THERMAL MASS FLOWMETER FOR AIR & GAS

Thermal Mass flow meters measure the mass flow rate of gases and air directly. Volumetric measurements are affected by all ambient and process conditions that influence unit volume or indirectly affect pressure drop, while mass flow measurement is unaffected by changes in viscosity, density, temperature, or pressure. Thermal mass flow meters are often used in monitoring or controlling mass-related processes such as chemical reactions that depend on the relative masses of unreacted ingredients. In detecting the mass flow of compressible vapors and gases, the measurement is unaffected by changes in pressure and/or temperature. One of the capabilities of thermal mass flow meters is to accurately measure low gas flowrates.

Operating Principle

Thermal mass flow meters are most often used for the regulation of low gas flows. They operate either by introducing a known amount of heat into the flowing stream and measuring an associated temperature change or by maintaining a probe at a constant temperature and measuring the energy required to do so. The components of a basic thermal mass flow meter include two temperature sensors and an electric heater between them. The heater can protrude into the fluid stream (Figure 5-8A) or can be external to the pipe (Figure 5-8B).

In the direct-heat version, a fixed amount of heat (q) is added by an electric heater. As the process fluid flows through the pipe, resistance temperature detectors (RTDs) measure the temperature rise, while the amount of electric heat introduced is held constant.

The mass flow (m) is calculated on the basis of the measured temperature difference (T2 - T1), the meter coefficient (K), the electric heat rate (q), and the specific heat of the fluid (Cp), as follows:
$m = Kq/(Cp(T2 - T1))$

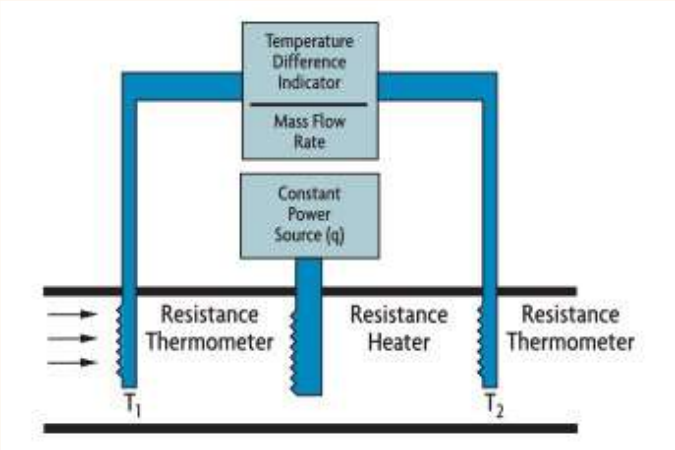

Figure 5-8A

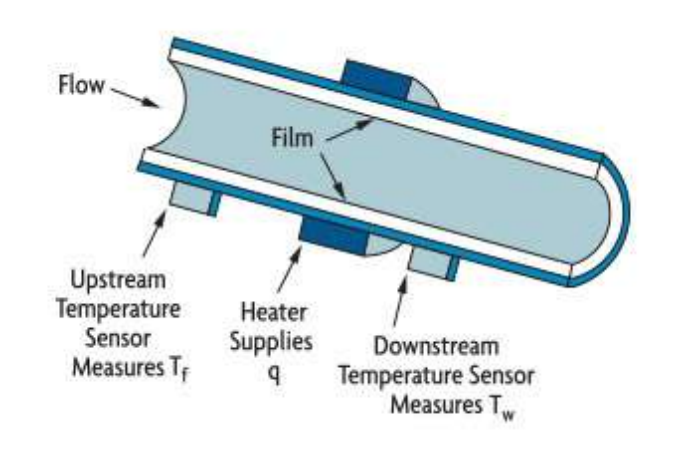

Figure 5-8B

Heated-tube flow meters were developed to protect the heater and sensor elements from corrosion and any coating effects of the process. By mounting the sensors externally to the piping (Figure 5-8B), the sensing elements respond more slowly, and the relationship between mass flow and temperature difference becomes nonlinear. This nonlinearity results from the fact that the heat introduced is distributed over some portion of the pipe's surface and transferred to the process fluid at different rates along the length of the pipe.

The pipe wall temperature is highest near the heater (detected as Tw in Figure 5-8B), while, some distance away, there is no difference between wall and fluid temperature. Therefore, the temperature of the unheated fluid (Tf) can be detected by measuring the wall temperature at this location further away from the heater. This heat transfer process is non-linear, and the corresponding equation differs from the one above as follows:

$m0.8 = Kq/(Cp(Tw - Tf))$

This flow meter has two operating modes: one measures the mass flow by keeping the electric power input constant and detecting the temperature rise. The other mode holds the temperature difference constant and measures the amount of electricity needed to maintain it. This second mode of operation provides for a much higher meter rangeability.

Technical Data

Measuring Principal : Thermal
Analogue Output: 4-20mA;
Communication Output : rs485 Modbus RTU;
Accuracy: <3% of Measured Value;
Operating Temp.:-20...+150°C;
Air Temp.: -20...+150°C;
Housing Material: Aluminum /SS304/SS316;
Max Velocity: 0~100m/s
Sensitivity : 0.01m/s
Response Time : < 2sec.
Warm Up Time : 30 Sec.

SMALL LINE SIZE
[15 mm TO 25mm]

INLINE FLOWMTER
[25 mm TO 80mm]

INSERTION FLOW MTER
[80mm TO 500 mm]

ORDER CODE

MODEL										
AITMF INSERSION	A									
AITMF INLINE	B									
SMALL LINE SIZE	C									
LINE SIZE										
DIAMETER DN		X	X	X						
STRUCTURE										
COMPACT					S					
REMOTE					L					
BODY MATERIAL										
ALUMINUM						A	L			
S.S. 304						S	4			
S.S. 316						S	6			
SIGNAL OUTPUT										
NO OUTPUT							0			
4~20mA							1			
COMMUNICATION										
NONE							N			
RS485							R			
POWER SUPPLY										
110-240VAC									0	
24VDC									1	
CONNECTION										
THREAD										D
ANSI 150 # FLANGE										A
TC										T

*** WE CAN DESIGN CUSTOMIZED FLOW METER**

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