

ISO/TS 21354:2020 (E)

Measurement of multiphase fluid flow

Contents

	Foreword
	Introduction
1	Scope
2	Normative references
3	Terms and definitions
3.1	Terms related to multiphase flow metering
3.2	Terms related to metrology
4	Symbols and subscripts
4.1	Symbols
4.2	Colours and symbols used in schematic drawings
5	Multiphase flow
5.1	General
5.2	Multiphase flow regime maps
5.2.1	General
5.2.2	Vertical flows
5.2.3	Horizontal flows
5.3	Slip effects
5.4	Classification of multiphase flows
6	Aims of multiphase flow measurement
6.1	General
6.2	Individual-well surveillance or monitoring
6.2.1	General
6.2.2	Production optimization
6.2.3	Flow assurance
6.3	Well testing
6.3.1	General
6.3.2	Conventional well testing
6.3.3	Well testing by MPFMs
6.4	Production allocation metering
6.5	Fiscal or custody transfer measurement
6.6	Summary of advantages and disadvantages of MPFMs
7	Production envelope and installation design guidelines
7.1	General
7.2	Production envelope
7.2.1	Plotting the production envelope in the two-phase flow map
7.2.2	Plotting the production envelope in the composition map
7.3	MPFM measuring envelope
7.3.1	Plotting the MPFM measuring envelope in the two-phase flow map
7.3.2	Plotting the MPFM measuring envelope in the composition map
7.4	Using the flow maps during testing
7.5	Cumulative performance plot
7.6	Other considerations
8	Performance specification
8.1	General
8.2	Technical description

- 8.3 Specification of individual sensors and primary devices
- 8.4 Specification of output data and formats
- 8.5 Measuring range, rated operating conditions and limiting conditions
- 8.6 Measurement uncertainty
 - 8.6.1 General
 - 8.6.2 Measurement uncertainty evaluation of MPFMs
 - 8.6.3 Influence quantities and sensitivity coefficients
 - 8.6.4 Repeatability
 - 8.6.5 Stability and frequency response
- 8.7 Guideline on MPFM performance specification
 - 8.7.1 General
 - 8.7.2 Technical descriptions
 - 8.7.3 Specification of input data
 - 8.7.4 Specification of output data
 - 8.7.5 Rated operating conditions and limiting conditions
 - 8.7.6 Measurement uncertainty
 - 8.7.7 Two-phase flow map
 - 8.7.8 Composition map
- 9 Testing, calibration and adjustment
 - 9.1 General
 - 9.2 Factory acceptance testing (FAT)
 - 9.3 Calibration and test of MPFMs
 - 9.3.1 General
 - 9.3.2 Performance verification in static conditions
 - 9.3.3 Performance verification in dynamic conditions
 - 9.3.3.1 General
 - 9.3.3.2 Fluids
 - 9.3.3.3 Operational constraints
 - 9.3.3.4 Test matrix
 - 9.3.3.5 Reference measurement uncertainties
 - 9.3.4 Factory test
 - 9.3.5 Test facility
 - 9.3.5.1 General
 - 9.3.5.2 Independent laboratory test
 - 9.3.5.3 Field test
 - 9.3.6 In situ test
 - 9.3.6.1 General
 - 9.3.6.2 Testing using test separator as reference
 - 9.3.6.3 Testing at start-up of a satellite field
 - 9.3.6.4 Tracer techniques
 - 9.3.7 Further information on performance testing
 - 9.3.7.1 General
 - 9.3.7.2 Field test description
 - 9.3.7.3 Field test matrix
 - 9.3.7.4 Comparison between MPFM under test and reference measurements
 - 9.3.8 Test report
 - 9.4 Adjustment of MPFMs
 - 9.4.1 General
 - 9.4.2 Adjustment based on static configuration
 - 9.4.3 Adjustment based on performance verification in dynamic conditions
 - 9.4.3.1 General
 - 9.4.3.2 Matrix calibration
 - 9.4.3.3 Curve-fit calibration
 - 9.4.3.4 Factor calibration
 - 9.5 Blind tests
 - 9.5.1 Scope and objective of MPFM blind test
 - 9.5.2 Organization and implementation
 - 9.5.3 Multiphase flow loop
 - 9.5.4 Test matrix
 - 9.5.5 Information to be provided by MPFM vendors
 - 9.5.6 Information provided to MPFM vendors
 - 9.5.6.1 General
 - 9.5.6.2 PVT data

- 9.5.7 Test completion
 - 9.5.7.1 General
 - 9.5.7.2 Comparison
- 9.5.8 Test results and deliverables
- 10 Field installation and commissioning
 - 10.1 General
 - 10.2 Installation considerations
 - 10.3 Installation and site integration
 - 10.3.1 General
 - 10.3.2 Installation requirements
 - 10.3.3 Electrical connections and power requirements
 - 10.3.4 Function test
 - 10.3.5 Fluid calculation checks
 - 10.4 Commissioning
 - 10.4.1 General
 - 10.4.2 Preparation
 - 10.4.3 Documentation and equipment
 - 10.4.4 On site authorization
 - 10.4.5 Commissioning activities
 - 10.5 Start-up
- 11 Verification during operation
 - 11.1 General
 - 11.2 Baseline monitoring
 - 11.3 Self-checking, self-diagnostic capabilities and internal redundancy
 - 11.4 Comparison with model-based multiphase flow calculations
 - 11.5 Two meters in series
 - 11.6 Mobile test units
 - 11.7 Tracer technology
 - 11.8 Injection
 - 11.9 Sampling
 - 11.9.1 General
 - 11.9.2 Sampling for information about WLR
 - 11.10 Imbalances and reconciliation factor
 - 11.11 Geo-chemical fingerprinting
 - 11.12 Subsea systems verification
- Annex A (informative) Multiphase meter technologies
 - A.1 General
 - A.2 Meter categories
 - A.2.1 General
 - A.2.2 In-line meters
 - A.2.3 Separation-type meter systems
 - A.2.3.1 General
 - A.2.3.2 Full two-phase gas/liquid separation
 - A.2.3.3 Partial separation
 - A.2.3.4 Separation in sample line
 - A.2.4 Wet-gas meters
 - A.2.5 Other categories of multiphase metering systems
 - A.3 Measurement principles
 - A.3.1 General
 - A.3.2 Phase velocities and volume flow
 - A.3.2.1 Venturi tube (or other differential pressure meter)
 - A.3.2.2 Cross correlation
 - A.3.3 Phase fractions
 - A.3.3.1 General
 - A.3.3.2 Gamma-ray methods
 - A.3.3.3 Electrical impedance methods (capacitance and conductance)
 - A.3.3.4 Microwave technology
 - A.3.3.5 Magnetic resonance technology
 - A.4 Selection of technology in relation to maintenance requirements
 - A.4.1 General
 - A.4.2 Pressure measurements

- A.4.3 Electrical impedance and microwave sensors**
- A.4.4 Gamma-ray technologies**
- A.4.5 Limitations of technologies — Use of partial separation meters**
- A.4.6 Calibration and fluid properties**

Annex B (informative) Fluid properties and hydrocarbon behaviour

- B.1 Fluid data requirements**
 - B.1.1 General**
 - B.1.2 Determination of the single-phase properties at the MPFM conditions**
 - B.1.3 Conversions of measured flow rates at actual MPFM conditions to standard conditions**
 - B.1.4 Application of thermodynamics to MPFM technology**
- B.2 Challenges in characterizing petroleum fluid properties**

Annex C (informative) Example of field test reference measurements

Page count: 98