Petrol vapour recovery during refuelling of motor vehicles at service stations - Part 2: Test methods for verification of vapour recovery systems at service stations

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NATIONAL FOREWORD

See Eesti standard EVS-EN 16321-2:2013 sisaldab Euroopa standardi EN 16321-2:2013 ingliskeelset teksti.	This Estonian standard EVS-EN 16321-2:2013 consists of the English text of the European standard EN 16321-2:2013.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 25.09.2013.	Date of Availability of the European standard is 25.09.2013.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

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ICS 75.200

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16321-2

September 2013

ICS 75.200

English Version

Petrol vapour recovery during refuelling of motor vehicles at service stations - Part 2: Test methods for verification of vapour recovery systems at service stations

Récupération des vapeurs d'essence lors du ravitaillement en carburant des véhicules à moteur dans les stations-service - Partie 2: Méthodes d'essai pour la vérification des systèmes de récupération des vapeurs dans les stations-service

Benzindampf-Rückführung während der Betankung von Kraftfahrzeugen an Tankstellen - Teil 2: Prüfverfahren für die Kontrolle von Gasrückführungssystemen an Tankstellen

This European Standard was approved by CEN on 26 July 2013.

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Foreword

This document (EN 16321-2:2013) has been prepared by Technical Committee CEN/TC 393 "Equipment for storage tanks and for filling stations", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2014, and conflicting national standards shall be withdrawn at the latest by March 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

EN 16321, *Petrol vapour recovery during refuelling of motor vehicles at service stations*, is divided into the following parts:

— *Part 1: Test methods for the type approval efficiency assessment of petrol vapour recovery systems*;

— *Part 2: Test methods for verification of vapour recovery systems at service stations.*

WARNING — Persons using this European Standard should be familiar with measurement principles. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

The application of this standard is only valid on installations that comply with manufacturer´s requirements.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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1 Scope

This European Standard specifies the test methods for verification of vapour recovery systems at service stations (Stage II).

This European Standard does not specify the test method for the air and vapour tightness testing of the vapour recovery systems at service stations.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 16321-1:2013, *Petrol vapour recovery during refuelling of motor vehicles at service stations — Part 1: Test methods for the type approval efficiency assessment of petrol vapour recovery systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16321-1:2013 apply.

4 Requirements for petrol vapour/petrol ratio

The petrol vapour/petrol ratio shall be equal to or greater than 0,95 but less than or equal to 1,05.

5 Measurement methods for in service tests

5.1 General

In this European Standard three test methods for verification of vapour recovery systems at service stations are described. For any verification only one method shall be employed.

The in service verification test shall only be carried out at ambient temperature between +5 °C to +25 °C under real or simulated petrol flow conditions.

Where it has been demonstrated that the combination of vapour recovery system and the verification equipment operates to this standard at a temperature range beyond +5 °C to +25 °C, there shall be a technical file which defines:

— how this has been achieved;

— justification for the test method;

— the upper and lower temperature limits for performing the verification.

This technical file shall be available.

The seals of the weights and measures components of the fuel dispenser shall not be broken.

For all tests, the instructions of the manufacturer of the vapour recovery system shall be followed.

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Consult manufacturer's instructions for the location of the permanently fixed label, in accordance with EN 16321-1, which contains the setting data relevant for the measurements (pulsing rate of the fuel dispenser, correction factor, certificate number of the built-in vapour recovery systems, etc.).

After testing, the system shall be returned to normal operation.

5.2 Sequence of tests

For each nozzle of the vapour recovery system to be tested the ambient temperature shall be measured at the start and end of the test sequence using a temperature measuring device, measuring range 0 °C to 40 °C and an accuracy of maximum ± 1 °C. The temperatures shall be recorded.

If the temperature at the start of the test is outside +5 °C to +25 °C no test shall be carried out except where the temperature is within the extended temperature range according to 5.1.

If the temperature at the end of the test is outside +5 °C to +25 °C the test results are not valid except where the temperature is within the temperature range according to 5.1.

The test sequence for each nozzle shall be as set out below and given in Figure 1.

Where the test result meets the requirement of Clause 4 the nozzle shall be considered to pass the test. No further test is required.

Where the test result fails to meet the requirement of Clause 4 the nozzle shall be retested.

Where the test result fails to meet the requirement of Clause 4 the nozzle shall be considered to have failed. No further test is required.

Where the test result meets the requirement of Clause 4 the nozzle shall be retested.

Where the test result meets the requirement of Clause 4 the nozzle shall be considered to pass the test. No further test is required.

Where the test result fails to meet the requirement of Clause 4 the nozzle shall be considered to have failed. No further test is required.

The results shall be recorded.

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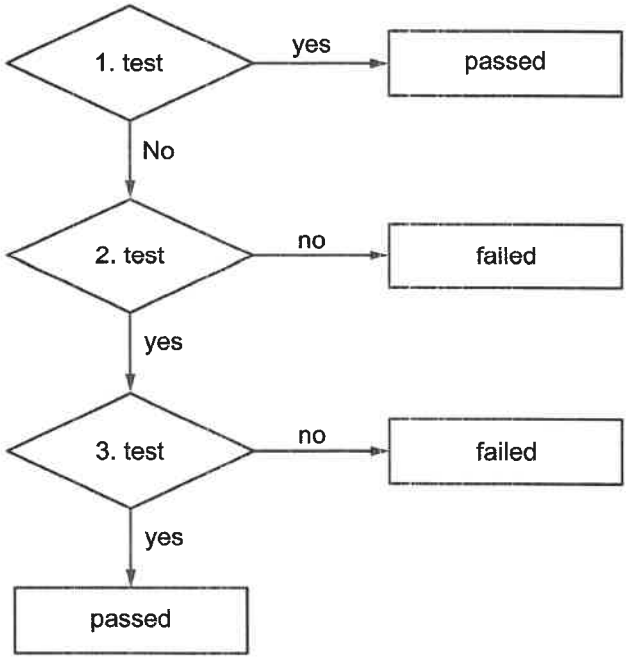

Figure 1 —Flow chart of tests

5.3 Preparation

For vapour recovery measurements a measuring adapter shall be mounted over the nozzle onto the vapour spout and connected with a hose to a gas volume meter (see Figure 2 to Figure 4). Air tightness between the nozzle and the gas volume meter shall be ensured.

To ensure that the petrol vapour/petrol ratio measurement is not adversely affected by the measurement procedure the hose connecting the measuring adapter to the gas volume meter shall:

— not exceed 3 m in total length;

— be protected against kinking;

— have smooth inner walls;

— have a minimum internal diameter of 10 mm.

The gas volume meter for direct determination of the vapour or air volume shall cover a working range of 10 $l \cdot min^{-1}$ to 60 $l \cdot min^{-1}$ and shall have an accuracy of maximum ± 2 %.

The signal output of the gas volume meter shall be connected to the post processing unit (PPU) or equivalent equipment. The calibration factor of the gas volume meter shall be stored in the memory of the PPU.

5.4 Measurement principle with simulated petrol flow (dry test method)

5.4.1 Test procedure

The test may be performed on the basis of total volumes, record V_a and V_K, or volume flow, record $\overline{Q_a}$ and $\overline{Q_K}$ according to 5.4.2.

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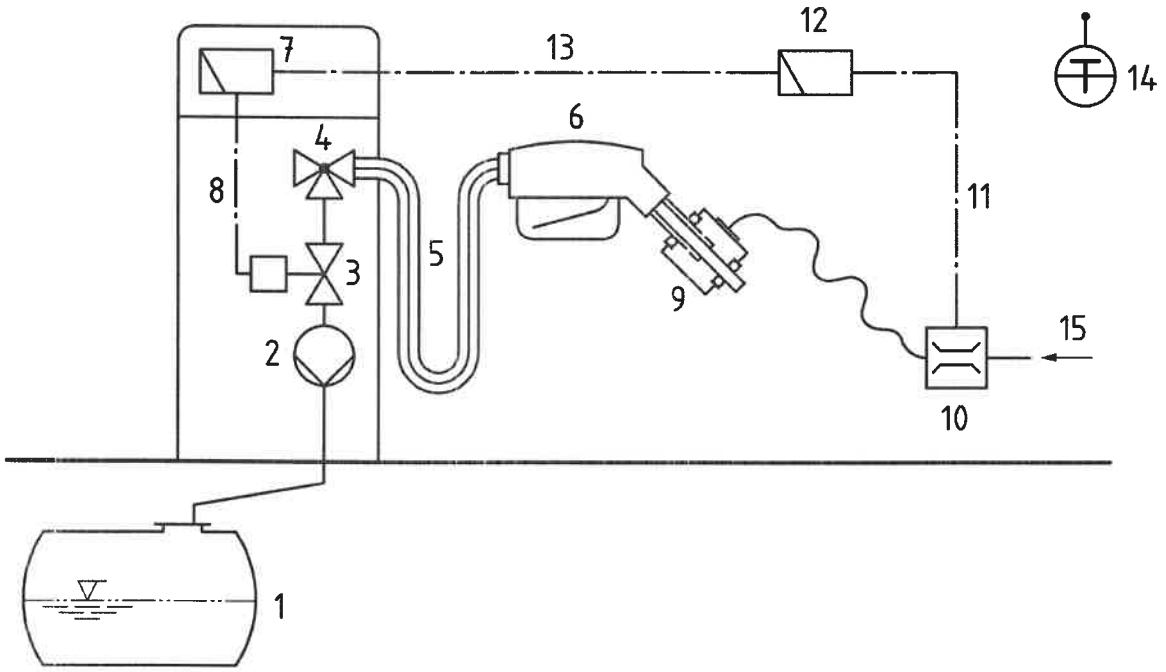
The vapour recovery system, shown schematically in Figure 2, shall be tested at simulated petrol volume flow rate of (38,0 ± 1,0) l min^{-1}. The simulated flow shall be generated by a PPU or other methods as described by the supplier.

During simulated petrol flow measurement, air is drawn through the gas volume meter (10) and the vapour recovery system. The different properties between air and petrol vapour/air mixture are correlated using the correction factor (k), which shall be given in the certificate of the vapour recovery system. Validation of entered setting into the PPU shall start the petrol flow simulation and the vapour recovery system to provide a corresponding air flow. The measurement time shall be not less than 60 s and up to a maximum of 90 s. The accuracy of the time measurement device shall be at least 0,2 s over 60 s.

The result may be read out directly on the PPU or may be evaluated according to 5.4.2. Where no PPU is used the dry test shall be performed and evaluated according to 5.4.2.



Key

part of the dispenser

1 underground storage tank
2 vapour recovery pump part of the dispenser
3 proportional valve part of the dispenser
4 splitter valve part of the dispenser
5 hose part of the dispenser
6 nozzle part of the dispenser
7 vapour recovery control board part of the dispenser
8 signal line part of the dispenser

part of the measuring equipment

9 measuring adapter
10 gas volume meter
11 signal line
12 post processing unit
13 interface cable
14 temperature measuring device
15 air inlet

Figure 2 — Schematic representation of a measuring set-up (example)

5.4.2 Evaluation

The petrol vapour/petrol ratio shall be calculated using Formula (1) or Formula (2). Because ambient air is sucked in during the dry measurement, the calculated air volumetric flow shall be divided by the correction factor as well.

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$$R = \frac{V_a}{k \cdot V_K} \quad (1)$$

where

R is the petrol vapour/petrol ratio;

V_a is the measured air volume, in litres;

V_K is the simulated volume, in litres;

k is the correction factor (as specified in the certificate).

$$R = \frac{\overline{Q_a}}{k \cdot \overline{Q_K}} \quad (2)$$

where

R is the petrol vapour/petrol ratio;

$\overline{Q_a}$ is the calculated air volume flow during the measurement (average value), in $l \cdot min^{-1}$;

$\overline{Q_K}$ is the simulated volume flow, in $l \cdot min^{-1}$;

k is the correction factor (as specified in the certificate).

5.5 Measurement principle with real petrol flow (wet test method A)

5.5.1 Test procedure

The vapour recovery system, shown schematically in Figure 3, shall be tested with the nozzle fully open. The uninterrupted petrol volume flow rate shall be between 25 l min^{-1} and the maximum petrol volume flow rate as given in the certificate whilst drawing in ambient air.

The measurement time (t) shall be not less than 30 s and up to a maximum of 90 s and shall be recorded. The accuracy of the time measurement device shall be at least 0,2 s over 30 s.

During real petrol flow measurement, air is drawn through the gas volume meter and the vapour recovery system. The different properties between air and petrol vapour/air mixture are correlated using the correction factor (k), which shall be given in the certificate of the vapour recovery system.

The result shall be evaluated according to 5.5.2.

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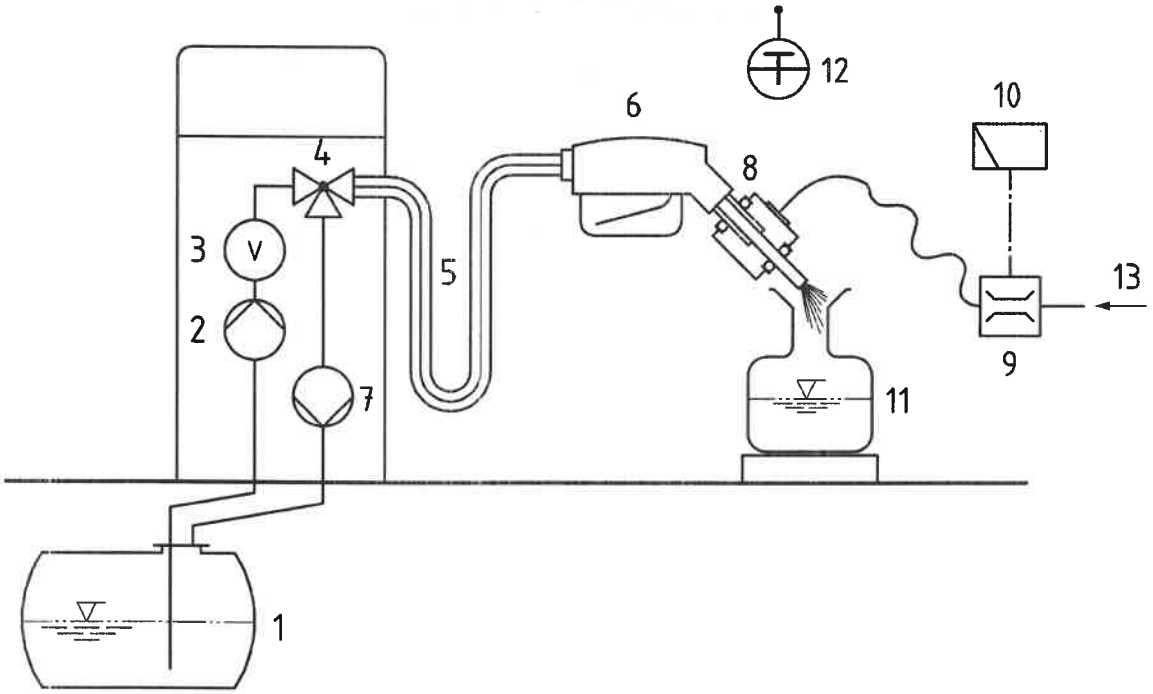

Key

part of the dispenser

1	underground storage tank	5	hose part of the dispenser
2	suction/submersible pump	6	nozzle part of the dispenser
3	petrol volume meter part of the dispenser	7	vapour recovery pump part of the dispenser
4	splitter valve part of the dispenser		

part of the measuring equipment

8	measuring adapter	11	collecting facility
9	gas volume meter	12	temperature measuring device
10	post processing unit	13	air inlet

Figure 3 — Schematic representation of a measuring set-up (example)

5.5.2 Evaluation

The petrol vapour/petrol ratio for the volume or volume flow measurement methods shall be calculated according to Formula (3) or Formula (4). In this method ambient air is sucked in, therefore the determined vapour volume or the determined vapour flow rate shall be divided by the correction factor.

$$R = \frac{V_a}{k \cdot V_K} \tag{3}$$

$$R = \frac{\overline{Q}_a}{k \cdot V_K} \frac{t}{60} \tag{4}$$

where

R is the petrol vapour/petrol ratio;

V_a is the determined air volume, in litres;

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V_K is the volume of dispensed petrol during the measurement, in litres;

k is the correction factor (as specified in the certificate);

$\overline{Q_a}$ is the determined air volume flow rate in $l \cdot min^{-1}$ (mean value);

t is the measuring time in seconds.

5.6 Measurement principle with real petrol flow (wet test method B)

5.6.1 Test procedure

The vapour recovery system, shown schematically in Figure 4, shall be tested with the nozzle fully open. The uninterrupted petrol volume flow rate shall be between 25 $l \cdot min^{-1}$ and the maximum petrol volume flow rate as given in the certificate whilst recovering petrol vapour displaced by the refilling process.

The measurement time (t) shall be not less than 30 s and up to a maximum of 90 s and shall be recorded. The accuracy of the time measurement device shall be at least 0,2 s over 30 s.

The collecting facility shall be equipped with a drain and a vapour path according to vapour recovery stage Ib.

Venting of the collecting facility shall only be allowed via the filler neck.

The complete volume of the collecting facility shall contain saturated vapour before the beginning of each test.

Saturated vapour within the collecting facility may be achieved by approximately 90 % filling with petrol, draining and refilling with petrol to approximately 10 % of the volume of the collecting facility.

While draining the collecting facility the filler neck shall be closed. For draining the collecting facility the vapour recovery stage Ib hose shall be connected to the underground storage tank.

Where measurements were made of gas volume (V_G) and petrol volume (V_K) the result shall be evaluated according to Formula (5).

Where measurements were made of gas volume flow rate (V_G), petrol volume (V_K) and the measuring time (t) the result shall be evaluated according to Formula (6).

The result shall be evaluated according to 5.6.2.

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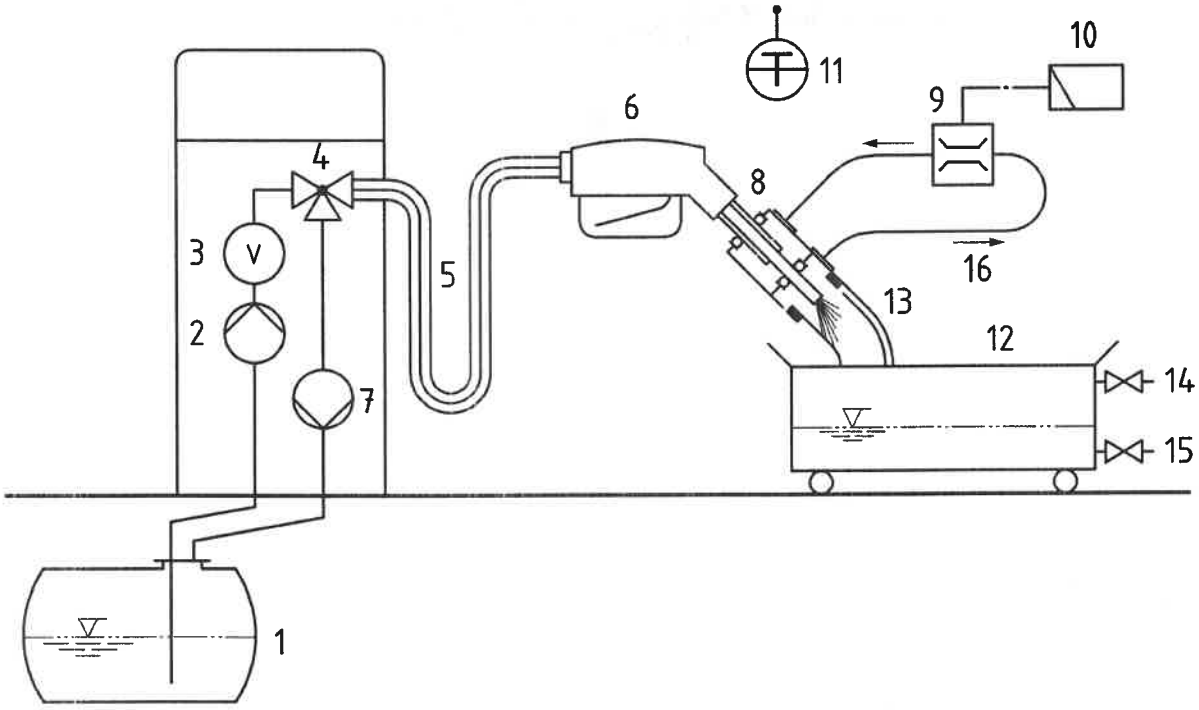

Key

part of the dispenser

1	underground storage tank	5	hose part of the dispenser
2	suction/submersible pump	6	nozzle part of the dispenser
3	petrol volume meter part of the dispenser	7	vapour recovery pump part of the dispenser
4	splitter valve part of the dispenser		

part of the measuring equipment

8	measuring adapter	13	collecting facility
9	gas volume meter	14	stage Ib vapour path
10	post processing unit	15	draining path
11	temperature measuring device	16	connection hoses
12	collecting facility		

Figure 4 — Schematic representation of a measuring set-up (example)

5.6.2 Evaluation

The petrol vapour/petrol ratio for the volume or volume flow measurement methods shall be calculated according to Formula (5) or Formula (6):

$$R = \frac{V_G}{V_K} \tag{5}$$

$$R = \frac{\overline{Q}_G}{V_K} \frac{t}{60} \tag{6}$$

where

R is the petrol vapour/petrol ratio;

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V_G is the determined gas volume, in litres;

V_K is the volume of dispensed petrol during the measurement, in litres;

$\overline{Q}_G$ is the determined gas volume flow rate in $l \cdot min^{-1}$ (mean value);

t is the measuring time, in seconds.

NOTE For this method, no correction factor (k) is required.

6 Automatic monitoring systems

Where automatic monitoring systems are used they shall meet the requirements according to Annex A.

7 Test report

All measured and calculated values shall be recorded. For the recording the test report given in Annex B can be used.

8 Environmental aspects

Environmental aspects should be considered in accordance with Annex C.

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Annex A
(normative)

Monitoring systems — Test for deactivation of a delivery point

A refuelling operation shall be initiated prior to the deactivation test, and it shall be verified that the delivery point has not been deactivated.

The deactivation time for the monitoring system may be reduced for the test. An error shall be created by inducing or simulating a self-test error.

It shall be verified that an alarm is signalled in the manner described in the site documentation.

A refuelling operation shall be initiated after the deactivation time has expired, and it shall be verified that the delivery point has been deactivated.

It may be sufficient to lift a nozzle and check whether the dispenser display commences a new transaction or that a motor starts to determine whether the delivery point has been deactivated, thus avoiding the need to dispense fuel.

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Annex B
(informative)

Example of test report on the verification of vapour recovery systems

Service-station operator:

_____

Address:

_____

Vapour recovery system certificate no.:

_____

Reason for testing: ☐ Initial verification. ☐ Verification by order of

☐ Periodic verification. ☐ Voluntary verification

☐ Verification following substantial modification

Test method used:

☐ Dry test method

☐ Wet test method A

☐ Wet test method B

Description and serial number of test equipment used ...

Correction factor (k), where used, as shown at certificate:

_____

Measuring results:

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Table B.1 — Example test report for vapour recovery systems

Dispenser side	Serial number of the dispenser	Delivery point according type plate of the dispenser	Ambient temperature °C		petrol vapour/petrol ratio (allowed ratio ≥ 0,95 and ≤ 1,05)	
			start of test	end of test	test results	test results after adjustment, if necessary
1		1 2 3 n				
2						
3						
4						
5						
6						
n						

This table contains the last result of the test sequence for each nozzle.
The result for the petrol vapour/petrol ratio should be rounded to two decimal places.

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Table B.2 — Example test report for monitoring systems

Dispenser side	Delivery point according type plate of the dispenser	Monitoring absent pass fail
1	1 2 3 n	□ □ □ □ □ □ □ □ □ □ □ □
2		
3		
n		

Date of last verification: _____

Date of next verification: _____

Repeat verification required for: _____

_____, _____ _____

(Place) (Date) Tester

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Annex C
(informative)

Environmental aspects

C.1 The number of tests should be as low as necessary for verification.

C.2 Used petrol should be returned to the appropriate storage tank.

C.3 The collecting facilities for the wet test methods should be designed to minimise spillage of petrol.

C.4 The collecting facilities for the wet test methods should be designed that it can be emptied completely.

C.5 When wet test methods are used for verification petrol vapour losses should be minimised.

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