

# ISO 14511:2019 (E)

## Measurement of fluid flow in closed conduits — Thermal mass flowmeters

---

### Contents

	Foreword
	Introduction
1	Scope
2	Normative references
3	Terms and definitions
3.1	General terms
3.2	Specific terms
4	Selection of thermal mass flowmeters
5	Capillary thermal mass flowmeter (CTMF meter)
5.1	Principles of measurement
5.2	Typical design
5.3	Applications and limitations of use
5.3.1	Gas property effects
5.3.2	Application and fluid properties
5.3.3	Temperature effects
5.3.4	Pressure effects
5.3.5	Pulsation effects
5.3.6	Pressure loss
5.3.7	Cleanness of the gas
5.3.8	Mounting orientation effects
5.3.9	Installation effects for flow profile
5.3.10	Vibrations — Hydraulic and mechanical
5.3.11	Valves
5.4	Meter selection
5.4.1	Principal requirement
5.4.2	Performance specifications
5.4.3	Physical specifications
5.4.4	Meter ratings
5.4.5	Application and fluid properties
5.4.6	Corrosion
5.4.7	Transmitter specifications
5.5	Installation and commissioning
5.5.1	General considerations
5.5.2	Safety
5.5.3	Mechanical stress
5.5.4	Process adjustment
5.5.4.1	General
5.5.4.2	Zero adjustment
5.5.4.3	Span adjustment
6	Insertion and/or in-line thermal mass flowmeter (ITMF meter)
6.1	Principle of measurement
6.1.1	General
6.1.2	Constant power method
6.1.3	Constant-temperature-differential method
6.2	Typical design
6.2.1	ITMF basic design
6.2.2	In-line ITMF meter
6.2.3	Insertion-ITMF meter

- 6.2.4 Multi-point insertion-ITMF meter
- 6.3 Applications and limitations of use
  - 6.3.1 General remarks
  - 6.3.2 Normalized volume flowrate units
  - 6.3.3 Fluid property effects
  - 6.3.4 Temperature effects
  - 6.3.5 Pressure effects
  - 6.3.6 Fluid phase
  - 6.3.7 Bi-directional flow
  - 6.3.8 Pulsation effects
  - 6.3.9 Pressure loss
  - 6.3.10 Sensor contamination
  - 6.3.11 Mounting orientation effects
  - 6.3.12 Installation effects
  - 6.3.13 Conduit vibrations
- 6.4 Meter selection
  - 6.4.1 General
  - 6.4.2 Performance specifications
  - 6.4.3 Physical specifications
  - 6.4.4 Meter ratings
  - 6.4.5 Application and fluid properties
  - 6.4.6 Corrosion
  - 6.4.7 Transmitter specifications
- 6.5 Installation and commissioning
  - 6.5.1 General considerations
  - 6.5.2 Cleaning
  - 6.5.3 Safety
  - 6.5.4 Mechanical stress
  - 6.5.5 Process conditions
    - 6.5.5.1 General
    - 6.5.5.2 Zero adjustment
    - 6.5.5.3 Span adjustment
- 7 Instrument specification sheet and marking
  - 7.1 User specification sheet
  - 7.2 Manufacturer's data sheet
  - 7.3 Marking
    - 7.3.1 Mandatory
    - 7.3.2 Optional
- 8 Calibration
  - 8.1 General considerations
  - 8.2 Use of the desired gas under process conditions
  - 8.3 Use of a surrogate gas
  - 8.4 In situ calibration
  - 8.5 Insertion-ITMF meter
  - 8.6 Calibration frequency
  - 8.7 Calibration certificate
- 9 Pre-installation inspection and testing
- 10 Maintenance
  - 10.1 General
  - 10.2 Visual inspection
  - 10.3 Functional test
  - 10.4 Record keeping (Maintenance audit trail)