This project has received funding from the European Union's H2020 Coordination Support Action under Grant Agreement No. 894356.

Best Practice	HYDRAULIC BALANCING	HYDR-02
Application	Heat distribution	
SME sector	All	
SME Sub-sector	All	
Technical description	Water follows, pretty much like electricity, the path with the least resistance. Paths with low resistance get a higher volume flow than paths with high resistance. Multiple different pipes in the system lead then to different volume flows, which results in uneven distribution of the energy. To ensure proper operation of all users, even the ones far away on paths with high resistance, a higher demand of energy is needed. Hydraulic balancing should be done when: • Uneven operation of the users • Low difference in the temperatures between inlet and return • Noise in the users or pumps • High pressure losses • Missing circuit control valve or differential pressure regulator • Nominal volume flow is not available at all users at full load	
Recommendation for optimisation	Hydraulic balancing actively controls the volume flow in the different branches of the system, regulating them depending on the demand. There are 2 ways for hydraulic balancing: • Static • Dynamic The static balancing is usually done in big buildings with circuit control valves and pre-set valves at the users. It is based on the calculated volume flow rates during full load operation. The volume flow rates set during the balancing are static and thus only optimal for the full load operation. The efficiency gain in part load operations is reduced. The dynamic balancing requires special components such as adjustable valves (e.g., differential pressure regulators) and pumps that can vary the volume flow (by e.g. modulating the frequency). The dynamic balancing is also based on the volume flow rates at full load operation. However due to the various intelligent components, the volume flow can be regulated for each distribution area depending on the current need. This leads to an optimal increase in efficiency, even during part load operation.	

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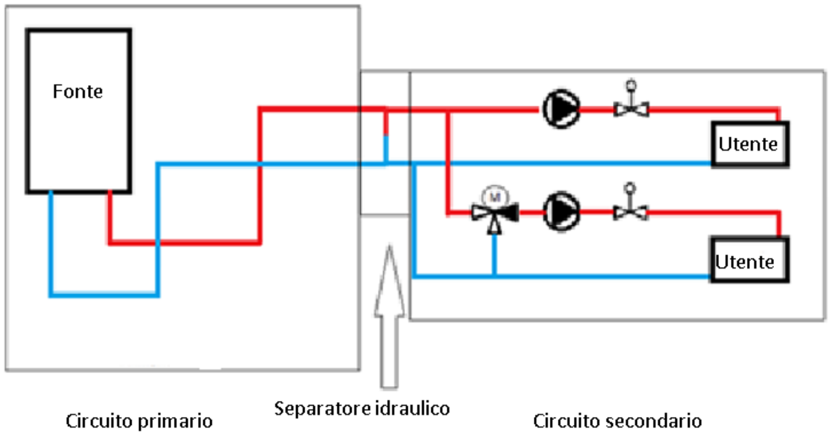
Schemes and diagrams	 Scheme of a Heat Distribution System
Economics	Costs depend on the size of the circuit. 90-300 EUR (unit cost of a balancing valve)
Energy savings	The components of a hydraulically balanced heating system work more efficiently, thus ensuring a reduction in investment and energy costs. The potential savings depend on the type of balancing (static or dynamic) and the energy performance of the building. As a rule, the newer the building, the greater the amount of heating energy that can be saved by hydraulic balancing. • About 5%: old buildings not renovated • About 10%: newer buildings, buildings undergoing renovations
Economic savings	The optimized system is 15% cheaper in operating costs.
Average Payback Time	3-6 years Depending on the system, some components, such as pumps, need to be replaced, resulting in higher investment costs, but with increased efficiency, reducing the average payback time
Emissions	Reduction of CO_2 emissions
Environmental benefits	Reduction of CO_2 emissions
Main NEBs (Multiple benefits)	☒ Environmental benefits ☐ Increased productivity ☒ Work environment/ Health/Safety ☐ Increased competitiveness Environmental benefits through reduced CO_2 emissions. Working conditions can be improved through more even heat distribution in the workplace.

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	☐ Maintenance	
Replicability	High	
Related measures	• HYDR-01: Insulation • HYDR-03: Delta T Optimization	
Case study	Dynamic hydraulic balancing company "Innsbrucker Kommunalbetriebe" (Austria, 2014) • Initial Situation: the hydraulic system has grown with the historical development of the building. The unbalanced heating system leads to an increase in flow rate and a low temperature difference between incoming and return flow. Too large pumps with high consumption were also found. • Description of the optimisation: a dynamic hydraulic balancing has been implemented on the system. This leads to a decrease in the required flow rate from 24 m^3/h to 15m^3/h. The temperature difference between the inlet and outlet flow could double and is therefore ideal for heat pumps. In this case it was possible to save 19,000 kWh/year of thermal energy and 17,000 kWh/year of electricity used for the pumps. • Implementation costs: 31,000 EUR • Payback Time: approx. 10 years	
References	Bauer M.: Leitfaden zur Optimierung von Wärmeverteilung, Wien 2018 Kulterer K.: Leitfaden technische Wärmeisolierung, Wien 2017 Novak K.: Energy recovery, The technical potential of large and industrial heat pumps, 2017 https://www.ee-ip.org/articles/detailed/87f4ab4b1d6c3c767a9dcae1e30b0808/the-technical-potential-of-large-and-industrial-heat-pumps/ Wolff D.: Einsparpotenzial des hydraulischen Abgleichs ist hoch, 2009 https://www.co2online.de/energie-sparen/heizenergie-sparen/hydraulischer-abgleich/kommentar-hydraulischer-abgleich-einsparpotential/ ASUE, Arbeitsgemeinschaft für sparsamen und umweltfreundlichen Energieverbrauch: Optimierung von Wärmenetzen bei KWK-Anlagen	

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