INFLEUNCE OF TYPICAL FLOW DISTURBING COMPONENTS ON THE FLOW RATE IN SELECTED AVERAGING PITOT TUBES

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Flowmeters with averaging Pitot tubes are becoming more and more common in industrial practice. It is often the case in long straight sections of channels with large diameters that the conditions regarding the adequately long sections of pipelines before and behind a flowmeter cannot be fulfilled. This is associated with the occurrence of an additional measurement uncertainty with an unknown value. In handbooks un the metrology of liquid streams [1, 2], technical documentation of flowmeters [3] as well as standards [4] one can come cross information regarding the necessary lengths of straight sections of a pipeline before and behind a flowmeter in order to maintain the guaranteed certainty of measurements. Most of information regarding this issue can be found for the case of Venturi probes. The amount of data regarding flow averaging Pitot tubes is also limited. Hence the decision to undertake the proposed subject. The tests were undertake on a test stand whose principal component is an open wind tunnel that operates on the principle of section and a system of pipelines with throttles and installed turbine flowmeters. The pumping unit in the system is made of a centrifugal fan powered by an electric motor. The efficiency of the fan could be smoothly regulated by a frequency converter. The diagram of the test stand is presented in Fig. 1.

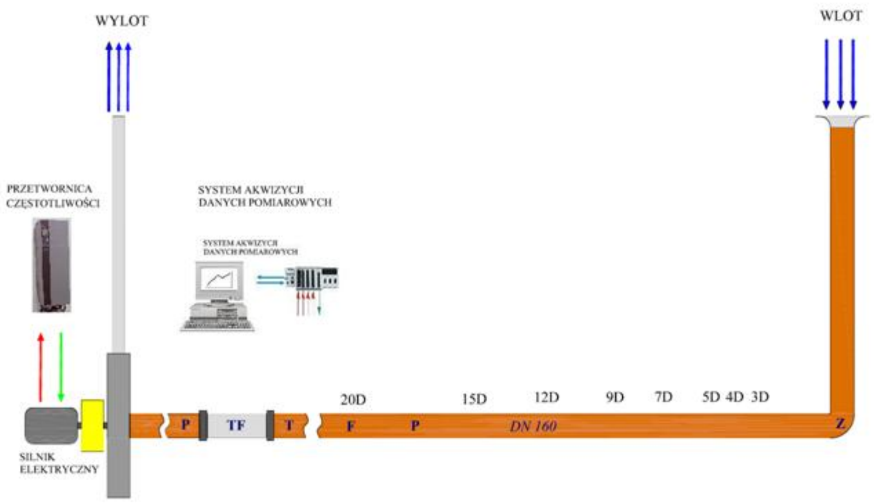

Fig.1. Layout of the test stand: **P**- measurement of absolute pressure, **T**- measurement of temperature , **TF**- turbine flowmeter, **F**- tested flowmeter , **Z**- flow disturbing element

The testing involved placing flow averaging Pitot tubes in various distances from the flow disturbing element located in two planes. The testing involved INTROBAR streamlined flowmeter, two-profiled flowmeter and a flowmeter with sensor a circular shape. The indications of the flowmeter were compared with the measured value of the stream by means of a reference flowmeter, which in this case was a turbine flowmeter. The characteristics of K=f(w) were calculated for various locations and arrangements of flowmeters.

Where the flow coefficient K relates the value of the stream $\dot{V}$ to the measured differential pressure Δp

$$\dot{V} = K \cdot F \sqrt{\frac{2\Delta p}{\rho}}. \qquad (1)$$

In the above formula F is the cross-section area of the pipeline and ρ is the liquid density. The flow disturbing element in the research was among other a single segmented 90^o elbow. Fig. 2 presents the results of research conducted in a test stand of a probe with a two-profiled sensor. The following charts present the value of the flow coefficient places with a various distance from the obstacle in the function of the velocity. The probes was situated in the plane of the disturbing system in the perpendicular plane to it.

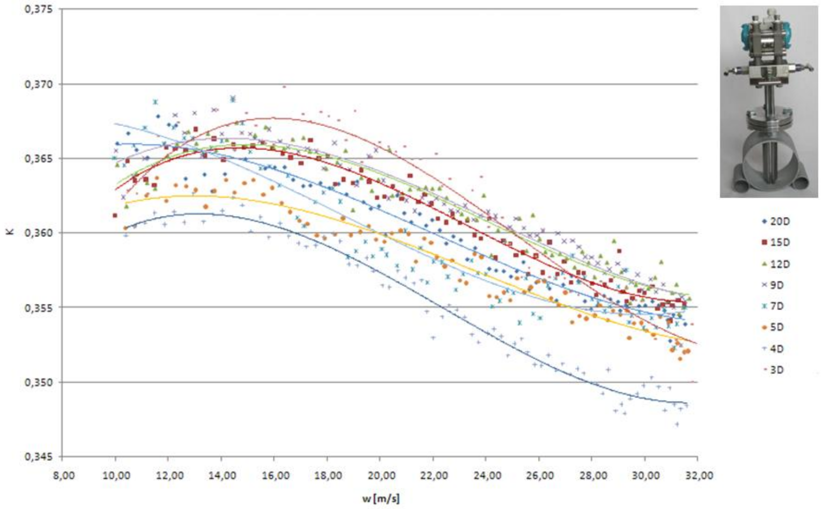

Fig. 2. Results of experiments for a two-profiled sensor located in a horinzontal plane

The conducted research made it possible to state recommendations regarding metrology of testing. The results indicate that not only the distance from the flow disturbing element play a role but also the plane in which the sensor is located affect the uncertainty of measurements of the flow averaging Pitot tubes.

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