International Recommendation OIML R 81 Annex D

Edition 2006 (E)

Dynamic measuring devices and systems for cryogenic liquids

Annex D: Test Report Format

Dispositifs et systèmes de mesure dynamique des liquides cryogéniques

Annexe D: Format du rapport d'essai



Organisation Internationale de Métrologie Légale

INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY

Contents

Foreword		3
Introductio	on	4
D.1	General information concerning the pattern (type)	7
D.2	General information concerning the test conditions	8
D.3	Metrological requirements: Checklist	9
D.4	Technical requirements: Checklist	10
D.5	Requirements for electronic measuring systems: Checklist	17
D.6	Summary of the tests	23
D.7	Tests for maximum errors	24
D.7.1	Tests for maximum errors - Flowrate, accuracy and repeatability	24
D.7.2	Tests for maximum errors - Minimum measured quantity	25
D.7.3	Tests for maximum errors - Flow disturbances	26
D.8	Dry heat test	27
D.9	Cold test	28
D.10	Damp heat. Performance test after cycle 2	29
D.11	Vibration test	30
D.12	Power voltage variation test	31
D.12.1	AC power voltage variation test	31
D.12.2	DC power voltage variation test	33
D.13	Short time power reduction test	35
D.14	Electrical bursts test	37
D.14.1	Electrical bursts test for power supply lines	37
D.14.2	Electrical bursts test for I/O circuits and communication devices	41
D.15	Electrostatic discharge test	45
D.15.1	Electrostatic discharge test - Direct application	45
D.15.2	Electrostatic discharge test - Indirect application	49
D.15.3	Electrostatic discharge test - Test setup	53
D.16	Electromagnetic susceptibility test	54
D.17	Perturbations on DC voltage powered instruments	59
D.18	Endurance test	62
D.18.1	Performance test before endurance test	62
D.18.2	Performance test after endurance test	63

Foreword

The International Organization of Legal Metrology (OIML) is a worldwide, intergovernmental organization whose primary aim is to harmonize the regulations and metrological controls applied by the national metrological services, or related organizations, of its Member States. The main categories of OIML publications are:

- International Recommendations (OIML R), which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity. OIML Member States shall implement these Recommendations to the greatest possible extent;
- International Documents (OIML D), which are informative in nature and which are intended to harmonize and improve work in the field of legal metrology;
- International Guides (OIML G), which are also informative in nature and which are intended to give guidelines for the application of certain requirements to legal metrology; and
- International Basic Publications (OIML B), which define the operating rules of the various OIML structures and systems.

OIML Draft Recommendations, Documents and Guides are developed by Technical Committees or Subcommittees which comprise representatives from the Member States. Certain international and regional institutions also participate on a consultation basis. Cooperative agreements have been established between the OIML and certain institutions, such as ISO and the IEC, with the objective of avoiding contradictory requirements. Consequently, manufacturers and users of measuring instruments, test laboratories, etc. may simultaneously apply OIML publications and those of other institutions.

International Recommendations, Documents, Guides and Basic Publications are published in English (E) and translated into French (F) and are subject to periodic revision.

Additionally, the OIML publishes or participates in the publication of **Vocabularies (OIML V)** and periodically commissions legal metrology experts to write **Expert Reports (OIML E)**. Expert Reports are intended to provide information and advice, and are written solely from the viewpoint of their author, without the involvement of a Technical Committee or Subcommittee, nor that of the CIML. Thus, they do not necessarily represent the views of the OIML.

This publication - reference OIML R 81 Annex D, Edition 2006 (E) - was developed by the OIML Technical Subcommittee TC 8/SC 6 *Measurement of cryogenic liquids*. It was approved for final publication by the International Committee of Legal Metrology in 1999.

OIML Publications may be downloaded from the OIML web site in the form of PDF files. Additional information on OIML Publications may be obtained from the Organization's headquarters:

Bureau International de Métrologie Légale11, rue Turgot - 75009 Paris - FranceTelephone:33 (0)1 48 78 12 82Fax:33 (0)1 42 82 17 27E-mail:biml@oiml.orgInternet:www.oiml.org

Dynamic measuring devices and systems for cryogenic fluids Annex D: Test Report Format

Introduction

This Annex is **informative** with regard to the implementation of OIML Recommendation R 81 in national regulations; however, use of the Test Report Format is **mandatory** for application of the Recommendation within the OIML Certificate System.

Test procedures are included in Annex A and Annex B of OIML R 81.

Possible situations that ma	v occur in testing o	dvnamic measurir	ig systems:

		<u><u><u></u></u> <u></u> <u></u></u>	
Meter	Measurement	Calculator	Remarks
	transducer	(including the	
		indicating device)	
Included	Included	Included	During the test the reference value (also called "true
			value") is provided by the reference (or working)
			standard (see 3.3 in R 81); the gravimetric method is
			recommended (see A.1 in R 81); other suitable
			methods may be used provided that the require-
			ments of A.1.1 in R 81 are met (see A.1 in R 81).
Not	Included	Not included	The measurement transducer may be tested alone
included			provided that the computing and indicating devices
			have been subject to separate pattern (type)
			approvals (see 15.1.5.1, fourth paragraph in R 81);
			if applicable, the correction algorithm shall be
			applied to the output signal of the transducer to
			determine its errors (see 15.1.5.1, fourth paragraph
			in R 81); if applicable, the pulser is part of the
			transducer (see 3.6 in R 81) but may be tested
			together with the calculator (see third row below).
			See also the remark above in the first sentence.
Not	Not included	Included	Tests are conducted by simulating the different
included			inputs (see 15.1.6 in R 81). The signal generated by
			the measurement transducer should be simulated
			(for example by an impulse generator), generating a
			preset amount of pulses or by the pulser of the
			transducer which should be driven by a stepper
			motor; in the latter case the stepper motor should be
			driven by an impulse generator, generating a preset
			amount of pulses.
			When simulation of the transducer is not possible
			(for example in case of a Coriolis meter) other
			solutions may be acceptable.

Explanatory note to the use of the Test Report Format

General information

Numbers in brackets after the title on the test forms refer to the corresponding clause/subclause of OIML R 81.

Each of the following test forms contains four tables. **Select only one of the four tables for test results** (even when they are spread over two pages from D.13 to D.17).

Information on gravimetric test tables

Three tables accommodate the measurement results indicated in terms of:

- 1. Mass,
- 2. Liquid volume at the normal boiling point (NBP), or
- 3. Gas equivalent of a liquid volume at base conditions.

The reference value used in the tables is provided by the reference (or working) standard (See 3.3 in R 81) and shall be greater than or equal to five times the minimum measured quantity (A.1.2.1 and 6.5 in R 81).

Information on the master meter test table

- The temperature in the master meter table is at metering conditions (see 3.16 in R 81).
- The pressure of the product in the master meter table is at metering conditions (see 3.16 in R 81).
- The volume indication of the master meter is the total pulses divided by the K-factor (expressed as accumulated pulses per unit volume).
- In the master meter table, use temperature and pressure to obtain the density and correction factor (for nonlinearity of the meter's K-factor as a function of temperature and pressure).
- Use the correction factor to obtain the volume indication of the master meter corrected for meter error.

Meaning of symbols and abbreviations used in this Annex

mpe = maximum permissible error	Calc. = calculated	Avg.= average
mmq = minimum measured quantity	Vol. = volume	Temp. = temperature
NBP = normal boiling point	Ind. = indication or indicated	H = horizontal
Ref. = reference	Corr. = corrected	V = vertical
EUT = equipment under test	n/a = not applicable	

For each examination and test, the checklist shall be completed according to one of these examples:

Pass	Fail
Х	
	Х
n/a	n/a

Page numbering

A space has been left on the top of each page (starting on page 7) for numbering the pages of reports established following this model. In particular, each test is reported individually on a separate page following the relevant format.

For a given report, it is advisable to complete the sequential numbering of each page by indicating the total number of pages in the report.

Pattern (type) evaluation test report

Application No.:		Date:
Model designation		
trioder designation.		
Manufacturer:		
Address.		
ruaress.		
Applicant:		
A damage		
Address.		
Representative:		
Telenhone		Fav
F-mail [.]		 1 dA
L'inuit.		
Technical manual prov	ided:	
Operating manual prov	ided:	
Description of device of	or system:	
	-	
	-	
	-	
	-	
	_	
Accuracy class designation	tion:	
Maximum flowrate:	_	
Minimum flowrate:	_	
Unit for flowrate:	_	
Minimum measured qu	antity (mmq):	
Unit for mmq:	-	

D.1 General information concerning the pattern (type)

D.2 General information concerning the test conditions

Device submitted	Model:	Serial No.:	Date:
A. Measurement standa	rds		
1. Gravimetric system	Description:		
Uncertainty:			
Accuracy.			
2. Volumetric system	Description:		
Uncertainty:			
Accuracy:			
Test liquid(s):			
B. Environmental test eq	quipment	Description:	
Temperature range:			
Humidity range:			
Disturbance test equipment:			
Test location:			

D.3 Metrological requirements: Checklist

Application No.:	
Model No.:	
Serial No.:	
Date:	
Observer:	

Clause	Title	PASS	FAIL	REMARKS
7	Flowrates of a measuring system or meter			
7.1	The maximum and minimum authorized flowrates for a measuring system are specified by the manufacturer.			
7.2	The ratio between the maximum and minimum flowrates of a meter shall be at least equal to 5.			
8	Minimum measured quantity			
8.1	The minimum measured quantity of the system shall be specified by the manufacturer.			
8.2	The minimum measured quantity shall not be less than 100 scale intervals.			
8.3	The value of the minimum measured quantity shall be in the form 1×10^{n} or 2×10^{n} or 5×10^{n} authorized units, n being a positive or negative whole number or zero.			

Table D.3 Metrological requirements: Checklist

Г

D.4 Technical requirements: Checklist

Application No.:	
Model No.:	
Serial No.:	
Date:	
Observer:	

Clause	Title	PASS	FAIL	REMARKS
9	Indicating devices (indicators)			
9.1	General provisions			
	Indications shall be in legal units as described in subclause 5.1 and shall be accompanied by the name or symbol of the unit.			
	Indications that are not subject to metrological control are allowed, provided that they cannot be confused with metrological information.			
	Reading of the indications shall be precise, easy and non-ambiguous when the indicating device comes to rest.			
	If the indicating device comprises several elements, the installation shall be arranged in such a way that the readings of the measurand can be effected by simple juxtaposition of the indications of the different elements.			
9.1.1	The scale interval of the indication shall be in the form of 1×10^{n} or 2×10^{n} or 5×10^{n} authorized units, n being a positive or negative whole number or zero.			
9.1.2	The indicated units specified in subclause 5.1 shall be clearly defined.			
9.1.3	The decimal mark shall appear distinctly.			

Table D.4 Technical requirements: Checklist

Г

D.4 Technical requirements: Checklist (Cont.)

Application No.:	
Model No.:	
Serial No.:	
Date:	
Observer:	

Clause	Title	PASS	FAIL	REMARKS
9.2	Zero-setting device			
9.2.1	An indicating device may be provided with a device which returns the indication to zero either by manual operation or by automatic means.			
9.2.2	The zero-setting device shall not permit any alteration of the measurement result shown by the indicator (other than by making the result disappear and replacing it by zeros).			
9.2.3	Once the zeroing operation has begun it shall be impossible for the indicator to show a result different from that of the measurement which has just been made, until the zeroing operation has been completed.			
	Indicating devices shall not be capable of being reset to zero during measurement.			
9.3	Totalizing indicator			
	An indicator with a zeroing device may be equipped with a device for totalizing the different quantities shown successively by the indicator.			
	The totalizing indicator shall be non-resettable.			
10	Printing devices (printers)			
10.1	A printing device may be connected to an indicator.			

Table D.4 Technical requirements: Checklist (Cont.)

Īī

D.4 Technical requirements: Checklist (Cont.)

Application No.:	
Model No.:	
Serial No.:	
Date:	
Observer:	

				REMARKS
Clause	Title	PASS	FAIL	
10.2	The printed scale interval shall be the same as the scale interval of the indicator.			
10.3	The quantity printed shall be expressed in one of the units authorized for the indicator.			
	The unit used or its symbols, and the decimal mark if any, shall be indicated on the ticket.			
	The printed quantities shall be adequately and clearly defined.			
10.4	The printer may print other information identifying the measurement such as: serial number, date, place of measurement, type of liquid, etc.			
	The totalizing indicator shall be non-resettable.			
10.5	If a printer allows repetition of the printing before a new measurement has started, copies shall be clearly marked as such, for example by printing "duplicate".			
10.6	For any quantity, the printed values shall be the same as those indicated.			
10.7	Printed ticket In the case of a volume indication, the ticket shall have printed on it the base conditions in terms of gas or liquid.			
11	Measuring systems			
11.1	Maintenance of liquid state.			
	A measuring system shall be so designed and operated that the product being measured will remain in a liquid state during passage through the meter.			

Table D.4 Technical requirements: Checklist (Cont.)

Τ

h

D.4 Technical requirements: Checklist (Cont.)

Application No.:	
Model No.:	
Serial No.:	
Date:	
Observer:	

Clause	Title	PASS	FAIL	REMARKS
11.2	Adjusting means			
11.2.1	Meters shall be provided with adjusting means that permit adjustments of the ratio between the quantity indicated and the actual quantity of liquid which has passed through the measuring device.			
11.2.2	If the adjusting means modifies this ratio in a discontinuous manner, the consecutive values of the ratio shall not differ by more than 0.002.			
11.2.3	Adjustment by means of a by-pass on the measuring device is prohibited.			
11.3	Sealing			
	Sealing means shall be provided for those parts that can affect the accuracy of the measurement and the parameters (e.g. correction and conversion) that can affect the measurement results.			
11.3.1	Mechanical sealing			
	Mechanical sealing shall be carried out by means of lead and wire seals or other equally effective means.			
11.3.2	Electronic sealing			
	When access to parameters that affect the determination of the results of a measurement is not protected by mechanical sealing means, the protection shall fulfill the following:			
	 Access shall only be possible by such means as an alpha or numeric code, or "hard key". An event counter (000-999) shall be provided to indicate that interventions have been made. 			

Table D.4 Technical requirements: Checklist (Cont.)

D.4 Technical requirements: Checklist (Cont.)

Application No.:	
Model No.:	
Serial No .:	
Date:	

Observer:

Clause	Title	PASS	FAIL	REMARKS
11.3.2 (Cont.)	The electronic sealing device shall have a means of identifying if an intervention occurs and by whom. The responsible national body may require such means as the use of labels or an event logger that includes an event counter, date and time of intervention, and the identity and value of the parameter changed.			
11.4	Memory devices			
11.4.1	Measuring systems may be fitted with a memory device to store measurement results until their use or to keep a trace of commercial transactions, providing proof in case of dispute. Devices used to read stored information are considered as included in the memory devices.			
11.4.2	The medium on which the data are stored shall have sufficient permanency to ensure that the data are not corrupted under normal storage conditions.			
	Sealing means shall be provided for those parts that can affect the accuracy of the measurement and the parameters (e.g. correction and conversion) that can affect the measurement results.			
11.4.3	When the storage is full, memorized data may be deleted when the following conditions are met:			
	a. The rules established for the particular application are respected,			
	b. Data are deleted in the same order as the recording order, and			
	c. Deletion is carried out after a special manual operation.			
12	Discharge lines			
12.1	Vapor return lines			
	A vapor return line between the supplier's tank and the customer's tank shall not be permitted, unless this is required to complete a delivery.			

Table D.4 Technical requirements: Checklist (Cont.)

D.4 Technical requirements: Checklist (Cont.)

Application No.:	
Model No.:	
Serial No.:	
Date:	
Observer:	

Clause	Title	PASS	FAIL	REMARKS
12.2	Directional flow valve			
	Valve(s) or other means intended to prevent flow			
	reversal, that is(are) automatic in operation shall be			
	installed either on the outlet side of the meter or in the			
12.3	Diversion of measured liquid			
12.3				
	No means shall be provided by which any measured			
	inquid can be diverted from the measuring element of the meter or from the discharge line			
	A manually controlled outlet that may be opened for			
	purging or draining the measuring system shall be			
	permitted.			
	Effective means shall be provided to prevent the			
	passage of liquid through any such outlet during			
	normal operation of the measuring system.			
12.4	Transfer point			
12.4.1	The measuring systems shall incorporate a transfer			
	point.			
	The transfer point shall be located downstream of the			
	meter in a delivery system, and upstream of the meter			
	in a receiving system.			
12.4.2	The transfer point may be in the form of a closing			
	device combined with a system which ensures the			
	evacuation of the discharge hose after each measuring			
	operation.			

Table D.4 Technical requirements: Checklist (Cont.)

D.4 Technical requirements: Checklist (Cont.)

Application No.:	
Model No.:	
Serial No.:	
Date:	
Observer:	

Clause	Title	PASS	FAIL	REMARKS
12.5	Valves and control mechanisms			
	Check valves and closing mechanisms not used to			
	define the measuring quantity shall, if necessary, have			
	relief valves in order to dissipate any abnormally high			
	pressures which may arise in the measuring system.			
	A vapor return line between the supplier's tank and the customer's tank shall not be permitted unless this is			
	required to complete a delivery			
12.6	Discharge hose			
	The discharge hose of a measuring system shall be of			
	the empty-hose type.			
13	Markings			
	A measuring system shall be legibly and clearly marked			
	with the following information:			
<u>a)</u>	Pattern (type) approval mark;			
<u>b)</u>	Manufacturer's identification mark or trademark;			
<u>c)</u>	Designation selected by the manufacturer;			
d)	Serial number and year of manufacture;			
e)	Maximum and minimum flowrates, Q_{max} and Q_{min} ;		L	
f)	Maximum working pressure, P_{max} ;			
g)	Maximum and minimum temperatures, T_{max} and T_{min} ;			
h)	Minimum measured quantity, mmq.			

Table D.4 Technical requirements: Checklist (Cont.)

D.5 Requirements for electronic measuring systems: Checklist		
Application No.:		
Model No.:		
Serial No.:		
Date:		
Observer:		

Clause	Title	PASS	FAIL	REMARKS
14.1	General requirements			
14.1.1	Electronic measuring systems shall be designed and manufactured such that their errors do not exceed the maximum permissible errors (mpe), as defined in clause 6, under rated operating conditions.			
14.1.1.1	Interruptible electronic measuring systems shall be designed and manufactured such that, when they are exposed to the disturbances specified in B.4, either:			
	a) significant faults do not occur, or			
	b) significant faults are detected and acted upon by means of checking facilities.			
	Note: This provision may apply separately to each individual cause of significant fault and/or each part of the measuring system.			
14.1.1.2	Non-interruptible electronic measuring systems shall be designed and manufactured in such a way that no significant faults occur when they are exposed to the disturbances specified in B.4.			
14.1.2	It is the responsibility of the manufacturer to decide whether a given type of measuring system is interruptible or not, taking account of the applicable rules of security.			

D.5 Requireme	nts for electronic measuring systems: Checklist (Cont.)
Application No.:	
Model No.:	
Serial No.:	
Date:	
Observer:	

Clause	Title	PASS	FAIL	REMARKS
14.1.2.1	Measuring systems for direct selling to the public shall be interruptible.			
	When, at the time of pattern (type) approval, it is not possible to specify the future utilization of the instrument, the requirements in subclause 14.1.1.2 shall apply.			
14.1.3	Electronic measuring systems shall be provided with the checking facilities specified in subclause 14.3.			
14.1.4	A type of a measuring system is presumed to comply with the requirements in subclauses 14.1.1 and 14.1.3 if it passes the inspection and tests specified in subclause 15.1.10.			
14.1.5	When a significant fault occurs, measuring systems shall permit the retrieval of the information relating to the measured quantity, that is contained within the measuring system.			
14.2	Power supply device When the flow is interrupted during a failure of the principal power supply device:			
	1. The measuring system shall be provided with an emergency power supply device to safeguard all the measuring functions during that failure; or,			
	2. Data contained at the moment of the failure shall be saved and displayed on the resumption of power on an indicating device subject to legal metrological control for a sufficient time to permit the conclusion of the current transaction.			

D.5 Requirem	D.5 Requirements for electronic measuring systems: Checklist (Cont.)		
Application No.:			
Model No.:			
Serial No.:			
Date:			
Observer:			

Clause	Title	PASS	FAIL	REMARKS
14.2	The absolute value of the maximum permissible error			
(Cont.)	for the indicated volume is increased by 5 % of the minimum measured quantity (subclause 8.1).			
14.3	Checking facilities			
14.3.1	Action of checking facilities			
	The detection by the checking facilities of significant faults shall result in the following actions, according to the type:			
14.3.1.1a)	Checking facilities of type I or P			
	(non-interruptible)			
	a) Non-interruptible measuring systems (such as pipelines) shall:			
	1. Have automatic correction of the fault, or			
	2. Allow stopping of the faulty device when the measuring system without that device continues to comply with the regulations, or			
	3. Have a visible or audible alarm for the operator; this alarm shall continue until such time as the cause of the alarm is suppressed (not applicable for the disturbances specified in B.4).			
	When the measuring system transmits data to any peripheral equipment, the transmission shall be accompanied by a message indicating the presence of a fault.			

D.5 Requireme	D.5 Requirements for electronic measuring systems: Checklist (Cont.)		
Application No.:			
Model No.:			
Serial No.:			
Date:			
Observer:			

Clause	Title	PASS	FAIL	REMARKS
14.3.1.1 a) (Cont.)	The instrument may be provided with devices to estimate the amount of liquid having passed through the installation during the occurrence of the fault. The result of this estimate shall not be capable of being mistaken for a valid indication.			
14.3.1.1 b)	Checking facilities of type I or P (interruptible) shall:			
	1. Have automatic correction of the fault, or			
	2. Allow stopping only the faulty device, when the			
	measuring system without that device continues to comply with the regulations, or			
	3. Allow stopping the flow.			
14.3.2	Checking facilities for the measurement			
	transducer			
	The object of these checking facilities after the presence of the transducer has been confirmed, is to verify its correct operation and the correctness of data transmission.			
	Checking facilities shall provide a level of security equivalent to ISO 6551, part 3 Levels of security, 3.1.4 Level B, except for equipment with a cable length of 3 meters or less, for which 3.1.3 Level C applies. This requirement can be fulfilled without generating two pulses.			

D.5 Requireme	D.5 Requirements for electronic measuring systems: Checklist (Cont.)		
Application No.:			
Model No.:			
Serial No.:			
Date:			
Observer:			

Clause	Title	PASS	FAIL	REMARKS
14.3.3	Checking facilities for the calculator (Type P or I)			
	The object of these checking facilities is to check if the calculator system functions correctly and to ensure the validity of the calculations made.			
	There are no special means required for indicating that these checking facilities function correctly. The correct value of all data relating to the measurement shall be checked by the instrument whenever these data are transmitted to an ancillary device through an interface.			
	In addition, the calculation system shall be provided with a means for controlling the continuity of the calculation program.			
14.3.4	Checking facilities for the indicating device (Type N)			
	The object of this checking facility is to verify that the primary indications are displayed and correspond to the data provided by the calculator.			
	In addition, it aims at verifying the presence of the indicating devices, when they are removable.			
	The checking facility for the indicating device shall include at least a visual checking of the display as follows:			
	1. Displaying all the elements ("eights" test),			
	2. Blanking all the elements ("blank" test),			
	3. Displaying "zeros".			
	Each step of the sequence shall last at least 0.75 second.			
	The produced signal shall originate from the calculator.			

D.5 Requireme	ents for electronic measuring systems: Checklist (Cont.)
Application No.:	
Model No.:	
Serial No.:	
Date:	
Observer:	

Clause	Title	PASS	FAIL	REMARKS
14.3.5	Checking facilities for an ancillary device			
	Any ancillary device with primary indications shall include a checking facility of type I or P.			
	The object of this checking facility is to verify the presence of the ancillary device, when it is a necessary device, and to validate the data transmitted by the calculator.			
	The object of the checking of a printing device is to ensure that the printing controls function properly so that output corresponds to the data transmitted by the calculator.			
	The presence of paper shall be checked.			
	Where the action of the checking facility is a warning, this shall be given on or by the ancillary device which is at its origin.			
14.3.6	Checking facilities for the associated measuring			
	instruments			
	Associated measuring instruments shall include a checking facility of type P.			
	The aim of this checking facility is to ensure that the signal given by these associated instruments is within a pre-determined measuring range.			

ĪĒ

٦ì

D.6 Summary of the tests

•	

Clause	Title		PASS	FAIL	REMARKS
D.7	Tests for maximum errors (Flowrate and accuracy test)	A.1.3 - Liquids A.1.4 - Flowrates			
D.8	Dry heat test (B.4.1)				
D.9	Cold test (B.4.2)				
D.10	Damp heat, cyclic test (B.4.3)				
D.11	Vibration test (B.4.4)				
D.12.1	AC power voltage variations te	est (B.4.5.1)			
D.12.2	DC power voltage variation tes	st (B.4.5.2)			
D.13	Short-time power reduction tes	t (B.4.6)			
D.14	Electrical burst test (B.4.7)				
D.15	Electrostatic discharge test (B.4	4.8)			
D.16	Electromagnetic susceptibility	test (B.4.9)			
D.17	Perturbations on DC voltage po (B.4.10)	owered instruments			
D.18	Endurance test (A.1.5)				
D.19	Repeatability test (6.5 and A.1.	.2.1)			

Table D.6 Summary of the tests

Note: The repeatability test result (D.19) is based on tests conducted under D.7.1

D.7 Tests for maximum errors

D.7.1 Tests for maximum errors -	Flowrate, accuracy and repeatability	test (of 6) (A.1.2, A.1.3,
A.1.4)		

Application No:				E	Environme	ntal conditie	ons
Model No.:				_	at start	at end	
Serial No.:				Temperature:			°C
Test liquid:				Rel. humidity:			%
Date test performed	1:			Bar. pressure:			hPa
Test type	Simulated:	□ Operational:		Time:			actual
Density of test liqu	id:	kg/cm ³ at	°C and at 101	325 Pa (N	IBP)		
Observer:							

Flowrate: Nominal value (in % of Q_{max}) = ____%

GRAVIMETRIC TEST:

Table D.7.1 Flowrate, accuracy and repeatability test (test for maximum errors) – at flowrate² #... (SELECT ONLY ONE TABLE)

Indications in mass

Test	Flowrate	Indicated value	Reference value	Error	mpe					
No.	(mass unit/time)	(mass unit)	(mass unit)	%	%					
1										
2										
3										
Avg.										
	Indications in liquid volume at NBP									

]	Indications	in	liquio	l vo	lume	at	NB

Test No.	Flowrate (mass or volume unit/time)	Indicated value (unit – liquid volume at NBP)	Reference value (mass unit)	Ref. value calc. to liquid vol. at NBP (volume unit)	Error %	mpe %
1						
2						
3						
Avg.						

Indications in equivalent gas volume at base conditions

Test No.	Flowrate (mass or volume unit/time)	Indicated value (normal cubic meters)	Reference value (mass unit)	Ref. value calc. to vol. at NBP (unit of liquid volume at NBP)	Ref. value calc. to gas vol. at base cond. (normal cubic metres)	Error %	mpe %
1							
2							
3							
Avg.							

MASTER METER TEST: **Indications in mass**

Test No.	Flowrate (mass or vol. unit/time)	Master meter temp. (°C)	Master meter pressure (kPa)	Master meter volume indication (liters)	Master meter K-factor	Master meter vol. ind. corrected for meter error	Calc. mass from master meter indication	Indicated value (mass unit)	Error %	mpe %
1										
2										
3										
Avg.										
mpe ² at flo	owrate #:							Pass	sed: 🗖	Failed:

Repeatability^{1,2} at flowrate #:

Passed: 🗖 Failed: 🗖

1. The repeatability shall not be greater than 1 % of the measured quantity (see 3.19, 6.5 of OIML R 81). Notes 2. Copy this form and use for test at each flowrate (minimum 6). Indicate serial number of flowrate after #.

D.7.2 Tests for maximum errors - Minimum measured quantity (Ref. R 81: 15.1.5.2.2)

Application No:				 I	Environmer	ntal conditic	ons
Model No.:				 _	at start	at end	_
Serial No.:				 Temperature:			°C
Test liquid:				Rel. humidity:			%
Date test performed	l:			Bar. pressure:			hPa
Test type	Simulated:		Operational:	Time:			actual
Density of test liqui Observer:	°C and at 101	325 Pa (N	IBP)	-			
Flowrate: Nominal	value (in % of	f Q_{max}	s) =%				

Table D.7.2 Tests for maximum errors at minimum measured quantity Minimum measured quantity: -----

				(S	SELECT	ONLY ON	E TABI	LE)					
GRAVIN	IETRIC TE	ST:			Indi	cations in	mass						
Test	Flowr	ate	Indica	ted v	alue	Referen	Reference value		Erro	or		mpe	
No.	(mass uni	t/time)	(ma	ss un	unit) (mass u		s unit)		%				0
1													
2													
3								_					
Avg.													
				Indi	cations i	n liquid vo	olume at	t NBP	-				
Test	Flowrat	e	Indicated va	alue	Ref	erence	Ref. val	lue calc. to		Error		1	mpe
No.	(mass or vo	lume	(unit – liqu	– liquid v		alue	liquid v	ol. at NBP		%			%
	unit/time	e) '	volume at N	BP)	(mas	ss unit)	(volu	me unit)					
3													
Δνα									Ī				
Avg.			Indicatio	na in	oguivel	ont gog vol	umo of	hasa aand	itiona				
	Pef value calo Pef value calo												
	Flowrate	Indi	cated value	P	eference	to vol	at NRP	to gas ve	calc.				
Test	(mass or	indi	(normal	val	lue (mass	(unit o	f liquid	base co	nd.	Erro	r		mpe
No.	volume	cut	oic meters)	meters) unit)		volu	me at	(normal c	cubic	%			%
	unit/time)				NBP)		metre	s)					
1													
2													
3													
Avg.													
MASTER	R METER T	EST:			Indi	cations in	mass						
				T	Master		Mast	er Cal	c.				
	Flowrate	Maste	r Master	[meter	Master	meter y	vol. mass f	rom	Indicated	-		
Test	(mass or	tomp	meter		volume	meter	ind.	mas	ter	value	Err	or	mpe
NO.	voi. unit/time)	$(^{\circ}C)$	(kPa)	e in	dication	K-factor	for me	ter met	er	(mass unit)	70)	70
	unit/time)	(C)	(KI <i>u</i>)		(liters)		erro	r indica	tion	unity			
1							1						
2							1						
3													
Avg.													

Passed:
Failed:

Note: ¹Test to be performed if practical.

D.7.3 Tests for maximum errors – Flow disturbances (Ref. R 81: 15.1.5.2.2.)

		E	Invironmen	ntal conditi	ons
			at start	at end	
		Temperature:			°C
		Rel. humidity:			%
		Bar. pressure:			hPa
□ Operational:		Time:			actual
kg/cm ³ at	°C and at 101	325 Pa (N	BP)		
	☐ Operational: kg/cm ³ at	□ Operational: □ kg/cm ³ at	Image: matrix of the system Image: matrix of the system <t< td=""><td>Environmer at start Temperature: Rel. humidity: Bar. pressure: Deprational: Time: kg/cm³ at</td><td>Environmental conditional at start at end Temperature: Rel. humidity: Bar. pressure: Bar. pressure: kg/cm³ at °C and at 101 325 Pa (NBP)</td></t<>	Environmer at start Temperature: Rel. humidity: Bar. pressure: Deprational: Time: kg/cm³ at	Environmental conditional at start at end Temperature: Rel. humidity: Bar. pressure: Bar. pressure: kg/cm³ at °C and at 101 325 Pa (NBP)

Flowrate: Normal value (in % of Q_{max}) = ____%

Table D.7.3 Tests for maximum errors with flow disturbances Description of the disturbance:

CDAVID	(SELECT ONLY ONE TABLE)												
GRAVIMETRIC TEST: Indications in mass													
Test	Flowrate	Indicated value	Reference value	Error	mpe								
No.	(mass unit/time)	(mass unit)	(mass unit)	%	%								
1													
2													
3													
Avg.													

|--|

Test No.	Flowrate (mass or volume unit/time)	Indicated value (unit – liquid volume at NBP)	Reference value (mass unit)	Ref. value calc. to liquid vol. at NBP (volume unit)	Error %	mpe %
1						
2						
3						
Avg.						

Indications in equivalent gas volume at base conditions

Test No.	Flowrate (mass or volume unit/time)	Indicated value (normal cubic meters)	Reference value (mass unit)	Ref. value calc. to vol. at NBP (unit of liquid volume at NBP)	Ref. value calc. to gas vol. at base cond. (normal cubic metres)	Error %	mpe %
1							
2							
3							
Avg.							

Indications in mass

Test No.	Flowrate (mass or vol. unit/time)	Master meter temp. (°C)	Master meter pressure (kPa)	Master meter volume indication (liters)	Master meter K-factor	Master meter vol. ind. corrected for meter error	Calc. mass from master meter indication	Indicated value (mass unit)	Error %	mpe %
1										
2										
3										
Avg.										

Passed: 🛛 🛛 Failed: 🗖

Notes: 1. Test to be performed if appropriate.

2. Copy this test form if several disturbances can be applied.

Remarks:

MASTER METER TEST:

D.8 Dry heat test (B.4.1)

Application No: Model No.:	. <u> </u>		 E	Environmen at start	ntal condition at end	ons	
Serial No.:				 Temperature:			°C
Test liquid:				 Rel. humidity:			%
Date test performed	d:			Bar. pressure:			hPa
Test type	Simulated:		Operational:	Time:			actual
Density of test liqu	id:	kg/cm ³ at	°C and at 101	325 Pa (N	VBP)	_	
Observer:							

Table D.8 Dry heat test

(SELECT ONLY ONE TABLE)

GRAVIN						
Test	Reference temp. ¹	Flowrate	Indicated value	Reference value	Error	mpe
No.	(°C)	(mass unit/time) (mass unit)		(mass unit)	%	%
1	20 °C					
2	$max^1 =$					
3	20 °C					

	Indications in liquid volume at NBP													
Test No.	Reference temp. ¹ (°C)	Flowrate (mass unit/time)	Flowrate (mass unit/time)	Reference value (mass unit)	Ref. value calc. to liquid vol. at NBP (volume unit)	Error %	mpe %							
1	20 °C													
2	$max^1 =$													
3	20 °C													

Indications in equivalent gas volume at base conditions

Test No.	Reference temp. ¹ (°C)	Flowrate (mass unit/time)	Indicated value (normal cubic meters)	Reference value (mass unit)	Ref. value calc. to vol. at NBP (unit of liquid volume at NBP)	Ref. value calc. to gas vol. at base cond. (normal cubic metres)	Error %	mpe %
1	20 °C							
2	$max^1 =$							
3	20 °C							

MASTER METER TEST:

Indications in mass

Test No.	Refer- ence temp. ¹ (°C)	Flowrate (mass or vol. unit/ time)	Master meter temp. (°C)	Master meter pressure (kPa)	Master meter volume indication (liters)	Master meter K-factor	Master meter vol. ind. corrected for meter error	Calc. mass from master meter indica- tion	Indicated value (mass unit)	Error %	mpe %
1	20 °C										
2	$max^1 =$										
3	20 °C										

Passed: 🛛 🛛 Failed: 🗖

Notes:

- 1. Maximum temperature shall be 55 °C for Class C of I (Severity level 3) or 40 °C for Class B (Severity level 2) (See B.4.3 of R 81).
- 2. Shall be tested at at least one flowrate.
- 3. Duration is 2 hours.
- 4. The temperature recorded in the table is the product temperature, measured in test measure or master meter.
- 5. All functions shall operate as designed.
- 6. All indications shall be within the maximum permissible errors.

D.9 Cold test (B.4.2)

Application No:				Ε	Environme	ntal conditie	ons	
Model No.:						at start	at end	_
Serial No.:					Temperature:			°C
Test liquid:					Rel. humidity:			%
Date test performe	ed:				Bar. pressure:			hPa
Test type	Simulated:		Operational:		Time:			actual
Density of test liquid: kg/cm ³ at					°C and at 101	325 Pa (N	VBP)	
Observer:								

Table D.9 Cold test

					(SELE	CT O	NLY ONE	TABL	E)								
GRAVIN	IETRIC T	EST:				I	ndicatio	ns in	mass								
Test	Reference	e temp.	1	Flowr	ate	Ind	licated va	alue	Refe	eren	ce val	ue	Er	ror		n	ipe
No.	(°C	Ľ)	(ma	ass uni	t/time)	(mass uni	t)	(r	nass	s unit)		%		%		<i>%</i>
1	20 °	°C															
2	min	¹ =															
3	20 °	°C															
					Indic	atio	ns in liqu	uid vo	olume	at I	NBP						
Test No.	Referen temp. (°C)	nce 1	Flo [.] (n unit	owrate nass t/time)	F1 (un	owra (mas it/tin	vrate ass time) Reference value (mass unit) Ref. value calc. to liquid vol. at NBP (volume unit)			Error %		mpe %					
1	20 °C	2															
2	min ¹	=															
3	20 °C	2															
Indications in equivalent gas volume at base conditions																	
Test No.	Reference temp. ¹ (°C)	ce l	Flowrate (mass nit/time) Indica valu (norm cubic me		Indicate value (norma ubic met	ed Reference value (mass unit)		calc. to vol. at NBP (unit of liquid volume at NBP) c		Ref. valu calc. to g vol. at ba cond. (norma cubic met	alc. to gas ol. at base cond. (normal bic metres)		or		mpe %		
1	20 °C																
2	min ¹ =	:															
3	20 °C																
MASTEF	R METER	TEST	:			Ι	ndicatio	ns in	mass								
Test No.	Refer- ence temp. ¹ (°C)	Flowr (mass vol. ur time	ate M or nit/	Master meter temp. (°C)	Maste mete pressu (kPa	er r ire)	Master meter volume indication (liters)	Ma m n K-f	aster eter àctor	Ma m vol corr for er	aster neter l. ind. rected meter error	Calc. mass from master meter indica- tion	In	idicated value (mass unit)	Err %	or	mpe %
1	20 °C																
2	$m_{1n} =$	1			1							1					

Passed: 🗖 Failed: 🗖

Notes:

3

1. Minimum temperature shall be -25 °C for Class C of I (Severity level 3) or -10 °C for Class B (Severity level 2) (See B.4.3 of R 81).

2. Shall be tested at at least one flowrate.

3. Duration is 2 hours.

20 °C

4. The temperature recorded in the table is the product temperature, measured in test measure or master meter.

All functions shall operate as designed.
 All indications shall be within the maximum permissible errors.

D.10 Damp heat. Performance test after cycle 2 (B.4.3)

Application No:				E	Environmen	ntal conditie	ons
Model No.:					at start	at end	
Serial No .:				Temperature:			°C
Test liquid:			Rel. humidity:			%	
Date test performe	ed:			Bar. pressure:			hPa
Test type	Simulated:	□ Operational:		Time:			actual
Density of test liqu	uid:	kg/cm ³ at		°C and at 101	325 Pa (N	IBP)	
Observer:							

Table D.10 Damp heat. Performance test after cycle 2 (SELECT ONLY ONE TABLE) GRAVIMETRIC TEST: Indications in mass

Test No.	Flowrate (mass unit/time)	Indicated value (mass unit)	Reference value ¹ (mass unit)	Error %	mpe %
1					
2					
3					
Avg.					

Indications in liquid volume at NBP Flowrate Indicated value Reference Ref. value calc. to Error Test mpe (unit – liquid (mass or volume value liquid vol. at NBP % % No. unit/time) volume at NBP) (mass unit) (volume unit) 1 2 3 Avg

Indications in equivalent gas volume at base conditions

Test No.	Flowrate (mass or volume unit/time)	Indicated value (normal cubic meters)	Reference value (mass unit)	Ref. value calc. to vol. at NBP (unit of liquid volume at NBP)	Ref. value calc. to gas vol. at base cond. (normal cubic metres)	Error %	mpe %
1							
2							
3							
Avg							

MASTER METER TEST: Indications in mass

Test No.	Flowrate (mass or vol. unit/time)	Master meter temp. (°C)	Master meter pressure (kPa)	Master meter volume indication (liters)	Master meter K-factor	Master meter vol. ind. corrected for meter error	Calc. mass from master meter indication	Indicated value (mass unit)	Error %	mpe %
1										
2										
3										
Avg.										
								Pass	sed: 🗖	Failed:

1. Pre-condition meter.

2. Apply damp heat cycles (duration 24 hours), 2 cycles between 25 °C and 40 °C for Class B (Severity level 1) or 55 °C for Class C or I (Severity Level 2) (See B.4.3. of R 81).

3. Duration is 24 hours.

4. Maintain RH above 95 % during temperature changes and during phases of low temperature.

5. RH shall be 93 % or greater at the upper temperature range.

6. Test cannot be conducted by simulating the flow without any actual product passing through the measuring system.

7. All functions shall operate as designed.

- 8. All indications shall be within the maximum permissible errors.
- 9. After the damp heat test, a performance test under reference conditions consisting of three consecutive measurements for at least one flowrate is conducted.

D.11 Vibration test (B.4.4)

Application No	:		Environmental conditions				
Model No.:					at start	at end	
Serial No.:				Temperature:			°C
Test liquid:				Rel. humidity:			%
Date test perfor	med:			Bar. pressure:			hPa
Test type	Simulated:		Operational:	Time:			actual
Density of test	liquid:		kg/cm ³ at	°C and at 101	325 Pa (N	(BP)	
Observer:			-				

Axis⁹ Table D.11 Vibration test for

					(SI	ELECT O	NLY (ONE (TABLE)							
GRAVIMI	ETRI	C TI	EST:			I	ndica	atio	ns in n	nass							
			Flov	vrate	e Iı	ndicated	l valu	ie	Refe	erence va	lue		Erre	or		m	pe
			(mass	/tim	e)	(mass u	unit)		(r	nass unit)		%	1		0	6
Before ex	posu	e															
After exp	posure	е															
					In	dicatio	ns in	liqu	id vol	ume at N	BP						
		(ma	Flowrate ass or volution unit)	ume	Indicated (unit – 1 volume a	l value liquid t NBP)	R (r	Refer val nass	rence lue s unit)	Ref. v to liq	value uid v NBP ume	e calc. vol. at unit)		Error %		1	npe %
Before exp	osure																
After expo	osure																
				In	dications	in equi	valen	nt og	s volu	me at ba	se co	ondition	5				
		Flowrate I (mass or volume (no unit/time)		ndicated value rmal cubic meters)	dicated value nal cubic neters) Referenc value (mass uni		e it)	Ref. valueRecalc. to vol. atcalcNBP (unit ofvolliquid volumecondat NBP)cubi		ef. value ilc. to gas ol. at base id. (norm bic metres	s e al s)	Error %			mpe %		
Before exposure	e																
After exposure	e																
MASTER	MET	'ER '	TEST:]	Indic	atio	ns in r	nass							
	Flov (ma: vo unit/	vrate ss or ol. time	Maste meter temp. (°	er f PC)	Master meter pressure (kPa)	Maste mete volun indicat (liters	er er ne ion s)	Ma ma K-fa	aster eter actor	Master meter vo ind. correcte for mete error	d d r	alc. mass from master meter ndication	In	dicated value (mass unit)	En %	ror 6	mpe %
Before exposure																	

Notes:

After exposure

Passed: □ Failed: □

1. Frequency range is from 10 Hz to 150 Hz.

2. Maximum acceleration level is 20 m/s^2 .

- 3. Number of test cycles is 20 cycles per axis.
- 4. Test cannot be conducted by simulating the flow without any actual product passing through the measuring system. 5. The non-operational device shall be tested by sweeping the frequency in the specified frequency range, at 1
- octave/minute, at the specified acceleration level with a specified number of sweep cycles per axis.
- 6. The device shall be tested in its three, mutually perpendicular main axes, mounted on a rigid fixture by its normal mounting means.

7. It shall normally be mounted so that the gravitational force acts in the same direction as it would in normal use.

8. After the vibration test, a performance test under reference conditions at least one flowrate is conducted.

9. Copy this form and use for test on each axis.

D.12 Power voltage variation test (B.4.5) **D.12.1** AC power voltage variation test (B.4.5.1)

Application No:	 Environmental conditions					
Model No.:				at start	at end	
Serial No.:			 Temperature:			°C
Test liquid:			Rel. humidity:			%
Date test performe	d:		Bar. pressure:			hPa
Test type	Simulated:	Operational:	Time:			actual
Density of test liqu	iid:	kg/cm ³ at	°C and at 101	325 Pa (N	IBP)	
Observer:		-				

Table D.12.1 AC power voltage variation testMarked nominal voltage (U_{nom})V

(SELECT ONLY ONE TABLE)

GRAVIMETRIC	C TEST:	Ir	idications in mas			
Test	Voltago 1	Flowrate	Indicated value	Reference value	Error	mpe
No.	vonage 1	(mass unit/time)	(mass unit)	(mass unit)	%	%
1	Ref. volt.					
2	10 %					
3	-15 %					
Avg.	Ref. volt.					

		Inc	lications in liqu	iid volume at N	IBP		
Test No.	Voltage 1	Flowrate (mass or volume unit)	Indicated value (unit – liquid volume at NBP)	Reference value (mass unit)	Ref. value calc. to liquid vol. at NBP (volume unit)	Error %	mpe %
1	Ref. volt.						
2	10 %						
3	-15 %						
Avg.	Ref. volt.						

Indications in equivalent gas volume at base conditions

Test No.	Voltage 1	Flowrate (mass or volume unit/time)	Indicated value (normal cubic meters)	Reference value (mass unit)	Ref. value calc. to vol. at NBP (unit of liquid volume at NBP)	Ref. value calc. to gas vol. at base cond. (normal cubic metres)	Error %	mpe %
1	Ref. volt.							
2	10 %							
3	-15 %							
Avg.	Ref. volt.							

Remarks:

Passed: □ Failed: □

.../cont'd

MASTER	R METEI	R TEST:	I	ndications	s in mass						
Test No.	Voltage 1	Flowrate (mass or vol. unit/time)	Master meter temp. (°C)	Master meter pressure (kPa)	Master meter volume indication (liters)	Master meter K-factor	Master meter vol. ind. corrected for meter error	Calc. mass from master meter indica- tion	Indicated value (mass unit)	Error %	mpe %
1	Ref.										
	volt.										
2	10 %										
3	-15 %										
Avg.	Ref.								-		
	volt.										

MASTER METER TEST:

Passed: □ Failed: □

Notes:

1. Shall be tested at at least one flowrate (or simulated flowrate), at the upper and lower voltage limits.

- 2. Number of cycles shall be one.
- 3. The test consists of exposure of the device to power voltage variations, while the device is operating under normal atmospheric conditions.
- 4. All functions shall operate as designed.
- 5. All indications shall be within the maximum permissible errors.

D.12.2 DC power voltage variation test (B.4.5.2)



Table D.12.2 DC power voltage variation testMarked nominal voltage (U_{nom}) V

(SELECT ONLY ONE TABLE)

GRAVIMET	RIC TEST:	I	Indications in ma			
Test	Valtaga	Flowrate	Indicated value	Reference value	Error	mpe
No.	voltage	(mass unit/time)	(mass unit)	(mass unit)	%	%
1	Nominal =					
2	Lower =					
3	Upper =					
Avg.	Nominal =					

		Ind	ications in liqu	id volume at N	BP		
Test No.	Voltage	Flowrate (mass or volume unit)	Indicated value (unit – liquid volume at NBP)	Reference value (mass unit)	Ref. value calc. to liquid vol. at NBP (volume unit)	Error %	mpe %
1	Nominal =						
2	Lower =						
3	Upper =						
Avg.	Nominal =						

Indications in equivalent gas volume at base conditions

Test No.	Voltage 1	Flowrate (mass or volume unit/time)	Indicated value (normal cubic meters)	Reference value (mass unit)	Ref. value calc. to vol. at NBP (unit of liquid volume at NBP)	Ref. value calc. to gas vol. at base cond. (normal cubic metres)	Error %	mpe %
1	Nominal =							
2	Lower =							
3	Upper =							
Avg.	Nominal =							

Passed: D Failed: D

.../cont'd

33

MASTER METER TEST:

Indications in mass

Test No.	Voltage 1	Flowrate (mass or vol. unit/time)	Master meter temp. (°C)	Master meter pressure (kPa)	Master meter volume indication (liters)	Master meter K-factor	Master meter vol. ind. corrected for meter error	Calc. mass from master meter indica- tion	Indicated value (mass unit)	Error %	mpe %
1	Nominal										
2	Lower										
3	Upper										
Avg.	Nominal										

Notes:

Passed: □ Failed: □

1. Shall be tested at at least one flowrate (or simulated flowrate), at the upper and lower voltage limits.

2. Number of cycles shall be one.

3. The test consists of exposure of the device to power voltage variations.

4. All functions shall operate as designed.

5. Indications shall be within the maximum permissible errors.

D.13 Short-time power reduction test (B.4.6)

Application No:			Environmental conditions					
Model No.:					at start	at end		
Serial No.:				Temperature:			°C	
Test liquid:				 Rel. humidity:			%	
Date test performed:				Bar. pressure:			hPa	
Test type Sim	ulated:	□ Op	perational:	Time:			actual	
Density of test liquid:		kg	/cm ³ at	°C and at 101	325 Pa (N	BP)		
Observer:								
Marked nominal voltage	, $U_{\text{nom}} = $							

Table D.13 Short-time power reduction test

(SELECT ONLY ONE TABLE)

GRAVIMETRIC TES	Г:		Indication	ns in mass	,					
			Disturbance				Result			
Flowrate (mass unit/time)	rate Reference value it/time) (mass unit)		Duration	Number of	Repetition	Indication	Difference	S (fa	Significant fault ault > 20 % mpe)	
		or $v_{\rm nom}$	(1115)	uistuibances	intervais		(unit)	No	Yes (remarks)	
			Without disturbance							
		0	10	10						
		50	20	10						

Indications in liquid volume at NBP

Flowrate	Reference value (mass unit)	Ref. value calc. to vol. at NBP			Result					
(mass or volume unit/time)			Amplitude %	Duration	Number of	Repetition	Indication	Difference	S (fa	significant fault ault > 20 % mpe)
unit/time)			$OI U_{nom}$	(1115)	distuibances	inter vars		(unit)	No	Yes (remarks)
				Without d	listurbance					
			0	10	10					
			50	20	10					

Remarks:

Table D.13 Short-time power reduction test (B.4.6) (Cont.)

Application No:			 Environmental conditions				
Model No.:				at start	at end		
Serial No.:			 Temperature:			°C	
Test liquid:			 Rel. humidity:			%	
Date test performed	1:		Bar. pressure:			hPa	
Test type	Simulated:	Operational:	Time:			actual	
Density of test liqu	id:	kg/cm ³ at	°C and at 101	325 Pa (N	BP)		
Observer:		_					
Marked nominal vo	ltage, $U_{\rm nom} =$						

Indications in equivalent gas volume at base conditions

	Reference	Ref value	Ref. value	Disturbance				Result			
Flowrate (mass	value (mass	calc. to vol. at NBP (unit liq.	calc. to gas vol. at base	Amplitude %	Duration	Number of	Repetition	Indication	Difference		Significant fault (fault > 20 % mpe)
unit/time)	unit)	vol. at NBP)	cond. (normal cubic meters)	of $U_{\rm nom}$	(ms)	disturbances	intervals		(unit)	No	Yes (remarks)
					Without	disturbance					
				0	10	10					
				50	20	10					

MASTER N	METER	FEST:			Indicatio	ns in liquid	volume at NB	P						
	Master Master				Master	Calc mass	Disturbance				Result			
Flowrate (mass or	Master meter	Master meter	meter volume	Master meter	meter vol. ind.	from master	Amplitude %	Duration	Number of	Repetition	Indication	Difference		Significant fault (fault > 20 % mpe)
unit/time)	(°C)	(kPa)	indication (liters)	K-factor	for meter error	meter indication	of $U_{\rm nom}$	(ms)	disturbances	intervals		(unit)	No	Yes (remarks)
								Without						
							0	10	10					
							50	20	10					

Remarks:

Passed: 🗖 Failed: 🗖

D.14 Electrical bursts test (B.4.7) D.14.1 Electrical bursts test for power supply lines (B.4.7)

Application No:	Environmental conditions
Model No.:	at start at end
Serial No.:	Temperature: °C
Test liquid:	Rel. humidity: %
Date test performed:	Bar. pressure: hPa
Test type Simulated:	Time: actual
Density of test liquid: kg/cm ³ at	°C and at 101 325 Pa (NBP)
Observer:	
Indicated value: mass D Liqui	id volume at NBP □ Volume of reference conditions □
a) Power supply lines: N	Jumber of test cycles 10 10
	Marked nominal voltage, $U_{\text{nom}} =$
	$Amplitude = 1\ 000\ V$

Table D.14.1 Electrical bursts test for power supply lines

(SELECT ONLY ONE TABLE) **GRAVIMETRIC TEST:** Indications in mass Disturbance Result Significant fault (fault > 20 % mpe) Protective Ref. value Flowrate Neutral Line Polarity Indication Earth (unit) (unit) ↓ \downarrow ↓ ground ground Yes (remarks) No ground Without disturbance pos Х neg Without disturbance pos Х neg Without disturbance pos Х neg

Remarks:

Table D.14.1 Electrical bursts test for power supply lines (Cont.)

			Ind	ications in liq	uid volume at	NBP				
		Ref. value calc. to vol.		Disturbance		= Polarity	Result			
Flowrate (mass or volume	Ref. value (mass unit)		Line	Neutral	Protective earth		Indication		Significant fault (fault > 20 % mpe)	
unit/time)		at NBP		ground	↓ ground			No	Yes (remarks)	
				Without c	listurbance					
			v			pos				
			Λ			neg				
				Without c	listurbance					
				x		pos				
				A		neg				
			Without disturbance							
			v		x	pos				
						neg				

Remarks:

D.14.1 Electrical bursts test for power supply lines (B.4.7) (Cont.)

		I	Environme	ntal conditic	ons
			at start	at end	
		Temperature:			°C
		Rel. humidity:			%
		Bar. pressure:			hPa
Operational:		Time:			actual
kg/cm ³ at		°C and at 101	325 Pa (N	NBP)	
-					
🗖 Liqi	uid volur	ne at NBP 🗖	V	/olume of re	eference conditions \Box
1	Number	of test cycles	10	10	
	Marke	d nominal voltage	e, $U_{\text{nom}} =$		
		Amj	plitude =	1 000 V	
	Operational: _kg/cm ³ at	Operational: kg/cm ³ at Liquid volu Number Marke	Image: constraint of the system Image: constraint of the system Image: constraint of the system Temperature: Rel. humidity: Bar. pressure: Operational: Image: constraint of the system kg/cm³ at °C and at 101 Image: constraint of the system Number of test cycles Marked nominal voltage Am	Environme at start Temperature: Rel. humidity: Bar. pressure: Operational: Time: kg/cm³ at °C and at 101 325 Pa (Number of test cycles Number of test cycles Marked nominal voltage, $U_{nom} =$ Amplitude =	Environmental conditional: Temperature: at end Marked nominal voltage, $U_{nom} =$ Amplitude = 1000 V

Table D.14.1 Electrical bursts test for power supply lines

(SELECT ONLY ONE TABLE)

	Indications in e	equivalent g	as volume at	base conditions
--	------------------	--------------	--------------	-----------------

		Ref value	Ref. value		Disturbance					Result
Flowrate (mass or volume	Reference value	calc. to vol. at NBP	calc. to gas vol. at base	Line	Neutral	Protective Earth	Polarity	Indication		Significant fault (fault > 20 % mpe)
unit/time)	(mass unit)	(unit liq. vol. at NBP)	(normal cubic meters)	↓ ground	↓ ground	↓ ground			No	Yes (remarks)
					Without c	listurbance				
				Y			pos			
				Α			neg			
					Without c	listurbance				
					v		pos			
					Λ		neg			
					Without c	listurbance				
						v	pos			
						Λ	neg			

Remarks:

Table D.14.1 Electrical bursts test for power supply lines (Cont.)

MASTER	STER METER TEST: Indications in mass												
Flowrate	Master	Master	Master			Ref value		Disturbance					Result
(mass or volume	meter temp.	meter	meter volume	Master meter	Ref. value (mass	calc. to volume	Line	Neutral	Protective earth	Polarity	Indication		Significant fault (fault > 20 % mpe)
unit/time)	(°Ĉ)	(kPa)	(liters)	K-lactor	unit)	at NBP	ground	ground	↓ ground			No	Yes (remarks)
							v			pos			
							Λ			neg			
								Without c	listurbance				
								V		pos			
								Λ		neg			
								Without c	listurbance				
									x	pos			
									~	neg			

Remarks:

D.14.2 Electrical bursts test for I/O circuits and communication devices (B.4.7)



Table D.14.2 Electrical bursts test for I/O circuits and communication devices

(SELECT ONLY ONE TABLE)

GRAVIMETRIC	TEST:		Indicatio	ns in mass					
								Result	
Flowrate (unit)	Ref. value (unit)	Tes	ted cable/inter	face	Polarity	Indication	Significant fault (fault > 20 % mpe)		
							No	Yes (remarks)	
			Without c	listurbance			-		
		v			pos				
		А			neg				
			Without c	listurbance					
			v		pos				
			А		neg				
		Without disturban							
				v	pos				
				Δ	neg				

Remarks:

Table D.14.2 Electrical bursts test for I/O circuits and communication devices (Cont.)

			Ind	ications in liq	uid volume at	NBP				
									Result	
Flowrate (mass or volume	Ref. value (mass unit)	Ref. value calc. to volume	Tes	Tested cable/interface			Indication	Significant fault (fault > 20 % mpe)		
unit/time)		at INDF						No	Yes (remarks)	
				Without c	listurbance					
			X			pos				
			2			neg				
				Without c	listurbance					
				v		pos				
				Λ		neg				
			Without disturbance		listurbance					
			v		pos					
					Λ	neg				

Remarks:

D.14.2 Electrical bursts test for I/O circuits and communication devices (Cont.)



Table D.14.2 Electrical bursts test for I/O circuits and communication devices (Cont.) (SELECT ONLY ONE TABLE)

Indications in equivalent gas volume at base conditions

		Ref. value	Ref. value							Result
Flowrate (mass or	Reference value	calc. to vol. at NBP	calc. to gas vol. at base	Tested cable/interface			Polarity	Indication		Significant fault (fault > 20 % mpe)
time)	(mass unit)	(unit liq. vol. at NBP)	(normal cubic meters)						No	Yes (remarks)
					Without d	listurbance			-	
				X			pos			
				А			neg			
					Without d	isturbance				
					x		pos			
					28		neg			
					Without d	listurbance				
						v	pos			
						Δ	neg			

Passed: □ Failed: □

MASTER	METER T	'EST:						Indication	ıs in mass				
Flowrate	Master	Master	Master			Ref value						Result	
(mass or vol.	meter temp.	meter	meter volume	Master meter	Ref. value (mass	calc. to volume	Tested cable/interface			Polarity	Indication		Significant fault (fault > 20 % mpe)
unit/time)	(°Ĉ)	(kPa)	(liters)	K-lactor	unit)	at NBP						No	Yes (remarks)
							Y			pos			
							А			neg			
								Without d	isturbance	-			
								v		pos			
								Λ		neg			
								Without d	isturbance				
									x	pos			
									Λ	neg			

Remarks:

Passed:
Failed

D.15 Electrostatic discharge test D.15.1 Electrostatic discharge test – Direct application (B.4.8)

Application No:				I	Environme	ntal conditio	ns
Model No.:					at start	at end	
Serial No.:				Temperature:			°C
Test liquid:				Rel. humidity:			%
Date test performe	d:			Bar. pressure:			hPa
Test type	Simulated:	□ Operational:		Time:			actua
Density of test liqu	uid:	kg/cm ³ at		°C and at 101	325 Pa (N	NBP)	
Observer:							
Air discharge]	Polarity (**	*): 🗖 pos	neg			

Table D.15.1 Electrostatic discharge test - Direct application

(SELECT ONLY ONE TABLE)

GRAVIMETRIC TEST

GRAVIMETRIC	TEST:			Indi	cations in mass			
				Discharges				Result
Type of	Flowrate (unit)	Reference value	Test voltage	Number of discharges	Repetition interval	Indication		Significant fault (fault > 20 % mpe)
test ((unit)	(kV)	≥ 10	(s)		No	Yes (remarks)
				Without disturbance				
A			2					
All discharge			4					
uisenarge			6					
			8					
				Without disturbance				
Contact			2					
discharge			4					
			6					

Remarks:

Passed:
Failed

Table D.15.1 Electrostatic discharge test - Direct application (Cont.)

				Indicatio	ons in liquid volume	e at NBP			
	Flowrate		Ref value		Discharges				Result
Type of	(mass or volume	Reference value	calc. to volume	Test voltage	Number of discharges	Repetition interval	Indication		Significant fault (fault > 20 % mpe)
test	unit/time)	(mass unit)	at NBP	(kV)	≥10	(s)		No	Yes (remarks)
				V	Vithout disturbance	<u>.</u>			
A				2					
Alf				4					
uisenarge				6					
				8					
				V	Vithout disturbance				
Contact				2					
discharge				4					
				6					

Remarks:

Passed:
Failed

D.15.1 Electrostatic discharge test - Direct application (B.4.8) (Cont.)

Application No:				E	Environme	ntal conditic	ns
Model No.:					at start	at end	
Serial No .:				Temperature:			°C
Test liquid:				Rel. humidity:			%
Date test perform	med:			Bar. pressure:			hPa
Test type	Simulated:	□ Operational:		Time:			actual
Density of test li	iquid:	kg/cm ³ at		°C and at 101	325 Pa (N	VBP)	
Observer:							
Air discharge		Polarity (**)	: 🗖 pos	neg			

Table D.15.1 Electrostatic discharge test - Direct application (Cont.)

1 4010 211		0.000000000	,	or Enter app	neurion (e	(SIIC.)	ELECT ONLY O	NE TABLE)		
					Indica	tions in equi	ivalent gas v	olume at ba	se conditio	ns
			Ref. value	Ref. value calc.		Discharges				Result
Type of	Flowrate (mass or	Reference value	cal. to vol. at NBP	to gas vol. at base cond.	Test	Number of	Repetition	Indication		Significant fault (fault > 20 % mpe)
test	unit/time)	unit)	(unit liq. vol. at NBP)	(normal cubic meters)	(kV)	≥ 10	(s)		No	Yes (remarks)
					Wit	hout disturba	ance		-	
Air					2					
discharge					4					
					6					
					8					
					Wit	hout disturba	ance			
Contact					2					
discharge					4					
					6					

Remarks:

Passed:
Failed

Table D.15.1 Electrostatic discharge test - Direct application (Cont.)

MASTER	IASTER METER TEST: Indications in mass												
				Master					Discharges				Result
Type of	Flowrate (mass or	Master meter	Master meter	meter volume	Master meter	Reference value	Ref. value calc. to	Test	Number of	Repetition	Indication		Significant fault (fault > 20 % mpe)
test	unit/time)	(°C)	(kPa)	indica- tion (liters)	K-factor	(mass unit)	at NBP	(kV)	discharges ≥ 10	interval (s)		No	Yes (remarks)
								Wit	thout disturba	ance		-	
Air								2					
discharge								4					
uisenuige								6					
								8					
								Wit	thout disturba	ance			
Contact								2					
discharge								4					
								6					

Remarks:

Passed: 🗆 Failed 🗆

D.15.2 Electrostatic discharge test test - Indirect application (B.4.8)

Application No	:			I	Environmen	tal conditie	ons
Model No .:					at start	at end	
Serial No .:				Temperature:			°C
Test liquid:				Rel. humidity:			%
Date test perfor	med:			Bar. pressure:			hPa
Test type	Simulated:	□ Operational:		Time:			actual
Density of test	liquid:	kg/cm ³ at		°C and at 101	325 Pa (N	BP)	
Observer:							
Indirect applic	ation - Contact o	discharge only					
a) Vertical cou	pling plane		Polarity	(**): 🗆 pc	os □neg		

Table D.15.2.1 Electrostatic discharge test - Indirect application

(SELECT ONLY ONE TABLE)

GRAVIMETR	IC TEST:		Indication	ns in mass				
		Discharges					Result	
Flowrate (unit)	Reference value (unit)	Test voltage	Number of discharges	Repetition interval (s)	Indication	Significant fault (fault > 20 % mpe)		
		(kV)	≥ 10			No	Yes (remarks)	
		1	Without disturbance					
		2						
		4						
		6						

Indications in liquid volume at NBP

					Result			
Flowrate (mass or volume	Reference value (mass unit)	Ref. value calc. to vol.	Test voltage	Number of discharges	Repetition	Indication	Significant fault (fault > 20 % mpe)	
unit/time)	(at NBP	(kV)	≥ 10	(s)		No	Yes (remarks)
				Without disturbance				
			2					
			4					
			6					

Remarks:

Passed: 🗆 Failed 🗆

D.15.2 Electrostatic discharge test - mun ect applic	(Cont.)
Application No:	Environmental conditions
Model No.:	at start at end
Serial No.:	Temperature: °C
Test liquid:	Rel. humidity: %
Date test performed:	Bar. pressure: hPa
Test type Simulated: Operational:	Time: actual
Density of test liquid: kg/cm ³ at	°C and at 101 325 Pa (NBP)
Observer:	
Indirect application – Contact discharge only	
a) Vertical coupling plane (Cont.)	Polarity (**): □ pos □ ineg

D.15.2 Electrostatic discharge test - Indirect application (B.4.8) (Cont.)

Table D.15.2.1 Electrostatic discharge test - Indirect application (Cont.)

F	lowrate		R	Ref. value	Re	f. value		Discharge	s			Result				
(mass or volume	Referen value	nce ca at	al. to vol. NBP (unit	calc vol.	to gas at base	Test voltage	Number of discharges	Repetition interval	ⁿ Indicatio	on			Significant (fault > 20 %	t fault % mpe)	
u	nit/time)	(mass u		NBP)	cubio	c meters)	(kV)	≥ 10	(s)		No)		Yes	s (remarks)	
							Wi	thout disturl	Dance							
							2									
							4									
							6									
M	ASTER N	AETER 1	FEST:									Indicatio	ons in 1	mass		
				Ма	ster		Vol. ind.	Calc.		Discharge	S				Result	
F (1	nass or	Master meter	Mast mete	er volu	eter ume	Master meter	master meter	mass from master	Test	Number of	Repetitio	on Indic	cation		Significant fault (fault > 20 % mpe)	
ur	vol. nit/time)	(°C)	press (kPa	a) indic	ation ers)	K-factor	for meter error	meter indication	voltage (kV)	discharges ≥10	interva (s)	1		No	Yes (remark	ks)
									Wi	thout distur	bance					
									2							
									4							
									6							

(SELECT ONLY ONE TABLE)

Indications in equivalent gas volume at base conditions

Remarks:

Passed:
Failed

D.15.2 Electrostatic discharge test - Indirect application (B.4.8) (Cont.)

Application No:	:		E	Environmen	ntal conditio	ons
Model No .:			_	at start	at end	
Serial No .:			Temperature:			°C
Test liquid:			 Rel. humidity:			%
Date test perfor	med:		Bar. pressure:			hPa
Test type	Simulated:	□ Operational:	Time:			actual
Density of test l	iquid:	kg/cm ³ at	°C and at 101	325 Pa (N	BP)	
Observer:			 			
Indirect applic	ation – Contact	discharge only				
b) Horizontal c	oupling plane		Polarity	(**): 🗆 pc	os 只 neg	

 Table D.15.2.2 Electrostatic discharge test - Indirect application

(SELECT ONLY ONE TABLE)

GRAVIMETRIC TEST.

GRAVIMETR	RIC TEST:		Indicatio	ns in mass				
						Result		
Flowrate (mass	Reference value (mass unit)	Test voltage	Number of discharges	Repetition interval	Indication	Significant fault (fault > 20 % mpe)		
unit/time)	(mass unit)	(KV)	≥ 10	(s)		No	Yes (remarks)	
			Without disturbance	e				
		2						
		4						
		6						

Indications in liquid volume at NBP

Flowrate		Ref value			Result			
(mass or volume (mass unit)		calc. to vol.	Test voltage	Number of discharges	Repetition interval	Indication	Significant fault (fault > 20 % mpe)	
unit/time)	, , ,	at NBP	(kV)	≥ 10	(s)		No	Yes (remarks)
			,	Without disturbance	•			
			2					
			4					
			6					

Remarks:

Passed: 🗆 Failed 🗆

D.15.2 Electrostatic discharge test – Indirect application (B.4.8) (Cont.)

Application No:		 E	Environme	ntal conditio	ns
Model No.:		_	at start	at end	_
Serial No.:		Temperature:			°C
Test liquid:		Rel. humidity:			%
Date test performed:		 Bar. pressure:			hPa
Test type Simulated:	□ Operational:	Time:			actual
Density of test liquid:	kg/cm ³ at	°C and at 101	325 Pa (N	NBP)	
Observer:					

Indirect application – Contact discharge only

b) Horizontal coupling plane (Cont.)

Polarity (**): □ pos □ neg

 Table D.15.2.2 Electrostatic discharge test - Indirect application (Cont.)

 Indications in equivalent gas volume at base condition

(SELECT ONLY ONE TABLE)

			111		ulvalcht j	zas volume	at base co	nuntions					
Flowrate		Ref.	value	Ref. value		Discharge	S			Res	sult		
(mass or volume	Reference value	ce cal vol. a	c. to t NBP	calc. to gas vol. at base	Test voltage	Number of discharges	Repetition interval	ⁿ Indicatio	n	Si (fau	gnificant fau 1lt > 20 % m	ılt pe)	
unit/time)	(mass un	vol. at	t nq. t NBP)	cubic meters)	(kV)	≥ 10	(s)	1	No		Yes (re	marks)	
					Wi	thout disturl	bance						
					2								
					4								
					6								
MASTER N	MASTER METER TEST: Indications in mass												
			Mast	er	Vol. ind.	Calc		Discharge	8			Result	
Flowrate (mass or	Master meter	Master meter	mete	er Master ne meter	master meter	mass from master	Test	Number of	Repetition	Indication		Significant fault (fault > 20 % mpe)	
vol. unit/time)	(°C)	(kPa)	indicat (liter	s) K-factor	corrected for meter error	meter indication	voltage (kV)	discharges ≥10	interval (s)	Ι	No	Yes (remarks)	
							Wi	thout disturb	bance				
							2						
							4						
							6						

Remarks:

Passed:
Failed

^{**}IEC 1000-4-2 specifies that the test shall be conducted with the most sensitive polarity report.

D. 15.3 Electrostatic discharge test – Test setup (B.4.8)

Specifications of test points (direct application), e.g. by photos or sketches

a) Direct application

Contact discharge:

Air discharge:

b) Indirect application

D.16 Electromagnetic susceptibility test (B.4.9 and 14.1.1)

Application No:	1	Environme	ental conditie	ons
Model No.:		at start	at end	_
Serial No.:	Temperature:			°C
Test liquid:	Rel. humidity:			%
Date test performed:	Bar. pressure:			hPa
Test type Simulated:	Time:			actual
Density of test liquid: kg/cm ³ at	°C and at 101	325 Pa (1	NBP)	
Observer:				
Frequency range: 26 – 1 000 MHz	Rate of	f sweep:		
Field strength: 3 V/m				
Modulation: 80 % AM, 1 kHz since wave				

Table D.16 Electromagnetic susceptibility test

(SELECT ONLY ONE TABLE)

GRAVIME	TRIC TEST:			Indications in	mass				
Flowrate	Reference value		Distu	rbance		Result			
(mass unit/time)	(mass unit)	Antenna	Frequency range (MHz)	Polarization Facing		Indication	No	Yes (Remark)	
			Without d	isturbance					
					Front				
					Right				
					Left				
					Rear				
					Front				
					Right				
					Left				
					Rear				

Table D.16 Electromagnetic susceptibility test (Cont.)

				mulcatio	ns ni nquiu voiu	Inc at 1\D1			
Flowrate	Reference	Ref value		Distu	rbance			R	esult
(mass or volume unit/time)	value (mass unit)	calc. to vol. at NBP (volume unit)	Antenna	Frequency range (MHz)	Polarization	Facing	Indication	No	Yes (Remark)
				Without of	listurbance				
						Front			
						Right			
						Left			
						Rear			
						Front			
						Right			
						Left			
						Rear			

Indications in liquid volume at NBP

Passed:
Failed

D.16 Electromagnetic susceptibility test (B.4.9 and 14.1.1) (Cont.)

Application No:	Environm	ental conditions
Model No.:	at start	at end
Serial No.:	Temperature:	°C
Test liquid:	Rel. humidity:	%
Date test performed:	Bar. pressure:	hPa
Test type Simulated:	Time:	actual
Density of test liquid: kg/cm ³ at	°C and at 101 325 Pa (NBP)
Observer:		
Frequency range: 26 – 1 000 MHz	Rate of sweep:	
Field strength: 3 V/m		
Modulation: 80 % AM, 1 kHz since wave		
······································		

 Table D.16 Electromagnetic susceptibility test (Cont.)

(SELECT ONLY ONE TABLE) Indications in equivalent gas volume at base conditions

		Ref.	Ref value		Distu	rbance				Result
Flowrate (mass or volume unit/time)	Reference value (mass unit)	value calc. to vol at NBP (unit liq. vol. at NBP)	calc. to gas vol. at base cond. (normal cubic meters)	Antenna	Frequency range (MHz)	Polarization	Facing	Indication	No	Yes (Remark)
					Without d	isturbance				
							Front			
							Right			
							Left			
							Rear			
							Front			
							Right			
							Left			
							Rear			

Remarks:

MASTER I	METER 1	FEST:								Indica	ations in liquid vo	lume at N	BP
			Master		Vol ind	Calc.		Distur	bance				Result
Flowrate (mass or	Master meter	Master meter	meter volume	Master meter	master meter	mass from master		Frequency					
unit/time)	(°C)	(kPa)	tion (liters)	K-factor	for meter error	meter indica- tion	Antenna	range (MHz)	Polarization	Facing	Indication	No	Yes (Remarks)
								Without di	isturbance				-
										Front			
										Right			
										Left			
										Rear			
										Front			
										Right			
										Left			
										Rear			

Passed:
Failed

D.16 Electromagnetic susceptibility test - Test setup (B.4.9 and 14.1.1) (Cont.)

Description of the setup, e.g. by photos or sketches

D.17 Perturbations on DC voltage-powered instruments (B.4.10)

Application No:				I	Environmen	tal conditi	ons
Model No.:				_	at start	at end	
Serial No.:				Temperature:			°C
Test liquid:				Rel. humidity:			%
Date test performe	ed:			Bar. pressure:			hPa
Test type	Simulated:	Operational:	(Time:			actual
Density of tes	st						
liquid:		kg/cm3 at		°C and at 1	01 325 P	a (NBP)	
Observer:							

- 1. Test pulses as in ISO 7637-2, 4.6.
- 2. Values agreed to between manufacturer & supplier.
- 3. The amplitudes are the values of Va, as defined for each test pulse in ISO 7637-2, 4.6.
- 4. If power < -15 % Unom or > +10 % Unom shall indicate within mpe or provide no indication that can be used as a measurement. (Minimum severity level for pattern (type) approval is level II)

Table D.17 Perturbations on DC voltage powered instruments

GRAVIMET	RIC TEST:							Indicati	Indications in mass						
Test	Selected test]	Fest levels voltage	s ³	Minimun of pulse	n number s or test	Pulse cy	cle time	Flowrate (mass	Indicated value	Reference value	Error	mpe		
puise	level ²	Ι	Π	III	tir	ne	min. max.		unit/time)	(mass unit)	(mass unit)	/0	/0		
1a															
1b															
2															
3a															
3b															

(SELECT ONLY ONE TABLE)

Indications in liquid volume at NBP

Test	Selected	Γ	est levels voltage	3	Minimun	n number	Pulse cycle time		Flowrate	Indicated value	Reference value	Ref. value calc. vol. at NBP	Error	mpe
pulse ¹	level ²	Ι	II	III	tir	ne	min.	max.	unit/time)	(mass unit)	(mass unit)	(unit liquid volume)	%	%
1a														
1b														
2														
3a														
3b														

Remarks:

Passed:
Failed

D.17 Perturbations on DC voltage-powered instruments (B.4.10) (Cont.)

Application No:			 E	Environmen	tal conditie	ons
Model No.:			_	at start	at end	_
Serial No .:			 Temperature:			°C
Test liquid:			Rel. humidity:			%
Date test perform	ed:		Bar. pressure:			hPa
Test type	Simulated:	□ Operational:	Time:			actual
Density of test liq	uid:	kg/cm ³ at	°C and at 101	325 Pa (N	BP)	
Observer:						

- 1. Test pulses as in ISO 7637-2.4.6.
- 2. Values agreed to between manufacturer & supplier.
- 3. The amplitudes are the values of Va, as defined for each test pulse in ISO 7637-2.4.6.
- 4. If power < -15% U_{nom} shall indicate within mpe or provide no indication that can be used as a measurement. (Minimum severity level for pattern (type) approval is level II)

Table D.17 Perturbations on DC voltage powered instruments (Cont.)

	(SELECT ONLY ONE TABLE)
Indications in eq	uivalent gas volume at base conditions

Test	Selected	Te	st levels voltage	s ³	Minimum number of		Pulse cycle time		Flowrate	Indicated value	Reference	Ref. value calc. vol. at NBP (unit of	Ref. value calc. gas vol. at NBP	Error	mpe
pulse ¹	level ²	Ι	Π	III	pulses tin	or test ne	min.	max.	(mass/time)	(normal cubic meters)	(mass unit)	NBP (unit of liquid volume at NBP)	(unit in normal cubic meters)	%	%
1a															
1b															
2															
3a															
3b															

Table D.17 Perturbations on DC voltage powered instruments (Cont.)

MASTER ME	ETER TEST:						Indicatio	ns in mass							
Test pulse ¹	Selected test	T	est levels voltage	3	Mini numl pulses	mum per of or test	Pulse cycle time		Flowrate (mass/time)	Indicated value (normal cubic	Reference value	Ref. value calc. vol. at NBP (unit of liquid	Ref. value calc. gas Vol. at NBP (unit in	Error	mpe %
F		Ι	Π	III	tin	ne	min.	max.	(mass/time)	meters)	(mass unit)	volume at NBP)	normal cubic meters)		, •
1a															
1b															
2															
3a															
3b															
													Passe	ed: 🗆	Failed 🗆

Remarks:

62

D.18 Endurance test (A.1.5, 15.1.5.3) **D.18.1 Performance test before endurance test**

Application No:				Ε	Environmen	tal conditi	ons
Model No.:					at start	at end	
Serial No.:				Temperature:			°C
Test liquid:				Rel. humidity:			%
Date test performe	d:			Bar. pressure:			hPa
Test type	Simulated:	□ Operational:		Time:			actual
Density of test liqu	uid:	kg/cm ³ at		°C and at 101	325 Pa (N	BP)	_
Observer:							
1. Perform initia	l test, accordin	g to A.1.4 and 15.1.5.	2 prior t	o endurance test			

- 2. Error of initial test is within mpe: Yes I No I
- 3. Operate for 100 hours at flowrate between 0.8 Q_{max} and Q_{max} with the liquid the device is intended to measure, or one with similar characteristics.

Maximum flowrate of meter, Q_{max} =

4. Perform final test with the same liquid, according to A.1.4 and 15.1.5.2. The test results shall not vary from the initial test by more than 1.5 % of the measured quantity.

Table D.18.1 Performance test before endurance test

(SELECT ONLY ONE TABLE) Indications in mass

GRAVIMETRIC TE	ST:	Indicatio	ons in mass		
Test No.	Flowrate (mass unit/time)	Indicated value (mass unit)	Reference value ¹ (mass unit)	Error %	mpe %
1					
2					
3					
Avg.					

Indications in liquid volume at NBP

Test No.	Flowrate (mass or volume unit/time)	Indicated value (unit – liquid volume at NBP)	Reference value (mass unit)	Ref. value calc. to liquid vol. at NBP (volume unit)	Error %	mpe %
1						
2						
3						
Avg.						

Indications in equivalent gas volume at base conditions

Test No.	Flowrate (mass or volume unit/time)	Indicated value (normal cubic meters)	Reference value (mass unit)	Ref. value calc. to vol. at NBP (unit of liquid volume at NBP)	Ref. value calc. to gas vol. at base cond. (unit in normal cubic meters)	Error %	mpe %
1							
2							
3							
Avg.							

MASTER METER TEST: Indications in mass

Test No.	Flowrate (mass or vol. unit/time)	Master meter temp. (°C)	Master meter pressure (kPa)	Master meter volume indication (liters)	Master meter K-factor	Vol. ind. master meter corrected for meter error	Calc. mass from master meter indication	Indicated value (mass unit)	Error %	mpe %
1										
2										
3										
Avg.										

Remarks:

Passed: D Failed: D

D.18 Endurance test (A.1.5, 15.1.5.3) (Cont.) **D.18.2 Performance test after endurance test**

Application No:	Environmental conditions						
Model No.:					at start	at end	
Serial No .:				Temperature:			°C
Test liquid:	Rel. humidity:			%			
Date test performe	ed:			Bar. pressure:			hPa
Test type	Simulated:	□ Operational:		Time:			actua
Density of test liqu	°C and at 101	325 Pa (N	(BP)				
Observer:							

After endurance testing:

Perform final test with the same liquid, according to A.1.4. and 15.1.5.2. The test results shall not vary from the initial test by more than 1.5 % of the measured quantity.

Table D.18.2 Performance test after endurance test

(SELECT ONLY ONE TABLE)

GRAVIMETRIC T	EST:	Indications in mass					
Test No.	Flowrate (mass unit/time)	Indicated value (mass unit)	Reference value ¹ (mass unit)	% Error	mpe %		
1	()	()	()				
2							
3							
Avg.							

Indications in liquid volume at NBP											
Test No.	Flowrate (mass or volume unit/time) Indicated va (unit - liqu volume at N		Reference value (mass unit)	Ref. value calc. to liquid vol. at NBP (volume unit)	Error %	mpe %					
1											
2											
3											
Avg.											

Indications in equivalent gas volume at base conditions

Test No.	Flowrate (mass or volume unit/time)	Indicated value (normal cubic meters)	Reference value (mass unit)	Ref value calc. to vol. at NBP (unit of liquid volume at NPB)	Ref. value calc. to gas vol. at base cond. (unit in normal cubic meters)	Error %	mpe %
1							
2							
3							
Avg.							

MASTER METER TEST: Indications in mass

Test No.	Flowrate (mass or vol. unit/time)	Master meter temp. (°C)	Master meter pressure (kPa)	Master meter volume indication (liters)	Master meter K-factor	Vol. ind. master meter corrected for meter error	Calc. mass from master meter indication	Indicated value (mass unit)	Error %	mpe %
1										
2										
3										
Avg.						-				

Remarks:

Passed:
Failed: