Technical Paper

Flow and Difference Pressure Optimize Guide

Introduction

Between 80 and 90 % of all buildings in Northern Europe have heating systems with little or no hydronic balancing.
The results are:

- Discomfort due to under- or overheating
- Discomfort due to noise problems
- High energy costs

In 2-pipe heating systems a correct dimensioning and adjustment of the valves is a prerequisition for achieving optimal energy consumption and high user comfort.
By spending a few minutes on studying this paper you will be ready to use RA-DV *Dynamic Valves™*.

Balancing a heating system

The purpose of balancing a heating system is to optimize the flow and get as good a heat consumption as possible.
To achieve this we have to make sure that the right amount of water is distributed to the radiators, as well as the pump pressure or setting of the differential pressure regulator is correct.

Balancing - installation - performance

1. Exact calculation of the heating output,

or

2. Estimation of the Heating output:
   - Get drawings with room sizes in m^2 of all flats. If drawings are not available a laser range finder can be used for measuring the areas.
   - Select the heat loss.
   - Calculate the flow.
   - Determine preset values for each radiator valve according to the calculated flow. Find the selected preset in the Presetting table (see next page).
   - Decide together with the property owner or caretaker limitations and the current room temperature. Consider the need for thermostats with remote sensor.
   - All radiator valves must be preset.
   - Fill with water and bleed the system.

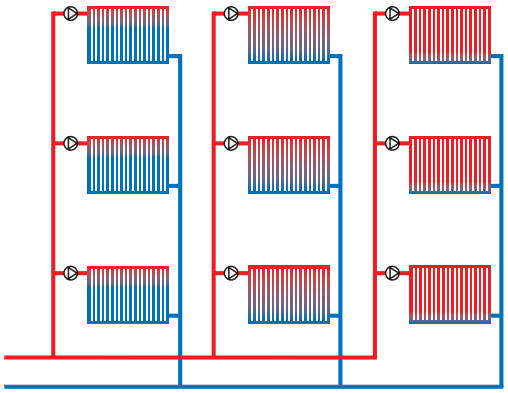

Fig. 1: Pressure and flow changes

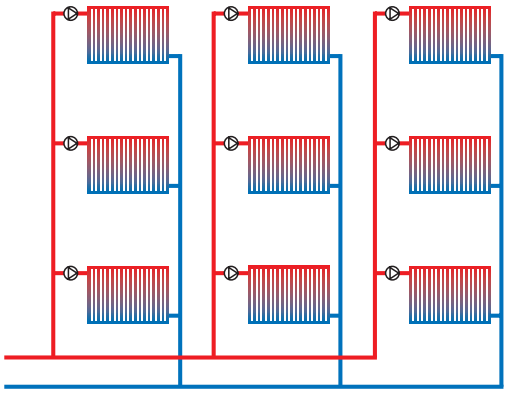

Fig 2: Comfort with hydronic balancing

Tables

1. Heat loss (empirical values)

Year of construction	until 1958	1959-1968	1969-1973	1974-1977	1978-1983	1984-1994	1995-2001	from 2002
Single family house	180 W/m²	170 W/m²	150 W/m²	115 W/m²	95 W/m²	75 W/m²	60 W/m²	40 W/m²
Townhouse: - at the end - in the middle	 160 W/m² 140 W/m²	 150 W/m² 130 W/m²	 130 W/m² 120 W/m²	 110 W/m² 100 W/m²	 90 W/m² 85 W/m²	 70 W/m² 65 W/m²	 55 W/m² 50 W/m²	 35 W/m² 30 W/m²
Multi family house: - up to 8 floors - more than 8 floors	 130 W/m² 120 W/m²	 120 W/m² 110 W/m²	 110 W/m² 100 W/m²	 75 W/m² 70 W/m²	 65 W/m² 60 W/m²	 60 W/m² 55 W/m²	 45 W/m² 40 W/m²	 33 W/m² 33 W/m²

2. Difference flow and return temperature

Typical values (K)	
Δt (K)	**Heat source**
10-15	Heat pump
15-20	Low temperature boiler
20-25	Condensing boiler
25-40	District energy, indirect

3. Presetting

RAW	RA2000	*living*/TWA	Presetting
15	20	25	1
20	25	30	2
30	30	35	3
40	40	45	4
50	50	60	5
70	75	80	6
90	95	100	7
110	125	135	N

Example

Building type	Multi family house
Year of construction	1984
Room size	40 m²
Number of radiators in the room	1
Heat effect needed	55 W/m² (according to table 1)
Difference flow (ΔT) needed	20° C (according to table 2)

Formula: $\dot{V} = \frac{\dot{Q}\ (W/m^2) \times m^2 \times 0.86}{\Delta t\ (K)} = \ldots\ldots\ l/h \rightarrow \dot{V} = \frac{55 \times 40 \times 0.86}{20} = 94.6\ l/h$

Presetting should be 7 (according to table 3, with RA2000).

Presetting of more radiators in the room

Two radiators in the room of same size should be preset to:

$\frac{94.6}{2} = 47.3\ l/h =$ presetting 5 (with RA2000)

Are the radiators of different sizes, the presetting should be calculated according to each radiator's area coverage.

Further calculation possibilities concerning the radiator performance as well as the heat loss offers the Danfoss Heating App and the DanBasic-Software.

Note!
Corner rooms, rooms with ceiling towards the outside and without heated floors, walls and concrete deck directly on soil requires slightly more effect from the radiator to provide the same comfort as in other rooms (raise the presetting with 0.5 compared with a normal room).

Presetting

The presetting values of RA-DV valves can be adjusted easily and accurately without the use of tools (default setting = N).

Presetting can be selected in steps from 1 to 7:
- Remove protective cap / thermostatic sensor.
- Find reference mark (R).
- Turn setting ring until the aquired presetting aligns with the reference mark.

At setting N the valve is fully open. This setting can be used as a flushing position, if the system has to be flushed out because of dirt problems.

When the thermostatic sensor has been installed, the presetting is protected against unintended regulation.

For easy presetting a special presetting tool (code no. 013G7830) is available.

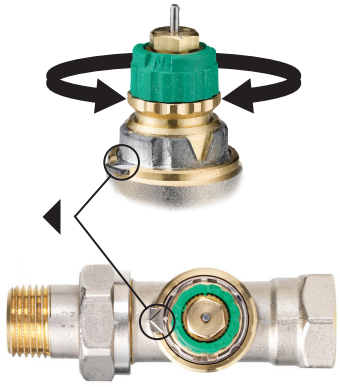

Fig. 3: RA-DV reference mark

Fig. 4: Presetting tool 013G7830

Pump Optimization

It is posilbe to save pump energy. Rule-of-tumb: 1/2 flow = 1/8 charging rate.
The operation is as follows:
- All RA-DV valves must be preset.
- Demount all the sensors.
- Change the current presetting of the valve at the most unfavorable position to 2. Measure the differential pressure over this valve with Danfoss ΔP tool and adjust the pressure of the pump (fig. 6).
- During the process the pressure for open and closed valve positions are measured and the difference is displayed (fig. 5). Lower the pump pressure until it changes, then increase the pressure until it does not change. Now the desired ΔP is obtained (RA-DV ΔP min. = 0.1 bar).
- Reinstall the sensors.
- Set the heat curve on the controller (in the heating room) at a reasonable value compared to previous settings and in relation to dimensioning outdoor temperature = approx. 65° C inlet temperature (according to the heat curve).

How to use the Danfoss Δp tool - see movie on YouTube.com

Fig. 5: Danfoss Δp tool

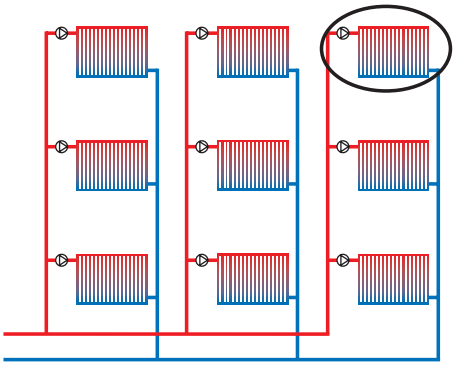

Fig. 6: Measure on the last radiator (valve).

Danfoss Installer App

Make balancing easy with the Danfoss Installer App!
Get it for free at App Store / Google Play or scan the QR code.

For more information on RA-DV valves, see special data sheet.