European Cooperation in
Legal Metrology (WELMEC)
e. V. Bundesallee 100 38116
Braunschweig Germany

WELMEC Guide 10.8

Guide for common application of MID Annex VII (MI-005) and OIML R117-1, (R81, R80, R139)

Version 2026

WELMEC e.V., Bundesallee 100, 38116 Braunschweig, Germany.
Phone: +49 531 592 1980 E-mail: secretary@welmec.org www.welmec.org

WELMEC is a cooperation between the legal metrology authorities of the Member States of the European Union and EFTA.

This document is one of a number of Guides published by WELMEC to provide guidance to manufacturers of measuring instruments and to Notified Bodies responsible for conformity assessment of their products.

The Guides are purely advisory and do not themselves impose any restrictions or additional technical requirements beyond those contained in relevant EU Directives.

Alternative approaches may be acceptable, but the guidance provided in this document represents the considered view of WELMEC as to the best practice to be followed.

Published by:
WELMEC Secretariat

E-mail: secretary@welmec.org
Website: www.welmec.org

Foreword

This document is intended to provide guidance to all those concerned with the application of MID Annex VII (MI-005) and/or OIML International Recommendation R117-1 'Dynamic Measuring Systems for Liquids other than Water'.

This document provides a record of the continuing work of WELMEC Working Group 10 in the area of the common application of MID Annex VII (MI-005) and/or OIML R117-1 itself and in addition seeks to provide information, which is specific to individual member countries.
(*Author's note 29/02/2012: Country specific information, once available, will be added in a separate Annex*).

Some of the decisions made, were based on the R117 (1995). Where applicable, reference to the OIML R117 (1995) articles is presented in ~~strikethrough~~ font and reference to the R117-1 (2007) article has been added in regular font.

This document is one of Guides published by WELMEC to provide guidance to manufacturers of measuring instruments and to bodies responsible for conformity assessment of their products. The Guides are purely advisory and do not themselves impose any restrictions or additional technical requirements beyond those contained in OIML International Recommendation R117. Alternative approaches may be acceptable, but the guidance provided in this document represents the considered view of WELMEC as to the best practice to be followed.

Contents

1 Section 1, MID Annex VII (MI-005) related decisions, interpretations, etc. 5
1.1 Annex VII (MI-005) article 5.3 MPE's with air / gas intake 5
1.2 Annex VII (MI-005) article 5.3 absolute MPE for air or gas pockets 5
1.3 Mechanical class Fuel Dispensers M1 or M2 9
1.4 Harmonised EU Approach Self Service Devices 9
1.5 On-site verification Yes / No 10
1.6 Interpretation point 2.8 14
2 Section 2, OIML R117-1 related decisions, interpretations, etc. 16
2.1 Sub-merged pumps 16
2.2 Non-interruptible systems performance criteria 18
2.3 Sealing of Associated measuring sensors and mandatory printing 18
2.4 Conformity assessment of MSLOTW's Temperature sensor 19
3 Section 3, ARCHIVE / REMINDERS 21
3.1 Pulser testing 21

1 Section 1, MID Annex VII (MI-005) related decisions, interpretations, etc.

1.1 Annex VII (MI-005) article 5.3 MPE's with air / gas intake

1.1.1 Introduction

During WG10 meetings and in the MID Amendment discussions it became apparent that article 5.3 of Annex VII (MI-005) and the corresponding OIML R117-1 articles were interpreted inconsistently by the various stakeholders. As a result of this undesirable situation the subject has been discussed at various occasions, ultimately resulting in below interpretation.

1.1.2 Argumentation

Milk measuring systems and their MPE during the entrance of air
This section describes the interpretation of the relevant articles of MID article 5.3 and R117-1, related to milk measuring systems and their MPE, when air is sucked in under normal operating conditions. It also applies to measuring systems fitted with gas elimination devices where air / gas intake occurs often during normal operation, or in other words, is part of the normal operating conditions.

Due to R117-1 2.10.1 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 meter. The suitability of the gas elimination device shall be such that the effect due to the influence of the air or gases on the measuring result does not exceed the values in 2.10.1.

For milk measuring systems, a gas/air elimination device is required according to R117-1 5.6. 5.6.3 first and second sentence describe two situations where air is entering the measuring system; 5.6.3 requires an adequate reaction of the air elimination device and makes a reference to the requirements in 2.10.1.
This statement might give the impression that 5.6.3 deals with an operational condition of the measuring system beyond the rated operating conditions, leading to the assumption that it is acceptable to exceed the MPE of the measuring system (see table 1 of 2.4 and table 2 of 2.5.1) by the values in 2.10.1.

1.1.3 Summary

But contrary to other measuring systems, where the entrance of air is beyond the normal operating conditions, the entrance of air described in 5.6.3 represents the normal working principle of a milk measuring system under rated operating conditions, for which the MPE applies.
Summarised, for measuring systems where air / gas intake occurs often and is therefore considered to be a part of the normal operating conditions, the MPE equals the MPE associated with that application in accordance with Annex VII (MI-005) table 2 only, and no additional shifts.

1.2 Annex VII (MI-005) article 5.3 absolute MPE for air or gas pockets

1.2.1 Introduction

During the 30th WELMEC WG10-meeting in Lisbon on 20 September 2018 the following question has been addressed:

What does clause 5.3 of MID, annex VII (MI-005) mean, especially the wording "***shall never be smaller than 1% of MMQ***"?

1.2.2 Background information

To answer this question, we have to analyze and explain the requirements according to clause 5.3 of MID, annex VII (MI-005) very carefully:

Sentence	Annex VII (MI-005) clause 5.3	Explanation
1	Any percentage of air or gas not easily detectable in the liquid	The following requirement refers to undissolved air or gas contained in the liquid (let's call it: "gas bubbles")
	shall not lead to	
	a variation of error	MPE (Maximum Permissible Error) of the additional error effect due to the influence of the air or gases on the measuring result
	greater than: — 0,5 % for liquids other than potable liquids and for liquids of a viscosity not exceeding 1 mPa·s, or — 1 % for potable liquids and for liquids of a viscosity exceeding 1 mPa·s.	Relative allowed error
2	However, the allowed variation	MPE (Maximum Permissible Error) of the additional error effect due to the influence of the air or gases on the measuring result
	shall never be smaller than 1 % of MMQ.	Explaining that the absolute allowed error shall not be smaller than 1 % of the MMQ (Minimum Measured Quantity).
3	This value	Value = 1% of MMQ (reference to sentence 2)
	applies in the case of air or gas pockets.	This means: in the case of only air/gas (no liquid), when the supply tank becomes empty or other empty pipe sections (note: no gas bubbles in the liquid; only: air/gas)

So in conclusion:

1. Sentence 1: In the case of air/gas in the liquid (= both air/gas AND liquid are present) the maximum permissible variation of error is 0.5% or 1% (depending on the properties of the liquid). This maximum permissible variation of error is a relative error, because it is expressed as a percentage. Depending on the actual measured quantity this absolute error might be greater or smaller.
2. Sentence 2: The absolute value of the permissible variation of error is never smaller than 1% of the MMQ.
3. Sentence 3: The case described in sentence 3 is different from the case described in sentences 1 and 2, because sentence 3 describes the case of air or gas pockets (= no liquid present; only air/gas). This situation in particular occurs when the supply tank or other empty pipe sections become empty. The term "This value" refers to sentence 2, where a value of 1% of the MMQ is stated. Therefore, an additional MPE of 1% of the MMQ is applicable if the supply tank becomes empty.

1.2.3 Comparison of MID with OIML R117-1 (2007)

According to the cross-table (OJ 2011/C 33/01) clause 5.3 only refers to R117-1 sub-clause 2.10.1 (not to the complete clause 2.10).

In OIML R117-1 edition 2007 is stated:

> R117-1(2007), clause 2.10.1:
> 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 meter. […]
> 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, and for liquids of 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.
> […]

This shows that R117-1 clause 2.10.1 is consistent with MID annex VII (MI-005) clause 5.3 sentences 1 and 2.

Sentence 3 of clause 5.3 (MID) is not covered by R117-1 clause 2.10.1. Because 2.10.1 (R117-1) only refers to "*air or undissolved gases which may be contained in the liquid*", but sentence 3 of clause 5.3 (MID) describes "*air or gas pockets*". In clause 2.10.1 the presence of air or gas pockets (= "pure air" or "pure gas") is not mentioned. The requirement related to sentence 3 of clause 5.3 (air or gas pockets) is made clear in R117-1 clause 2.10.2 and clause 2.10.9, although there is no reference in the cross-table of the OJ (Official Journal).

Reference to clauses 2.10.2 and 2.10.9 (R117-1) is available in the cross-table e.g. from 7.1 (annex I of the MID) and from 5.4.4 (annex VII (MI-005) of the MID), which both refer to clause 2.10 (R117-1). Clause 2.10, of course, includes 2.10.2 and 2.10.9:

> R117-1(2007), clause 2.10.2 (partial extract):
> […]
> 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**.
> […]
> When applying this provision concerning gaseous formations, it is important to consider that:
> - gaseous formations are likely to occur because of thermal contraction during shutdown periods, and
> - 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 vapor 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.
> […]
>
> R117-1(2007), clause 2.10.9, 1st paragraph:
> 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**.
> […]

1.2.4 Conclusion

Both MID and OIML R117 are making distinction between:

- a relative MPE for any air or undissolved gases which may be contained in the liquid; and
- an absolute MPE for air or gas pockets.

For the latter, the wording of the absolute MPE is different:

- MID: This value applies in the case of air or gas pockets (1 % MMQ).
- R117: No resulting additional effect greater than 1 % of the MMQ.

However, both wordings lead to the conclusion that the MPE for air or gas pockets is 1 % of the MMQ.

1.2.5 Example for testing the requirements on air/gas pockets:

The measuring system shall be calibrated without any air inbreak to an error as close as possible to zero. Therefore, any error during the empty compartment test will be due to the air intake into the liquid. This is an absolute error and not a relative error. This error is independent of the size of the proving tank.

For example using:

Proving tank: 1000 L
MMQ of the measuring system: 200 L

The empty compartment test is performed once at maximum possible flow rate, e.g. at 600 L/min. After the system has stopped by detecting the air intake, restart the measuring system by opening a full compartment and fill up the proving tank to the nominal volume, in our case 1000 L.

Based on the test data calculate the error.
If this error is ≤ 1% of MMQ (here: 2 L), the system fulfills the essential requirements. If this error is > 2 L, then the system has not passed this test, and it does not fulfill the essential requirements.

Usually the MMQ of the gas elimination device defines the MMQ of the measuring system and not the MMQ of the meter itself.

1.3 Mechanical class Fuel Dispensers M1 or M2

1.3.1 Introduction

In the past, under OIML R117 (1995), it was not customary to perform vibration tests on electronic components of fuel dispensers. In MID however, the definition of the mechanical classes differs somewhat from the then common classification.
Recent experience has shown this leads to questions, which can be settled by means of this decision.

1.3.2 Legal Background

MID
M1 This class applies to instruments used in locations with vibration and shocks of low significance, e.g. for instruments fastened to light supporting structures subject to negligible vibrations and shocks transmitted from local blasting or pile-driving activities, slamming doors, etc.

M2 This class applies to instruments used in locations with significant or high levels of vibration and shock, e.g. transmitted from machines and passing vehicles in the vicinity or adjacent to heavy machines, conveyor belts, etc.

OIML R117 (1995)
From Annex A.4.4 Vibration
This test should normally apply to mobile measuring systems only.

Cross-reference table MID / R117-1, June 2007
M1 is applicable to all measuring systems except those installed on trucks.

M2 is applicable to all measuring systems on trucks and to other types of measuring systems for specific applications.

1.3.3 Technical Background

Often Fuel Dispensers are installed on so-called islands, which are mechanically isolated from the surrounding road paving.

1.3.4 Decision

MID Mechanical Class M1 is applicable for Fuel Dispensers which are mechanically fixed on a dispenser island or solid platform, without performing vibration tests.

1.4 Harmonised EU Approach Self Service Devices

[Still under discussion]

1.5 On-site verification Yes / No

1.5.1 Introduction

MID doesn't specify the location of tests and/or examination performed during conformity assessment of product at the level of production (with or without quality assurance).

In the field of measuring systems for liquids other than water it is current practice that some tests and/or examination are performed on the instrument or a part of it at the manufacturers premises (by himself under quality assurance or by a notified body).

However there remain cases where due to the design of the system, it is necessary that some tests or part of the examination are performed when the instrument is installed at the place of use just before it is legally put into service.

The responsibility of the manufacturer goes "until and including “putting into use”.

This Guide has the intension to help manufacturers in deciding when to perform tests in situ[1].

1. If there is a low risk that the metrological characteristics could be changed during handling, transportation or installation and the end user is considered capable to install the MI himself according to the manufacturer’s instructions, the MI may be fully assessed at the manufacturers' premises by himself or by a notified body,
2. If there is a high risk that the metrological characteristics could be changed during handling, transportation or installation the MI should be assessed on site of installation (or at least the final part of the conformity assessment is performed in situ).

The following table is an attempt to reach common interpretation about what has to be in situ. It is also recalled that the content of the type examination certificate (module B) and design examination certificate (module H1) is defined in the relevant annexes of MID and in particular:
- In 6 second paragraph of Annex II, Module B "The certificate and its annexes shall contain all relevant information for conformity evaluation and in service control. In particular …."
- In 4.3 second paragraph of Annex II, Module H1 "The certificate and its annexes shall contain all relevant information for conformity evaluation and in service control. It shall …"

For this purpose for each case of different type of measuring systems of liquids other than water different risks have been evaluated.

[1] It is recalled that concerning installation, even when under MID it is considered that the instrument does not need to be tested in situ , a Member State may have its own legislation concerning installation which could be distinguished from the instruments themselves provided that it does not interfere with the implementation of MID and the "fitness for installation" of the instrument. (Of course such a legislation has to be notified in advance to the Commission and other Member states)

Family of MS	Ref in R 117-1	In case of complete conformity assessment of MI in factory the risk that metrological characteristics or performances of the MI are changed before installation is completed is			High probability that examination on site of use, either under Annex II, Module D or F is necessary*	High probability that testing on site of use, either under Annex II, Module D or F (e.g. accuracy) is necessary*	High probability that certification on site of use, either under Annex II, Module D or F is necessary*	Necessity of demonstrating the competence for installers to be demonstrated to Manufacturer (or to national authority, depending on national legislation)
		due to packaging / handling	due to transportation	due to installation (conditions, need to break a seal…)				
Fuel Dispensers other than LPG and without self-service device with gas separator	5.1	Low	Low	Low	No 1)	No 2)	No 1) 2)	Yes
Fuel Dispensers other than LPG and without self-service device and without gas separator (submerged pumps in particular…)	5.1	Low	Low	High	Yes	No 2)	Yes	Not relevant
Measuring systems on road tankers for liquids of low viscosity	5.2			High	Yes	Yes	Yes	Not relevant
Measuring systems for the unloading of ship’s tanks and rail and road tankers using an intermediate tank	5.3			High	Yes	Yes	Yes	Not relevant

Family of MS	Ref in R 117-1	In case of complete conformity assessment of MI in factory the risk that metrological characteristics or performances of the MI are changed before installation is completed is			High probability that examination on site of use, either under Annex II, Module D or F is necessary*	High probability that testing on site of use, either under Annex II, Module D or F (e.g. accuracy) is necessary*	High probability that certification on site of use, either under Annex II, Module D or F is necessary*	Necessity of demonstrating the competence for installers to be demonstrated to Manufacturer (or to national authority, depending on national legislation)
		due to packaging / handling	due to transportation	due to installation (conditions, need to break a seal…)				
Measuring systems (other than LPG dispensers) for liquefied gases under pressure measured	5.4			High	Yes	Yes	Yes	Not relevant
LPG fuel dispensers for motor vehicles without self-service	5.5	Low	Low	Low	No 1)	No 2)	No 1) 2)	Yes
Measuring systems for milk with a constant level tank	5.6			High	Yes	Yes	Yes	Not relevant
Measuring systems on pipeline and measuring systems for loading ships	5.7			High	Yes	Yes	Yes	Not relevant
Measuring systems for the refuelling of aircraft	5.8			High	Yes	Yes	Yes	Not relevant

Family of MS	Ref in R 117-1	In case of complete conformity assessment of MI in factory the risk that metrological characteristics or performances of the MI are changed before installation is completed is			High probability that examination on site of use, either under Annex II, Module D or F is necessary*	High probability that testing on site of use, either under Annex II, Module D or F (e.g. accuracy) is necessary*	High probability that certification on site of use, either under Annex II, Module D or F is necessary*	Necessity of demonstrating the competence for installers to be demonstrated to Manufacturer (or to national authority, depending on national legislation)
		due to packaging / handling	due to transportation	due to installation (conditions, need to break a seal…)				
Blend dispensers without self-service	5.9	Idem Fuel Dispensers other than LPG						
Fuel dispensers with self-service device	5.1, 5.5 or 5.9 + 5.10	Low	Low	High	Yes	4)	Yes	Not relevant
Other MS, in particular for loading trucks		Low 3)	Low 3)	Low 3)	No 1) 3)	No 2) 3)	No 1) 2) Yes	Yes Not relevant

* For a MS on truck, the site of uses is the truck

1) Provided there is no break of seal
2) Provided the MS in tested in laboratory with the intended liquid or with an appropriate substitution liquid
3) As soon as there is risk this line applies
4) The conditions for the fuel dispenser apply

1.6 Interpretation point 2.8

1.6.1 Introduction

Point 2.8 in Annex VII (MI-005) of the MID (Directive 2014/32/EU) which had been added to the specific requirements of Directive 2004/22/EC by Directive 2009/137/EC reads as follows:

"2.8. The measuring system shall not exploit the MPEs or systematically favour any party".

This article shall transpose into a requirement for modules D, G, H1 and F to insure compliance with this article. The suggested method below gives only guidance for fuel dispensers placed on the market only under Module D of the MID since these are produced in high numbers which can be used in statistical analysis.

Note: For now, modules G, H1 and F are not covered in this Guide.
In the case of F, because the number of individual dispensers may be lower

1.6.2 Suggested method

General information
When manufacturing instruments under Annex VII (MI-005) (petrol stations) and using module D, calibration means and methods shall comply with clause 4.2.1 of OIML R117-2 (2014):

When a test is conducted, the expanded uncertainty of the determination of errors on indications of volume or mass shall be less than one-fifth of the maximum permissible error applicable for that test during type evaluation and one-third of the maximum permissible error applicable for that test during other verifications. The expanded uncertainty is calculated according to the "Guide to the expression of uncertainty in measurement" (2008 edition) with k = 2. In the calculation of the uncertainty, the resolution of the EUT shall be taken into account.

Calibration process shall be such that the adjustment shall lead to measuring instrument error curves which are as much as possible near to zero with calibration tools, taking into account the technical opportunities of a measuring instrument.

As a consequence, when manufacturing instruments under Annex VII (MI-005) and using module D, statistical results (based on the final control recorded data, such data being the base for recalibration decisions at final control) of any given population(*) of instruments (minimum of 20 instruments) passed under module D shall comply with:

- Flow rate: tests used in the sample/population analysis shall be done at maximum flow rate for instruments (if possible, min 80% of approval maximum flowrate).
- Standard deviation calculation (over n-1)
- On complete dispenser

Sample size assessment can be established using WELMEC guide 8.10

Note: *The population is determined at the discretion of the auditor.*

Expected results
Expected results to comply with requirements of point 2.8, Annex VII (MI-005).

- Mean value (M): shall be very close to zero (fair limit : ± 0,05%) (note 1)
- Population in ± ⅓ of MPE with k=2 (note 2)

An example how to check:

- Collect population sample calibration data (always after any recalibration action)
- Calculate mean value and population standard deviation (n-1) for all collected data
- Check versus Note 2 approach

Note 1:
This is the average calibration value after any recalibration decision

- Instruments will show a standard bell curve distribution before any recalibration decision.
- The mean value and standard deviation of that population will depend on of the manufacturing quality of the sub-components involved upstream final metrology test (meter, etc.).
- After calibration check, decision should be taken to always pull back to the closest to zero any offset seen during final metrology test.
- Statistical information (here, mean value and standard deviation) to be built from metrological calibration information AFTER any decision to recalibrate is applied.

Note 2:
Population interval for k=2 is established as $[(M - 2 \times \sigma) ; (M + 2 \times \sigma)]$

- It is assumed that statistically, 95% of sampled population is compliant to requirement if population interval does not overlay outside of ± ⅓ of MPE from zero.
- Easy approach is to require that $- ⅓ \times 0{,}5\% \leq (M - 2 \times \sigma)$ and $(M + 2 \times \sigma) \leq + ⅓ \times 0{,}5\%$

2 Section 2, OIML R117-1 related decisions, interpretations, etc.

2.1 Sub-merged pumps

This section describes the interpretation of the relevant articles of R117-1, related to the omitting of the gas elimination device in fuel dispensers, other than LPG dispensers, intended for installation in a system with a submerge pump.

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, e.g. the provisions in point 2.10.1. Because of the pumped flow, the provisions of point 2.10.2 are also applicable.
As a general rule a gas elimination device is to be installed.

However the second paragraph of point 5.1.3 says:
"If it is not intended to install a gas elimination device, there shall be ~~the manufacturer or installer has to prove that there is~~ 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) ~~the minimum level in the storage tank must be automatically secured and any leakage shall be checked~~."

When no gas elimination device is installed, these prescriptions may be fulfilled by applying all of the following provisions 1 to 8.

1. Air intake / Minimum level.

To secure automatically the minimum level in the storage tank, a level detection system shall be installed. This system prevents using the submerge pump when the liquid level reaches a minimum level above the inlet of the pump, so that there is no risk of air intake.
The minimum level that has to be respected is given by the following formula:

$h => k.v^2 / 2.g$

where:
h: minimum level of the liquid above the suction inlet of the pump [m]
v: maximum velocity of the liquid at the pump inlet [m/s]
g: acceleration of gravity [m/s²]
k: security factor; k is at least equal to 6

with k=6 the formula becomes:

$h => 3v^2 / g$

2. Gas release

Gas can be generated during shut down periods as a result of temperature drop.
If it cannot be proven by calculation (see point 2.13.2) that the gaseous formation has a specific effect smaller than or equal to 1 % of the minimum measured quantity (see 2.10.2 ~~10.2.2~~) than at least one of the following provisions shall be applied to assure that no released gas will be in the system at the start and during the delivery:

2.1 A detection system based on a pressure control device holds the pressure of the liquid always well above the vapour pressure.
2.2 Each delivery shall be delayed until the submerge pump has been running for at least 3 seconds.

3. Leak detection

A leak detection system shall be installed.
Detection of any leakage in the line shall result in stopping or preventing of any delivery.
The detection system of 2.1 can fulfil the leak detection function.

4. Pipeline construction

The pipelines between the pump unit and the dispenser are installed with a positive slope of at least 1 %. There shall be no significant portion with no slope.
No high points are allowed upstream of each dispenser, except for the ones needed for the connection with other dispensers.

5. Non-return valve

At least one non-return valve shall be installed in the system. It is advisable to install a non-return valve upstream of every measurement transducer.
Note: this non-return valve shall not be likely to create gaseous formations.

6. Security of the devices

All the devices mentioned shall be in “positive” security so that no delivery is possible if one of these devices fail.
It shall be possible to check if the electronic devices (e.g. by simulation) are functioning correctly.

7. Type approval

The type approval certificate of the fuel dispenser shall clearly describe the above provisions 1 to 7 that have to be followed to allow the omitting of the gas elimination device.

8. Initial verification

The initial verification of the fuel dispenser shall include examination on site of use with respect to the above provisions:

- testing the positive security of all the devices,
- checking the correct functioning of the electronic devices by simulation,
- checking that the prescription for the minimum level is fulfilled,
- checking the presence of a leak detection system,
- if applicable, checking the delay time of delivery for each dispenser,
- checking the slope of the pipes on drawings.

2.2 Non-interruptible systems performance criteria

According to this definition, it is not logical to allow that a perturbation considered in A.11 ~~A.4~~ imply the impossibility of performing any measurement for a non-interruptible measuring system, when no significant fault is allowed (4.1.1.2).
A high level of reliability is necessary for a non-interruptible measuring system. In any case, whatever the reason of the impossibility of performing a measurement, the concrete effect can only be one of the two following aspects:

- stopping the flow, or
- blocking or blanking the display.

In the case of a non-interruptible measuring system, the first hyphen is not applicable.
The spirit of 4.1.1.2 of R 117-1 is to have an accurate result without any alarm, since no alarm with significant fault is allowed. The logical conclusion is that the instrument has to continue working and displaying correctly.
The corresponding provision in T.f.1 ~~T.3.12~~ should be interpreted as following:

a) The impossibility of performing any measurement is only acceptable for an interruptible measuring system.
b) During tests considered in A.11 ~~A.4~~, a non-interruptible measuring system shall continue to operate as designed and accurately according to 4.1.1.2. However there is no need that checking facilities ensure and control that it continues operating. When it operates, checking facilities shall only control it operates as designed and accurately.

(Authors note 29/02/2012: article 4.1.1.2 has not changed between the 1995 and 2007 edition of R117; only change made is replacement of "R117" by "R117-1").

2.3 Sealing of Associated measuring sensors and mandatory printing

a) Associated measuring instruments sensors involved in the correction and/or conversion of volumes have to be sealed against unauthorized removal.

b) According to 3.1.4.5 ~~the fifth paragraph of 2.20.1~~ it is not acceptable in case of **direct selling to the public** to enter manually into the calculator at the beginning of the measurement operation the nature of the measured liquid or its viscosity when this datum participates in the **correction** of the volume.

   This may be acceptable only in case of **selling between professionals** and only for the nature of the measured liquid or its viscosity. According to 3.1.4.5 ~~the last sentence of the fifth paragraph of 2.20.1~~ in this case it is necessary to provide the measuring system with a printing device. This device shall print this datum and a note explaining that this datum has been entered manually. According to 3.1.4.5 ~~2.2.2~~ this printing device shall be subject to control.
   It is allowed to replace the printing device 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 correction (for instance by displaying the nature of the liquid at the end of the transaction if the nature of the liquid participates in the correction). The pattern approval certificate may indicate how to gain access to the memorized data.

   In case of **correction and direct selling to the public**, it is not authorized to enter manually the nature of the liquid or any other datum at the beginning of the measurement operation when this datum participates in the result.

2.4 Conformity assessment of MSLOTW's Temperature sensor

2.4.1 Introduction

Temperature sensor as a constitutive part of a MSLOTW may with application of a valid temperature compensation play a crucial role enabling a correct operation of a MS.
On 37th WELMEC WG10 meeting applied means of conformity assessment procedures regarding temperature sensors were discussed.

2.4.2 Legal background and Temperature sensor requirements

OIML R 117-1 includes certain requirements regarding temperature sensors in following chapters:

- 2.5 Maximum permissible errors and significant faults (for mass and volume indications of the measuring system)
- 2.7 Provisions for converted indications
- 2.7.2.2.2; digital output; Table 5.2
- 2.9 Indications
- 3.7 Conversion devices (3.7.7)

OIML R 117-2 in Chapter 6.5 describes Tests of the response time of the measuring system temperature sensor.

Practical procedures and modes of conformity assessment in praxis are described and explained in Chapter 2.4.3.

2.4.3 Procedures of conformity assessment of MSLOTW's Temperature sensor

Various procedures of temperature sensor's assessment are agreed. They vary in terms of their reliability and complexity. Regarding available means most reliable shall be chosen:

a) Traceability with a (factory) calibration certificate (ISO17025) of the sensor

Providing traceability of a temperature sensor to a required level with a calibration certificate is most reliable and accurate procedure. Use of relevant certificates is encouraged. In case calibration certificate is not available, alternative methods may be applied.

b) Comparing the temperature indication of the MSLOTW with the indication of a reference thermometer

Temperature of measuring point(s) is limited (and defined) with the present liquid temperature in EUT. Traceability of a reference thermometer is required.

MPEs are given in OIML R117-1, Ch. 2.7.2.2.2, Table 5.2.

c) Comparing the indicated converted volume ($V15_{indicated}$) with the calculated converted volume ($V15_{calculated}$)

Values of calculated converted volume, indicated (and calculated) by measuring system [$V15_{indicated}$] and calculated by control officer [$V15_{calculated}$] both require temperature measurements with relevant temperature sensors (either as part of MSLOTW or inserted in a well of MS, as appropriate).

Converted volume values are therefore directly linked and dependant on by applied temperature sensors measured temperatures.

MPE (for volumes greater than 2 L) of measured errors after conversion due to conversion device are given in OIML R117-1, Ch. 2.5, Table 3.

d) Ice test

Basic and simplified metrological test may be provided by performing 'an ice test'.

Dipping a temperature sensor in a crushed ice bath (ice slurry) represents exposure of a temperature sensor to a (most) severe environment.

MPEs are given in OIML R117-1, Ch. 2.7.2.2.2, Table 5.2.

e) Fulfilling the requirements, i.e. sensors are manufactured and tested for the required accuracy or better (normally Class A)

In case other methods are not feasible to apply one can rely on the state of the art of temperature measurement sensors technology. Providing installation and use of temperature sensors of Class A (or higher, i.e. AA) should guarantee trustworthy temperature measurements.

f) Correct identification, installation and sealing

Minimum level of assessment confirmation is limited to visual test with checking and establishing that the installed temperature sensor is correctly identified, installed and sealed.

2.4.4 Risks

When installing and/or testing temperature sensors in MSLOTW precautions shall be paid to avoid or limit at least following risks:

- The void (and/or entrapped air) between the sensor well/pocket and the temperature sensor itself can result in significant changes of thermal insulation properties of temperature sensor.
  Response time may be influenced and requirements of OIML R-117-1 3.7.7. questioned.
- Excessive lenght of the pipeline may result in liquid temperature stabilization challenges.
- Attention shall be paid to avoid incorrect operations such as entering/applying wrong factors of fluid density, measurement coefficients, product names and properties,…
- Operators may unintentionally and unaware of consequences remove and/or change temperature sensors without acknowledging the applied seals.

2.4.5 Decision

Confirming sensor’s properties with a relevant calibration certificate is a secure way to establish conformity.

In case we’re faced with lack of required documents various tests/comparisons shall suffice.

In case certificates and measurement results are not at disposal, technological state of art of temperature sensors is on a level high enough to allow establishing conformity already by choosing appropriate sensor accuracy class.

Special attention shall be paid to avoid/limit certain practical risks.

3 Section 3, ARCHIVE / REMINDERS

3.1 Pulser testing

According to this definition the pulser has to be considered as a part of the measurement transducer.
At the moment R 117-1 gives no possibility to issue a pattern approval for a pulser alone.
According to the current definition the pulser could be included in the pattern approval certificate of a meter or a measurement transducer but not in the pattern approval certificate of a calculator / indicating device.
Nevertheless, if the pulser is an electronic device, it has to be submitted to tests of Annex A.11 of R 117-1. It seems that the most convenient way to test a pulser according to Annex A.11 is to connect it to an electronic calculator / indicating device. These two devices could be tested at the same time. In that case the test report covers both devices.

Revision History

Version	Significant changes
2016	Addition section 1.6 regarding interpretation point 2.8
2019	Update to Directive 2014/32/EU
2020	Addition section 1.2 with explanation of MID, annex VII (MI-005) clause 5.3 absolute MPE for air or gas pockets
2026	Addition section 2.4 : Conformity assessment of MSLOTW's Temperature sensor