INTERNATIONAL RECOMMENDATION

OIML R 117-3

Edition 2019 (E)

Dynamic measuring systems for liquids other than water

Part 3: Test report format

Ensembles de mesurage dynamique de liquides autres que l'eau

Partie 3: Format du rapport d'essai

ORGANISATION INTERNATIONALE DE MÉTROLOGIE LÉGALE

INTERNATIONAL ORGANIZATION OF LEGAL METROLOGY

Contents

Foreword

The International Organisation of Legal Metrology (OIML) is a worldwide, intergovernmental organisation whose primary aim is to harmonise the regulations and metrological controls applied by the national metrological services, or related organisations, 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 harmonise 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 Project Groups linked to 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 117-3, Edition 2019 (E) - was developed by OIML Project Group 4 of OIML TC 8/SC 3 *Dynamic measuring systems for liquids other than water*. It was approved for final publication by the International Committee of Legal Metrology in 2019 and will be submitted to the International Conference of Legal Metrology in 2020 for formal sanction. It supersedes OIML R 117-3 dated 2014.

Other OIML Recommendations that have been superseded by the OIML R 117 series of Recommendations include:

- OIML R 86:1989 *Drum meters for alcohol and their supplementary devices*;
- OIML R 105:1993 *Direct mass flow measuring systems for quantities of liquids*; and
- OIML R 118:1995 *Testing procedures and test report format for pattern examination of fuel dispensers for motor vehicles*.

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Dynamic measuring systems for liquids other than water
Part 3: Test report format

1 Introduction

This report format applies to any kind of dynamic measuring system for liquids other than water independent of its technology. It presents a standardised format for the results of the various tests and examinations, described in OIML R 117-2, to which a type of a measuring system or a sub-assembly shall be submitted with a view to its approval based on this OIML Recommendation.

It is recommended that all metrology services or laboratories evaluating and/or testing types of measuring systems or sub-assemblies according to OIML R 117-1:2019 and R 117-2:2019, or to national or regional regulations based on this Recommendation, use this report format directly, or after translation into a language other than English or French. If this Recommendation needs to be translated, it is highly recommended to leave the structure and the numbering of the clauses unchanged, thus facilitating the interpretation of most of the contents even for those readers that are not able to easily interpret the applied language.

2 Applicability of this test report format

In the framework of OIML B 18 *Framework for the OIML Certification System (OIML-CS)* applicable to measuring systems or sub-assemblies in conformity with OIML R 117-1:2019 and R 117-2:2019, the use of this report format in French and/or in English is mandatory, including its translation into the national languages of the countries issuing such certificates, where appropriate.

Concerning the implementation of OIML R 117-1:2019 and R 117-2:2019 in national regulations, this report format is informative.

3 Guidance for the application of this test report format

Key to the symbols and expressions used in the following pages:

- The “summary of the results” and the “results of the tests” shall be completed in agreement with the following examples:

	Class 0.3	Class 0.5	Class 1	Class 1.5	No	Meaning
Passed for	X					passed for class 0.3
Passed for		X	X	X		passed for class 0.5, 1 and 1.5
Passed for					X	failed for all classes
Passed for	/	/	/	/	/	test is not applicable for this instrument

- Unless prescribed otherwise, “Date” in the test report refers to the date of testing.
- The name(s) or symbol(s) of the unit(s) used to express the test results shall be specified where applied.
- Where in a table one or several choices can be made, checkboxes are applied. In such case the columns Pass, Fail, N/A are generally not applicable and thus presented crosshatched (see the example below).

Clause	Requirement		Pass	Fail	N/A	Remarks

If a prescribed test is not relevant for the type of instrument to be tested, the reason why the test is omitted shall be clearly stated in the field "Remarks" (for instance, tests related to AC mains supply in the case of an instrument only powered by batteries, or partial testing after modification of a previously approved type).

The testing and report formats described in this Recommendation are generally via the volumetric method. However, testing using the gravimetric method is also acceptable.

The numbering of the report and the page numbers shall be completed in the heading.

Pages 1–5 of this report format shall be replaced by a cover page added by the OIML Issuing Authority.

4 The report format

The following pages concern the format for the individual report, starting with space for the cover page.

**<Cover page
to be added by the
OIML Issuing Authority>**

Test report format

Contents of the report

A References of the authority responsible for this report

Name	
Address	
Report number	
Application number (project number)	
Period of execution of the tests	
Date of issuing the report	
Name and signature of the person responsible for the report and stamp(s) (if applicable)	

B Synopsis of the results of the examination and tests

(To be completed by the OIML Issuing Authority)

The tested specimen fulfils ALL applicable requirements in OIML R 117-1:2019 for: ☐ Class 0.3 ☐ Class 0.5 ☐ Class 1.0 ☐☐ Class 1.5
☐ Yes ☐ No
Observations:

C Summary of the results of the examination and tests

The information in sections C, D and E refer to test reports and explain/clarify how the tests performed can be used to approve all types (size, model, configuration, housing, etc.) to be included in the OIML Certificate

(To be completed by the OIML Issuing Authority)

C.1 Examinations

Details of the evaluation results are available in the corresponding referenced rows in clause E.

Clause(s) in R 117-1		Compliance with OIML R 117-1		
		Pass	Fail	N/A
2	General requirements			
2.1	Constituents of a measuring system			
2.2	Ancillary devices			
2.3	Rated operating conditions			
2.4	Accuracy classes			
2.5	Maximum permissible errors and significant faults			
2.6	Conditions for applying maximum permissible errors			
2.7	Provisions for converted indications			
2.8	Maximum permissible errors and significant faults on calculators			
2.9	Indications			
2.10	Elimination of air or gases			
2.11	Gas indicator			
2.12	Transfer point			
2.13	Complete filling of the measuring system			
2.14	Emptying of the delivery hose			
2.15	Variations in the internal volume of full hoses			
2.16	Branches and bypasses			
2.17	Control and closing mechanisms			
2.18	Various provisions			
2.19	Markings			
2.20	Sealing devices and stamping plate			
2.21	Unattended delivery			
3	Requirements for meters and ancillary devices of a measuring system			
3.1	Meter			
3.2	Indicating device			
3.3	Price indicating device			
3.4	Printing device			
3.5	Memory device			
3.6	Pre-setting device			
3.7	Conversion device			
3.8	Calculator			
3.9	Self-service devices (SSD)			
4	Measuring systems equipped with electronic devices			
4.1	General requirements			
4.2	Power supply device			
4.3	Checking facilities			
5	Requirements specific to certain types of measuring systems			
5.1	Fuel dispensers			
5.2	Measuring systems on road tankers			
5.3	Measuring systems for the unloading of ships' tanks and of rail and road tankers using an intermediate tank			
5.4	Measuring systems for liquefied gases under pressure (other than LPG dispensers)			
5.5	Fuel dispensers for liquefied gases under pressure (LPG dispensers)			
5.6	Measuring systems for milk, beer and other foaming potable liquids			
5.7	Measuring systems on pipelines and systems for loading ships			
5.8	Measuring systems intended for the fueling of aircraft			

5.9	Blend dispensers			
5.10	Measuring systems for bunkering			
5.11	Measuring systems for liquefied natural gas (LNG)			

C.2 Performance tests

Details of the test results are available in the referenced subclauses of clause F of this report.

Clause R 117-3	Clause R 117-2	Performance tests	Clause R 117-1	Complies with R 117-1		
				Pass	Fail	N/A
F.1	**4**	**Type evaluation performance tests**	**2.3**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.2	**5**	**Meter sensors and measuring devices**	**3**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.3, F4, F5	**6**	**Electronic calculators, indicating devices and associated devices**	**3**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.6	**7**	**Gas elimination devices**	**2.10**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.7	**8**	**Ancillary devices**				
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.8.1, F.8.2	**A**	**Fuel dispensers**	**5.1**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.8.3, F.8.4	**A-LPG**	**LPG dispensers**	**5.5**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.8.5	**B**	**Measuring systems on road tankers**	**5.2**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.8.6	**C**	**Measuring systems for the unloading of ships' tanks and for rail and road tankers using an intermediate tank**	**5.3**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.8.7	**D**	**Measuring systems for liquefied gases under pressure (other than LPG dispensers)**	**5.4**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.8.8	**E**	**Measuring systems for milk, beer and other foaming potable liquids**	**5.6**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.8.9	**F**	**Measuring systems on pipelines and systems for loading ships**	**5.7**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			

Clause R 117-3	Clause R 117-2	Performance tests	Clause R 117-1	Complies with R 117-1		
				Pass	Fail	N/A
F.8.10	**G**	**Measuring systems intended for the fueling of aircraft**	**5.8**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.8.11, F.8.12	**K**	**Measuring systems for bunkering**	**5.10**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			
F.8.13	**L**	**Measuring systems for Liquefied Natural Gas (LNG)**	**5.11**			
yy	xx	Xx	XX			
yy	xx	Xx	XX			

Note: yy, xx, Xx and XX shall be completed by the OIML Issuing Authority

D General information

D.1 Manufacturer

Company	
Address	

D.2 Applicant

Company	
Representative	
Address	
Reference	
Date of application	

Applicant is authorised by the manufacturer (documented)	☐ Yes ☐ No
No application for OIML type evaluation has been made to any other OIML Issuing Authority (see OIML B 3, 3.1.2)	☐ Yes ☐ No

Observations:

D.3 Testing laboratories involved in the tests

(This table to be completed for each test laboratory)

Name	
Address	
Application number	
Tests by this laboratory	
Date/period of tests	
Name(s) of test engineer(s)	
In case tests have been performed on another location than the premises of this laboratory, give details here	
Name of the responsible person	
Date of signature	
Stamp (if applicable) and signature of the responsible person	
Observations:	

D.4 General information concerning the type and the specimen(s) supplied for the tests
(as stated on the instrument / provided by the manufacturer)

Information, indicated on the instrument	
Manufacturer's trade mark	
Type designation	
Accuracy class	
Size of the meter	
Cyclic volume (if applicable)	
Minimum pressure p_{min} (if applicable)	
Maximum pressure p_{max} (if applicable)	
Ambient temperature range (if applicable)	
Liquid temperature range (if applicable)	
Base pressure (if applicable)	
Base temperature (if applicable)	
t_{sp} (if applicable)	
Electrical power (if applicable)	
Identification of software (if applicable)	

The following specimens are used during the tests:

Specimen no.	Model	Size [inch or mm]	Serial no.	Year of fabrication
1				
2				
3				
4				
5				
…				

The following meter sizes are approved with the parameters as indicated in the table (if applicable).

Type			
Diameter in- / outlet [mm]			
Q_{min} [m^3/h]			
Q_{max} [m^3/h]			
Reynolds num. [-]			
Density [kg/m^3]			
Viscosity [cSt]			
MMQ [m^3]			
Temperature range liquid [°C]			
Temperature range ambient [°C]			
Maximum pressure [kPa]			

If the family of meter approach is used, the sizes which are approved but not tested will also be added to the table. The sizes that are tested are in bold.

Relevant external/internal photographs taken during the examination and tests:

D.5 Adjustments and modifications

Adjustments, modifications, and repairs made to the specimens during the testing:

D.6 Additional information concerning the type

Additional observations and/or information (connection equipment, interfaces, etc.):

D.7 Results of previous tests that were taken into account

D.8 Information concerning the test equipment used for the tests (including details of simulations and the way uncertainties are taken into account)

E Check list for type evaluation and performance test

E.1 Check list for type evaluation

Note: Item numbering refers to OIML R 117-1:2019
"Dynamic measuring systems for liquid other than water"
Part 1: Metrological and technical requirements

For each test, the check list has been completed according to this example:

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2	**General requirements**				
2.7	**Provisions for converted indications**				
	There are two approaches to verify a conversion device:				
	The **first approach** verifies the conversion device with the associated measuring devices, the calculator, and the indicating device (together). This approach applies to mechanical conversion devices and may apply to electronic conversion devices.				
	The **second approach** allows for separate verification of the individual components of a conversion device. This approach allows the **separate** verification of associated measuring sensors, associated measuring devices (made up of an associated measuring sensor plus an associated measuring transducer), and the conversion function.				
	In both of these approaches, for the purpose of the verification, the indication of the quantity at metering conditions is assumed to be without any				
	The approach to be applied shall be specified by the applicant for type evaluation.				
2.7.1	**First approach:** Verification of a conversion device with the associated measuring devices, the calculator, and the indicating device (together)				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.7.1.1	It is not mandatory that a conversion device indicates the quantities measured by the associated measuring devices (such as temperature, pressure, and density).				
2.7.1.2	When a conversion device is verified using the first approach, the MPE allowable on the converted indication due to the conversion device (positive or negative), is the greater of: • the value specified in line C of Table 3, or • one half of the minimum specified quantity deviation, E_{min}.				
2.7.1.3	The value of a significant fault on converted indications (from 2.5.4) is the greater of: • one fifth of the absolute value of the MPE for the measured quantity, or • the minimum specified quantity deviation, E_{min}.				
2.7.2	**Second approach:** Verification of the individual components of the conversion device				
2.7.2.1	Verification of a conversion device (as part of the calculator with its indicating device), using simulated inputs				
2.7.2.1.1	Using digital input signals: when a calculator with its indicating device is verified separately, using known "digital input signals" to simulate inputs from associated measuring devices, the MPE and the significant fault for the indication of the temperature or pressure or density are restricted to rounding errors.				
2.7.2.1.2	Using analogue input signals: when a calculator with its indicating device is verified separately, using known "analogue input signals" to simulate inputs from associated measuring devices, the MPE and the significant fault for the indication of the temperature or pressure or density are those specified in Table 5.1.				
2.7.2.1.3	Verification of indications of converted quantities using simulated inputs The indication of the converted quantity shall agree with the "true value", within one tenth of the MPE stated in line A of Table 3 for the applicable accuracy class. The "true value" is calculated based on the quantities indicated for the simulated inputs for the following: • the unconverted quantity, • the temperature or pressure or density as determined by associated measuring devices, • as well as: • any characteristic quantities entered into the calculator (typically density), and • appropriate values from applicable International Recommendations and Standards.				
2.7.2.2	Verification of associated measuring devices or associated measuring sensors				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.7.2.2.1	The MPE and significant fault for indications of temperature or pressure or density measured by an associated measuring device (which is made up of an associated measuring sensor and an associated measuring transducer) when it is subjected to a known temperature or pressure or density, are those specified in Table 5.1. If the indication is provided by the conversion device (as part of the calculator with its indicating device), this MPE includes the MPE of the corresponding calculator as specified in 2.7.2.1.1.				
2.7.2.2.2	When an associated measuring device, which provides a digital signal output is verified by subjecting it to a known temperature or pressure or density, the MPE and significant fault are those specified in Table 5.2. The rounding errors of the calculator or other indicting device are assumed to be negligible.				
2.7.2.2.3	When an associated measuring sensor (which provides an analogue output) is verified separately by subjecting it to a known temperature or pressure or density, the MPE and significant fault are those specified in Table 5.3.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.8	**Maximum permissible errors and significant faults on calculators**				
	Maximum permissible errors and significant faults on quantities of liquid indications applicable to calculators, positive or negative, when they are tested separately, are equal to one-tenth of the maximum permissible error defined in line A of Table 3.				
	However, the magnitude of the maximum permissible error, respectively significant fault, shall not be less than one half of the scale interval of the measuring system in which the calculator is intended to be included.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.9	**Indications**				
2.9.1	The volume shall be indicated in cubic centimetres or millilitres, in cubic decimetres or litres, or in cubic metres. The mass shall be indicated in grams, kilograms, or metric tons (tonnes). The name of the unit or its symbol shall appear in the immediate vicinity of the indication. For mass, according to the case, the name of the unit or its symbol shall be accompanied by the term “mass” (actual mass) or “conventional mass” (comparison to weights). Where units of quantity are delivered by associated measuring instruments: temperature shall be indicated in degrees Celsius or in Kelvin, density shall be indicated in kilograms per cubic meter, and pressure shall be indicated in bars or Pascals (Pa, kPa or MPa).				
	If units of measurement outside the SI are required by a country’s national regulations, these units of measurement shall be considered acceptable for indications in that country. In international trade, the officially agreed equivalents between these units of measurement and those of the SI shall be applied.				
2.9.2	Measuring systems shall be provided with an indicating device giving the quantity of liquid measured at metering conditions. When a measuring system is fitted with a conversion device, it shall be possible to indicate the quantity at metering conditions and the converted quantity. In the case of fuel dispensers, only the quantity used in the transaction shall be indicated in normal operation. The use of the same display for the indications of quantities at metering conditions and converted indications is permitted provided that the nature of the displayed quantity is clear, unambiguous, and not misleading (see also Annex B). Provisions applicable to devices which indicate the quantity at metering conditions apply to devices which indicate the converted quantities by analogy.				
2.9.3	A measuring system may have several devices indicating the same quantity. Each shall meet the requirements of this Recommendation. Scale intervals of the various indications may be different.				
2.9.4	For any measured quantity relating to the same measurement, the indications provided by various devices shall not deviate one from another by more than one scale interval or the greatest of the two scale intervals if they differ, except otherwise provided in clause 3 (see 3.9.1.3).				
	For totalisers, this requirement applies to the difference in indication before and after the measurement.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.9.5	Subject to specific provisions for certain types of measuring systems, use of the same indicating device for the indications of several measuring systems (which then have a common indicating device) is permitted provided that one of the following conditions is met: • it is impossible to use any two of these measuring systems simultaneously, • the indications relating to a given measuring system are accompanied by a clear identification of that measuring system, and the user may obtain the indication corresponding to any of the measuring systems concerned, using a simple command.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.10	**Elimination of air or gases**				
2.10.1	General requirements				
	Measuring systems shall incorporate a gas elimination device for the proper elimination of any air or undissolved gases which may be contained in the liquid before it enters the measurement device (measuring systems for bunkering are an exception to this requirement, see 5.10.). In the case that neither air intake nor gas release will occur in the liquid upstream of the measurement device, a gas elimination device is not required.				
2.10.1	The gas elimination device shall be suitable for the supply conditions and be arranged in such a way that the effect due to the influence of the air or gases on the measuring result does not exceed: • 1 % of the quantity measured for milk, beer, other foaming potable liquids (such as beer and milk), and for liquids of a viscosity exceeding 1 mPa·s (at 20 °C), or • 0.5 % of the quantity measured for all other liquids. However, it is not necessary for this effect to be less than 1 % of the minimum measured quantity. The values specified in this section apply to the difference between: • the meter errors with air intake or with gas, and • the meter errors without air intake or gas. Gas elimination devices shall be installed in accordance with the manufacturer's instructions. Gas elimination devices that contain electronic components for gas detection shall undergo influence and disturbance tests.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.10.2	Pumped flow				
	A gas separator shall be provided when, without prejudice to the requirements in 2.10.4, the pressure at the pump inlet may, even momentarily, fall below either the atmospheric pressure or the saturated vapour pressure of the liquid, which can result in mixed air or gas. If gaseous formations such as pockets liable to have a specific effect greater than 1 % of the minimum measured quantity can occur as well, this gas separator shall also be approved as a gas extractor. Depending on the supply conditions, a special gas extractor can be used for that purpose if the risk of mixed air or gas is smaller than 5 % of the volume delivered at the maximum flowrate. When applying this provision concerning gaseous formations, it is important to consider that: • gaseous formations in the form of air pockets can occur because of thermal contraction during shutdown periods, and • entrained gas and/or air pockets are likely to be introduced into the pipework when the supply tank becomes empty. A gas extractor is required when the pressure at the pump inlet is always greater than the atmospheric pressure and the saturated vapour pressure of the liquid, but gaseous formations liable to have a specific effect greater than 1 % of the minimum measured quantity can occur. When applying this provision, it is necessary to consider the situations concerning gaseous formations that were mentioned above. No gas elimination device is required if, throughout the delivery, the pressure at the pump inlet is always greater than the atmospheric pressure and the saturated vapour pressure of the liquid, and if any gaseous formation liable to have a specific effect greater than 1 % of the minimum measured quantity cannot form or enter the inlet pipework of the meter, whatever the conditions of use.				
	If the gas elimination device is installed below the level of the meter, a non-return valve shall be incorporated to prevent the pipework between the two components from emptying. The loss of pressure caused by the flow of liquid between the gas elimination device and the meter shall be as small as possible. If the pipework upstream of the meter incorporates several high points, it may be necessary to provide one or more automatic or manual evacuation devices.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.10.3	Non-pumped flow				
	When a meter is supplied by gravity without the use of a pump, and if the pressure of the liquid in all parts of the pipework upstream of the meter and in the meter itself is greater than the saturated vapour pressure of the liquid and the atmospheric pressure at metering conditions, a gas elimination device is not necessary. If the pressure of the liquid is likely to be lower than the atmospheric pressure while remaining greater than the saturated vapour pressure, an appropriate automatic device shall prevent entry of gas/air into the meter. In other cases, an appropriate gas elimination device shall be provided. If a meter is supplied under gas pressure, the measuring system shall be so constructed that release of gas dissolved in the liquid is avoided. An appropriate device shall prevent entry of gas into the meter. In all circumstances, the pressure of the liquid between the meter and the transfer point shall be greater than the saturated vapour pressure of the liquid.				
2.10.4	High viscosity liquids				
2.10.4.1	High viscosity liquids – general requirements (for measuring systems for bunkering see 2.10.4.2)				
	Since the effectiveness of gas elimination devices decreases as the viscosity of the liquids increases, these devices are not required for measuring liquids with a dynamic viscosity of more than 20 mPa·s at 20 °C. In this case, it is necessary to make provisions to prevent entry of gas/air. The pump shall be so arranged that the inlet pressure is always greater than the atmospheric pressure. If it is not always possible to meet this condition, a device shall be provided to stop the flow of liquid automatically as soon as the inlet pressure falls below the atmospheric pressure. A pressure gauge shall be used to monitor this pressure. These provisions are not necessary if devices are provided which ensure that no gas/air can enter through the joints in the sections of the pipework under reduced pressure and if the measuring system is so arranged that no air or dissolved gases will be released.				
2.10.4.2	High viscosity liquids – special requirements applicable to measuring systems for bunkering (see also 5.10)				
	Subclause 2.10.1 is not applicable to measuring systems for bunkering. Since the effectiveness of gas elimination devices decreases as the viscosity of the liquids increases, these devices are not required for measuring liquids with a dynamic viscosity of more than 20 mPa·s at 20 °C. *Note:* On measuring systems for bunkering (especially for the dynamic measurement of bunker fuel), the use of a gas elimination device is not required if the presence of gas/air can be detected and corrected by the system to ensure that the required mpe is met.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
	Measuring systems for bunkering, even when measuring very high viscosity liquids and regardless of the presence of gas/air, shall continue to meet the requirements of 2.4 to 2.6 with respect to the maximum permissible errors and the accuracy class of the measuring system.				
2.10.5	Gas removal pipe				
	The gas removal pipe of a gas elimination device shall not normally include a manually-controlled valve, unless it is required for safety reasons. If such a manually-controlled valve is present, it shall be possible to ensure that the valve remains in the open position during operation by means of a sealing device or by means of a system interlock that would prevent further measurement upon valve closure.				
2.10.6	Anti-swirl device				
	If the supply tank of a measuring system is normally to be completely emptied, the outlet of the tank shall be fitted with an anti-swirl device, unless the measuring system incorporates a gas separator.				
2.10.7	General provisions for gas elimination devices				
2.10.7.1	The gas separated in a gas elimination device shall be evacuated automatically unless a device is provided which automatically either stops or sufficiently reduces the flow of liquid when there is a risk of air or gases entering the meter. In the case of shutdown, no measurement shall be possible unless the air or gases are automatically or manually eliminated.				
2.10.7.2	The operational limits of a gas elimination device are as follows: • the maximum flowrate(s) for one or more specified liquids, • the maximum pressure (with no flow running) and minimum pressure (with liquid and without gas/air intake while the pump is running at maximum flowrate) compatible with the correct operation of the gas elimination device, and • the minimum measured quantity for which it is designed.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.10.8	Special provisions applicable to gas separators				
	Within the error limits specified in 2.10.1, a gas separator shall ensure the elimination of air or gases mixed with the liquid. A gas separator designed for a maximum flowrate lower than or equal to 20 m^3/h shall ensure the elimination of any proportion by volume of air or gases relative to the measured liquid. A gas separator designed for a maximum flowrate higher than 20 m^3/h shall ensure the elimination of 30 % air or gases relative to the measured liquid (the volumes of air or gases are measured at atmospheric pressure in determining their percentages). The percentage is considered only when the meter is running at flow rates higher than the minimum flow rate (mean value during one minute). *Note:* Gas separators for flow rates up to 20 m^3/h are therefore of relatively larger size than those for higher flow rates. Furthermore, when provided, the automatic gas elimination device must continue to operate at the maximum pressure fixed for the gas separator.				
2.10.9	Special provisions applicable to gas extractors				
	A gas extractor shall, at the maximum flowrate of the measuring system, ensure the elimination of an air or gas pocket of a volume (measured at atmospheric pressure) at least equal to the minimum measured quantity with no resulting additional effect greater than 1 % of the minimum measured quantity, which is an absolute error. A special gas extractor (capable of eliminating mixed gas and gas pockets), shall also be capable, at the system's maximum flowrate, of continuously separating a volume of air or gas mixed with the liquid equal to 5 % of the volume of liquid delivered (at the maximum flowrate) without the resulting additional effect exceeding the limits fixed in 2.10.1.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.11	**Gas indicator**				
	For certain types of measuring systems, a gas indicator may be required. The gas indicator shall be designed so as to provide a satisfactory indication of the presence of air or gases in the liquid. The gas indicator shall be downstream of the meter. In empty hose measuring systems, the gas indicator may be in the form of a weir-type sight glass and may also be used as the transfer point. The gas indicator may be fitted with a bleed screw or with any other venting device when it forms a high point of the pipework. No pipe shall be connected to the venting device. Flow indicating devices (e.g. spinners) may be incorporated in gas indicators provided that such devices do not prevent observation of any gaseous formations which could be present in the liquid.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.12	**Transfer point**				
2.12.1	Measuring systems shall incorporate a minimum of one transfer point. This transfer point is located downstream of the meter in delivery systems and upstream of the meter in receiving systems.				
2.12.2	Measuring systems may be of two types: “empty hose” systems and “full hose” systems. The term “hose” includes rigid pipework.				
2.12.2.1	In the case of an empty hose system the transfer point may be in the form of either a weir-type sight glass, or a closing device combined, in each case, with a system which ensures the emptying of the delivery hose after each measuring operation.				
2.12.2.2	When, in the case of full hose systems, the delivery line has a free end, the closing device must be installed as close as possible to this end.				
2.12.2.3	In the case of receiving equipment, the same provisions apply by analogy to the reception pipework upstream of the meter.				
2.12.2.4	Measuring systems for bunkering (5.10) and measuring systems for LNG (5.11) may in different instances actually have piping/hose that is “partially filled.” The manufacturer shall provide documentation that explains how this is corrected in the measurement.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.13	**Complete filling of the measuring system**				
2.13.1	The meter and the pipework between the meter and the transfer point shall be kept full of liquid during measurement and during shutdown periods. When this condition is not met, especially in the case of fixed installations, the complete filling of the measuring system up to the transfer point shall be carried out manually or automatically and shall be monitored during measurement and shutdowns. To ensure complete elimination of air and gases from the measuring system, a venting device (with means for visual or automatic detection of the complete filling) shall be placed in appropriate positions.				
2.13.2	The effect of contraction due to temperature change on the liquid in the pipework between the meter and the transfer point shall not be greater than 1 % of the minimum measured quantity due to variations in temperature, equal to: • 10 °C for exposed pipes, and • 2 °C for insulated or underground pipes. To calculate this additional effect the coefficient of thermal expansion for the liquid shall be rounded to 1×10^{-3} per degree Celsius.				
2.13.3	Following the provisions in 2.10.3, a pressure maintaining device shall, if necessary, be installed downstream of the meter to ensure that the pressure in the gas elimination device and in the meter is always greater than both the atmospheric pressure and the saturated vapour pressure of the liquid.				
2.13.4	When reversal of the flow could result in errors greater than the minimum specified quantity deviation, a measuring system (in which the liquid could flow in the opposite direction when the pump is stopped) shall be provided with a non-return valve. If necessary, the system shall also be fitted with a pressure limiting device. The measuring system shall either prevent reverse flow or accurately account for reverse flow by appropriate means.				
2.13.5	In empty hose measuring systems, the pipework downstream of the meter and, if necessary, the pipework upstream of the meter shall have a high point so that all parts of the measuring system except the hose, always remain full.				
2.13.6	In full hose measuring systems which are used for measuring liquids other than liquefied gases, the free end of the hose shall incorporate a device which prevents the draining of the hose during shutdown periods. When a closing device is installed downstream of this device, the volume of the space between them shall be as small as possible and, in all cases, be less than the minimum specified quantity deviation.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.13.7	If the hose comprises several components, these shall be assembled either by means of a special connector which keeps the hose full, or by a connection system which is either sealed or requires the use of a special tool to be disconnected.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.14	**Emptying of the delivery hose**				
	In empty hose measuring systems, emptying of the delivery hose referred to in 2.12.2.1 is ensured by a venting valve. In some cases, this valve may be replaced by an active means, such as an auxiliary pump or compressed gas injector. This active device shall operate automatically. However, when it is not possible, for duly established technical or safety reasons, to deliver (or to receive) the measured quantity contained in hoses of an empty hose measuring system (for example when measuring liquefied carbon dioxide), this quantity shall be smaller than or equal to half the minimum specified quantity deviation, E_{min}.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.15	**Variations in the internal volume of full hoses**				
	For full hoses in a measuring system provided with a hose reel, the increase in internal volume due to the change from the coiled hose position when not under pressure to the uncoiled hose position when under pressure without any flow of liquid, shall not exceed twice the minimum specified quantity deviation. If the measuring system is not provided with a hose reel, the increase in internal volume shall not exceed the minimum specified quantity deviation.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.16	**Branches and bypasses**				
2.16.1	In measuring systems intended to deliver liquids, no means shall be provided by which any measured liquid can be diverted downstream of the meter. However, two or more delivery outlets may be permanently installed and operated simultaneously or alternately provided so that any diversion of flow to other than the intended receiving receptacle(s) cannot be readily accomplished or is readily apparent. Such means include, for example, physical barriers, visible valves or indications that make it clear which outlets are in operation, and explanatory signs, if necessary. For measuring systems intended to receive liquids, such provisions apply by analogy. A manually controlled outlet may be available for purging or draining the measuring system. Effective means shall be provided to prevent the passage of liquid through any such outlet during normal operation of the measuring system. For purposes of safety, a pressure relief valve may be installed downstream of the meter. Subject to relevant safety requirements, which shall take precedence, the activation pressure of the pressure relief valve shall be set at or above the maximum operating pressure of the measuring system.				
2.16.2	In measuring systems which may operate either with an empty hose or with a full hose and which are equipped with flexible pipes, a non-return valve shall be incorporated in the rigid pipework leading to the full hose immediately downstream from the selector valve. In addition, the selector valve shall not, in any position, permit connection of the discharge hose, operating as an empty hose to the pipework leading to the full hose.				
2.16.3	It shall not be possible to bypass the meter (see also note in Annex B). *Note:* In certain cases where a bypass does exist (such as for cooling the system), effective means shall be provided to prevent the passage of liquid through any such bypass during normal operation of the measuring system.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.17	**Control and closing mechanisms**				
2.17.1	If there is a risk that the supply conditions could cause the meter to operate above its approved flowrate range (overloading the meter), a flow limiting device shall be provided. This device shall be installed downstream of the meter (solution "A"). It shall be possible to seal it. An alternative solution "B" by software is also acceptable (e.g. software to stop the flow if the flowrate exceeds meter limits). This technical choice must be described by the manufacturer.				
2.17.2	The various positions of the controls of multi-way valves shall be easily visible and located by notches, stops or other fixing devices. Deviations from this requirement are permissible when the adjacent positions of the controls form an angle of 90º or more.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.18	**Various provisions**				
2.18.1	If provided, filters shall not disturb the accuracy or operation of the measuring system or its components				
2.18.2	In the case of measuring liquid petroleum products, means for vapour recovery shall not influence the accuracy of measurements such that the maximum permissible error is exceeded.				
2.18.3	It may be possible in meters for liquid food (for example, milk) to dismount and disassemble the measuring device to the extent necessary for cleaning. The measuring device must be designed such that improper assembly of the components of the measuring device is not possible. Instead, the meters may be provided with assembly instructions or marks that will ensure correct measurements.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.19	**Markings**				
2.19.1	Each measuring system, component or sub-system for which type approval has been granted shall bear, placed together legibly and indelibly either on the dial of the indicating device or on a special data plate, the following information: • type approval number, • manufacturer's identification mark, trademark or name, • designation selected by the manufacturer, if appropriate, • year of manufacture, • serial number, • characteristics as defined in 2.3.1 (measuring system), 3.1.1.1 (meter), or 2.10.7.2 (gas elimination device), • accuracy class, and • verification marks. This information shall be put on one or several data plates on a part not likely to be removed in normal conditions of use. At least the information related to the minimum measured quantity and the verification marks shall be visible in normal conditions of use. The information marked on the measuring system shall be the information based on the type approval, including the temperature range, and should not be confused with descriptions affixed for safety reasons, in particular the pressure limits.				
2.19.2	Each component or sub-system for which type approval has been granted shall bear the following information: • serial number, and • type approval number. This information shall be part of the component or sub-system itself or shall be put on a data plate not likely to be removed from the component or sub-system under normal conditions of use.				
2.19.3	If several components operate in a single measurement system, the markings required for each part of the system may be combined on a single plate. If several separate measuring systems operate in a common housing, only one data plate is required. When a measuring system can be transported without being dismantled, the markings required for each component may also be combined on a single plate.				
2.19.4	When volume at base conditions is indicated, the measurement result shall be accompanied with information with respect to the base conditions, for example: "at 15 °C" or "at 15 °C and 1013.25 hPa".				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.20	**Sealing devices and stamping plate**				
2.20.1	General				
	Sealing may be carried out with metal, plastic or other suitable means as long as it is sufficiently durable and provides evidence of tampering. The seals shall, in all cases, be easily accessible. Sealing shall be provided on all parts of the measuring system which cannot be materially protected in any other way against operations liable to affect the measurement accuracy. Without prejudice to the provisions in 3.1.4 and 3.7.5, it shall be prohibited to change parameters which participate in the determination of the results of measurement (parameters for correction and conversion in particular) by means of sealing devices. A plate, referred to as the stamping plate, intended for receiving the verification marks, shall be sealed or permanently attached on a support of the measuring system. It may be combined with the data plate of the measuring system referred to in 2.19. In the case of a measuring system used for potable liquids, sealing shall be applied such that the equipment may be dismantled for cleaning purposes.				
2.20.2	Electronic sealing devices				
2.20.2.1	When access to parameters that participate in the determination of the measurement results is not protected by mechanical sealing devices, the protection shall fulfil the provisions of 2.20.2.1.1 through 2.20.2.1.5.				
2.20.2.1.1	Either: • access shall only be allowed to authorised persons, e.g. by using a “password” and, after changing parameters, the measuring system may be put into use “in sealed condition” again without any restriction; or • access is allowed without restrictions (similar with the classical sealing) but, after changing parameters, the measuring system shall only be put into use “in sealed condition” again by authorised persons, e.g. by using a “password”.				
2.20.2.1.2	The “password” must be changeable.				
2.20.2.1.3	In the case of direct selling to the public, the use of only a “password” is not allowed and the measuring system shall be provided with a mechanical sealing device, e.g. access cover protected switch or key switch.				
2.20.2.1.4	When it is in the configuration mode (a mode in which parameters can be changed), the device shall either not operate, or it shall clearly indicate that it is in the configuration mode. This status shall remain until the measuring system has been put into use “in sealed condition” in accordance with 2.20.2.1.1.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.20.2.1.5	For identification, data concerning the latest intervention shall be automatically recorded into an event logger. The record shall include at least: • an event counter, • the identifier of the parameter, • the date the parameter was changed (this is allowed to be entered manually), and • the value of the new parameter. The traceability of the last intervention shall be assured for at least two years, if it is not over-written on the occasion of a further intervention. Given the current state of technology, it is strongly encouraged that the event logger store more than just one intervention. If more than one intervention is stored, and if deletion of a previous intervention must occur to permit a new record, the oldest record shall be deleted.				
2.20.2.2	For measuring systems with parts which may be disconnected one from another by the user and which are interchangeable, the following provisions shall be fulfilled: • it shall not be possible to access parameters that participate in the determination of results of measurements through disconnected points unless the provisions in 2.20.2.1 are fulfilled; • interposing any device which may influence the accuracy shall be prevented by means of electronic and data processing securities or, if not possible, by mechanical means.				
2.20.2.3	For measuring systems with parts which may be disconnected one from another by the user and which are not interchangeable, the provisions in 2.20.2.2 apply. Moreover, these measuring systems shall be provided with devices which do not allow them to operate if the various parts are not associated according to the manufacturer's configuration. *Note:* Disconnections which are not allowed to the user may be prevented, for example by means of a device that prevents any measurement after disconnecting and reconnecting.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
2.21	**Unattended delivery**				
	Measuring systems for unattended delivery (such as those for fuel delivery from road tankers into filling stations or for direct sale to the public) may be designed in such a way that the transaction is not settled when the supplier leaves the delivery location. This arrangement is only applicable when there is an existing agreement between the parties. National or regional regulations may require that measuring systems intended for unattended delivery are equipped with devices that support such transactions, including but not limited to: • an automatic device to identify the unloading location; • a printing device for automatically issuing a receipt to the customer; and • a memory device in which the following data are recorded: o identification of the measuring system; o measurement data; o time and date of delivery; and o the unloading location.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3	**Requirements for meters and ancillary devices of a measuring system**				
3.1	**Meter**				
3.1.1	Rated operating conditions				
3.1.1.1	The rated operating conditions of a meter are determined at least by the following characteristics: • minimum measured quantity, MMQ; • flowrate range limited by the minimum flowrate, Q_{min}, and the maximum flowrate, Q_{max}, (or by the Reynolds number range, if applicable); • name or type of the liquid or its relevant characteristics, for example the viscosity range limited by the minimum viscosity of the liquid and the maximum viscosity of the liquid and/or the density range limited by the minimum density of the liquid ρ_{min} and the maximum density of the liquid ρ_{max}; • the pressure range limited by the minimum pressure of the liquid, P_{min} and the maximum pressure of the liquid, P_{max}; • the temperature range limited by the minimum temperature of the liquid, T_{min} and the maximum temperature of the liquid, T_{max}; • climatic and mechanical environmental class (see also R 117-2); and • nominal value of the AC voltage supply and/or limits of DC voltage supply.				
3.1.1.2	The value of the minimum measured quantity shall be in the form 1×10^n, 2×10^n or 5×10^n authorised units of volume or mass, n being a positive or negative whole number, or zero.				
3.1.2	Metrological requirements In this section, the requirements for a meter also apply to measuring devices (see 6.1.5).				
3.1.2.1	The maximum permissible errors for a meter, under rated operating conditions, are equal to those specified in line B of Table 3.				
3.1.2.2	For any quantity equal to or greater than 5 times the minimum measured quantity, the repeatability error of the meter shall not be higher than two-fifths of the value specified in line A of Table 3.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.1.2.3	Under rated operating conditions for a given liquid, meters shall present a magnitude of the difference between the initial intrinsic error and the error after the endurance test equal to or less than the value specified in line B in Table 3. *Note:* The requirements concerning the endurance testing are found in 6.1.5 and in R 117-2. It should also be noted that the endurance test is only required for meters with an operating principle that involves movement (e.g. rotating or reciprocating movement) of mechanical parts that are directly exposed to the liquid that is being measured under normal operation (this means that Coriolis, ultrasonic, and electromagnetic meters are not required to undergo an endurance test).				
3.1.2.4	The minimum specified quantity deviation, E_{min}, for the meter is given by the second formula in 2.5.3.				
3.1.3	Adjustment device (see also Annex B)				
	A meter may have a sealable means of adjustment which permits modification of the ratio between the indicated quantity and the actual quantity to be within: • 0.05 % for meters intended for measuring systems of accuracy class 0.3; and • 0.1 % for meters intended for measuring systems of all other accuracy classes. An adjustment device shall only be used to reduce the errors to as close to zero as possible. Adjustment by means of a bypass of the meter is prohibited.				
3.1.4	Correction device				
3.1.4.1	Meters may be fitted with correction devices; such devices are always considered as an integral part of the meter. All requirements that apply to the meter, in particular the maximum permissible errors specified in 3.1.2.1, are therefore applicable to the corrected quantity (at metering conditions). Submitted type evaluation paperwork must state if the correction device is a mandatory part of the meter.				
3.1.4.2	In normal operation, the non-corrected quantity shall not be displayed. The non-corrected quantity shall, however, be available for test purposes.				
3.1.4.3	The correction device shall only be used to reduce the errors to as close to zero as possible.				
3.1.4.4	All the parameters which are not measured and which are necessary for correcting shall be contained in the calculator or the meter at the beginning of the measurement operation. The type approval certificate may prescribe the possibility of checking parameters that are necessary for correctness at the time of verification of the correction device.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.1.4.5	For transactions that involve direct selling to the public, applying a correction is allowed only by selecting the name or the type of the liquid at the beginning of the measurement operation. For transactions that do not involve direct selling to the public, it is allowed to select or enter the name or type of the liquid or any other data, when this data participates in the correction of the quantity. This other allowed data is that which characterises the name or type of the measured liquid without any ambiguity.				
3.1.4.5	All cases are subject to the following conditions: • a printing device subject to legal metrological control is mandatory; • this data and a note explaining that this data has been entered manually shall be printed at the same time as the measuring results; and • the name or type of the liquid shall be known and printed without any ambiguity. For transactions that do not involve direct selling to the public (especially transactions governed by specific contracts), a printing device is not required when the following conditions exist: • when the correction is stored by a memory device accessible to all parties involved; or • when both parties have the possibility to be present to conclude the transaction, by any appropriate means, and the two parties are informed of the conditions of the correction. The type approval certificate may indicate how to gain access to the memorised data.				
3.1.4.6	The correction device shall not allow the correction of a pre-estimated drift (such as in relation to time or total quantity).				
3.1.4.7	The associated measuring devices, if any, shall comply with the applicable International Recommendations or Standards. Their accuracy shall be good enough to permit that the requirements on the meter be met, as specified in 3.1.2.1.				
3.1.4.8	Associated measuring devices shall be fitted with checking facilities, as specified in 4.3.6.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.1.5	Measuring systems equipped with turbine meters				
3.1.5.1	The pressure downstream of the meter shall be such that cavitation is avoided.				
3.1.5.2	If the accuracy of the meter is affected by disturbances in the upstream or downstream pipeline, the meter shall be provided with an appropriate length of straight pipe and/or other flow straightening devices (immediately before and/or after the meter), as specified by the manufacturer, so that the indications of the installed measuring system including the meter meet the requirements of 2.4 to 2.6 with respect to the maximum permissible errors and according to the accuracy class of the measuring system.				
3.1.5.3	The characteristics of the flow straightening devices, and/or straight pipe lengths, if required, shall be specified in the type approval certificate.				
3.1.5.4	If the system is provided with a programmable or adjustable “low-flow cut-off” feature, a “zero-offset adjustment” feature, or any other adjustable feature relied upon to comply with a test requirement throughout the rated operating conditions, the feature(s) shall be sealable. Clear instructions for the proper setting of the feature(s) shall be provided by the manufacturer. The limitations and setting of the feature(s) shall be detailed in the type approval certificate. “Low-flow cut-off” features shall not be set at flow rates higher than 20 % of the application-defined minimum flow rate. The error caused by the zero-offset of the meter, related to the minimum flowrate, shall not exceed the value specified in line C of Table 3.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.1.6	Measuring systems equipped with electromagnetic meters				
3.1.6.1	The requirements in 3.1.5.1 to 3.1.5.4 apply.				
3.1.6.2	The rated operating conditions with respect to the conductivity of the liquid and the cable characteristics shall be specified by the manufacturer and shall be documented in the type approval certificate.				
3.1.7	Measuring systems equipped with ultrasonic meters				
3.1.7.1	The requirements in 3.1.5.1 to 3.1.5.4 apply.				
3.1.7.2	The minimum Reynolds number of the liquid to be measured shall be specified by the manufacturer.				
3.1.8	Measuring systems equipped with vortex meters				
3.1.8.1	The requirements in 3.1.5.1 to 3.1.5.4 and the requirement in 3.1.7.2 apply.				
3.1.9	Measuring systems equipped with mass flow meters				
3.1.9.1	The requirements in 3.1.5.1 to 3.1.5.4 apply.				
3.1.9.2	The mass flowmeter shall be installed in the measuring system in accordance with the system manufacturer’s recommendations and with any conditions or limitations set out in the type approval certificate.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.1.10	Measuring systems equipped with drum meters for alcohol				
3.1.10.1	The volume of the individual measuring chambers of the drum meter shall be 1×10^n, 2×10^n, or 5×10^n litres, where n is a positive or negative whole number, or zero. The chambers of the drum shall be of equal size. The drum axis shall be horizontal. In order to be able to ensure that it is correctly installed, the meter shall be equipped with a level indicating device if, when the drum axis is inclined up to 3º to the horizontal, the indication of the meter varies by more than half the maximum permissible error on verification.				
3.1.10.2	The volumes of the individual measuring chambers of a drum meter may be adjusted by means of displacement bodies. The associated conversion device which measures the density and the temperature of the measured liquid shall be adjustable.				
3.1.10.3	The conversion device to determine the volume of ethanol belonging to a drum meter shall function in accordance with OIML R 22:1975 *International alcoholometric tables*. The reference temperature for the alcohol measurement is 20 ºC. The conversion may be applied mechanically or electronically. These requirements also apply to other measuring principles (see also T.c.4 and 2.7).				
3.1.10.4	The sampler of a drum meter shall automatically separate and collect a representative sample of the liquid to be measured in order to permit the separate determination of the average alcohol content of liquid which has passed through the measuring device, for example, by separating an equal volume each time the measuring chambers are filled. If the test volume withdrawn is subject to special or separate treatment, the measuring device shall be so adjusted that the volume withdrawn is not included in the indication of the drum meter.				
3.1.10.5	The elimination of air intake or gas release will be performed by the drum meter itself, so no additional gas elimination device is required.				
3.1.10.6	The following inadmissible operating conditions and failures of a drum meter shall either be prevented by special devices incorporated in the meter, or their occurrences shall be indicated by warning devices: • excessive flowrate; • obstruction of free flow; • overfilling of the drum due to obstruction of the rotating elements; • temperature outside the permissible range; and • inadmissible heating of the separated sample.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.2	**Indicating device**				
3.2.1	General provisions				
3.2.1.1	Reading of the indications shall be precise, easy and non-ambiguous whatever position the indicating device comes to rest; if the device comprises several elements, it shall be arranged in such a way that the reading of the measured quantity can be made by simple juxtaposition of the indications of the different elements. The decimal sign shall appear distinctly.				
3.2.1.2	The scale interval of indication shall be in the form 1×10^n, 2×10^n or 5×10^n authorised units of quantity, where n is a positive or negative whole number, or zero.				
3.2.1.3	Non-significant minimum increments of registration should be avoided. This does not apply to price indications.				
3.2.1.4	The scale interval shall satisfy the following requirements: • for analogue indicating devices, the quantity corresponding to 2 mm on the scale or to one-fifth of the scale interval (of the first element for mechanical indicating devices), whichever is greater, shall be less than or equal to the minimum specified quantity deviation; and • for digital indicating devices, the quantity corresponding to two minimum increments of registration shall be less than or equal to the minimum specified quantity deviation.				
3.2.2	Mechanical indicating device				
3.2.2.1	When the graduation of an element is entirely visible, the value of one revolution of that element shall be in the form 10^n authorised units of quantity, where n is a whole number. This rule however, does not apply to the element corresponding to the maximum range of the indicating device.				
3.2.2.2	On an indicating device having several elements, the value of each revolution of an element whose graduation is entirely visible must correspond to the scale interval of the following element.				
3.2.2.3	An element of the indicating device may have continuous or discontinuous movement, but when elements other than the first have only part of their scales visible through the windows, these elements shall have discontinuous movement.				
3.2.2.4	The advance by one figure of any element having discontinuous movement shall occur and be completed when the preceding element passes from 9 to 0.				
3.2.2.5	When the first element has only a part of its scale visible through a window and has a continuous movement, the dimension of that window shall be at least equal to 1.5 times the distance between two consecutive graduated scale marks.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.2.2.6	All scale marks shall have the same width, constant along the line and not exceeding one quarter of the scale spacing. The apparent scale spacing shall be equal to or greater than 2 mm. The apparent height of the figures shall be equal to or greater than 4 mm, unless otherwise specified in the requirements for particular measuring systems.				
3.2.3	Electronic indicating device				
	The continuous display of quantity during the period of measurement is only mandatory in the case of direct selling to the public. However, if interrupting the display of quantity interrupts the action of some checking facilities that are mandatory or necessary to ensure correct measurement, the quantity passing through the meter during each interruption shall be smaller than or equal to the minimum measured quantity. If the device is capable of hiding a small number of "minimum increments of registration" at the beginning of a measurement, it must be possible during type evaluation and initial verification to easily switch off this feature.				
3.2.4	Zero-setting device for quantity indicating device				
3.2.4.1	A quantity indicating device may be provided with an ancillary device for setting the indication to zero either by manual operation or by means of an automatic system.				
3.2.4.2	Once the zeroing operation has begun it shall be impossible for the quantity indication to show a result different from that of the measurement, which has just been made, until the zeroing operation has completed. Indicating devices on fuel dispensers and electronic measuring systems shall not be capable of being reset to zero during measurement. On other measuring systems, either this provision shall be fulfilled or a clearly visible notice shall be provided on the indicating device stating that this operation is prohibited.				
3.2.4.3	On analogue indicating devices, the residual indication after return to zero shall not be more than half the minimum specified quantity deviation.				
3.2.4.4	On digital indicating devices, the quantity indication after return to zero shall be zero without any ambiguity.				
3.2.4.5	In the case of direct selling to the public, and except for fuel dispensers, the following provisions apply: • the next delivery shall be inhibited until the indicating device has been reset to zero; or • when the zeroing operation is not automatic, the measuring system shall bear legible and indelible information inviting the customer to reset the indication before the delivery.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.3	**Price indicating device**				
3.3.1	A quantity indicating device with aligned figures and zero-setting may be complemented with a price indicating device, also with aligned figures and zero-setting.				
3.3.2	The unit price may be displayed before the delivery (3.3.2.1) or the unit price may be keyed in after the delivery (3.3.2.2).				
3.3.2.1	The selected unit price shall be displayed by an indicating device before the start of the measurement (unless the option in 3.3.2.2 is used). The unit price shall be adjustable; changing the unit price may be carried out either directly on the measuring system or through ancillary devices. The indicated unit price at the start of the measurement operation shall be valid for the whole transaction. A new unit price shall only be effective at the moment of a new measurement operation. A period of at least 5 seconds shall elapse between indicating a new unit price and before the next measurement operation can start, if the unit price is set from ancillary devices.				
3.3.2.2	This section is a different option from 3.3.2.1 and is not applicable to fuel dispensers. In the case of price indicating devices for measuring systems other than fuel dispensers, it is permitted to display only the quantity before and during the delivery. Neither the unit price nor the total price is required to be displayed before and during the delivery. After the measurement operation is complete, the unit price is selected (or keyed in) to process the total price calculation to conclude the transaction; this unit price shall be valid for the whole transaction. In the case of direct selling to the public, the unit price shall be displayed or printed.				
3.3.3	The provisions in 3.2 relating to quantity indicating devices apply also, by analogy, to the price indicating devices.				
3.3.4	The monetary unit used, or its symbol, shall appear in the immediate vicinity of the indication.				
3.3.5	The zero-setting devices of the price indicating device and of the quantity indicating device shall be designed in such a way that zeroing either indicating device automatically involves zeroing the other.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.3.6	The scale interval shall satisfy the following requirements • for analogue indicating devices, the price corresponding to 2 mm on the scale or to one-fifth of the scale interval (of the first element for mechanical indicating devices), whichever is greater, shall be less than or equal to the minimum specified price deviation; and • for digital indicating devices, the price corresponding to two minimum increments of registration, shall be less than or equal to the minimum specified price deviation. However, the interval of one-fifth of the scale interval or of 2 mm in the case of the first bullet or the scale interval in the case of the second bullet needs not correspond to a value less than that of the smallest coin in circulation in the country in which the equipment is used.				
3.3.7	The difference between the indicated price and the price calculated from the unit price and the indicated quantity shall not exceed the minimum specified price deviation. However, this difference need not be less than the smallest coin in circulation in the country in which the equipment is used. Moreover, this requirement does not apply when the unit price has been changed between two measurements.				
3.3.8	The significant fault on price indication (the difference in 3.3.7) is the price corresponding to the significant fault for the quantity as specified in 2.5.4.				
3.3.9	On analogue indicating devices, the residual indication after zeroing shall not exceed half the minimum specified price deviation. However, this indication need not be less than the smallest coin in circulation in the country in which the equipment is used.				
3.3.10	On digital indicating devices, the price indication after zeroing shall be zero without any ambiguity.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.4	**Printing device**				
3.4.1	The printed scale interval shall be in the form of 1×10^n, 2×10^n or 5×10^n authorised units of quantity, n being a positive or negative whole number, or zero, and shall not be greater than the minimum specified quantity deviation. The printed scale interval shall not be less than the smallest scale interval of the indicating devices.				
3.4.2	The quantity printed shall be expressed in one of the units authorised for the indication of quantity and expressed in the same units as the indicating device. The figures, the unit used or its symbol and the decimal sign, if any, shall be printed unambiguously on the ticket.				
3.4.3	The printing device may also print information identifying the measurement such as sequence number, date, identification of the measuring system, type or name of liquid, etc. If the printing device is connected to more than one measuring system, it shall print the identification of the relevant system.				
3.4.4	If a printing device allows repetition of the printing before a new delivery has started, copies shall be clearly marked as such, for example by printing duplicate.				
3.4.5	If the quantity is determined by the difference between two printed values, even if one is expressed in zeros, it shall be impossible to withdraw the ticket from the printing device during measurement.				
3.4.6	Where the printing device and quantity indicating device each have a zeroing device, these devices shall be designed so that resetting one of them to zero also resets the other.				
3.4.7	The printing device may print, in addition to the measured quantity, the corresponding transaction price, or this price accompanied by the unit price. Any value shall be printed as a repeated value from the measuring system. The figures, the monetary unit used or its symbol, and the decimal sign, if any, shall be printed unambiguously on the ticket.				
3.4.8	The printed price scale interval shall be in the form 1×10^n, 2×10^n or 5×10^n monetary units, n being a positive or negative whole number, or zero; it shall not exceed the minimum specified price deviation. However, it need not be less than the smallest coin in circulation in the country in which the equipment is used.				
3.4.9	If the quantity indicating device is not fitted with a price indicating device, the difference between the printed price and the price calculated on the basis of the indicated quantity and the printed unit price shall comply with the requirements in 3.3.7.				
3.4.10	Electronic printing devices are also subject to the requirements in 4.3.5.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.5	**Memory device**				
3.5.1	Measuring systems may be fitted with a memory device to store measurement results until their use or to keep a record of commercial transactions, providing proof in the event of a dispute. Devices used to read stored information are considered as included in the memory devices. It is not required that the parties interested in a transaction shall be provided continuously with the results of measurement, but only that they shall have access to these results (for example, in the event of a dispute). In addition, in the case of self-service filling stations or truck filling stations, the owner of the measuring system is considered to have access to the indications of the measuring system even when he/she does not use this possibility in practice.				
3.5.2	The medium on which data are stored shall have sufficient permanency to ensure that the data are not corrupted under normal storage conditions. There shall be sufficient memory storage for any particular application.				
3.5.3	Stored data may be deleted if either: • the transaction is settled; or • these data are printed by a printing device subject to legal control.				
3.5.4	After the requirements in 3.5.3 are fulfilled and when the storage is full, it is permitted to delete memorised data when both the following conditions are met: • data are deleted in the same order as the recording order and the rules established for the particular application are respected; and • deletion is carried out either automatically or after a special manual operation.				
3.5.5	Memorisation shall be such that it is impossible in normal use to modify stored values. The memorised data shall be protected against unintentional and intentional changes with common software tools.				
3.5.6	Memory devices shall be fitted with checking facilities according to 4.3.5. The aim of the checking facility is to ensure that stored data correspond to the data provided by the calculator and that restored data correspond to stored data.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.6	**Pre-setting device**				
3.6.1	The preset quantity shall be indicated before the start of the measurement.				
3.6.2	Where pre-setting is carried out by means of several controls which are independent of each other, the scale interval corresponding to one control shall be equal to the pre-setting range of the control of the next lower order. Pre-setting devices with push-buttons or similar means to pre-set fixed quantities are allowed, provided that these fixed quantities are equal to a whole number of units of volume or mass.				
3.6.3	Pre-setting devices may be so arranged that the repetition of a selected quantity does not require a new setting of the controls.				
3.6.4	Where it is possible to view simultaneously the figures of the display device of the pre-setting device and those of the quantity indicating device, the former shall be clearly distinguishable from the latter.				
3.6.5	Indication of the selected quantity may, during measurement, either remain unaltered or return progressively to zero. However, for an electronic pre-setting device it is acceptable to indicate the preset value on the indicating device for quantity or price by means of a special operation with the restriction that this value shall be replaced by the zero indication for quantity or price before the measurement operation can start.				
3.6.6	In the case of a prepaid or pre-ordered delivery: • the difference found under normal operating conditions between the pre-set quantity and the quantity shown by the quantity indicating device at the end of the measurement operation shall not exceed the minimum specified quantity deviation; and • the difference found under normal operating conditions between the prepaid amount and the price shown by the price indicating device at the end of the measurement operation shall not exceed the minimum specified price deviation.				
3.6.7	The pre-set quantities and the quantities shown by the quantity indicating device shall be expressed in the same unit. This unit (or its symbol) shall be marked on the pre-setting mechanism.				
3.6.8	The scale interval of the pre-setting device shall not be less than the scale interval of the indicating device.				
3.6.9	Pre-setting devices may incorporate a device to permit the flow of liquid to be stopped quickly when necessary.				

3.6.10	Measuring systems with a price indicating device may also be fitted with a price pre-setting device which stops the flow of the liquid when the quantity delivered corresponds to the pre-set price. The requirements in 3.6.1 to 3.6.9 apply by analogy.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.7	**Conversion device**				
3.7.1	Measuring systems may be fitted with a conversion device as defined in T.c.4. The provisions of 3.7 apply to electronic conversion devices and, by analogy, to mechanical conversion devices.				
3.7.2	The calculation of the converted quantity shall be made according to the applicable International Recommendations or Standards, or other acceptable methods.				
3.7.3	The parameters which characterise the measured liquid and which are employed in the conversion formula shall be measured using associated measuring devices subject to control when the parameters vary during the measurement process. However, some of these parameters may be not measured, or associated measuring devices may be not subject to control if these parameters do not vary substantially. In any case, the maximum permissible errors an converted indications due to the conversion device, shall not exceed the values specified in 2.7.1.2.				
3.7.4	Associated measuring sensors and suitable provisions for testing shall be installed within a distance of one metre (1 m) of the meter wherever possible. Where this is not possible, it shall be possible to verify that the associated measuring devices are able to determine (within the maximum permissible errors as defined in Table 5.2) the relevant characteristic quantities of the liquid, as they exist in the measuring device (see also Annex B). The associated measuring devices shall not affect the correct functioning of the meter(s).				
3.7.5	All the parameters which are not measured and which are necessary for the conversion shall be present in the calculator at the beginning of the measurement operation. It must be possible to print or to indicate them from the calculator. The device(s) used exclusively to print or indicate these non measured parameters are considered to be non-critical and are only subject to tests showing their capability to correctly indicate or print these values. For a mechanical conversion device that cannot print or indicate these values, a seal must be broken to change any setting. For direct selling to the public, it is allowed to enter the name or type of the liquid into the calculator at the beginning of the measurement operation; it is not permitted to change any other parameter participating in the conversion unless a seal is broken.				
	In other cases, it is allowed to select or enter the name or type of the liquid or any other data, when this data participates in the conversion of the quantity, subject to the following conditions: • a printing device subject to legal metrological control is mandatory;				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
	• this data and a note explaining that this data has been entered manually shall be printed at the same time as the measurement results; • the name or type of the liquid shall be known and printed without any ambiguity; and • where the transaction does not involve direct selling to the public, the other allowed data are those which characterise the name or type of the measured liquid without any ambiguity.				
	Except in the case of direct selling to the public it is allowed to replace the printing device under the following conditions: • in the case of conversion by a memory device; or • when both parties have the possibility to be present to conclude the transaction, by any appropriate means to inform the two parties of the conditions of conversion.				
	The type approval certificate may indicate how to gain access to the memorised data.				
3.7.6	In addition to the quantity at metering conditions and the volume at base conditions or the mass, which shall be displayed according to 2.9.2, the values of other measured quantities (density, pressure, temperature) shall be accessible for testing purposes. When only used for testing or inspection purposes, the device(s) used to access and indicate these values is(are) considered to be non-critical, and is(are) only subject to tests showing its(their) capability to correctly indicate or print these values. Scale intervals for the indication of density, pressure and temperature shall be smaller than or equal to one fifth of the maximum permissible errors fixed in Table 5.2 in 2.7.2.2 for associated measuring devices.				
3.7.7	The temperature sensor shall respond rapidly to temperature changes in order to measure the temperature of the liquid passing through the meter in a sufficiently accurate way.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.8	**Calculator**				
	All parameters necessary for the elaboration of indications that are subject to legal metrology control, such as unit price, calculation table, correction polynomial, etc. shall be present in the calculator at the beginning of the measurement operation. The calculator may be provided with interfaces permitting the coupling of other devices. When these interfaces are used, the instrument shall continue to function correctly and its metrological functions shall not be influenced or affected.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
3.9	**Self-service device (SSD)**				
	The following requirements apply to measuring systems covered by 5.1, 5.2, 5.5, 5.6, or 5.9 when fitted with a self-service device. It is advisable, in particular, that national or international regulations include provisions prescribing that primary indications shall remain accessible to the parties involved in the transaction up to the settlement of the transaction.				
3.9.1	General requirements				
3.9.1.1	Marking, sealing and connection of the components are not covered by this Recommendation and may be established by national regulations.				
3.9.1.2	Where the self-service device serves two or more measuring systems, each system shall be provided with a unique identification that shall accompany any primary indication provided by the self-service device.				
3.9.1.3	The primary indications on indicating devices and printing devices of the self-service arrangement shall not indicate any mutual differences. Scale intervals of the primary indication on indicating devices and the printing devices and memory devices of the self-service device shall be the same. *Note:* For digital (serial) data transmission, this implies that there shall be no difference between primary indications provided by the measuring system on indicating devices and primary indications of the self-service device. However, if the data transmission between the measuring system and the self-service device is in the form of pulses, all primary indications provided by the self-service device shall not indicate any mutual differences for any measured quantity relating to the same measurement. The indications provided by the self-service device shall not deviate from (each of) the primary indications on the measuring system by more than one scale interval or the greater of the two scale intervals if they differ.				
3.9.1.4	Printing devices on the self-service device shall not reproduce the indications of a measuring system as the difference between two printed values.				
3.9.1.5	Indication of information that is not subject to metrological control is allowed, provided that it cannot be confused with metrological information.				
3.9.1.6	A change of the type of payment and/or mode of operation shall not be effective before the end of the current measurement operation.				
3.9.1.7	The self-service device, including provisions related to clearly defined methods of operation, shall be such that at least one primary indication for the benefit of the customer must be available at least up to the settlement of the transaction to enable the delivered quantity and the price to pay to be checked.				
3.9.1.8	In the case of a self-service device that totalises the delivered quantities for different registered customers over the course of time, the minimum measured quantity is not affected by the scale interval used for such totalisations.				

3.9.1.9	After a delivery, measuring systems shall not be capable of being reset to zero and authorised until measurement data are memorised or printed out.				
3.9.2	Attended service mode				
	If the measuring system indicating device provides the only primary indication, it shall bear a legend, which is clearly visible to the customer and which states that the next authorisation of a particular measuring system can only be given by the supplier after settlement of the current transaction and that in the event of dispute, the primary indication on the indicating device of the measuring system is correct. *Note 1:* In attended service mode, the settlement of the transaction takes place before the customer leaves the site of the delivery. *Note 2:* In attended service mode, the measurement operation ends at the moment settlement of the transaction takes place.				
3.9.2.1	Attended post-payment				
	The storage of more than two transactions awaiting payment shall not be permitted. A fuel dispenser may be authorised to initiate a new delivery before the previous transaction on the same dispenser has been settled, but a maximum of only two deliveries may be stored and the dispenser cannot be authorised to initiate a new delivery until one of them has been settled.				
3.9.2.1.1	Where the self-service device includes a device that provides an additional primary indication (additional to those of the indicating device of the measuring system), it shall consist of at least one installation for the reproduction of the quantity and the price (if calculated) indicated by the primary indicating device, consisting of at least: • an indicating device for the benefit of the supplier, and • a display, or a printing device for the issue of a receipt, for the benefit of the customer.				
3.9.2.1.2	For self-service devices with temporary storage (temporary storage mode) of measurement data of measuring systems, the following requirements apply: a) a measuring system may be authorised for the next delivery before the previous transaction on the same measuring system has been settled; b) the mandatory primary indication for the benefit of the supplier shall be accompanied by a clear mark representing the sequence (for example, the numbers 1 or 2, or the letters A or B); and c) when a mandatory primary indication of the self-service device is out of service, the self-service device may continue its operation provided that it no longer uses any temporary storage, and that the measuring system indicating device remains the primary indication. In such a case, the measuring system may bear a legend, which is clearly visible to the customer and which states that in the event of dispute, the primary indication on the indication device of the measuring system is correct.				

3.9.2.1.3	Where the mandatory primary indication for the benefit of the customer is provided by a device in the form of a separate constructional unit and this unit becomes uncoupled, or if the checking facilities detect a malfunction, the temporary storage mode shall be prohibited and the measuring system indicating device remains the primary indication. The temporary storage mode shall only be disabled when mandatory primary indication for the benefit of the customer cannot be provided in any other way.				
3.9.2.1.4	The self-service device shall be capable of indicating the status of those measuring systems (e.g. running, authorised, or unauthorised) that are connected to the self-service device and, in the case of multiple modes of service and/or type of payment, also that particular status of the measuring system.				
3.9.2.2	Pre-payment in attended service mode				
3.9.2.2.1	The requirements in 3.6 are applicable.				
3.9.2.2.2	A printed or hand-written receipt of the prepaid amount shall be provided upon request of the customer. *Note:* Hand-written receipts are subject to relevant national legislation.				
3.9.3	Unattended service mode				
3.9.3.1	General				
	In unattended service mode, the end of the measurement operation is the end of the registration (printing and/or memorising) of information concerning the measurement operation. *Note:* Measuring systems, especially those for loading road or rail tankers, may be designed in such a way that the transaction is not settled when the customer leaves the loading site, when an existing (prior) agreement exists with the supplier.				
3.9.3.1.1	The self-service device shall provide additional primary indications by means of • a printing device for the issue of a receipt to the customer (see note, below), and • a device (printing or memory) on which the measurement data are registered for the benefit of the supplier. *Note:* During the transaction initiation, the customer may be offered a choice to obtain a receipt from the printing device or not. If a printed ticket is unavailable, the customer shall be warned prior to the transaction so he/she may abort the process (see 3.9.3.1.2). The printed ticket is the legal format for the customer receipt. After the decision to obtain a printed ticket is made, the customer may also be offered an e-receipt (by email, SMS, or by another electronic format). In this case, the e-receipt is only informative. It does not replace the printed receipt and is not subjected to the requirements of this Recommendation. The customer shall be warned of this.				

3.9.3.1.2	When the printing device, as required by 3.9.3.1.1, is not able to provide any indication or becomes unserviceable, the customer shall be clearly warned by automatic means before the operation commences. Passing from attended to unattended service mode shall not be possible before correct operation of the arrangement is concluded as feasible by the checking facilities, including compliance with the above provision. Memorised data older than 3 months may be automatically deleted. *Note:* If the billing period is more than one month, it is advisable to store the memorised data longer than three months.				
3.9.3.1.3	Where the self-service device is provided with individual volume totalisers, one for each registered customer and visible to the customer, the requirements in 3.9.3.1.1 and 3.9.3.1.2 do not apply.				
3.9.3.1.4	Self-service devices shall be provided with a means for controlling the continuity of the calculation program ("watch-dog") for ensuring the discontinuation of the current delivery when the continuity of the processor program of the self-service device is no longer ensured. The next effective acceptance of payment shall only take place if the continuity of the processor program is re-established.				
3.9.3.1.5	When a power supply failure occurs, the delivery data shall be memorised. Settlement of the transaction shall occur before the next measurement may start.				
3.9.3.2	Delayed payment				
	The printed and/or memorised indications listed in 3.9.3.1 shall contain sufficient information for further checking and at least the measured quantity, the price to pay (if calculated) and ample data to identify the particular transaction (e.g. the measuring system number, location, date, time).				
3.9.3.3	Pre-payment in unattended service mode				
3.9.3.3.1	Following the termination of each delivery, the printed and/or memorised indications listed in 5.10.3.1 shall be made available, clearly indicating the amount which has been pre-paid and the price corresponding to the liquid obtained. These printed and/or memorised indications may be divided into two parts as follows: a) one part provided prior to the delivery on which the pre-paid amount is shown and recognisable as such; and b) one part provided following the termination of delivery, on condition that it is clear from the information provided on both parts that they are related to the same delivery.				
3.9.3.3.2	The requirements in 3.6 are applicable.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
4	**Measuring systems equipped with electronic devices**				
4.1	**General requirements**				
4.1.1	Electronic measuring systems shall be designed and manufactured such that their metrological functions are safeguarded and their errors do not exceed the maximum permissible errors as defined in 2.5 under rated operating conditions. *Note:* National or regional regulations may allow the manufacturer to be responsible for the continuation of operation under rated operating conditions. These regulations shall define the conditions of this responsibility and the information required on the type approval certificate (see also 6.1.2). This may allow the manufacturer to replace purely digital elements (elements that cannot influence the characteristics or the performance of the measuring system) by other functionally equivalent elements without having to demonstrate that the measuring system continues to operate as designed.				
4.1.1.1	Interruptible electronic measuring systems shall be designed and manufactured such that, when they are exposed to the disturbances specified in 6.1.2.2 and R 117-2, either a) significant faults do not occur; or b) checking facilities detect and act upon, in accordance with 4.3, the significant faults or any incorrectness in the generation, transmission (taking into account 4.3.2.1), processing, or indication of the measurement data.				
4.1.1.2	Non-interruptible 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 6.1.2.2 and R 117-2.				
4.1.2	It is the responsibility of the manufacturer to decide whether a given type of measuring system is interruptible or not, taking into account the applicable rules of security and type of application. However, measuring systems for direct selling to the public shall be interruptible. When, at the time of type evaluation, it is not possible to specify the future utilisation of the instrument the requirements in 4.1.1.2 apply.				
4.1.3	The requirements in 4.1.1 shall be met durably. For this purpose electronic measuring systems shall be provided with the checking facilities specified in 4.3.				
4.1.4	A type of a measuring system is presumed to comply with the requirements in 4.1.1 and 4.1.3 if it passes the inspection and tests specified in 6.1.11.1 and 6.1.11.2.				
4.1.5	Measuring systems shall permit the retrieval of the measurement result just before a malfunction (in particular significant faults and/or power supply failure) occurred and was detected by checking facilities.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
4.2	**Power supply device (see also Annex B)**				
4.2.1	When the flow is not interrupted during the failure of the principal power supply device, the measuring system shall be provided with a means to safeguard all measuring functions during that failure.				
4.2.2	When the flow is interrupted during the failure of the principal power supply device, the provisions in 4.2.1 shall be met, or data contained at the moment of the failure shall be saved and shall be available for (on-demand) display on an indicating device subject to legal metrology control during a period of at least 15 minutes, to permit the conclusion of the current transaction.				
4.2.2.1	If a provision for the manual activation of the display is present, the display shall be available for a minimum of two minutes.				
4.2.2.2	As an alternative, except for direct selling to the public, the last transaction may be memorizsed and displayable upon the restoration of power.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
4.3	**Checking facilities**				
4.3.1	Action of checking facilities The detection by the checking facilities of incorrectness in generation, transmission, processing and/or indication of measurement data shall result in the following actions, according to the type.				
4.3.1.1	Type N (Non-automatic): a visible or audible alarm for the attention of the operator.				
4.3.2	Checking facilities for the measuring device Checking facilities shall be designed and manufactured such that they can verify the presence of the measuring device, its correct operation, and the correctness of the data transmission.				
4.3.2.1	When the signals generated by the measuring device are in the form of pulses, each pulse representing an elementary quantity, significant faults shall be detected by checking facilities and acted upon (see also Annex B). These checking facilities shall be of type P and the checking shall occur at time intervals not exceeding the duration of the measurement of an amount of liquid equal to the minimum specified quantity deviation. While not a requirement for initial and subsequent verification, it shall be possible during type evaluation to ensure that these checking facilities function correctly • by disconnecting the transducer, or • by interrupting one of the sensor's pulse generators, or • by interrupting the electrical supply of the transducer.				
4.3.2.2	For electromagnetic meters only, where the amplitude of the signals generated by the measuring device is proportional to the flowrate, the procedure below may be used:				
	A simulated signal with a shape similar to that of the measurement signal is fed into the input of the secondary device, representing a flowrate between the minimum and maximum flowrate of the meter. The checking facility shall check the primary and the secondary device. The equivalent digital value is checked to verify that it is within predetermined limits given by the manufacturer and consistent with the maximum permissible errors.				
	This checking facility shall be of type P or I. In the latter case, the checking shall occur at least every 5 minutes.				
	Note: Following this procedure, additional checking facilities (more than two electrodes, double signal transmission, etc.) are not required.				
4.3.3	Checking facilities for the calculator				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
	These checking facilities shall verify that the calculator system functions correctly and shall ensure the validity of the calculations made. There are no special means required for indicating that these checking facilities function correctly.				
4.3.3.1	The checking of the functioning of the calculation system shall be of types P or I. In the latter case, the checking shall occur at least every 5 minutes, except in the case of fuel dispensers, for which it shall occur at each delivery. The objective of the checking is to verify that:				
	• the values of all permanently memorised instructions and data are correct, and				
	• all procedures of internal transfer and storage of data relevant to the measurement result are performed correctly (see Annex B, bullet 2).				
4.3.3.2	The checking of the validity of calculations shall be of type P. This consists of checking the correct value of all data related to the measurement whenever these data are internally stored or transmitted to an ancillary device through an interface.				
	In addition, the calculation system shall be provided with a means of controlling the continuity of the calculation program ("watch-dog") (see also Annex B).				
4.3.4	**Checking facilities for the indicating device (see also Annex B)** This checking facility shall verify that the primary indications are displayed and that they correspond to the data provided by the calculator. In addition, the checking facility shall verify the presence of the indicating devices, if they are removable.				
	The checking facility of the display shall provide the ability to visually check the entire display which shall meet the following description: a) For fuel dispensers with segmented displays: • displaying all the elements ("eights" test if appropriate); and • blanking all the elements ("blank" test), and displaying "zeros" for quantity and, if applicable, displaying the valid unit price and "zeros" for price, just before a new delivery starts. Each step of the sequence shall last at least 0.5 second. b) For all other interruptible and non-interruptible measuring systems, the test sequence shall be as described under a) (above) or any other automatic test cycle which indicates all possible states for each element of the display. This ability to visually check the display shall be of type I for fuel dispensers and of type N for other interruptible and non-interruptible measuring systems, but it is not mandatory for a malfunction to result in the actions described in 4.3.1.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
	While not a requirement for initial and subsequent verification, it shall be possible during type evaluation to ensure that the checking facility of the indicating device is working properly.				
	Possible verification for checking facilities: First acceptable technical solution: To automatically control the complete indicating device. The checking facility of the indicating device is of type P. However, it may be of type I if a primary indication is provided by another device of the measuring system or if the indication may be easily determined from other primary indications (for example, in the case of a fuel dispenser, it is possible to determine the price to pay from the quantity and the unit price). Second acceptable technical solution: To automatically check the data transmitted to the indicating device and the electronic circuits used for the indicating device, except the driving circuits of the display itself, and to also check the display (see also Annex B). The automatic checking facility of the transmitted data and of the electronic circuits used for the indicating device is of type P. However, it may be of type I if a primary indication is provided by another device of the measuring system, or if the indication may be easily determined from other primary indications (for example, in the case of the presence of a price indicating device, it is possible to determine the price to pay from the quantity and the unit price).				
4.3.5	**Checking facilities for ancillary devices** An ancillary device (repeating device, printing device, self-service device, memory device, etc.) 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 verify the correct transmission of data from the calculator to the ancillary device.				
	In particular, the checking of a printing device aims to ensure that the data received and processed by the printing device correspond to the data transmitted by the calculator. At least the following shall be checked: • presence of paper; • transmission of data; and • the electronic control circuits (except the driving circuits of the printing mechanism itself). While not a requirement for initial and subsequent verification, it shall be possible during type approval to ensure that the checking facility of the printing device is functioning by an action that forces a printing malfunction. This action should be a simulated incorrectness in the generation, transmission (taking into account 4.3.2.1), processing, or indication of measurement data.				
	Where the action of the checking facility is a warning, this shall be given on or by the ancillary device concerned.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
4.3.6	**Checking facilities for the associated measuring devices** Associated measuring devices shall include a checking facility of type P. The aim of this checking facility is to ensure that the signal given by these associated devices is inside a pre-determined measuring range. Data from associated measuring devices shall be read at least 5 times during a quantity equal to the minimum measured quantity. Each time the data is read there shall be a check.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5	**Requirements specific to certain types of measuring systems**				
5.1	**Fuel dispensers**				
	Except where otherwise specified, the requirements in this section do not apply to LPG dispensers. This subclause can also be used for other liquid dispensers usually used at petrol station locations (such as urea (AUS32/DEF) dispensers, dispensers for windscreen washer fluid (isopropanol/water), and lubricant dispensers) and boat or small aircraft dispensers, when the operation is carried out "full-hose". Also considered as "similar" is any dispenser for foaming liquid that works in a similar way with a "full-hose" operation.				
5.1.1	Where installed, the ratio between the maximum and the minimum flowrate may be smaller than 10 provided that it is not less than 5. *Note*: This (as installed) requirement is different than the requirement in 2.3.3.3.				
5.1.2	When the measuring system includes its own pump, a gas elimination device shall be installed immediately upstream of the meter inlet.				
5.1.3	When the measuring system is intended for installation in a centrally pumped system, or for a remote pump, the general provisions in 2.10 shall be applied (see also Annex B.5.1.3). If it is not intended to install a gas elimination device, there shall be no risk of air intake or gas release. In this case, an automatic facility (such as a storage tank level detector) shall automatically prevent further deliveries when the storage tank minimum level is reached (see also 2.10.2).				
5.1.4	Where a gas indicator is fitted, it shall not have a venting device as mentioned in 2.11.				
5.1.5	Fuel dispensers shall be equipped with a device for simultaneously resetting the quantity indicating device and the price indicating device to zero. If these systems also include a price indicating device, this indicating device shall be fitted with a zero-setting device.				
5.1.6	The minimum height for the figures of the resettable quantity indicator is 10 mm. The minimum height for the resettable price indicator is 10 mm. The minimum height for the unit price is 4 mm.				
5.1.7	When only one nozzle can be used during a delivery, and after the nozzle has been replaced, the next delivery shall be inhibited until the corresponding indicating device has been reset to zero. When two or more nozzles can be used simultaneously or alternately, and after the utilised nozzles have been replaced, the next delivery shall be inhibited until the indicating device has been reset to zero. Moreover, by design, the provisions in the first paragraph of 2.16.1 shall be fulfilled. The above requirements do not apply when an auxiliary hand pump is used.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.1.8	Measuring systems having a maximum flowrate not greater than 60 L/min (3.6 m^3/h) shall have a minimum measured quantity not exceeding 5 L.				
5.1.9	When the measuring system is fitted with a ticket printing device which is subject to control, this printing device shall comply with the relevant requirements in 3.4. In addition, any printing operation shall prevent the continuation of the delivery until a reset to zero has been performed. However, the printing operation shall not change the quantity indicated on the indicating device.				
5.1.10	Fuel dispensers shall be interruptible.				
5.1.11	In addition to the requirements in 4.2.2, electronic fuel dispensers shall be designed such that the minimum duration of operation of the display shall be either: • at least 15 min continuously and automatically after the failure of the principal electrical supply or a total of at least 5 min in one or several periods controlled manually during one hour after the failure.				
	The instrument shall be supplied with electric power for the 12 hours preceding a test of this requirement. In addition, electronic fuel dispensers shall be designed such that an interrupted delivery cannot be continued after the power supply has been re-established if the power failure has lasted more than 15 seconds.				
5.1.12	When several fuel dispensers have a common indicating device it shall be impossible to use any of these measuring systems simultaneously.				
5.1.13	The checking of the operation of the calculator, as described in 4.3.3.1, shall be performed at least once for each delivery.				
5.1.14	It is not required to display quantities, and prices if applicable, that correspond to a small number of "minimum increments of registration" at the beginning of the delivery. The display of quantity or price may start after the hidden quantity has been reached. The quantity thus hidden shall not be greater than two times the minimum specified quantity deviation. The hidden price shall not be greater than the price corresponding to that quantity. It shall not be possible to change the amount that is being masked without breaking a seal. Without breaking a seal, it is desirable to disable the "hiding function" to allow: • verification of the hose inflation volume: • reduction of measurement errors during verifications (assessing the contribution of the hose inflation volume) and checking that the device incorporated at the dispenser end of the hose prevents the draining of the hose during shutdown periods as per 2.13.6.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.1.15	All dispensers with electronic indicators shall be fitted with a time-out function that terminates a transaction (i.e. the dispenser is reset to zero before delivery starts), should a period of inactivity (no flow) of more than 120 seconds occur during the transaction.				
5.1.16	When a fuel dispenser has a temperature compensation system incorporated (or connected), the temperature compensation functionality shall be sealed against removal. It shall not be possible to disable the compensation function in the electronics without breaking a seal. See also 3.7. During verification, the maximum deviation between the temperature measured by the dispenser and a reference shall be 1.4 °C.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.2	**Measuring system on road tankers**				
5.2.1	The provisions hereafter apply to measuring systems mounted on road tankers or on transportable tanks for the transport and delivery of liquids of low viscosity (≤ 20 mPa·s at 20 °C) and stored at atmospheric pressure with the exception of road tankers containing liquids covered by more specific sections of this Recommendation (such as 5.6 for foaming potable liquids, 5.11 for LNG, etc.).				
5.2.2	**Multiple compartments** Tanks equipped with measuring systems may comprise one or more compartments. The largest MMQ of the meter and gas separator must not exceed the volume of the smallest compartment. *Note:* It must be possible to reach MMQ when delivering the full volume of any compartment. The MMQ of the measuring instrument and the air separator must not exceed 50 % of the volume of the largest compartment. *Note:* It must be possible to reach 2 MMQ during verification as per 2.5.1, 2.5.3 and 2.10.1.				
5.2.3	The compartments of road tankers shall be fitted with an anti-swirl device, except when the measuring system is fitted with a gas separator which complies with 2.10.8.				
5.2.4	When a tank comprises more than one compartment, each compartment shall be provided with an individual (manual or automatic) closing device in each outlet line.				
5.2.5	In conformity with national regulations on their use, each measuring system shall be allocated to a specific product or to a range of products for which the meter has been approved. The pipework shall, to the extent possible, be designed so that products cannot become mixed in the measuring system.				
5.2.6	Subject to the requirements in 2.16.2, a measuring system mounted on a road tanker may include empty or full hoses or both.				
5.2.7	The quantity indicating device shall include a zero-setting device complying with 3.2.4. When the measuring system is fitted with a ticket printing device, any printing operation shall prevent the continuation of the delivery until a reset to zero has been performed.				
5.2.8	Measuring systems mounted on road tankers may be designed to operate by pump only, or by gravity only, or with the choice of either pump or gravity, or by gas pressure.				
5.2.8.1	Measuring systems fed by pump only may operate either empty hose or full hose and shall comply with the requirements in 5.2.8.1.1 and 5.2.8.1.2.				
5.2.8.1.1	As there is a risk that the requirements in 2.10.2 related to the absence of air or gas cannot be met, the measuring system shall have a suitable gas elimination device upstream of the meter (see 2.10.7, 2.10.8 and 2.10.9).				

5.2.8.1.2	When, in a measuring system, the pressure at the outlet of the meter can be lower than atmospheric pressure, but still higher than the saturated vapour pressure, an automatic means to prevent any air from entering the meter shall be installed. When the pressure at the outlet of the meter cannot be lower than atmospheric pressure (this is especially the case for systems operating solely full hose), the use of automatic devices for slowing down and stopping the flow is not required.				
5.2.8.2	Measuring systems operating solely by gravity shall comply with the requirements of 5.2.8.2.1 to 5.2.8.2.4.				
5.2.8.2.1	The equipment shall be so constructed that the total contents of the compartment(s) can be measured at a flowrate greater than or equal to the minimum flowrate of the measuring system.				
5.2.8.2.2	If there are connections with the gas phase in the tank of the road tanker, appropriate devices shall prevent any gas/air from entering the meter.				
5.2.8.2.3	The requirements in 2.10.3 concerning non-pumped flow shall apply. A pump downstream of the transfer point for increasing the flowrate may be authorised if the foregoing provisions are complied with. This pump shall not cause a fall in pressure in the meter.				
5.2.8.2.4	Where a gas/air release to atmosphere is required to ensure the complete emptying of all piping downstream of the transfer point, it shall be automatic in operation. Means for visual or automatic detection of the complete emptying are mandatory in this case.				
5.2.8.3	Measuring systems capable of being operated either by gravity or by pump shall comply with the requirements in 5.2.8.1 and 5.2.8.2.				
5.2.8.4	Measuring systems operated by means of gas pressure may operate empty hose or full hose. The pipework which links the meter to the device intended to prevent any gas from entering the meter as specified in 2.10.3 shall have no constriction or component likely to cause a pressure loss which could generate gas pockets by releasing the gas dissolved in the liquid. These systems shall include a pressure gauge which indicates the pressure in the tank. The dial of this gauge shall indicate the range of permissible pressures.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.3	**Measuring systems for the unloading of ships' tanks and of rail and road tankers using an intermediate tank**				
5.3.1	Measuring systems designed to measure quantities of liquids during the unloading of ships' tanks and of rail and road tankers may include an intermediate tank in which the liquid level determines the transfer point. This intermediate tank may be designed to ensure the elimination of gas. The cross section of the intermediate tank shall be such that a quantity equal to the minimum specified quantity deviation corresponds to a difference in level of at least 2 mm.				
5.3.2	In the case of road and rail tankers, the intermediate tank shall automatically ensure a constant level, visible or detectable, at the beginning and at the end of the measurement operation. The level is considered to be constant when it settles within a range corresponding to a quantity of no more than the minimum specified quantity deviation.				
5.3.3	In the case of ships' tanks, it is not necessary to provide for the automatic maintenance of a constant level. Where such a provision is not made, it shall be possible to measure the contents in the intermediate tank. If the ship's tank is unloaded by means of pumps located in the bottom of the ship, the intermediate tank may be used only at the beginning and at the end of the measurement operation.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.4	**Measuring systems for liquefied gases under pressure (other than LPG dispensers)**				
5.4.1	Only full hose measuring systems are authorised (unless 5.4.9 is applicable).				
5.4.2	The design of the measuring system shall ensure that the product in the meter remains in a liquid state during the measurement.				
5.4.3	A thermometer well shall be provided close to the meter for verification purposes.				
5.4.4	Provisions shall be made for fitting a pressure measuring device downstream and close to the meter. This measuring device shall be available for verification. If necessary, provisions for sealing shall be made.				
5.4.5	When the quantity is delivered using a measuring system mounted on a road tanker, any connection between the gaseous phases of the vehicle's (supply) tank and of the receiving tank is prohibited. For other measuring systems for liquefied gas, such connections are permitted when the quantities of gas transferred via these connections are measured by means of suitable measuring instruments and subtracted from the delivered quantity.				
5.4.6	Pressure relief valves may be incorporated in measuring systems in order to prevent abnormally high pressures. If they are located downstream of the meter, they shall open to the atmosphere or be connected to the receiving tank. In no case shall the safety valves located upstream of the meter be connected to the valves located downstream by pipes which bypass the meter.				
5.4.7	When the conditions of operation require the use of detachable hoses, these hoses shall remain full if their quantities are greater than the minimum specified quantity deviation. Detachable full hoses shall be fitted with special connections for full hoses, so-called couplers or self-sealing valves. Manually operated blow-off devices shall be provided at the ends of these hoses, if necessary.				
5.4.8	For measuring systems mounted on road tankers the quantity indicating device and its printing device, if provided, shall comply with the requirements in 5.2.7.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.4.9	The provisions in 5.4 also apply for measuring systems for liquefied carbon dioxide with the following exceptions: • only empty hose measuring systems are authorised (see 5.4.1); • the connection between the gaseous phases of the vehicle's tank and of the receiving tank is permitted if (i) a device is installed to allow compensation of the delivered quantity by an amount relating to the quantity of vapour returned in the gas line, or (ii) compensation is made by automatic calculation. However, in both cases, flow from the delivery tank to the receiving tank by means of the gas return line shall be securely prevented; the requirements in 5.4.7 are not mandatory for these systems.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.5	**Fuel dispensers for liquefied gases under pressure (LPG dispensers)**				
5.5.1	The requirements in 5.1.1, 5.1.6, 5.1.7, 5.1.9 to 5.1.16, 5.4.1, and 5.4.2 are applicable to LPG dispensers for motor vehicles. Where installed, the ratio between the maximum flowrate and the minimum flowrate may be smaller than 5 provided that it is not less than 2.5.				
5.5.2	Provisions shall be made to ensure that the LPG in the measuring system remains in the liquid state. Often, this is accomplished through a pressure-maintaining device.				
5.5.3	A thermometer well may be provided close to the meter. When it is not provided, the legal metrology authority may require that the manufacturer or the owner of the measuring system provide an equivalent means for measuring temperature. When a pressure-maintaining device is used, provision shall be made for fitting a pressure-measuring device close to the meter and upstream of the pressure-maintaining device. This measuring device shall be available for verification. If necessary, provision for sealing shall be made. For testing/verification purposes, provisions should be included to allow for the circulation of the LPG.				
5.5.4	Connection between the gas phase of the feed tank and the gas phase of the vehicle's tank (e.g. a vapour return line) is prohibited.				
5.5.5	When only one nozzle can be used during a delivery, and after the nozzle has been returned to its holder, the next delivery shall be inhibited until the indicating device has been reset to zero. When two or more nozzles can be used simultaneously or alternately, and after the utilised nozzles have been returned to their holders, the next delivery shall be inhibited until the indicating device has been reset to zero. Moreover, by design, the provisions in the first paragraph of 2.16.1 shall be fulfilled. Moreover, in both cases, when the flow is stopped by emergency means and a predetermined delay is exceeded, the current delivery shall be stopped and the next delivery shall be preceded by a reset to zero.				
5.5.6	A non-return valve, downstream of the meter, is mandatory. The pressure loss caused by it shall be sufficiently low to be considered negligible.				
5.5.7	Hoses shall be fitted with special connections for full hoses, so-called couplers or self-sealing valves.				
5.5.8	Safety features shall not affect the metrological performance.				
5.5.9	When the measuring system is provided with a conversion device, it shall be possible to verify separately the indications of quantity at measuring conditions and associated measuring devices.				
5.5.10	Construction of the nozzle shall be such that, at the moment of coupling or uncoupling, the loss of liquid does not exceed the minimum specified quantity deviation.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.6	**Measuring systems for milk, beer, and other foaming potable liquids**				
5.6.1	The following requirements apply to transportable measuring systems for foaming potable liquids which are mounted on road tankers and also to fixed measuring systems used for the reception or delivery of these liquids.				
5.6.2	The transfer point in reception installations is defined by a constant level gas elimination system upstream of the meter. The gas elimination device must make use of a constant level tank which is usually combined in one device but may be separate if the gas elimination device is downstream of the constant level tank and before the meter. It must be possible to verify a constant level in the gas elimination device before and after each measurement. The level shall be established automatically. In the event the measuring system measures the level in the gas elimination device/constant level tank automatically before and after measurement (e.g. by an automatic level gauge) and corrects the received quantity according to the levels, 5.6.2.4 does not apply.				
5.6.2.1	The gas elimination device may be placed either upstream of the pump or between the pump and the meter. The gas elimination device is usually considered to be necessary whether the liquid meter is fed by gravity, by emptying milk churns, by means of an auxiliary pump, or by means of a vacuum system. If the liquid is introduced by means of a pump or a vacuum system, a gas elimination device is necessary. This device may be combined with the constant level tank. However, new technologies that do not include a gas elimination device (such as systems with some type of a correction function) shall not be prevented by this subclause. These systems shall comply with the general requirements in 2.10.1 during the whole measuring operation.				
5.6.2.2	The requirement in 2.13.3 does not apply to measuring systems for milk, and the meter may be fed by means of a vacuum system. In this case, the pressure inside the pipework connecting the constant level tank to the meter will be lower than atmospheric pressure and the tightness of the joints of this connection must be particularly well ensured. It must be possible to check the tightness and a notice plate drawing attention to this checking shall be provided.				

5.6.2.3	In all installations for reception, the pipework upstream of the air elimination device is assumed to empty completely and automatically under the rated operating conditions. After measurement, any unmeasured liquid in hoses designed to be coupled to the outlet of the supply tank, is assumed to belong to the supply tank, thus to the delivering party. It must be possible to check the emptiness of the hoses and a warning plate drawing attention to this verification step shall be provided.				
5.6.2.4	The constant level in the gas elimination device/constant level tank is monitored by means of a sight glass or a level indicating device. The level is considered to be constant when it settles within a range defined by two marks at least 15 mm apart and corresponding to a difference in quantity of no more than twice the minimum specified quantity deviation. *Note:* The constant level is not required in the case when the system measures the level in the constant level tank automatically before and after a measurement (e.g. by a level gauging device) and takes the equivalent volume into account when determining the transaction volume.				
5.6.2.5	If, in order to meet the above condition, devices for reducing the flowrate are incorporated in the measuring system, the flowrate during the period of reduced flowrate shall be at least equal to the minimum flowrate of the meter.				
5.6.2.6	If, in a reception installation, the measured liquid flows to a level lower than that of the meter, a device shall automatically ensure that the pressure at the outlet of the meter remains above atmospheric pressure.				
5.6.2.7	Measuring systems shall be fully filled before a measurement commences. In the case of receiving systems, if it is not practical to fill the measuring system before a measurement, it is acceptable to determine the quantity required to fill the measuring system and this quantity shall be indicated on the data plate of the measuring system so that it can be taken into account, by calculation, in the first measurement of a reception period. The first quantity measured by the measuring system during a reception period shall be equal to or greater than the quantity which is necessary for the complete filling of the measuring system.				

5.6.3	In contrast to the general requirements in 2.10 concerning the elimination of air or gases, the gas elimination devices shall meet the requirements in 2.10.1 under operating conditions only, such as when gas/air enters at the beginning and end of each measuring operation. However, when the measuring system is equipped with hoses, which are designed to be coupled to the outlet of the supply tank, the gas elimination device shall also comply with the requirements in 2.10.1 during the whole measuring operation. For reception equipment, the user shall be able to ascertain the leak-tightness of the connections so that no gas/air may enter upstream of the meter during measuring. For delivery equipment, the system shall be assembled so that the liquid pressure in the connecting pipes running from the supply tank is always positive.				
5.6.4	The indicating device of a transportable measuring system and its printing device, if provided, shall comply with the requirements in 5.2.7.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.7	**Measuring systems on pipelines and systems for loading ships**				
5.7.1	The ratio between the maximum flowrate and the minimum flowrate of the measuring system may be less than 5 (see 2.3.3). In this case, the measuring system shall be fitted with an automatic checking device to verify that the flowrate of the liquid to be measured is within the restricted measuring range of the measuring system. This checking device shall be of type P and shall meet the requirements in 4.3.1.2. The maximum and minimum flowrates may be determined in relation to the liquid to be measured and manually introduced into the calculator.				
5.7.2	Prevention of gas flow The measuring system shall be provided with a means of eliminating any air or gas contained in the liquid unless the entry of gas/air into the liquid or release of gas from the liquid is prevented by the configuration of the pipework or by the arrangement and operation of the pump(s).				
5.7.3	Special conditions of installation Reverse flow of the liquid to be measured in the measuring system shall be prevented by a suitable device, unless otherwise approved.				
5.7.4	Sampling device The measuring system may include a sampling device intended to determine the properties of the liquid to be measured. It is not necessary to take into account the quantity of the sample in the results of the measurement if this sample is less than 0.1 times the maximum permissible error of the measuring system.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.8	**Measuring systems intended for the fueling of aircraft**				
	The requirements of this section also apply to the fueling of helicopters.				
5.8.1	General				
5.8.1.1	Measuring systems intended for fueling aircraft are full hose measuring systems.				
5.8.1.2	The gas elimination device function may be performed by a microfilter water elimination device provided that the requirements in 2.10 are fulfilled. A water elimination device may be placed downstream of the meter. The water draw-off valve should not be sealed.				
5.8.1.3	These systems shall be interruptible measuring systems.				
5.8.1.4	Pressure relief valves may be incorporated in measuring systems in order to relieve excessively high pressures (for safety reasons). If they are located downstream of the meter, they shall open to the atmosphere or be connected to the receiving tank. In no case shall the pressure relief valves located upstream of the meter be connected to the pressure relief safety valves located downstream by pipes (which would bypass the meter).				
5.8.2	**Stationary measuring systems**				
5.8.2.1	The requirements applicable to fuel dispensers apply to stationary measuring systems intended for the refueling of aircraft, except those in 5.1.1.				
5.8.2.2	These systems may include their own pumps or be designed for installation in a centrally pumped system.				
5.8.2.3	The microfilter-water elimination device shall be fitted upstream of the gas elimination device.				
5.8.3	**Mobile measuring systems**				
5.8.3.1	General				
5.8.3.1.1	If more than one transfer point is provided, interlocks should prevent the usage of two or more transfer points together unless the arrangement is such that it would be difficult to use them on different aircrafts at the same time.				
5.8.3.1.2	They may be designed for defueling aircraft provided that the connecting point for defueling is located upstream of the gas elimination device. A weir-type sight glass is not mandatory. Interlocks may also be necessary to prevent bypassing metered liquid through the return line back to the supply tank while delivering fuel to the aircraft.				
5.8.3.1.3	Where the microfilter-water elimination device may be used to perform the function of the gas elimination device, to verify whether the requirements in 2.10 are fulfilled it may be sufficient to solely examine the documents.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.8.3.1.4	Each installation shall be provided with or accompanied by: • instructions for use; • a liquid circulation plan; • a description of necessary operations for use; and • a description of control and connecting devices positions related to their use.				
5.8.3.2	Aircraft fueling tanker measuring systems The requirements in 5.2.2, 5.2.3, 5.2.4, 5.2.6, 5.2.7 and 5.2.8.1 apply. *Note*: For good practice in the use of the system, when the aircraft fueling tanker measuring system is fitted with a device used to perform the gas extractor or special gas extractor function, a manometer should be provided upstream of the pump in order to detect depressions when they occur. Its indications should be easily visible by the operator.				
5.8.3.3	**Aircraft hydrant measuring systems**				
5.8.3.3.1	The gas elimination device may be a device performing the function of a gas extractor when the underground pipe: • is designed for easy elimination of the gas/air contained in the pipe with appropriate devices; • is fitted with special connecting devices for full hoses; and is supplied so that, in designed supply conditions, no gaseous formation can occur or enter the underground pipe.				
5.8.3.3.2	When the aircraft hydrant measuring system is equipped with a device for froth recovery and reinjection, it shall be located upstream of the gas elimination device and it shall not permit permanent introduction of gas into the meter.				
5.8.3.3.3	Depressurisation valves for the hoses to facilitate their connection and disconnection shall be accompanied by interlocks to prevent metered liquid from being diverted.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.9	**Blend dispensers**				
5.9.1	The requirements in 5.1.1 to 5.1.15 are applicable to both parts of the multigrade-dispenser and to the gasoline part of the gasoline-oil-dispenser (with the words "blend dispensers" in the place of "fuel dispensers" where appropriate). However, by design, the ratio between the maximum flowrate and the minimum flowrate shall be at least 5 in the case of multigrade-dispensers.				
5.9.2	When only one nozzle can be used during a delivery, and after the nozzle has been replaced, the next delivery shall be inhibited until the indicating device has been reset to zero. When two or more nozzles can be used simultaneously or alternately, and when the utilised nozzles have been replaced, the next delivery shall be inhibited until the indicating device has been reset to zero. Moreover, by design, the provisions in the first paragraph of 2.16.1 shall be fulfilled.				
5.9.3	The requirements in 5.9.4 through 5.9.8 do not apply if the designations of the various mixtures do not allow conclusions to be drawn concerning the ratio of quantities of the two components. Examples of such designations: • number of stars (2, 3, 4 stars); • octane-number; and • two-stroke-mixture (without designation such as 5 %).				
	Moreover, the requirement in 5.9.4 or 5.9.5 only applies where the measuring system provides the indication of the mixed quantity and the price of the mixture depends on the blending ratio. It does not apply where the measuring system provides: • an indication of the mixed quantity and the price does not depend on the blending ratio; or • a quantity indication for each component of the mixture does not provide an indication of the mixed quantity. To ensure compliance with the requirement in 5.9.4 or 5.9.5 to be verified, it is necessary: • for multigrade-dispensers to measure the quantities of both components; • for gasoline-oil-dispensers to measure either the quantities of oil and gasoline or the quantities of oil and mixture; and • for both types to make the separate collection of both components feasible during verification or have an adequate calibration procedure to check effective dispensed volumes.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.9.4	The accuracy of the blending ratio for multigrade-dispensers shall be as follows. The designations of the various mixtures being indicated as the ratio of quantities of the two components (for example 1:1), the real ratio of the quantities of two components shall be within the limits of ± 5 %, i.e. the real ratio $k_{real} = V_2 / V_1$ of quantities of both components determined during the verification shall be equal to the nominal (indicated) ratio k_{nom} , within the limits: $k_{min} = k_{nom} - 0.05\ k_{nom}$ and $k_{max} = k_{nom} + 0.05\ k_{nom}$ Examples: Designation 3:1 1:1 1:3 k_{nom} 0.333 1.00 3.00 k_{min} 0.316 0.95 2.85 k_{max} 0.350 1.05 3.15				
5.9.5	Oil injected downstream of the meter. In this case, oil is not measured with the volume of gasoline, and oil mix/injection shall be disabled to perform the accuracy test. The contribution/volume of oil injected can be checked as additional volume dispensed when the oil injection is enabled. The accuracy of the total volume, with and without oil injected, shall both meet the MPE requirements. *Note 1:* If the influence of the additive injection is negligible the additive injection system shall be excluded from metrological control. *Note 2:* If a non-continuous system is used for oil injection this should not have an effect on the MPE. Special means shall be provided in the dispenser to route oil to a special sampling point where the oil volume to be injected is collected and volume measured for verification of the blend ratio. The sampling point shall be capable of being sealed to prevent fraud.				
5.9.6	If the blend dispenser is capable of delivering more than one mixture with the same nozzle and the blending ratios are being guaranteed, the installation of two hoses and a special blending device close to the transfer point is required. If the blend dispenser can deliver only one mixture per nozzle, the blending device may be installed inside the dispenser, using a single hose per nozzle. *Note:* This might be allowed in some countries when more than one blending ratio is available.				
5.9.7	If the blend dispenser is capable of delivering one or both single components (in addition to the mixtures) with a common nozzle, a device shall prevent the liquid flow through the unused part of the blend device.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.9.8	The lubricating oil part of a gasoline-oil-dispenser shall be designed so as to prevent air bubbles in the oil passing through the oil measuring device. There shall also be a device to detect the presence of oil. In the absence of oil, delivery has to be stopped by means, e.g. of: • an intermediate oil reservoir and a device which stops the delivery when the oil reservoir is empty; and • a pressure detecting device which stops the delivery in the case of an oil pressure drop.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.10	**Measuring systems for bunkering**				
5.10.1	The requirements of 5.10 apply to all measuring systems for bunkering. *Note 1:* Measuring systems for bunkering are located either on a special bunkering vessel (such as bunker barge/tanker) or on the receiving ship. *Note 2:* Systems that measure LNG in a bunkering application are covered by 5.11.				
5.10.2	Bunkering systems are non-interruptible.				
5.10.3	The requirements in 5.7.1 and 5.7.3 are applicable to measuring systems for bunkering. When a system is capable of bi-directional flow, it must evaluated bi-directionally. The MPE requirements of 2.10.4.2 shall be applied.				
5.10.4	The liquid to be measured in the system may include gas/air during a minor part of the delivery period. A type P checking facility must be present to detect the presence of gas/air, enabling the effect of gas/air on the measured quantity to be detected. The effect of gas/air on the actual transferred quantity during delivery/receipt shall be continuously calculated and indicated as the flow-weighted average effect on the transferred quantity. Upon completion of the delivery/receipt, the effect of air is calculated as the flow-weighted average of the total transferred quantity and shall not exceed the value of line C of Table 3 for a legal transaction. If the effect of gas/air exceeds the value of line C in Table 3 (resulting in a non-legal transaction), a warning is displayed and the data is stored and/or printed, and the fact that the quantity of gas/air in the liquid has exceeded the limits is marked. The operator shall take measures to make the transaction legally acceptable, by reducing gas/air entrainment during the delivery based on the indication of entrained gas/air. The manufacturer shall specify the critical characteristics of the checking facility; instructions for the use of the checking facility shall be provided by the manufacturer. *Note:* The effect of gas/air on the accuracy will be quantified during type evaluation to configure this as parameter within the system.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.11	**Measuring systems for Liquefied Natural Gas (LNG)**				
5.11.1	The design and operation of an LNG measuring system shall ensure that the product in the liquid flow meter remains in a liquid state during the measurement.				
5.11.2	LNG delivery systems shall indicate quantity delivered in terms of mass. *Note:* Supplemental information may include energy unit quantity.				
5.11.3	Requirements in 5.1.6, 5.1.7, 5.1.8, 5.1.10, 5.1.11, 5.1.12, 5.1.13, 5.1.14, 5.1.15 and 5.1.16 are applicable to LNG fuel dispensers. LNG fuel dispensers for direct selling to the public shall have a minimum measured quantity not exceeding 20 kg.				
5.11.4	For measuring systems mounted on road tankers and LNG fuel dispensers, the quantity indicating device and its printing device, if provided, shall comply with the requirements in 3.2.4.				
5.11.5	When it is necessary to cool the delivery path of the LNG prior to making a delivery (to prevent vaporisation of the liquid), the measuring system may include a circuit, downstream of the meter, to allow for the recirculation of product. Such circuits shall be equipped with a suitable means to indicate when there is product flowing through the circuit. If flow is detected in this circuit before or during a delivery, the delivery shall not be started or be terminated.				
5.11.6	If the piping/hose downstream of the meter of an LNG system is not designed to remain filled between transactions, the system must employ a means to automatically account for the quantity of product required to fill the piping/hose downstream of the meter prior to starting a transaction. The calculator that indicates the total mass of the transaction may: • reset to a negative value (buyer credit) compensating for the mass of LNG that is missing from the hose during normal transaction conditions, prior to commencing the transaction; • reset to zero before the transaction commences, but after the hose has been filled; or • suppress the advancement of the indication until the piping/hose is charged and start the transaction at zero at that time.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.11.7	When LNG is measured using a measuring system other than an LNG fuel dispenser, any connection between the vapour space of the storage tank and that of the receiving tank is prohibited unless a correction device is used to measure any vapour returned. In that case, the vapour quantity shall be subtracted from the liquid quantity. The vapour quantity shall be measured with an accuracy better than 20 %. The manufacturer shall specify the operating conditions required for the correction device to ensure the stated accuracy. A suitable correction device can be a flow meter in the vapour return line. *Note:* See the testing procedures for the vapour return meter in Annex L.5 of R 117-2. There shall not be an ability to flow liquid between the delivery tank and the receiving tank through the vapour return line. If it is possible for liquid to enter the gas return line, provisions shall be made to detect this and stop the transaction.				
5.11.8	For LNG fuel dispensers, any connection between the vapour space of the storage tank and that of the receiving tank is prohibited during the transaction (unless the system is equipped with a vapour return correction device). When the LNG fuel dispenser has a vapour return correction device, 5.11.7 is also applicable. In addition, all of the following are prohibited: • a negative indication at the start of a transaction (e.g. because of the pressure relief of the receiving tank; see 5.11.9); • a decreasing totaliser at any moment during the transaction; • a separate indication for vapour return quantity and a separate price indication for vapour return quantity; and • a gas flow between the receiving and the storage tank when the liquid flow is stopped (either on a temporary basis or at the end of the transaction).				
5.11.9	To accommodate the delivery of LNG to a vehicle tank, the pressure in the receiving tank may be relieved prior to commencing a transaction. *Note 1:* This may be done through the use of a separate vapour return line which must be disconnected before the transaction is initiated. Alternatively, the pressure may be relieved via the piping/hose and the recirculation circuit noted in 5.11.5. National law may specify that the relief of pressure from the receiving tank prior to the commencement of a transaction is not part of the transaction. *Note 2:* It is preferable that the vapour is not vented to the atmosphere.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
5.11.10	Pressure relief valves may be incorporated in measuring systems in order to prevent excessively high pressures. If they are located downstream of the meter, they shall open to the atmosphere or be connected to the receiving tank. In no case shall the pressure relief valves located upstream of the meter be connected to the pressure relief located downstream by pipes (which would bypass the meter).				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
Annex A	**Requirements for software-controlled components and measuring systems**				
A.1	**General requirements**				
A.1.1	**Software identification**				
	Legally relevant software of a measuring system and/or its constituents shall be clearly identified with the software version. The identification may consist of more than one part but at least one part shall be dedicated to the legal purpose. The identification shall be inextricably linked to the software itself and shall be presented or printed on command or displayed during operation or at start up for a measuring instrument that can be turned off and on again. If a sub-assembly/electronic device has neither a display nor a printer, the identification shall be sent via a communication interface in order to be displayed/printed on another sub-assembly/electronic device. As an exception, an imprint of the software identification on the instrument/electronic device shall be an acceptable solution if it satisfies all of the following conditions: (1) the user interface does not have any control capability to activate the indication of the software identification on the display, or the display does not technically allow the identification of the software to be shown (analogue indicating device or electromechanical counter); (2) the instrument/electronic device does not have an interface to communicate the software identification; and (3) after production of the instrument/electronic device, a change of the software is not possible, or only possible if the hardware or a hardware component is also changed. The manufacturer of the hardware or the concerned hardware component is responsible for ensuring that the software identification is correctly marked on the concerned instrument/electronic device. The software identification and the means of identification shall be stated in the type evaluation certificate. *Note:* Each measuring instrument in use shall conform to the approved type. The software identification enables surveillance personnel and persons affected by the measurement to determine whether the instrument under consideration conforms to the approved type.				
A.1.2	**Correctness of algorithms and functions**				
	The algorithms and functions of the measuring system and/or its constituents shall be appropriate and functionally correct. It shall be possible to examine algorithms and functions either by functional testing of software functions (VFTSw) or documentary analysis (AD), of the complete measuring system or with simulated test inputs.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
A.1.3	**Software securing and protection**				
A.1.3.1	The legally relevant software shall be secured against unauthorised modification, loading, or changes by swapping the memory device. In addition to mechanical sealing, technical means may be necessary to protect measuring systems equipped with an operating system or an option to load software.				
A.1.3.2	Only clearly documented functions (see A.3) are allowed to be activated by the user interface, which shall be realised in such a way that it does not facilitate fraudulent use.				
A.1.3.3	Parameters that fix the legally relevant characteristics of the measuring system shall be protected against unauthorised modification. For the purpose of verification it shall be possible to display or print the current parameter settings.				
A.1.3.4	Software protection comprises appropriate sealing by mechanical, electronic and/or cryptographic means, making an unauthorised intervention impossible or evident.				
A.1.4	**Prevention of misuse**				
	A measuring instrument shall be constructed in such a way that possibilities for unintentional, accidental, or intentional misuse are minimal. The presentation of the measurement results should be unambiguous for all parties affected (stakeholders).				
A.1.5	**Support of fault detection**				
	Software may be involved in the checking facilities used for the detection of faults and to act upon significant faults or to prevent these significant faults from occurring. In such a case, this detecting software is considered legally relevant. The documentation to be submitted for type evaluation shall contain a list of parameters and their valid and controlled ranges which may generate faults and which will be detected by the software including the expected reaction and, if necessary for understanding the detection algorithm, its description.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
A.2	**Requirements specific for configurations**				
A.2.1	**Specifying and separating relevant parts and specifying interfaces of parts**				
	Metrologically critical parts of a measuring system – whether software or hardware parts – shall not be inadmissibly influenced by other parts of the measuring system. This requirement applies if the measuring system and/or its constituent parts have interfaces for communicating with other electronic devices, with the user, or with other software parts next to the metrologically critical parts.				
A.2.1.1	**Separation of constituents of a measuring system**				
A.2.1.1 a	Constituents of a measuring system that perform functions which are legally relevant shall be identified, clearly defined, and documented. These form the legally relevant part of the measuring system.				
A.2.1.1 b	It shall not be possible that the legally-relevant functions and the data of constituents can be inadmissibly influenced by commands received via an interface. This implies that there is an unambiguous assignment of each command to all initiated functions or data changes in the constituent.				
A.2.1.2	**Separation of software parts**				
A.2.1.2 a	All software modules (programs, subroutines, objects, etc.) that perform legally relevant functions or that contain legally relevant data domains form the legally relevant software part of a measuring system. This part shall be made identifiable as described in A.1.1. If the separation of the software is not possible, the software is legally-relevant as a whole.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
A.2.1.2 b	If the legally relevant software part communicates with other software parts, a software interface shall be defined. All communication shall be performed exclusively via this interface. The legally relevant software part and the interface shall be clearly documented. All legally relevant functions and data domains of the software shall be described to enable a type approval authority to decide on correct software separation. The interface consists of program code and dedicated data domains. Defined coded commands or data are exchanged between the software parts by storing to the dedicated data domain by one software part and reading from it by the other. Reading and writing program code is part of the software interface. The data domain forming the software interface, including the code that exports from the legally relevant part to the interface data domain and the code that imports from the interface to the legally relevant part, shall be clearly defined and documented. The declared software interface shall not be circumvented. The manufacturer is responsible for respecting these constraints. Technical means (such as sealing) of preventing a program from circumventing the interface or programming hidden commands are not possible. The programmer of the legally relevant software part, as well as the programmer of the legally non-relevant part, should be provided with instructions concerning these requirements by the manufacturer.				
A.2.1.2 c	There shall be an unambiguous assignment of each command to all initiated functions or data changes in the legally relevant part of the software. Commands that communicate through the software interface shall be declared and documented. Only documented commands are allowed to be activated through the software interface. The manufacturer shall state the completeness of the documentation of commands.				
A.2.1.2 d	Where legally relevant software has been separated from non-relevant software, the legally relevant software shall have priority using the resources over non-relevant software. The measurement task (realised by the legally relevant software part) shall not be delayed or blocked by other tasks. The manufacturer is responsible for respecting these constraints. Technical means for preventing a legally non-relevant program from disturbing legally relevant functions shall be provided. The programmer of the legally relevant software part as well as the programmer of the legally non-relevant part should be provided with instructions concerning these requirements by the manufacturer.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
A.2.2	**Shared indications**				
	A display or printout may be employed for presenting both information from the legally relevant part of software and other information. Software that realises the indication of measurement values and other legally relevant information belongs to the legally relevant part. The window containing this data shall have highest priority, i.e. it shall not be deleted by other software or overlapped by windows generated by other software, or minimised, or made invisible as long as the measurement is running and the presented results are needed for the legally-relevant purpose.				
A.2.3	**Storage of data, transmission via communication systems**				
	If measurement values (i.e. the final completed measurement result) will be used at a location different from that of the measurement or at a later stage than the moment of measurement, these measurement values may need to leave the measuring system or device and be stored or transmitted in an insecure environment before being used for legal purposes. In this case the requirements in A.2.3.1, A.2.3.2 and A.2.3.3 apply:				
A.2.3.1	The measurement value stored or transmitted shall be accompanied by all relevant information necessary for the future legally relevant use. The time stamp shall be read from the clock of the device. The setting of the time and date shall be secured.				
A.2.3.2	The data shall be protected by software means so as to guarantee the authenticity, integrity and, if necessary the correctness of the information concerning the time of measurement. The software that displays or further processes the measurement values (the final completed measurement result) and the accompanying data shall check the time of measurement, authenticity, and integrity of the data after having read them from the insecure storage or after having received them from an insecure transmission channel. The memory device shall be fitted with a checking facility of type P to ensure that if an irregularity is detected, the data shall be discarded or marked unusable. Software modules that prepare data for storing or sending, or that check data after reading or receiving are considered part of the legally relevant software.				
A.2.3.3	When transferring measurement values (the final completed measurement result) through an open network, it is necessary to apply cryptographic methods. Confidentiality keys employed for this purpose shall be kept secret and secured in the measuring instruments, electronic devices, or sub-assemblies involved. Means shall be provided whereby these keys can only be input or read if a seal is broken.				
A.2.4	**Transmission delay or interruption**				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
	The measurement shall not be inadmissibly influenced by a transmission delay or interruption. If network services become very slow or unavailable, no measurement data shall be lost. If there is a risk of loss of measurement data, the measurement process shall be stopped.				
A.2.4	**Automatic storage**				
	When, considering the application, data storage is required, measurement data must be stored automatically when the measurement is concluded, i.e. when the final value used for the legal purpose has been generated. The storage device shall have sufficient permanency to ensure that the data will not become corrupted under normal storage conditions. There shall be sufficient memory storage for any particular application. When the final value used for the legal purpose results from a calculation, all data that are necessary for the calculation shall be automatically stored with the final value.				
A.2.5	**Deletion of stored data**				
	Stored data concerning a single transaction and not relevant to maintain for other purposes may be deleted on the condition that the transaction is settled. Only after this condition is met and insufficient memory capacity is available for storage of successive data, is it permitted to delete memorised data when both the following conditions are met: • the sequence of deletion of data shall be in the same order as the recording order (FIFO) while the rules established for the particular application are respected; and • the required deletion will start either automatically or after a specific manual operation.				
A.2.6	**Compatibility of operating system and hardware, portability**				
	The manufacturer shall identify the hardware and software environment that is suitable. Minimum resources and a suitable configuration which is necessary for correct functioning shall be declared by the manufacturer and stated in the type approval certificate.				
	Technical means shall be provided to prevent operation if the minimal configuration requirements are not met.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
A.3	**Maintenance and reconfiguration**				
A.3.1	**Versions**				
	Only versions of legally-relevant software that conform to the approved type are allowed for use.				
A.3.2	**Verified update**				
	After the update of the legally relevant software of a measuring instrument (exchange with another approved version or re-installation), the measuring instrument is not allowed to be employed for legal purposes before a verification of the instrument has been performed and the securing means have been renewed.				
A.3.3	**Traced update**				
	a) Traced update of software shall be automatic. Upon completion of the update procedure, the software protection environment shall be at the same level as required by the type approval. b) The target measuring instrument shall have fixed legally-relevant software. c) Technical means shall be employed to guarantee the authenticity of the loaded software. d) If the loaded software fails the authenticity check, the instrument shall discard it and use the previous version of the software or switch to an inoperable mode. e) Technical means shall be employed to ensure the integrity of the loaded software, i.e. that it has not been inadmissibly changed before loading. f) Appropriate technical means shall be employed to ensure that traced updates are adequately traceable within the instrument. g) The measuring instrument shall have a sub-assembly/electronic device for the user or owner to express his/her consent. It shall be possible to enable and disable this sub-assembly/electronic device, e.g. by means of a switch that can be sealed or by a parameter. If the sub-assembly/electronic device is enabled, each download must be initiated by the user or owner. If it is disabled, no activity by the user or owner is necessary to perform a download. h) If the requirements A.3.3 a) through f) cannot be fulfilled, it is still possible to update the legally non-relevant software part. In this case, the following requirements shall be met: • there is a distinct separation between the legally relevant and non-relevant software according to A.2.1; • the whole legally-relevant software part cannot be updated without breaking a seal; and • it is stated in the type approval certificate that updating of the legally non-relevant part is acceptable.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
A.3.4	The measuring instrument shall be fitted with a facility to automatically and non-erasably record any adjustment of a device-specific parameter, e.g. an audit trail. The instrument shall be capable of presenting the recorded data.				
A.3.5	The traceability means and records are part of the legally-relevant software and shall be protected as such.				

§ (R 117-1)	Requirement	Pass	Fail	N/A	Remarks
A.4	**Software documentation**				
	All program functions shall be explained in the documentation of the measuring system, including relevant data structures and software interfaces of the legally relevant part of the software that is implemented in the measuring instrument. All commands and their effects shall be completely described in the software documentation. The documentation (for the measuring instrument, constituents of a measuring system, or software module) shall include: a) a description of the legally-relevant software and how the requirements are met; b) a list of the software modules that belong to the legally-relevant part; c) a declaration that all legally relevant functions are included in the description; d) a description of the software interfaces of the legally-relevant software part and of the commands and data flows via this interface, including a statement of completeness; e) a description of the generation of the software identification; f) a list of parameters to be protected and a description of protection means; g) a description of suitable system configuration and minimal required resources (see 5.2.4); h) a description of security means of the operating system (password, etc. if applicable); i) a description of the (software) protection method(s); j) an overview of the system hardware, e.g. topology block diagram, type of computer(s), type of network, etc. Where a hardware component is deemed legally-relevant or where it performs legally relevant functions, this should also be identified; k) a description of the accuracy of the algorithms (e.g. filtering of A/D conversion results, price calculation, rounding algorithms, etc.); l) a description of the user interface, menus, and dialogues; m) the software identification and instructions for obtaining it from an instrument in use; n) a list of commands of each hardware interface of the measuring instrument / electronic device / sub-assembly, including a statement of completeness; o) a list of durability errors that are detected by the software and (if necessary for understanding) a description of the detecting algorithms; p) a description of data sets stored or transmitted; q) if fault detection is realised in the software, a list of faults that are detected and a description of the detecting algorithm; and r) the operating manual.				

E.2 Symbols, units and equations used

Symbol	Description	Unit
Q	Flow rate	[L/min]
Q_i	Indicated flow rate	[L/min]
V	Volume under metering conditions	[L]
V_b	Base volume	[L]
M	Mass	[kg]
T	Temperature	[°C]
P	Pressure	[kPa]
ρ	Density	[kg/m^3]
T_{min}	Minimum temperature (for the application)	[°C]
T_{med}	Medium temperature (for the application)	[°C]
T_{max}	Maximum temperature (for the application)	[°C]
P_{min}	Minimum pressure (for the application)	[kPa]
P_{med}	Medium pressure (for the application)	[kPa]
P_{max}	Maximum pressure (for the application)	[kPa]
ρ_{min}	Minimum density (for the application)	[kg/m^3]
ρ_{med}	Medium density (for the application)	[kg/m^3]
ρ_{max}	Maximum density (for the application)	[kg/m^3]
ρ_{15}	Base density	[kg/m^3]
V_i	Indicated volume under metering conditions*	[L]
V_{bi}	Indicated base volume*	[L]
M_i	Indicated mass*	[kg]
T_i	Indicated temperature	[°C]
P_i	Indicated pressure	[bar]
ρ_i	Indicated density	[kg/m^3]
ρ_{15i}	Indicated base density	[kg/m^3]
V_{ref}	Reference volume under metering conditions	[L]
V_{bref}	Reference base volume	[L]
M_{ref}	Reference mass	[kg]
T_{ref}	Reference temperature	[°C]
P_{ref}	Reference pressure	[bar]
ρ_{ref}	Reference density	[kg/m^3]
ρ_{15ref}	Reference base density	[kg/m^3]
np_{out}	Number of output pulses	[-]
R_{out}	Output resistance	[Ω]
I_{out}	Output current	[mA]
f_{out}	Output frequency	[Hz]
np_{in}	Number of input pulses	[-]

Symbol	Description	Unit
R_{in}	Input resistance	[Ω]
I_{in}	Input current	[mA]
f_{in}	Input frequency	[Hz]
E_V	Deviation on volume under metering conditions	[%]
E_{Vb}	Deviation on base volume	[%]
E_M	Deviation on mass	[%]
E_T	Deviation on temperature	[°C]
E_P	Deviation on pressure	[kPa] or [%]
E_ρ	Deviation on density	[kg/m^3]
MPE_V	Maximum permissible error on volume under metering conditions	[%]
MPE_{Vb}	Maximum permissible error on base volume	[%]
MPE_M	Maximum permissible error on mass	[%]
MPE_T	Maximum permissible error on temperature	[°C]
MPE_P	Maximum permissible error on pressure	[kPa] or [%]
MPE_ρ	Maximum permissible error on density	[kg/m^3]
Avg.	Average	[-]
ε_0	Initial intrinsic error	[L], [kg] or [kg/m^3]
ε_{0V}	Initial intrinsic error on volume	[L]
ε_{0M}	Initial intrinsic error on mass	[kg]
$\varepsilon_{0\rho}$	Initial intrinsic error on density	[kg/m^3]
CCV_V	Critical change value on volume under metering conditions	[%]
CCV_{Vb}	Critical change value on base volume	[%]
CCV_M	Critical change value on mass	[%]
CCV_T	Critical change value on temperature	[°C]
CCV_P	Critical change value on pressure	[bar] or [%]
CCV_ρ	Critical change value on density	[kg/m^3]

*Note*s:

*Indicated measurement value can be the difference between the beginning and the end of the measurement.

Where applicable, flow rate, indicated and/or reference values can be calculated from simulated signals.

Absolute errors are calculated by subtracting the reference value from the indicated value.

Relative errors are calculated by subtracting the reference value from the indicated value; that result is divided by the reference value and multiplied by 100 %.

F Performance tests

F.1 Test reports for influence factor tests and disturbance tests

F.1.1 Disturbance and influence factor tests – climatic and mechanical environmental conditions (R 117-2, 4.8)

F.1.1.1 Dry heat (R 117-2, Table 4.8.5)

Application no.:
Model:
Serial no.:
Test date:
Observer:

	Ambient conditions		
	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition	Input value[(b)]	Indicated measurement value[(b)]	Reference value[(b)]	E_i [%]	MPE [%]
Reference at 20 °C					
°C [(a)]					
Reference at 20 °C					

Passed	☐ Yes	☐ No

Remarks:

Notes: [(a)] Specified by the manufacturer, see applicable test levels in R 117-2, Table 4.8.5

[(b)] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.1.2 Cold (R 117-2, Table 4.8.6)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition	Input value[(b)]	Indicated measurement value[(b)]	Reference value[(b)]	E_i [%]	MPE [%]
Reference at 20 °C					
°C [(a)]					
Reference at 20 °C					

Passed	☐ Yes	☐ No

Remarks:

Notes: [(a)] Specified by the manufacturer, see applicable test levels in R 117-2, Table 4.8.6

[(b)] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.1.3 Damp heat, cyclic (condensing) (R 117-2, Table 4.8.7)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition	Input value[b]	Indicated measurement value[b]	Reference value[b]	E_i [%]	MPE [%]
Reference at 20 °C					
Damp heat, EUT switched off [a]					
Reference at 20 °C					

Passed	☐ Yes	☐ No

Remarks:

Notes: [a] Specified by the manufacturer, see applicable test levels in R 117-2, 4.8.3 and Table 4.8.7

[b] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2
C.F.: Checking facility activated during the test

F.1.1.4 Vibration (random) (R 117-2, Table 4.8.8)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition	Input value[(b)]	Indicated measurement value[(b)]	Reference value[(b)]	E_i [%]	MPE [%]
Reference					
Vibration, EUT switched off [(a)]					
Reference					

Passed	☐ Yes	☐ No

Remarks:

Notes: [(a)] Specified by the manufacturer, see applicable test levels in R 117-2, 4.8.4 and Table 4.8.8

[(b)] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2 Disturbance and influence factor tests – electrical tests (R 117-2, 4.9)

F.1.2.1 AC mains voltage variation (R 117-2, Table 4.9.2.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition		Input value [a]	Indicated measurement value [a]	E_i [%]	MPE [%]
	U [V]				
Reference	U_{nom}				
$U_{min} = U_{nom} - 15$ %					
$U_{max} = U_{nom} + 10$ %					
Reference	U_{nom}				

Passed	☐ Yes	☐ No

Remarks:

Note: [a] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2.2 DC mains voltage variation (R 117-2, Table 4.9.2.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition		Input value [b]	Indicated measurement value [b]	E_i [%]	MPE [%]
	U [V]				
Reference	U_{nom}				
U_{min} = [a]					
U_{max} = [a]					
Reference	U_{nom}				

Passed	☐ Yes	☐ No

Remarks:

Notes: [a] Specified by the manufacturer but not less than $U_{nom} - 15\ \% \leq U_{nom} \leq U_{nom} + 10\ \%$

[b] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2.3 AC mains voltage dips, short interruptions and reductions (R 117-2, Table 4.9.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition [a]			Input value [b]	Indicated measurement value [b]	E_i [%]	S.F. [%]	C.F. [yes/no]
Test	Reduction to [%]	Cycles					
Reference							
a							
b							
c							
d							
e							
Reference							

Passed		Yes		No

Remarks:

Notes: [a] Specified by the manufacturer, see applicable test levels in R 117-2, Table 4.9.3
C.F.: Checking facility activated during the test

[b] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2.4 Bursts (transients) on AC and DC mains (R 117-2, Table 4.9.4)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

AC mains power lines

Test condition [a]		Input value [a]	Indicated measurement value [a]	E_i [%]	S.F. [%]	C.F. [yes/no]
Line	Level [kV]					
Reference						
L1 - Phase	+					
	-					
L2 - Neutral	+					
	-					
PE - Earth	+					
	-					
L1 + PE	+					
	-					
L2 + PE	+					
	-					
L1 + L2	+					
	-					
L1 + L2 +PE	+					
	-					
Reference 2						

DC mains power lines

Test condition [a]		Input value [b]	Indicated measurement value [ba]	E_i [%]	S.F. [%]	C.F. [yes/no]
Line	Level [kV]					
Reference						
DC mains cable	+					
DC mains cable	-					
Reference						

Passed	☐ Yes	☐ No

Remarks:

Notes: [a] Specified by the manufacturer, see applicable test levels in R 117-2, Table 4.9.4
C.F.: Checking facility activated during the test

[b] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2.5 Electrostatic discharge (R 117-2, Table 4.9.5)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition				Input value [(b)]	Indicated measurement value [(b)]	E_i [%]	S.F. [%]	C.F. [yes / no]
Nr.	Test Point [(a)]	Level [kV]	C/A					
1	Reference							
2	[1]	+						
3		-						
4	[2]	+						
5		-						
n-2	[n]	+						
n-1		-						
n	Reference							
Reference quantity = (Reference quantity 1 + Reference quantity 2) / 2								

Passed		Yes		No

Remarks:

Notes: C: Contact discharge, A: Air discharge
C.F.: Checking facility activated during the test

[(a)] Location of the discharge points

[(b)] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2.6 Bursts (transients) on signal, data and control lines (R 117-2, Table 4.9.6)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition [a]		Input value [b]	Indicated measurement value [b]	E_i [%]	S.F. [%]	C.F. [yes/no]
Line	Level [kV]					
Reference						
IO-line	+					
	-					
Reference						

Passed	☐ Yes	☐ No

Comments:

Remarks:

Notes: [a] Specified by the manufacturer, see applicable test levels in R 117-2, Table 4.9.6
C.F.: Checking facility activated during the test

[b] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2.7 Surges on signal, data and control lines (R 117-2, Table 4.9.7)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition		Input value [a]	Indicated measurement value [a]	E_i [%]	S.F. [%]	C.F. [yes/no]
Line	Level [kV]					
Reference						
IO-line	+					
	-					
Reference						

Passed		Yes		No

Remarks:

Notes: C.F.: Checking facility activated during the test

[a] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2.8 DC mains voltage dips, short interruptions and (short term) variations (R 117-2, Table 4.9.8)

Voltage dips

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition		Input value [a]	Indicated measurement value [a]	E_i [%]	S.F. [%]	C.F. [yes/no]
Amplitude [% of U_{nom}]	Duration [s]					
Reference						
40	0.01					
	0.03					
	0.1					
	0.3					
	1					
Reference						

Test condition		Input value[a]	Indicated measurement value[a]	E_i [%]	S.F. [%]	C.F. [yes/no]
Amplitude [% of U_{nom}]	Duration [s]					
Reference						
70	0.01					
	0.03					
	0.1					
	0.3					
	1					
Reference						

Passed	☐ Yes	☐ No

Remarks:

Notes: C.F.: Checking facility activated during the test

[a] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

Voltage variations

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition		Input value [a]	Indicated measurement value [a]	E_i [%]	S.F. [%]	C.F. [yes/no]
Amplitude [% of U_{nom}]	Duration [s]					
Reference						
85	0.1					
	0.3					
	1					
	3					
	10					
Reference						

Test condition		Input value	Indicated measurement value	E_i [%]	S.F. [%]	C.F. [yes/no]
Amplitude [% of U_{nom}]	Duration [s]					
Reference						
120	0.1					
	0.3					
	1					
	3					
	10					
Reference						

Passed	☐ Yes	☐ No

Remarks:

Notes: C.F.: Checking facility activated during the test

[a] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

Short interruptions

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition (High and/or low impedance)		Input value [a]	Indicated measurement value [a]	E_i [%]	S.F. [%]	C.F. [yes/no]
Amplitude [% of U_{nom}]	Duration [s]					
Reference						
0	0.001					
	0.003					
	0.01					
	0.03					
	0.1					
	0.3					
	1					
Reference						

Passed	☐ Yes	☐ No

Remarks:

Notes: C.F.: Checking facility activated during the test

[a] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2.9 Ripple on DC mains power (R 117-2, Table 4.9.9)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition		Input value [(a)]	Indicated measurement value [(a)]	E_i [%]	S.F. [%]	C.F. [yes/no]
Line	Frequency [Hz]					
Reference						
Ripple	50					
Ripple	100					
Ripple	150					
Ripple	300					
Reference						

Passed	☐ Yes	☐ No

Remarks:

Notes: C.F.: Checking facility activated during the test

[(a)] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2.10 Surges on AC and DC mains power lines (R 117-2, Table 4.9.10)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

AC mains power lines

Test condition		Input value [a]	Indicated measurement value [a]	E_i [%]	S.F. [%]	C.F. [yes/no]
Line	Level [kV]					
Reference						
phase to earth	+ 2					
phase to earth	– 2					
neutral to earth	+ 2					
neutral to earth	– 2					
phase to neutral	+ 1					
phase to neutral	– 1					
Reference						

Passed	☐ Yes	☐ No

DC mains power lines

Test condition		Input value [a]	Indicated measurement value [a]	E_i [%]	S.F. [%]	C.F. [yes/no]
Line	Level [kV]					
Reference						
+ line to earth	+ 2					
+ line to earth	– 2					
- line to earth	+ 2					
- line to earth	– 2					
+ line to line	+ 1					
+ line to line	– 1					
Reference						

Passed	☐ Yes	☐ No

Remarks:

Notes: C.F.: Checking facility activated during the test

[a] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2.11 Electromagnetic fields of general origin (R 117-2, Tables 4.9.11 and 4.9.11.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition [a]			Input value [b]	Indicated measurement value [b]	E_i [%]	S.F. [%]	C.F. [yes/no]
Frequency		Pol [H/V]					
Start [MHz]	Stop [MHz]						
Reference							
26							
	1000						
Reference							

Passed		Yes		No

Remarks:

Notes: [a] Specified by the manufacturer, see applicable test levels in R 117-2, Table 4.9.11.1
C.F.: Checking facility activated during the test

[b] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2.12 Electromagnetic fields specifically caused by wireless communication networks (R 117-2, Tables 4.9.11 and 4.9.11.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition			Input value [(a)]	Indicated measurement value [(a)]	E_i [%]	S.F. [%]	C.F. [yes/no]
Frequency		Pol [H/V]					
Start [GHz]	Stop [GHz]						
Reference							
0.446							
0.8							
	3						
Reference							

Passed		Yes		No

Remarks:

Notes: C.F.: Checking facility activated during the test

[(a)] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.2.13 Conducted (common mode) currents generated by RF EM fields (R 117-2, Table 4.9.11.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition [a]			Input value [b]	Indicated measurement value [b]	E_i [%]	S.F. [%]	C.F. [yes/no]
Frequency		Pol [H/V]					
Start [MHz]	Stop [MHz]						
Reference							
0.15							
	80						
Reference							

Passed		Yes		No

Remarks:

Notes: [a] Specified by the manufacturer, see applicable test levels in R 117-2, Table 4.9.11.3
C.F.: Checking facility activated during the test

[b] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.3 Tests for EUTs powered by a road vehicle battery (R 117-2, 4.10)

F.1.3.1 Voltage variations (R 117-2, Table 4.10.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition		Input value [(a)]	Indicated measurement value [(a)]	E_i [%]	MPE [%]
Line	Level [V]				
Reference	U_{nom}				
$U_{min} = U_{nom} - 15\ \%$					
$U_{max} = U_{nom} + 10\ \%$					
Reference	U_{nom}				

Passed		Yes		No

Remarks:

Notes: C.F.: Checking facility activated during the test

[(a)] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.3.2 Electrical transient conduction along supply lines (road vehicle battery) (R 117-2, Table 4.10.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test condition		Input value [a]	Indicated measurement value [a]	E_i [%]	S.F. [%]	C.F. [yes/no]
Test pulse	Pulse voltage [V]					
Reference						
2a						
2b						
3a						
3b						
Reference						

Passed	☐ Yes	☐ No

Remarks:

Notes: C.F.: Checking facility activated during the test

[a] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.3.3 Battery voltage variations during starting up a vehicle engine (R 117-2, Table 4.10.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test pulse shape [(a)]	Input value [(b)]	Indicated measurement value [(b)]	E_i [%]	S.F. [%]	C.F. [yes/no]
Reference					
U_S [V]					
U_A [V]					
t_S [s]					
t_f [ms]					
Reference					

Passed	☐ Yes	☐ No

Remarks:

Notes: [(a)] Specified by the manufacturer, see applicable test levels in R 117-2, Table 4.10.3
C.F.: Checking facility activated during the test

[(b)] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.1.3.4 "Load dump" test (R 117-2, Table 4.10.4)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test pulse shape [(a)]	Input value [(b)]	Indicated measurement value [(b)]	E_i [%]	S.F. [%]	C.F. [yes/no]
Reference					
U_S [V]					
R_i [V]					
t_r [ms]					
t_f [ms]					
Reference					

Passed	☐ Yes	☐ No

Remarks:

Notes: [(a)] Specified by the manufacturer, see applicable test levels in R 117-2, Table 4.10.4

[(b)] The applicable units are defined in F.2.11, F.3.2, F.4.2, F.4.4, F.5.2, F.7.1, F.7.3.2

F.2 Test reports for meter sensors and measuring devices (R 117-2, 5.3)

F.2.1 Indication at zero flowrate (R 117-2, 5.3.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Test time [s]	$V_{i\,start}$ [L]	$V_{i\,end}$ [L]	p_t [kPa]	T_t [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Passed		☐	Yes	☐	No

Remarks:

F.2.2 Accuracy at reverse flow conditions

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

$Q(1)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

$Q(2)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

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$Q(n)$ [ℓ/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Passed		Yes		No

Remarks:

Notes: (1) V_i and V_s may be replaced by V_n and V_r, if appropriate.

(2) The units of volume may be replaced by units of mass, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.2.3 Accuracy at metering conditions (R 117-2, 5.3.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Q(1) [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Q(2) [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

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Q(n) [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Passed	☐ Yes	☐ No

Remarks:

Notes: (1) V_i and V_s may be replaced by V_n and V_r, if appropriate.

(2) The units of volume may be replaced by units of mass, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.2.4 Accuracy at metering conditions for drum meter for alcohol (R 117-2, 5.3.2.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no.	Q [L/min]	V_i [L]	T_t [°C]	T_s [°C]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1	Q_1							0.2
2								
3								
1	Q_2							0.25
2								
3								
1	Q_3							0.3
2								
3								

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.2.5 Accuracy at limits of temperature, pressure, viscosity and density (R 117-2, 5.3.3.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no.	Limits of T, p, μ, ρ	Q [L/min]	V_i [L]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1	T_{min} [°C]	Q_{min}					
		Q_{mid}					
		Q_{max}					
	T_{max} [°C]	Q_{min}					
		Q_{mid}					
		Q_{max}					
2	p_{min} [kPa]	Q_{min}					
		Q_{mid}					
		Q_{max}					
	p_{max} [kPa]	Q_{min}					
		Q_{mid}					
		Q_{max}					
3	μ_{min} [mPa·s]	Q_{min}					
		Q_{mid}					
		Q_{max}					
	μ_{max} [mPa·s]	Q_{min}					
		Q_{mid}					
		Q_{max}					
4	ρ_{min} [kg/m^3]	Q_{min}					
		Q_{mid}					
		Q_{max}					
	ρ_{max} [kg/m^3]	Q_{min}					
		Q_{mid}					
		Q_{max}					

Passed	☐ Yes	☐ No

Remarks:

Notes: (1) V_i and V_s may be replaced by V_n and V_r, if appropriate.

(2) The units of volume may be replaced by units of mass, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.2.6 Accuracy of the converted indication within a Coriolis meter (R 117-2, 5.3.3.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

	Meter indication				Reference				
$Q(1)$ [kg/min]	M_i [kg]	V_i [L]	T_i [°C]	ρ_i [kg/m³]	M_n [kg]	V_s [L]	ρ [kg/m³]	T_t [°C]	p_t [kPa]

	Mass		Volume		Density		Temperature	
$Q(1)$ [kg/min]	E [%]	MPE [%]	E [%]	MPE [%]	E [%]	MPE [%]	E [%]	MPE [%]
$\bar{E}$ =	%							
Range =	%							

.
.
.

	Meter indication				Reference				
$Q(n)$ [kg/min]	M_i [kg]	V_i [L]	T_i [°C]	ρ_i [kg/m³]	M_n [kg]	V_s [L]	ρ [kg/m³]	T_t [°C]	p_t [kPa]

	Mass		Volume		Density		Temperature	
$Q(n)$ [kg/min]	E_{Mi} [%]	MPE [%]	E_{vi} [%]	MPE [%]	$E_{\rho i}$ [%]	MPE [%]	E_{Ti} [%]	MPE [%]
$\bar{E}$ =	%							
Range =	%							

Passed		☐ Yes	☐ No

Remarks:

Note: (1) V_s may be replaced by V_r, if appropriate.

Test liquid:
ρ (15 °C) kg/m³
α: °C⁻¹
χ: kPa⁻¹
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C⁻¹
Nominal volume: L

F.2.7 Flow disturbance test (R 117-2, 5.3.4)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Disturber used: Half moon plate

Test no.	Disturber installation position	Q [L/min]	V_i [L]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
Reference		Q_{min}					
		Q_{max}					
1	0°	Q_{min}					
		Q_{max}					
	90°	Q_{min}					
		Q_{max}					
2	0°	Q_{min}					
		Q_{max}					
	90°	Q_{min}					
		Q_{max}					
3	0°	Q_{min}					
		Q_{max}					
	90°	Q_{min}					
		Q_{max}					

Passed	☐ Yes	☐ No

Remarks:

Notes: (1) V_i and V_s may be replaced by V_n and V_r, if appropriate.

(2) The units of volume may be replaced by units of mass, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.2.7 Flow disturbance test (R 117-2, 5.3.4) (cont'd.)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Disturber used: Ball valve

Test no.	Valve opening position	Q [L/min]	V_i [L]	V_s [L]	E_{vi} [%]	E_{vi} [%]	MPE [%]
Reference		Q_{min}					
		Q_{max}					
1	90°	Q_{min}					
		Q_{max}					
	80°	Q_{min}					
		Q_{max}					
	65°	Q_{min}					
		Q_{max}					
	45°	Q_{min}					
		Q_{max}					
2	90°	Q_{min}					
		Q_{max}					
	80°	Q_{min}					
		Q_{max}					
	65°	Q_{min}					
		Q_{max}					
	45°	Q_{min}					
		Q_{max}					
3	90°	Q_{min}					
		Q_{max}					
	80°	Q_{min}					
		Q_{max}					
	65°	Q_{min}					
		Q_{max}					
	45°	Q_{min}					
		Q_{max}					

Passed	☐ Yes	☐ No

Remarks:

Notes: (1) V_i and V_s may be replaced by V_n and V_r, if appropriate.

(2) The units of volume may be replaced by units of mass, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3	Test measures used:	
α:	°C^{-1}	T_r:	°C
χ:	kPa^{-1}	β:	°C^{-1}
μ (20 °C):	mPa·s	Nominal volume:	ℓ

F.2.8 Drum meters for alcohol (R 117-2, 5.3.5)

F.2.8.1 Conversion device (R 117-2, 5.3.5.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

	Indications				Reference values						
Test no. [-]	V_i [L]	V_{bi} [L]	M_i [kg]	ρ_{15i} [kg/m^3]	Q [L/min]	np_{in} [-]	V_{ref} [L]	V_{bref} [L]	M_{ref} [kg]	T_{ref} [°C]	ρ_{15ref} [kg/m^3]
1										T_{min}	
2										T_{med}	
3										T_{max}	

	Error calculations					
	V		V_b		M	
Test no. [-]	E_V [%]	MPE_V [%]	E_{Vb} [%]	MPE_{Vb} [%]	E_M [%]	MPE_M [%]
1						
2						
3						

Passed	☐ Yes	☐ No

Remarks:

Notes: (1) V_i and V_s may be replaced by V_n and V_r, if appropriate.

(2) The units of volume may be replaced by units of mass, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.2.8.2 Volume of individual measuring chambers (R 117-2, 5.3.5.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Chamber no. [-]	V_{nom} [L]	V_s [L]	T_L [°C]	T_s [°C]	E_v [L]	E_v [%]	MPE [%]
1							0.2
n							0.2

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.2.8.3 Inclined drum axis (R 117-2, 5.3.5.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test conditions	Test no.	Q_{min} [L/min]	V_i [L]	T_t [°C]	T_s [°C]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
Reference									
Drum axis Inclined 3°	1								
	2								
	3								
Reference									

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.2.8.4 Test of accuracy of the sampling device (R 117-2, 5.3.5.4)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	V_{nom} [L]	V_s [L]	T_L [°C]	T_s [°C]	E_v [L]	E_v [%]	MPE [ℓ]
1							
n							

Passed	☐ Yes	☐ No

Remarks:

Note: $V_{nom} = n \bullet V_{nom\ ladles}$ [L]
MPE = 0.1 • V_{nom} [L]

Test liquid:

ρ (15 °C)	kg/m^3
α:	°C^{-1}
χ:	kPa^{-1}
μ (20 °C):	mPa·s

Test measures used:

T_r:	°C
β:	°C^{-1}
Nominal volume:	L

F.2.8.5 Test of volume of the containers (R 117-2, 5.3.5.5)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

	V_{nom} [L]	V_s [L]	T_t [°C]	T_s [°C]	E_{vi} [ℓ]	E_{vi} [%]	MPE [%]
Collecting container							± 5
Inserting container							– 5
Surge container							– 2.5

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.2.8.6 Test of accuracy of the thermometer (R 117-2, 5.3.5.6)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test conditions	T_i [°C]	T_s [°C]	E_{Ti} [°C]	MPE [°C]
T_{min}				1
T_{mid}				
T_{max}				

Passed	☐ Yes	☐ No

Remarks:

F.2.9 Endurance test (R 117-2, 5.4)

Accuracy before endurance test

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

$Q(1)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}(B)$ = %	Range = %

$Q(2)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}(B)$ = %	Range = %

$Q(3)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}(B)$ = %	Range = %

Passed	☐ Yes	☐ No

Remarks:

Notes: 1) V_i and V_s may be replaced by V_n and V_r, if appropriate.

2) The units of volume may be replaced by units of mass, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Endurance test

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions at start

Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Date	Time	Observer	Q [ℓ/min]	V_i [L]	Hours run [h]

Remarks:

Note: The units of volume may be replaced by units of mass, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3
α:	°C^{-1}
χ:	kPa^{-1}
μ (20 °C):	mPa·s

Accuracy after endurance test

Ambient conditions at end

Application no.:
Model:
Serial no.:
Test date:
Observer:

Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			hPa
Time:			

$Q(1)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$(A) = %	$\bar{E}$(A) – $\bar{E}$(B) = %

$Q(2)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$(A) = %	$\bar{E}$(A) – $\bar{E}$(B) = %

$Q(3)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$(A) = %	$\bar{E}$(A) – $\bar{E}$(B) = %

Passed		☐	Yes	☐ No

Remarks:

Notes: 1) V_i and V_s may be replaced by V_n and V_r, if appropriate.

2) The units of volume may be replaced by units of mass, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.2.10 Accuracy on the minimum measured quantity (R 117-2, 5.5)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Q_{min} [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Q_{max} [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Passed		Yes		No

Remarks:

Notes: 1) V_i and V_s may be replaced by V_n and V_r, if appropriate.

2) The units of volume may be replaced by units of mass, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.2.11 Additional influence and disturbance tests for electronic measuring devices (R 117-2, 5.6)

The test report formats of F.1 are applied.

Input value is:	Flowrate	[L/min or m^3/h or t/h or kg/min or pulses/min]
Indicated measurement value is:	Indicated quantity	[L or m^3 or t or kg]

F.3 Test reports for electronic calculators, indicating devices and associated devices (R 117-2, 6)

F.3.1 Accuracy of electronic calculators and indicating devices (R 117-2, 6.2.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test No. [-]	Q_i [L/min]	np_{in} [-]	V_{ref} [L]	V_i [L]	E_V [%]	MPE_V [%]
1						
2						
3						

Passed	☐ Yes	☐ No

Remarks:

Note: The units of volume may be replaced by units of mass, if appropriate.

F.3.2 Influence factor tests and disturbance tests (R 117-2, 6.2.2 and 6.2.3)

The test report formats of F.1 are applied.

Input value is:	Flowrate	[L/min or m^3/h or t/h or kg/min or pulses/min]
Indicated measurement value is:	Indicated quantity	[L or m^3 or t or kg]

F.4 Test reports for conversion devices as part of an electronic calculator (R 117-2, 6.3)

F.4.1 Accuracy: First approach (R 117-2, 6.3.1.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			hPa
Time:			

	Indications				Reference values								
Test no. [-]	V_i [L]	V_{bi} [L]	M_i [kg]	ρ_{15i} [kg/m³]	Q [L/min]	np_{in} [-]	V_{ref} [L]	V_{bref} [L]	M_{ref} [kg]	T_{ref} [°C]	P_{ref} [kPa]	ρ_{ref} [kg/m³]	ρ_{15ref} [kg/m³]
1										T_{min}	P_{min}	ρ_{min}	
2										T_{med}	P_{med}	ρ_{med}	
3										T_{max}	P_{max}	ρ_{max}	

	Error calculations					
	V		V_b		M	
Test no. [-]	E_V [%]	MPE_V [%]	E_{Vb} [%]	MPE_{Vb} [%]	E_M [%]	MPE_M [%]
1						
2						
3						

Passed	☐ Yes	☐ No

Remarks:

F.4.2 Influence factor tests and disturbance tests (R 117-2, 6.3.1.2 and 6.3.1.3)

The test report formats of F.1 are applied.

Input values are:	Flowrate Q	[L/min]
	Reference temperature T_{ref}	[°C]
	Reference pressure p_{ref}	[kPas]
	Reference density ρ_{ref}	[kg/m^3]
	Reference volume V_{ref}	[L]
	Reference mass M_{ref}	[kg]
Indicated measurement values are:	Indicated volume V_i	[L]
	Indicated volume at base condition V_{bi}	[L]
	Indicated mass M_i	[kg]

F.4.3 Accuracy: Second approach (R 117-2, 6.3.2.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

	V						T				
Test No. [-]	Q_i [L/min]	np_{in} [-]	V_{ref} [L]	V_i [L]	E_V [%]	MPE_V [%]	R_{in} [Ω]	T_{ref} [°C]	T_i [°C]	E_T [°C]	MPE_T [°C]
1								T_{min}			
2								T_{med}			
3								T_{max}			

	P							ρ				
Test No. [-]	I_{in} [mA]	p_{ref} [kPa]	p_i [kPa]	E_P [kPa]	E_P [%]	MPE_P [kPa]	MPE_P [%]	f_{in} [Hz]	ρ_{ref} [kg/m³]	ρ_i [kg/m³]	E_ρ [kg/m³]	MPE_ρ [kg/m³]
1		p_{min}			-				ρ_{min}			
2		p_{med}		-					ρ_{med}			
3		p_{max}			-				ρ_{max}			

	Calculation V_{bi}, V_{bref} based on V_i, T_{ref}, p_{ref} and ρ_{ref}					Calculation M_i, M_{ref} based on V_i, T_{ref}, p_{ref} and ρ_{ref}			
Test No. [-]	V_{bi} [L]	V_{bref} [L]	ρ_{15ref} [kg/m³]	E_{Vb} [%]	MPE_{Vb} [%]	M_i [kg]	M_{ref} [kg]	E_M [%]	MPE_M [%]
1									
2									
3									

Passed	☐ Yes	☐ No

Remarks:

F.4.4 Influence factor tests and disturbance tests (R 117-2, 6.3.2.2 and 6.3.2.3)

The test report formats of F.1 are applied.

Input values are:	Flowrate Q or number of pulses np_{in}	[L/min] or [pulses/min]
	Reference temperature T_{ref} or resistance R_{in}	[°C] or [Ω]
	Reference pressure p_{ref} or current I_{in}	[bar] or [mA]
	Reference density ρ_{ref} or frequency f_{in}	[kg/m^3] or [Hz]
Indicated measurement values are:	Indicated volume V_i	[L]
	Indicated volume at base condition V_{bi}	[L]
	Indicated mass M_i	[kg]

F.5 Test reports for associated measuring devices (R 117-2, 6.4)

F.5.1 Accuracy test (R 117-2, 6.4.1)

Ambient conditions

Model:
Test date:
Observer:

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

	T				
Test No. [-]	T_{ref} [°C]	R_{out} [Ω]	T_i [°C]	E_T [°C]	MPE_T [°C]
1	T_{min}				
2	T_{med}				
3	T_{max}				

	P						
Test No.	P_{ref}	I_{out}	P_i	E_P	E_P	MPE_P	MPE_P
[-]	[kPa]	[mA]	[kPa]	[kPa]	[%]	[kPa]	[%]
1	P_{min}						
2	P_{med}						
3	P_{max}						

	ρ				
Test No.	ρ_{ref}	f_{out}	ρ_i	E_ρ	MPE_ρ
[-]	[kg/m^3]	[Hz]	[kg/m^3]	[kg/m^3]	[kg/m^3]
1	ρ_{min}				
2	ρ_{med}				
3	ρ_{max}				

Passed	☐ Yes	☐ No

Remarks:

F.5.2 Influence factor tests and disturbance tests (R 117-2, 6.4.2 and 6.4.3)

The test report formats of F.1 are applied.

Input values are:	Reference temperature T_{ref}	[°C]
	Reference pressure p_{ref}	[bar]
	Reference density ρ_{ref}	[kg/m^3]
Indicated measurement values are:	Indicated temperature T_i or resistance R_{out}	[°C] or [Ω]
	Indicated pressure p_i or current I_{out}	[bar] or [mA]
	Indicated density ρ_i or frequency f_{out}	[kg/m^3] or [Hz]

F.5.3 Test of response time of the measuring system temperature sensor (R 117-2, 6.5)

Application no.:
Model:
Serial no.:
Test date:
Observer:

	Ambient conditions		
	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

ΔT [°C]	MMQ [L]	Q_{max} [L/min]	t_d [s]	t_{90} [s]	τ_{max} [s]

Passed	☐ Yes	☐ No

Remarks:

Notes: t_d [s] = Delivery time = 2 MMQ / Q_{max}

τ_{max} [s] = Maximum time constant = $t_d \times 2.3025$

ΔT [°C] = Temperature change = $T_2 - T_1$

t_{90} = 90 % of T_2

F.6 Test reports for gas elimination devices

F.6.1 Gas separator test (R 117-2, 7.2.1.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	V_i [L]	V_s [L]	V_n [L]	p_t [kPa]	V_a [L]	V_a/V_n [-]	$E_{vi\ (without\ gas)}$ [%]	$E_{vi\ (gas)}$ [%]	E_{vi} [%]
Reference	Q(1)									
1										
2										
Reference										
1										
2										
Reference	Q(n)									
1										
2										

Passed		Yes		No

Remarks:

Notes: $E_{vi} = E_{vi\ (gas)} - E_{vi\ (without\ gas)}$

$E_{vi\ (gas)} = (V_i\ V_n) / V_n$

$V_a = (V_{gas\ meter}\ (p_t + p_{atm})) / p_{atm}$

V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.6.2 Gas extractor test (R 117-2, 7.2.1.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Reference before testing											
Gas			Liquid								
P_{gr} [kPa]	V_{gr} [L]	V_{nom} [L]	Q_{max} [L/min]	T_L [°C]	P_L [kPa]	V_s [L]	V_i [L]	E [L]	E [%]	Gas in liquid [Yes/no]	Gas sep. shut off [Yes/no]
0	0	0								no	no

Test												
Gas			Liquid									Gas extractor
P_{gr} [kPa]	V_{gr} [L]	V_{nom} [L]	Q_{max} [L/min]	T_L [°C]	P_L [kPa]	V_{ref} [L]	V_i [L]	E [L]	E [%]	Gas in liquid [Yes/no]	Gas sep. shut off [Yes/no]	MPE [%]

Reference after testing											
Gas			Liquid								
P_{gr} [kPa]	V_{gr} [L]	V_{nom} [L]	Q_{max} [L/min]	T_L [°C]	P_L [kPa]	V_s [L]	V_i [L]	E [L]	E [%]	Gas in liquid [Yes/no]	Gas sep. shut off [Yes/no]
0	0	0									

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.6.3 Special gas extractor not intended for road tankers (R 117-2, 7.2.1.3)

Test on gas separator function: see test report format F.6.1
Test on gas extractor function: see test report format F.6.2

F.6.4 Special gas extractor intended for road tankers (R 117-2, 7.2.1.4)

F.6.4.1 Residual discharge test from the supply tank (R 117-2, 7.2.1.4.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_i [L]	T_t [°C]	p_t [kPa]	V_s [L]	T_s [°C]	V_n [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1										
2										
3										

$\bar{E}$ = %	Range = %

Passed		☐	Yes	☐	No

Remarks:

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.6.4.2 Gas pocket test (R 117-2, 7.2.1.4.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Reference before testing										
Gas			Liquid							
P_{gr} [kPa]	V_{gr} [L]	V_{nom} [L]	Q_{max} [L/min]	T_L [°C]	P_L [kPa]	V_s [L]	V_i [L]	E [L]	Gas in liquid [Yes/no]	Gas sep. shut off [Yes/no]
0	0	0							no	no

Test											
Gas			Liquid								Gas extractor
P_{gr} [kPa]	V_{gr} [L]	V_{nom} [L]	Q_{max} [L/min]	T_L [°C]	P_L [kPa]	V_{ref} [L]	V_i [L]	E [L]	Gas in liquid [Yes/no]	Gas sep. shut off [Yes/no]	1 % of MMQ [L]

Reference after testing										
Gas			Liquid							
P_{gr} [bar]	V_{gr} [L]	V_{nom} [L]	Q_{max} [L/min]	T_L [°C]	P_L [kPa]	V_s [L]	V_i [L]	E [L]	Gas in liquid [Yes/no]	Gas sep. shut off [Yes/no]
0	0	0								

Passed	☐ Yes	☐ No

Remarks:

Notes: V_i and V_s may be replaced by V_n and V_r, if appropriate.

E [L] must be smaller than 1 % of MPE [L]

Test liquid:

ρ (15 °C)	kg/m^3	Test measures used:	
α:	°C^{-1}	T_r:	°C
χ:	kPa^{-1}	β:	°C^{-1}
μ (20 °C):	mPa·s	Nominal volume:	L

F.6.4.3 Switching test to an empty supply tank (R 117-2, 7.2.1.4.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_i [L]	T_t [°C]	p_t [kPa]	V_s [L]	T_s [°C]	V_n [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1										
2										
3										

$\bar{E}$ = %	Range = %

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.6.5 Gas elimination devices forming part of a measuring system (R 117-2, 7.2.2)

F.6.5.1 Gas separator in fuel dispenser (R 117-2, 7.2.2.1.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	V_i [L]	V_s [L]	V_n [L]	p_t [kPa]	V_a [L]	V_a/V_n [-]	$E_{vi\ (without\ gas)}$ [%]	$E_{vi\ (gas)}$ [%]	E_{vi} [%]
Reference	$Q(1)$									
1										
2										
Reference										
1										
2										
Reference	$Q(n)$									
1										
2										

Passed	☐ Yes	☐ No

Remarks:

Notes: $E_{vi} = E_{vi\ (gas)} - E_{vi\ (without\ gas)}$

$E_{vi\ (gas)} = (V_i\ V_n) / V_n$

$V_a = (V_{gas\ meter}\ (p_t + p_{atm})) / p_{atm}$

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.6.5.2 Gas extractor tests (R 117-2, 7.2.2.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Reference before testing											
Gas			Liquid								
P_{gr} [kPa]	V_{gr} [L]	V_{nom} [L]	Q_{max} [L/min]	T_L [°C]	P_L [kPa]	V_s [L]	V_i [L]	E [L]	E [%]	Gas in liquid [Yes/no]	Gas sep. shut off [Yes/no]
0	0	0								no	no

Test												
Gas			Liquid									Gas extractor
P_{gr} [kPa]	V_{gr} [L]	V_{nom} [L]	Q_{max} [L/min]	T_L [°C]	P_L [kPa]	V_{ref} [L]	V_i [L]	E [L]	E [%]	Gas in liquid [Yes/no]	Gas sep. shut off [Yes/no]	MPE [%]

Reference after testing											
Gas			Liquid								
P_{gr} [bar]	V_{gr} [L]	V_{nom} [L]	Q_{max} [L/min]	T_L [°C]	P_L [bar]	V_s [L]	V_i [L]	E [L]	E [%]	Gas in liquid [Yes/no]	Gas sep. shut off [Yes/no]
0	0	0									

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.6.5.3 Special gas extractor not intended for measuring systems on road tankers (R 117-2, 7.2.2.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Reference before testing							
Q_{max} [L/min]	T_L [°C]	P_L [kPa]	V_s [L]	V_i [L]	E [L]	Gas in liquid [Yes/no]	Gas sep. shut off [Yes/no]
						no	no

Test								
Q_{max} [L/min]	T_l [°C]	P_L [kPa]	V_{ref} [L]	V_i [L]	E [L]	Gas in liquid [Yes/no]	Gas sep. shut off [Yes/no]	Gas extractor 1 % of MMQ [L]

Passed	☐ Yes	☐ No

Remarks:

Notes: V_i and V_s may be replaced by V_n and V_r, if appropriate.
E [L] must be smaller than 1 % of MPE

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.6.5.4 Special gas extractor intended for measuring systems on road tankers (R 117-2, 7.2.2.3)

Residual discharge test: Test report format F.6.4.1 can be used.

Gas pocket test: Test report format F.6.4.2 can be used

Switching test on empty supply tank: Test report format F.6.4.3 can be used

F.7 Test reports for ancillary devices (R 117-2, 8)

F.7.1 Influence factor tests and disturbance tests for printing devices (R 117-2, 8.3)

The test report formats of F.1 are applied.

Input values are:	Data sent to the printing device	These data can be for example: [L or m^3 or t or kg or NCU or NCU / L or NCU /m^3 or NCU / t or NCU / kg]
Output values are:	Data printed by the printing device	

F.7.2 Influence factor tests and disturbance tests for memory devices (R 117-2, 8.4)

The test report formats of F.1 are applied.

Input values are:	Data to be stored	These data can be for example: [L or m^3 or t or kg or NCU or NCU / L or NCU /m^3 or NCU / t or NCU / kg]
Output values are:	Accessed data	

F.7.3 Conversion devices (R 117-2, 8.5)

F.7.3.1 Accuracy tests (R 117-2, 8.5.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

	V						T				
Test No. [-]	Q_i [L/min]	np_{in} [-]	V_{ref} [L]	V_i [L]	E_V [%]	MPE_V [%]	R_{in} [Ω]	T_{ref} [°C]	T_i [°C]	E_T [°C]	MPE_T [°C]
1								T_{min}			
2								T_{med}			
3								T_{max}			

	P							ρ				
Test No. [-]	I_{in} [mA]	p_{ref} [kPa]	p_i [kPa]	E_P [kPa]	E_P [%]	MPE_P [bar]	MPE_P [%]	f_{in} [Hz]	ρ_{ref} [kg/m³]	ρ_i [kg/m³]	E_ρ [kg/m³]	MPE_ρ [kg/m³]
1		p_{min}			-				ρ_{min}			
2		p_{med}		-					ρ_{med}			
3		p_{max}			-				ρ_{max}			

	Calculation V_{bi}, V_{bref} based on V_i, T_{ref}, p_{ref} and ρ_{ref}					Calculation M_i, M_{ref} based on V_i, T_{ref}, p_{ref} and ρ_{ref}			
Test No. [-]	V_{bi} [L]	V_{bref} [L]	ρ_{15ref} [kg/m³]	E_{Vb} [%]	MPE_{Vb} [%]	M_i [kg]	M_{ref} [kg]	E_M [%]	MPE_M [%]
1									
2									
3									

Passed	☐ Yes	☐ No

F.7.3.2 Influence factor tests and disturbance tests (R 117-2, 8.5.2)

The test report formats of F.1 are applied.

Input values are:	Flowrate Q or number of pulses np_{in}	[L/min] or [pulses/min]
	Reference temperature T_{ref} or resistance R_{in}	[°C] or [Ω]
	Reference pressure p_{ref} or current I_{in}	[bar] or [mA]
	Reference density ρ_{ref} or frequency f_{in}	[kg/m^3] or [Hz]
Indicated measurement values are:	Indicated volume V_i	[L]
	Indicated volume at base condition V_{bi}	[L]
	Indicated mass M_i	[kg]

F.7.4 Self-service device (R 117-2, 8.6)

F.7.4.1 Unattended mode (R 117-2, 8.6)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Date correctly transmitted [Yes/No]
Check of correct transmission to the SSD	

Passed	☐ Yes	☐ No

Remarks:

Test [-]	Last transaction correctly memorised [Yes/No]
Check of good retrieving from SSD memory	

Passed	☐ Yes	☐ No

Remarks:

F.7.4.2 Attended mode (R 117-2, 8.6)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Date correctly transmitted [Yes/No]
Check of correct transmission to the SSD Transmission 1	
Check of correct transmission to the SSD Transmission 2	

Passed	☐ Yes	☐ No

Remarks:

Test [-]	Last transaction correctly memorised [Yes/No]
Check of good retrieving from SSD memory Transmission 1	
Check of good retrieving from SSD memory Transmission 2	

Passed	☐ Yes	☐ No

Remarks:

F.8 Test reports for complete measuring systems

F.8.1 Test reports for fuel dispensers, type evaluation (R 117-2, A.6)

For tests of individual components of the measuring system, the test report formats of F.1 to F.7 can be used.

F.8.1.1 Flow interruption (R 117-2, A.6.2.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test conditions	Test no.	Q_{max} [L/min]	V_i [L]	T_t [°C]	T_s [°C]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
Reference									
5 interruptions	1								
5 interruptions	2								
5 interruptions	3								
Reference									

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:
ρ (15 °C): kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.1.2 Variation of the internal volume of the hose (R 117-2, A.6.3.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test conditions	V_i [L]	Hose reel present [yes/no]	E [L]	MPE [ℓ]
Initial indication	0			
Hose pressurised for 10 s				

Passed	☐ Yes	☐ No

Remarks:

Notes: MPE = 2 × E_{min} if hose reel is present

MPE = E_{min} if hose reel is not present

F.8.1.3 Functional test of the communication protocol (R 117-2, A.6.4.1)

Test a: Communication link lost during ongoing transaction

Test no.	Test description	Transaction authorised [yes/no]	Display indication		
			Volume [L]	Price [NCU]	Unit price [NCU/L]
1	Connect dispenser to POS				
2	Start transaction, disconnect dispenser from POS, hang nozzle				
3	Lift nozzle				
4	Hang nozzle				

Passed	☐ Yes	☐ No

Test b: influence of remote price change on display indication

Test no.	Test description	Transaction authorised [yes/no]	Display indication		
			Volume [L]	Price [NCU]	Unit price [NCU/L]
1	Lift nozzle				
2	Authorise transaction		0	0	
3	Try to change unit price		0	0	
4	Perform a delivery, hang the nozzle				
5	Carry out usual “cash in” steps at POS				

Passed	☐ Yes	☐ No

F.8.1.4 Accuracy at MMQ (R 117-2, A.6.4.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Q [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Remarks:

Notes: 1) V_i and V_s may be replaced by V_n and V_r, if appropriate.

2) The units of volume may be replaced by units of mass, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.1.5 Temperature conversion (R 117-2, A.6.4.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			hPa
Time:			

	Indications			Reference values				
Test no. [-]	V_i [L]	V_{bi} [L]	ρ_{15i} [kg/m^3]	Q [L/min]	V_{ref} [L]	V_{bref} [L]	T_{ref} [°C]	ρ_{15ref} [kg/m^3]
1							T_{min}	
2							T_{med}	
3							T_{max}	

	Error calculations			
	V		V_b	
Test no. [-]	E_V [%]	MPE_V [%]	E_{Vb} [%]	MPE_{Vb} [%]
1				
2				
3				

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.1.6 Test of timeout function (R 117-2, A.6.4.4)

Test no.	Test description	Dispenser switch off time [s]	Maximum permissible dispenser switch off time [s]
1	Activate dispenser, no delivery, wait for timeout.		120
2	Activate dispenser, deliver, stop flow, wait for timeout.		120

Passed		Yes		No

F.8.1.7 Blender testing

F.8.1.7.1 Blending gasoline / gasoline (R 117-2, A.6.5.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Accuracy test							
Test conditions	Q_{max} [L/min]	V_i [L]	V_s [L]	p_t [bar]	T_t [°C]	T_s [°C]	MPE [%]
Meter 1							
Meter 2							

Calculations					
k_{nom} [%]	k_{real} [%]	$V_{Meter\ 1}$ [L]	$V_{Meter\ 2}$ [L]	E_{Blend} [%]	MPE [c] [%]

Passed		Yes		No

Remarks:

Notes: $V_{Oil/Additive} = V_{i\ Test\ 1} - V_{i\ Test\ 2}$
$V_{Gasoline} = V_{i\ Test\ 1}$
$k_{real} = 100\ V_{Meter\ 1} / (V\ V_{Meter\ 1} + V_{Meter\ 2})$
k_{nom} = Nominal blending ratio
$E_{Blend} = (k_{real} - k_{nom}) / k_{nom}$
[c] As required in R 117-1, 5.9.4

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.1.7.2 Oil or additive injected upstream of the meter (R 117-2, A.6.5.2.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no.	Blending ratio k [-]	Q [L/min]	V_i [L]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
	k_{min}	Q_{min}					
		Q_{mid}					
		Q_{max}					
	k_{mid}	Q_{min}					
		Q_{mid}					
		Q_{max}					
	k_{max}	Q_{min}					
		Q_{mid}					
		Q_{max}					

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.1.7.3 Oil or additive injected downstream of the meter (R 117-2, A.6.5.2.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Accuracy test							
Test conditions	Q_{max} [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	MPE [%]
Test 1 (a)							0.5
Test 2 (b)							0.5

Calculations					
T_{nom} [%]	T_{real} [%]	$V_{Oil/Additive}$ [L]	$V_{Gasoline}$ [L]	E_{Blend} [%]	MPE (c) [%]

Passed	☐ Yes	☐ No

Remarks:

Notes: (a) Oil/Additive blend disengaged or oil injection disconnected

(b) Oil/Additive blend engaged or oil injection connected

$V_{Oil/Additive} = V_{i\ Test\ 1} - V_{i\ Test\ 2}$

$V_{Gasoline} = V_{i\ Test\ 1}$

$T_{real} = 100\ V_{Gasoline} / (V_{Gasoline} + V_{Oil/Additive})$

T_{nom} = Nominal blending ratio

$E_{Blend} = (k_{real} - k_{nom}) / k_{nom}$

(c) As required in R 117-1, 5.9.5

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.2 Test reports for fuel dispensers, initial verification (R 117-2, A-I.7)

F.8.2.1 Initial verification at manufacturer's premises (R 117-2, A-I.7.1)

F.8.2.1.1 Administrative verification (R 117-2, A-I.7.1.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

	Passed	
Compliance of the design to the type approval certificate	☐ Yes	☐ No
All components are referenced in the type approval certificate	☐ Yes	☐ No
Seals are in place and prevent normal dismounting/opening of the associated components	☐ Yes	☐ No
MMQ is clearly indicated for normal conditions of use at dial level	☐ Yes	☐ No
Identification plate(s) is (are) compliant with the type approval certificate.	☐ Yes	☐ No
Identification plate(s) is (are) sealed/attached to the dispenser in a durable way	☐ Yes	☐ No

Remarks:

F.8.2.1.2 Accuracy test at high and low flowrates (R 117-2, A-I.7.1.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
High flow					
Low flow					

Passed	☐ Yes	☐ No

Remarks:

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.2.1.3 Accuracy test at MMQ and vapour recovery check (R 117-2, A-I.7.1.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Maximum flowrate					
Zero flow for 2 minutes	----	----			

Passed	☐ Yes	☐ No

Remarks:

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.2.1.4 Check of hose dilation and draining (R 117-2, A-I.7.1.4)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Hose dilation without hose reel

Test [-]	*MMQ* [L]	*HD1* [L]	E_V [%]	*MPE* [%]
Hose dilation				

Passed	☐ Yes	☐ No

Test [-]	*MMQ* [L]	*HD1* [L]	E_V [%]	*MPE* [%]
Draining				

Passed	☐ Yes	☐ No

Hose dilation with hose reel

Test [-]	*MMQ* [L]	*HD1* [L]	E_V [%]	*MPE* [%]
Hose dilation				

Passed	☐ Yes	☐ No

Test [-]	*MMQ* [L]	*HD1* [L]	E_V [%]	*MPE* [%]
Draining				

Passed	☐ Yes	☐ No

Remarks:

F.8.2.1.5 Test of timeout function on dispensers with an electronic calculator (R 117-2, A-I.7.1.5)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no.	Test description	Dispenser switch off time [s]	Maximum permissible dispenser switch off time [s]
1	Activate dispenser, no delivery, wait for timeout.		120
2	Activate dispenser, deliver, stop flow, wait for timeout.		120

Passed	☐ Yes	☐ No

Remarks:

F.8.2.1.6 Gas/air elimination check (R 117-2, A-I.7.1.6)

F.8.2.1.6.1 Alternative method 1 – gas/air elimination test with result (R 117-2, A-I.7.1.6.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Maximum flowrate					

Passed	☐ Yes	☐ No

Remarks:

F.8.2.1.6.2 Alternative method 2 – gas/air elimination test with blowing evidence (R 117-2, A-I.7.1.6.3)

Test [-]	Q_i [L/min]	Evidence of air blowing out of air vent / air separator [Yes/No]
Maximum flowrate		

Passed	☐ Yes	☐ No

Remarks:

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.2.1.7 Ancillary devices (R 117-2, A-I.7.1.7)

F.8.2.1.7.1 Prepay-preset (R 117-2, A-I.7.1.7.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Target check volume [L]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Volume preset test					

Passed	☐ Yes	☐ No

Remarks:

Test [-]	Target check price [NCU]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Price preset test					

Passed	☐ Yes	☐ No

Remarks:

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.8.2.1.7.2 Printer for dispenser (R 117-2, A-I.7.1.7.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Test [-]	Ticket reflects the information of the display with no allowed difference [Yes/No]
Check of ticket	

Passed	☐ Yes	☐ No

Remarks:

F.8.2.1.8 Temperature conversion (R 117-2, A-I.7.1.8)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	T_{ref} [°C]	T_i [°C]	E_T [°C]	MPE_T [°C]
Accuracy of temperature reading				1.6

Passed	☐ Yes	☐ No

Remarks:

Test [-]	Conversion table as per type approval [Yes/No]
Check of correct conversion table	

Passed	☐ Yes	☐ No

Remarks:

F.8.2.2 Initial verification on demand, at place of use (R 117-2, A-I.7.2)

F.8.2.2.1 Administrative verification (R 117-2, A-I.7.2.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

	Passed	
Compliance of the design to the type approval certificate	☐ Yes	☐ No
All components are referenced in the type approval certificate	☐ Yes	☐ No
Seals are in place and prevent normal dismounting/opening of the associated components	☐ Yes	☐ No
MMQ is clearly indicated for normal conditions of use at dial level	☐ Yes	☐ No
Identification plate(s) is (are) compliant with the type approval certificate	☐ Yes	☐ No
Identification plate(s) is (are) sealed/attached to the dispenser in a durable way	☐ Yes	☐ No

Remarks:

F.8.2.2.2 Accuracy test at high and low flowrates (R 117-2, A-I.7.2.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
High flow					
Low flow					

Passed	☐ Yes	☐ No

Remarks:

Test liquid:
ρ (15 °C): kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.2.2.3 Accuracy test at MMQ and hose check (R 117-2, A-I.7.2.4)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Maximum flowrate					
Zero flow for 1 minute	----	----			

Passed	☐ Yes	☐ No

Remarks:

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.2.2.4 Test of timeout function on dispensers with an electronic indicator (R 117-2, A-I.7.2.5)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no.	Test description	Dispenser switch off time [s]	Maximum permissible dispenser switch off time [s]
1	Activate dispenser, no delivery, wait for timeout.		120
2	Activate dispenser, deliver, stop flow, wait for timeout.		120

Passed	☐ Yes	☐ No

Remarks:

F.8.2.2.5 Gas/air elimination check (R 117-2, A-I.7.2.6)

F.8.2.2.5.1 Alternative method 1 – gas/air elimination test with result (R 117-2, A-I.7.2.6.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Maximum flowrate					

Passed	☐ Yes	☐ No

Remarks:

F.8.2.1.6.2 Alternative method 2 – gas/air elimination test with blowing evidence (R 117-2, A-I.7.2.6.3)

Test [-]	Q_i [L/min]	Evidence of air blowing out of air vent / gas separator [Yes/No]
Maximum flowrate		

Passed	☐ Yes	☐ No

Remarks:

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.2.2.6 Ancillary devices (R 117-2, A-I.7.2.7)

F.8.2.2.6.1 Prepay-preset (R 117-2, A-I.7.2.7.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Target check volume [L]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Volume preset test					

Passed	☐ Yes	☐ No

Remarks:

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.8.2.2.6.2 Printer for the dispenser (R 117-2, A-I.7.2.7.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Test [-]	Ticket reflects the information of the display with no allowed difference [Yes/No]
Check of ticket	

Passed	☐ Yes ☐ No

Remarks:

F.8.2.2.7 Temperature conversion (R 117-2, A-2.7.2.8)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	T_{ref} [°C]	T_i [°C]	E_T [°C]	MPE_T [°C]
Accuracy of temperature reading				1.6

Passed	☐ Yes	☐ No

Remarks:

Test [-]	Conversion table as per type approval [Yes/No]
Check of correct conversion table	

Passed	☐ Yes	☐ No

Remarks:

F.8.3 Test reports for LPG dispensers, type evaluation (R 117-2, A-LPG.6)

For tests of individual components of the measuring system, the test report formats of F.1 to F.7 can be used.

F.8.3.1 Flow interruption (R 117-2, A-LPG.6.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test conditions	Test no.	Q_{max} [L/min]	V_i [L]	T_t [°C]	T_s [°C]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
Reference									
5 interruptions	1								
5 interruptions	2								
5 interruptions	3								
Reference									

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.3.2 Variation of the internal volume of the hose (R 117-2, A-LPG.6.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test conditions	V_i [L]	Hose reel present [yes/no]	E [L]	MPE [L]
Initial indication	0			
Hose pressurised for 10 s				

Passed	☐ Yes	☐ No

Remarks:

Note: MPE = 2 × E_{min} if hose reel is present
MPE = E_{min} if hose reel is not present

F.8.3.3 Functional test of the communication protocol (R 117-2, A-LPG.6.4.1)

Test a: Communication link lost during ongoing transaction (R 117-2, A-LPG.6.4.1.2)

Test no.	Test description	Transaction authorised [yes/no]	Display indication		
			Volume [L]	Price [NCU]	Unit price [NCU/L]
1	Connect dispenser to POS				
2	Start transaction, disconnect dispenser from POS, hang nozzle				
3	Lift nozzle				
4	Hang nozzle				

Passed	☐ Yes	☐ No

Test b: influence of remote price change on display indication (R 117-2, A-LPG.6.4.1.3)

Test no.	Test description	Transaction authorised [yes/no]	Display indication		
			Volume [L]	Price [NCU]	Unit price [NCU/L]
1	Lift nozzle				
2	Authorise transaction		0	0	
3	Try to change unit price		0	0	
4	Perform a delivery, hang the nozzle				
5	Carry out usual “cash in” steps at POS				

Passed	☐ Yes	☐ No

F.8.3.4 Accuracy at MMQ (R 117-2, A-LPG.6.4.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Q [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Remarks:

Notes: (1) V_i and V_s may be replaced by V_n and V_r, if appropriate.
(2) The units of volume may be replaced by units of mass, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.3.5 Temperature conversion (R 117-2, A-LPG.6.4.3)

Method 1:

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			hPa
Time:			

	Q_{max} [L/min]	T_i [°C]	V_{bi} [L]	V_s [L]	V_{bref} [L]	E [%]	MPE (c) [%]
Tank 1							
Tank 2							
Tank 1							

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

Method 2:

	T_{P1} [°C]	T_{P2} [°C]	T_{P0} [°C]	T_{Ps} [°C]	T_{PI} [°C]	MPE (c) [%]
T1						
T2						

Passed	☐ Yes	☐ No

F.8.3.6 Test of timeout function (R 117-2, A-LPG.6.4.4)

Test no.	Test description	Dispenser switch off time [s]	Maximum permissible dispenser switch off time [s]
1	Activate dispenser, no delivery, wait for timeout.		120
2	Activate dispenser, deliver, stop flow, wait for timeout.		120

Passed	☐ Yes	☐ No

F.8.3.7 LPG remaining liquid in the measuring system (R 117-2, A-LPG.6.4.5)

Test no.	Test description	Q [L/min]	P_L [bar]	P_G [bar]	ΔP_{GL} [bar]	PMD [yes/no]
1	Gas return line open	0				no
2	Gas return line open					no
3	Gas return line close	0			0	yes
4	Gas return line open					no

Passed	☐ Yes	☐ No

Note: PDM: Pressure maintaining device activated

F.8.4 Test reports for LPG dispensers, initial verification (R 117-2, A-LPG-I.7)

F.8.4.1 Initial verification at manufacturer's premises (R 117-2, A-LPG-I.7.1)

F.8.4.1.1 Administrative verification (R 117-2, A-LPG-I.7.1.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

	Passed	
Compliance of the design to the type approval certificate	☐ Yes	☐ No
All components are referenced in the type approval certificate	☐ Yes	☐ No
Seals are in place and prevent normal dismounting/opening of the associated components	☐ Yes	☐ No
MMQ is clearly indicated for normal conditions of use at dial level	☐ Yes	☐ No
Identification plate(s) is (are) compliant with the type approval certificate	☐ Yes	☐ No
Identification plate(s) is (are) sealed/attached to the dispenser in a durable way	☐ Yes	☐ No

Remarks:

F.8.4.1.2 Accuracy test at high and low flowrates (R 117-2, A-LPG-I.7.1.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
High flow					
Low flow					

Passed	☐ Yes	☐ No

Remarks:

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.4.1.3 Accuracy test at MMQ (R 117-2, A-LPG-I.7.1.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Maximum Flowrate					

Passed	☐ Yes	☐ No

Remarks:

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.8.4.1.4 Check of hose dilation and draining (R 117-2, A-LPG-I.7.1.4)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Hose dilation without hose reel

Test [-]	*MMQ* [L]	*HD1* [L]	E_V [%]	*MPE* [%]
Hose dilation				

Passed	☐ Yes	☐ No

Test [-]	*MMQ* [L]	*HD2* [L]	E_V [%]	*MPE* [%]
Draining				

Passed	☐ Yes	☐ No

Hose dilation with hose reel

Test [-]	*MMQ* [L]	*HD3* [L]	E_V [%]	*MPE* [%]
Hose dilation				

Passed	☐ Yes	☐ No

Test [-]	*MMQ* [L]	*HD4* [L]	E_V [%]	*MPE* [%]
Draining				

Passed	☐ Yes	☐ No

Remarks:

F.8.4.1.5 Test of the timeout function on dispensers with an electronic indicator (R 117-2, A-LPG-I.7.1.5)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no.	Test description	Dispenser switch off time [s]	Maximum permissible dispenser switch off time [s]
1	Activate dispenser, no delivery, wait for timeout.		120
2	Activate dispenser, deliver, stop flow, wait for timeout.		120

Passed	☐ Yes	☐ No

Remarks:

F.8.4.1.6 Gas/air elimination check – Process for fully assembled dispenser (R 117-2, A-LPG-I.7.1.6)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Maximum flowrate					

Passed	☐ Yes	☐ No

Remarks:

F.8.4.1.7 Ancillary devices (R 117-2, A-LPG-I.7.1.7)

F.8.4.1.7.1 Prepay-preset (R 117-2, A-LPG-I.7.1.7.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Target check volume [L]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Volume preset test					

Passed	☐ Yes	☐ No

Remarks:

Test [-]	Target check price [NCU]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Price preset test					

Passed	☐ Yes	☐ No

Remarks:

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.4.1.7.2 Printer for dispenser (R 117-2, A-LPG-I.7.1.7.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Test [-]	Ticket reflects the information of the display with no allowed difference [Yes/No]
Check of ticket	

Passed	☐ Yes	☐ No

Remarks:

F.8.4.1.8 Temperature conversion (R 117-2, A-LPG-I.7.1.8)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	T_{ref} [°C]	T_i [°C]	E_T [°C]	MPE_T [°C]
Accuracy of temperature reading				1.6

Passed	☐ Yes	☐ No

Remarks:

Test [-]	Conversion table as per type approval [Yes/No]
Check of correct conversion table	

Passed	☐ Yes	☐ No

Remarks:

F.8.4.2 Initial verification on demand, at place of use (R 117-2, A-LPG-I.7.2)

F.8.4.2.1 Administrative verification (R 117-2, A-LPG-I.7.2.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

	Passed	
Compliance of the design to the type approval certificate	☐ Yes	☐ No
All components are referenced in the type approval certificate	☐ Yes	☐ No
Seals are in place and prevent normal dismounting/opening of the associated components	☐ Yes	☐ No
MMQ is clearly indicated for normal conditions of use at dial level	☐ Yes	☐ No
Identification plate(s) is (are) compliant with the type approval certificate	☐ Yes	☐ No
Identification plate(s) is (are) sealed/attached to the dispenser in a durable way	☐ Yes	☐ No

Remarks:

F.8.4.2.2 Accuracy test at high and low flowrates (R 117-2, A-LPG-I.7.2.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
High flow					
Low flow					

Passed	☐ Yes	☐ No

Remarks:

Test liquid:
ρ (15 °C): kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.4.2.3 Accuracy test at MMQ (R 117-2, A-LPG-I.7.2.4)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Maximum flowrate					

Passed	☐ Yes	☐ No

Remarks:

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.4.2.4 Test of timeout function on dispensers with an electronic indicator (R 117-2, A-LPG-I.7.2.5)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no.	Test description	Dispenser switch off time [s]	Maximum permissible dispenser switch off time [s]
1	Activate dispenser, no delivery, wait for timeout.		120
2	Activate dispenser, deliver, stop flow, wait for timeout.		120

Passed	☐ Yes	☐ No

Remarks:

F.8.4.2.5 Gas/air elimination check (R 117-2, A-LPG-I.7.2.6)

Application no.:
Model:
Serial no.:
Test date:
Observer:

	Ambient conditions		
	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Maximum flowrate					

Passed	☐ Yes	☐ No

Remarks:

F.8.4.2.6 Ancillary devices (R 117-2, A-LPG-I.7.2.7)

F.8.4.2.6.1 Prepay-preset (R 117-2, A-LPG-I.7.2.7.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Target check volume [L]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Volume preset test					

Passed	☐ Yes	☐ No

Remarks:

Test [-]	Target check price [NCU]	V_{ref} [L]	V_i [L]	E_V [%]	*MPE* [%]
Price preset test					

Passed	☐ Yes	☐ No

Remarks:

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.4.2.6.2 Printer for the dispenser (R 117-2, A-LPG-I.7.2.7.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Test [-]	Ticket reflects the information of the display with no allowed difference [Yes/No]
Check of ticket	

Passed	☐ Yes ☐ No

Remarks:

F.8.4.2.7 Temperature conversion (R 117-2, A-LPG-I.7.2.8)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	T_{ref} [°C]	T_i [°C]	E_T [°C]	MPE_T [°C]
Accuracy of temperature reading				1.6

Passed	☐ Yes	☐ No

Remarks:

Test [-]	Conversion table as per type approval [Yes/No]
Check of correct conversion table	

Passed	☐ Yes	☐ No

Remarks:

F.8.5 Test reports for road tankers (R 117-2, Annex B)

For tests of individual components of the measuring system, the test report formats of F1 to F.7 can be used.

F.8.5.1 Complete emptying of the compartment of a road tanker (single compartment trucks only) (R 117-2, B.3.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			hPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_i [L]	T_t [°C]	p_t [kPa]	V_s [L]	T_s [°C]	V_n [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1										
2										
3										

$\bar{E}$ = %	Range = %

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.5.2 Connection of an empty compartment (multiple compartment trucks only) (R 117-2, B.3.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_i [L]	T_t [°C]	p_t [kPa]	V_s [L]	T_s [°C]	V_n [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1										
2										
3										

$\bar{E}$ = %	Range = %

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.5.3 Variation of the internal volume of the hose (full hose measuring systems only) (R 117-2, B.3.4)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	V_{nom} [L]	V_i [L]	$V_{nom} - V_i$ [L]	Hose reel present [yes/no]	MPE [L]

Passed		Yes		No

Remarks:

Notes: $E = V_{nom} - V_i$

V_{nom} is the nominal volume between the anti-drain device and the hose closing device

MPE = 2 × E_{min} if hose reel is present

MPE = E_{min} if hose reel is not present

F.8.5.4 Complete emptying of the compartment and piping system (empty hose measuring system only) (R 117-2, B.3.5)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	V_i [L]	T_t [°C]	p_t [kPa]	V_s [L]	T_s [°C]	V_n [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1										
2										
3										

$\bar{E}$ = %	Range = %

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.8.5.5 First delivery of top loaded road tanker (empty hose measuring system only) (R 117-2, B.3.5)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	V_i [L]	T_t [°C]	p_t [kPa]	V_s [L]	T_s [°C]	V_n [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1										
2										
3										

$\bar{E}$ = %	Range = %

Passed		☐	Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:		Test measures used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.6 Test reports for measuring systems for the unloading of ships' tanks and for rail and road tankers using an intermediate tank (R 117-2, Annex C)

For tests of individual components of the measuring system, the test report formats of F1 to F.7 can be used.

Application no.:
Model:
Serial no.:
Test date:
Observer:

Passed		☐	Yes	☐	No

The cross section of the intermediate tank shall be such that a quantity equal to the minimum specified quantity deviation corresponds to a difference in level of at least 2 mm (R 117-1, 5.3.1).	☐	Yes	☐	No
In the case of road and rail tankers, the intermediate tank automatically ensures a constant level, visible or detectable, at the beginning and at the end of the measurement operation. The level is considered to be constant when it settles within a range corresponding to a quantity of no more than the minimum specified quantity deviation (R 117-1, 5.3.2).	☐	Yes	☐	No
In the case of ships' tanks, it is not necessary to provide for the automatic maintenance of a constant level. Where such a provision is not made, it shall be possible to measure the contents in the intermediate tank (R 117-1, 5.3.3).	☐	Yes	☐	No
If the ship's tank is unloaded by means of pumps located in the bottom of the ship, the intermediate tank may be used only at the beginning and at the end of the measurement operation (R 117-1, 5.3.3).	☐	Yes	☐	No

F.8.7 Test reports for measuring systems for liquefied gases under pressure (other than LPG dispensers (R 117-2, Annex D)

For tests of individual components of the measuring system, the test report formats of F1 to F.7 can be used.

Application no.:
Model:
Serial no.:
Test date:
Observer:

Passed		☐	Yes	☐	No

Only full hose measuring systems are authorised (R 117-2, 5.4.1).	☐	Yes	☐	No
The design of the measuring system shall ensure that the product in the meter remains in a liquid state during the measurement (R 117-2, 5.4.2).	☐	Yes	☐	No
A thermometer well shall be provided close to the meter for verification purposes (R 117-2, 5.4.3).	☐	Yes	☐	No
Provisions shall be made for fitting a pressure measuring device downstream and close to the meter. This measuring device shall be available for verification. (R 117-2, 5.4.4).	☐	Yes	☐	No
When the quantity is delivered using a measuring system mounted on a road tanker, any connection between the gaseous phases of the vehicle's (supply) tank and of the receiving tank is prohibited (R 117-2, 5.4.5).	☐	Yes	☐	No
For other measuring systems for liquefied gas, such connections are permitted when the quantities of gas transferred via these connections are measured by means of suitable measuring instruments and subtracted from the delivered quantity (R 117-2, 5.4.5).	☐	Yes	☐	No
Pressure relief valves may be incorporated in measuring systems in order to prevent abnormally high pressures. If they are located downstream of the meter, they shall open to the atmosphere or be connected to the receiving tank (R 117-2, 5.4.6).	☐	Yes	☐	No
In no case shall the pressure relief valves located upstream of the meter be connected to the valves located downstream by pipes which bypass the meter (R 117-2, 5.4.6).	☐	Yes	☐	No

When the conditions of operation require the use of detachable hoses, these hoses shall remain full if their quantities are greater than the minimum specified quantity deviation. Detachable full hoses shall be fitted with special connections for full hoses, so-called couplers or self-sealing valves. Manually operated blow-off devices shall be provided at the ends of these hoses, if necessary (R 117-2, 5.4.7).		Yes		No
For measuring systems mounted on road tankers the quantity indicating device and its printing device, if provided, shall include a zero-setting device (R 117-2, 5.4.8).		Yes		No

F.8.8 Test report for measuring systems for milk, beer and other foaming potable liquids (R 117-2, Annex E)

For tests of individual components of the measuring system, the test report formats of F.1 to F.7 can be used.

F.8.8.1 Measuring systems for milk (R 117-2, E.6.1)

F.8.8.1.1 Receiving measuring systems (R 117-2, E.6.1.1)

F.8.8.1.1.1 Accuracy with suction pipe (R 117-2, E.6.1.1)

(sampling device not activated)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_i [L]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1						
2						
3						

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.8.1.1.2 Reports on accuracy without suction pipe (R 117-2, E.6.1.1)

(sampling device not activated)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_i [L]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1						
2						
3						

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.8.8.1.1.3 MMQ with suction pipe (R 117-2, E.6.1.1)

(sampling device not activated)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	$Q_{operation}$ [L/min]	V_i [L]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1						
2						
3						

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.8.8.1.1.4 MMQ with suction pipe (R 117-2, E.6.1.1)

(sampling device activated)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	$Q_{operation}$ [L/min]	V_i [L]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1						
2						
3						

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.8.8.1.1.5 Test of the special gas extractor function of the gas elimination device (R 117-2, E.6.1.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_i [L]	V_s [L]	V_n [L]	p_t [kPa]	V_a [L]	V_a/V_n [-]	$E_{vi\ (without\ gas)}$ [%]	$E_{vi\ (gas)}$ [%]	E_{vi} [%]
1										
2										
n-1										
n										

Passed	☐ Yes	☐ No

Remarks:

Notes: $E_{vi} = E_{vi\ (gas)} - E_{vi\ (without\ gas)}$

$E_{vi\ (gas)} = (V_i - V_n) / V_n$

$V_a = (V_{gas\ meter}\ (p_t + p_{atm})) / p_{atm}$

Test liquid:

ρ (15 °C)	kg/m^3	Test measures used:	
α:	°C^{-1}	T_r:	°C
χ:	kPa^{-1}	β:	°C^{-1}
μ (20 °C):	mPa·s	Nominal volume:	L

F.8.8.1.2 Delivering measuring systems for milk (R 117-2, E.6.1.3)

F.8.8.1.2.1 Accuracy (R 117-2, E.6.1.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_i [L]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1	Q_{min}					
	Q_{mid}					
	Q_{max}					
2	Q_{min}					
	Q_{mid}					
	Q_{max}					
3	Q_{min}					
	Q_{mid}					
	Q_{max}					

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.8.1.2.2 MMQ (R 117-2, E.6.1.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_i [L]	V_s [L]	E_{vi} [L]	E_{vi} [%]	MPE [%]
1	Q_{min}					
	Q_{mid}					
	Q_{max}					
2	Q_{min}					
	Q_{mid}					
	Q_{max}					
3	Q_{min}					
	Q_{mid}					
	Q_{max}					

Passed	☐ Yes	☐ No

Remarks:

Note: V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:
ρ (15 °C): kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C^{-1}
Nominal volume: L

F.8.8.1.2.3 Gas elimination devices for delivering measuring systems for milk (R 117-2, E.6.1.4)

F.8.8.1.2.3.1 Gas separators for delivering measuring systems for milk (R 117-2, E.6.1.4.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	V_i [L]	V_s [L]	V_n [L]	p_t [kPa]	V_a [L]	V_a/V_n [-]	$E_{vi\ (without\ gas)}$ [%]	$E_{vi\ (gas)}$ [%]	E_{vi} [%]
Reference	$Q(1)$									
1										
2										
Reference										
1										
2										
Reference	$Q(n)$									
1										
2										

Passed	☐ Yes	☐ No

Remarks:

Notes: $E_{vi} = E_{vi\ (gas)} - E_{vi\ (without\ gas)}$

$E_{vi\ (gas)} = (V_i\ i_n) / V_n$

$V_a = (V_{gas\ meter}\ (p_t + p_{atm})) / p_{atm}$

V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3	Test measures used:	
α:	°C^{-1}	T_r:	°C
χ:	kPa^{-1}	β:	°C^{-1}
μ (20 °C):	mPa·s	Nominal volume:	L

F.8.8.1.2.3.2 Gas extractors for delivering measuring systems for milk (R 117-2, E.6.1.4.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_i [L]	V_s [L]	V_n [L]	$E_{vi\ (without\ gas)}$ [%]	$E_{vi\ (gas)}$ [%]	E_{vi} [%]
Reference							
1							
2							

Passed	☐ Yes	☐ No

Remarks:

Notes: $E_{vi} = E_{vi\ (gas)} - E_{vi\ (without\ gas)}$

$E_{vi\ (gas)} = (V_i\ V_n) / V_n$

V_i and V_s may be replaced by V_n and V_r, if appropriate.

Test liquid:

ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

Test measures used:

F.8.8.1.2.3.3 Reports on special gas extractors (R 117-2, E.6.1.4.3)

F.8.8.1.2.3.3.1 Special gas extractor not intended for measuring systems on road tankers

Test on gas separator function: see test report format F.6.1
Test on gas extractor function: see test report format F.6.2

F.8.8.1.2.3.3.2 Special gas extractor intended for measuring systems on road tankers

Test on gas separator function and gas extractor function:

1a) Volumetric procedure by receiving the liquid from a standard capacity measure

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_s [L]	T_s [°C]	V_i [L]	V_n [L]	E_{vi} [%]	MPE [%]
1							
2							

Passed	☐ Yes	☐ No

1b) Volumetric procedure by delivering the liquid into a standard capacity measure

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_s [L]	T_s [°C]	V_i [L]	V_n [L]	E_{vi} [%]	MPE [%]
1							
2							

Passed	☐ Yes	☐ No

2a) Gravimetric procedure by receiving the liquid from a tank on a balance

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	W_{gross} [kg]	W_{net} [kg]	$\rho(T_s')$ [kg/m³]	$\rho(T_s)$ [kg/m³]	T_s [°C]	(T_s') [°C]	V_n [L]	E_{vi} [%]	MPE [%]
1										
2										

Passed	☐ Yes	☐ No

Remarks:

Notes: $\rho(T_s) = \rho(T_s') + 200 \bullet 10^{-6} \bullet (T_s' - T_s)$
$V_n = (W_{gross} - W_{net}) / \rho(T_s) \bullet (1 + 0.0012 / \rho(T_s))$

2b) Gravimetric procedure by delivering the liquid into a tank on a balance

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	W_{gross} [kg]	W_{net} [kg]	$\rho(T_s')$ [kg/m³]	$\rho(T_s)$ [kg/m³]	T_s [°C]	(T_s') [°C]	V_n [L]	E_{vi} [%]	MPE [%]
1										
2										

Passed	☐ Yes	☐ No

Remarks:

Notes: $\rho(T_s) = \rho(T_s') + 200 \times 10^{-6} \times (T_s' - T_s)$
$V_n = (W_{gross} - W_{net}) / \rho(T_s) \times (1 + 0.0012 / \rho(T_s))$

F.8.8.1.2.4 Volume required to fill the measuring system (R 117-2, E.6.1.6)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	V_s [L]	V_i [L]	V_{MS} [L]	V_{MSc} [L]	$\overline{V}_{MSc}$ [L]
1					
2					

Passed		Yes		No

Remarks:

Notes: $V_{MS} = V_s - V_i$ [ℓ]
$V_{MSc} = V_{MS}$ corrected by meter error
$\overline{V}_{MSc}$ = mean volume of V_{MSc}

F.8.8.2 Measuring systems for beer and other foaming liquids (R 117-2, E.6.2)

F.8.8.2.1 Delivering measuring systems (R 117-2, E.6.2.1)

F.8.8.2.1.1 Accuracy (R 117-2, E.6.2.1)

1) Gravimetric procedure by delivering the liquid into a tank on a balance

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	W_{gross} [kg]	W_{net} [kg]	$\rho(T_s')$ [kg/m³]	$\rho(T_s)$ [kg/m³]	T_s [°C]	(T_s') [°C]	V_n [L]	E_{vi} [%]	MPE [%]
1										
n										

Passed	☐ Yes	☐ No

Remarks:

Notes: $V_{gas/air\ in\ tank} = V_{tank} - V_{liquid\ in\ tank}$

$\rho_{gas}(p) = \rho_{gas}(p_{atmosphere}) \times$ (reading of tank manometer in bar + 1)

$\rho(T_s) = \rho(T_s') + 200 \times 10^{-6} \times (T_s' - T_s)$

$\rho_{CO2}(15\ °C, 1\ bar) \approx 1.8\ kg/m^3$

$V_n = (W_{gross} - W_{net}) / \rho(T_s)$

2) Volumetric procedure by delivering the liquid into a standard capacity measure

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	V_s [L]	T_s [°C]	V_i [L]	V_n [L]	E_{vi} [%]	MPE [%]
1							
2							

Passed	☐ Yes	☐ No

F.8.8.2.1.2 Minimum measured quantity (R 117-2, E.6.2.1)

1) Gravimetric procedure by delivering the liquid into a tank on a balance

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	W_{gross} [kg]	W_{net} [kg]	$\rho(T_s')$ [kg/m³]	$\rho(T_s)$ [kg/m³]	T_s [°C]	(T_s') [°C]	V_n [L]	E_{vi} [%]	MPE [%]
1										
n										

Passed		Yes		No

Remarks:

Notes: $V_{gas/air\ in\ tank} = V_{tank} - V_{liquid\ in\ tank}$

$\rho_{gas}(p) = \rho_{gas}(p_{atmosphere}) \times$ (reading of tank manometer in bar + 1)

$\rho(T_s) = \rho(T_s') + 200 \times 10^{-6} \times (T_s' - T_s)$

$\rho_{CO2}(15\ °C, 1\ bar) \approx 1.8\ kg/m^3$

$V_n = (W_{gross} - W_{net}) / \rho(T_s)$

2) Volumetric procedure by delivering the liquid into a standard capacity measure

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	V_s [L]	T_s [°C]	V_i [L]	V_n [L]	E_{vi} [%]	MPE [%]
1							
n							

Passed	☐ Yes	☐ No

F.8.8.2.1.3 Gas elimination device (R 117-2, E.6.2.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q_{max} [L/min]	V_i [L]	V_s [L]	V_n [L]	$E_{vi\ (without\ gas)}$ [%]	$E_{vi\ (gas)}$ [%]	E_{vi} [%]	$\bar{E}_{vi}$ [%]	MPE [%]
Reference									
1									
2									

Passed	☐ Yes	☐ No

Remarks:

Notes: $E_{vi} = E_{vi\ (gas)} - E_{vi\ (without\ gas)}$

$E_{vi\ (gas)} = (V_i - V_n) / V_n$

$\bar{E}_{vi}$ = mean value of E_{vi}

F.8.8.2.1.4 Variation of the internal volume of the hose (R 117-2, E.7)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	V_{nom} [L]	V_i [L]	$V_{nom} - V_i$ [L]	Hose reel present [yes/no]	MPE [L]

Passed	☐ Yes	☐ No

Remarks:

Notes: $E = V_{nom} - V_i$

V_{nom} is the nominal volume between the anti-drain device and the hose closing device

MPE = 2 × E_{min} if hose reel is present

MPE = E_{min} if hose reel is not present

F.8.8.2.2 Receiving measuring systems (R 117-2, E.6.2.1)

F.8.8.2.2.1 Accuracy (R 117-2, E.6.2.1)

1) Gravimetric procedure by receiving the liquid from a tank on a balance

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	W_{gross} [kg]	W_{net} [kg]	$\rho(T_s')$ [kg/m³]	$\rho(T_s)$ [kg/m³]	T_s [°C]	(T_s') [°C]	V_n [L]	E_{vi} [%]	MPE [%]
1										
n										

Passed	☐ Yes	☐ No

Remarks:

Notes: $V_{gas/air\ in\ tank} = V_{tank} - V_{liquid\ in\ tank}$

$\rho_{gas}(p) = \rho_{gas}(p_{atmosphere}) \times$ (reading of tank manometer in bar + 1)

$\rho(T_s) = \rho(T_s') + 200 \times 10^{-6} \times (T_s' - T_s)$

$\rho_{CO2}(15\ °C, 1\ bar) \approx 1.8\ kg/m^3$

$V_n = (W_{gross} - W_{net}) / \rho(T_s)$

2) Volumetric procedure by receiving the liquid from a standard capacity measure

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	V_s [L]	T_s [°C]	V_i [L]	V_n [L]	E_{vi} [%]	MPE [%]
1							
n							

Passed	☐ Yes	☐ No

F.8.8.2.2.2 Minimum measured quantity (R 117-2, E.6.2.1)

1) Gravimetric procedure by receiving the liquid from a tank on a balance

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	W_{gross} [kg]	W_{net} [kg]	$\rho(T_s')$ [kg/m³]	$\rho(T_s)$ [kg/m³]	T_s [°C]	(T_s') [°C]	V_n [L]	E_{vi} [%]	MPE [%]
1										
n										

Passed	☐ Yes	☐ No

Remarks:

Notes: $V_{gas/air\ in\ tank} = V_{tank} - V_{liquid\ in\ tank}$

$\rho_{gas}(p) = \rho_{gas}(p_{atmosphere}) \times$ (reading of tank manometer in bar + 1)

$\rho(T_s) = \rho(T_s') + 200 \times 10^{-6} \times (T_s' - T_s)$

$\rho_{CO2}(15\ °C, 1\ bar) \approx 1.8\ kg/m^3$

$V_n = (W_{gross} - W_{net}) / \rho(T_s)$

2) Volumetric procedure by receiving the liquid from a standard capacity measure

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test no. [-]	Q [L/min]	V_s [L]	T_s [°C]	V_i [L]	V_n [L]	E_{vi} [%]	MPE [%]
1							
n							

Passed	☐ Yes	☐ No

F.8.9 Test reports for measuring systems on pipelines and systems for loading of ships (R 117-2, Annex F)

For tests of individual components of the measuring system, the test report formats of F.1 to F.7 can be used.

F.8.10 Test reports for measuring systems for fueling aircraft, type evaluation (R 117-2, Annex G)

For tests of individual components of the measuring system, the test report formats of F.1 to F.7 can be used.

F.8.10.1 Accuracy test using a volumetric test measure (R 117-2, G.2.5.1.2 A)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

$Q(1)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

$Q(2)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

$Q(3)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Passed	☐ Yes	☐ No

Remarks:

Notes: (1) V_i and V_s may be replaced by V_n and V_r, if appropriate.
(2) Recommended flowrates $Q(1)$: 0.8 Q_{max} to Q_{max}
$Q(2)$: Intermediate flowrate
$Q(3)$: Q_{min} to 0.2 Q_{max}

Test liquid:		Test measure used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.10.2 Accuracy on minimum measured quantity

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Q_{min} [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Q_{min} [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Q_{max} [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Passed	☐ Yes	☐ No

Remarks:

Notes: (1) V_i and V_s may be replaced by V_n and V_r, if appropriate.
(2) Recommended flowrates $Q(1)$: 0.8 Q_{max} to Q_{max}
$Q(2)$: Intermediate flowrate
$Q(3)$: Q_{min} to 0.2 Q_{max}

Test liquid:		Test measure used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.10.3 Accuracy test using a master meter (R 117-2, G.2.5.1.2 B)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

$Q(1)$ [L/min]	V_i [L]	V_s [L]	E_{vi} [%]	MPE [%]
$\bar{E}$ = %			Range = %	

$Q(2)$ [L/min]	V_i [L]	V_s [L]	E_{vi} [%]	MPE [%]
$\bar{E}$ = %			Range = %	

$Q(3)$ [L/min]	V_i [L]	V_s [L]	E_{vi} [%]	MPE [%]
$\bar{E}$ = %			Range = %	

Passed	☐ Yes	☐ No

Remarks:

Notes: (1) V_i and V_s may be replaced by V_n and V_r, if appropriate.
(2) Recommended flowrates $Q(1)$: 0.8 Q_{max} to Q_{max}
$Q(2)$: Intermediate flowrate
$Q(3)$: Q_{min} to 0.2 Q_{max}

Test liquid:

ρ (15 °C)	kg/m^3
α:	°C^{-1}
χ:	kPa^{-1}
μ (20 °C):	mPa·s

F.8.10.4 Accuracy on minimum measured quantity

(Test necessary for MMQ < 500 L)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

$Q(1)$ [L/min]	V_i [L]	V_s [L]	E_{vi} [%]	MPE [%]
$\bar{E}$ = %			Range = %	

$Q(2)$ [L/min]	V_i [L]	V_s [L]	E_{vi} [%]	MPE [%]
$\bar{E}$ = %			Range = %	

$Q(3)$ [L/min]	V_i [L]	V_s [L]	E_{vi} [%]	MPE [%]
$\bar{E}$ = %			Range = %	

Passed	☐ Yes	☐ No

Remarks:

Notes: (1) Recommended flowrates $Q(1)$: 0.8 Q_{max} to Q_{max}
$Q(2)$: Intermediate flowrate
$Q(3)$: Q_{min} to 0.2 Q_{max}

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

F.8.11 Test reports for type evaluation for measuring systems for bunkering (R 117-2, Annex K)

F.8.11.1 Test reports for type evaluation without gas/air entrainment (R 117-2, K.2)

F.8.11.1.1 Test reports for the flow meter without gas/air entrainment (R 117-2, K.2.1)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

$Q(1)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

$Q(2)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

$Q(3)$ [L/min]	V_i [L]	V_s [L]	p_t [kPa]	T_t [°C]	T_s [°C]	E_{vi} [%]	MPE [%]

$\bar{E}$ = %	Range = %

Passed	☐	Yes	☐ No

Remarks:

Test liquid:		Test measure used:	
ρ (15 °C)	kg/m^3	T_r:	°C
α:	°C^{-1}	β:	°C^{-1}
χ:	kPa^{-1}	Nominal volume:	L
μ (20 °C):	mPa·s		

F.8.11.1.2 Test reports for other individual components of the measuring system (R 117-2, Annex K.2.2)

For tests of individual components of the measuring system, the test report formats of F.1 to F.7 can be used.

F.8.11.2 Test reports for type evaluation with gas/air entrainment (R 117-2, K.3 and X.K)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	Q_{min} [L/min]	$V_{opening\ reading}$ (indication B) [L]	$V_{closing\ reading}$ (indication D) [L]	V_i [L]	V_{ref} (indication A or C) [L]	Aeration parameter [-]	E_V [%]	*MPE* [%]
1								
2								
3								

Test [-]	$Q_{intermediate}$ [L/min]	$V_{opening\ reading}$ (indication B) [L]	$V_{closing\ reading}$ (indication D) [L]	V_i [L]	V_{ref} (indication A or C) [L]	Aeration parameter [-]	E_V [%]	*MPE* [%]
1								
2								
3								

Test [-]	Q_{max} [L/min]	$V_{opening\ reading}$ (indication B) [L]	$V_{closing\ reading}$ (indication D) [L]	V_i [L]	V_{ref} (indication A or C) [L]	Aeration parameter [-]	E_V [%]	*MPE* [%]
1								
2								
3								

Passed	☐ Yes	☐ No

Note: $V_i = V_{closing\ reading} - V_{opening\ reading}$

Remarks:

Test liquid:
ρ (15 °C) kg/m³
α: °C⁻¹
χ: kPa⁻¹
μ (20 °C): mPa·s

Test measures used:
T_r: °C
β: °C⁻¹
Nominal volume: L

F.8.12 Test reports for initial verification for measuring systems for bunkering (R 117-2, K.4)

F.8.12.1 Test reports for initial verification for the flow meter (R 117-2, K.4.2.1)

Test	[Yes/No]
Zero offset after zero setting does not exceed ± 0.2 % of Q_{min}	
Deviation of flow meter density reading from supplier's density information does not exceed ± 1 kg/m^3	

Passed	☐ Yes	☐ No

Remarks:

F.8.12.2 Test reports for initial verification of additional measuring instruments (R 117-2, K.4.2.2)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Test [-]	The instrument meets the requirements of R 117-2, K.4.2.2 [Yes/No]
Check of instrument 1	
Check of instrument x	
Check of instrument n	

Passed	☐ Yes	☐ No

Remarks:

F.8.12.3 Test reports for initial verification of process switches (R 117-2, K.4.2.3)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Test [-]	The instrument meets the requirements of R 117-2, K.4.2.3 [Yes/No]
Check of type	

Passed	☐ Yes	☐ No

Remarks:

Test [-]	Process switch operates as specified [Yes/No]
Check of operation	

Passed	☐ Yes	☐ No

Remarks:

F.8.12.4 Test reports for initial verification of the ticket printer (R 117-2, K.4.2.4)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Test [-]	The printer type meets the requirements of R 117-2, K.4.2.4 [Yes/No]
Check of type	

Passed	☐ Yes	☐ No

Remarks:

Test [-]	Ticket reflects the information required in R 117-2, K.4.2.4 [Yes/No]
Check of ticket	

Passed	☐ Yes	☐ No

Remarks:

F.8.12.5 Test reports for initial verification of the complete measuring system (R 117-2, K.4.3)

F.8.12.5.1 Vessels

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions

	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Q_i [L/min]	V_{ref} [L]	V_i [L]	E_V [L]	E_V [%]	*MPE* [%]
					0.71

Passed	☐ Yes	☐ No

Note: V_{ref} is the volume indicated by the certified system.
V_i is the volume indicated by the system under test.

Remarks:

Test liquid:

ρ (15 °C)	kg/m^3
α:	°C^{-1}
χ:	kPa^{-1}
μ (20 °C):	mPa·s

F.8.12.5.2 Barges

Application no.:
Model:
Serial no.:
Test date:
Observer:

Ambient conditions	At start	At end	
Temperature:			°C
Relative humidity:			%
Atmospheric pressure:			kPa
Time:			

Q_i [L/min]	$V_{loadedf}$ [L]	$V_{delivered\ back}$ [L]	E_V [L]	E_V [%]	*MPE* [%]
					0.2

Passed	☐ Yes	☐ No

Note: $V_{loadedf}$ is the volume indicated at loading without entrained air.
$V_{delivered\ back}$ is the volume indicated at back delivering under normal operating conditions.

Remarks:

Test liquid:
ρ (15 °C) kg/m^3
α: °C^{-1}
χ: kPa^{-1}
μ (20 °C): mPa·s

F.8.13 Test reports for measuring systems for Liquefied Natural Gas (R 117-2, Annex L)

For tests of individual components of the measuring system, the test report formats of F.1 to F.7 can be used.

F.8.13.1 Test report for testing procedures for complete measuring systems (R 117-2, L.8)

Application no.:
Model:
Serial no.:
Test date:
Observer:

Passed		☐	Yes	☐ No

Measuring system is compensating for the case that the delivery hose or piping between meter and transfer point of an LNG fuel dispenser is not designed to remain filled between deliveries	☐	Yes	☐	No
Measuring system ensures that the product in the liquid meter remains in a liquid state during the measurement (R 117-1, 5.11.1)	☐	Yes	☐	No
Safety valves are properly incorporated in the measuring systems	☐	Yes	☐	No
Delivery systems indicate quantity delivered in terms of mass (R 117-1, 5.11.2)	☐	Yes	☐	No
For measuring systems mounted on road tankers and LNG fuel dispensers, the quantity indicating device and its printing device complies with the requirements in R 117-1, 3.2.4	☐	Yes	☐	No
For LNG fuel dispensers, any connection between the gaseous phases of the storage tank and that of the receiving tank is prohibited during the transaction (R 117-1, 5.11.8)	☐	Yes	☐	No
Pressure relief valves are incorporated in measuring systems in order to prevent excessively high pressures (R 117-1, 5.11.10)	☐	Yes	☐	No
Connection between the gaseous phase and the storage tank is in compliance with R 117-1, 5.11	☐	Yes	☐	No

Remarks: