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NMI R 118
Testing Procedures and Test Report Format for Pattern Evaluation of Fuel Dispensers for Motor Vehicles

(OIML R 118:1995(E), NEQ)

The English version of international standard OIML R 118:1995 Testing Procedures and Test Report Format for Pattern Evaluation of Fuel Dispensers for Motor Vehicles has been adapted to become the non-equivalent national standard with the reference number NMI R 118

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Foreword

NMI requires a minimum test module to examine the component and its compatibility with devices to which it will be connected. In addition, the minimum test module is required to enable the component to be examined for the requirements specified in section 4 of NMI R 117-1 which deals with checking facilities, in particularly verifying the presence of the component, its correct operation, and to verify the correct transmission of data between the component and other devices to which it will be connected, especially when subjected to disturbances.

Examples of minimum test modules for approving certain components

1 The minimum test module for a **calculator/indicator** submitted for approval must comprise the calculator/indicator interfaced to an approved pulse generator. Similarly, when a pulse generator is submitted for approval, it must be supplied interfaced to an approved calculator/indicator in order to form a minimum test module.

Alternatively, a calculator/indicator interfaced to a pulse generator can be supplied as complete new items, in which case both the calculator/indicator and the pulse generator are subject to testing and compliance with the requirements.

2 The minimum test module for a **self-serve device** submitted for approval must include an approved calculator/indicator, incorporating an approved pulse generator. Note that the various components need not be approved, however in this case all unapproved components are subject to examination.

At least one calculator/indicator is required to be supplied interfaced to the self-serve device. The approval will identify the calculator/indicator with which the self-serve device was tested. In addition, the approval will allow the self-serve device to be used with other compatible calculators/indicators which have been approved.

Note that ‘compatibility’ means that the approved device(s) do not require any changes/additions/modifications to the approved hardware/software in order for the system to operate satisfactorily and to comply with the requirements.

If any changes/additions/modifications to any of the approved hardware/software are required then an application for a variation to the approval is required.

Components of a measuring system (other than a meter or measurement transducer) approved by the Chief Metrologist are issued with a supplementary certificate of approval.

At this stage, the Chief Metrologist can only approve the flowmeter with components that form a complete metering system.

CONTENTS

1 Scope

This international recommendation concerns the metrological controls to which fuel dispensers for motor vehicles or constituent elements shall be submitted in order to verify that their characteristics comply with the requirements of NMI R 117-1 *Measuring systems for liquids other than water*. The procedures are intended for testing complete fuel dispensers, constituent elements and specific ancillary devices which can be covered by an OIML certificate of conformity. For fuel dispensers where some of the constituent elements have been previously approved, the number of tests and examination should be adapted.

The following constituent elements or specific ancillary devices of a fuel dispenser can be covered by an OIML certificate of conformity:

- calculator and indicating device, which may include an adjustment device, a correction device, a price indicating device, a zero setting device, a totalising device, a repeating-indicating device, a printing device, a memory device, a pre-setting device, ...,
- measurement transducer, including the pulse generator,
- meter for quantities of liquid,
- gas separator,
- gas extractor,
- self-service device, which may include a memory and/or a printing device.

An OIML certificate of conformity may be issued for a measurement transducer itself when for instance it is intended to be connected to different types of calculators and indicating devices. In this case, the measurement transducer shall be tested with a calculator and indicating device provided that it has been verified previously that the calculator and indicating device used for tests complies with the requirements of NMI R 117-1.

The purpose of this recommendation is to facilitate the recognition of test results and examination among countries. In this way, duplication of tests and examination can be avoided, thereby simplifying considerably the work associated with pattern approval.

Although some parts of this recommendation are of interest and could be adapted for blend dispensers, fuel dispensers with non-volumetric meters with signals in the form of (or equivalent to) pulses, fuel dispensers for viscous liquids and for fuel dispensers for liquefied petroleum gases (LPG), this recommendation does not apply to these measuring systems.

The standardised tests reports format for pattern evaluation of fuel dispensers for motor vehicles, constituent elements or ancillary devices are given in Annex A. The relevant points of the general checklist applicable to the constituent elements are given in Annex B. Figures are given in Annex C.

2 Reference conditions

Except when otherwise specified, the reference conditions are the following:

- ambient temperature: 20°C ±5°C
- relative humidity: 60% ±15%
- atmospheric pressure: 86 kPa to 106 kPa
- mains power voltage: nominal voltage (V_{nom})
- mains power frequency: nominal frequency (F_{nom})

Except when otherwise specified, during test the temperature and relative humidity shall not vary by more than 5°C or 10% respectively within the reference range. Ambient temperature shall be measured close to the equipment under test (EUT).

3 Symbols, units and equations

In this recommendation the following symbols, units and equations are used:

CID	Calculator and indicating device
NCU	National currency unit
EUT	Equipment under test
MPE	Maximum permissible error
RH	Relative humidity
e	Volume scale interval (L) of the main indicating device
f	Frequency of pulses sent to the CID (Hz)
i	Number of pulses sent to the CID
K	Variable determined by the ratio Q_{min}/Q_{max} and the number of flowrates for accuracy
n_F	Sequence number of a flowrate test
N_F	Number of flowrates for accuracy
n_o	Number of operations testing a gas extractor
P_u	Indicated unit price (NCU/L)
p_t	Pressure of the liquid passing through the meter or the measurement transducer (bar)
p_{min}	Minimum pressure of the liquid passing through the meter or the measurement transducer (bar)
p_{max}	Maximum pressure of the liquid passing through the meter or the measurement transducer (bar)
Q	Simulated or real flowrate of liquid (L/min)
Q_{min}	Minimum flowrate of liquid (L/min)
Q_{max}	Maximum flowrate of liquid (L/min)
Q_a	Flowrate of air (L/min)
t	Time (s)
T_s	Temperature of the liquid in the standard capacity measure (°C)
T_r	Reference temperature of the standard capacity measure (°C)
T_t	Temperature of the liquid passing through the meter or measurement transducer (°C)
V_{min}	Minimum measured quantity (L)
V_i	Indicated volume at metering conditions by the CID (L)
V_s	Volume indication of the standard capacity measure (L)
V_r	Volume indication of the standard capacity measure, compensated from the deviation of the reference temperature (L)
V_m	Volume at metering conditions stored by the CID if the CID is fitted with a memory device (L)
V_p	Printed volume at metering conditions if the CID is fitted with a printing device (L)
V_c	Volume at metering conditions calculated from the number of simulated pulses i and the weight of one pulse w (L)
V_n	Volume at metering conditions (L) passing through the meter compensated for deviation from reference temperature of the standard capacity measure and pressure and temperature of the liquid
V_a	Volume of air (L)
w	Weight of one pulse, volume per pulse (L/pulse)
α	Cubic expansion coefficient of the test liquid due to temperature ($°C^{-1}$)
χ	Cubic expansion coefficient of the test liquid due to pressure (bar^{-1})
β	Cubic expansion coefficient of the standard capacity measure due to temperature ($°C^{-1}$)

Notes:

1 For the determination of α refer to OIML R 63 or ISO 91-1 for petroleum products.

2 For the determination of χ refer to API Manual of Petroleum Measurements Standards Chapter 11.2.1 for petroleum products. If β is not known, the following values can be used.

Material	β ($°C^{-1}$) (uncertainty 5×10^{-6} $°C^{-1}$)
Borosilica glass	10×10^{-6}
Glass	27×10^{-6}
Mild steel	33×10^{-6}
Stainless steel	51×10^{-6}
Copper, brass	53×10^{-6}
Aluminium	69×10^{-6}

P_i Indicated price (price to pay) by the CID (NCU)
P_m Price stored by the CID if the CID is fitted with a memory device (NCU)
P_p Printed price if the CID is fitted with a printing device (NCU)
P_c Calculated price (NCU)
E_{vi} Error of indicated volume at metering conditions (%)
E_{vm} Error of stored volume at metering conditions if the CID is fitted with a memory device (%)
E_{vp} Error of printed volume at metering conditions if the CID is fitted with a printing device (%)
E_{va} Error of indicated volume at metering conditions resulting of the presence of air (%)
ε_0 Intrinsic error of the instrument at metering conditions (%)
ε_1 Intrinsic error at metering conditions obtained at the first accuracy test (%)
ε_2 Intrinsic error at metering conditions obtained at the second accuracy test (%)
ε_3 Intrinsic error at metering conditions obtained at the third accuracy test (%)
$E_{vi}(B)$ Error of indicated volume at metering conditions before the endurance test (%)
$E_{vi}(A)$ Error of indicated volume at metering conditions after the endurance test (%)
E_{pi} Error of indicated price (NCU)
E_{pm} Error of stored price if the CID is fitted with a memory device (NCU)
E_{pp} Error of printed price if the CID is fitted with a printing device (NCU)
$\bar{}$ Mean value of errors (%, NCU, °C, bar)
n Number of tests at the same condition

$Q = 60 \times f \times i$ (if Q is simulated)
$V_c = i \times w$
$P_c = V_i \times P_u$
$V_r = V_s \times [1 + \beta(T_s - T_r)]$
$V_n = V_r \times [1 + \alpha(T_t - T_s)] \times [1 - \chi p_t]$
$E_{vi} = [(V_i - V_c) / V_c] \times 100$ V_c may be replaced by V_r or V_n if appropriate
$E_{vm} = [(V_m - V_c) / V_c] \times 100$ V_c may be replaced by V_r or V_n if appropriate
$E_{vp} = [(V_p - V_c) / V_c] \times 100$ V_c may be replaced by V_r or V_n if appropriate

E_{va} = $[(V_i - V_c) / V_c] \times 100$ V_c may be replaced by V_r or V_n if appropriate
ΔE_{vi} = $E_{va} - E_{vi}$
E_{pi} = $P_i - P_c$
E_{pm} = $P_m - P_c$
E_{pp} = $P_p - P_c$
$\bar{E}$ = $[E(1) + E(2) + ... + E(n)] / n$
ε_1 = $[(V_i - V_c) / V_c]_1 \times 100$ V_c may be replaced by V_r or V_n if appropriate
ε_2 = $[(V_i - V_c) / V_c]_2 \times 100$ V_c may be replaced by V_r or V_n if appropriate
ε_3 = $[(V_i - V_c) / V_c]_3 \times 100$ V_c may be replaced by V_r or V_n if appropriate
ε_0 = $[\varepsilon_1 + \varepsilon_2 + \varepsilon_3] / 3$

$Q = K^{n_F - 1} \times Q_{max}$, where $K = \left[\frac{Q_{min}}{Q_{max}}\right]^{\frac{1}{N_F - 1}}$

$n_o = 0.002 \times V_s / 0.01 \times V_{min}$
Range = Maximum error – minimum error (%, NCU)

4 Testing procedures for electronic calculator and indicating devices

4.1 General information

The present testing procedures apply to calculator and indicating devices (CID) which are not fitted with a conversion device and which are not installed in a mobile fuel dispenser. Thus performance and accuracy tests, sinusoidal vibration and perturbations on dc voltage powered instruments tests are not described.

The present testing procedures apply to CID which may be fitted with an adjustment device, a correction device, a price indicating device, a zero setting device, a totalising device, a repeating-indicating device, a printing device, a memory device or a presetting device.

The CID shall be built-in in a housing representative for the housing of the fuel dispenser. The approving authority may decide that an OIML certificate of conformity covering a given pattern of CID with a given housing will cover any other housing of the same pattern.

Before conducting tests it is necessary to execute the design evaluation of the CID by using the general checklist given in Annex A and the relevant points of this checklist given in Annex B.

Test procedures are given in condensed form, adapted from the mentioned IEC publications. Before conducting tests, consult the applicable IEC Publication.

During these tests the equipment under test (EUT) shall be switched on except for the damp heat cyclic (condensing) test (4.5).

If the CID is provided with a totalising device and or repeating indicating device 2.9.4 and 2.9.5 in NMI R 117-1 have to interpreted as follows:

It is required to check the indication of the main indicating device (first primary indicating device) in relation to the MPE or significant fault. For other indicating devices it is sufficient that the requirements in 2.9.5 are fulfilled.

Notes:

1 Before conducting any disturbance (short time power reductions, electrical bursts, electrostatic discharges and electromagnetic susceptibility) it is necessary to calculate the intrinsic error ε_0 of the CID. The description of the test intended to calculate ε_0 is given in part 4.7. ε_0 is the mean value of three errors, ε_1, ε_2 and ε_3 obtained at three successive individual accuracy tests.

2 No significant fault is explicitly defined in NMI R 117-1 for unit price and price. However it seems logical to apply the following provisions:
   (a) the unit price shall not be changed by disturbances,
   (b) the significant fault on the price to pay is the price corresponding to the significant fault for the volume.

4.2 Test equipment

The test equipment shall be a simulation set-up representative of the normal operation of the measuring system. The simulation set-up shall be designed to permit the CID to calculate at the maximum processing speed stated in the application. The maximum processing speed corresponds to the possibilities of the device to calculate accurately according to the maximum allowable variation given by each test. The processing speed may correspond either to the frequency of pulses (number of pulses per second) if pulses are sent to the CID, or to the minimum repeating data time if data are sent to the CID.

During the tests the CID may be connected to the part of the measurement transducer where signals are passed to the calculator (for purpose of the present testing procedures and test report format this part of the measurement transducer is called the 'pulse generator' or 'data generator'). That means that the following tests can also be conducted to verify that the characteristics of the pulse (resp. data) generator of the measurement transducer comply with the requirements of NMI R 117-1. If the pulse (resp. data) generator of the measurement transducer is not connected to the CID during tests, pulses (resp. data) may be simulated by a special device which send pulses (resp. data) directly to the calculator to be processed. Thus, the movement of liquid is simulated either by rotating the shaft of the pulse (resp. data) generator or by a special device which send pulses (resp. data) directly to the calculator to be computed.

If the pulse (resp. data) generator is not connected to the CID, the maximum processing speed which shall be considered to perform tests shall be the minimum of the maximum processing speed of test equipment and CID.

If the pulse (resp. data) generator is connected to the CID, the maximum processing speed which shall be considered to perform tests shall be the minimum of the maximum processing speed of test equipment, the pulse generator and the CID.

This value shall be indicated in the test report.

Whatever the choice, the pulse (resp. data) generator, which shall be installed in the fuel dispenser shall have been tested according to requirements and performance tests of NMI R 117-1.

Due to uncertainty, the minimum value of the volume simulated during the tests, except when otherwise specified, shall be at least 10 000 e. As stated in clause 3, e is the volume scale interval of the main indicating device.

Except for a specific reason, it may be assumed that the relative error (see T.3.3 in NMI R 117-1) of the CID at a given frequency is independent of the tested volume.

4.3 Dry heat (non-condensing) (influence factor)

Object of the test

To verify that all functions operate as designed and all errors do not exceed the maximum permissible errors under the effect of high temperature.

References

IEC 60068-2-2 (1974-01), IEC 60068-2-2-am1 (1993-02), IEC 60068-2-2-am2 (1994-05),

Basic environmental testing procedures, Part 2: Tests, Test Bd: Dry heat, for heat-dissipating specimen with gradual change of temperature.

Background information concerning dry heat tests is given IEC 60068-3-1 (1974-01), IEC 60068-1A (1978-01), Background information, section 1: Cold and dry heat tests. General background information on basic environmental testing procedures is given in IEC 60068-1 (1988-06), IEC 60068-am1 (1992-04).

Test equipment

Testing chamber capable of maintaining the specified temperatures within ±2°C.

Test procedure

1 Maintain the EUT under reference conditions for at least two hours.

2 Set the maximum value of unit price, if applicable.

3 Adjust the maximum processing speed in accordance with procedure 4.2.

4 Reset the indications of the CID.

5 Simulate a delivery in accordance with procedure 4.2.

6 Read all primary indications on volume and on price if applicable.

7 Calculate the relevant true values and the relevant errors.

8 Change the temperature of the EUT to 55°C (environmental class C) at a rate not exceeding 1°C/min. Maintain this temperature for at least two hours after it has reached stability. The humidity shall not exceed 20 g/m^3 or 19% RH.

9 Repeat steps 4 to 7.

10 Return the temperature of the EUT to the reference temperature at a rate not exceeding 1°C/min. Maintain this temperature for at least 2 hours after it has reached stability.

11 Repeat steps 4 to 7.

12 Fill in the test report No 1.

4.4 Cold (influence factor)

Object of the test

To verify that all functions operate as designed and all errors do not exceed the maximum permissible errors under the effect of low temperature.

References

IEC 60068-2-1 (1990-05), IEC 60068-2-1-am1 (1993-02), IEC 60068-2-1 -am2 (1994-06), Basic environmental testing procedures, Part 2: Tests, Test Ad: Cold for heat-dissipating specimen with gradual change temperature.

Background information concerning cold tests is given IEC 60068-3-1 (1974-01), IEC 60068-1A (1978-01), Background information, section 1: Cold and dry heat tests. General background information on basic environmental testing procedures is given in IEC 60068-1 (1988-06), IEC 60068-am1 (1992-04).

Test equipment

Testing chamber capable of maintaining the specified temperatures within ±2°C.

Test procedure

1 Maintain the EUT under reference conditions for at least two hours.

2 Set the maximum value of unit price, if applicable.

3 Adjust the maximum processing speed in accordance with procedure 4.2.

4 Reset the indications of the CID.

5 Simulate a delivery in accordance with procedure 4.2.

6 Read all primary indications on volume and on price if applicable.

7 Calculate the relevant true values and the relevant errors.

8 Change the temperature of the EUT to –25°C (environmental class C) at a rate not exceeding 1°C/min. Maintain this temperature for at least two hours after it has reached stability.

9 Repeat steps 4 to 7.

10 Return the temperature of the EUT to the reference temperature at a rate not exceeding 1°C/min. Maintain this temperature for at least two hours after it has reached stability.

11 Repeat steps 4 to 7.

12 Fill in the test report No 2.

4.5 Damp heat, cyclic (condensing) (influence factor)

Object of the test

To verify that all functions operate as designed and all errors do not exceed the maximum permissible errors after exposing the EUT to the effect of high humidity, combined with cyclic temperature changes and recovery.

References

IEC 60068-2-30 (1980-01), IEC 60068-2-30-am1 (1985-01), Basic environmental testing procedures, Part 2: Tests, test Db and guidance: Damp heat, cyclic (12 + 12 hour cycle), test variant 1.

Background information concerning damp heat tests is given in IEC 60068-2-28 (1990-03): Guidance for damp heat tests.

Test equipment

Testing chamber capable of maintaining the specified temperature within ±2°C and the relative humidity within ±3%.

Test procedure

1 Maintain the EUT under reference conditions with a relative humidity of 50% for at least two hours.

2 Set the maximum value of unit price, if applicable.

3 Adjust the maximum processing speed in accordance with procedure 4.2.

4 Reset the indications of the CID.

5 Simulate a delivery in accordance with procedure 4.2.

6 Read all primary indications on volume and on price if applicable.

7 Calculate the relevant true values and the relevant errors.

8 After switching off the power, change the temperature of the EUT from the reference temperature to 25°C and the relative humidity above 95%.

9 Change the temperature of the EUT from 25°C to 55°C (environmental class C) during three hours maintaining the relative humidity above 95% during the temperature change and lower temperature phases. Condensation should occur on the EUT during the temperature rise.

10 Maintain the temperature of 55°C (environmental class C) and the relative humidity of 95% until 12 hours from the start of the temperature rise.

11 Change the temperature of the EUT from 55°C (environmental class C) to 25°C within three to six hours maintaining the relative humidity above 95% during the temperature change and lower temperature phases. In the first half fall, the temperature should be lowered from 55°C to 40°C in one and a half hour.

12 Maintain the temperature of 25°C and the relative humidity above 95% until 24 hours from the start of the temperature rise from 25°C.

13 Repeat steps 9 to 12.

14 Return the temperature of the EUT to the reference temperature and the relative humidity to 50%. Maintain this temperature and relative humidity for one or two hours after the chamber has obtained the prescribed recovery conditions.

15 Switch on the power and repeat steps 2 to 7.

16 Fill in the test report No 3.

4.6 Power voltage variations (influence factor)

Object of the test

To verify that all functions operate as designed and all errors do not exceed the maximum permissible errors under the effect of varying A.C. mains power supply.

References

IEC 61000-4-11(1994-06), Electromagnetic compatibility (EMC) - Part 4: Testing and measuring techniques - section 11: Voltage dips, short interruptions and voltage variations immunity tests.

Test equipment

Voltage regulator.

Test procedure

1 Maintain the EUT under reference conditions.

2 Set the maximum value of unit price, if applicable.

3 Adjust the maximum processing speed in accordance with procedure 4.2.

4 Reset the indications of the CID.

5 Simulate a delivery in accordance with procedure 4.2.

6 Read all primary indications on volume and on price if applicable.

7 Calculate the relevant true values and the relevant errors.

8 Change the mains voltage to 110% of the nominal value.

9 Repeat steps 4 to 7.

10 Change the mains voltage to 85% of the nominal value.

11 Repeat steps 4 to 7.

12 Fill in the test report No 4.

4.7 Intrinsic error

Object of the test

To determine the intrinsic error of the instrument before conducting disturbances.

References

No reference to international standard.

Test equipment

As designed in part 4.2.

Test procedure

1 Maintain the EUT under reference conditions for at least two hours.

2 Adjust the maximum processing speed in accordance with procedure 4.2.

3 Reset the indications of the CID.

4 Simulate a delivery of 10 000e at the processing speed of step 2.

5 Read $V_{i.}$

6 Calculate $V_{c.}$

7 Calculate $\varepsilon_{1.}$

8 Repeat steps 3 to 6.

9 Calculate $\varepsilon_{2.}$

10 Repeat steps 3 to 6.

11 Calculate $\varepsilon_{3.}$

12 Calculate $\varepsilon_{0.}$

13 Fill in the relevant test report.

4.8 Short-time power reductions (disturbance)

Object of the test

To verify, under the effect of short-time interruptions and reductions in mains voltage, that either the difference between the indications subject to legal metrological control during the test and under reference conditions do not exceed the significant faults or significant faults are detected and acted upon by means of checking facilities.

References

IEC 61000-4-11(1994-06), Electromagnetic compatibility (EMC) - Part 4: Testing and measuring techniques - section 11: Voltage dips, short interruptions and voltage variations immunity tests.

Test equipment

Test generator suitable to reduce the amplitude of one or more half cycles (at zero crossings) of the AC mains voltage.

Test procedure

1 Determine the intrinsic error ε_0 in accordance with 4.7 and maintain the EUT under reference conditions.

2 Adjust the maximum processing speed in accordance with procedure 4.2.

3 Connect the test generator to the EUT and adjust it to the specified conditions.

4 Set the maximum value of unit price, if applicable.

5 Reset the indications of the CID.

6 Calculate the time necessary to deliver 10 000e at the processing speed of step 2. If this value is less than 100 s, increase the volume delivered so that the time necessary to deliver this volume is about 100 s.

7 Simulate at the processing speed of step 2 a delivery of 10 000e or more according to step 6.

8 Reduce the mains voltage to 100% for half a cycle and repeat nine times with an interval of one tenth of the time calculated in step 6.

9 Stop the simulated delivery after two minutes or after a volume of 10 000e if the simulated volume measured after two minutes is smaller than 10 000e.

10 Read all primary indications on volume and on price if applicable.

11 Calculate the relevant true values and the relevant errors.

12 Calculate $| \varepsilon_0 - E_{vi} |$.

13 Repeat steps 5 and 7.

14 Reduce the mains voltage by 50% for one cycle and repeat nine times with an interval of one tenth of the time calculated in step 6.

15 Repeat steps 9 to 12.

16 Fill in the test report No 5.

4.9 Electrical bursts (disturbance)

Object of the test

To verify, when electrical bursts are superimposed on the mains voltage, that either the difference between the indications subject to legal metrological control during the test and under reference conditions do not exceed the significant faults or significant faults are detected and acted upon by means of checking facilities.

References

IEC 61000-4-4 (1995-01), Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - section 4: Electrical fast transient/burst immunity test. Basic EMC Publication.

Test equipment

Test generator having an output impedance of 50 Ω, and capable of superimposing electrical bursts, of which each spike has a peak value of 1 kV, a rise time of 5 ns, a burst length of 15 ms and a burst period (repetition time interval) of 300 ms, on the AC mains voltage.

Test procedure

1 Determine the intrinsic error ε_0 in accordance with 4.7 and maintain the EUT under reference conditions.

2 Adjust the maximum processing speed in accordance with procedure 4.2.

3 Set the maximum value of the unit price, if applicable.

4 Connect the test generator to the EUT and adjust it to the specified conditions.

5 Set the test generator in a non-symmetrical condition between the reference ground and one line of the AC mains power supply.

6 Reset the indications of the CID.

7 Simulate a delivery at the processing speed of step 2.

8 Apply positive, randomly phased bursts, each of which has a length of 15 ms and a repetition time interval of 300 ms during time necessary to perform the whole delivery.

9 Stop the simulated delivery after one minute or after a volume of 10 000e (or 5 000e if applicable) if the simulated volume measured after one minute is smaller than 10 000e (or 5 000e if applicable).

10 Read all primary indications on volume and on price if applicable.

11 Calculate the relevant true values and the relevant errors.

12 Calculate $| \varepsilon_0 - E_{vi} |$.

13 Repeat steps 6 and 7.

14 Apply negative, randomly-phased bursts in the same way as in step 8.

15 Repeat steps 9 to 12.

16 Set the test generator in a non-symmetrical condition between the reference ground and the other line of the AC mains power supply.

17 Repeat steps 6 to 15.

18 Set the test generator in a symmetrical condition between the reference ground and both lines of the AC mains power supply.

19 Repeat steps 6 to 15.

20 Fill in the test report No 6.

4.10 Electrostatic discharges (disturbance)

Object of the test

To verify, under the effect of electrostatic discharges, that either the difference between the indications subject to legal metrological control during the test and under reference conditions do not exceed the significant faults or significant faults are detected and acted upon by means of checking facilities.

References

IEC 61000-4-2 (1995-01), IEC 61000-4-2-am1 (1998-01), Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - section 2: Electrostatic discharge immunity test. Basic EMC Publication.

IEC 61000-4-2 (1999-05) Ed. 1.1 Consolidated Edition, Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test.

Test equipment

Test equipment having a capacitor of 150 pF, which is able to be charged up to 8 kV DC voltage and then discharged through the EUT, or vertical or horizontal coupling plate (VCP or HCP) by connecting one terminal to the ground (earth reference plane) and the other via 330 Ω resistance to the surfaces of the EUT, or VCP or HCP.

Test procedure

Both direct and indirect discharges shall be applied including the paint penetration method.

When contact discharges (test voltage: 6 kV) are not possible, air discharges (test voltage: 8 kV) shall be applied.

1 Determine the intrinsic error ε_0 in accordance with 4.7 and maintain the EUT under reference conditions.
2 Adjust the maximum processing speed in accordance with procedure 4.2.
3 Set the maximum value of unit price, if applicable.
4 Adjust the test equipment to the specified conditions.
5 Reset the indications of the CID.
6 Simulate a delivery at the processing speed of step 2.
7 Apply ten discharges, at intervals of about ten seconds, to the selected point on a surface which is normally accessible to the operator.
8 Stop the simulated delivery after two minutes or after a volume of 10 000e (or 5 000e if applicable) if the simulated volume measured after two minutes is smaller than 10 000e (or 5 000e if applicable).
9 Read all primary indications on volume and on price if applicable.
10 Calculate the relevant true values and the relevant errors.
11 Calculate $| \varepsilon_0 - E_{vi} |$.
12 Repeat steps 5 to 11 to each selected point that is normally accessible to the operator. The number of times this step is repeated will depend upon the type and configuration of the EUT, but as many surfaces as practical shall be tested.
13 Repeat steps 5 to 11. However, in step 7 apply the discharge to the VCP or HCP.
14 Fill in the test report No 7.

4.11 Electromagnetic susceptibility (disturbance)

Object of the test

To verify, under the effect of electromagnetic fields, that either the difference between the indications subject to legal metrological control during the test and under reference conditions do not exceed the significant faults or significant faults are detected and acted upon by means of checking facilities.

References

IEC 61000-4-3 (1995-02), IEC 61000-4-3-am1 (1998-06), Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - section 3: Radiated, radio-frequency, electromagnetic field immunity test.

IEC 61000-4-3 (1998-11) Ed. 1.1 Consolidated Edition, Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test.

Test equipment

Signal generator(s) capable of generating 80% AM 1 kHz sine wave with the frequency range from 26 to 1000 MHz, power amplifier(s), antenna system capable of satisfying frequency requirements, a field strength monitoring system, and a shielded room kept at reference conditions.

Test procedure

With the antenna method, the test is normally performed with the EUT rotating on an insulated table or with the EUT on a fixed insulated table. In any case the EUT is positioned in its normal position. In the case of a fixed table the test shall be performed for two perpendicularly axes. The polarisation of the field generated by the antenna necessitates testing each position twice, once with the antenna positioned vertically and again with the antenna positioned horizontally.

1 Determine the intrinsic error ε_0 in accordance with 4.7 and maintain the EUT under reference conditions.

2 Adjust the maximum processing speed in accordance with procedure 4.2.

3 Set the maximum value of unit price, if applicable.

4 Place the EUT in the shielded room.

5 Switch on the field and adjust the field strength at the place of the EUT to 3 V/m at a frequency near 26 MHz.

6 Reset the indications of the CID.

7 Start simulation of a delivery at the processing speed of step 2.

8 Sweep the frequency from 26 MHz to 80 MHz. The sweep velocity shall not exceed 1.5×10^{-3} decades/s. Where the frequency range is swept incrementally the step size shall not exceed 1% of fundamental with linear interpolation between calibration points.

9 Stop the simulated delivery just when 80 MHz has been reached.

10 Read all primary indications on volume and on price if applicable.

11 Calculate the relevant true values and the relevant errors.

12 Calculate $| \varepsilon_0 - E_{vi} |$.

13 Repeat step 6 and 7.

14 Sweep the frequency from 80 MHz to 200 MHz. The sweep velocity shall not exceed 1.5×10^{-3} decades/s. Where the frequency range is swept incrementally the step size shall not exceed 1% of fundamental with linear interpolation between calibration points.

15 Stop the simulated delivery just when 200 MHz has been reached.

16 Repeat step10 to 12.

17 Repeat step 6 and 7.

18 Sweep the frequency from 200 MHz to 500 MHz. The sweep velocity shall not exceed 1.5×10^{-3} decades/s. Where the frequency range is swept incrementally the step size shall not exceed 1% of fundamental with linear interpolation between calibration points.

19 Stop the simulated delivery just when 500 MHz has been reached.

20 Repeat step10 to 12.

21 Adjust the field strength at the place of the EUT to 1 V/m at a frequency near 500 MHz.

22 Repeat steps 6 and 7

23 Sweep the frequency from 500 MHz to 1 000 MHz. The sweep velocity shall not exceed 1.5×10^{-3} decades/s. Where the frequency range is swept incrementally the step size shall not exceed 1% of fundamental with linear interpolation between calibration points.

24 Stop the simulated delivery just when 1 000 MHz has been reached.

25 Repeat steps 10 to 12.

26 Fill in the test report No 8.

Notes:

1 The above procedure may be modified according to the configuration of the EUT and of the test equipment.

2 If a frequency or a range of frequencies seems to have a significant influence on the EUT it is appropriate to test again the instrument around this (range of) frequency/frequencies.

5 Testing procedures for measurement transducers and meters with mechanical indicating devices

5.1 General information

The measurement transducer may be tested in two ways, either in a test bench or in a complete dispenser. If the measurement transducer is tested in a complete fuel dispenser especially at lower flowrates a temperature rise during the successive tests can occur. To avoid temperature rise a connection with a non-return valve and flow regulating valve from the pipe between the gas separator and the measurement transducer to the supply tank can be installed. At lower flowrates the main liquid flow is fed back to the storage tank via this extra outlet.

Every time the measurement transducer to be tested is connected hydraulically, it shall be operated at the maximum flowrate for at least five minutes before measurement starts. Every time a new work session starts (for example after a stop of one hour or more), the measurement transducer to be tested shall work at the maximum flowrate for at least one minute before measurement starts.

Before conducting tests it is necessary to execute the design evaluation of the measuring transducer by using the general checklist given in Annex A and the relevant points of this checklist given in Annex B.

According to clause 6.1.5.2.2 of NMI R 117-1, tests should be carried out at the limits of the field of operation, i.e. at the limits of pressure, temperature and viscosity. A measurement transducer of a fuel dispenser is normally intended to measure liquids with different viscosity characteristics, especially petrol/gasoline and diesel oil. Tests shall be performed for each category of product. However it is possible to reduce the number of liquids tested if it is assumed regarding the knowledge of the technology of the meter and the possible effects that all requirements would be fulfilled for any other liquids. However, anyway the tests shall at least be carried out at the lowest and the highest viscosity.

In principle no test is required at maximum and minimum liquid pressure. This applies also for the maximum and minimum liquid temperature as far as the liquid temperature lies within the range –10ºC and +50ºC.

5.2 Test equipment

To determine the volume of liquid passed through the measurement transducer standard test measures or pipe provers have to be used. The test measures and their use shall be in accordance with OIML R 120 *Standard capacity measures for testing of measuring systems for liquids other than water.* The pipe provers and their use shall be in accordance with OIML R 119 *Pipe provers for testing measuring systems for liquids other than water.*

Other test methods may be used provided that the test method has been described in the test report and is accompanied by an uncertainty analysis, demonstrating that the expanded uncertainty is in accordance with clause 6 of NMI R 117-1, being smaller than 0.06%. When calculating the expanded uncertainty, the repeatability of the EUT shall not be included.

The test procedures described hereafter, the use of a standard capacity measure is assumed. In case use is made of another test method the test procedure has to be adapted likewise.

The volume of the supply tank shall be of sufficient capacity not to cause foaming of the liquid or a rise in temperature during the tests.

According to clause 6.1.5.1, third paragraph, of NMI R 117-1, the measurement transducer shall be tested with a calculator and indicating device. Previously it has been verified that the calculator and indicating device used for the tests comply with the requirements of NMI R 117-1. The test report of the measurement transducer shall contain information about the calculator and indicating device used for test.

The temperature and pressure of the liquid passing through the measurement transducer shall be measured close to the measurement transducer. Furthermore the temperature of the liquid in the test measure shall be measured too.

The environmental test conditions shall be within the rated operating conditions.

5.3 Determination of flowrate

The flowrate can be obtained under flying start/stop conditions by the following procedure:

1 Insert the nozzle of the dispenser into a container of suitable capacity, or back into the supply tank.

2 Start the pump. When the volume indication is at a whole number of litres, start the stopwatch. The volume indication at which the stopwatch was started should be noted

(V_1).

3 After at least 30 seconds, stop the stopwatch when the volume indication is at a whole number of litres (V_2).

4 Calculate the flowrate $Q = (V_2 - V_1) \times (60 / t)$ in L/min.

Where t = the time elapsed in seconds, from the stopwatch in step 3.

5.4 Volume accuracy at metering conditions

Object of the test

The objective of this test is to verify that each measurement result at each flowrate meets the requirements concerning the maximum permissible errors.

General information

The flowrate and the number of flowrates, for a specified ratio of Q_{max}/Q_{min}, are defined by:

$$Q(n_F) = K^{n_F - 1} \times Q_{max}$$

where: $K = \left[\frac{Q_{min}}{Q_{max}}\right]^{\frac{1}{N_F - 1}}$

n_F = a sequence number of the flowrate test, and
N_F = the number of flowrates as in the following table

Q_{max}/Q_{min}	N_F
10 - 12	6
13 - 21	7
22 - 35	8
36 - 60	9

When $Q_{max}/Q_{min} = 10$, this gives

$Q(1) = 1.00 \times Q_{max}$ $\quad (0.90 \times Q_{max} \leq Q(1) \leq 1.00 \times Q_{max})$
$Q(2) = 0.63 \times Q_{max}$ $\quad (0.56 \times Q_{max} \leq Q(2) \leq 0.70 \times Q_{max})$
$Q(3) = 0.40 \times Q_{max}$ $\quad (0.36 \times Q_{max} \leq Q(3) \leq 0.44 \times Q_{max})$
$Q(4) = 0.25 \times Q_{max}$ $\quad (0.22 \times Q_{max} \leq Q(4) \leq 0.28 \times Q_{max})$
$Q(5) = 0.16 \times Q_{max}$ $\quad (0.14 \times Q_{max} \leq Q(5) \leq 0.18 \times Q_{max})$
$Q(6) = 0.10 \times Q_{max}$ $\quad (0.10 \times Q_{max} \leq Q(6) \leq 0.11 \times Q_{max})$

The real test flowrate shall not differ by more than 10% from the calculated test flowrate except that Q_{max} shall not be exceeded and Q_{min} shall not be less.

Three independent and identical tests shall be carried out at each flowrate.

The difference between the largest and the smallest results of the three successive measurements (range) is a measure of the repeatability error and shall, according to clause 3.1.2.2 of NMI R 117-1, not be greater than 0.20% for volumes ≥5 times the minimum measured quantity.

It is recommended in clause 4.5.3 of OIML R 120 that, at all flowrates, the test time shall not

be less than 1 minute.

If the measurement transducer is intended to be used together with a mechanical calculator/indicating device tests shall be performed at two unit prices which correspond to the maximum and minimum torques. This is generally near the maximum and minimum unit prices.

Test procedure

1 Set the maximum unit price, if applicable.

2 Determine the flow rates at which the tests will be performed.

3 Determine and adjust the flowrate Q in accordance with section 5.3.

4 Wet and drain the test measure.

5 Reset the indication of the CID.

6 Fill the test measure at the fixed flowrate ($5 \times V_{min}$), avoiding interruptions.

7 Read p_t and T_t at 50% of the test volume.

8 Read V_i, V_s and T_s.

9 Calculate V_n and E_{vi}.

10 Drain the test measure.

11 Repeat steps 5 to 10 twice, and calculate the mean value $\bar{E}_{vi}$ of the errors E_{vi} and the range of these errors.

12 Repeat steps 3 to 11 for the other flowrates.

13 Set the minimum unit price, if applicable.

14 Repeat steps 3 to 12.

15 Repeat steps 1 to 14 with another liquid, in case of a mechanical counter.

16 Fill in test report No 9.

17 Draw an error-curve with $\bar{E}_{vi}$ as a function of Q for each liquid and each unit price (optional).

5.5 Endurance test

Object of the test

To determine the long-term stability of the measurement transducer (see subclause 6.1.5.3 of NMI R 117-1).

General information

An endurance test should be carried out at a flowrate between $0.8 \times Q_{max}$ and Q_{max} of the measurement transducer using the liquid the measurement transducer is intended to measure or a liquid with simular characteristics.

The measurement transducer shall be of the same type and model as used for the accuracy test, but may be not the same individual device.

When the transducer is intended to measure different liquids, the test should be carried out with the liquid that provides the most severe conditions (normally the liquid of lowest viscosity).

An accuracy test shall precede the endurance test.

In principle the duration of the endurance test shall be 100 hours in one or several periods. In specific cases (e.g. new technologies) the duration may be increased up to 200 hours. It is also possible to divide the period in representative deliveries of a dispenser. Taking into consideration safety and security conditions the duration of the test shall be as short as possible. Information on the concrete test shall be in the test report.

After the endurance test, the measurement transducer is subject to an accuracy test. The deviation between the mean errors after the endurance test and the initial intrinsic error shall remain within 0.3% without any changes of the adjustment or corrections, as specified in clause 3.1.2.3 of NMI R 117-1.

Test procedure

1 Define three flowrates according procedure 5.4.

2 Perform accuracy tests in accordance with procedure 5.4 at 3 flowrates with the liquids for which the transducer is used.

3 Calculate $\bar{E}_{vi}(B)$ for each flowrate.

4 Operate the transducer for 100 hours (or 200 h in specific cases) at a flowrate between $0.8 \times Q_{max}$ and Q_{max}. For practical reasons, the volume may be divided in a number of deliveries.

5 Perform an accuracy test in accordance with procedure 5.4 at the three flowrates with the liquids for which the transducer is used. The unit price P_u shall be the same as during the initial accuracy test (only relevant for mechanical calculating/indicating devices).

6 Calculate $\bar{E}_{vi}(A)$ and the difference $\bar{E}_{vi}(A) - \bar{E}_{vi}(B)$ for each flowrate.

7 Fill in test report No 10.

Note: If appropriate, the results from the accuracy tests according to procedure 5.4 can be used for step 2 of the test procedure. In this situation the second flowrate of the accuracy test, according to step 5 is the nearest flowrate of the accuracy test according to procedure 5.4 of the value calculated from $\sqrt{Q_{min}/Q_{max}}$.

5.6 Accuracy on the minimum measured quantity

Object of the test

To determine the error of volume indication E_{vi} when the transducer delivers the minimum measured quantity.

General information

The manufacturer or the applicant for OIML certification of a measurement transducer has to define the minimum measured quantity. The indicating device used for test has to be suitable for this minimum measured quantity.

An accuracy test is made with a test volume equal to the minimum measured quantity at two flowrates, at Q_{min} and at the highest attainable flowrate.

Note: These tests shall be performed even if the requirements on uncertainty given in section 6 of NMI R 117-1 are not fulfilled because of the small volume related to scale interval.

If the measurement transducer is intended to be used with a mechanical calculator/indicating device the tests shall be performed at the unit price which corresponds to the maximum torque. This is generally near the maximum unit price.

For electronic calculator/indicating devices the set unit price is not relevant.

Test procedure

1 Set the maximum unit price, if applicable.

2 Determine and adjust the highest attainable flowrate Q in accordance with procedure 5.3.

3 Wet and drain the test measure.

4 Reset the indication of the CID.

5 Fill the test measure at the fixed flowrate, avoiding interruptions.

6 Read p_t and T_t at 50% of the test volume.

7 Read V_i, V_s and T_s.

8 Calculate V_n and E_{vi}.

9 Drain the test measure.

10 Repeat steps 4 to 9 twice and calculate the mean value $\bar{E}_{vi}$ of the errors E_{vi}.

11 Determine and adjust the flowrate Q_{min} in accordance with procedure 5.3.

12 Repeat steps 3 to 10.

13 Repeat steps 2 to 12 with another liquid, if appropriate.

14 Fill in test report No 11.

5.7 Additional testing procedures for electronic measurement transducers

General information

For measurement transducers equipped with electronic devices like a pulser additional tests shall be performed. These tests aim at verifying that the electronic devices of the measurement transducer comply with the provisions of 4.1.1 of NMI R 117-1 with regard to influence quantities.

(a) Performance tests under the effect of influence factors:

When subjected to the effect of influence factors the equipment shall continue to operate correctly and the errors shall not exceed the applicable maximum permissible errors.

(b) Performance tests under the effect of disturbances:

When subjected to external disturbances the equipment shall either continue to operate correctly or detect and indicate the presence of any significant faults.

The tests may be omitted if an OIML certificate of conformity or a national pattern approval according to NMI R 117-1 has been issued:

- for any CID which was tested with the same type of pulser, or
- for any other measurement transducer with the same type of pulser.

It is nevertheless necessary to verify that the maximum processing speed complies with the maximum flowrate of the measurement transducer.

Test equipment

As described in procedures 4.2.

Testing procedures

As described in procedures 4.3 to 4.11.

6 Testing procedures for meters

6.1 General information

A meter consists basically of two constituent elements, i.e. the measurement transducer and the calculator and indicating device. According to clause 6.1.1 of NMI R 117-1 the constituent elements of a measuring system shall comply with the relevant requirements. This means that both the measurement transducer and the calculator and indicating device shall be tested to verify that they comply with the relevant requirements. Because a measurement transducer shall be tested with a calculator and indicating device which complies with the requirements of NMI R 117-1, the calculator and indicating device shall be tested first. When the calculator and indicating device and the measurement transducer are approved separately it is possible to replace pattern approval based on tests by pattern approval of drawings of the constituent elements.

According to clause 6.1.5.1 of NMI R 117-1 the meter shall be fitted with all ancillary devices intended to be fitted in the fuel dispenser and likely to be influence the accuracy.

Before conducting tests it is necessary to execute the design evaluation of the meter by using the general checklist given in Annex A and the relevant points of this checklist given in Annex B.

6.2 Testing procedures for calculator and indicating devices

See procedures in section 4.

6.3 Testing procedures for measurement transducers

See procedure in section 5.

7 Testing procedures for gas elimination devices

Object of the test

To determine the efficiency of the gas elimination device and to verify that the efficiency complies with the requirements in 2.10 of NMI R 117-1.

7.1 General information

In order to examine whether the pattern of a gas elimination device complies with the requirements in clause 2.10 of NMI R 117-1, a specimen of the pattern will be tested in a liquid fuel dispenser or a specimen of the pattern must be installed on a suitable test bench equipped with a meter and a standard capacity measure.

The efficiency of the gas elimination device is determined as a function of the relative value of the volume of air (V_a) and the volume of liquid (V_n). The efficiency of the gas elimination device is determined with reference to the meter error at the same flowrate. The volume of air is isothermally converted to atmospheric pressure.

There shall be provisions to measure the pressure of the liquid preferably inside the device or close to the inlet of the gas elimination device.

It is recommended in clause 4.5.3 of OIML R 120 that, at all flowrates, the test time shall not be less than 1 minute.

The test volume shall be determined such that the overall uncertainty does not exceed one-fifth of the maximum permissible error on pattern approval tests according to the provision in section 6 of NMI R 117-1.

According to the configuration of the dispenser in which the gas elimination device is intended to be used adaptations of the described test procedures shall be made.

Before conducting tests it is necessary to execute the design evaluation of the gas elimination device by using the general checklist given in Annex A and the relevant points of this checklist given in Annex B.

7.2 Test equipment

The test measures and their use shall be in accordance with OIML R 120 *Standard capacity measures for testing of measuring systems for liquids other than water.*

The volume of the supply tank shall be of sufficient capacity not to cause foaming of the liquid or a rise in temperature during the tests.

The liquid used for the tests should either be the same as that for which the device is intended or should be of a viscosity which is at least equal to that of the liquid for which it is intended. Gas elimination devices may be tested with a liquid having a viscosity higher to that of the liquid for which it is intended assuming that the requirements for liquids of lower viscosity are applied. Usually gas elimination devices for fuel dispensers are tested with petrol/gasoline and/or diesel oil.

A gas-meter that has an error in the relevant flow range within ±2% may be provided to measure the volume of the air.

During the investigation of gas separators air is usually drawn into test bench or into the fuel dispenser upstream of the pump by suction. The air inlet should be fitted with a control valve, a stop valve and a non-return valve to prevent liquid from entering the inlet and draining out of the test installation. A schematic diagram of a typical piping arrangement is shown in Figure 1. A gas indicator is installed downstream of the meter, even when the gas separator is intended to be used in fuel dispensers without a gas indicator.

An example of a test installation for testing gas extractors is shown in Figure 2. It includes a container for creating a pocket of air to be removed with a volume equal to the minimum measured quantity of the gas extractor (the minimum measured quantity of the fuel dispenser being not yet specified). When the test is carried out with a standard capacity measure having a capacity so large that the maximum permissible error cannot be evaluated correctly on the basis of a single operation of the gas extractor, the number of operations during the same test shall be multiplied by 2, 3, 4 etc. to obtain the required accuracy.

As guideline for calculating the number of operations n_o the following formula can be used:

$$n_o = 0{,}002 \times V_s / 0{,}01 \times V_{min}$$

7.3 Testing procedures for gas separators

7.3.1 Gas separators for fuel dispensers with gas indicator

1 Determine, according to clause 2.10.7.2 of NMI R 117-1, the operational limits of the gas separator, i.e. the maximum flowrate Q_{max}, the maximum pressure p_{max} (with no flow running) and minimum pressure p_{min} (with liquid and without air intake while the pump is running at maximum flowrate).

Note: The maximum attainable flowrate during test should be equal to the maximum flowrate (Q_{max} ±2.5 L/min) of the gas separator as defined by the manufacturer.

2 Wet and drain the test measure.

3 Adjust the entry of air at 2% (liquid viscosity > 1 mPa.s) or 4% (liquid viscosity ≤ 1 mPa.s) at maximum liquid flowrate (for practical reasons the adjustment of the entry of air may be determined by the ratio of flowrate of air (Q_a) and the flowrate of liquid (Q)).

4 Run the dispenser or test installation for at least one minute to make sure the conditions are steady.

5 Stop delivery of liquid and entry of air simultaneously for a short moment but without switching off the pump motor and read the volume indication (V_{i1}) and the gas meter indication (V_{a1}).

6 Fill the test measure at the maximum attainable flowrate.

7 Note any air bubbles in the gas indicator.

8 Determine Q_a and Q in accordance with procedure 5.3.

9 Read p_t and T_t at 50% of the test volume.

10 Stop delivery of liquid and the entry of air after reaching the test volume.

11 Read the volume indication (V_{i2}) and gas meter indication (V_{a2}).

12 Calculate and record V_i (= $V_{i2} - V_{i1}$) and V_a (= $V_{a2} - V_{a1}$), and read V_s and T_s.

13 Calculate and record V_n, V_a/V_n and E_{va}.

14 Drain the test measure.

15 Adjust the flowrate **without** the entry of air to the same value (±5%) of Q as determined in step 8 and run the dispenser or test installation for at least one minute to make sure that the conditions are steady.

16 Perform a single accuracy test in accordance with 5.4 to determine the meter error E_{vi}.

Note: E_v may be determined from previous accuracy tests of the meter and step 15 and step 16 can be skipped.

17 Calculate and record the efficiency, $\Delta E_{vi} = E_{va} - E_{vi}$.

18 Drain the test measure.

19 Increase the entry of air by 2% (liquid viscosity > 1 mPa.s) or 4% (liquid viscosity ≤1 mPa.s).

20 Repeat step 4 to 19 four times.

21 Fill in test report No 12.

22 Draw a curve ΔE_{vi} as a function of (V_a/V_n), optional.

Note: In accordance with 2.10.8.2 of NMI R 117-1 the gas indicator must clearly reveal the presence of air or gas bubbles when the proportion by volume of air or gases relative to the liquid is greater than the abovementioned percentages of 20%, respectively 10%, **and** when the gas separator does not meet the requirements with respect to the maximum permissible errors. Extra tests have to be performed to verify this requirement.

7.3.2 Gas separators for fuel dispensers without gas indicator

1 Determine, according to clause 2.10.7.2 of NMI R 117-1, the operational limits of the gas separator, i.e. the maximum flowrate Q_{max}, the maximum pressure p_{max} (with no flow running) and minimum pressure (with liquid and without air intake while the pump is running at maximum flowrate).

Note: The maximum attainable flowrate during test should be equal to the maximum flowrate (Q_{max} ± 2.5 L/min) of the gas separator as defined by the manufacturer.

2 Wet and drain the test measure.

3 Determine maximum value of Q_a. Open the gas entry valve and use the gas entry control valve to adjust the entry of air until the liquid flow stops for at least 10 s before liquid is delivered again and note the ratio of the volume of air and volume of liquid (for practical reasons the adjustment of the entry of air may be determined by the ratio of flowrate of air (Q_a) and the flowrate of liquid (Q)).

4 Determine the four regular intervals for the entry of air between the value noted in step 3 and 10% (liquid viscosity > 1 mPa.s) or 20% (liquid viscosity ≤ 1 mPa.s).

5 Adjust the entry of air at 10% (liquid viscosity > 1 mPa.s) or 20% (liquid viscosity ≤1 mPa.s) at maximum liquid flowrate.

6 Shut the gas entry valve and run the dispenser or test installation for at least one minute to make sure the conditions are steady.

7 Stop delivery of liquid for a short moment but without switching off the pump motor and read the volume indication (V_{i1}) and the gas meter indication (V_{a1}).

8 Open gas entry valve and fill the test measure at the maximum attainable flowrate.

9 Determine Q_a and Q in accordance with 5.3.

10 Read p_t and T_t at 50% of the test volume

11 Stop delivery of liquid and the entry of air after reaching the test volume.

12 Read the volume indication (V_{i2}) and gas meter indication (V_{a2}).

13 Calculate and record V_i (= V_{i2} - V_{i1}) and V_a (= V_{a2} - V_{a1}), and read V_s and T_s.

14 Calculate and record V_n, V_a/V_n and E_{va}.

15 Drain the test measure.

16 Adjust the flowrate **without** the entry of air to the same value (±5%) of Q as determined in step 9 and run the dispenser or test installation for at least one minute to make sure that the conditions are steady.

17 Perform a single accuracy test in accordance with 5.4 to determine the meter error E_{vi}.

Note: E_{vi} may be determined from previous accuracy tests of the meter and step 16 and step 17 can be skipped.

18 Calculate and record the efficiency $\Delta E_{vi} = E_{va} - E_{vi}$.

19 Drain the test measure.

20 Open the gas entry valve and increase the entry of air by an interval as determined in step 4.

21 Repeat step 6 to 21 four times.

22 Fill in test report No 12.

23 Draw a curve ΔE_{vi} as a function of (V_a/V_n), optional.

7.4 Gas extractors

1 Wet and drain the test measure.

2 Run the test installation or dispenser at maximum flowrate for at least one minute.

3 Determine, according to clause 2.10.7.2 of NMI R 117-1, the operational limits of the gas extractor, i.e. the maximum flowrate Q_{max}, according to procedure 5.3, the maximum pressure p_{max} (with no flow running) and minimum pressure (with liquid and without air intake while the pump is running at maximum flowrate).

Note: The maximum attainable flowrate during test should be equal to the maximum flowrate (Q_{max} ±2.5 L/min) of the gas extractor as defined by the manufacturer.

4 Perform a single accuracy test at maximum flowrate in accordance with procedure 5.4 to determine the meter error $E_{vi.}$

5 Wet and drain the test measure.

6 Create an air pocket upstream of the gas extractor with a volume (measured under atmospheric conditions) equal to the minimum measured quantity, specified by the applicant.

7 Start the pump, launch the air pocket in the liquid stream and supply a volume of liquid equal to V_s/n_o in the test measure.

8 Note p_t and T_t at 50% of the volume in step 7.

9 Stop delivery and repeat step 6 and 7 n_o times.

10 Calculate V_n and $E_{via.}$

11 Calculate the efficiency $E_{va} - E_{vi}$ relative and in units of volume.

12 Calculate the additional effect per operation in units of volume.

13 Fill in test report No 13.

8 Testing procedures for fuel dispensers

8.1 General information

Fuel dispensers consist basically of several constituent elements. These constituent elements may or may not be subject to a separate pattern approval. According to clause 6.1.1 of NMI R 117-1 the constituent elements of a measuring system shall comply with the relevant requirements.

The pattern approval of a fuel dispenser consists of verifying that the constituent elements of the dispenser, which have not been subject to separate pattern approvals, satisfy the applicable requirements.

Tests for carrying out the pattern approval of a fuel dispenser shall therefore be determined on the basis of the pattern approvals already granted for the constituent elements.

When none of the constituent elements has been subject to separate pattern approval, all the tests provided in chapter 4, 5 and 7 shall be performed. On the contrary, when the various constituent elements are all approved separately, it may be possible to replace pattern approval based on tests by pattern approval of drawings of the constituent elements. This possibility has to be considered cautiously and it may be appropriate even if in this case to perform an accuracy test on the complete measuring system due to the possible influence of hose or hydraulic conditions on the accuracy of the complete system.

Before conducting tests it is necessary to execute the design evaluation of the fuel dispenser by using the general checklist given in Annex A and the relevant points of this checklist given in Annex B.

8.2 Testing procedures for calculator and indicating devices

See procedures in section 4.

8.3 Testing procedures for measurement transducers

See procedures in section 5.

8.4 Testing procedures for gas elimination devices

See procedures in section 7.

Note: If the measuring system is not fitted with a gas elimination device the requirements of clause 2.10 and clause 5.1.3 of NMI R 117-1 shall be fulfilled.

8.5 Additional testing procedures for complete fuel dispensers

8.5.1 Flow interruption

Object of the test

To determine the effect of sudden pressure variations on the accuracy of the volume and price indications.

Test procedure

The interruption test shall be performed three times at the maximum flowrate of the dispenser. The test volume shall be at least the volume delivered in one minute at Q_{max}. Using the nozzle valve, the liquid flow is started and stopped abruptly five times during the same measurement. These stops shall be made at various intervals. The test volume shall be equal to the volume dispensed in one minute at maximum flowrate, rounded up to the nearest 50, 100, 200, etc. litres.

1 Set the maximum unit price, if applicable.

2 Wet and drain the test measure.

3 Reset the indication of the CID.

4 Fill the test measure at Q_{max}, with 5 stops.

5 Read p_t and T_t at 50% of the test volume.

6 Read V_i, V_s, T_s and P_i, if applicable.

7 Calculate V_n and E_{vi}, and if applicable P_c and E_{pi}.

8 Drain the test measure.

9 Repeat steps 3 to 8 twice, and calculate the mean values $\bar{E}_v$ and $\bar{E}_p$.

10 Fill in test report No 14.

8.5.2 Variation in the internal volume of the hose

Object of the test

To determine the increase in internal volume of a hose under pressure and to verify that the variation in the internal volume complies with the requirements in 2.15 of NMI R 117-1.

References

None.

General information

The manufacturer may provide information on how the requirement in 2.15 of NMI R 117-1 is fulfilled. It may consist in providing the reference of the hose if it has been used previously in an approved fuel dispenser or results of tests performed by the manufacturer of the fuel dispenser or of the hose.

It than has to be verified that the hose is not used in worse conditions (pressure, length) than previously tested.

If the manufacturer is not able to provide this information a test is necessary.

There are two ways to perform the test:

1 Simplified test may be used when possible and when there is no ambiguity on the conformance of the hose (see below).

2 Normal test that may be used in any case.

A hose is characterised by:
- manufacturer
- designation
- inner diameter
- length of the hose

The test report shall further contain data concerning:
- maximum operating pressure of the dispenser
- minimum measured quantity of the dispenser

Simplified test

A manometer should be mounted to measure the pressure of the liquid in the hose during test. Moreover the conclusion of this test shall be non-ambiguous. For instance, if the allowed effect due to the pressure is 0.04 L the conclusion is considered non-ambiguous if the effect is smaller than or equal to 0.03 L (pass) or larger than or equal to 0.05 L (fail).

Test procedure

1 If the measuring system is fitted with a device which hides a small number of scale intervals at the beginning of the delivery this device shall be non-operational.

2 Hang out the nozzle, hold the hose in the coiled position (only applicable for dispensers with a hose reel) and let the pump motor switch on.

3 Switch off the pump motor by manual serving the nozzle contact.

4 Depressurise the hose by opening the nozzle (eventually liquid flowing out of the nozzle should be caught into a container for environmental reasons).

5 Bring the hose in the uncoiled position (only applicable for dispensers with a hose reel).

6 Switch on the pump motor by manual serving the nozzle contact.

7 Read indicated volume, V_i.

8 Replace the nozzle in the booth (coiled position if applicable)

9 Repeat steps 2 to 8 twice.

10 Fill in test report No 15 (simplified test).

Note: For fuel dispensers with mechanical calculator and indicating device an eventual indication after resetting to zero shall be taken into account.

Normal test

Test equipment

A test installation, equipped with liquid supply, pressure source, a pressure gauge calibrated before test, a graduated cylindrical glass tube of suitable capacity, valves and piping, as illustrated in Figure 3.

Test procedure (see Figure 3)

1 All valves should be closed before test.

2 Connect the hose in position on the test installation.

3 Open valves V_A, V_B and V_C, and fill the pressure source, the hose and the glass tube with liquid. Partially open valve V_D and allow the liquid to run from the tank through the glass tube until no air bubbles are seen in the glass tube. Then close all valves.

4 Open valve V_D, and adjust the liquid level to an appropriate position. Then close valve V_D, and read level X.

5 Open valve V_B. Adjust the pressure source until the reading of the pressure gauge is stable at the maximum operating pressure of the fuel dispenser

6 Close valve V_B.

7 Open valve V_C, and read level Y.

8 Calculate Y – X.

9 Close valve V_C.

10 Repeat steps 4 to 9 twice.

11 Calculate the mean value of Y – X.

12 Fill in test report No 16 (normal test)

Note: In case the hose is intended to be connected to different types of dispensers with different maximum operating pressures the hose shall be tested with test pressures 1, 2, 3 and 4 bar.

9 Testing procedures for self-service devices

9.1 General information

A self-service device is an ancillary device of a fuel dispenser for which an OIML certificate of conformity can be issued. The test report shall indicate the primary indications (displayed, printed or memorised) which were subject to the evaluation. Self-service device and fuel dispenser together forms the self-service arrangement.

According to clause 6.1.9.1 of NMI R 117-1 for a self-service device that provides primary indications and is intended to be approved separately the indications shall be compared with those provided by an indicating device that has already been approved. According to clause 5.10.1.3 the scale intervals of the primary indication on indicating devices and printing devices and memory devices of the self-service arrangement (i.e. including the indications provided by the already approved indicating device) shall be the same. Additionally, the primary indications on indicating devices and printing devices and memory devices of the self-service device shall not indicate any mutual differences and any differences with the indication given by the indicating device used for test. This requirement applies under reference conditions, under the effect of influence factors and under the effect of disturbances.

Self-service devices with pre-setting device have to be tested to verify that the provisions of 3.6.6 of NMI R 117-1 are fulfilled.

Before conducting tests it is necessary to execute the design evaluation of the self-service device by using the general checklist given in Annex A and the relevant points of this checklist given in Annex B.

Where in the test procedure an arbitrary quantity is mentioned very small quantities should be avoided. Quantities usual for self-service may be used.

9.2 Test equipment

The self-service device shall be tested with a dispenser with an approved CID **or** in a simulation set-up representative of the normal operation of the fuel dispenser.

A pre-setting device in the self-service device shall be tested with an approved fuel dispenser. In the case that the self-service device controls the pre-payment the test shall be carried out with the highest and lowest current value of unit price.

9.3 Test on deviation of the primary indications

Object of the test

To verify that under reference conditions for any measured quantity relating to the same measurement, the indications provided by the various devices, shall not deviate one from another as required in 5.10.1.3 of NMI R 117-1.

Test procedure

1 Maintain the EUT under reference conditions for at least two hours.

2 Set the maximum unit price P_u, if applicable.

3 Adjust the dispenser or simulation set-up at its maximum flowrate.

4 Do a self-service delivery with arbitrary quantity following the normal operating procedure of the self-service device.

5 Read all primary indications and settle the measurement transaction.

6 Repeat step 4 and 5 two times.

7 Fill in test report No 17.

9.4 Accuracy test on pre-set deliveries

Object of the test

To verify that under reference conditions the difference found under normal operating conditions, between the pre-set quantity and the quantity shown by the volume or price-indicating device at the end of the measurement operation, do not exceed the minimum specified volume deviation or minimum specified price deviation of the fuel dispenser (3.6.6 of NMI R 117-1).

Test procedure

1 Maintain the EUT under reference conditions for at least two hours.

2 Set the highest current unit price P_u, if applicable.

3 Adjust the dispenser at its maximum flowrate.

4 Pre-pay or pre-set an arbitrary quantity of liquid or amount of money and note this value.

5 Do a self-service delivery, following the normal operating procedure of the self-service device.

6 Read all primary indications and settle the measurement transaction.

7 Repeat step 4 to 6 at two times.

8 Set the lowest current unit price P_u, if applicable.

9 Repeat steps 4 to 7.

10 Fill in test report No 18.

9.5 Dry heat (non-condensing) (influence factor)

Object of the test

To verify that all functions operate as designed and that for any measured quantity relating to the same measurement, the indications provided by the various devices, shall not deviate one from another as required in 5.10.1.3 of NMI R 117-1 under the effect of high temperature.

References

IEC 60068-2-2 (1974-01), IEC 60068-2-2-am1 (1993-02), IEC 60068-2-2-am2 (1994-05), Basic environmental testing procedures, Part 2: Tests, Test Bd: Dry heat, for heat-dissipating specimen with gradual change of temperature.

Background information concerning dry heat tests is given IEC 60068-3-1 (1974-01), IEC 60068-1A (1978-01), Background information, section 1: Cold and dry heat tests. General background information on basic environmental testing procedures is given in IEC 60068-1 (1988-06), IEC 60068-am1 (1992-04).

Test equipment

Testing chamber capable of maintaining the specified temperatures within ±2°C.

Test procedure

1 Maintain the EUT under reference conditions for at least two hours.

2 Set the maximum value of unit price, if applicable.

3 Adjust the dispenser or simulation set-up at its maximum flowrate.

4 Simulate a self-service delivery with arbitrary quantity following the normal operating procedure of the self-service device.

5 Read all primary indications and settle the measurement transaction.

6 Change the temperature of the EUT to 55°C (Class C) or 40°C (Class B) at a rate not exceeding 1°C/min. Maintain this temperature for at least two hours after it has reached stability. The humidity shall not exceed 20 g/m^3 or 19% RH (Class C), respectively 38% RH (Class B).

7 Repeat steps 4 and 5.

8 Return the temperature of the EUT to the reference temperature at a rate not exceeding 1°C/min. Maintain this temperature for at least 2 hours after it has reached stability.

9 Repeat steps 4 and 5.

10 Fill in the test report No 19.

9.6 Cold (influence factor)

Object of the test

To verify that all functions operate as designed and for any measured quantity relating to the same measurement, the indications provided by the various devices, shall not deviate one from another as required in 5.10.1.3 of NMI R 117-1 under the effect of low temperature.

References

IEC 60068-2-1 (1990-05), IEC 60068-2-1-am1 (1993-02), IEC 60068-2-1 -am2 (1994-06), Basic environmental testing procedures, Part 2: Tests, Test Ad: Cold for heat-dissipating specimen with gradual change temperature.

Background information concerning cold tests is given IEC 60068-3-1 (1974-01), IEC 60068-1A (1978-01), Background information, section 1: Cold and dry heat tests. General background information on basic environmental testing procedures is given in IEC 60068-1 (1988-06), IEC 60068-am1 (1992-04).

Test equipment

Testing chamber capable of maintaining the specified temperatures within ±2°C.

Test procedure

1 Maintain the EUT under reference conditions for at least two hours.

2 Set the maximum value of unit price, if applicable.

3 Adjust the dispenser or simulation set-up at its maximum flowrate.

4 Simulate a self-service delivery with arbitrary quantity following the normal operating conditions of the self-service device.

5 Read all primary indications and settle the measurement transaction.

6 Change the temperature of the EUT to –25°C (Class C) or –10°C (Class B) at a rate not exceeding 1°C/min. Maintain this temperature for at least two hours after it has reached stability.

7 Repeat steps 4 and 5.

8 Return the temperature of the EUT to the reference temperature at a rate not exceeding 1°C/min. Maintain this temperature for at least two hours after it has reached stability.

9 Repeat steps 4 and 5.

10 Fill in the test report No 20.

9.7 Damp heat, cyclic (condensing) (influence factor)

Object of the test

To verify that all functions operate as designed and that for any measured quantity relating to the same measurement, the indications provided by the various devices, shall not deviate one from another as required in 5.10.1.3 of NMI R 117-1 after exposing the EUT to the effect of high humidity, combined with cyclic temperature changes and recovery.

References

IEC 60068-2-30 (1980-01), IEC 60068-2-30-am1 (1985-01), Basic environmental testing procedures, Part 2: Tests, test Db and guidance: Damp heat, cyclic (12 + 12 hour cycle), test variant 1.

Background information concerning damp heat tests is given in IEC 60068-2-28 (1990-03): Guidance for damp heat tests.

Test equipment

Testing chamber capable of maintaining the specified temperature within ±2°C and the relative humidity within ±3%.

Test procedure

1 Maintain the EUT under reference conditions with a relative humidity of 50% for at least two hours.

2 Set the maximum value of unit price, if applicable.

3 Adjust the dispenser or simulation set-up at its maximum flowrate.

4 Simulate a self-service delivery with arbitrary quantity following the normal operating conditions of the self-service device.

5 Read all primary indications and settle the measurement transaction.

6 After switching off the power, change the temperature of the EUT from the reference temperature to 25°C and the relative humidity above 95%.

7 Change the temperature of the EUT from 25°C to 55°C (Class C) or 40°C (Class B) during three hours maintaining the relative humidity above 95% during the temperature change and lower temperature phases. Condensation should occur on the EUT during the temperature rise.

8 Maintain the temperature of 55°C (Class C) or 40°C (Class B) and the relative humidity of 95% until 12 hours from the start of the temperature rise.

9 Change the temperature of the EUT from 55°C, respectively 40°C, to 25°C within three to six hours maintaining the relative humidity above 95% during the temperature change and lower temperature phases. In the first half fall, the temperature should be lowered from 55°C to 40°C, respectively from 40 to 32.5, in one and a half hour.

10 Maintain the temperature of 25°C and the relative humidity above 95% until 24 hours from the start of the temperature rise from 25°C.

11 Repeat steps 7 to 10.

12 Return the temperature of the EUT to the reference temperature and the relative humidity to 50%. Maintain this temperature and relative humidity for one or two hours after the chamber has obtained the prescribed recovery conditions.

13 Switch on the power and repeat steps 2 to 5.

14 Fill in the test report No 21.

9.8 Power voltage variations (influence factor)

Object of the test

To verify that all functions operate as designed and that for any measured quantity relating to the same measurement, the indications provided by the various devices, shall not deviate one from another as required in 5.10.1.3 of NMI R 117-1 under the effect of varying A.C. mains power supply.

References

IEC 61000-4-11(1994-06), Electromagnetic compatibility (EMC) - Part 4: Testing and measuring techniques - section 11: Voltage dips, short interruptions and voltage variations immunity tests.

Test equipment

Voltage regulator.

Test procedure

1 Maintain the EUT under reference conditions.

2 Set the maximum value of unit price, if applicable.

3 Adjust the dispenser or simulation set-up at its maximum flowrate.

4 Simulate a self-service delivery with arbitrary quantity following the normal operating conditions of the self-service device.

5 Read all primary indications and settle the measurement transaction.

6 Change the mains voltage to 110% of the nominal value.

7 Repeat steps 4 and 5.

8 Change the mains voltage to 85% of the nominal value.

9 Repeat steps 4 and 5.

10 Fill in the test report No 22.

9.9 Short-time power reductions (disturbance)

Object of the test

To verify that all functions operate as designed and that for any measured quantity relating to the same measurement, the indications provided by the various devices, shall not deviate one from another as required in 5.10.1.3 of NMI R 117-1 under the effect of short-time interruptions and reductions in mains voltage.

References

IEC 61000-4-11(1994-06), Electromagnetic compatibility (EMC) - Part 4: Testing and measuring techniques - section 11: Voltage dips, short interruptions and voltage variations immunity tests.

Test equipment

Test generator suitable to reduce the amplitude of one or more half cycles (at zero crossings) of the AC mains voltage.

Test procedure

1 Maintain the EUT under reference conditions.

2 Adjust the dispenser or simulation set-up at its maximum flowrate.

3 Connect the test generator to the EUT and adjust it to the specified conditions.

4 Set the maximum value of unit price, if applicable.

5 Start simulation of a self-service delivery at maximum flowrate following the normal operating conditions of the self-service device.

6 Reduce the mains voltage to 100% for half a cycle and repeat nine times with an interval of about 10 seconds.

7 Stop simulation after an arbitrary volume has been passed.

8 Read all primary indications and settle the measurement transaction.

9 Repeat step 5.

10 Reduce the mains voltage by 50% for one cycle and repeat nine times with an interval of about 10 seconds.

11 Repeat steps 7 and 8.

12 Fill in the test report No 23.

9.10 Electrical bursts (disturbance)

Object of the test

To verify that all functions operate as designed and that for any measured quantity relating to the same measurement, the indications provided by the various devices, shall not deviate one from another as required in 5.10.1.3 of NMI R 117-1 when electrical bursts are superimposed on the mains voltage

References

IEC 61000-4-4 (1995-01), Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - section 4: Electrical fast transient/burst immunity test. Basic EMC Publication.

Test equipment

Test generator having an output impedance of 50 Ω, and capable of superimposing electrical bursts, of which each spike has a peak value of 1 kV, a rise time of 5 ns, a burst length of 15 ms and a burst period (repetition time interval) of 300 ms, on the AC mains voltage.

Test procedure

1 Maintain the EUT under reference conditions.

2 Adjust the dispenser or simulation set-up at its maximum flowrate.

3 Set the maximum value of the unit price, if applicable.

4 Connect the test generator to the EUT and adjust it to the specified conditions.

5 Set the test generator in a non-symmetrical condition between the reference ground and one line of the AC mains power supply.

6 Start simulation of a self-service delivery at maximum flowrate following the normal operating conditions of the self-service device.

7 Apply positive, randomly phased bursts, each of which has a length of 15 ms and a repetition time interval of 300 ms during the time to perform the whole delivery.

8 Stop simulation after an arbitrary volume has been passed.

9 Read all primary indications and settle the measurement transaction.

10 Repeat step 6.

11 Apply negative, randomly-phased bursts in the same way as in step 7.

12 Repeat steps 8 and 9.

13 Set the test generator in a non-symmetrical condition between the reference ground and the other line of the AC mains power supply.

14 Repeat steps 6 to 12.

15 Set the test generator in a symmetrical condition between the reference ground and both lines of the AC mains power supply.

16 Repeat steps 6 to 12.

17 Fill in the test report No 24.

9.11 Electrostatic discharges (disturbance)

Object of the test

To verify that all functions operate as designed and that for any measured quantity relating to the same measurement, the indications provided by the various devices, shall not deviate one from another as required in 5.10.1.3 of NMI R 117-1 under the effect of electrostatic discharges,

References

IEC 61000-4-2 (1995-01), IEC 61000-4-2-am1 (1998-01), Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - section 2: Electrostatic discharge immunity test. Basic EMC Publication.

IEC 61000-4-2 (1999-05) Ed. 1.1 Consolidated Edition, Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test.

Test equipment

Test equipment having a capacitor of 150 pF, which is able to be charged up to 8 kV DC voltage and then discharged through the EUT, or vertical or horizontal coupling plate (VCP or HCP) by connecting one terminal to the ground (earth reference plane) and the other via 330 Ω resistance to the surfaces of the EUT, or VCP or HCP.

Test procedure

Both direct and indirect discharges shall be applied including the paint penetration method.

When contact discharges (test voltage: 6 kV) are not possible, air discharges (test voltage: 8 kV) shall be applied.

1 Maintain the EUT under reference conditions.

2 Adjust the dispenser or simulation set-up at its maximum flowrate.

3 Set the maximum value of unit price, if applicable.

4 Adjust the test equipment to the specified conditions.

5 Start simulation of a self-service delivery at maximum flowrate following the normal operating conditions of the self-service device.

6 Apply ten discharges, at intervals of about ten seconds, to a point on a surface which is normally accessible to the operator.

7 Stop simulation after two minutes.

8 Read all primary indications and settle the measurement transaction.

9 Repeat steps 5 to 8. However, in step 6 apply the discharges to other points and surfaces which are normally accessible to the operator. The number of times this step is repeated will depend upon the type and configuration of the EUT, but as many surfaces as practical shall be tested.

10 Repeat steps 5 to 8. However, in step 5 apply the discharge to the VCP or HCP.

11 Fill in the test report No 25.

9.12 Electromagnetic susceptibility (disturbance)

Object of the test

To verify that all functions operate as designed and that for any measured quantity relating to the same measurement, the indications provided by the various devices, shall not deviate one from another as required in 5.10.1.3 of NMI R 117-1 under the effect of electromagnetic fields.

References

IEC 61000-4-3 (1995-02), IEC 61000-4-3-am1 (1998-06), Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - section 3: Radiated, radio-frequency, electromagnetic field immunity test.

IEC 61000-4-3 (1998-11) Ed. 1.1 Consolidated Edition, Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test.

Test equipment

Signal generator(s) capable of generating 80% AM 1 kHz sine wave with the frequency range from 26 MHz to 1000 MHz, power amplifier(s), antenna system capable of satisfying frequency requirements, a field strength monitoring system, and a shielded room kept under reference conditions.

Test procedure

With the antenna method, the test is normally performed with the EUT rotating on an insulated table. In any case the EUT is positioned in its normal position. In the case of a fixed table the test shall be performed for two perpendicular axes.

The polarisation of the field generated by the antenna necessitates testing each position twice, once with the antenna positioned vertically and again with the antenna positioned horizontally.

1 Maintain the EUT under reference conditions.

2 Adjust the dispenser or simulation set-up at its maximum flowrate.

3 Set the maximum value of unit price, if applicable.

4 Place the EUT in the shielded room.

5 Switch on the field and adjust the field strength at the place of the EUT to 3 V/m at a frequency near 26 MHz.

6 Start simulation of a self-service delivery at maximum flowrate following the normal operating conditions of the self-service device.

7 Stop simulation of delivery after an arbitrary volume has been passed.

8 Read all primary indications and settle the measurement transaction.

9 Increase the frequency to the next step with 1% of the fundamental and maintain the field strength 3 V/m. This means that the frequency of each step is the frequency of the previous step after multiplication by a factor of 1.01.

10 Repeat steps 6 to 9 till a frequency of 500 MHz has been reached.

11 Adjust the field strength at the place of the EUT to 1 V/m at a frequency near 500 MHz.

12 Repeat steps 6 to 9 till a frequency of 1000 MHz has been reached.

13 Switch off the field.

14 Fill in the test report No 26.

Notes

1 The above procedure may be modified according to the configuration of the EUT and of the test equipment.

2 If a frequency or a range of frequencies seems to have a significant influence on the EUT it is appropriate to test again the instrument around this (range of) frequency/frequencies.

3 The above test procedure takes up a great deal of time (368 tests per orientation per polarisation giving a total of 2944 tests!).

However, the object of the test is to verify that:

- all functions operate as designed
- for any measured quantity relating to the same measurement, the indications provided by the various devices, shall not deviate one from another as required in 5.10.1.3 of NMI R 117-1 under the effect of electromagnetic fields.

In case of signals transmitted between the calculator and the self-service device; the various

components of the self-service device (e.g. displays and/or printers) are digital (serial communication with data checking by, for example, parity bit or LRC or CRC), the requirement has to be considered fulfilled if it has been verified that signals during transmission are not influenced by electromagnetic fields as specified in 9.12. In order to save test time the use of special simulation software in the calculator and/or in the self-service device by which fixed data pattern are sent to the self-service device and are indicated, memorised and printed, might be acceptable.

Annex A.1. General information concerning the pattern

Application no: (new/modification)

Manufacturer:

Applicant:

Representative:

Calculator and indicating device

Manufacturer:

Pattern designation: Pattern approval mark: Environmental class:

Type of display: (mechanical/electromechanical/electronic)

Unit and scale interval for volume indication:

Maximum volume indication:

Unit and scale interval for price indication:

Maximum price indication:

Unit and scale interval for unit price indication:

Maximum unit price indication:

Minimum measured quantity:

Maximum processing speed:

Measurement transducer

Manufacturer:

Pattern designation: Pattern approval mark: Environmental class:

Maximum flowrate: Minimum flowrate:

Maximum pressure of the liquid: Minimum pressure of the liquid if necessary:

Nature of the liquids to be measured:

Maximum temperature of the liquid: Minimum temperature of the liquid:

Minimum measured quantity:

Maximum rotation speed outgoing shaft:

Periodic variation:

Cyclic volume:

Number of pulses per revolution:

Volume per pulse

Meter

Manufacturer:

Pattern designation: Pattern approval mark: Environmental class:

Maximum flowrate: Minimum flowrate:

Maximum pressure of the liquid: Minimum pressure of the liquid if necessary:

Nature of the liquids to be measured:

Maximum temperature of the liquid: Minimum temperature of the liquid:

Minimum measured quantity:

Gas separator

Manufacturer:

Pattern designation: Pattern approval mark:

Maximum flowrate:

Maximum pressure: Minimum pressure:

Gas extractor

Manufacturer:

Pattern designation: Pattern approval mark:

Maximum flowrate:

Maximum pressure: Minimum pressure:

Minimum measured quantity:

Hose

Manufacturer:

Pattern designation:

Inner diameter:

Length:

Maximum operating pressure:

Nozzle

Manufacturer:

Pattern designation:

Inlet diameter:

Fuel dispenser

Manufacturer:

Pattern designation: Pattern approval mark: Environmental class:

Maximum flowrate: Minimum flowrate:

Maximum pressure of the liquid: Minimum pressure of the liquid:

Maximum temperature of the liquid: Minimum temperature of the liquid:

Minimum measured quantity:

Nature of the liquid to be measured (or viscosity):

Mains power:

Voltage: Frequency: Consumption:

Self-service device

Manufacturer:

Pattern designation: Pattern approval mark: Environmental class:

Service mode: Attended / Unattended

Type of payment: Attended post payment / Pre-payment in attended service mode / Delayed payment / Pre-payment in unattended service mode.

Operator display: yes / no

Unit and scale interval indicated volume:

Maximum indicated volume:

Unit and scale interval indicated price:

Maximum indicated price:

Unit and scale interval indicated unit price:

Maximum indicated unit price:

Customer display: yes /no

Unit and scale interval indicated volume:

Maximum indicated volume:

Unit and scale interval indicated price:

Maximum indicated price:

Unit and scale interval indicated unit price:

Maximum indicated unit price:

Printing device (ticket printer customer): yes / no

Unit and scale interval printed volume:

Maximum printed volume:

Unit and scale interval printed price:

Maximum printed price:

Unit and scale interval printed unit price:

Maximum printed unit price:

Printing device (journal): yes / no

Unit and scale interval printed volume:

Maximum printed volume:

Unit and scale interval printed price:

Maximum printed price:

Unit and scale interval printed unit price:

Maximum printed unit price:

Memory device (journal): yes / no

Unit and scale interval stored volume:

Maximum stored volume:

Unit and scale interval stored price:

Maximum stored price:

Unit and scale interval stored unit price:

Maximum stored unit price:

Memory device (delayed payment deliveries): yes / no

Unit and scale interval stored volume:

Maximum stored volume:

Unit and scale interval stored price:

Maximum stored price:

Unit and scale interval stored unit price:

Maximum stored unit price:

Annex A.2. General information concerning the test equipment

In this annex list all equipment (pulse generator, standard test measure, temperature gauge, pressure gauge, gas meter etc.) with identification (serial number) used to carry out the test.

The test set-up has to be specified by means of pictures, drawings, photographs, etc

Annex A.3. General checklist

Notes: Item numbering refers to NMI R 117-1 *Measuring systems for liquids other than water*.

[...] replaces a sentence or a complete paragraph not applicable to fuel dispensers

+	–	
×		Satisfies the requirement
	×	Does not satisfy the requirement
/		Requirement is not applicable

NMI R 117-1	Requirement	+	–	Remarks
GENERAL REQUIREMENTS				
(2.9) INDICATIONS				
2.9.1	The volume indication shall be made in cubic centimetres or millilitres, in cubic decimetres or litres, or in cubic metres. The symbol or the name of the unit shall appear in the immediate vicinity of the indication. [...]			
2.9.4	A measuring system may have several devices indicating the same quantity. Each shall meet the requirements of this recommendation. The scale intervals of the various indications may be different.			
2.9.5	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 5 (see 5.10.1.3).			
2.9.6	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 authorised 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			

NMI R 117-1	Requirement	+	–	Remarks
	systems concerned, using a simple command.			
(2.10) ELIMINATION OF AIR OR GASES				
2.10.1	GENERAL REQUIREMENTS Measuring systems shall be constructed and installed so that during normal operation, neither air intake nor gas release will occur in the liquid upstream of the meter. If there is a risk that this requirement may not be met, the measuring systems shall incorporate a gas elimination device permitting 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: a 0.5% of the quantity measured for liquids other than potable liquids and for liquids of a viscosity not exceeding 1 mPa.s, b 1% of the quantity measured for potable liquids and for liquids of a viscosity exceeding 1 mPa.s. However, it is not necessary for this effect to be less than 1% of the minimum measured quantity. The values specified in this paragraph apply to the gas elimination device when it is subject to separate control, e.g. for pattern approval. In this case, they apply to the differences between: • the meter errors with air intake or with gas, and • the meter errors without air intake or gas.			
2.10.2	PUMPED FLOW A gas separator shall be provided when, subject to the provisions 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. No gas elimination device is required when 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 be the conditions of use. A gas elimination device 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, in particular:			

NMI R 117-1	Requirement	+	–	Remarks
	1 gaseous formations likely to occur owing to thermal contraction during shutdown periods; if gaseous formation is possible, a gas extractor is required, 2 air pockets likely to be introduced into the pipework when the supply tank is completely empty; in case there is a possibility of gaseous formation, a special gas extractor is required. The gas elimination device shall be installed downstream of the pump or be combined with the pump. If the gas elimination device is installed below the level of the meter, a non-return valve fitted, if necessary, with a pressure-limiting device shall be incorporated to prevent the pipe work 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 pipe work upstream of the meter incorporates several high points, it may be necessary to provide one or more automatic or manual evacuation devices.			
2.10.5	REMOVAL OF GASES The gas removal pipe of a gas elimination device shall not include a manually controlled valve if closure of this valve prevents the operation of the gas elimination device. However, if such a closing element is required for safety reasons, it shall be possible to ensure by means of a sealing device that it remains in the open position, unless closure of the valve automatically prevents further measurement.			
(2.10.7) GENERAL PROVISIONS FOR GAS ELIMINATION DEVICES				
2.10.7.1	In principle, the gas separated in a gas elimination device is evacuated automatically. However, the automatic operation is not necessary if 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.			
(2.10.8) SPECIAL PROVISIONS APPLICABLE TO GAS SEPARATORS				
2.10.8.1	Within the error limits specified in 2.10.1, a gas separator fitted in a measuring system that does not incorporate a gas indicator as specified in 2.11, shall ensure the elimination of air or gases mixed with the liquid to be measured under the following conditions: a without air or gases the measuring system operates at the maximum flowrate and at the minimum pressure specified for the gas separator,			

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	b then air is introduced or gases are created as long as the measuring system operates. Any proportion by volume of air or gases relative to the liquid is permitted if the gas separator is designed for a maximum flowrate lower than or equal to 20 m^3/h; it is limited to 30% if the gas separator is designed for a maximum flowrate higher than 20 m^3/h (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. Furthermore, when provided, the automatic gas removal device must continue to operate correctly at the maximum pressure fixed for these gas separators.			
2.10.8.2	Within the error limits specified in 2.10.1, a gas separator fitted in a measuring system that incorporates a gas indicator shall ensure the elimination of air or gases mixed with the liquid to be measured under the following conditions: a without air or gases the measuring system operates at the maximum flowrate and at the minimum pressure specified for the measuring system, b then air is introduced or gases are created as long as the measuring system operates. The proportion by volume of air or gases relative to the liquid does not exceed: • 20% for liquids of a viscosity not exceeding 1 mPa.s, other than potable liquids, • 10% for potable liquids and for liquids of a viscosity exceeding 1 mPa.s. The percentages are considered only when the meter is running. When the proportion by volume of air or gases relative to the liquid is greater than the abovementioned percentages and when the gas separator does not meet the requirements with respect to the maximum permissible errors, the gas indicator must clearly reveal the presence of air or gas bubbles.			
2.10.9	SPECIAL PROVISIONS APPLICABLE TO GAS EXTRACTORS A gas extractor or special 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.			

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	Moreover, a special gas extractor shall also be capable of separating continuously 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. Notes: 1 [...] 2 Installing a special gas extractor is subject to feeding conditions. Therefore, no performance is required for proportions greater than 5%.			
(2.11) GAS INDICATOR				
2.11	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 installed 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 must 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.			
(2.12) TRANSFER POINT				
2.12.1	Measuring systems shall incorporate a transfer point. This transfer point is located downstream of the meter in delivery systems and upstream of the meter in receiving systems.			
2.12.2.2	Full hose systems, in the case of delivery equipment, are measuring systems in which the transfer point consists of a closing device located in the delivery line. When the delivery line has a free end, the closing device must be installed as close as possible to this end.			
(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. [...].			
2.13.2	The additional effect of 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:			

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	• 10°C for exposed pipes, • 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	Subject to 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	A measuring system in which the liquid could flow in the opposite direction to that of normal flow when the pump is stopped shall be provided with a non-return valve, fitted with a pressure limiting device if necessary, when reversal of the flow could result in errors greater than the minimum specified volume deviation.			
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 volume deviation.			
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.			
(2.14) DRAINING				
2.14.2	In full hose measuring systems, particularly those intended for measuring viscous liquids, the nozzle shall be so designed that it cannot retain a volume of liquid exceeding 0.4 times the minimum specified volume deviation.			
(2.15) VARIATIONS IN THE INTERNAL VOLUME OF FULL HOSES				
2.15	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 volume deviation. If the measuring system is not provided with a hose reel, the increase in internal volume shall not exceed			

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	the minimum specified volume deviation.			
(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. [...]. 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.			
2.16.3	Any connections which may be provided for bypassing the meter shall be closed by means of blanking flanges. However, if the operating requirements make such a bypass necessary, it shall be closed either by means of a closing disc or a double closing device with a monitoring valve in between. It shall be possible to ensure closure by means of seals, or there shall be an automatic monitoring of the double block-and-bleed valve in the bypass giving an alarm signal in case of leakage in this valve.			
(2.17) CONTROL AND CLOSING MECHANISMS				
2.17.1	If there is a risk that the supply conditions can overload the meter, a flow limiting device shall be provided. This device shall be installed downstream of the meter. It shall be possible to seal it.			
(2.18) VARIOUS PROVISIONS				
2.18.1	If provided, filters shall not disturb the measuring operation.			
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.			
(2.19) MARKINGS				
2.19.1	Each measuring system, component or sub-system for which pattern 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:			

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	a pattern approval sign b manufacturer's identification mark or trademark c designation selected by the manufacturer, if appropriate d serial number and year of manufacture e characteristics as defined in 2.3.1, 3.1.1.1, 2.10.7.2, or 3.1.7.1, f accuracy class, if other than 0.5. Note: The indicated characteristics should be the actual characteristics of use, if they are known when the plate is affixed. When they are not known, the indicated characteristics are those allowed by the pattern approval certificate. However, the minimum and the maximum temperatures of the liquids shall appear on the data plate only when they differ from -10 C and +50 C respectively. The minimum measured quantity of the measuring system shall in all cases be clearly visible on the dial of any indicating device visible to the user during the measurement. If several meters operate in a single system using common components, the marking required for each part of the system may be combined on a single plate. When a measuring system can be transported without being dismantled, the markings required for each component may also be combined on a single plate.			
2.19.2	Any information, markings or diagrams specified by this recommendation or possibly by the pattern approval certificate, shall be clearly visible on the dial of the indicating device or within proximity to it. The markings on the dial of the indicating device of a meter forming a part of a measuring system shall not contravene those on the data plate of the measuring system.			
(2.20) SEALING DEVICES AND STAMPING PLATE				
2.20.1	GENERAL Sealing is preferably carried out by means of lead seals. However, other types of sealing are permitted on fragile instruments or when these seals provide sufficient integrity, electronic seals for instance. The seals shall, in all cases, be easily accessible. Sealing should 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. It must be prohibited to change parameters which			

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	participate in the determination of the results of measurement (parameters for correction and conversion in particular) by means of sealing devices. Except for direct selling to the public, [...] A plate, referred to as the stamping plate, aimed at receiving the control 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. [...]			
(2.20.2) ELECTRONIC SEALING DEVICES				
2.20.2.1	When access to parameters that participate in the determination of results of measurement is not protected by mechanical sealing devices, the protection shall fulfil the following provisions (except in cases related to the 5th paragraph of 2.20.1): a access shall only be allowed to authorised people, e.g. by means of a code (key-word) or of a special device (hard key, etc.); the code must be changeable; access by means of only a code is not allowed in the case of direct selling to the public; b it shall be possible for at least the last intervention to be memorised; the record shall include the date and a characteristic element identifying the authorised person making the intervention (see (a) above); 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; if it is possible to memorise more than one intervention, 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: a 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; b 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			

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	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.			
REQUIREMENTS FOR METERS AND ANCILLARY DEVICES OF A MEASURING SYSTEM				
(3.1) METER The meter(s) of a measuring system shall meet the following requirements, whether or not it (they) is (are) subject to a separate pattern approval:				
(3.1.1) FIELD OF OPERATION				
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, n being a positive or negative whole number, or zero.			
(3.1.2) METROLOGICAL REQUIREMENTS				
3.1.2.2	For any quantity equal to or greater than five 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 2.			
3.1.2.3	For a given liquid within their fields of operation, 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 2.			
3.1.3	CONNECTIONS BETWEEN THE FLOW SENSOR AND THE INDICATING DEVICE In the text, the expression ‘flow sensor’ also means ‘volume sensor’. The connections between the flow sensor and the indicating device shall be reliable and, for electronic devices, durable, in accordance with 4.1.3 and 4.3.2. [...]			
3.1.4	ADJUSTMENT DEVICE Meters may be provided with an adjustment device which permits modification of the ratio between the indicated volume and the actual volume of liquid passing through the meter, by a simple command. When this adjustment device modifies this ratio in a discontinuous manner, the consecutive values of the ratio shall not differ by more than 0.0005 for meters			

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	intended to equip measuring systems of class 0.3, and 0.001 for other meters. Adjustment by means of a bypass of the meter is prohibited.			
3.1.5	CORRECTION DEVICE Meters may be fitted with correction devices; such devices are always considered as an integral part of the meter. The whole of the requirements which apply to the meter, in particular the maximum permissible errors specified in 3.1.2.1, are therefore applicable to the corrected volume (at metering conditions). In normal operation, non-corrected volume shall not be displayed. The aim of a correction device is to reduce the errors as close to zero as possible. Note: National regulations should state that the use of this device for adjusting the errors of a meter to values other than as close as practical to zero is forbidden, even when these values are within the maximum permissible errors. All the parameters which are not measured and which are necessary for correcting shall be contained in the calculator at the beginning of the measurement operation. The pattern approval certificate may prescribe the possibility of checking parameters that are necessary for correctness at the time of verification of the correction device. The correction device shall not allow the correction of a pre-estimated drift in relation to time or volume flow, for example. The associated measuring instruments, if any, shall comply with the applicable International Standards or recommendations. Their accuracy shall be good enough to permit that the requirements on the meter be met, as specified in 3.1.2.1. Associated measuring instruments shall be fitted with checking devices, as specified in 4.3.6.			
3.1.6	MEASURING SYSTEMS EQUIPPED WITH VOLUMETRIC METERS The periodic variation of a volumetric meter shall be less than half the minimum specified volume deviation. When a volumetric meter is approved separately, the pattern approval certificate shall indicate the value of its cyclic volume.			
(3.2) INDICATING DEVICE				

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(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 volume 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 volume, where n is a positive or negative whole number, or zero.			
3.2.13	Non-significant scale intervals should be avoided. This does not apply to price indications			
3.2.14	The minimum specified volume deviation shall be equal to or greater than the following value: • for continuous indicating devices, the volume 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, • for discontinuous indicating device, the volume corresponding to two scale intervals			
(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 volume; 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.			
3.2.2.6	All scale marks shall have the same width, constant			

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	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 volume during the period of measurement is only mandatory in the case of direct selling to the public. However, if interrupting the display of volume interrupts the action of some checking facilities that are mandatory or necessary to ensure correct measurement, the volume passing through the meter during each interruption shall be smaller than or equal to the minimum measured quantity.			
(3.2.4) ZERO SETTING DEVICE FOR VOLUME INDICATING DEVICE				
3.2.4.1	A volume indicating device may be provided with a device for setting the indication to zero either by manual operation or by means of an automatic system.			
3.2.4.2	The zero setting device shall not permit any alteration of the measurement result shown by the volume indicating device (other than by making the result disappear and displaying zeros).			
3.2.4.3	Once the zeroing operation has begun it shall be impossible for the volume indicating device to show a result different from that of the measurement which has just been made, until the zeroing operation has been completed. Indicating devices on fuel dispensers and electronic measuring systems shall not be capable of being reset to zero during measurement. [...].			
3.2.4.4	On continuous indicating devices, the residual indication after return to zero shall not be more than half the minimum specified volume deviation.			
3.2.4.5	On discontinuous indicating devices, the indication after return to zero shall be zero without any ambiguity.			
(3.3) PRICE INDICATING DEVICE				
3.3.1	A volume 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 selected unit price shall be displayed by an indicating device before the start of the measurement. The unit price shall be adjustable; changing the unit price may be carried out either directly on the measuring system or through peripheral equipment. The indicated unit price at the start of a measurement			

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	operation shall be valid for the whole transaction. A new unit price shall only be effective at the moment a new measurement operation may start. A time of at least 5 s shall elapse between indicating a new unit price and before the next measurement operation can start, if the unit price is set from peripheral equipment.			
3.3.3	The provisions in 3.2 relating to volume 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 volume indicating device shall be designed in such a way that zeroing either indicating device automatically involves zeroing the other.			
3.3.6	The minimum specified price deviation shall be greater than or equal to the following value: • for continuous 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, • for discontinuous indicating devices, the price corresponding to two scale intervals. However, the interval of one-fifth of the scale interval or of 2 mm in the case of the first hyphen or the scale interval in the case of the second hyphen 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 volume shall not exceed the minimum specified price deviation. However this difference need not be less than the smallest monetary value as defined in 3.3.6. Moreover, this requirement does not apply when the unit price has been changed between two measurements.			
3.3.8	On continuous 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 monetary value as defined in 3.3.6.			
3.3.9	On discontinuous indicating devices, the indication after zeroing shall be zero without any ambiguity.			

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(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 volume, n being a positive or negative whole number, or zero, and shall not be greater than the minimum specified volume deviation. The printed scale interval shall not be smaller than the smallest scale interval of the indicating devices.			
3.4.2	The volume printed shall be expressed in one of the units authorised for the indication of volume. The figures, the unit used or its symbol and the decimal sign, if any, shall be printed on the ticket by the device.			
3.4.3	The printing device may also print information identifying the measurement such as: sequence number, date, identification of the dispenser, type of liquid, etc. If the printing device is connected to more than one measuring system, it must 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'.			
3.4.6	Where the printing device and volume 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, either the corresponding price or this price and the unit price. In the case of 'direct selling to the public' it may also print only the price to be paid (without the volume) when it is connected to a volume indicating device and to a price indicating device both of which are visible to the purchaser. The figures, the monetary unit used or its symbol and the decimal sign, if any, shall be printed by the device.			
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 monetary value specified in 3.3.6.			
3.4.9	If the volume 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 volume and the unit price shall comply with the requirements in 3.3.7.			

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3.4.10	Electronic printing devices are also subject to the requirements in 4.3.5.			
(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 trace of commercial transactions, providing proof in case of a dispute. Devices used to read stored information are considered as included in the memory devices.			
3.5.2	The medium on which data are stored must 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	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, • deletion is carried out after a special manual operation.			
3.5.4	Memorisation shall be such that it is impossible in normal use to modify stored values.			
3.5.5	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.			
(3.6) PRE-SETTING DEVICE				
3.6.1	The selected quantity is pre-set by operating a device provided with scales and scale marks or a numerical device which indicates that quantity. The preset quantity shall be indicated before the start of the measurement			
3.6.2	Where pre-setting is effected 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.			
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 volume indicating device, the former shall be clearly distinguishable from the latter.			

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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 volume or price by means of a special operation with the restriction that this value shall be replaced by the zero indication for volume 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 volume or price indicating device at the end of the measurement operation, shall not exceed the minimum specified volume or price deviation.			
3.6.7	The pre-set quantities and the quantities shown by the volume 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.			
(3.8) CALCULATOR				
3.8	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 peripheral equipment. When these interfaces are used, the instrument shall continue to function correctly and its metrological functions shall not be capable of being affected.			
MEASURING SYSTEMS EQUIPPED WOTH ELECTRONIC DEVICES				
(4.1) GENERAL REQUIREMENTS				
4.1.1	Electronic measuring systems shall be designed and manufactured such that their errors do not exceed the maximum permissible errors as defined in 2.5 under rated operating conditions.			
4.1.1.1	Interruptible electronic measuring systems shall be designed and manufactured such that, when they are exposed to the disturbances specified in A.4, either:			

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	a significant faults do not occur, or b significant faults are detected and acted upon by means of checking facilities. This provision may apply separately to: • each individual cause of significant fault and/or • each part of the measuring system			
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.			
4.1.5	Measuring systems shall permit the retrieval of the information relating to the measured volume contained within the instrument when a significant fault occurred and was detected by checking facilities.			
(4.2) POWER SUPPLY DEVICE				
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 an emergency power supply device 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 displayable on an indicating device subject to legal metrology control for sufficient time to permit the conclusion of the current transaction. The absolute value of the maximum permissible error for the indicated volume in this case is increased by 5% of the minimum measured quantity.			
(4.3) CHECKING FACILITIES				
(4.3.1) ACTION OF CHECKING FACILITIES The detection by the checking facilities of significant faults shall result in the following actions, according to the type.				
4.3.1.2	CHECKING FACILITIES OF TYPES I OR P: a [...] b for interruptible measuring systems, in particular for fuel dispensers: • automatic correction of the fault, or • stopping only the faulty device, when the measuring system without that device continues to comply with the regulations, or • stopping the flow.			
(4.3.2) CHECKING FACILITIES FOR THE MEASUREMENT TRANSDUCER The objective of these checking facilities is to verify the presence of the transducer, its correct operation and the correctness of data transmission.				
4.3.2.1	When the signals generated by the flow sensor are in the form of pulses, each pulse representing an elementary volume, at least security level B defined by ISO 6551 *Cabled transmission of electric and/or*			

NMI R 117-1	Requirement	+	–	Remarks
	electronic pulsed data is required. 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 volume deviation. It shall be possible during pattern approval and initial verification to check that these checking facilities function correctly: • by disconnecting the transducer, or • by interrupting one of the sensor's pulse generators, • by interrupting the electrical supply of the transducer.			
(4.3.3) CHECKING FACILITIES FOR THE CALCULATOR The objective of these checking facilities is to verify that the calculator system functions correctly and to ensure the validity of the calculations made.				
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 five 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: a the values of all permanently memorised instructions and data are correct, by such means as: • summing up all instruction and data codes and comparing the sum with a fixed value, • line and column parity bits (LRC and VRC), • cyclic redundancy check (CRC 16), • double independent storage of data, • storage of data in 'safe coding', for example protected by checksum, line and column parity bits, b all procedures of internal transfer and storage of data relevant to the measurement result are performed correctly, by such means as: • write-read routine, • conversion and reconversion of codes, • use of 'safe coding' (check sum, parity bit), • double storage.			
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 peripheral equipment through an interface; this check may be carried out by such means as parity bit, check sum or double storage. In addition, the calculation system shall be provided with a means of controlling the continuity of the calculation program.			

NMI R 117-1	Requirement	+	–	Remarks
4.3.4	CHECKING FACILITIES FOR THE INDICATING DEVICE The objective of this checking facility is to verify that the primary indications are displayed and that they correspond to the data provided by the calculator. In addition, it aims at verifying the presence of the indicating devices, when they are removable. These checking facilities shall either have the form as defined in 4.3.4.1 or the form as defined in 4.3.4.2.			
4.3.4.1	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 volume and the unit price). Means may include, for example: • for indicating devices using incandescent filaments or LEDs, measuring the current in the filaments, • for indicating devices using fluorescent tubes, measuring the grid voltage, • for indicating devices using electromagnetic shutters, checking the impact of each shutter, • for indicating devices using multiplexed liquid crystals, output checking of the control voltage of segment lines and of common electrodes, so as to detect any disconnection or short circuit between control circuits.			
4.3.4.2	The checking facility for the indicating device shall include type I or type P checking of the electronic circuits used for the indicating device (except the driving circuits of the display itself); this checking shall meet the requirements in 4.3.1.2. It shall also provide visual checking of the entire display which shall meet the following description: a for fuel dispensers: • displaying all the elements (‘eights’ test) • blanking all the elements (‘blank’ test) • displaying ‘zeros’ Each step of the sequence shall last at least 0.75 second. b [...]. This visual checking facility shall be of type I for fuel dispensers and of type N for other measuring systems, but it is not mandatory for a malfunction to result in the actions described in 4.3.1.			

NMI R 117-1	Requirement	+	–	Remarks
4.3.4.3	It shall be possible during verification to determine that the checking facility of the indicating device is working, either: • by disconnecting all or part of the indicating device, or • by an action which simulates a failure in the display, such as using a test button.			
4.3.5	CHECKING FACILITIES FOR ANCILLARY DEVICES An ancillary device (repeating device, printing device, self-service device, memory device, etc.) with primary indications shall include a checking facility of type I or P. The object of this checking facility is to verify the presence of the ancillary device, when it is a necessary device, and to verify the correct transmission of data from the calculator to the ancillary device. In particular, the checking of a printing device aims at ensuring that the printing controls correspond to the data transmitted by the calculator. At least the following shall be checked: • presence of paper, • the electronic control circuits (except the driving circuits of the printing mechanism itself). It shall be possible during pattern approval and other verifications to check that the checking facility of the printing device is functioning by an action simulating a printing fault, such as using a test-button. Where the action of the checking facility is a warning, this shall be given on or by the ancillary device concerned.			
REQUIREMENTS SPECIFIC TO CERTAIN TYPES OF MEASURING SYSTEMS				
(5.1) FUEL DISPENSERS Except where otherwise specified, the requirements in this subclause do not apply to LPG dispensers.				
5.1.1	By design, the ratio between the maximum flowrate and the minimum flowrate for these systems shall be at least ten; on site, this ratio may be smaller provided that it is not less than five.			
5.1.2	When the measuring system includes its own pump, a gas elimination device shall be installed, immediately upstream of the meter inlet. Where a gas indicator is fitted, it shall not have a venting device as mentioned in 2.11.			
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.			

NMI R 117-1	Requirement	+	–	Remarks
	If it is not intended to install a gas elimination device the manufacturer or installer has to prove that there is no risk of air intake or gas release. In this case the minimum level in the storage tank must be automatically secured and any leakage shall be checked (see also 2.10.2).			
5.1.4	Fuel dispensers shall be equipped with a device for resetting the volume indicating device to zero. The minimum height for the figures of the resettable volume indicator is 10 mm. If these systems also include a price indicating device, this indicating device shall be fitted with a zero resetting device. The minimum height for the price indicator remains 4 mm (see 3.2.2.6).			
5.1.5	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 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.			
5.1.6	Measuring systems having a maximum flowrate not greater than 3.6 m^3/h shall have a minimum delivery not exceeding 5 L.			
5.1.7	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.			
5.1.8	Fuel dispensers shall be interruptible.			
5.1.9	In addition to requirements in 4.2.2, electronic fuel dispensers shall be 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. Note: If a test during pattern approval is necessary to verify that the fuel dispenser fulfils this requirement, the instrument has to be supplied with electric power normally for the 12 hours which preceded the test.			

NMI R 117-1	Requirement	+	–	Remarks
	Before this supply the battery (if provided) may be unloaded. In addition, fuel dispensers shall be designed so that an interrupted delivery cannot be continued after the power supply device has been re-established if the power failure has lasted more than 15 s.			
5.1.10	Electronic fuel dispensers shall be such that the delay time between the measurement value and the corresponding indicated value shall not exceed 500 ms. Several fuel dispensers may have a common indicating device if and only if the first provision in 2.9.6 is met.			
5.1.11	The checking of the operation of the calculator, as described in 4.3.3.1, shall be performed at least once for each delivery.			
5.1.12	It is not required to display volumes, and prices if applicable, that correspond to a small number of scale intervals at the beginning of the delivery, and to start the display with that volume and the corresponding price. The volume thus hidden shall not be greater than two times the minimum specified volume deviation. The hidden price shall not be greater than the price corresponding to that volume.			
(5.10) SELF-SERVICE ARRANGEMENT WITH FUEL DISPENSERS The following requirements apply to measuring systems covered by 5.1, 5.7 or 5.9 when fitted with self-service arrangements.				
(5.10.1) GENERAL REQUIREMENTS				
5.10.1.2	Where the self-service device serves two or more dispensers, each dispenser shall be provided with a dispenser identification number that shall accompany any primary indication provided by the self-service device.			
5.10.1.3	The primary indications on indicating devices and printing devices of the self-service arrangement shall not indicate any mutual differences. The scale intervals of the primary indication on indicating devices and the printing devices and memory devices of the self-service arrangement shall be the same.			
5.10.1.4	Printing devices on the self-service arrangement shall not reproduce the indications of a dispenser as the difference between two printed values.			
5.10.1.5	Indication of information that is not subject to metrological control is allowed, provided that it cannot be confused with metrological information.			

NMI R 117-1	Requirement	+	–	Remarks
5.10.1.6	The control device of the self-service device should be capable of indicating the status of the dispensers (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.			
5.10.1.7	A change of the type of payment and/or mode of operation shall not be effective before the end of the current measurement operation.			
5.10.1.8	The self-service arrangement, 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			
5.10.1.9	In the case of a self-service arrangement that totalises the delivered volumes for different registered customers over the course of time, the minimum measured quantity is not affected by the scale interval used for such totalisations.			
5.10.2	ATTENDED SERVICE MODE If the dispenser indicating device provides the only primary indication, provisions shall be made to inform the customer that the next authorisation of a particular dispenser can only be given by the supplier after settlement of the current transaction.			
(5.10.2.1) ATTENDED POST-PAYMENT				
5.10.2.1.1	Where the self-service arrangement includes a device that provides an additional primary indication (additional to those of the indicating device of the dispenser), it shall consist of at least one installation for the reproduction of the volume and/or the price indicated by the dispenser indicating device, consisting of: • a printing device for the issue of a receipt to the customer, or • an indicating device for the benefit of the supplier together with a display for the benefit of the customer. Note: As a consequence of 3.4.7, the reproduction of the volume and price is necessary when the dispenser can be authorised before the settlement of the transaction.			
5.10.2.1.2	For self-service devices with temporary storage (temporary storage mode) of measurement data of dispensers the following requirements apply: a temporary storage of measurement data shall be restricted to one delivery for each dispenser, b the primary indication shall be accompanied by a clear mark representing the sequence. For example,			

NMI R 117-1	Requirement	+	–	Remarks
	the number 1 or 2 or the letter A or B, c when a primary indication of the self-service device is out of service, the self-service arrangement may continue its operation provided that it no longer uses any temporary storage, and that the dispenser indicating device remains the primary indication.			
5.10.2.1.3	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 dispenser indicating device remains the primary indication.			
(5.10.2.2) Pre-payment in attended service mode				
5.10.2.2.1	The requirements of 3.6 are applicable.			
5.10.2.2.2	A printed or hand-written receipt of the pre-paid amount shall be provided.			
(5.10.3) UNATTENDED SERVICE MODE				
(5.10.3.1) GENERAL				
5.10.3.1.1	The self-service arrangement shall provide additional primary indications by means of: • a printing device for the issue of a receipt to the customer, and • a device (printing or memory device) on which measurement data are registered for the benefit of the supplier.			
5.10.3.1.2	When the printing devices or memory device, as required by 5.10.3.1.1, are not able to provide any indication or become 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.			
5.10.3.1.3	Where the self-service arrangement is used by registered customers, the provisions of 5.10.3.1.1 and 5.10.3.1.2 do not apply to measurements related to such customers. An additional individual volume totaliser is considered to provide a primary indication.			

5.10.3.1.4	Micro-processors, which upon disturbance or interference influence the measurement operation, shall be equipped with means for controlling the continuity of the processor program and for ensuring the discontinuation of the current delivery when the continuity of the processor program is no longer ensured. The next effective acceptance of notes, cards or other equivalent mode of payment shall only take place if the continuity of the processor program is re-established.			
5.10.3.1.5	When a power supply failure occurs, the delivery data shall be memorised. The requirements of 5.1.9 apply.			
5.10.3.2	DELAYED PAYMENT The printed and/or memorised indications as mentioned in 5.10.3.1 shall contain sufficient information for further checking and at least, the measured quantity, the price to pay and information to identify the particular transaction (e.g. the dispenser number, location, date, time).			
(5.10.3.3) PRE-PAYMENT IN UNATTENDED SERVICE MODE				
5.10.3.3.1	Following the termination of each delivery, the printed and/or memorised indications as intended 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: 1 one part provided prior to the delivery on which the pre-paid amount is shown and recognisable as such, 2 one part provided following the termination of delivery, provided that it is clear from the information provided on both parts that they are related to the same delivery.			
5.10.3.3.2	The requirements of 3.6 are applicable.			
3.3.7	The difference between the indicated price and the price calculated from the unit price and the indicated volume shall not exceed the minimum specified price deviation. However this difference need not be less than the smallest monetary value as defined in 3.3.6. Moreover, this requirement does not apply when the unit price has been changed between two measurements.			

3.3.8	On continuous 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 monetary value as defined in 3.3.6.					
3.3.9	On discontinuous indicating devices, the indication after zeroing shall be zero without any ambiguity.					
(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 volume, n being a positive or negative whole number, or zero, and shall not be greater than the minimum specified volume deviation. The printed scale interval shall not be smaller than the smallest scale interval of the indicating devices.					
3.4.2	The volume printed shall be expressed in one of the units authorised for the indication of volume. The figures, the unit used or its symbol and the decimal sign, if any, shall be printed on the ticket by the device.					
3.4.3	The printing device may also print information identifying the measurement such as: sequence number, date, identification of the dispenser, type of liquid, etc. If the printing device is connected to more than one measuring system, it must 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’.					
3.4.6	Where the printing device and volume indicating device each have a zeroing device, these devices shall be designed so that resetting one of them to zero also resets the other.					

Annex A.4. Conclusion of tests

Application no: Date:

Certificate of conformity no: Date:

No	Test description	+	–	Remarks
Electronic calculator and indicating device, also additional tests for electronic measurement transducer				
1	Dry heat (non-condensing)			
2	Cold			
3	Damp heat, cyclic (condensing)			
4	Power voltage variations			
5	Short-time power reductions			
6	Electrical bursts			
7	Electrostatic discharges			
8	Electromagnetic susceptibility			
Measurement transducer or meter with mechanical indicating device				
9	Volume accuracy at metering conditions			
10	Endurance test			
11	Accuracy on the minimum measured quantity			
Gas separator				
12	Efficiency of the gas elimination			
Gas extractor				
13	Efficiency of the gas elimination			
Additional tests for complete fuel dispenser				
14	Flow interruption			
15	Variation internal volume of the hose (simplified test)			
16	Variation internal volume of the hose (normal test)			
Self-service devices				
17	Deviation of the primary indications			
18	Accuracy on pre-set deliveries			
19	Dry heat (non-condensing)			
20	Cold			
21	Damp heat, cyclic (condensing)			
22	Power voltage variations			
23	Short-time power reductions			
24	Electrical bursts			
25	Electrostatic discharges			
26	Electromagnetic susceptibility			

Notes:

+	–	
×		if the instrument has passed the test
	×	if the instrument has failed
/	/	if the test is not applicable

Remarks:

Observer:

Annex A.5. Tests reports

In these test reports the following symbols, units and equations are used:

NCU	National currency unit
mpe	Maximum permissible error
RH	Relative humidity
MSPD	Minimum specified price deviation
S.F	Significant fault
f	Frequency of pulses sent to the CID (Hz)
i	Number of pulses sent to the CID
n_o	Number of operations testing a gas extractor
P_u	Indicated unit price (NCU/L)
p_t	Pressure of the liquid passing through the meter or the measurement transducer (bar)
p_{min}	Minimum pressure of the liquid passing through the meter or the measurement transducer (bar)
p_{max}	Maximum pressure of the liquid passing through the meter or the measurement transducer (bar)
Q	Simulated or real flowrate of liquid (L/min)
Q_{max}	Maximum flowrate of liquid (L/min)
Q_a	Flowrate of air (L/min)
Q_l	Flowrate of liquid (L/min)
t	Time (s)
T_s	Temperature of the liquid in the standard capacity measure (°C)
T_r	Reference temperature of the standard capacity measure (°C)
T_t	Temperature of the liquid passing through the meter or measurement transducer (°C)
V_{min}	Minimum measured quantity (L)
V_i	Indicated volume at metering conditions by the CID (L)
V_s	Volume indication of the standard capacity measure (L)
V_r	Volume indication of the standard capacity measure, compensated for the deviation from the reference temperature (L)
V_m	Volume at metering conditions stored by the CID if the CID is fitted with a memory device (L)
V_p	Printed volume at metering conditions if the CID is fitted with a printing device (L)
V_c	Volume at metering conditions calculated from the number of simulated pulses i and the weight of one pulse w (L)
V_n	Volume at metering conditions (L) passing through the meter compensated for deviation from reference temperature of the standard capacity measure and pressure and temperature of the liquid
V_a	Volume of air (L)
w	Weight of one pulse, volume per pulse (L/pulse)
α	Cubic expansion coefficient of the test liquid due to temperature ($°C^{-1}$)
χ	Cubic expansion coefficient of the test liquid due to pressure (bar^{-1})
β	Cubic expansion coefficient of the standard capacity measure due to temperature ($°C^{-1}$)
Notes:	For the determination of α refer to OIML R 63 or ISO 91-1 for petroleum products. For the determination of χ refer to API Manual of Petroleum Measurements Standards Chapter 11.2.1 for petroleum products If β is not known, the following values can be used.

Material	β (°C^{-1}) (uncertainty 5×10^{-6} °C^{-1})
Borosilica glass	10×10^{-6}
Glass	27×10^{-6}
Mild steel	33×10^{-6}
Stainless steel	51×10^{-6}
Copper, brass	53×10^{-6}
Aluminium	69×10^{-6}

P_i Indicated price (price to pay) by the CID (NCU)
P_m Price stored by the CID if the CID is fitted with a memory device (NCU)
P_p Printed price if the CID is fitted with a printing device (NCU)
P_c Calculated price (NCU)
E_{vi} Error of indicated volume at metering conditions (%)
E_{vm} Error of stored volume at metering conditions if the CID is fitted with a memory device (%)
E_{vp} Error of printed volume at metering conditions if the CID is fitted with a printing device (%)
E_{va} Error of indicated volume at metering conditions resulting of the presence of air (%)
ε_0 Intrinsic error of the instrument at metering conditions (%)
ε_1 Intrinsic error at metering conditions obtained at the first accuracy test (%)
ε_2 Intrinsic error at metering conditions obtained at the second accuracy test (%)
ε_3 Intrinsic error at metering conditions obtained at the third accuracy test (%)
$E_{vi}(B)$ Error of indicated volume at metering conditions before the endurance test (%)
$E_{vi}(A)$ Error of indicated volume at metering conditions after the endurance test (%)
E_{pi} Error of indicated price (NCU)
E_{pm} Error of stored price if the CID is fitted with a memory device (NCU)
E_{pp} Error of printed price if the CID is fitted with a printing device (NCU)
$\bar{}$ Mean value of errors (%, NCU, °C, bar)
n Number of tests at the same condition

$Q = 60 \times f \times i$ (if Q is simulated)
$V_c = i \times w$
$P_c = V_i \times P_u$
$V_r = V_s \times [1 + \beta(T_s - T_r)]$
$V_n = V_r \times [1 + \alpha(T_t - T_s)] \times [1 - \chi p_t]$
$E_{vi} = [(V_i - V_c) / V_c] \times 100$ V_c may be replaced by V_r or V_n if appropraite
$E_{vm} = [(V_m - V_c) / V_c] \times 100$ V_c may be replaced by V_r or V_n if appropraite
$E_{vp} = [(V_p - V_c) / V_c] \times 100$ V_c may be replaced by V_r or V_n if appropraite
$E_{va} = [(V_i - V_c) / V_c] \times 100$ V_c may be replaced by V_r or V_n if appropraite
$\Delta E_{vi} = E_{va} - E_{vi}$
$E_{pi} = P_i - P_c$
$E_{pm} = P_m - P_c$
$E_{pp} = P_p - P_c$
$\bar{E} = [E(1) + E(2) + ... + E(n)] / n$
$\varepsilon_1 = [(V_i - V_c) / V_c]_1 \times 100$ V_c may be replaced by V_r or V_n if appropraite
$\varepsilon_2 = [(V_i - V_c) / V_c]_2 \times 100$ V_c may be replaced by V_r or V_n if appropraite
$\varepsilon_3 = [(V_i - V_c) / V_c]_3 \times 100$ V_c may be replaced by V_r or V_n if appropraite
$\varepsilon_0 = [\varepsilon_1 + \varepsilon_2 + \varepsilon_3] / 3$

Report no:
Page: of
Application no:
Date:
Observer:

Calculator and indicating device
Test Report No 1 Dry heat (non-condensing)

Test condition	Q L/min	P_u NCU/L	V_i L	P_i NCU	V_c L	E_{vi} %	mpe %	P_c NCU	E_{pi} NCU	MSPD
20°C										
55°C										
20°C										

Note: In case of the calculator is provided with a printing and/or memory device columns shall be added with regard to V_p, V_m, P_p, P_m, E_{vp}, E_{vm}, E_{pp} and $E_{pm.}$

Remarks:

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Calculator and indicating device
Test Report No 2 Cold

Test condition	Q L/min	P_u NCU/L	V_i L	P_i NCU	V_c L	E_{vi} %	mpe %	P_c NCU	E_{pi} NCU	MSPD
20°C										
-25°C										
20°C										

Note: In case of the calculator is provided with a printing and/or memory device columns shall be added with regard to V_p, V_m, P_p, P_m, E_{vp}, E_{vm}, E_{pp} and $E_{pm.}$

Remarks:

Report no:
Page: of
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Date:
Observer:

Calculator and indicating device
Test Report No 3 Damp heat, cyclic (condensing)

Test condition	Q L/min	P_u NCU/L	V_i L	P_i NCU	V_c L	E_{vi} %	mpe %	P_c NCU	E_{pi} NCU	MSPD
20°C 50% RH										
Damp heat cyclic (24 h × 2 cycles)										
20°C 50% RH										

Note: In case of the calculator is provided with a printing and/or memory device columns shall be added with regard to V_p, V_m, P_p, P_m, E_{vp}, E_{vm}, E_{pp} and $E_{pm.}$

Remarks:

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Date:
Observer:

Calculator and indicating device
Test Report No 4 Power voltage variation

Test condition	U_i	Q L/min	P_u NCU/L	V_i L	P_i NCU	V_c L	E_{vi} %	mpe %	P_c NCU	E_{pi} NCU	MSPD
U											
1.1 U											
0.85 U											

Note: In case of the calculator is provided with a printing and/or memory device columns shall be added with regard to V_p, V_m, P_p, P_m, E_{vp}, E_{vm}, E_{pp} and $E_{pm.}$

U: Mains voltage
U_i: Indicated mains voltage

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Calculator and indicating device
Test Report No 5 Short-time power reductions (page 1 of 2), determination of initial intrinsic error

Q (L/min)	V_i (L)	V_c (L)	E (%)
			ε_1:
			ε_2:
			ε_3:
			ε_0:

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Calculator and indicating device
Test Report No 5 Short time power reductions (page 2 of 2)

Test condition	Q L/min	P_u NCU/L	V_i L	P_i NCU	V_c L	E_{vi} %	ε_0-E_{vi}	SF %	P_c NCU	E_{pi} NCU	MSPD NCU	Checking facility	
100% reduction, ½ cycle, 10 times												Yes	No
50% reduction, 1 cycle, 10 times												Yes	No

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
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Date:
Observer:

Calculator and indicating device
Test Report No 6 Electrical bursts (page 1 of 2), determination of initial intrinsic error

Q (L/min)	V_i (L)	V_c (L)	E (%)
			ε_1:
			ε_2:
			ε_3:
			ε_0:

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Calculator and indicating device
Test Report No 6 Electrical bursts (page 2 of 2)

Test condition	Q L/min	P_u NCU/L	V_i L	P_i NCU	V_c L	E_{vi} %	ε_0-E_{vi}	SF %	P_c NCU	E_{pi} NCU	MSPD NCU	Checking facility	
Line 1 non-symmetrical positive												Yes	No
Line 1 non-symmetrical negative												Yes	No
Line 2 non-symmetrical positive												Yes	No
Line 2 non-symmetrical, negative												Yes	No
Line 1 + 2 symmetrical positive												Yes	No
Line 1 + 2 symmetrical negative												Yes	No

Line 1: Phase/Neutral, Line 2: Phase/Neutral
Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Calculator and indicating device
Test Report No 7 Electrostatic discharges (page 1 of 2), determination of initial intrinsic error

Q (L/min)	V_i (L)	V_c (L)	E (%)
			ε_1:
			ε_2:
			ε_3:
			ε_0:

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Calculator and indicating device
Test Report No 7 Electrostatic discharges (page 2 of 2)

Test condition		Q L/min	P_u NCU/L	V_i L	P_i NCU	V_c L	E_{vi} %	ε_0-E_{vi}	SF %	P_c NCU	E_{pi} NCU	MSPD NCU	Checking facility	
Discharged point	C/A													
													Yes	No
													Yes	No
													Yes	No
													Yes	No
													Yes	No
													Yes	No

C: Contact discharge, A: Air discharge

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Calculator and indicating device
Test Report No 8 Electromagnetic susceptibility (page 1 of 2), determination of initial intrinsic error

Q (L/min)	V_i (L)	V_c (L)	E (%)
			ε_1:
			ε_2:
			ε_3:
			ε_0:

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Calculator and indicating device
Test Report No 8 Electromagnetic susceptibility (page 2 of 2)

Test condition* / Antenna method	SV decade/ s	Q L/min	P_u NCU/L	V_i L	P_i NCU	V_c L	E_{vi} %	ε_0-E_{vi}	SF %	P_c NCU	E_{pi} NCU	MSPD NCU	Checking facility	
													Yes	No
													Yes	No
													Yes	No
													Yes	No
													Yes	No
													Yes	No

* Information shall be given concerning frequency range, field strength, antenna position, etc, SV: sweep velocity

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Measurement transducer
Test Report No 9 Accuracy liquid (page 1 of 2)

$Q(1)$ L/min	P_u NCU/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}$	%	Range	%						

$Q(2)$ L/min	P_u NCU/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}$	%	Range	%						

$Q(3)$ L/min	P_u NCU/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}$	%	Range	%						

Remarks:

Test measures used		Liquid		Ambient conditions	
β:	$°C^{-1}$	α:	$°C^{-1}$	Temperature:	°C
Reference temperature:	°C	κ:	bar^{-1}	Humidity:	% RH
Nominal volume:	L	Viscosity at 20°C:	mPa.s	Pressure:	hPa
Identification:					

Report no:
Page: of
Application no:
Date:
Observer:

Measurement transducer
Test Report No 9 Accuracy liquid (page 2 of 2)

$Q(4)$ L/min	P_u NCU/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}$ %		Range %							

$Q(5)$ L/min	P_u NCU/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}$ %		Range %							

$Q(6)$ L/min	P_u NCU/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}$ %		Range %							

Remarks:

Test measures used		Liquid		Ambient conditions	
β:	$°C^{-1}$	α:	$°C^{-1}$	Temperature:	°C
Reference temperature:	°C	κ:	bar^{-1}	Humidity:	% RH
Nominal volume:	L	Viscosity at 20°C:	mPa.s	Pressure:	hPa
Identification:					

Report no:
Page: of
Application no:
Date:
Observer:

Measurement transducer
Test Report No 10 Endurance test (page 1 of 3)

Date of accuracy test before endurance test:	
Liquid:	
Viscosity:	mPa.s
Volume per delivery:	L
Total time of endurance test:	hour
Total volume:	L
Resetting between deliveries:	Yes / No
Number of stops:	
Date of accuracy test after endurance test:	
Remarks:	

Report no:
Page: of
Application no:
Date:
Observer:

Measurement transducer
Test Report No 10 Accuracy liquid before endurance test (page 2 of 3)

$Q(1)$ L/min	P_u NLG/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}$(B) %		Range %							

$Q(2)$ L/min	P_u NLG/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}$(B) %		Range %							

$Q(3)$ L/min	P_u NLG/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}$(B) %		Range %							

Remarks:

Test measures used		Liquid		Ambient conditions	
β:	$°C^{-1}$	α:	$°C^{-1}$	Temperature:	°C
Reference temperature:	°C	κ:	bar^{-1}	Humidity:	% RH
Nominal volume:	L	Viscosity at 20°C	mPa.s	Pressure:	hPa
Identification:					

Report no:
Page: of
Application no:
Date:
Observer:

Measurement transducer
Test Report No 10 Accuracy liquid after endurance test (page 3 of 3)

$Q(1)$ L/min	P_u NLG/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}(A)$ %		$\bar{E}_{vi}(A)–\bar{E}_{vi}(B)$ %							

$Q(1)$ L/min	P_u NLG/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}(A)$ %		$\bar{E}_{vi}(A)–\bar{E}_{vi}(B)$ %							

$Q(1)$ L/min	P_u NLG/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}(A)$ %		$\bar{E}_{vi}(A)–\bar{E}_{vi}(B)$ %							

Remarks:

Test measures used	Liquid	Ambient conditions
β: °C^{-1} Reference temperature: °C Nominal volume: L Identification:	α: °C^{-1} κ: bar^{-1} Viscosity at 20°C mPa.s	Temperature: °C Humidity: % RH Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Measurement transducer
Test Report No 11 Accuracy on the minimum measured quantity

Q L/min	P_u NLG/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}$	%								

Q L/min	P_u NLG/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}$	%								

Remarks:

Test measures used		Liquid		Ambient conditions	
β:	$°C^{-1}$	α:	$°C^{-1}$	Temperature:	°C
Reference temperature:	°C	κ:	bar^{-1}	Humidity:	% RH
Nominal volume:	L	Viscosity at 20°C	mPa.s	Pressure:	hPa
Identification:					

Report no:
Page: of
Application no:
Date:
Observer:

Gas separator
Test Report No 12 Efficiency of the gas elimination (page 1 of 2)

Operating limits	
Q_{max}	L/min
p_{max}	bar
p_{min}	bar

Q_a L/min	Q_l L/min	p_t bar	T_t °C	V_i L	V_a L	V_s L	T_s °C	V_n L	E_{va} %	E_{vi} %	ΔE_{vi} %	mpe %	V_a/V_n %	Air bubble (yes or no)

$\Delta E_{vi} = E_{va} - E_{vi}$
Remarks:

Test measures used	Liquid	Gas meter identification	Ambient conditions
β: °C^{-1} Reference temp: °C Identification:	α: °C^{-1} κ: bar^{-1} Viscosity at 20°C: mPa.s	Suction height (for the liquid): m Diameter: mm Length: m	Temperature: °C Humidity: % RH Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Gas separator
Test Report No 12 Accuracy without air (page 2 of 2)

Q_l L/min	P_u NCU/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %

Remarks:

Test measures used		Liquid		Ambient conditions	
β:	$°C^{-1}$	α:	$°C^{-1}$	Temperature:	°C
Reference temperature:	°C	κ:	bar^{-1}	Humidity:	% RH
Nominal volume:	L	Viscosity at 20°C	mPa.s	Pressure:	hPa
Identification:					

Report no:
Page: of
Application no:
Date:
Observer:

Test Report No 13 Gas extractor

Operating limits	
Q_{max}	L/min
p_{max}	bar
p_{min}	bar
V_{min}	L

Accuracy at maximum flowrate without air

Q_l L/min	P_u NLG/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %

Accuracy at maximum flowrate with air

n_o	Q_l L/min	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	E_{vi} cm^3	E_{vi}/n_o cm^3	mpe cm^3

Remarks:

Test measure used		Liquid		Ambient conditions	
β:	$°C^{-1}$	α:	$°C^{-1}$	Temperature:	°C
Reference temp:	°C	κ:	bar^{-1}	Humidity:	% RH
Nominal volume:	L	Viscosity at 20°C:	mPa.s	Pressure:	hPa
Identification:					

Report no:
Page: of
Application no:
Date:
Observer:

Fuel dispenser
Test Report No 14 Flow interruption

Q_{max} L/min	P_u NCU/L	V_i L	T_t °C	p_t bar	V_s L	T_s °C	V_n L	E_{vi} %	mpe %
$\bar{E}_{vi}$ %			Range %						

Remarks:

Test measures used		Liquid		Ambient conditions	
β:	$°C^{-1}$	α:	$°C^{-1}$	Temperature:	°C
Reference temp:	°C	κ:	bar^{-1}	Humidity:	% RH
Nominal volume:	L	Viscosity at 20°C:	mPa.s	Pressure:	hPa
Identification:					

Report no:
Page: of
Application no:
Date:
Observer:

Fuel dispenser
Test Report No 15 Variation of internal volume of the hose (simplified test)

Characteristics hose		Characteristics fuel dispenser	
Manufacturer		Manufacturer	
Designation		Designation	
Inner diameter	mm	Maximum operating pressure	kPa
Length	m	Minimum measured quantity	L

Test number	Remaining start pressure (kPa)	Pressure kPa	Vi mL		
1					
2					
3				mpe (mL) without hose reel	mpe (mL) with hose reel
		mean variation			

Ambient conditions	
Temperature	°C
Humidity	% RH
Pressure	hPa

Remarks:

Report no:
Page: of
Application no:
Date:
Observer:

Fuel dispenser
Test Report No 16 Variation internal volume of the hose (normal test)

Characteristics	
Manufacturer	
Designation	
Inner diameter	mm
Length	m
Max operating pressure	bar
Minimum measured quantity	L

X	Y	Y – X	Scale division mL	Variation mL		
					mpe without hose reel	mpe with hose reel
			mean variation			

Ambient conditions	
Temperature	°C
Humidity	% RH
Pressure	hPa

Report no:
Page: of
Application no:
Date:
Observer:

Self-service device
Test Report No 17 Deviations of the primary indications

Primary indications dispenser/simulator		Primary indications self-service device										No mutual differences	
		Operator display		Customer display		Ticket printer		Log printer		Memory device		Volume indications P/F	Price indications P/F
Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU		

P/F = Passed/Failed

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Self-service device
Test Report No 18 Accuracy on pre-set deliveries

Pre-pay or pre-set NCU or L	Primary indications dispenser/simulator		Primary indications self-service device										No mutual differences	
			Operator display		Customer display		Ticket printer		Log printer		Memory device		Volume indications P/F	Price indications P/F
	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU		

P/F = Passed/Failed

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa
Report no:

Page: of
Application no:
Date:
Observer:

Self-service device
Test Report No 19 Dry heat (non-condensing)

Test condition	Primary indications dispenser/simulator		Primary indications self-service device										No mutual differences	
			Operator display		Customer display		Ticket printer		Log printer		Memory device		Volume indications P/F	Price indications P/F
	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU		
20°C														
40/50°C														
20°C														

P/F = Passed/Failed

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Self-service device
Test Report No 20 Cold

Test condition	Primary indications dispenser/simulator		Primary indications self-service device										No mutual differences	
			Operator display		Customer display		Ticket printer		Log printer		Memory device		Volume indications P/F	Price indications P/F
	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU		
20°C														
–10/–25°C														
20°C														

P/F = Passed/Failed

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Self-service device
Test Report No 21 Damp heat, cyclic (condensing)

Test condition	Primary indications dispenser/simulator		Primary indications self-service device										No mutual differences	
			Operator display		Customer display		Ticket printer		Log printer		Memory device		Volume indications P/F	Price indications P/F
	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU		
20°C 50% RH														
Damp heat cyclic 40 / 55°C (24 h × 2 cycles)														
20°C 50% RH														

P/F = Passed/Failed

Remarks:

Report no:
Page: of
Application no:
Date:
Observer:

Self-service device
Test Report No 22 Power voltage variation

Test condition	Primary indications dispenser/simulator		Primary indications self-service device										No mutual differences	
			Operator display		Customer display		Ticket printer		Log printer		Memory device		Volume indications P/F	Price indications P/F
	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU		
U_i														
1.10 U_i														
0.85 U_i														

U_i: nominal voltage V
P/F = Passed/Failed

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Self-service device
Test Report No 23 Short-time power reductions

Test condition	Primary indications dispenser/simulator		Primary indications self-service device										No mutual differences	
			Operator display		Customer display		Ticket printer		Log printer		Memory device		Volume indications P/F	Price indications P/F
	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU		
100% reduction ½ cycle 10 times														
50% reduction 1 cycle 10 times														

P/F = Passed/Failed

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Self-service device
Test Report No 24 Electrical bursts

Test condition	Primary indications dispenser/simulator		Primary indications self-service device										No mutual differences	
			Operator display		Customer display		Ticket printer		Log printer		Memory device		Volume indications P/F	Price indications P/F
	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU		
L1 + asymmetric														
L1 – asymmetric														
L2 + asymmetric														
L2 + asymmetric														
L1/2 + symmetric														
L1/2 – symmetric														

P/F = Passed/Failed
Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Self-service device
Test Report No 25 Electrostatic discharges

Test condition	Primary indications dispenser/simulator		Primary indications self-service device										No mutual differences	
			Operator display		Customer display		Ticket printer		Log printer		Memory device		Volume indications P/F	Price indications P/F
Discharge point C/A	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU		

P/F = Passed/Failed
C / A = Contact /Air

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Report no:
Page: of
Application no:
Date:
Observer:

Self-service device
Test Report No 26 Electromagnetic susceptibility

Test condition*	SV Dec/s	Primary indications dispenser/simulator		Primary indications self-service device										No mutual differences	
				Operator display		Customer display		Ticket printer		Log printer		Memory device		Volume indications P/F	Price indications P/F
Ant meth		Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU	Volume L	Price NCU		

* Information shall be given concerning frequency range, field strength, antenna position, etc
P/F = Passed/Failed
SV: Sweep velocity

Remarks:

Ambient conditions
Temperature: °C
Humidity: % RH
Pressure: hPa

Annex B. Relevant points of the general checklist applicable to fuel dispensers and constituent elements

	Fuel dispenser	Calculator/ indicating device	Measurement transducer	Meter	Printing device	Memory device	Gas separator	Gas extractor	Self-service device
2.9.1	x	x		x	x	x			x
2.9.2	x	x							
2.9.3	x	x							
2.9.4	x	x		x	x	x			x
2.9.5	x	x		x	x	x			x
2.9.6	x								
2.10.1	x						x	x	
2.10.2	x								
2.10.3	x								
2.10.5	x						x	x	
2.10.7.1	x						x	x	
2.10.8.1	x						x		
2.10.8.2	x						x		
2.10.9	x							x	
2.11	x								
2.12.1	x								
2.12.2.2	x								
2.13.1	x								
2.13.2	x								
2.13.3	x								
2.13.4	x								
2.13.6	x								
2.13.7	x								
2.14.2	x								
2.15	x								
2.16.1	x								
2.16.3	x								
2.17.1	x								
2.17.2	x								
2.18.1	x								
2.18.2	x								
2.19.1	x	x	x	x	x	x	x	x	x
2.19.2	x	x		x					
2.20.1	x	x	x	x			x	x	x
2.20.2.1	x	x	x	x					
2.20.2.2	x	x	x	x					

	Fuel dispenser	Calculator/ indicating device	Measurement transducer	Meter	Printing device	Memory device	Gas separator	Gas extractor	Self-service device
2.20.2.3	x	x	x	x					
3.1.1.2	x	x	x	x				x	
3.1.2.2	x		x	x					
3.1.2.3	x		x	x					
3.1.3	x			x					
3.1.4	x			x					
3.15	x	x	x	x					
3.1.6	x		x	x					
3.2.1.1	x	x		x	x	x			x
3.2.1.2	x	x		x	x	x			x
3.2.1.3	x	x		x	x	x			x
3.2.1.4	x	x		x	x	x			x
3.2.2.1	x	x		x					
3.2.2.2	x	x		x					
3.2.2.3	x	x		x					
3.2.2.4	x	x		x					
3.2.2.5	x	x		x					
3.2.2.6	x	x		x					
3.2.3	x	x		x					
3.2.4.1	x	x		x					
3.2.4.2	x	x		x					
3.2.4.3	x	x		x					
3.2.4.4	x	x		x					
3.2.4.5	x	x		x					
3.3.1	x	x		x					x
3.3.2	x	x		x					x
3.3.3	x	x		x					x
3.3.4	x	x		x					x
3.3.5	x	x		x					x
3.3.6	x	x		x					x
3.3.7	x	x		x					x
3.3.8	x	x		x					x
3.3.9	x	x		x					x
3.4.1	x				x				x
3.4.2	x				x				x
3.4.3	x				x				x
3.4.4	x				x				x
3.4.6	x				x				x
3.4.7	x				x				x

	Fuel dispenser	Calculator/ indicating device	Measurement transducer	Meter	Printing device	Memory device	Gas separator	Gas extractor	Self-service device
3.4.8	x				x				x
3.4.9	x				x				x
3.4.10	x				x				x
3.5.1	x					x			x
3.5.2	x					x			x
3.5.3	x					x			x
3.5.4	x					x			x
3.5.5	x					x			x
3.6.1	x	x		x					
3.6.2	x	x		x					
3.6.3	x	x		x					
3.6.4	x	x		x					
3.6.5	x	x		x					
3.6.6	x	x		x					
3.6.7	x	x		x					
3.6.8	x	x		x					
3.6.9	x	x		x					
3.6.10	x	x		x					
3.8	x	x		x					
4.1.1	x	x	x	x	x	x			
4.1.1.1	x	x	x	x	x	x			
4.1.3	x	x	x	x	x	x			x
4.1.5	x	x		x					
4.2.1	x	x		x					
4.2.2	x	x		x					
4.3.1.2	x	x		x					
4.3.2.1	x	x	x	x					
4.3.2.3	x	x	x	x					
4.3.3.1	x	x		x					
4.3.3.2	x	x		x					
4.3.4	x	x		x					
4.3.4.1	x	x		x					
4.3.4.2	x	x		x					
4.3.4.3	x	x		x					
4.3.5	x	x		x	x	x			x
5.1.1	x								
5.1.2	x								
5.1.3	x								
5.1.4	x	x		x					

	Fuel dispenser	Calculator/ indicating device	Measurement transducer	Meter	Printing device	Memory device	Gas separator	Gas extractor	Self-service device
5.1.5	x								
5.1.6	x								
5.1.7	x				x				
5.1.9	x	x		x					
5.1.10	x	x		x					
5.1.11	x	x		x					
5.1.12	x	x		x					
5.10.1.2									x
5.10.1.3									x
5.10.1.4									x
5.10.1.5									x
5.10.1.6									x
5.10.1.7									x
5.10.1.8									x
5.10.1.9									x
5.10.2									x
5.10.2.1.1									x
5.10.2.1.2									x
5.10.2.1.3									x
5.10.2.2.1									x
5.10.2.2.2									x
5.10.3.1.1									x
5.10.3.1.2									x
5.10.3.1.3									x
5.10.3.1.4									x
5.10.3.1.5									x
5.10.3.2									x
5.10.3.3.1									x
5.10.3.3.2									x

Annex C. Figures

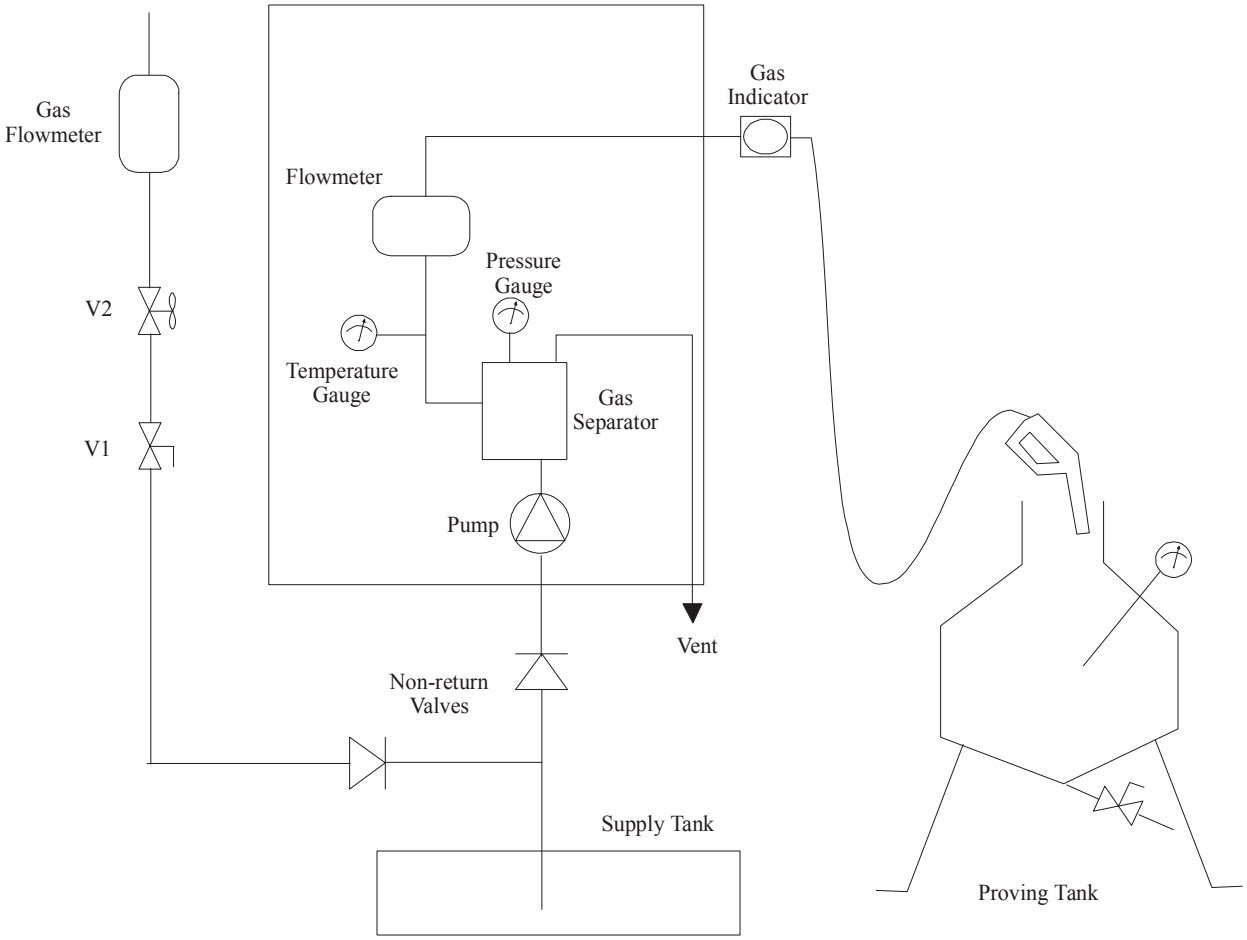

Figure 1. Test installation for gas separators in fuel dispensers

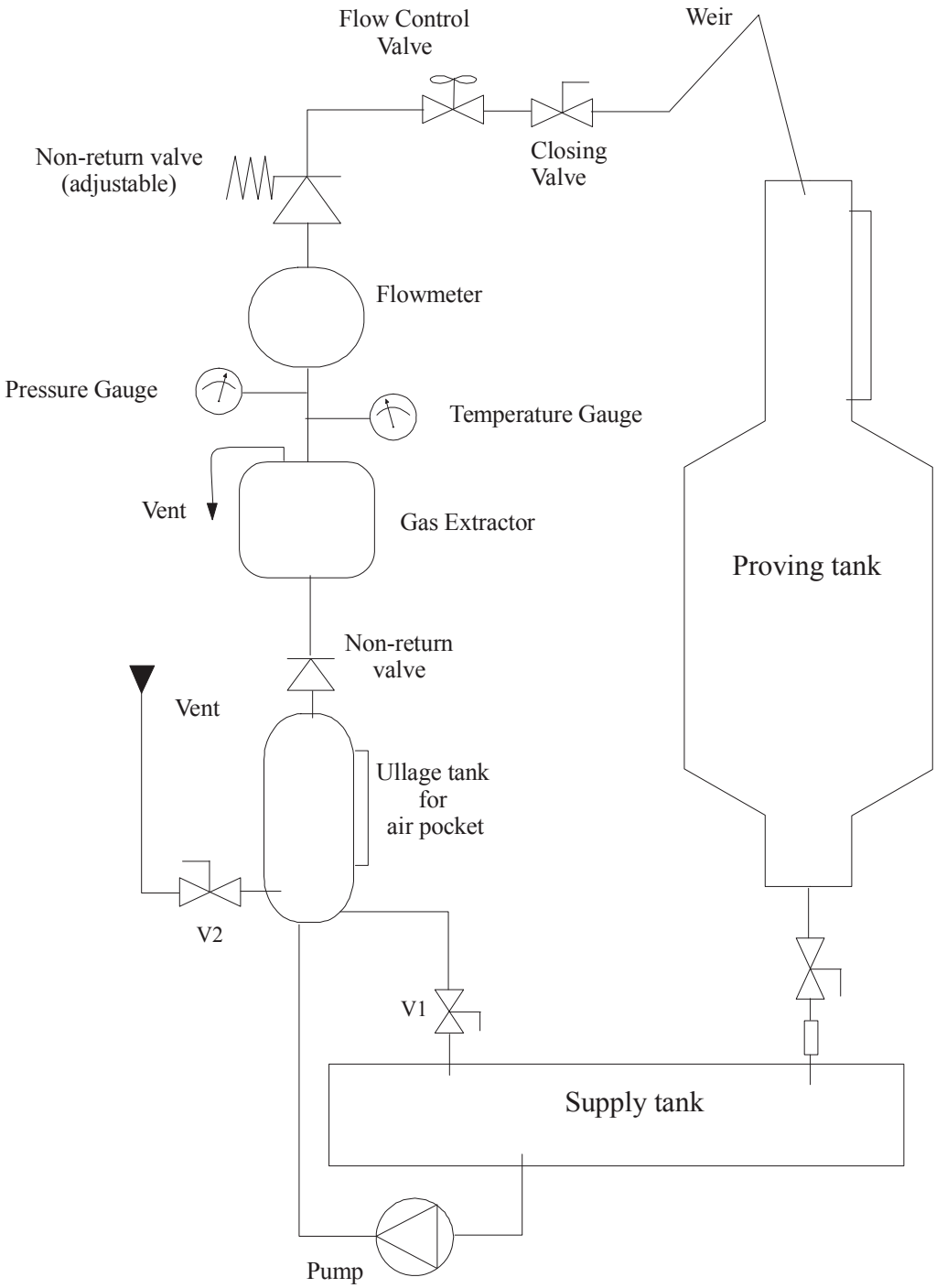

Figure 2. Test installation for gas extractor

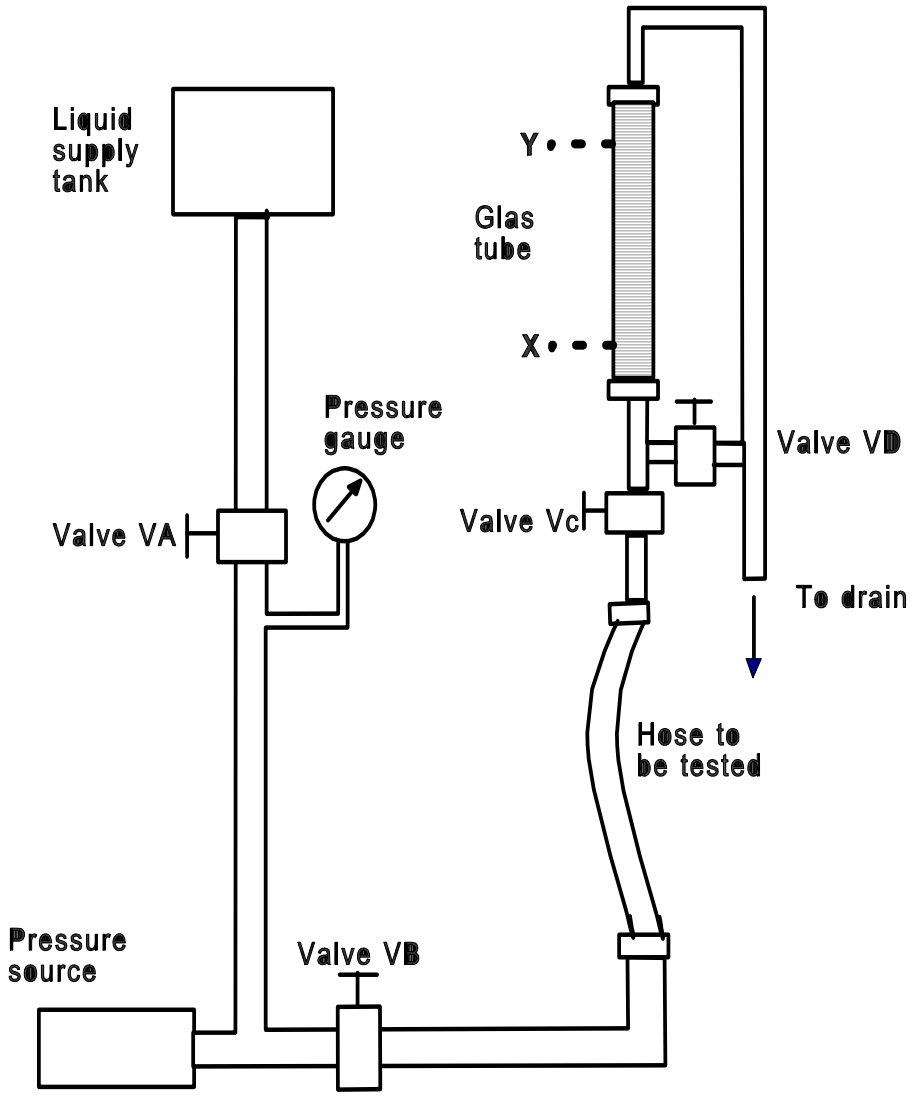

Figure 3. Test apparatus for variation in the internal volume of the hose