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European Cooperation in Legal Metrology

Guide for Evaluating a Pre-setting Device for Fuel Dispensers (MI-005)

For information:
This guide is available to the Working Group Measuring Instruments for future reference on the Europa Website.

WELMEC

European Cooperation in Legal Metrology

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.

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1 Scope

This guides deals with pre-setting devices as a part of Fuel Dispenser, used as measuring instruments for liquids other than water as specified by Annex VII (MI-005) of the Measuring Instrument Directive, 2014/32/EU (MID).

Since the MID in itself does not have requirements for a pre-setting device, guidance in this guide is derived from the normative document, OIML R117, edition 2007, (R117) that gives presumption of conformity to the essential requirements of Annex I and the instrument specific requirements of Annex VII (MI-005) of the MID.

2 Functioning of the pre-setting device

A pre-setting device is a device which permits the selection of the quantity to be measured and which automatically stops the flow of the liquid at the end of the measurement of the selected quantity. The pre-set quantity may be the volume, the mass or the related price to pay.
(See T.p.3, OIML R117, 2007)

Pre-setting requires the dispenser to be fitted with a pre-set valve which can stop the flow when the target is reached.

Preset valves can use for example:

- A type 2 valve with two activation coils, High Flow and Low Flow, with high accuracy stop;
- A type 3 proportional control coil, with high accuracy stop.

It could be that the flow of the liquid is stopped too late or too early. If the flow of the liquid is stopped too late it is overshooting, if the flow of liquid is stopped too early it is undershooting.

- Overshooting can happen when particles are disturbing the response time of the low flow system at shut-off time or the reaction time of the valve is influenced by low temperatures.

- Undershooting can happen if slow-flow valve fails to open while high-flow has already shut, or if a slow-valve shuts prematurely.

3 Legal background

In some cases, the pre-setting device can be seen as “legal” or “legally relevant”, i.e. when the transaction is based on the pre-set value instead of the actual measured quantity.

If the transaction is based on the pre-set value, both the fuel dispenser and the pre-setting device have to comply with the essential requirements of the MID..

With respect to the pre-setting device the following requirements needs special consideration.

From annex I of the MID:

- Annex I Essential requirements: A measuring instrument shall provide a high level of metrological protection in order that any party affected can have confidence in the result of measurement, and shall be designed and manufactured to a high level of quality in respect of the measurement technology and security of the measurement data.
- Article 7.1: A measuring instrument shall have no feature likely to facilitate fraudulent use, whereas possibilities for unintentional misuse shall be minimal.
- Article 7.2: A measuring instrument shall be suitable for its intended use taking account of the practical working conditions and shall not require unreasonable demands of the user in order to obtain a correct measurement result.
- Article 7.6: A measuring instrument shall be designed so as to allow the control of the measuring tasks after the instrument has been placed on the market and put into use. If necessary, special equipment or software for this control shall be part of the instrument. The test procedure shall be described in the operation manual.
- Article 8.1: The metrological characteristics of a measuring instrument shall not be influenced in any inadmissible way by the connection to it of another device, by any feature of the connected device itself or by any remote device that communicates with the measuring instrument.
- Article 8.2: A hardware component that is critical for metrological characteristics shall be designed so that it can be secured. Security measures foreseen shall provide for evidence of an intervention.
- Article 8.3: Software that is critical for metrological characteristics shall be identified as such and shall be secured.
- Article 8.4: Measurement data, software that is critical for measurement characteristics and metrologically important parameters stored or transmitted shall be adequately protected against accidental or intentional corruption.
- Article 10.1: Indication of the result shall be by means of a display or hard copy.
- Article 10.2: The indication of any result shall be clear and unambiguous and accompanied by such marks and inscriptions necessary to inform the user of the significance of the result. Easy reading of the presented result shall be permitted under normal conditions of use. Additional indications may be shown provided they cannot be confused with the metrologically controlled indications.
- Article 10.4: A measuring instrument for direct sales trading transactions shall be designed to present the measurement result to both parties in the transaction when installed as intended. When critical in case of direct sales, any ticket provided to the consumer by an ancillary device not complying with the appropriate requirements of this Directive shall bear appropriate restrictive information.

From Annex VII (MI-005) of the MID:

- Article 5.5.3: Where a measuring system is fitted with a price display, the difference between the indicated price and the price calculated from the unit price and the indicated quantity shall not exceed the price corresponding to Emin. However this difference need not be less than the smallest monetary value.

OIML R117-1, edition 2007 (R117) can be used as a normative document. Compliance with the technical and performance specifications of R117, give rise to a presumption of conformity.

In the case of a pre-setting device article 3.6 of R117 is applicable.

4 Evaluation of the pre-setting device

The fuel dispenser needs to be evaluated to check if the fuel dispenser complies with the essential and instrument specific requirements together with the following additional evaluation of the pre-setting device.

Therefore it is necessary to evaluate, if the pre-setting device performs as described in the technical documentation of the measuring instrument.

Tests if the pre-setting device meets the requirements of OIML R117-1, edition 2007, article 3.6:

- Tests during module B (EU-type examination), module H1 (conformity based on full quality assurance) or module G (conformity based on unit verification): conformity with OIML R117-1, edition 2007, 3.6.1, 3.6.2, 3.6.5, 3.6.7, 3.6.8, 3.6.9, 3.6.10.

- Tests during Module F (conformity to type based on product verification), module D (conformity to type based on quality assurance of the production process) or module G (conformity based on unit verification) while carrying out the accuracy tests for the fuel dispenser also the conformity with OIML R117-1, edition 2007, 3.6.6.

4.1 Tests at manufacturer’s premises

The prepay-preset function shall be tested in accordance with Annex A-I section A-I.7.1.7.1. Purpose of the test is to check that the valve(s) of the dispenser will stop the transaction at the targeted volume with no unacceptable error above the acceptable MPE.

4.2 Tests at place of use

The prepay function shall be tested in accordance with Annex A-I section A-I.7.2.7.1. The check of the prepay function of the dispenser must be activated from the console controlling the site (ancillary device).

5 Special considerations

The pre-set quantity may be the volume, the mass or the related price to pay.

5.1 Calculated volume target

In case the pre-set quantity is set by means of the related price, the target volume has to be calculated. This could lead to a rounding error when the indicated price is displayed. Nevertheless the indicated price should be displayed as calculated.

For example:

If the price per litre is €3,495 and the customer pre-pays €50,- than the calculated volume to be delivered is €50/3,495 = 14,3061516 litre.

The smallest increment for volume is 0,01 litre on the display of the dispenser, therefore if the fuel dispenser reaches its target, it can either display 14,30 litre or 14,31 litre.

Article 5.5.3 of Annex VII (MI-005) of the Measuring Instrument Directive, 2014/32/EU states: Where a measuring system is fitted with a price display, the difference between the indicated price and the price calculated from the unit price and the indicated quantity shall not exceed the price corresponding to Emin.
However this difference need not be less than the smallest monetary value.

The minimum specified price deviation with MMQ = 2 L is Emin = 0,02 * 3,495 €/L = €0,0699.

The value of the price to pay taken from the indicated quantity and the unit price is either

- 14,30 * 3,495 = 49.9785 Euro (calculated), the indicated price is Euro 49,98; the difference is less than the minimum specified price deviation, so passed.
- 14,31 * 3,495 = 50.01345 Euro (calculated), the indicated price is Euro 50.01; the difference is less than the minimum specified price deviation, so passed.

Article 3.6.6 of OIML R117-1, edition 2007 states: 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.

The difference between the price indicating device and the prepaid amount is,

- €50,00 – €49,98 = €0.02 < €0.0699 so passed;
- €50,01 – €50 = €0.01 < €0.0699 so passed.

Based on the essential requirements, see chapter 3, it is not allowed to mask the actual price indicated in such a way that these "rounding errors" are not visible.

- For example €49,98 is displayed as €50,- is not acceptable;
- For example €50,01 is displayed as €50,- is not acceptable.

5.2 Keyed-in volume target

In case the pre-set quantity is set by means of the volume, it might be that the system will over- or undershoot.

In the case of over- and undershooting the Fuel Dispenser shall indicate the measured quantity, i.e. the measurement results – in accordance with the relevant requirement.

For example:

A fuel dispenser is set for 20 litre with an MMQ of 5 litre with a unit price of €1.495. According to article 3.6.6 of R117, 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, in this case 0,05 litre.

- If the system overshoots with 0,04 litre it is within the maximum permissible error of article 3.6.6 of R117, the indicated price should be 20,04 l * 1,495 €/l = €29,96;
- If the system undershoot with 0,04 litre it is within the maximum permissible error of article 3.6.6 of R117, the indicated price should be 19,96 l * 1,495 €/l = €29,84.

Based on the essential requirements, see chapter 3, it is not allowed to mask the over- or undershooting and not to show the actual value if the over- or undershooting is smaller than the minimum specified quantity deviation, i.e. in our example smaller than 0,05 litre.

- In the case of overshooting, a quantity of 20,00 l is displayed instead of 20,04 l. The overshoot of 0,04 l is masked. This is not allowed.
- In the case of undershooting, a quantity of 20,00 l is displayed instead of 19,96 l. The undershoot of 0,04 l is masked. This is not allowed.

Moreover the indicated price shall be calculated from the unit price and indicated volume (in our example 20,04 l or 19,96 l not 20 l).

5.3 Preset the ceiling limit for credit card systems

The transaction is based on the actual volume purchased, however the organization that has issued the credit card can put a restriction on the maximum amount the customer is allowed to buy.

As a result, the fuel dispenser is instructed to not allow a transaction to go over a “ceiling” amount (e.g.: 100€). In this case, since the transaction is still based on the actual volume the pre-setting device does not have to meet the requirements of article 3.6 of OIML R117-1, edition 2007 provided that the preset quantity is not indicated before the start of the measurement.