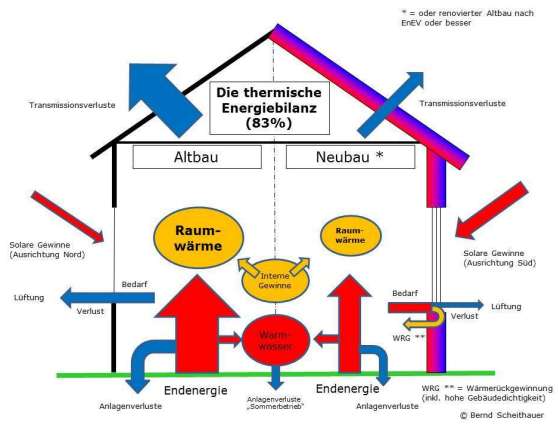
- The function of the fittings (pressure-dependent or pressure-independent) and …
- The process of setting (calculation or automaticmatic/temperature-based process), the system temperatures to be aimed for are determined, taking into account the heat generation.

5 Define the quality of the postplanning

- The procedures for a practical recalculation with varying quality

To get started: The theses for success

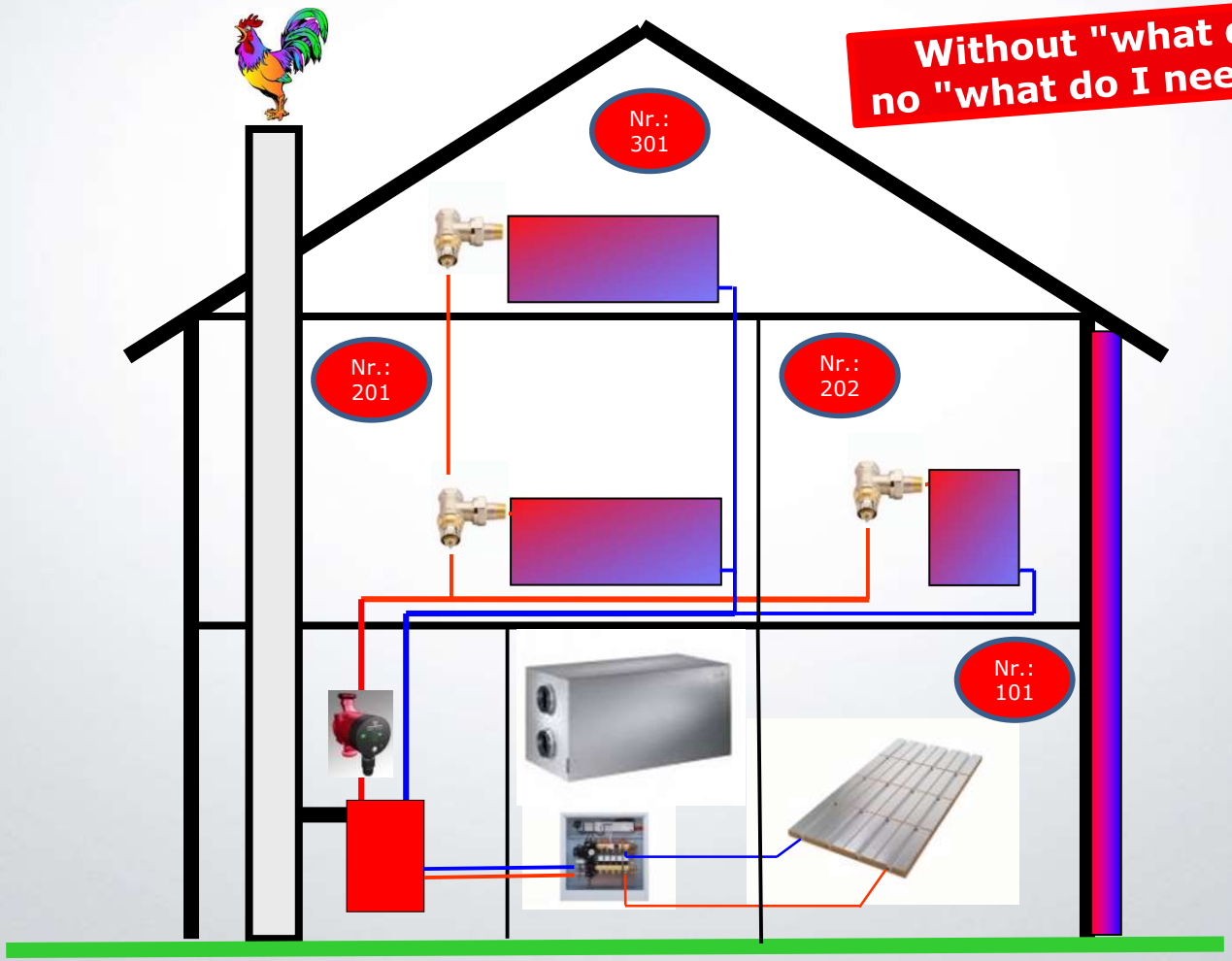
- An understanding of the system
- A common thread
- A suitable tool



Modul: The room-by-room heating load calculation

1

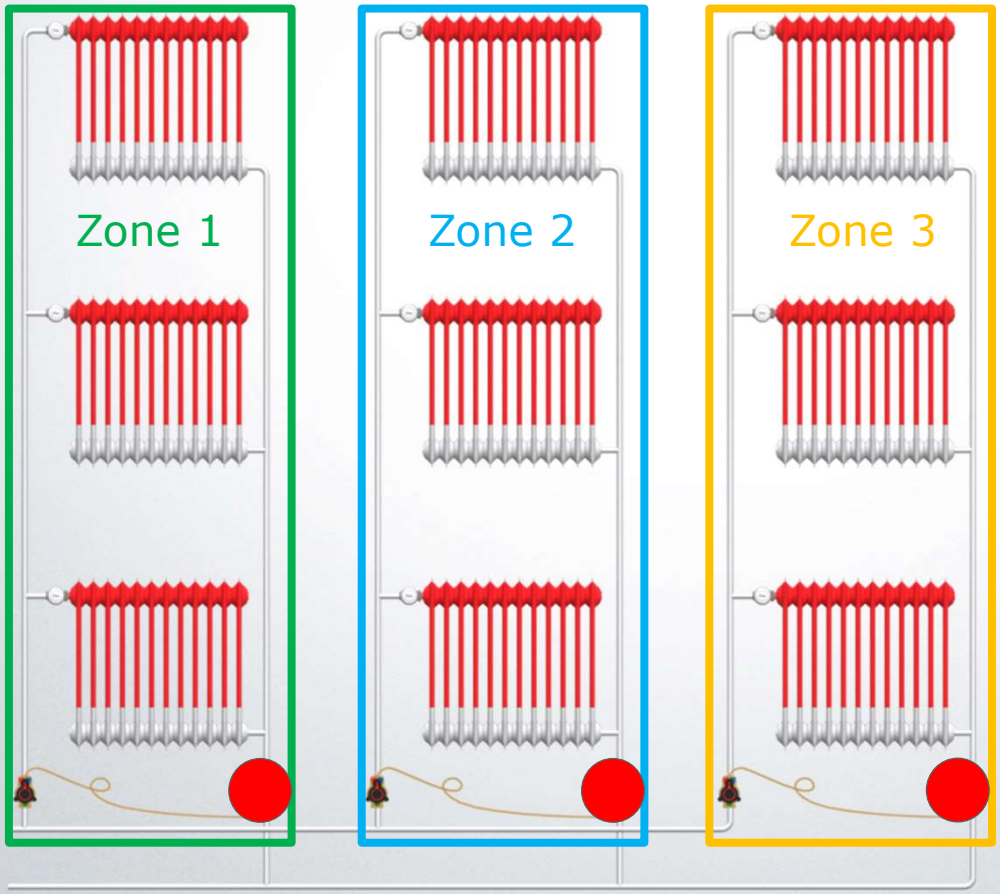
Without "what do I need"
no "what do I need to provide"

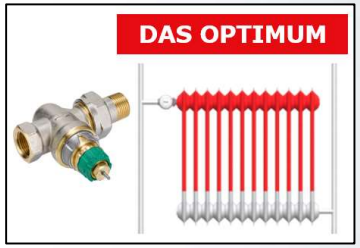


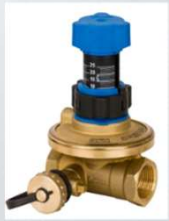
Heating load: The simplified room-by-room heating load calculation (transmission and ventilation) per room is the basis for every calculation / design.

Modul: Zoning in consumer units

2







Reference point

Zoning: breaking down a large heating system into many small systems

Modul: The type of heat exchanger surface

3

radiator

datasource: Brötje

underfloor heating

Datasource: itself

Type: The evaluation of the transformer area is just as different as the flowchart of the calculation

Modul: Function and process

4

Target: combination of transmission systems, static/dynamic fittings and adjustment process

case	transmission in existance	function of the fitting	design process	solution for practice
1	radiator	static	calculation	procedure A procedure B
2	radiator	dynamic	calculation	procedure A procedure B
3	radiator	static	automatic	No calculation*1
4	radiator	dynamic	automatic	No calculation*1
5	radiator	static	calculation + automatic	procedure A + automatic procedure B + automatic
6	radiator	dynamic	calculation + automatic	procedure A + automatic procedure B + automatic
7	underfloor heating	static	calculation	procedure A procedure B
8	underfloor heating	dynamic	calculation	procedure A procedure B
9	underfloor heating	static	automatic	No calculation*1
10	underfloor heating	dynamic	automatic	No calculation*1
11	underfloor heating	static	calculation + automatic	procedure A + automatic procedure B + automatic
12	underfloor heating	dynamic	calculation + automatic	procedure A + automatic procedure B + automatic

*1 No calculation: max. 20 consumers / zone and dp=constant per zone

function and process (radiator)

static
- Pressure-dependent valves
- Design for full load


RA-N


ASV-BD

dynamic
- Pressure-independent valves
- Design for full and partial loads


RA-DV


ASV-PV

function

calculation
- Determination of a Kv value / limitation by throttle
- Calculation parameters mass flow and differential pressure

process

automatic
- Determination of the operating point, max. valve stroke / stroke limitation
- Controlled variable room temperature and other functions

* Heating profiles, self-learning function

Function und process (underfloor heating)

static
- Pressure-dependent valves
- Design for full load

HK-Verteiler

ASV-BD

dynamic
- Pressure-independent valves
- Design for full and partial loads

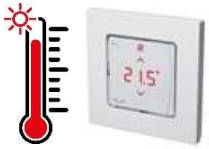
HK-Verteiler

ASV-PV

function

calculation
- Determination of a Kv-value / limitation by throttle or determination of the volume flow / flow meter
- Calculation parameters mass flow and differential pressure

automatic
- Determination of the operating point / max. valve stroke
- Two-point control with PWM signal or continuous with stroke limitation
- Controlled variable room temperature and other functions*



process

* Heating profiles, self-learning function, flow temperature control

Modul: The quality of the calculation

Overview Procedure A - B - B+ - C

Objective: Defined procedures for the determination of mass flows by calculation

Procedure ->	A	B	B+*1	C*1 new construction
Assumption: Heating load=heating capacity	Yes	No	No	No
Simplified room-by-room heating load	No	Yes	Yes	No
Heating load according to standard	No	No	No	Yes
Assumption of pipe lengths/dimensions	No	Yes	Yes	No
Pipe network calculation	No	No	No	Yes
System optimisation				
Temperature optimisation "New heating curve"	No	No	Yes	Yes
Pressure optimisation	No	No	Yes	Yes
Heat output transformer				
Radiator (2-pipe)	x*2	x*3	x*4	x
Underfloor heating	x*2	x*5	x*4/5	x

*1 Working title *2 Fixed spread *3 Real return temperature *4 New heating curve *5 Variable spread based on heating load according to calculation and heating capacity according to DIN EN 1264 / wet system

zu 5

Content description / commentary on ...

- **Procedure A:** The entry-level solution, better than nothing, but ..... very inaccurate! If you take the trouble to compare heating load and heating output, you will quickly notice that the calculation results differ immensely. For me, acceptable at best in combination with automaticmatic balancing/temperature-based procedures in small residential units.
- **Procedure B:** This should be the minimum standard for the re-design of existing systems on the basis of a simplified, room-by-room heating load calculation.
- **Procedure B+:** My proposal for a really sensible extension of a required verification procedure. In the new BEG (from 1.1.2021), the adaptation of the heating curve to the existing building is generally required in the minimum technical requirements. It is also urgently necessary to optimise the pressure ratios for heat distribution and transfer. Note the different procedure for a system with radiators or underfloor heating.
- **Procedure C:** Basically, a description is superfluous here, as planning with the listed parameters has been carried out (or should be carried out) with calculation programmes for decades! The procedure / designation is only used to recalculate buildings in the case of comprehensive renovation measures as in the case of a new building.

Appendix: The flow chart for radiators and underfloor heating

1. **Room-by-room heating load calculation** according to the permissible, simplified method B: Transmission heat demand taking into account external windows and doors, external walls, walls to ground and unheated, roof/roof space ceilings, floor to basement, floor to ground with U-values according to year of construction/age classes, new windows and subsequent insulation must be taken into account. Likewise the ventilation heat requirement.
2. **Calculation of the output of the installed heating surfaces** with a practical system temperature of 70/55°C and a dp-valve of 50 mbar
3. **Comparison of the heating load** (per room) **and the heating output** (of the radiator(s)) with the aim of determining the radiator oversizing factors.
4. Determination of the **real mass flows and real return temperatures.**
5. **Optimisation by lowering the system temperatures** = reduction of the average overtemperature = heating output of the radiator up to the calculated heating load. The "target" of a new flow and return temperature is given by the type of heat generator!
6. **Optimisation by lowering the differential pressures** across the thermostatic valves by determining the real necessary differential pressures depending on the real volume flow and the required valve authority.
7. This results in the **necessary settings** (volume flow, delivery head) of the radiator thermostatic valves, the central heating circulation pump and/or the decentralised differential pressure regulators.

Calculation tools for existing plants for

- Heating load and radiators
- Underfloor heating

1. **Room-by-room heating load calculation** according to the permissible, simplified method B: Transmission heat demand taking into account external windows and doors, external walls, walls to ground and unheated, roof/roof space ceilings, floor to basement, floor to ground with U-values according to year of construction/age classes, new windows and subsequent insulation must be taken into account. Also the ventilation heat requirement. Alternatively: heating load according to building age class, if an automaticmatic/adaptive procedure is used for balancing.
2. **Determination of the installation distance**. Suggested value: 15 cm (corresponds to 6.5m/m²). If necessary, consider edge zones.
3. The **flow temperature** (wet system, stone floor covering) required for the thermal output (= heating load) is determined from the heating load and the installation distance and **the spread** required for further calculation is determined.
4. The necessary **mass flow per heating coil** is calculated from this.
5. The **pressure loss per heating coil** is calculated using the size of the heating circuit/heating coil (m²), the installation distance (m/m²) and an assumed pressure loss (suggestion: 1.5 mbar/m).
6. From the calculated values, the **total mass flow** per manifold / system and the **minimum required differential pressure** (heating register with the highest pressure loss) are determined.
7. This results in the **required delivery head of the heating pump**, taking into account the pipe length from the furthest circuit distributor to the pump.
8. For **floor coverings with an increased thermal resistance**, the flow temperature must first be increased by calculation. Approximate values: +3K parquet, +6K carpet.
9. A **final adjustment** can only be made during operation or by adaptive systems.

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THE guide for practice! The alternative to standards and regulations for theory and practice!

The german website - knowledge for practice
www.hydraulischer-abgleich.de