The present development of thermostatic control in individual rooms

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When we remember that almost one-third of the carbon dioxide emitted in Germany is produced during the heating of houses, it is obvious what the significance of this area for the future energy savings is [1]. Since the introduction of the Act on energy savings in 1976 there have been attempts to utilize this enormous saving potential by raising the requirements concerning thermal insulation and heating systems. The law concer-ning the management of natural resources that came into force in February 2002 has got the same target [2]. The regulation concerning individual rooms with new amendments is still binding as a standard.

Theoretically, there is a number of methods to control temperature in rooms: the temperature control of the heating medium in front of each heating surface, the control depending on the load, the modification of air-flow at a radiator and the control of the heating medium stream. The decentralized control of the initial tempera-ture would require various devices and is rare due to relatively high outlay it requires. The change of the airflow around a radiator is prac-tical when the heating is purely convective and is used only in individual cases. The change of the heating medium stream is, in technical terms, the simplest to implement and its most popular standard application are thermostatic valves.

A thermostatic valve of a radiator is a proportional controller that does not require any auxiliary energy and its functions are simple. The energy present in a room is utilized in order to assume the modifications of the setting values. The main part of the controller is an extensible element that reacts to any changes of the room temperatures. A corrugated pipe filled with gas or liquid that expands while heated and influences the valve by limiting the supply of the heating agent is used here. However, when the room temperature drops, the supply of the heating agent rises. Wax elements do not meet the present standards, as the savings of energy are small due to their durability.

The technical requirements for thermostatic valves are uniform all over Europe [4]. For all thermostatic valves that have the mark of compliance with CEN there are uniform quality standards. The minimal requirements concerning the thermostatic function of a radiator valve with regard to hysteresis, the influence of the differential pressure, the impact of the constant pressure and other qualities as well as other significant control factors are precisely defined.

Nonetheless, the accurate balance and the operating conditions of a thermostatic valve are also key criteria for the thermostatic functions of a radiator.For example, the kv value of a valve above the fixed settings in a valve should be possible to adjust precisely to the heat efficiency of a radiator and the resulting mass stream. The regulation concerning energy savings and the German Industrial Standard 4701 T 10 [3] differentiate here between the proportional scope of compensation with the value of 2K and the higher energy saving of the optimised AP scope with the xp value equal 1K. These requirements are met especially by RA 2000 sensor elements with a high specific stroke manufactured by Danfoss. In order to optimise the control characteristics, a constant differen-tial pressure is to be maintained within the scope from 5 to 10 kPa and it should not exceed 10-20 kPa under a partial load. Besides, there is an option of selecting a proper pump depending on the system an additional decentralized controller of the differential pressure can be fitted [5].

Unfortunately, these criteria of compensation are too often neglected while installing a system, in spite of the development of technology in this regard [6]. Even more often is the significance of the precise selection and the correct fitting of a sensor overlooked. Generally speaking a sensor is to be fitted in such a way that it can measure a room temperature as precisely as possible. Additionally, it is recommended that the air heated by a radiator or piping should not influence the sensor. This may be the case when a sensor is fitted behind dense curtains or verti-cally in a deep recess. In such cases one should use a sensor whose detecting instrument is remote from the valve.

Modern designs of valves offer additionally ergonomic sensors with adaptable length of a capillary pipe that can be easily fitted in hidden locations. If a valve is fitted in an inaccessible place, for example behind a housing or directly next to an under-floor convector,

one can use an element fitted remotely, in which the control element is fitted in a wall far from the valve.

The saving of energy obtained by the use of thermo-static valves compared to manually con-trolled valves amounts to 10-15% according to the experience (in individual cases up to 20%) and results primarily from the use of the free heat in a room. This may come from the thermal radiation of electrical appliances or solar radia-tion but also from the presence of a larger number of people in a room. Moreover, the volume of energy savings depends to a large extend on the habits of users, as has been confirmed by numerous researches [7]. Apart from the better information provided to the users on the functions of thermal controllers, it is still necessary to make the operation by the users easier and to use any possibilities to save energy [8].

The decisive step in this direction are the program-mable radiator thermostats. In fact the point here are the controllers that do not use any external energy and enable, by the use of built-in time switches, the individual reduction of heating at times when an individual room does not need to be heated. Hence a user gains comfort of a heated room when this is required. Thanks to the automatic phase of the reduction the thermostat of a programmable radiator takes over the manual function of reducing heating that is rarely used by users and in this way saves more energy. This device is particularly useful in rooms that are used regularly but have to be heated for only a limited period of time. An example of such a room is the bathroom, which should be warm when users get up and next the temperature may be automatically reduced, or a children's bedroom, where energy can be saved when children are at school.

The thermostatic valve of a radiator, due to its good value for money and, as the recent research shows, still not utilized potential of energy saving, is a standard solution of econo-mical and current control of heat in individual rooms. Its optimal operation is reached in com-bination with the correct com-pensation and operation by users. A programmable thermostat offers even better possibilities of energy saving thanks to its automatic functions and at the same time it ensures higher comfort.

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