SLOVENSKI STANDARD
SIST EN 16321-1:2013

01-december-2013

Rekuperiranje bencinskih hlapov med polnjenjem motornih vozil na bencinskih servisih - 1. del: Preskusne metode za odobritev tipa, ocena učinkovitosti sistema za rekuperiranje bencinskih hlapov

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

Benzindampf-Rückrückführung während der Betankung von Kraftfahrzeugen an Tankstellen - Teil 1: Prüfverfahren für die Typzulassung der Effizienzbewertung von Gasrückführsystemen

Récupération des vapeurs d'essence lors du ravitaillement en carburant des véhicules à moteur dans les stations-service - Partie 1: Méthodes d'essai pour l'homologation et l'évaluation de l'efficacité des systèmes de récupération des vapeurs

Ta slovenski standard je istoveten z: EN 16321-1:2013

ICS:

75.200	Oprema za skladiščenje nafte, naftnih proizvodov in zemeljskega plina	Petroleum products and natural gas handling equipment

SIST EN 16321-1:2013 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16321-1

September 2013

ICS 75.200

English Version

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 16321-1:2013: E

Contents

Page

Foreword

This document (EN 16321-1:2013) 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of an identical text or by endorsement, at the latest by March 2014, and conflicting national standards shall be withdrawn at the latest by March 2014.

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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 normal laboratory practice. 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.

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1 Scope

This European Standard specifies the measurement and test methods for the efficiency assessment of petrol vapour recovery systems for service stations (Stage II).

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 228:2012, *Automotive fuels — Unleaded petrol — Requirements and test methods*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
back pressure
differential pressure relative to atmosphere caused by the flow resistance of the petrol vapour recovery return line from the system to the petrol vapour receiving area

3.2
maximum back pressure
differential pressure relative to atmosphere at the outlet of the vapour pump up to which the system operates properly

3.3
basic emission
hydrocarbons (petrol vapour) that are emitted into the environment during refuelling of test tanks without an operating petrol vapour recovery system

3.4
gas volume meter
device for continuous measurement of air or vapour volume

Note 1 to entry: Bellows type gas volume meters are recommended.

3.5
boot measurement method
measurement method whereby the hydrocarbon emissions from the filler neck area of the test tanks that are not retrieved by the petrol vapour recovery system are collected in a collecting device (boot)

3.6
calibration factor of the gas volume meter
specific factor of the gas volume meter used for the data processing when using an external display

3.7
certificate
qualification document confirming that the petrol vapour recovery system meets the requirements of this standard

3.8
correction factor
system dependent factor used to allow calibration and periodic checking of the vapour recovery system under simulated flow conditions using air

3.9
simulated petrol flow method
dry test method
method for determining the petrol vapour/petrol ratio without any fuel flow

3.10
efficiency
ratio between the average values of the hydrocarbon mass recovered to the petrol vapour receiving area and the basic emission

3.11
petrol dispenser
metering pump or dispenser according to EN 13617-1

3.12
petrol meter
measuring instrument to measure the petrol volume flow

3.13
hose assembly
fuel hose complete with an internal vapour tubing or vapour hose and fitted with couplings

[SOURCE: EN 13483:2013, Clause 3]

3.14
nozzle
automatic delivery nozzle which is a manually operated device that controls the flow of fuel during a dispensing operation and includes a spout and an automatic shut-off mechanism

[SOURCE: EN 13012:2012, 3.1]

3.15
pulsing rate
number of pulses generated from 1 l of petrol flow

3.16
proportionality
linearity of the petrol vapour/petrol ratio at different petrol volume flow rates

3.17
residual emission
hydrocarbons (petrol vapour) that are emitted to the environment during refuelling of test tanks with the petrol vapour recovery system operating

3.18
SHED chamber
measuring facility for verification of the test equipment used in determining the basic and residual emission

Note 1 to entry: SHED stands for Sealed Housing for Evaporative Determination.

3.19
test tank
petrol tank and filler neck of a motor vehicle of the representative fleet of motor vehicles, fitted with a plate allowing the interface of the test equipment to be positioned in a similar way as would be achieved with the motor vehicle body

3.20
petrol vapour/petrol ratio
ratio of the recovered volume of petrol vapour/air mixture to the volume of petrol dispensed at the same time

Note 1 to entry: Petrol vapour/petrol ratio expressed in percentage.

3.21
post processing unit
PPU
device for setting and control of the vapour recovery system to simulate petrol flow, to read data, to change settings, to calculate and to indicate results

Note 1 to entry: A hand-held control unit is a post-processing unit.

3.22
collecting device
boot
device to capture the hydrocarbon emissions from the filler neck of the motor vehicle or test tank

3.23
vapour processing unit
unit to process petrol vapour captured during refuelling

Note 1 to entry: The vapour processing unit may exhaust petrol vapour to atmosphere.

3.24
delivery point
dispensing nozzle with associated vapour collection components

3.25
de-activation time
time between the detection of a petrol vapour/petrol ratio error, self-diagnostic error or self-test error, and the delivery point being de-activated

3.26
wet test method
method for determining the petrol vapour/petrol ratio with fuel flow

3.27
air/petrol ratio
ratio of the recovered volume of air to the volume of petrol dispensed at the same time

Note 1 to entry: Air/petrol ratio expressed in percentage.

3.28
gas flow meter
device for measurement of air or vapour flow rate

3.29
maximum petrol volume flow rate
maximum petrol volume flow rate stated by the applicant of the petrol vapour recovery system

Note 1 to entry: Maximum petrol volume flow rate expressed in litre per minute.

4 Requirements

4.1 General

The maximum back pressure stated by the applicant of the petrol vapour recovery system shall be ≥ 1 kPa.

The test equipment placed in the return-line shall not add more back pressure than 1 kPa.

An overview of the performance characteristics and the appropriate tests is given in Table 1.

Table 1 — Performance characteristics

Performance characteristic	Requirement	Subclause	Criterion	Test according to:
efficiency	η ≥ 85 %	4.2	—	5.2
petrol vapour/petrol ratio	individual measurement: 95 % ≤ x ≤ 105 % average value: 98 % ≤ y ≤ 102 %	4.3	—	5.3
proportionality	95 % ≤ z ≤ 105 %	4.4.2 4.4.3	maximum petrol flow rate stated by the applicant petrol volume flow rate (38,0 ± 1,0) l·min^{-1}	5.4
	z ± 5 %	4.4.4	(28,5 ± 1,0) l·min^{-1}	5.4
	z ± 10 %	4.4.5	(19,0 ± 1,0) l·min^{-1}	5.4
	95 % ≤ z ≤ 105 %	4.4.6	(38,0 ± 1,0) l·min^{-1}	5.4
	z ± 10 %	4.4.7	(19,0 ± 1,0) l·min^{-1}	5.4
	$\lvert k_b - k_a \rvert \leq 0{,}03$	4.5.7	petrol volume flow rate (38,0 ± 1,0) l min^{-1}, maximum back pressure and back pressure < 1 kPa	5.5.2, 5.5.3

4.2 Efficiency

When tested in accordance with 5.2 the efficiency of each petrol vapour recovery system shall reach at least 85 %.

4.3 Petrol vapour /petrol ratio

Systems intended to return petrol vapour directly to a storage tank, shall be tested in accordance with 5.3 at a petrol volume flow rate of (38,0 ± 1,0) l·min^{-1}.

Where a petrol vapour recovery pump serves more than one delivery point, the test shall initially be performed on one delivery point with no other delivery points dispensing. The test shall be repeated on the same delivery point with the maximum number of simultaneous delivery points, as stated by the applicant of the vapour recovery system, also delivering fuel. During this test all delivery points shall deliver fuel at a petrol volume flow rate of (38,0 ± 1,0) l·min^{-1}.

The individual petrol vapour/petrol ratios shall be ≥ 95 % and ≤ 105 %. The average petrol vapour/petrol ratios of all tests according to 5.3 shall be ≥ 98 % and ≤ 102 %.

For systems which process the petrol vapour, the requirements of 4.6 apply.

4.4 Proportionality

4.4.1 The sequence 4.4.2 to 4.4.12 shall be carried out at a defined back pressure. The defined back pressure shall be the maximum back pressure stated by the applicant of the petrol vapour recovery system measured at a petrol volume flow rate of (38,0 ± 1,0) l·min^{-1}.

4.4.2 Where the maximum petrol volume flow rate stated by the applicant of the petrol vapour recovery system is greater than 38,0 l·min^{-1}, the petrol vapour recovery system shall be tested at the maximum petrol flow rate according to 5.4 and the result shall be recorded. The petrol vapour/petrol ratio shall be ≥ 95 % and ≤ 105 %.

4.4.3 The petrol vapour recovery system shall be tested according to 5.4 at a petrol volume flow rate of (38,0 ± 1,0) l·min^{-1} and the result shall be recorded. The petrol vapour/petrol ratio shall be ≥ 95 % and ≤ 105 %.

4.4.4 The petrol vapour recovery system shall be tested according to 5.4 at a petrol volume flow rate of (28,5 ± 1,0) l·min^{-1} and the result shall be recorded.

4.4.5 The petrol vapour recovery system shall be tested according to 5.4 at a petrol volume flow rate of (19,0 ± 1,0) l·min^{-1} and the result shall be recorded.

4.4.6 The petrol vapour recovery system shall be tested according to 5.4 at a petrol volume flow rate of (38,0 ± 1,0) l·min^{-1} and the result shall be recorded.

4.4.7 The petrol vapour recovery system shall be tested according to 5.4 at a petrol volume flow rate of (19,0 ± 1,0) l·min^{-1} and the result shall be recorded.

4.4.8 Where the maximum petrol volume flow rate stated by the applicant of the petrol vapour recovery system is greater than 38,0 l·min^{-1}, the petrol vapour recovery system shall be tested at the maximum petrol flow rate according to 5.4 and the result shall be recorded. The petrol vapour/petrol ratio shall be ≥ 95 % and ≤ 105 %.

4.4.9 The result of 4.4.4 shall be within ± 5 % of 4.4.3.

4.4.10 The result of 4.4.5 shall be within ± 10 % of 4.4.3.

4.4.11 The result of 4.4.6 shall be within the tolerance of 4.4.3.

4.4.12 The result of 4.4.7 shall be within ± 10 % of 4.4.6.

4.4.13 The sequence 4.4.2 through 4.4.12 shall be repeated at a back pressure < 1 kPa.

4.4.14 The maximum petrol volume flow rate stated by the applicant shall be tested and given in the test certificate.

4.4.15 Where a petrol vapour recovery pump serves more than one delivery point the sequence 4.4.2 through 4.4.13 shall initially be performed with only one delivery point operational. The sequence shall be repeated at the maximum vacuum pressure stated by the applicant of the vapour recovery system. The sequence shall then be repeated at the minimum vacuum pressure stated by the applicant of the vapour recovery system. The maximum number of delivery points stated on the certificate shall not require a vacuum pressure greater than the maximum vacuum pressure used for the tests.

4.5 Correction factor

4.5.1 The petrol vapour recovery system shall be tested according to 5.5.2 at a petrol volume flow rate of (38,0 ± 1,0) l·min^{-1} and maximum back pressure stated by the applicant of the vapour recovery system, the ratio calculated in 5.5.2 is (r_1) and shall be recorded.

4.5.2 The petrol vapour recovery system shall be tested according to 5.5.3 at a petrol volume flow rate of (38,0 ± 1,0) l·min^{-1} and maximum back pressure stated by the applicant of the vapour recovery system, the ratio calculated in 5.5.3 is (r_2) and shall be recorded.

4.5.3 The petrol vapour recovery system shall be tested according to 5.5.2 at a petrol volume flow rate of (38,0 ± 1,0) l min^{-1} and at a back pressure < 1 kPa, the ratio calculated in 5.5.2 is (r_3) and shall be recorded.

4.5.4 The petrol vapour recovery system shall be tested according to 5.5.3 at a petrol volume flow rate of (38,0 ± 1,0) l·min^{-1} and at a back pressure < 1 kPa, the ratio calculated in 5.5.3 is (r_4) and shall be recorded.

4.5.5 The correction factor k_a shall be calculated according to Formula (1) with maximum back pressure and record the result:

$$k_a = \frac{r_2}{r_1} \tag{1}$$

4.5.6 The correction factor k_b shall be calculated according to Formula (2) with a back pressure < 1 kPa and record the result:

$$k_b = \frac{r_4}{r_3} \tag{2}$$

4.5.7 $|k_b - k_a|$ shall be ≤ 0,03.

The correction factor k shall be calculated according to Formula (3) and shall be rounded to two decimal places.

$$k = \frac{k_a + k_b}{2} \tag{3}$$

4.6 Vapour processing unit

Vapour processing units are not mandatory. Vapour processing units may be used in systems which do not return petrol vapour to a storage tank. When vapour processing units are incorporated the exhaust emission hydrocarbon content shall be ≤ 3 % of the input hydrocarbon mass when tested with a state of the art measurement method, e.g. with FID (Flame Ionisation Detector).