Micro Thermal Gas Metering

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Preface

Like other thermodynamic parameters measured, the measurement of fluid flow rate, in order to calculate the amount of fluid flowing through a conduit, particularly measured natural gas per unit of time, has always been very important in the industry. Different techniques and instrumentation is used to measure these parameters depending on the type, flow, precision measuring flow rate range that regardless of how the act of measurement, the most famous ones are: turbine, ultrasonic, magnetic, pressure differential and thermal mass flow meters. Such flow meters are divided in three groups sensitive to the size, mass and velocity of fluid flow in terms of structure and function.

Among these meters, thermal mass flow meters are more sensitive to low flows. Due to the lack of mechanical moving components, a very little pressure drop is provide in the flow passage path.

The measurement technology is based on a MEMS "Micro Thermal Flow Sensing" principle. A micro heating element heats two temperature sensors placed symmetrically to the heater in a bypass. In presence of gas flow the two sensors measure a temperature differential which is related to the flow on the basis of known physics principles. Measurement accuracy is high and suitable for gas meters which are in accordance with the measuring instrumentation directive. Such micro-thermal measuring principle is also used in the laboratory instrumentation.

Gas enters the meter and is divided into two flow paths; in both, laminar flow is ensured in the bypass capillary tube by the very small diameter of the capillary, and in the main tube by the pressure dropper/laminar flow element. Most of the flow goes through the main pipe with pressure dropper: the pressure drop forces a small fraction of flow through the bypass capillary tube.

At the maximum flow rate, the pressure dropper placed in the main gas flow generates a pressure drop. Less than 1 % of the gas stream, i.e. the mass flow rate in the capillary circuit is thereby forced to flow through the bypass capillary tube and over the sensor.

In the micro-thermal mass flow sensor, the temperature difference between two temperature sensors placed symmetrically upstream and downstream of the micro heater detects the passage of gas flow.

In this book, in the first chapter, the authors sought with regard to their many years of experience in the design, manufacture and optimization of equipment for measuring and controlling fluids, especially in the gas industry, in order to learn and use more and more artisans, academics, researchers and consumers in related fields, to explain the basic principles and practice their thermal mass gas flow meters. In the second chapter of this book, application and performance of MEMS is expressed and it is summarized a compare and review of existing technologies for measuring the gas. In the third chapter, the physical and technical characteristics of sensor and metering of Gas-Souzan company have been investigated and finally in the fourth chapter, it has been provided recommended standards such as EN 1359, EN 16234 and ISO 14511:2001 in order to selection, installation, operation and calibration of the thermal mass flow meters.

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