INTERNATIONAL RECOMMENDATION

OIML R 75-3

Edition 2006 (E)

Heat meters

Part 3: Test Report Format

Compteurs d'énergie thermique

Partie 3: Format du rapport d'essai

OIML R 75-3 Edition 2006 (E)

ORGANISATION INTERNATIONALE
DE MÉTROLOGIE LÉGALE

INTERNATIONAL ORGANIZATION
OF LEGAL METROLOGY

Contents

Foreword

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OIML R 75: Heat meters
Part 3: Test Report Format

Introduction

Heat meters and sub-assemblies which comply with the general requirements of OIML R 75-1 and which are submitted for type approval and for initial verification shall comply with the relevant tests specified in R 75-2.

Implementation of this Test Report Format is informative with regard to the implementation of R 75-1 and R 75-2 in national regulations; however, **its implementation for the Type Evaluation Report is mandatory within the framework of the OIML Certificate System for Measuring Instruments**.

Note: For terms and definitions, refer to R 75-1.

Explanatory notes to the Test Report Format

Section I includes the required format of a Type Evaluation Report and Section II includes a recommended format of an Initial Verification Report for a complete heat meter, a calculator, a flow sensor, a temperature sensor pair or a combined sub-assembly.

The symbols used in the tables are:

MPE .... Maximum Permissible Error
EUT .... Equipment Under Test
RVM .... Reference Values for the Measurand (5.3 in R 75-2)
n/a .... not applicable

The summary tables of tests and the tables for each test shall be completed according to this example:

Pass ×	Fail ___	When the EUT passes the test
Pass ___	Fail ×	When the EUT fails the test
Pass **n/a**	Pass **n/a**	Not applicable

Note concerning the numbering of the following pages

In addition to the sequential numbering at the bottom of the pages of this Publication, a special place is left at the top of each page (starting with the following page) for numbering the pages of reports established following this model. For a given report, it is advisable to complete the sequential numbering of each page by the indication of the total number of pages of the report.

I. TYPE EVALUATION REPORT

1 Information concerning the type

1.1 General information

Testing Authority

Name:..

Address: ....

Accredited laboratory: Yes ☐ No ☐ Accreditation No.: ………….. By company: ....

Test No.: …………… Declaration of expanded uncertainty of test equipment No.: ....

Contact information: ....

Date of beginning and end of tests: ....

Name(s) of test engineer(s): ....

Applicant/manufacturer information

Application No.:...

Application date:..

Model designation:...

Applicant:..

Address: ....

Manufacturer:..

Address: ....

Representative:..

(Name, telephone)..

1.2 Information concerning the type

Instrument category:

Complete instrument ☐ Documentation No.: …….. Serial No.: …….. Year of manufacture: ……..

Calculator ☐ Documentation No.: …….. Serial No.: …….. Year of manufacture: ……..

Flow sensor ☐ Documentation No.: …….. Serial No.: …….. Year of manufacture: ……..

Temperature sensor pair ☐ Documentation No.: …….. Serial No.: …….. Year of manufacture: ……..

Combined sub-assemblies ☐ Documentation No.: …….. Serial No.: …….. Year of manufacture: ……..

Short description of the principle of measurement (measuring method): ....

....

List of documents provided by the manufacturer: ....

All values in this table are taken from documentation pages: ....

....

Additional qualifying information supplied: Yes ☐ No ☐ Remarks: ....

....

Completeness and correctness of instruction manual, marking, assembly instructions, installation instructions, security sealing plan, initial functionality check and operation instruction submitted for type evaluation (requirements of sections 11 and 12 in R 75-1 and 8.1 in R 75-2):

Pass ☐ Fail ☐ Remarks: ....

....

1.2.1 Complete instrument specifications

Accuracy class: Class 1 ☐ Class 2 ☐ Class 3 ☐

Heat conveying liquid: Water ☐ Water-glycol solution ☐ Mixing: ___/___

Environmental class: A ☐ B ☐ C ☐

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐ other ☐

Indication if shielding: Yes ☐ No ☐

Flow sensor to be operated: In the flow ☐ In the return ☐

Limits of temperature: θ_{min} = ______ °C θ_{max} = ______ °C

Limits of temperature difference: $\Delta\theta_{min}$ = ______ K $\Delta\theta_{max}$ = ______ K

Display unit options: GJ ☐ MJ ☐ kWh ☐

Maximum value of thermal power (P_s): ______ MW

Output signal for testing: Type: ______ Level: ______ V

Corresponding factor for test output: ______ Wh/pulse

Display unit options for testing: MJ ☐ kWh ☐ Wh ☐

Dynamic behavior (circumstances of temperature measurement and integration): ....

Other functions in addition to heat indication: ....

For the flow sensor:

Physical dimensions (length, thread/flange specification): ....

Installation conditions (e.g. straight sections of piping): ....

Upstream/downstream, vertical/horizontal position: ....

Maximum admissible working pressure (PN-class): ....

Maximum pressure loss at q_p: ______ bar ______ Pa

Temperature sensor installed: Yes ☐ No ☐

Filter installed: Yes ☐ No ☐

Straightener installed: Yes ☐ No ☐

Range of electrical conductivity of water (if necessary): ______ µS/cm to ______ µS/cm

Length of the connection cable to the electrodes
(if the electronic part is separated from the sensor head): ______ m

Response time (for fast response meters): ______ s

Limits of flowrate: q_p = ______ m³/h q_i = ______ m³/h q_s= ______ m³/h

Low flow threshold value: ______ m³/h

Limits of temperature (heat conveying liquid): θ_{min} = ______ °C θ_{max} = ______ °C

Nominal meter factor: ______ litres/pulse

Output signal for testing: Type: ______ Level: ______ V

Corresponding factor for test output: ______ litres/pulse

1.2.2 Calculator specifications

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

(or declaration of sensor coefficients: R_0: _______Ω A: _______ B: _______)

Wiring of sensors: 4-wire ☐ 3-wire ☐ 2-wire ☐

Indication if shielding: Yes ☐ No ☐

Flow sensor to be operated: In the flow ☐ In the return ☐

Environmental class: A ☐ B ☐ C ☐

Heat conveying liquid: Water ☐ Water-glycol solution ☐ Mixing: ___/___

Limits of temperature: θ_{min} = ____ °C θ_{max} = ____ °C

Limits of temperature difference: $\Delta\theta_{min}$ = ____ K $\Delta\theta_{max}$ = ____ K

Display unit options: GJ ☐ MJ ☐ kWh ☐

Maximum value of thermal power (P_s): ______ MW

RMS value of temperature sensor current: ______ mA

Required input signal from the flow sensor:

Nominal meter factor: _______ litres/pulse (or corresponding factor for test input)

Input signal for testing, type: ______ level: ______ V

Maximum frequency of flow sensor signal: For testing: ______ Hz In normal use: ______ Hz

Output signal for testing: Type: ______ level: ______ V

Corresponding factor for test output: ______ Wh/pulse

Display unit options for testing: MJ ☐ kWh ☐ Wh ☐

Dynamic behavior (circumstances of temperature measurement and integration): ....

Other functions in addition to heat indication: ....

1.2.3 Flow sensor specifications

Accuracy class: Class 1 ☐ Class 2 ☐ Class 3 ☐

Environmental class: A ☐ B ☐ C ☐

Heat conveying liquid: Water ☐ Water-glycol solution ☐ Mixing: ___/___

Physical dimensions (length, thread/flange specification): ....

Installation conditions (e.g. straight sections of piping): ....

Upstream/downstream, vertical/horizontal position: ....

Maximum admissible working pressure (PN-class): ....

Maximum pressure loss at q_p: ____ bar ____ Pa

Temperature sensor installed: Yes ☐ No ☐

Filter installed: Yes ☐ No ☐

Straightener installed: Yes ☐ No ☐

Limits of temperature (heat conveying liquid): θ_{min} = ______ °C θ_{max} = ______ °C

Range of electrical conductivity of water (if necessary): ___ µS/cm to ___ µS/cm

Length of the connection cable to the electrodes
(if the electronic part is separated from the sensor head): ______ m

Response time (for fast response meters): ______ s

Limits of flowrate: q_p = ______ m³/h q_i = ______ m³/h q_s= ______ m³/h

Low flow threshold value: ______ m³/h

Nominal meter factor: ______ litres/pulse

Corresponding factor for test output: ______ litres/pulse

Output signal for testing, type: ______ level: ______ V

1.2.4 Temperature sensor pair specifications

Type identification: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

(or declaration of sensor coefficients: R_0: _______ Ω A: _______ B: _______)

Wiring of sensors: 4-wire ☐ 3-wire ☐ 2-wire ☐

Total resistance of a 2-cable wire: ____ Ω/m Cross section of a wire: ____ mm²

Maximum length of a cable for: Pt 100 ______ m, Pt 500 ______ m, Pt 1000 ______ m, other ______ m

Indication if shielding Yes ☐ No ☐

Limits of temperature: θ_{min} = _______ °C θ_{max} = _______ °C

Limits of temperature difference: $\Delta\theta_{min}$ = _______ K $\Delta\theta_{max}$ = _______ K

Installation requirements (pocket mounting): Yes ☐ No ☐

Physical dimensions: Length: _______ mm Diameter: _______ mm

Minimum immersion depth: _______ mm

Maximum liquid velocity for sensors over 200 mm length: _______ m/s

Maximum admissible working pressure for direct mounted sensors (PN-class): _______

$\tau_{0.5}$ response time: ______ s

Identification of flow and return temperature sensors (if needed): At the flow ☐ At the return ☐

Maximum RMS value of sensor current: _______ mA

1.2.5 Combined sub-assemblies specifications (calculator + temperature sensor pair)

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

(or declaration of sensor coefficients: R_0: ______ A: ______ B: ______)

Wiring of sensors: 4-wire ☐ 3-wire ☐ 2-wire ☐ Indication if shielding: Yes ☐ No ☐

Environmental class: A ☐ B ☐ C ☐

Heat conveying liquid: Water ☐ Water-glycol solution ☐ Mixing: ___/___

Flow sensor to be operated: In the flow ☐ In the return ☐

Limits of temperature: θ_{min} = ______ °C θ_{max} = ______ °C

Limits of temperature difference: $\Delta\theta_{min}$ = ______ K $\Delta\theta_{max}$ = ______ K

Installation requirements (pocket mounting): Yes ☐ No ☐

Physical dimensions: Length: _______ mm Diameter: _______ mm

Minimum immersion depth: _______ mm

Maximum liquid velocity for sensors over 200 mm length: _______ m/s

Maximum admissible working pressure for direct mounted sensors (PN-class): _______

$\tau_{0.5}$ response time: ______ s

Display unit options: GJ ☐ MJ ☐ kWh ☐

Maximum value of thermal power (P_s): ______ MW

Output signal for testing: Type: ______ Level: ______ V

Corresponding factor for test output: ______ Wh/pulse

Display unit options for testing: MJ ☐ kWh ☐ Wh ☐

Required input signal from the flow sensor:

Input signal for testing: Type: ______ Level: ______ V

Nominal meter factor: _______ litres/pulse (or corresponding factor for test input)

Maximum frequency of flow sensor signal: For testing: ______ Hz In normal use: ______ Hz

Dynamic behavior (circumstances of temperature measurement and integration): ....

Other functions in addition to heat indication: ....

Correctness of identification of flow and return temperature sensors: Yes ☐ No ☐

1.2.6 Combined sub-assemblies specifications (calculator + flow sensor)

Accuracy class: Class 1 ☐ Class 2 ☐ Class 3 ☐

Environmental class: A ☐ B ☐ C ☐

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

Wiring of sensors: 4-wire ☐ 3-wire ☐ 2-wire ☐ Indication if shielding: Yes ☐ No ☐

Heat conveying liquid: Water ☐ Water-glycol solution ☐ Mixing: ___/___

Flow sensor to be operated: In the flow ☐ In the return ☐

Limits of temperature: θ_{min} = ____ °C θ_{max} = ____ °C

Limits of temperature difference: $\Delta\theta_{min}$ = ____ K $\Delta\theta_{max}$ = ____ K

Display unit options (MJ, kWh): ______

Maximum value of thermal power (P_s): ______ MW

Output signal for testing: Type:______ Level: ______ V

Corresponding factor for test output: ______ Wh/pulse

Display unit options for testing: MJ ☐ kWh ☐ Wh ☐

Dynamic behavior (circumstances of temperature measurement and integration): ....

Other functions in addition to heat indication: ....

<u>For the flow sensor:</u>
Physical dimensions (length, thread/flange specification): ....

Installation conditions (e.g. straight sections of piping): ....

Upstream/downstream, vertical/horizontal position: ....

Maximum admissible working pressure (PN-class): ______

Maximum pressure loss at q_p: ______ bar ______ Pa

Temperature sensor installed: ☐ Yes No ☐

Filter installed: ☐ Yes No ☐

Straightener installed: ☐ Yes No ☐

Range of electrical conductivity of water (if necessary): ______ µS/cm to ______ µS/cm

Length of the connection cable to the electrodes (if the electronic part is separated from the sensor head): ____ m

Response time (for fast response meters): ______ s

Limits of flowrate: q_p = ______ m³/h q_i = ______ m³/h q_s= ______ m³/h

Low flow threshold value: ______ m³/h

Limits of temperature (heat conveying liquid): θ_{min} = ______ °C θ_{max} = ______ °C

Nominal meter factor: ______ litres/pulse

Corresponding factor for test output: ______ litres/pulse

Output signal for testing: Type: ______ Level: ______ V

1.3 Rated operating conditions

Complete instrument, (combined) sub-assemblies

	Environmental class			Remarks
	A ☐	B ☐	C ☐	
Ambient temperature °C	+ 5 to + 55	- 25 to + 55	+ 5 to + 55	
Relative humidity %	< 93			
Mains supply voltage V Mains frequency Hz	U_{nom} (+ 10 %/- 15 %) f_{nom} (± 2 %)			Frequency used for measurement purpose: Yes ☐ No ☐
External low voltage V (< 50 V)	AC ☐ U_{nom} (+ 50 %/- 50 %) DC ☐ U_{nom} (+ 75 %/- 50 %)			Frequency used for measurement purpose: Yes ☐ No ☐
Battery voltage V	Voltage in service under normal conditions			Type, lifetime

General information concerning ambient test conditions

Test No.: ....

Application No.:...

Ambient temperature: ______ °C Relative humidity: ______ %

Barometric pressure: ______ kPa

2 Summary of the tests (Ref.: 6.2, Table 2 in R 75-2)

Test according to Subclause	Temperature sensor pair *Serial No.* ___________	Flow sensor *Serial No.* ___________	Calculator *Serial No.* ___________	Complete instrument *Serial No.* ___________	Combined sub-assemblies	
					Calculator + temp. sensor pair *Serial No.* ___________	Calculator + flow sensor *Serial No.* ___________
6.4	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
6.5	--- ---	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
6.6	--- ---	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
6.7	--- ---	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
6.8	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
6.9	--- ---	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
6.10	--- ---	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
6.11	--- ---	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
6.12	--- ---	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
6.13	--- ---	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
6.14	--- ---	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
6.15	--- ---	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐
6.16	--- ---	Pass ☐ Fail ☐	--- ---	Pass ☐ Fail ☐	--- ---	Pass ☐ Fail ☐
6.17	--- ---	Pass ☐ Fail ☐	--- ---	Pass ☐ Fail ☐	--- ---	Pass ☐ Fail ☐

3 Performance tests

3.1 Flow sensor

Test results: Flow sensor

<u>Table 1</u>: Performance test (Ref.: 6.4.1 in R 75-2)

Initial intrinsic error at RVM-conditions: ____ %

K = $(q_S/q_i)^{1/4}$ = ____ Electrical conductivity of water (if necessary): ____ µS/cm

Test number	Test point flowrate m³/h			Temperature of liquid °C		Flow sensor output signal volume m³	Conventional true volume m³	Error %	MPE %
	Calculated		Actual	Level	Measured				
1	q_1			$(\theta_{min} + 5)$					
2	q_2			$(\theta_{min} + 5)$					
3	q_3			$(\theta_{min} + 5)$					
4	q_4			$(\theta_{min} + 5)$					
5	q_5			$(\theta_{min} + 5)$					
6	q_1			(50 ± 5)					
7	q_2			(50 ± 5)					
8	q_3			(50 ± 5)					
9	q_4			(50 ± 5)					
10	q_5			(50 ± 5)					
11	q_1			(85 ± 5)					
12	q_2			(85 ± 5)					
13	q_3			(85 ± 5)					
14	q_4			(85 ± 5)					
15	q_5			(85 ± 5)					

Markings: Pass: _____ Fail: _____ Signature: ______________________________

3.1.1 Electromagnetic type flow sensors (Ref.: 6.4.1.2 in R 75-2)

The test results have to be noted according to Table 1. The electrical conductivity of water and the length of the connecting cable to the electrodes shall be noted in the type test report.

3.1.2 Fast response meters (Ref.: 6.4.1.3 in R 75-2)

Test results: Flow sensor

Table 2: Performance test - fast response meters (Ref.: 6.4.1.3 in R 75-2)

Initial intrinsic error at RVM-conditions: ____ %

In the case of a complete instrument or combined sub-assemblies:

Temperature difference: ____ K

Cycle No.	Test point flowrate q_s m^3/h	Temperature of liquid °C Level | Measured	Flow sensor output signal volume m^3	Conventional true volume m^3	Error %	MPE %
1		θ_{min} to (θ_{min} + 5)				
2		θ_{min} to (θ_{min} + 5)				
3		θ_{min} to (θ_{min} + 5)				
4		θ_{min} to (θ_{min} + 5)				
5		θ_{min} to (θ_{min} + 5)				
6		θ_{min} to (θ_{min} + 5)				
7		θ_{min} to (θ_{min} + 5)				
8		θ_{min} to (θ_{min} + 5)				
9		θ_{min} to (θ_{min} + 5)				
10		θ_{min} to (θ_{min} + 5)				

Markings: Pass: _____ Fail: _____ Signature: ______________________________

3.2 Calculator (Ref.: 6.4.2 in R 75-2)

Test results: Calculator

Table 3: Performance test (Ref.: 6.4.2 in R 75-2)

Initial intrinsic error at RVM-conditions: ____ %

Simulated volume: ____ m³

Simulated flowrate: ____ m³/h

Test No.	Test point °C	Temperature difference $\Delta\theta$ K									
	$\theta_{return} = \theta_{min}$ *)	$\Delta\theta_{min}$ *)		5 *)		20 *)		$\Delta\theta_{RVM}$ *)		$\Delta\theta_{max}$ *)	
		Error %	MPE %	Error %	MPE %	Error %	MPE %	Error %	MPE %	Error %	MPE %
1											
2											
3											
Test No.	$\theta_{return} = \theta_{RVM}$ *)	$\Delta\theta_{min}$ *)		5 *)		20 *)		$\Delta\theta_{RVM}$ *)			
		Error %	MPE %	Error %	MPE %	Error %	MPE %	Error %	MPE %		
4											
5											
6											
Test No.	$\theta_{flow} = \theta_{max}$ *)	20 *)		$\Delta\theta_{RVM}$ *)		$\Delta\theta_{max}$ *)					
		Error %	MPE %	Error %	MPE %	Error %	MPE %				
7											
8											
9											

*) Test points are measured values.

Errors calculated from (pulse) output signal ☐ or display indication ☐

Markings: Pass: _____ Fail: _____ Signature: ______________________________

3.3 Temperature sensors (Ref.: 6.4.3 in R 75-2)

Test results: Temperature sensors

Table 4: Minimum immersion depth, single sensors (Ref.: 4.16 in R 75-1 and 6.4.3.1 in R 75-2)

Temperature sensor serial No: ________________

Temperature of water bath: ____ °C

Maximum permissible change of the output value < 0.1 K

Immersion depth mm	Measured resistance Ω	Calculated temperature *) °C
10		
15		
20		
25		
30		
35		
40		
45		
50		

*) using standard IEC 60751 constants

Note: Values of immersion depths are examples.

Minimum immersion depth specified by measurements: ____ mm

Minimum immersion depth specified by the supplier: ____ mm

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Table 5a: Thermal response time, single sensors are not installed in pockets (Ref.: 4.1 in R 75-1 and 6.4.3.2 in R 75-2)

Water bath temperature: ____ °C

Thermal response time specified by the supplier: ____ s

Temperature sensor type, serial number	Measured response 50 % time $\tau_{0.5}$ s	Specified response 50 % time $\tau_{0.5}$ s

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Note: Repeat the measurements with sensors in pockets, if the tolerated gap between the sensor and the pocket is more than 0.125 mm or the immersion depth of the pocket is less than 70 mm.

Table 5b: **Thermal response time, single sensors are installed in pockets (Ref.: 4.1 in R 75-1 and 6.4.3.2 in R 75-2)**

Water bath temperature: ____ °C

Thermal response time specified by the supplier: ____ s

Temperature sensor serial number	Measured response 50 % time $\tau_{0.5}$ s	Specified response 50 % time $\tau_{0.5}$ s

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Table 6a: **Calculation of constants of the temperature/resistance equation of IEC 60751. Sensors are tested without pockets (Ref.: 9.2.2.2 in R 75-1 and 6.4.3.3 in R 75-2, IEC 60751)**

Sensor pair serial No.: ______________

Temperature range specified by the supplier from ____ °C to ____ °C

Temperature difference for the pair specified by the supplier from ____ K to ____ K

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

Sensors are intended to be installed in pockets: Yes ☐ No ☐

Temperature °C		Measured resistance Ω	
Level *)	Measured	Sensor 1 (flow)	Sensor 2 (return)
(5 ± 5)			
(40 ± 5)			
(70 ± 5)			
(90 ± 5)			
(130 ± 5)			
(160 ± 10)			

*) The temperature sensors shall be tested at least at three temperature levels. Temperature levels shall be chosen to optimize the spread of temperature over the temperature range specified by the supplier.

Constants of sensor 1 calculated according to IEC 60751:
R_0: __________ Ω A: _________ B: ________

Constants of sensor 2 calculated according to IEC 60751:
R_0: __________ Ω A: _________ B: ________

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Table 6b: **Calculation of constants of the temperature/resistance equation of IEC 60751. Sensors are tested in pockets (Ref.: 9.2.2.2 in R 75-1 and 6.4.3.3 in R 75-2, IEC 60751)**

Test is performed if sensors are intended to be installed in pockets and if the maximum tolerated gap between the sensor and the pocket is more than 0.125 mm or the immersion depth of the pocket is less than 70 mm.

Sensor pair: Serial No. (flow): ______________ Serial No. (return): ______________

Temperature range specified by the supplier from ____ °C to ____ °C

Temperature difference for the pair specified by the supplier from ____ K to ____ K

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

Temperature °C		Measured resistance Ω	
Level *)	Measured	Sensor 1 (flow)	Sensor 2 (return)
(5 ± 5)			
(40 ± 5)			
(70 ± 5)			
(90 ± 5)			
(130 ± 5)			
(160 ± 10)			

*) The temperature sensors shall be tested at least at three temperature levels. Temperature levels shall be chosen to optimize the spread of temperature over the temperature range specified by the supplier.

Constants of sensor 1 calculated according to IEC 60751:

R_0: __________ Ω A: _________ B: ________

Constants of sensor 2 calculated according to IEC 60751:

R_0: __________ Ω A: _________ B: ________

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Table 7: Performance tests. Maximum absolute error of each sensor of a temperature sensor pair. Single sensors are tested without pockets (Ref.: 9.2.2.2 in R 75-1 and 6.4.3.3 in R 75-2, IEC 60751)

Sensor pair: Serial No. (flow): ______________ Serial No. (return): ______________

Temperature range specified by the supplier from ____ °C to ____ °C

Temperature difference for the pair specified by the supplier from ____ K to ____ K

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

Sensors are intended to be installed in pockets: Yes ☐ No ☐

Sensor	Flow temperature °C	Return temperature °C	Maximum absolute error *) K	MPE K
Sensor 1 (flow)		---		± 2
Sensor 2 (return)	---			± 2

Markings: Pass: _____ Fail: _____ Signature: ______________________________

*) *Note:* The "ideal" sensor curve (with constants of IEC 60751) shall be subtracted from the characteristic curve for the sensor (calculated constants are below Table 6a). The difference between characteristics shall be determined over the temperature range specified for the temperature sensor. The maximum difference in Ω between characteristics at measured points of the temperature range shall be calculated as a difference in K. The maximum permissible difference between characteristics (MPE) is ± 2 K.

Table 8a: Performance test. Maximum relative error of a temperature sensor pair. Sensors are tested without pockets (Ref.: 9.2.2.2 in R 75-1 and 6.4.3.3 in R 75-2)

Sensor pair: Serial No. (flow): ______________ Serial No. (return): ______________

Temperature range specified by the supplier from ____ °C to ____ °C

Temperature difference for the pair specified by the supplier from ____ K to ____ K

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

Sensors are intended to be installed in pockets: Yes ☐ No ☐

Used temperature levels for the test: _____ °C and _____ °C and _____ °C

Constants of sensor 1 calculated according to IEC 60751:
R_0: __________ Ω A: _________ B: ________

Constants of sensor 2 calculated according to IEC 60751:
R_0: __________ Ω A: _________ B: ________

(Calculated constants are below Table 6a.)

Flow temperature °C	Return temperature °C	Relative error %	MPE %
22	20	0.40	3.5
73	71	- 0.59	3.5
40	20	0.06	0.8
60	20	0.03	0.65
120	20	- 0.01	0.56

Note to this Table with measurement results (all values are examples):

The Table shows examples of the relative error calculated at different temperature combinations. This example shows that the maximum relative error (- 0.59 %) is found at the temperature combination of 73 °C/71 °C.

Test result (summary)

Flow temperature °C	Return temperature °C	Maximum relative error *) E_{Tmax} %	MPE %
73	71	- 0.59	3.5

Markings: Pass: _____ Fail: _____ Signature: ______________________________

*) The calculation of the maximum relative error of the temperature sensor pair E_{Tmax} can be performed as on the following page (recommended method):

Calculation of the maximum relative error of the temperature sensor pair, E_{Tmax}:

1) First calculate:

$$E_T = \frac{e_1 - e_2}{\Delta\theta} \cdot 100\ \%$$

where:

e_1, e_2 are the absolute errors of single sensors in relation to the "ideal" sensor (IEC) at one temperature within the temperature range specified by the supplier (1 for the flow sensor, 2 for the return sensor);

$\Delta\theta$ is the temperature difference specified by the supplier ($\theta_{flow} - \theta_{return}$) (it is recommended to start with $\Delta\theta_{min}$).

The maximum values of the absolute errors of the single sensors tested without pockets are given in Table 7.

2) An auxiliary equation for the determination of E_{Tmax} is:

$$x = E_T / E_{t\,MPE}$$

where:

$E_{t\,MPE} = \pm (0.5 + 3\ \Delta\theta_{min}/\Delta\theta)$

(see: OIML R 75-1, clause 9.2.2.2, maximum permissible error of the temperature sensor pair).

3) To obtain the maximum value of x, the calculation according to the equation in 1) above has to be repeated taking into account the whole temperature range and the whole temperature difference range specified by the supplier, separately in two ranges of return temperature θ_{return}:

a) for $\theta_{return} \le 80$ °C in the whole range of temperature difference;
b) for $\theta_{return} > 80$ °C only for temperature differences over 10 K.

4) The biggest value of x calculated according to 3) above is "the worst case" x_{max}

5) The value of x_{max} shall be used for the calculation of the maximum value of the relative error E_T (E_{Tmax}):

$$E_{Tmax} = x_{max}\ E_{t\,MPE}$$

The combination of values of the flow temperature θ_{flow} and the return temperature θ_{return}, for which E_{Tmax} has appeared shall be determined. E_{Tmax} shall be within the limits of the MPE, observing the range of $\Delta\theta$ (see: OIML R 75-1, clause 9.2.2.2).

Table 8b: **Performance test. Maximum relative error of a temperature sensor pair. Sensors are tested in pockets (Ref.: 9.2.2.2 in R 75-1 and 6.4.3.3 in R 75-2)**

This test is performed if the sensors are intended to be installed in pockets and if the maximum tolerated gap between the sensor and the pocket is more than 0.125 mm or the immersion depth of the pocket is less than 70 mm.

Sensor pair: Serial No. (flow): ______________ Serial No. (return): ______________

Temperature range specified by the supplier from ____ °C to ____ °C

Temperature difference for the pair specified by the supplier from ____ K to ____ K

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

Used temperature levels for the test: _____ °C and _____ °C and _____ °C

Constants of sensor 1 calculated according to IEC 60751:
R_0: __________ Ω A: _________ B: ________

Constants of sensor 2 calculated according to IEC 60751:
R_0: __________ Ω A: _________ B: ________
(Calculated constants are beneath the table 6b.)

Test result (summary)

Flow temperature °C	Return temperature °C	Maximum relative error *) %	Maximum relative error deviation without/in pockets **) %	MPE %	1/3 MPE %

*) Calculations as in Table 8a

**) The maximum relative error determined for the sensor pair tested in pockets shall be subtracted from the maximum relative error of the sensor pair determined for sensors tested without pockets. The maximum permissible deviation from the value determined without pockets is 1/3 MPE.

Markings: Pass: _____ Fail: _____ Signature: ______________________________

3.4 Combined sub-assemblies or complete instrument (Ref.: 6.4.4 in R 75-2)

In the case of combined sub-assemblies or complete instruments the relevant tests as described in 3.1 for the flow sensor, 3.2 for the calculator and/or 3.3 for the temperature sensors shall be carried out.

4 Dry heat (Ref.: 6.5 in R 75-2)

Note: In the case of combined sub-assemblies or complete instruments the relevant tests as described for the calculator and flow sensor shall be carried out.

Test results: Calculator

Table 9: Dry heat (Ref.: 6.5.1 and 5.3 in R 75-2)

Simulated flowrate (impulse signal): ______ m³/h

Test number	Test point return temperature °C	Temperature difference $\Delta\theta$ K				
1	θ_{min} =	$\Delta\theta_{min}$ =		$\Delta\theta_{RVM}$ =		
		Error %	MPE %	Error %	MPE %	
2	θ_{RVM} =	$\Delta\theta_{min}$ =		$\Delta\theta_{RVM}$ =		
		Error %	MPE %	Error %	MPE %	

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor

Table 10: Dry heat (Ref.: 6.5.2 in R 75-2 and 5.3 in R 75-2)

Water temperature: ____ °C

Test number	Test point flowrate		Error %	MPE %
	Calculated m³/h	Actual m³/h		
1	(1 to 1.1) q_i			
2 *)	(0.7 to 0.75) q_p			

*) This test shall only be carried out if $q_p > 3.5$ m³/h

Markings: Pass: _____ Fail: _____ Signature: ______________________________

5 Cold (Ref.: 6.6 in R 75-2)

Note: In the case of combined sub-assemblies or complete instruments the relevant tests as described for the calculator and flow sensor shall be carried out.

Test results: Calculator

Table 11: Cold (Ref.: 6.6.1 in R 75-2)

Simulated flowrate (impulse signal): ______ m³/h

<table>
<tr><td>Test number</td><td>Test point return temperature °C</td><td colspan="5">Temperature difference
$\Delta\theta$
K</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">θ_{min} =</td><td colspan="2">$\Delta\theta_{min}$ =</td><td colspan="2">$\Delta\theta_{RVM}$ =</td><td></td></tr>
<tr><td>Error
%</td><td>MPE
%</td><td>Error
%</td><td>MPE
%</td><td></td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">θ_{RVM} =</td><td colspan="2">$\Delta\theta_{min}$ =</td><td colspan="2">$\Delta\theta_{RVM}$ =</td><td></td></tr>
<tr><td>Error
%</td><td>MPE
%</td><td>Error
%</td><td>MPE
%</td><td></td></tr>
</table>

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor

Table 12: Cold (Ref.: 6.6.2 in R 75-2 and 5.3 in R 75-2)

Water temperature: ____ °C

Test number	Test point flowrate		Error %	MPE %
	Calculated m^3/h	Actual m^3/h		
1	(1 to 1.1) q_i			
2 *)	(0.7 to 0.75) q_p			

*) This test shall only be carried out if $q_p > 3.5$ m³/h

Markings: Pass: _____ Fail: _____ Signature: ______________________________

6 Variations in supply voltage and frequency (Ref.: 6.7 in R 75-2)

Note: In the case of combined sub-assemblies or complete instruments the relevant tests as described for the calculator and flow sensor shall be carried out.

Test results: Calculator. Variation in supply voltage

Table 13: Supply mode a), mains operation with a single rated voltage U_{nom} (Ref.: 6.7a and 5.3 in R 75-2)

U_{nom} specified by the supplier: ______ V

f_{nom} specified by the supplier: ______ Hz

θ_{RVM} °C	$\Delta\theta_{RVM}$ K	Simulated flowrate m³/h	$U_{max} = 1.1\ U_{nom}$ V	Error at U_{max} %	$U_{min} = 0.85\ U_{nom}$ V	Error at U_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Calculator. Variation in supply frequency

Table 14: Supply mode a), mains operation with variations of frequency if mains frequency is used for measuring purposes (Ref.: 6.7a and 5.3 in R 75-2)

U_{nom} specified by the supplier: ______ V

f_{nom} specified by the supplier: ______ Hz

θ_{RVM} °C	$\Delta\theta_{RVM}$ K	Simulated flowrate m³/h	$f_{max} = 1.02\ f_{nom}$ Hz	Error at f_{max} %	$f_{min} = 0.98\ f_{nom}$ Hz	Error at f_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor. Variation in supply voltage

Table 15: Supply mode a), mains operation with a single rated voltage U_{nom} (Ref.: 6.7a and 5.3 in R 75-2)

U_{nom} specified by the supplier: ______ V

f_{nom} specified by the supplier: ______ Hz

Water temperature: ______ °C

Flowrate m³/h	$U_{max} = 1.1\ U_{nom}$ V	Error at U_{max} %	$U_{min} = 0.85\ U_{nom}$ V	Error at U_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor. Variation in supply frequency

Table 16: Supply mode a), mains operation with variations of frequency if mains frequency is used for measuring purposes (Ref.: 6.7a and 5.3 in R 75-2)

U_{nom} specified by the supplier: ______ V

f_{nom} specified by the supplier: ______ Hz

Water temperature: ______ °C

Flowrate m³/h	$f_{max} = 1.02\ f_{nom}$ Hz	Error at f_{max} %	$f_{min} = 0.98\ f_{nom}$ Hz	Error at f_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Calculator. Variation in supply voltage

Table 17: Supply mode b), mains operation with a nominal range of voltage from U_{nom1} to U_{nom2} (Ref.: 6.7b and 5.3 in R 75-2)

U_{nom1} specified by the supplier: ______ V

U_{nom2} specified by the supplier: ______ V

f_{nom} specified by the supplier: ______ Hz

θ_{RVM} °C	$\Delta\theta_{RVM}$ K	Simulated flowrate m³/h	$U_{max} = 1.1\ U_{nom2}$ V	Error at U_{max} %	$U_{min} = 0.85\ U_{nom1}$ V	Error at U_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Calculator. Variation in supply frequency

Table 18: Supply mode b), mains operation with variations of frequency if mains frequency is used for measuring purposes (Ref.: 6.7b and 5.3 in R 75-2)

U_{nom1} specified by the supplier: ______ V

U_{nom2} specified by the supplier: ______ V

$U_{nom,calculated} = (U_{nom2} + U_{nom1})/2$: ______ V

f_{nom} specified by the supplier: ______ Hz

θ_{RVM} °C	$\Delta\theta_{RVM}$ K	Simulated flowrate m³/h	$f_{max} = 1.02\ f_{nom}$ Hz	Error at f_{max} %	$f_{min} = 0.98\ f_{nom}$ Hz	Error at f_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor. Variation in supply voltage

Table 19: **Supply mode b), mains operation with a nominal range of voltage from U_{nom1} to U_{nom2} (Ref.: 6.7b and 5.3 in R 75-2)**

U_{nom1} specified by the supplier: ______ V

U_{nom2} specified by the supplier: ______ V

f_{nom} specified by the supplier: ______ Hz

Water temperature: ______ °C

Flowrate m³/h	$U_{max} = 1.1\ U_{nom2}$ V	Error at U_{max} %	$U_{min} = 0.85\ U_{nom1}$ V	Error at U_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ________________________________

Test results: Flow sensor. Variation in supply frequency

Table 20: **Supply mode b), mains operation with variations of frequency if mains frequency is used for measuring purposes (Ref.: 6.7b and 5.3 in R 75-2)**

U_{nom1} specified by the supplier: ______ V

U_{nom2} specified by the supplier: ______ V

$U_{nom,calculated} = (U_{nom2} + U_{nom1})/2$: ______ V

f_{nom} specified by the supplier: ______ Hz

Water temperature: ______ °C

Flowrate m³/h	$f_{max} = 1.02\ f_{nom}$ Hz	Error at f_{max} %	$f_{min} = 0.98\ f_{nom}$ Hz	Error at f_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ________________________________

Test results: Calculator. Variation in supply voltage

<u>Table 21</u>: Supply mode c), external AC low voltage operation with a single rated voltage (Ref.: 6.7c and 5.3 in R 75-2)

U_{nom} specified by the supplier: ______ V

f_{nom} specified by the supplier: ______ Hz

θ_{RVM} °C	$\Delta\theta_{RVM}$ K	Simulated flowrate m³/h	$U_{max} = 1.5\ U_{nom}$ V	Error at U_{max} %	$U_{min} = 0.5\ U_{nom}$ V	Error at U_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Calculator. Variation in supply frequency

<u>Table 22</u>: Supply mode c), external AC low voltage operation with variations of frequency if AC frequency is used for measuring purposes (Ref.: 6.7c and 5.3 in R 75-2)

U_{nom} specified by the supplier: ______ V

f_{nom} specified by the supplier: ______ Hz

θ_{RVM} °C	$\Delta\theta_{RVM}$ K	Simulated flowrate m³/h	$f_{max} = 1.02\ f_{nom}$ Hz	Error at f_{max} %	$f_{min} = 0.98\ f_{nom}$ Hz	Error at f_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor. Variation in supply voltage

Table 23: Supply mode c), external AC low voltage operation with a single rated voltage (Ref: 6.7c and 5.3 in R 75-2)

U_{nom} specified by the supplier: ______ V

f_{nom} specified by the supplier: ______ Hz

Water temperature: ______ °C

Flowrate m³/h	$U_{max} = 1.5\ U_{nom}$ V	Error at U_{max} %	$U_{min} = 0.5\ U_{nom}$ V	Error at U_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor. Variation in supply frequency

Table 24: Supply mode c), external AC low voltage operation with variations of frequency if AC frequency is used for measuring purposes (Ref.: 6.7c and 5.3 in R 75-2)

U_{nom} specified by the supplier: ______ V

f_{nom} specified by the supplier: ______ Hz

Water temperature: ______ °C

Flowrate m³/h	$f_{max} = 1.02\ f_{nom}$ Hz	Error at f_{max} %	$f_{min} = 0.98\ f_{nom}$ Hz	Error at f_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Calculator. Variation in DC supply voltage

<u>Table 25</u>: Supply mode d), external DC low voltage operation with a single rated voltage (Ref.: 6.7d and 5.3 in R 75-2)

U_{nom} specified by the supplier: ______ V

θ_{RVM} °C	$\Delta\theta_{RVM}$ K	Simulated flowrate m³/h	$U_{max} = 1.75\ U_{nom}$ V	Error at U_{max} %	$U_{min} = 0.5\ U_{nom}$ V	Error at U_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor. Variation in DC supply voltage

<u>Table 26</u>: Supply mode d), external DC low voltage operation and having a single rated voltage (Ref.: 6.7d and 5.3 in R 75-2)

U_{nom} specified by the supplier: ______ V

Water temperature: ______ °C

Flowrate m³/h	$U_{max} = 1.75\ U_{nom}$ V	Error at U_{max} %	$U_{min} = 0.5\ U_{nom}$ Hz	Error at U_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Calculator. Variation in battery supply voltage

<u>Table 27</u>: Supply mode e), operation with batteries (Ref.: 6.7e and 5.3 in R 75-2)

U_{max} specified by the supplier: ______ V

U_{min} specified by the supplier: ______ V

θ_{RVM} °C	$\Delta\theta_{RVM}$ K	Simulated flowrate m³/h	U_{max} V	Error at U_{max} %	U_{min} V	Error at U_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor. Variation in battery supply voltage

<u>Table 28</u>: Supply mode e), operation with batteries (Ref.: 6.7e and 5.3 in R 75-2)

U_{max} specified by the supplier: ______ V

U_{min} specified by the supplier: ______ V

Water temperature: ______ °C

Flowrate m³/h	U_{max} V	Error at U_{max} %	U_{min} Hz	Error at U_{min} %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

7 Durability test (Ref.: 6.8 in R 75-2)

Note: According to 6.8.3 in R 75-2 in the case of combined sub-assemblies or complete instruments the relevant tests for each sub-assembly shall be carried out. One exception is the insulation resistance for temperature sensors when they are not a part of the heat meter or the sub-assemblies.

Test results: Flow sensor

Table 29: Performance test after basic test (Ref.: 6.8.1 in R 75-2)

$K = (q_S/q_i)^{1/4} =$ _____

Initial intrinsic error at RVM-conditions: ____ %

Test number	Test point flowrate m³/h			Temperature of liquid °C	Flow sensor output signal volume m³	Conventional true volume m³	Error of indication %	MPE %
		Calculated	Actual					
1	q_1							
2	q_2							
3	q_3							
4	q_4							
5	q_5							

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor

Table 30: Performance test after additional test for long life sensors (Ref.: 6.8.1 in R 75-2)

K = $(q_S/q_i)^{1/4}$ = _____

Initial intrinsic error at RVM-conditions: ____ %

Test number	Test point flowrate m³/h			Temperature of liquid °C	Flow sensor output signal volume m³	Conventional true volume m³	Error of indication %	MPE %
		Calculated	Actual					
1	q_1							
2	q_2							
3	q_3							
4	q_4							
5	q_5							

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Temperature sensor pair

Table 31a: Durability test. Sensor constants before and after test (Ref: 6.8.2 in R 75-2)

Sensor 1: Serial No. (flow): ______________ Sensor 2: Serial No. (return): ______________

Temperature range specified by the supplier from ____ °C to ____ °C

Temperature difference for the pair specified by the supplier from ____ K to ____ K

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

Upper temperature of test: ____ °C Lower temperature of test: ____ °C

Immersion depth: ___ mm

Measurements								
Test temperature	Before test				After test (10 cycles)			
	Sensor 1 (flow)		Sensor 2 (return)		Sensor 1 (flow)		Sensor 2 (return)	
	Temp. °C	$R_{measured}$ Ω	Temp. °C	$R_{measured}$ Ω	Temp. °C	$R_{measured}$ Ω	Temp. °C	$R_{measured}$ Ω
θ_1								
θ_2								
θ_3								

Calculation of constants according to IEC 60751					
IEC 60751	Before test *)		After test (10 cycles)		Unit
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	
R_0					Ω
A					$°C^{-1}$
B					$°C^{-2}$

*) Calculated constants are below Table 6a.

Sensors are tested without pockets.

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Table 31b: Change of resistance corresponding to temperature (Ref: 6.8.2 in R 75-2, durability error)

Sensor 1: Serial No. (flow): ______________ Sensor 2: Serial No. (return): ______________

Temperature range specified by the supplier from ____ °C to ____ °C

Temperature difference for the pair specified by the supplier from ____ K to ____ K

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

Temperature sensors	Measured point of temperature range °C	Maximum change of resistance corresponding to temperature *) K	MPE K
Sensor 1 (flow)			±0.1
Sensor 2 (return)			±0.1

*) The characteristic curve for the sensor before the test shall be subtracted from the characteristic curve for the sensor after the test. The difference between the characteristics before and after the test shall be determined over the temperature range specified for the temperature sensor. The maximum difference in Ω between the characteristics at the measured points of the temperature range shall be calculated as a difference in K. The maximum permissible difference between the characteristics is ± 0.1 K.

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Temperature sensors

Table 32: Insulation resistance after durability test (Ref.: 6.8.2 in R 75-2)

Temperature sensor, serial number	Insulation resistance at reference temperature MΩ	Requirement: insulation resistance MΩ	Insulation resistance at maximum temperature MΩ	Requirement: insulation resistance MΩ
	at positive polarity: ____	≥ 100	at positive polarity: ____	≥ 10
	at negative polarity: ____	≥ 100	at negative polarity: ____	≥ 10
	at positive polarity: ____	≥ 100	at positive polarity: ____	≥ 10
	at negative polarity: ____	≥ 100	at negative polarity: ____	≥ 10

Markings: Pass: _____ Fail: _____ Signature: ______________________________

8 Damp heat cyclic (Ref.: 6.9 in R 75-2)

Note:
In case of combined sub-assemblies or complete instrument the relevant tests as described for the calculator and flow sensor shall be carried out.

Test results: Calculator

Table 33: Damp heat cyclic. Comparison: Initial intrinsic error, phase 1 and phase 2 (Ref.: 6.9 and 5.3 in R 75-2)

Lower temperature: _____ °C

Upper temperature: _____ °C

Relative humidity: _____ %

Simulated flowrate: _____ m^3/h

θ_{RVM}: _____ °C

$\Delta\theta_{RVM}$: _____ K

Initial intrinsic error %	Intrinsic error after phase 1 %	Intrinsic error after phase 2 %	MPE %

Markings: Pass: _____ Fail: _____ Signature: _______________________________

Note: After phase 1 means during the second cycle, phase 2 means after recovery.

Test results: Flow sensor

Table 34: Damp heat cyclic. Comparison: Initial intrinsic error, phase 1 and phase 2 (Ref.: 6.9 and 5.3 in R 75-2)

Lower temperature: _____ °C

Upper temperature: _____ °C

Relative humidity: _____ %

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

Initial intrinsic error %	Intrinsic error after phase 1 %	Intrinsic error after phase 2 %	MPE %

Markings: Pass: _____ Fail: _____ Signature: _______________________________

Note: After phase 1 means during the second cycle, phase 2 means after recovery.

Test results: Complete instrument

Table 35: Damp heat cyclic. Comparison: Initial intrinsic error, phase 1 and phase 2 (Ref.: 6.9 and 5.3 in R 75-2)

Lower temperature: _____ °C

Upper temperature: _____ °C

Relative humidity: _____ %

Flowrate: _____ m³/h

Water temperature in flow sensor: _____ °C

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Initial intrinsic error %	Intrinsic error after phase 1 %	Intrinsic error after phase 2 %	MPE %

Note: After phase 1 means during the second cycle, phase 2 means after recovery.

Markings: Pass: _____ Fail: _____ Signature: ______________________________

9 Short time mains voltage reduction (Ref.: 6.10 in R 75-2)

Note: In the case of combined sub-assemblies or complete instruments the relevant tests as described for the calculator and flow sensor shall be carried out.

Test results: Calculator

Table 36: Short time mains voltage reduction. Comparison: Initial intrinsic error, after short time mains voltage reduction (Ref.: 6.10 and 5.3 in R 75-2)

Simulated flowrate: _____ m³/h

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor

Table 37: Short time mains voltage reduction. Comparison: Initial intrinsic error, after short time voltage reduction (Ref: 6.10 and 5.3 in R 75-2)

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ________________________________

Test results: Complete instrument

Table 38: Short time mains voltage reduction. Comparison: Initial intrinsic error, after short time mains voltage reduction (Ref.: 6.10 and 5.3 in R 75-2)

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ________________________________

10 Electrical transients (Ref.: 6.11 in R 75-2)

Note: The electrical transient disturbance tests shall be carried out on fast transients and surge transients. In the case of combined sub-assemblies or complete instruments the relevant tests as described for the calculator and flow sensor shall be carried out. If the sub-assemblies or the combined sub-assemblies or complete instrument under test have a standardized data output(s), determination of intrinsic error before and after the test shall also be made using this data output(s).

Test results: Calculator

Table 39: Transients, coupled into DC lines. Comparison: Initial intrinsic error, change of display/readings and error after test (Ref.: 6.11.1/6.11.2 and 5.3 in R 75-2)

Kind of transients: Fast transients (bursts) ☐ Surge transients ☐

Simulated flowrate: _____ m^3/h

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ________________________________

Test results: Flow sensor

Table 40: Transients coupled into DC lines. Comparison: Initial intrinsic error, change of display/readings and error after test (Ref.: 6.11.1/6.11.2 and 5.3 in R 75-2)

Kind of transients: Fast transients (bursts) ☐ Surge transients ☐

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ________________________________

Test results: Complete instrument

Table 41: Transients coupled into DC lines. Comparison: Initial intrinsic error, change of display/readings and error after test (Ref.: 6.11.1/6.11.2 and 5.3 in R 75-2)

Kind of transients: Fast transients (bursts) ☐ Surge transients ☐

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Calculator

Table 42: Transients coupled into AC power lines. Comparison: Initial intrinsic error, change of display/readings and error after test (Ref.: 6.11.1/6.11.2 and 5.3 in R 75-2)

Kind of transients: Fast transients (bursts) ☐ Surge transients ☐

Simulated flowrate: _____ m^3/h

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor

Table 43: Transients coupled into AC power lines. Comparison: Initial intrinsic error, change of display/readings and error after test (Ref.: 6.11.1/6.11.2 and 5.3 in R 75-2)

Kind of transients: Fast transients (bursts) ☐ Surge transients ☐

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ____________________________

Test results: Complete instrument

Table 44: Transients coupled into AC power lines. Comparison: Initial intrinsic error, change of display/readings and error after test (Ref.: 6.11.1/6.11.2 and 5.3 in R 75-2)

Kind of transients: Fast transients (bursts) ☐ Surge transients ☐

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ____________________________

11 Electromagnetic field (Ref.: 6.12 in R 75-2)

Note: In the case of combined sub-assemblies or complete instruments the relevant tests as described for the calculator and flow sensor shall be carried out. If the sub-assemblies or the combined sub-assemblies or complete instrument under test have a standardized data output(s), the intrinsic error determination and determination of the intrinsic error after the test shall also be made using this data output(s). The responses within three requests have to be carried out according to the protocol in accordance with IEC 60870-5-1 or IEC 61107, see note to 6.12 in R 75-2.

Test results: Calculator

Table 45: Electromagnetic field (Ref.: 6.12 and 5.3 in R 75-2)

Test level: ____ V/m
Antenna polarization: Horizontal ☐ Vertical ☐

Dwell time: _____ s

Determination of intrinsic error: By display ☐ By standardized data output ☐

Protocol of standardized data output: _____

Simulated flowrate: _____ m³/h

θ_{RVM} : _____ C

$\Delta\theta_{RVM}$: _____ K

Carrier frequencies MHz	Transmitting antenna	Intrinsic error at test level %	MPE %
26	biconical		
40	biconical		
60	biconical		
80	biconical		
100	biconical		
120	biconical		
144	biconical		
150	biconical		
160	biconical		
180	biconical		
200	biconical		
250	log-periodic		
350	log-periodic		
400	log-periodic		
435	log-periodic		
500	log-periodic		
600	log-periodic		
700	log-periodic		
800	log-periodic		
934	log-periodic		
1000	log-periodic		

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor

<u>Table 46</u>: Electromagnetic field (Ref.: 6.12 and 5.3 in R 75-2)

Test level: ____ V/m

Antenna polarization: Horizontal ☐ Vertical ☐

Dwell time: _____ s

Determination of intrinsic error: By display ☐ By standardized data output ☐

Protocol of standardized data output: _____

Test with water flow: Yes ☐ No ☐

Flowrate: _____ m³/h

Water temperature in flow sensor: _____ °C

Carrier frequencies MHz	Transmitting antenna	Intrinsic error at test level %	MPE %
26	biconical		
40	biconical		
60	biconical		
80	biconical		
100	biconical		
120	biconical		
144	biconical		
150	biconical		
160	biconical		
180	biconical		
200	biconical		
250	log-periodic		
350	log-periodic		
400	log-periodic		
435	log-periodic		
500	log-periodic		
600	log-periodic		
700	log-periodic		
800	log-periodic		
934	log-periodic		
1000	log-periodic		

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Complete instrument

Table 47: Electromagnetic field (Ref: 6.12 and 5.3 in R 75-2)

Test level: ____ V/m
Antenna polarization: Horizontal ☐ Vertical ☐

Dwell time: _____ s

Determination of intrinsic error: By display ☐ By standardized data output ☐

Protocol of standardized data output: _____

Test with water flow: Yes ☐ No ☐

Flowrate: _____ m³/h

Water temperature in flow sensor: _____ °C

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Carrier frequencies MHz	Transmitting antenna	Intrinsic error at test level %	MPE %
26	biconical		
40	biconical		
60	biconical		
80	biconical		
100	biconical		
120	biconical		
144	biconical		
150	biconical		
160	biconical		
180	biconical		
200	biconical		
250	log-periodic		
350	log-periodic		
400	log-periodic		
435	log-periodic		
500	log-periodic		
600	log-periodic		
700	log-periodic		
800	log-periodic		
934	log-periodic		
1000	log-periodic		

Markings: Pass: _____ Fail: _____ Signature: ______________________________

12 Electrostatic discharge (Ref.: 6.13 in R 75-2)

Note: In the case of combined sub-assemblies or complete instruments the relevant tests as described for the calculator and flow sensor shall be carried out. If the sub-assemblies or the combined sub-assemblies or complete instrument under test have a standardized data output(s), the intrinsic error determination and determination of intrinsic error after the test shall also be made using this data output(s).

Test results: Calculator

Table 48: Electrostatic discharge. Comparison: Initial intrinsic error, change of display/readings and error after test (Ref.: 6.13 and 5.3 in R 75-2)

Simulated flowrate: _____ m^3/h

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ________________________________

Test results: Flow sensor

Table 49: Electrostatic discharge. Comparison: Initial intrinsic error, change of display/readings and error after test (Ref: 6.13 and 5.3 in R 75-2)

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ________________________________

Test results: Complete instrument

Table 50: Electrostatic discharge. Comparison: Initial intrinsic error, change of display/readings and error after test (Ref.: 6.13 and 5.3 in R 75-2)

Flowrate: _____ m³/h

Water temperature in flow sensor: _____ °C

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

13 Static magnetic field (Fraud protection, Ref.: 6.14 in R 75-2)

Note: In the case of combined sub-assemblies or complete instruments the relevant tests as described for the calculator and flow sensor shall be carried out.

Test results: Calculator

Table 51: Static magnetic field. Comparison: Initial intrinsic error, change of display information and error during test (Ref.: 6.14 and 5.3 in R 75-2)

Simulated flowrate: _____ m³/h

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor

<u>Table 52</u>: Static magnetic field. Comparison: Initial intrinsic error, change of display information and error during test (Ref.: 6.14 and 5.3 in R 75-2)

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Complete instrument

<u>Table 53</u>: Static magnetic field. Comparison: Initial intrinsic error, change of display information and error during test (Ref.: 6.14 and 5.3 in R 75-2)

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

14 Electromagnetic field at mains frequency (Ref.: 6.15 in R 75-2)

Note: In the case of combined sub-assemblies or complete instruments the relevant tests as described for the calculator and flow sensor shall be carried out.

Test results: Calculator

Table 54: Electromagnetic field at mains frequency. Comparison: Initial intrinsic error, change of display information and error after test (Ref.: 6.15 and 5.3 in R 75-2)

Simulated flowrate: _____ m^3/h

θ_{RVM} : _____ °C

$\Delta\theta_{RVM}$: _____ K

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Flow sensor

Table 55: Electromagnetic field at mains frequency. Comparison: Initial intrinsic error, change of display information and error after test(Ref.: 6.15 and 5.3 in R 75-2)

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Complete instrument

Table 56: Electromagnetic field at mains frequency. Comparison: Initial intrinsic error, change of display information and error after test (Ref.: 6.15 and 5.3 in R 75-2)

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

θ_{RVM}: _____ °C

$\Delta\theta_{RVM}$: _____ K

Display information/readings have changed due to the exposure:

Yes ☐ No ☐ Figure: _____

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

15 Internal pressure (Ref.: 6.16 in R 75-2)

Note: In the case of combined sub-assemblies or complete instruments the relevant tests as described for the calculator and flow sensor shall be carried out.

Test results: Flow sensor

Table 57: Internal pressure. Comparison: Initial intrinsic error before and intrinsic error after internal pressure test at RVM conditions (Ref.: 6.16 in R 75-2)

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Test results: Complete instrument

Table 58: Internal pressure. Comparison: Initial intrinsic error after internal pressure test (Ref.: 6.16 in R 75-2)

Flowrate: _____ m^3/h

Water temperature in flow sensor: _____ °C

θ_{RVM}: _____ °C

$\Delta\theta_{RVM}$: _____ K

Initial intrinsic error %	Intrinsic error after test %	MPE %

Markings: Pass: _____ Fail: _____ Signature: ______________________________

16 Pressure loss (Ref.: 6.17 in R 75-2)

Test results: Flow sensor. Complete instrument

Table 59: Pressure loss (Ref.: 6.17 in R 75-2 and 6.7 in R 49-2)

Flowrate set to (0.9 to 1.0) q_p	Temperature set to (50 ± 5) °C	Pressure loss		Requirement: Max. pressure loss	
m^3/h	°C	bar	Pa	bar	Pa
				0.25 *)	2.5×10^4 *)

*) Except where the flow sensor/heat meter includes a flow controller or also acts as a pressure-reducing device.

Markings: Pass: _____ Fail: _____ Signature: ______________________________

II INITIAL VERIFICATION REPORT (CERTIFICATE)

1 Information concerning the EUT verified

1.1 General information

Testing authority

Name: ....

Address: ....

Accredited laboratory: Yes ☐ No ☐

Accreditation No.: ……………………… by Company: ………………………

Test No.: ………………………

Declaration of expanded uncertainty of test equipment No.: ....

Contact information: ....

Date of beginning and end of tests: ....

Name(s) of test engineer(s): ....

Applicant/manufacturer information

Application No.:...

Application date:..

Model designation:..

Applicant:...

Address: ....

....

Manufacturer:..

Address: ....

....

Representative (name, telephone): ....

....

1.2 Information concerning the EUT

Instrument category:

Complete instrument ☐ Documentation No.: _____ Serial No.: _____ Year of manufacture: _____

Calculator ☐ Documentation No.: _____ Serial No.: _____ Year of manufacture: _____

Flow sensor ☐ Documentation No.: _____ Serial No.: _____ Year of manufacture: _____

Temperature sensor pair ☐ Documentation No.: _____ Serial No.: _____ Year of manufacture: _____

Combined Sub-Assemblies ☐ Documentation No.: _____ Serial No.: _____ Year of manufacture: _____

Type approval number of the EUT: ....

Short description of the principle of measurement (measuring method): ....

....

List of documents provided by the manufacturer: ....

....

All values in this table are taken from documentation pages ....

Additional qualifying information supplied: Yes ☐ No ☐ Remarks: ....

....

Completeness and correctness of instruction manual, marking, assembly instruction, installation instruction, security sealing plan, initial functionality check and operation instruction submitted for verification (requirements of sections 11 and 12 in R 75-1 and 8.2 in R 75-2):

Pass ☐ Fail ☐ Remarks: ....

....

1.2.1 Complete instrument specifications

Accuracy class: Class 1 ☐ Class 2 ☐ Class 3 ☐

Heat conveying liquid: Water ☐ Water-glycol solution ☐ Mixing: ___/___

Environmental class: A ☐ B ☐ C ☐

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐ other ☐

Indication if shielding: Yes ☐ No ☐

Flow sensor to be operated: In the flow ☐ In the return ☐

Limits of temperature: θ_{min} = ____ °C θ_{max} = ____ °C

Limits of temperature difference: $\Delta\theta_{min}$ = ____ K $\Delta\theta_{max}$ = ____ K

Display unit options: GJ ☐ MJ ☐ kWh ☐

Maximum value of thermal power (P_s): ____ MW

Output signal for testing: Type: ______ Level: ____ V

Corresponding factor for test output: ______ Wh/pulse

Display unit options for testing: MJ ☐ kWh ☐ Wh ☐

Dynamic behavior (circumstances of temperature measurement and integration): ....

Other functions in addition to heat indication: ....

<u>For the flow sensor:</u>

Physical dimensions (length, thread/flange specification): ....

Installation conditions (e.g. straight sections of piping): ....

Upstream/downstream, vertical/horizontal position: ....

Maximum admissible working pressure (PN-class): ______

Maximum pressure loss at q_p: ____ bar ____ Pa

Temperature sensor installed: Yes ☐ No ☐

Filter installed: Yes ☐ No ☐

Straightener installed: Yes ☐ No ☐

Range of electrical conductivity of water (if necessary): ___ µS/cm to ___ µS/cm

Length of the connection cable to the electrodes (if the electronic part is separated from the sensor head): ______ m

Response time (for fast response meters): ______ s

Limits of flowrate: q_p = ______ m³/h q_i = ______m³/h q_s= ______ m³/h

Low flow threshold value: ______ m³/h

Limits of temperature (heat conveying liquid): θ_{min} = ______ °C θ_{max} = ______ °C

Nominal meter factor: ______ litres/pulse

Output signal for testing: Type: ______ Level: ______ V

Corresponding factor for test output: ______ litres/pulse

1.2.2 Calculator specifications

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐ other ☐

(or declaration of sensor coefficients: R_0: _______Ω A: _______ B: _______)

Wiring of sensors: 4-wire ☐ 3-wire ☐ 2-wire ☐

Indication if shielding: Yes ☐ No ☐

Flow sensor to be operated: In the flow ☐ In the return ☐

Environmental class: A ☐ B ☐ C ☐

Heat conveying liquid: Water ☐ Water-glycol solution ☐ Mixing: ___/___

Limits of temperature: θ_{min} = ____ °C θ_{max} = ____ °C

Limits of temperature difference: $\Delta\theta_{min}$ = ____ K $\Delta\theta_{max}$ = ____ K

Display unit options: GJ ☐ MJ ☐ kWh ☐

Maximum value of thermal power (P_s): ____ MW

RMS value of temperature sensor current: ____ mA

Required input signal from the flow sensor:

Nominal meter factor: ____ litres/pulse (or corresponding factor for test input)

Input signal for testing: Type: ______ Level: ____ V

Maximum frequency of flow sensor signal: For testing: ____ Hz In normal use: ____ Hz

Output signal for testing: Type: ______ Level: ____ V

Corresponding factor for test output: ______ Wh/pulse

Display unit options for testing: MJ ☐ kWh ☐ Wh ☐

Dynamic behavior (circumstances of temperature measurement and integration): ....

Other functions in addition to heat indication: ....

1.2.3 Flow sensor specifications

Accuracy class: Class 1 ☐ Class 2 ☐ Class 3 ☐

Heat conveying liquid: Water ☐ Water-glycol solution ☐ Mixing: ___/___

Environmental class: A ☐ B ☐ C ☐

Physical dimensions (length, thread/flange specification): ....

Installation conditions (e.g. straight sections of piping): ....

Upstream/downstream, vertical/horizontal position: ....

Maximum admissible working pressure (PN-class): ______

Maximum pressure loss at q_p: ____ bar ____ Pa

Temperature sensor installed: Yes ☐ No ☐

Filter installed: Yes ☐ No ☐

Straightener installed: Yes ☐ No ☐

Limits of temperature (heat conveying liquid): θ_{min} = ______ °C θ_{max} = ______ °C

Range of electrical conductivity of water (if necessary): ___ µS/cm to ___ µS/cm

Length of the connection cable to the electrodes (if the electronic part is separated from the sensor head): ______ m

Response time (for fast response meters): ______ s

Limits of flowrate: q_p = ______ m³/h q_i = _______m³/h q_s= _______ m³/h

Low flow threshold value: ______ m³/h

Nominal meter factor: ______ litres/pulse

Corresponding factor for test output: ______ litres/pulse

Output signal for testing: Type: ______ Level: ______ V

1.2.4 Temperature sensor pair specifications

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐ other ☐

(or declaration of sensor coefficients: R_0: _______Ω A: _______ B: _______)

Wiring of sensors: 4-wire ☐ 3-wire ☐ 2-wire ☐

Total resistance of a 2-cable wire: ____ Ω/m Cross section of a wire: ____ mm^2

Maximum length of a cable for: Pt 100 ____ m, Pt 500 ____ m, Pt 1000 ____ m, other ____ m

Indication if shielding: Yes ☐ No ☐

Limits of temperature: θ_{min} = ____ °C θ_{max} = ____ °C

Limits of temperature difference: $\Delta\theta_{min}$ = ____ K $\Delta\theta_{max}$ = ____ K

Installation requirements (pocket mounting): Yes ☐ No ☐

Physical dimensions: Length: ____ mm Diameter: ____ mm

Minimum immersion depth: ____ mm

Maximum liquid velocity for sensors over 200 mm length: ____ m/s

Maximum admissible working pressure for direct mounted sensors (PN-class): ____

$\tau_{0.5}$ response time: ____ s

Identification of flow and return temperature sensors (if needed): At the flow ☐ At the return ☐

Maximum RMS value of sensor current: _____ mA

1.2.5 Combined sub-assemblies specifications (calculator + temperature sensor pair)

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐ other ☐

(or declaration of sensor coefficients: R_0: _______Ω A: _______ B: _______)

Wiring of sensors: 4-wire ☐ 3-wire ☐ 2-wire ☐

Indication if shielding: Yes ☐ No ☐

Environmental class: A ☐ B ☐ C ☐

Heat conveying liquid: Water ☐ Water-glycol solution ☐ Mixing: ___/___

Flow sensor to be operated: In the flow ☐ In the return ☐

Limits of temperature: θ_{min} = ____ °C θ_{max} = ____ °C

Limits of temperature difference: $\Delta\theta_{min}$ = ____ K $\Delta\theta_{max}$ = ____ K

Installation requirements (pocket mounting): Yes ☐ No ☐

Physical dimensions: Length: ___ mm Diameter: ____ mm

Minimum immersion depth: ___ mm

Maximum liquid velocity for sensors over 200 mm length: ____ m/s

Maximum admissible working pressure for direct mounted sensors (PN-class): ____

$\tau_{0.5}$ response time: ____ s

Maximum value of thermal power (P_s): ____ MW

Output signal for testing: Type: ______ Level: ____ V

Corresponding factor for test output: ______ Wh/pulse

Display unit options for testing: MJ ☐ kWh ☐ Wh ☐

Required input signal from the flow sensor:

Input signal for testing: Type: ______ Level: ____ V

Nominal meter factor: ____ litres/pulse (or corresponding factor for test input)

Maximum frequency of flow sensor signal: For testing: ____ Hz In normal use: ___Hz

Dynamic behavior (circumstances of temperature measurement and integration): ....

Other functions in addition to heat indication: ....

Correctness of identification of flow and return temperature sensors: Yes ☐ No ☐

1.2.6 Combined sub-assemblies specifications (calculator + flow sensor)

Accuracy class: Class 1 ☐ Class 2 ☐ Class 3 ☐

Heat conveying liquid: Water ☐ Water-glycol solution ☐ Mixing: ___/___

Environmental class: A ☐ B ☐ C ☐

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

Wiring of sensors: 4-wire ☐ 3-wire ☐ 2-wire ☐

Indication if shielding: Yes ☐ No ☐

Flow sensor to be operated: In the flow ☐ In the return ☐

Limits of temperature: θ_{min} = ____ °C θ_{max} = ____ °C

Limits of temperature difference: $\Delta\theta_{min}$ = ____ K $\Delta\theta_{max}$ = ____ K

Display unit options (MJ, kWh): _____

Maximum value of thermal power (P_s): ____ MW

Output signal for testing: Type: ______ Level: ____ V

Corresponding factor for test output: ______ Wh/pulse

Display unit options for testing: MJ ☐ kWh ☐ Wh ☐

Dynamic behavior (circumstances of temperature measurement and integration): ....

Other functions in addition to heat indication: ....

For the flow sensor:

Physical dimensions (length, thread/flange specification): ....

Installation conditions (e.g. straight sections of piping): ....

Upstream/downstream, vertical/horizontal position: ....

Maximum admissible working pressure (PN-class): ______

Maximum pressure loss at q_p: ____ bar ____ Pa

Temperature sensor installed: Yes ☐ No ☐

Filter installed: Yes ☐ No ☐

Straightener installed: Yes ☐ No ☐

Range of electrical conductivity of water (if necessary): ___ µS/cm to ___ µS/cm

Length of the connection cable to the electrodes (if the electronic part is separated from the sensor head): ______ m

Response time (for fast response meters): ______ s

Limits of flowrate: q_p = ______ m³/h q_i = _______m³/h q_s= _______ m³/h

Low flow threshold value: ______ m³/h

Limits of temperature (heat conveying liquid): θ_{min} = ______ °C θ_{max} = ______ °C

Nominal meter factor: ______ litres/pulse

Corresponding factor for test output: ______ litres/pulse

Output signal for testing: Type: ______ Level: ______ V

1.3 Rated operating conditions

Complete instrument, (combined) sub-assemblies

	Environmental class			Remarks
	A ☐	B ☐	C ☐	
Ambient temperature °C	+ 5 to + 55	- 25 to + 55	+ 5 to + 55	
Relative humidity %	< 93			
Mains supply voltage V Mains frequency Hz	U_{nom} (+ 10 %/- 15 %) f_{nom} (± 2 %)			Frequency used for measurement purpose: Yes ☐ No ☐
External low voltage V (< 50 V)	AC ☐ U_{nom} (+ 50 %/- 50 %) DC ☐ U_{nom} (+ 75 %/- 50 %)			Frequency used for measurement purpose: Yes ☐ No ☐
Battery voltage V	Voltage in service under normal conditions			Type, lifetime

General information concerning ambient test conditions

Test No.: ....

Application No.:..

....

Ambient temperature: ______°C Relative humidity: ______ %

Barometric pressure: ______ kPa

2 Initial verification tests (Ref.: 7 in R 75-2)

2.1 Summary of the verification tests

Note for combined instruments: According to 7.5 in R 75-2 the flow sensor, the temperature sensor pair and the calculator shall be tested separately, in accordance with 7.1 to 7.3 in R 75-2.

Temperature sensor pair *Serial No.* ___________	Flow sensor *Serial No.* ___________	Calculator *Serial No.* ___________	Combined sub-assemblies Calculator + temp. sensor pair *Serial No.* ___________	Combined sub-assemblies Calculator + flow sensor *Serial No.* ___________	Complete instrument *Serial No.* ___________
Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐	Pass ☐ Fail ☐

2.2 Results of verification tests

2.2.1 Flow sensor (Ref.: 7.1 in R 75-2)

<u>Table 1</u>: Verification test

Electrical conductivity of water (if necessary): ___ µS/cm

Remarks (e.g. straight inlet/outlet pipes, etc.): ....
....

Test No.	Test point flow rate m^3/h		Water temperature °C		Flow sensor output sign. volume m^3	Conven-tional true volume m^3	Error %	MPE %
	Calculated	Actual	Level	Measured				
1	$q_i \le q \le 1.1\ q_i$		(50 ± 5)					
2	$q_i \le q \le 1.1\ q_i$		(50 ± 5)					
3	$q_i \le q \le 1.1\ q_i$		(50 ± 5)					
4	$0.1\ q_p \le q \le 0.11 q_p$		(50 ± 5)					
5	$0.1\ q_p \le q \le 0.11 q_p$		(50 ± 5)					
6	$0.1\ q_p \le q \le 0.11 q_p$		(50 ± 5)					
7	$0.9\ q_p \le q \le 1.0 q_p$		(50 ± 5)					
8	$0.9\ q_p \le q \le 1.0 q_p$		(50 ± 5)					
9	$0.9\ q_p \le q \le 1.0 q_p$		(50 ± 5)					

Note: The verification may be carried out with cold water in accordance with the procedure laid down in the type approval certificate.

Markings: Pass: _____ Fail: _____ Signature: ______________________________

2.2.2 Temperature sensor pair (Ref.: 7.2 in R 75-2)

Table 2a: Verification test, temperature sensor pair, calculations of constants for each of the temperature sensors, resistance equation of IEC 60751

Sensor pair serial No.: ____

Temperature range specified by the supplier from ___ °C to ___ °C

Temperature difference for the pair specified by the supplier from ___ K to ___ K

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

Test point No.	For θ_{min}	Test temperature range °C		Measured resistance Ω	
		Level *)	Measured	Sensor 1 (flow)	Sensor 2 (return)
1	< 20 °C	θ_{min} to (θ_{min} + 10)			
	≥ 20 °C	35 to 45			
2	all θ_{min}	75 to 85			
3	all θ_{min}	(θ_{max} – 30) to θ_{max}			

Sensors are tested without pockets in the same temperature bath.

*) If specified in the type approval certificate, variations in the temperature ranges and the number of temperature points are permissible. The immersion depth of the temperature sensors shall not be less than their minimum immersion depth. The immersion depth of short temperature sensors should not be less than the total length plus 50 % of the thread respectively the mounting (recommended).

Constants of sensor 1 calculated according to IEC 60751:

R_0: __________ Ω A: _________ B: ________

Constants of sensor 2 calculated according to IEC 60751:

R_0: __________ Ω A: _________ B: ________

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Table 2b: Verification test, temperature sensor pair, maximum absolute error of each single temperature sensor of a pair

Sensor pair serial No.: ____

Temperature range specified by the supplier from ___ °C to ___ °C

Temperature difference for the pair specified by the supplier from ___ K to ___ K

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

Sensors are intended to be installed in pockets: Yes ☐ No ☐

Sensor	Flow temperature °C	Return temperature °C	Maximum absolute error *) K	MPE K
Sensor 1 (flow)		---		± 2
Sensor 2 (return)	---			± 2

*) The "ideal" sensor curve (with constants of IEC 60751) shall be subtracted from the characteristic curve for the sensor (calculated constants are given below Table 2a). The difference between the characteristics shall be determined over the temperature range specified for the temperature sensor. The maximum difference in Ω between the characteristics at the measured points of the temperature range shall be calculated as a difference in K. The maximum permissible difference between the characteristics (MPE) is ± 2 K.

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Table 2c: Verification test, temperature sensor pair, maximum relative error of a pair

Sensor pair serial No.: ____

Temperature range specified by the supplier from ___ °C to ___ °C

Temperature difference for the pair specified by the supplier from ___ K to ___ K

Type of temperature sensors: Pt 100 ☐ Pt 500 ☐ Pt 1000 ☐ Pt 10000 ☐

Flow temperature °C	Return temperature °C	Maximum relative error *) %	MPE %

*) Calculations as in Table 8a (the maximum values of the absolute errors of the single sensors are given in Table 2b).

Markings: Pass: _____ Fail: _____ Signature: ______________________________

Table 2d: **Insulation resistance between terminal and sheath**

Temperature sensor, serial number	Insulation resistance under ambient conditions MΩ	Requirement: Insulation resistance MΩ
	at positive polarity: ____	≥ 100
	at negative polarity: ____	≥ 100
	at positive polarity: ____	≥ 100
	at negative polarity: ____	≥ 100

Markings: Pass: _____ Fail: _____ Signature: ________________________________

2.2.3 Calculator (Ref.: 7.3 in R 75-2)

Table 3: **Verification test**

Simulated flowrate: _____ l/h

Test No.	Return temperature *) °C	Temperature difference Δθ K		Error %	MPE %
		Level	Simulated		
1	50	$\Delta\theta_{min} \leq \Delta\theta \leq 1.2\ \Delta\theta_{min}$			
2	50	$\Delta\theta_{min} \leq \Delta\theta \leq 1.2\ \Delta\theta_{min}$			
3	50	$\Delta\theta_{min} \leq \Delta\theta \leq 1.2\ \Delta\theta_{min}$			
1	50	$10\ K \leq \Delta\theta \leq 20\ K$			
2	50	$10\ K \leq \Delta\theta \leq 20\ K$			
3	50	$10\ K \leq \Delta\theta \leq 20\ K$			
1	50	$\Delta\theta_{max} - 5\ K \leq \Delta\theta \leq \Delta\theta_{max}$			
2	50	$\Delta\theta_{max} - 5\ K \leq \Delta\theta \leq \Delta\theta_{max}$			
3	50	$\Delta\theta_{max} - 5\ K \leq \Delta\theta \leq \Delta\theta_{max}$			

*) Values in the table are examples. The return temperature shall be in the temperature range between 40 °C and 70 °C, if θ_{max} is not exceeded.

Test of meter's indication: Pass ___ Fail ___

Markings: Pass: _____ Fail: _____ Signature: ________________________________

2.2.4 Subassembly of the calculator and temperature sensor pair (Ref.: 7.4 in R 75-2)

Notes:

(1) If the calculator and temperature sensor pair are tested as an inseparable sub-assembly, tests shall be done in accordance with 17.3 with the temperature sensor pair immersed in two temperature-regulated baths.

(2) The sub-assembly of the calculator and temperature sensor pair shall be tested using the temperature ranges of 17.2 and the temperature difference ranges of 17.3.

Additionally a final test is necessary, with the temperature sensor pair immersed in two temperature-regulated baths (see the following table No. 63).

Table 4: Additional test, sensor pair is immersed in temperature baths

Simulated flowrate: _____ l/h

Test No.	Return temperature *) °C	Temperature difference Δθ K		Error %	MPE %
		Level	Measured		
1	50	$3 \leq \Delta\theta \leq 4$			
2	50	$3 \leq \Delta\theta \leq 4$			
3	50	$3 \leq \Delta\theta \leq 4$			

*) Values in the table are examples. The return temperature shall be in the temperature range between 40 °C and 70 °C, if θ_{max} is not exceeded.

Markings: Pass: _____ Fail: _____ Signature: ______________________________

2.2.5 Combined instrument (Ref.: 7.5 in R 75-2)

The flow sensor, the temperature sensor pair and the calculator shall be tested separately; see 2.2.1, 2.2.2 and 2.2.3.

2.2.6 Complete instrument (Ref.: 7.6 in R 75-2)

Table 5: Verification test

Test No.	Test point				Error %	MPE %
	Temperature difference Δθ K		Flowrate q m³/h			
	Level	Measured	Level	Measured		
1	$\Delta\theta_{min} \leq \Delta\theta \leq 1.2\ \Delta\theta_{min}$		$0.9\ q_p \leq q \leq q_p$			
2	$\Delta\theta_{min} \leq \Delta\theta \leq 1.2\ \Delta\theta_{min}$		$0.9\ q_p \leq q \leq q_p$			
3	$\Delta\theta_{min} \leq \Delta\theta \leq 1.2\ \Delta\theta_{min}$		$0.9\ q_p \leq q \leq q_p$			
1	$10\ K \leq \Delta\theta \leq 20\ K$		$0.2q_p \leq q \leq 0.22q_p$			
2	$10\ K \leq \Delta\theta \leq 20\ K$		$0.2q_p \leq q \leq 0.22q_p$			
3	$10\ K \leq \Delta\theta \leq 20\ K$		$0.2q_p \leq q \leq 0.22q_p$			
1	$\Delta\theta_{max} - 5\ K \leq \Delta\theta \leq \Delta\theta_{max}$		$q_i \leq q \leq 1.1\ q_i$			
2	$\Delta\theta_{max} - 5\ K \leq \Delta\theta \leq \Delta\theta_{max}$		$q_i \leq q \leq 1.1\ q_i$			
3	$\Delta\theta_{max} - 5\ K \leq \Delta\theta \leq \Delta\theta_{max}$		$q_i \leq q \leq 1.1\ q_i$			

Markings: Pass: _____ Fail: _____ Signature: ______________________________