Hydraulic equilibration of heating and cooling systems

To electronic room regulation adapted flow

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According to recent estimates, only 10% of all heating systems work in optimal hydraulic conditions. This rate is the same for cooling systems. Radiators are pressurized irregularly, which leads to room temperature exceeding and minimum 10% energy waste. To solve this problem, ***ThermoZYKLUS*** *has developed a new electronic process to automatically control the stroke of radiator valves.*

The climate sector has had to deal with the issue of hydraulic equilibration in heating and cooling systems for several decades without finding a real solution, despite all information and training courses. The valves business offers a large range of differential pressure and flow regulators as well as softwares for network distribution calculations, but the lack of hydraulic equilibration remains the main problem in construction, may it be old or new. Even the governmental ordinance on construction services (VOB), part C, DIN 18360, which stipulates that a HVAC technician has to ensure the hydraulic equilibration of distribution networks, has very little impact.

Even the fact that energy saving measures financed by governmental subventions are linked to a mandatory hydraulic equilibration hasn't changed a thing. Experts estimate that hydraulic imbalance causes a 10 to 20% yield loss on the whole installation.

Problems caused by hydraulic imbalance:

- Too hot or too cold radiators, leading to under- or overheated rooms
- Noises from the radiator valves or lines
- High differential pressures in the valve causing its uncontrolled opening

To solve these problems and counter user dissatisfaction, users and heating professionals take following actions :

- Raise of room temperature to supply underheated radiators : performance of heat exchangers decreases, especially those of boilers (limited condensation) and heat pumps (low power).
- Raise of output by raise of pumps' speed (switch) or installation of a bigger pump : increase of energy consumption, heat loss in distribution network and traffic noises.

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Cooling system operators act in the same way (cooling ceilings and beams, ventilators, air condition). Rather than hydraulic equilibration, they prefer lowering cold water flow temperatures and increasing the pump power. Because specific refrigeration is very expensive and the power of a refrigeration unit depends on temperature fluctuations, hydraulic imbalance leads to much higher energy costs than heating installations.

"It will end up heating some time"

The process of hydraulic equilibration in new construction is well explained in specific works as well as by manufacturers of output and differential pressure regulators, radiator valves and heating pumps. Despite the large available product range and the many offered training courses, professionals most of the time drop hydraulic equilibration to save time and/or money. They hope that rooms will end up heating correctly. Hydraulic equilibration of existing installations is particularly complex because documents on the distribution network are often not available anymore. For lack of sufficient space, installors also don't use differential pressure and flow regulators which are regularly installed in new constructions. According to experts, chances for hydraulic equilibration to impose itself are very low because of too high costs. The Optimus project entitled "Optimization of heating systems thanks to information and training for a lasting use of energy saving potentials" (www.optimus-online.de) gives following guidelines for hydraulic equilibration:

- Radiator power
- System opening
- Real output (depending on power and opening)
- Duct diameter or R values and length of ducts
- Heat loss of the different resistances and special adjustments
- Residual manometric height defined for boiler

The opening/closing ratio as reference for calorie need

The electronic hydraulic equilibration by Thermozyklus is much faster, more precise and profitable. ***Reminder: Thermozyklus uses a patented regulation algorithm*** for the THZ thermocyclic regulation to open or close completely the radiator. The valve isn't used in the traditional positions of a regulator P, I or PID. Thanks to the permanent room temperature measurement, the THZ regulation detects temperature micro variations and analyzes them in order to regulate room temperature precisely at ± 0,15 Kelvin. The resulting information helps to determine the necessary liquid output to achieve the defined energy input.

This way, you'll obtain a pulsation period with active heating (open valve) and one while heating is not needed (closed valve). The ratio of opening and closing periods allows calculation of a room's real energy need, which leads to the representative value per room. By comparing all the data from a heating circuit, you determine the output of every radiator as well as variations between them. These data are then used to reduce radiators depending on their specific representative value.

Following this regulation method, two solutions are possible to achieve hydraulic equilibration:
1. Implementation of THZ System on radiators/collectors in order to determine their specific representative values; manual setting of the "té"
2. Implementation of THZ System on radiators/collectors in order to determine their specific representative values (as in point 1). Association of THZ System and proportional actuators ; limiting of actuator stroke depending on determined representative value so that the actuator varies between « open » and « reduced » position.

Thanks to THZ thermocyclic regulation, hydraulic equilibration becomes easy. Moreover, this process stores the real hydraulic conditions, which makes it even more precise than the distribution network.

In short…

The thermocyclic regulation is an approved method based on practice to automatically generate the individual characteristics for the reduction of radiators and distribution network cooling points, especially for existing installations.

The obtained data allows either to manually set radiator valves or valves' lower parts, or to automatically limitate the proportional actuators' valve's run with a regulator.

All complex distribution network calculation is useless. Depending on hydraulic conditions of an installation, you can save between 10 and 20% energy. That's especially true for heating systems whose boilers haven't been condensed enough and for installation where the heating pump COP is bad.

The method is also suitable to regulate cooling systems whose performances aren't sufficient because of hydraulic imbalance.

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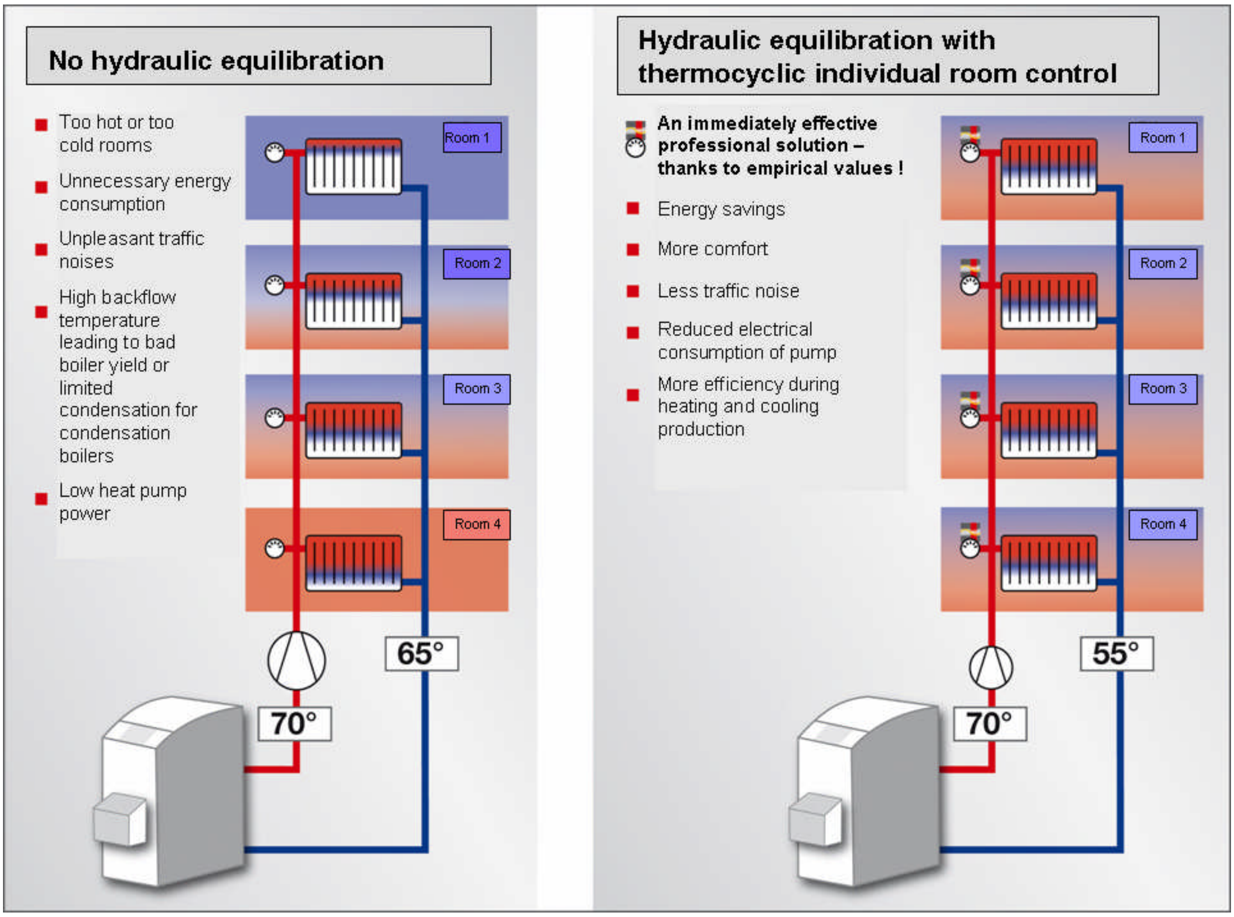
Illustration



Theoretically, hydraulic equilibration is reached when all thermal devices (all radiators in one heating circuit for a warm water heating installation) have the same hydraulic resistance to the heating liquid. In practice, this is only possible with stable conditions (open valves). Hydraulic equilibration is realized for the critical solution, which means for the maximal thermal load (when all radiators are crossed). If all radiators have the same size and proportion, hydraulic equilibration ensures that every radiator of a heating circuit is furnished with the same energy quantity because energy transported to the radiator is proportional to the heating liquid temperature and the output.

In practice, radiators are rarely identical because they are often chosen for their design and technical features that fit the building's construction. Moreover, the number and/or the type of radiators depend on the room to heat and on their location. The base for identical thermal conditions with a same energy input is the tailoring of number and type of radiators to calorie need. Energy distribution in the room and room temperature depend this way on local room conditions (calorie capacity, heat loss, internal and external thermal gains).

These relationships are taken into consideration as far as possible during radiator implementation in one room. But, as finished industrial products, radiators cannot be precisely adapted to every room. That's why it's interesting to regulate outflows to ensure ***every room receives exactly the needed energy input to reach the same temperature as the other rooms*** *(for expl 20°C). The energy input has to depend on a room's calorie need.*

To achieve an optimal hydraulic equilibration, it is necessary to regulate outflows in order to provide every room with the same energy input for the planned power.

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