



# THE INTELLIGENT WAY TO INSTANT COMFORT

**GRUNDFOS' POPULAR COMFORT CIRCULATOR PUMP HAS BEEN UPGRADED. THE NEW, INTELLIGENT COMFORT PUMP WITH AUTOADAPT ADAPTS THE DOMESTIC HOT WATER SUPPLY TO THE INDIVIDUAL CONSUMPTION PATTERN. BY EFFICIENTLY MINIMISING THE PUMP'S OPERATION TIME ENERGY SAVINGS OF UP TO 85% CAN BE ACHIEVED.**

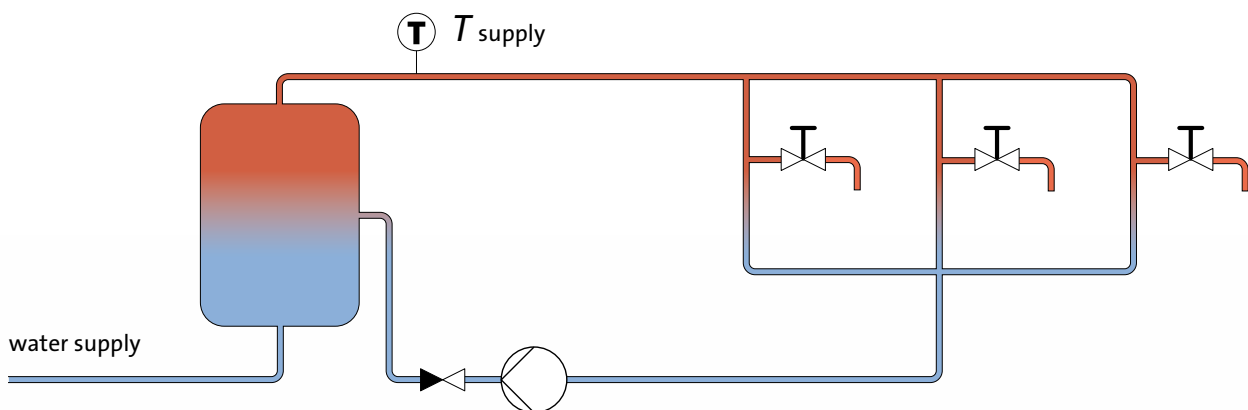
By Manfred Bayer, Global Product Manager, Grundfos Management A/S, Bjerringbro

Every year, an estimated 70-80 million m<sup>3</sup> clean drinking water flows unused into the sewer system, as consumers wait for hot water when they turn on the tap. A hot water recirculation installation eliminates this waste of valuable resources by providing instantly hot water. Another benefit is increased comfort for the consumer. Traditional domestic hot water pumps, however, demand circulation, also in-between tapping of water. This is why Grundfos has taken the COMFORT pump one step further and developed the AUTOADAPT system.

The COMFORT pump with AUTOADAPT automatically adapts to the individual water consumption pattern in one-family houses. The hot water supply is limited to the tapping time alone. Compared to traditional circulator pumps the AUTOADAPT function will cut back up to 85% of the energy consumption. On top of that, the innovative solution reduces heat radiation loss from the pipe – a waste of heat energy that actually forms the biggest part of the energy balance.

## THE PRINCIPLE OF AUTOADAPT

So how does AUTOADAPT work? To answer this question we must take a look at a simple hot water system, consisting of a heating element, a supply pipe, a secondary return pipe, and a number of tapping points (Fig 1). The hot water circulator pump is placed on the secondary return pipe (blue) and an external temperature sensor on the supply pipe (red).



The external sensor and the sensor integrated in the circulator pump regulate the temperature of the water, and recognise when hot water is tapped from the drinking water system. The pump is activated shortly before the hot water is needed, in order to fill the hot water pipe in its full length. The result is instantly hot water when the tap is turned on – and no waiting time or waste of water.

How the AUTOADAPT function is able to take perfect control of the hot water consumption is described in more detail the following.

## KNOWING THE HOT WATER TAPPING PATTERN

The external temperature sensor mounted on the supply pipe (red) tells the story about the hot water tapping pattern. Every time hot water is tapped the temperature changes, as soon as the hot water is led from the water heater. This is registered with a special filter and logged in the tapping calendar.

*Remark: Start-up of a circulating pump also causes a change in temperature. Therefore the algorithm takes into consideration whether the change in temperature is caused by pump start or by tapping of hot water. Only the latter is logged in the tapping calendar.*

## MAKING A TAPPING CALENDAR

Every hot water tapping is logged in the calendar that covers at least one week's tapping history (Fig 2). Each calendar day is divided into 15 minutes time slots. When tapping of hot water is registered within a time slot, a T (for tapping) is noted in the calendar for this particular time slot. If no tapping is registered within a time slot, a 0 is noted. Based on the algorithm in the calendar log the AUTOADAPT simply concludes when the next tapping of hot water can be expected; i.e. in those time slots where most T's have been noted over the days.

	0:00	0:15	0:30	...	7:00	7:15	7:30	7:45	8:00	...	23:30	23:45	
Today	0	0	0	•	•	•	0	T	0	0	•	•	•
Yesterday	0	0	0	•	•	•	0	T	T	0	•	•	•
	0	0	0	•	•	•	0	T	0	0	•	•	•
	0	0	0	•	•	•	0	T	0	0	•	•	•
	0	0	0	•	•	•	0	0	T	0	•	•	•
	0	0	0	•	•	•	0	T	0	0	•	•	•
1 week ago	•	•	•			•	•	•	•		•	•	•
	•	•	•			•	•	•	•		•	•	•

Time slots

Days

In the example shown in Fig 2, 6T are noted in the time slot 7:15-7:30, and 2T in the time slot 7:30-7:45. This means that the circulating pump will ensure that hot water is available at the tap the next day at 7:15. According to the calendar log in the example the pump should also ensure hot water at 7:45 and 23:30.

In the example only one week's data is logged. The AUTOADAPT's control function in fact logs two weeks' data. This way the different consumption patterns of workdays and weekends can be taken into account.

## CONTROLLING THE PUMP

The controlling of the pump is based on the calendar log and the temperature measured in the pipes. The temperature control follows the hot water temperature set on the pump thermostat and a hysteresis curve stored in the pump.

The temperature dependent hysteresis control is activated only when the data in the calendar log shows a high probability of tapping of hot water within the next 30 minutes. In the example the hysteresis control will be activated at 7:00, and deactivated at 7:45 when no more tapping of hot water is to be expected.

## PUMP CHARACTERISTICS

Characteristic of the COMFORT pump is the single-phase, 2-pole hysteresis-permanent-magnet motor. This construction is very resistant against impurities, even the unavoidable calcareous deposits in open systems.

Compared to a conventional canned motor the spheric motor has no circulating shaft, i.e. the magnet field is transferred from the stator to the rotor placed in the water-bearing part of the pump. The water-bearing part of the pump is hermetically divided from the stator by a calotte of stainless steel.

A benefit of this construction is the wear-less operation due to liquid lubricated bearing, securing noiseless operation and long life time. Furthermore an application area up to 14°dH water hardness is unproblematic. The pump motor can be separated from the pump housing, facilitating cleaning and service. Non return valves and shut-off valves are integrated in the pump housing, which is in brass.

## INSTALLATION ACCORDING TO DIN 1988

The hot water circulation system consists of a supply pipe and a secondary return pipe. The supply pipe runs from the water heater to the remotest tap. The secondary return pipe is led from below the remotest swivel fitting.

According to the flow a circulation of the water content with the factor 3 per hour in the circulation pipe is sufficient. To avoid noise and erosion in pipes the maximum flow rate should not exceed 1,0m/s, in copper pipes 0,5m/s. In circulation systems with more than one string the installation of string valves is absolutely necessary.

The regulations of the DVGW working papers W 551 and W 553 are also relevant when it comes to legionella prophylaxis.

*DIN 1988 describes how to plan and operate hot water installations, part 3 in particular hot water circulation installations and the installed circulating pumps.*

## CONCLUSION

The built-in AUTOADAPT functionality in the COMFORT circulator pump is based on the data of individual tapping habits. The control software uses the data in the calendar log to ensure the right temperature of the water at the right time, meaning that hot water is available shortly before the tap is turned on. Also the hygiene is secured: if there is a Legionella function in the boiler, the COMFORT pump with AUTOADAPT automatically recognises that thermal disinfection of the circulating system is required.

