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STUDY ON DETERMINING THE THRESHOLD OF SENSITIVITY OF WATER METERS

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Abstract: *The paper presents a study on determining the threshold of sensitivity of water meters. It presents also an experimental installation consisting of several water meters of different types which is used for determining the threshold of sensitivity of the water meters considered. The threshold of sensitivity may be defined as the slightest variation of the input parameter which can produce a variation of the output parameter, variation which can be measured.*

Key words: *threshold of sensitivity, metrological reliability, water meter.*

1. Introduction

The paper presents a study on determining the threshold of sensitivity of the water meters in an experimental installation consisting of several water meters of different types.

An essential element of water meters, not specified in the prospectus of the producers, but which proved to be important in practical terms, is the sensitivity of the water meter. This sensitivity, which represents a characteristic of all measuring instruments, is closely related to accuracy, typo-dimensions, and manufacturing method and it is expressed by the input flow *Qp* - the threshold of sensitivity.

The threshold of sensitivity is defined as the smallest variation in the size of input which can cause a noticeable change (which can be measured) in the output signal. It is a characteristic of entry and is the smallest measuring variation which can be highlighted. The threshold of sensitivity determines the accuracy and it is determined by the device resolution, the noise level (self and external) and the sensitivity of the null indicator; it can be increased by measuring at low temperatures or by increasing the measurement time [2-5].

The major disruptive factors which influence the threshold of sensitivity of the water meters are: noise in electric circuits, static friction and clearance in mechanical gears. The threshold of sensitivity can not be lowered below a minimum required [2].

2. Description of the Experimental Installation

The experimental installation used in the research is presented in Figure 1. The block scheme of the experimental installation is presented in Figure 2 [1].

The experimental installation consists of

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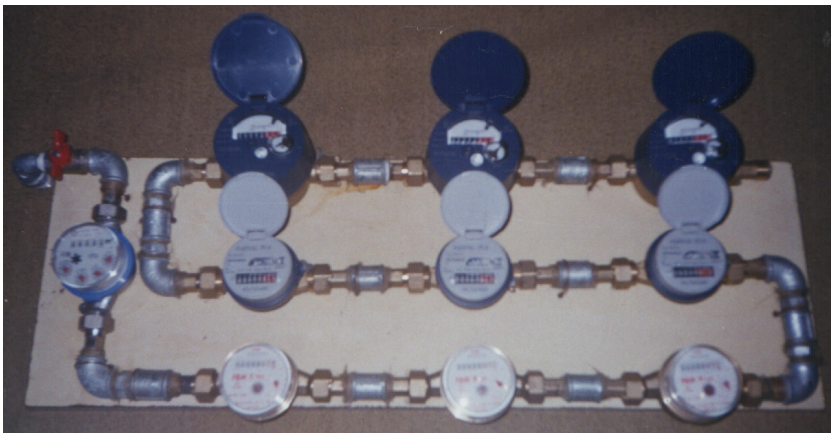

Fig. 1. *Experimental Installation*

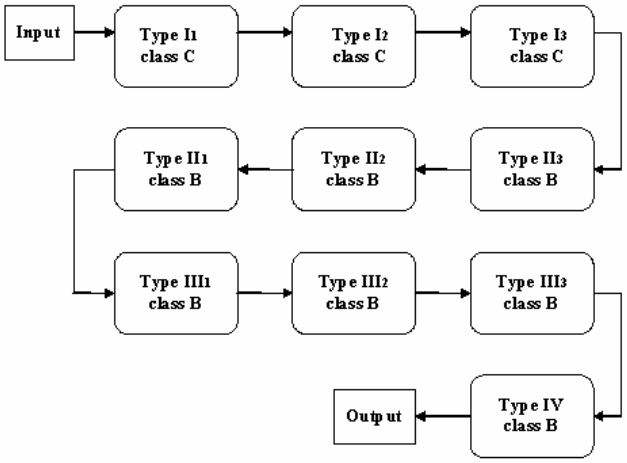

Fig. 2. *Block Scheme of the Experimental Installation*

ten water meters of four different types: three water meters of type I (precision class C), three water meters of type II (precision class B), three water meters of type III (precision class B) and a water meter of type IV (precision class B), connected in series arrangement [1].

3. Determining the Threshold of Sensitivity of the Water Meters

For determining the threshold of sensitivity of the water meters, experimental studies were conducted. In these experiments one decreased the water flow in order to achieve the moment when the water meters do not record any volume of water. Experiments were conducted in normal operating conditions [1].

Based on the differences between the indications of the water meters before and after flowing a specified volume of water in a certain time period, it was found that, by reducing the water flow to very low levels, all water meters have indicated a different volume of water than the real volume.

Threshold of sensitivity of the water meters Table 1

Group of the water meters	Precision class	No. of the water meter	Real water volume, [L]	Water flow *Qp*, [L/s]
Group I	C	1	0.1	32.432432×10^{-3}
		2		34.883721×10^{-3}
		3		33.898305×10^{-3}
Group II	B	4	0.1	19.78022×10^{-3}
		5		19.017433×10^{-3}
		6		20.536224×10^{-3}
Group III	B	7	0.1	22.727273×10^{-3}
		8		21.238938×10^{-3}
		9		22.126613×10^{-3}
Group IV	B	10	0.1	27.586206×10^{-3}

Table 1 presents the water flows representing the threshold of sensitivity for the water meters from the experimental installation, measured in normal operating conditions [1].

The water flows indicated in Table 1 represent the threshold of sensitivity of water meters considered; for these values of flow there is a noticeable variation in relation to the water volume recorded. By reducing the water flows below these limits, there is no indication towards the water volume flowing through the water meters, such as these volumes of water can not be recorded by the water meters.

By analyzing the values for the water flow presented in Table 1, one can draw the following conclusions:

- in normal operating conditions, comparable values are found for water meters of the same type;
- water meters of precision class C (group I) have a threshold of sensitivity higher than those of precision class B (group II and group III), in normal operating conditions.

The threshold of sensitivity of the water meters in a potable water supply system can be used in the analysis of the metrological reliability of the water meters, for the rational utilization of the potable water resources.

Water meters, due to their threshold of sensitivity, may produce errors in the metering of the consumed water. In case of a high value of the threshold of sensitivity of the water meter, due to the fact that water flows below this limit produce no indication of the water meter, the volumes of water passing through the water meter can not be recorded. All these facts lead to financial losses which are carried by the water company; on the other side, conditions for the irrational utilization of the potable water resources are created.

As a conclusion, it is important to determine the threshold of sensitivity of the water meters and to find solutions for decreasing the value of the threshold of sensitivity as much as possible for reducing or eliminating the errors produced in metering the consumed volume of water.

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