BRITISH STANDARD

BS EN
1761:1999

Rubber hoses and hose assemblies for fuel truck delivery — Specification

The European Standard EN 1761:1999 has the status of a British Standard

ICS 23.040.70; 75.200

National foreword

This British Standard is the English language version of EN 1761:1999.

The UK participation in its preparation was entrusted by Technical Committee PRI/66, Rubber and plastics tubing, hoses and hose assemblies, to Subcommittee PRI/66/1, Industrial, chemical and petrochemical applications, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 9 and a back cover.

This British Standard, having been prepared under the direction of the Sector Committee for Materials and Chemicals, was published under the authority of the Standards Committee and comes into effect on 15 June 1999

ISBN 0 580 32447 8

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1761

February 1999

ICS 23.040.70; 75.200

English version

Rubber hoses and hose assemblies for fuel truck delivery — Specification

Tuyaux et flexibles en caoutchouc pour la livraison d'hydrocarbures liquides par camions-citernes — Spécification

Gummischläuche und — schlauchleitungen für Tankwagen — Spezifikation

This European Standard was approved by CEN on 6 August 1999.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN 1761:1999 E

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 218, Rubber and plastics hoses and hose assemblies, the Secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by August 1999, and conflicting national standards shall be withdrawn at the latest by August 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This standard is based on ISO 2929, BS 3492 and the German military standard VG 95955.

Contents

1 Scope

This European Standard specifies the requirements for two types of rubber hoses and rubber hose assemblies for loading and discharge of liquid hydrocarbon fuels with a maximum working pressure of 10 bar (1,0 MPa).

Both types of hose are designed for:

a) use with hydrocarbon fuels, having an aromatic hydrocarbon content not exceeding 50 % by volume and containing oxygenated compounds up to 15 %;

b) operation within the temperature range of −30 °C to +70 °C, undamaged by climatic conditions of −50 °C to 70 °C when stored in static conditions.

NOTE Hoses for use at temperatures lower than −30 °C should be the subject of discussion between manufacturer and end users.

This standard is not applicable to hoses and hose assemblies for LPG, aviation fuel systems, fuel station systems and marine applications.

2 Normative references

This European Standard incorporates by dated or undated references, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated by amendment or revision. For undated references latest edition of the publication referred to applies.

EN 21746, *Rubber or plastics hoses and tubing — Bending test.*
(ISO 1746:1983)

EN 24671, *Rubber and plastics hoses and hose assemblies — Methods of measurements of dimensions.*
(ISO 4671:1984)

EN 24672, *Rubber and plastics hoses — Sub-ambient temperature flexibility tests.*
(ISO 4672:1988)

EN 27326, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions.*
(ISO 7326:1991)

EN 28033, *Rubber and plastics hose — Determination of adhesion between components.*
(ISO 8033:1991)

EN ISO 1402, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing.*
(ISO 1402:1994)

EN ISO 7233, *Rubber and plastic hoses and hose assemblies — Determination of suction resistance.*
(ISO 7233:1991)

EN ISO 8031, *Rubber and plastics hoses and hose assemblies — Determination of electrical properties.*
(ISO 8031:1993)

ISO 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties.*

ISO 188, *Rubber, vulcanized – Accelerated ageing or heat-resistance tests.*

ISO 1817:1985, *Rubber, vulcanized — Determination of the effect of liquids.*

ISO 4649, *Rubber — Determination of abrasion resistance using a rotating cylindrical drum device.*

ISO 8330, *Rubber and plastics hoses and hose assemblies — Vocabulary.*

3 Definitions

For the purposes of this standard, the definitions given in ISO 8330 apply.

4 Types

Hoses shall be one of the following types:

a) type D: delivery hose;

b) type SD: suction and delivery hose, helix reinforced.

Both these types can be either:

1) electrically bonded, designated and marked “M” type; or

2) electrically conductive, using a conductive rubber layer, designated and marked “Ω” type.

5 Materials and construction

If mandrel built, particulate type, release agents shall not be used.

The hose shall be uniform in quality and free from porosity, air holes, foreign inclusions and other defects.

The hose shall consist of the following:

a) a lining of synthetic rubber resistant to hydrocarbon fuels;

b) a reinforcement of layers of woven, braided or spirally wound textile material;

c) an embedded helix reinforcement (type SD only);

d) two or more low resistance electrical bonding wires (type “M” only);

e) an outer cover of synthetic rubber, resistant to abrasion, outdoor exposure and hydrocarbon fuels.

Table 1 — Dimensions

Nominal bore	Internal diameter mm	Tolerance mm	Outside diameter mm	Tolerance mm	Minimum external diameter of reeling drum used in service mm	Minimum bend radius mm
19	19,0	±0,5	31,0	±1,0	250	125
25	25,0		37,0		300	150
32	32,0		44,0		350	175
38	38,0		51,0		450	225
50	50,0	±0,7	66,0	±1,2	550	275
51	51,0		67,0		550	275
63	63,0	±0,8	79,0		600	300
75	75,0		91,0		700	350
76	76,0		92,0		700	350
100	100,0		116,0	±1,6		450
101	101,5		118,0		N.A	450
150	150,0	±1,6	170,0	±2,0	N.A	750

NOTE Other diameters than listed in the table can be agreed with the manufacturer.
N.A = not applicable.

6 Dimensions

6.1 Nominal bore, internal diameters, outside diameters, service reeling diameters, minimum bend radius

When measured in accordance with EN 24671 the internal diameter and outside diameter and their tolerances shall comply with the values given in Table 1.

When tested by the method described in EN 21746, the value of the minimum bend radius shall be as given in Table 1.

6.2 Concentricity

When determined in accordance with EN 24671, the concentricity, based on a total indicator reading between the internal diameter and the outside surface of the cover, shall be less than or equal to 1,0 mm for hoses of nominal bore up to and including 76, and 1,5 mm for hoses of nominal bore greater than 76.

6.3 Tolerances in length

The tolerance on the measured length of hose or hose assembly shall be ±1 %.

6.4 Minimum thickness of lining and cover

The minimum thickness of the lining of all hoses shall be 1,6 mm.

For hoses of nominal bore up to and including 50 the minimum thickness of the cover shall be 1,6 mm.

For hoses of nominal bore greater than 50 the minimum thickness of the cover shall be 2,0 mm.

7 Physical properties

7.1 Rubber compounds

The physical properties of the compounds used for the lining and cover shall comply with the values given in Table 2, when tested by the methods listed in Table 2.

Tests shall be carried out either on samples taken from the hose or from separately vulcanized sheets.

7.2 Finished hose

When tested by the methods listed in Table 3, the physical properties of the finished hose shall comply with the values given in Table 3.

8 Test for security of coupling attachment

When tested in accordance with annex D hose assemblies shall show no leakage nor movement of the coupling out of the hose. There shall be no visible cuts or other damage to the hose lining.

Table 2 — Physical properties of rubber compound

Property	Unit	Requirements		Test methods
		Lining	Cover	
1) Tensile strength min.	MPa	7,0	7,0	ISO 37 (dumb-bell test piece)
2) Elongation at break min.	%	250	250	ISO 37 (dumb-bell test piece)
3) Swelling in fuel max.	%	50		**8.2** of ISO 1817:1985, (72 h at 40 °C in liquid 3)
			100	ISO 1817:1985, **8.2** 48 h at 40 °C in liquid B)
4) Abrasion resistance max.	mm^3		180	Method A of ISO 4649
5) Ageing				ISO 188
Tensile strength	%	±30	±30	(7 days at 70 °C, air-oven method)
max. change from the original value				
Elongation at break	%	±30	±30	
max. change from the original value				

9 Electrical resistance

Electrical resistance of hose and hose assemblies can be obtained by two methods.

1) By incorporating two low resistance bonding wires into the hose construction. These shall be spirally applied and shall be positioned in such a way to cross uniformly;

When attaching fittings to this hose, the bonding wires shall be folded into the hose bore, positioned between the lining and the fitting tail and extended approximately 1/3rd of the length of the fitting tail into the bore.

When tested in accordance with ISO EN 8031 the resistance along the bonding wires, in the case of hose, or the resistance between fittings, in the case of hose assemblies, shall not exceed 1×10^2 Ω per length. When obtaining electrical continuity by this method the hose shall be marked with the symbol “M”.

2) Incorporating electrically conducting materials in the hose construction. When attaching fittings to this hose, an adequate connection between the end-fittings and the conductive layer shall be obtained.

When tested in accordance with ISO EN 8031, the resistance along the conductive layer, in the case of hose or the resistance between the fittings, in the case of hose assemblies, shall not exceed 1×10^6 Ω per length. When obtaining electrical resistance by this method the hose shall be marked with the symbol “Ω”.

During and after subjection to the hydrostatic tests as described in EN ISO 1402, the electrical continuity of each hose shall be maintained from end to end and electrical continuity of each hose assembly shall be maintained from one coupling to the other.

NOTE Electrical conductivity in Type SD cannot be obtained by only connecting to the helix.

10 Application of tests

10.1 Hoses

The minimum test frequency for production and routine tests is given in Table 4.

Type approved is obtained by the manufacturers supplying evidence that all requirements of this standard are met by his method of manufacture and hose design. The tests shall be repeated at a maximum of five year intervals, or whenever a change in the method of manufacture or materials used, occurs.

Production acceptance tests are carried out on a batch basis.

Routine tests are carried out on each finished length of hose.

10.2 Hose assemblies

If a statutory test frequency is not specified, the end user shall establish this test frequency, taking into account the operation conditions. This shall generally be six months, but no longer than one year.

Table 3 — Physical properties of finished hose

Property	Unit	Requirements	Test method
1) Proof test pressure min	bar	15 No leakage or other signs of weakness	EN ISO 1402
2) Change in length: max. at proof test pressure at −0,8 bar (vacuum)	%	a) type D: 0 to +8 b) type SD: 0 to +10 c) type SD: −2	EN ISO 1402
3) Change in twist at proof max. test pressure	°/m	8	EN ISO 1402
4) Resistance to vacuum (type SD only) at vacuum −0,8 bar for 10 min (see NOTE)	—	No structural damage	EN ISO 7233
5) Burst pressure min.	bar	40	EN ISO 1402
6) Adhesion between components dry min. after contact with fuel	N/mm	2,4 1,8	EN 28033 Annex A
7) Ozone resistance at 40 °C	—	No cracking observed under ×2 magnification	EN 27326 relative humidity 55% ± 10 % ozone concentration (50 ± 5) pphm elongation 20 %
8) Flexibility at 20 °C at −30 °C	 — —	No permanent deformation or visible structural damage, no increase in electrical resistance, no impairment of electrical continuity and shall comply with the proof pressure requirements	Annex B Method B of EN 24672
9) Electrical resistance max.	Ω	10^2/assembly, "M" type 10^6/assembly, "Ω" type	EN ISO 8031
10) Flammability test	—	Annex C	Annex C
11) Bending test at minimum bending radius and an internal pressure of 0,7 bar (type D only), deformation of the external hose diameter max.	%	10	EN 21746

NOTE Smaller sizes of type D hose i.e. 51 nominal bore and below, can be used for vacuum applications up to −0,3 bar.

Table 4 — Application of tests

Property	Type approval tests	Production acceptance tests		Routine tests
		per batch*)	per 10 batches	
Compound tests				
Tensile strength and elongation	X	X	N.A	N.A
Swelling in fuel	X	N.A	X	N.A
Abrasion resistance	X	N.A	X	N.A
Tensile strength and elongation after ageing	X	N.A	X	N.A
Hose tests				
Adhesion, dry	X	X	N.A	N.A
Adhesion after contact with fuel	X	N.A	X	N.A
Ozone resistance	X	N.A	X	N.A
Flexibility at 20 °C	X	N.A	X	N.A
Flexibility at −30 °C	X	N.A	X	N.A
Measurement of internal and external diameters	X	N.A	N.A	X
Measurement of thickness lining and cover	X	N.A	N.A	X
Measurement of concentricity	X	N.A	N.A	X
Resistance to vacuum (SD only)	X	N.A	X	N.A
Electrical resistance	X	N.A	N.A	X
Proof pressure	X	N.A	N.A	X
Bursting pressure	X	N.A	X	N.A
Bend strength	X	N.A	N.A	N.A
Flammability test	X	N.A	N.A	N.A
Hose assembly tests				
Electrical resistance	X	N.A	N.A	X
Proof pressure	X	N.A	N.A	X
Bursting pressure	X	N.A	N.A	N.A

*) Batch is defined as either 1 000 m hose or 2 000 kg of lining and/or cover compound.

N.A = not applicable
X = Test applied

11 Marking

11.1 Hoses

Each length of hose shall be legibly and durably marked, at intervals of not more than 2 m on the outer cover, with the following information:

a) manufacturer's name or identification, e.g. - Ltd;

b) number and year of this European Standard, EN 1761:1999;

c) type, e.g. D or SD;

d) nominal bore, e.g. 38;

e) maximum working pressure, in bar;

f) symbol for the electrical conductivity, e.g. M;

g) quarter and year of manufacture, e.g. 3Q-98.

EXAMPLE Ltd — EN 1761:1999 — Type D38 — PN 10 — M-3Q-98.

11.2 Hose couplings

The couplings shall be permanently marked with the following information:

a) name or identification of the manufacturer or assembler;

b) nominal bore (legible from the inside or outside), in addition to the nominal bore, the hose internal diameter and external diameter range e.g. 75 × 90–92 or the hose internal diameter range and the wall thickness shall be stated;

c) maximum working pressure (preferably legible from the inside).

Annex A (normative)
Test method for adhesion between components

A.1 Dry adhesion

Samples for type SD hose shall be cut parallel with the helix.

Subject the hose to the adhesion test described in EN 28033 and determine the minimum value (in newtons per millimetre) for adhesion:

a) between lining and reinforcement;

b) between reinforcement and cover;

c) between reinforcement layers.

A.2 Adhesion after contact with fuel

Cut a sample of the hose to be tested approximately 300 mm in length and seal one end.

Fill the hose with liquid B of ISO 1817:1985 and lightly cap the top.

Condition the sample at (20 ± 5) °C for (168 + 2) h.

Determine the minimum adhesion between components as stated in **A.1**.

Annex B (normative)
Test method for flexibility at 20 °C

Coil an empty hose at (20 ± 5) °C around a test drum of external diameter given in Table B.1 corresponding to the nominal bore. Uncoil and check for visible structural damage and permanent deformation.

Check the electrical continuity is undamaged.

Table B.1 — External diameter of drum for flexibility test

Nominal bore	External diameter of test drum mm
19	180
25	230
32	280
38	360
50	430
63	460
75	460
100	690

Annex C (normative)
Test method for flammability

C.1 Method

Bend the hose test piece into a U-shape of radius as indicated in Figure C.1.

Fill the test piece with liquid F of ISO 1817:1985.

Expose the test piece to a naked flame from a Bunsen burner of 10 mm pipe diameter for a period of 3 min, with the airflow to the burner shut off.

The distance between the burner and test piece is indicated in Figure C.1.

C.2 Assessment

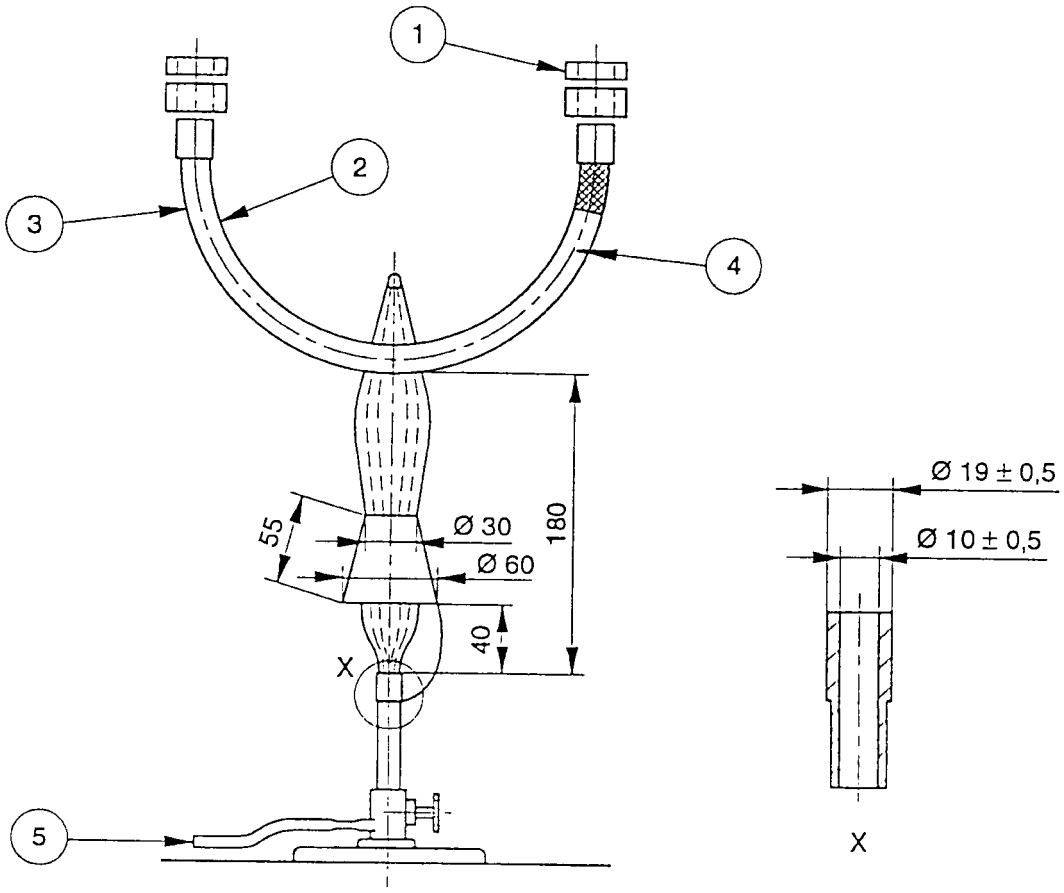
The hose sample is deemed to be non-flammable if:

a) it ceases to burn immediately on removal of the burner flame, or,

b) there are no sparks visible 2 min after removal of the burner flame.

On completion of the test the hose test piece shall be impervious to fluids, when visually examined.

The test can be carried out on a reference nominal bore hose, preferably 25. The result is applicable to the reference size and larger diameters, where materials of construction are the same for all of the sizes.



1 Cap
2 Bending radius = 10 to 15 times the outside diameter
3 Hose assembly
4 Liquid F of ISO 1817
5 Propane (LPG) = 50 mbar

Figure C.1 — Arrangement for flammability test

Annex D (normative)

Test method for security of coupling attachment

D.1 Apparatus

Test assembly, of 1 m in length, consisting of hose and end couplings.

D.2 Procedure

Use water as the test medium, raise the test pressure to 15 bar (1,5 MPa) and hold for 2 min.

Reduce the applied pressure to 0,7 bar (0,07 MPa). Increase the pressure to 10 bar, hold for 2 min and examine for leakage. Reduce the applied pressure to 0,7 bar.

Increase the pressure to 15 bar, hold for 2 min and examine for leakage. Reduce the applied pressure to 0,7 bar.

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