



**International
Standard**

ISO 5771

**Rubber hoses and hose assemblies
for transferring anhydrous
ammonia — Specification**

*Tuyaux et flexibles en caoutchouc pour le transfert d'ammoniac
anhydre — Spécifications*

**Fourth edition
2024-04**

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Rubber and plastics hoses and hose assemblies*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 218, *Rubber and plastic hoses and hose assemblies*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 5771:2008), which has been technically revised.

The main changes are as follows:

- the scope has been updated to include the working pressure of the hose;
- the normative references in [Clause 2](#) have been updated: ISO 188 has been changed to the latest edition and reference to ISO 10619-2 has been added;
- the expression of pressure units throughout the document (MPa, bar) has been updated;
- the type, frequency and routine testing clause has been modified in accordance with the current layout (see [Clause 9](#));
- the marking clause has been updated (see [Clause 10](#));
- proof pressure and change of length tests as routine tests on finished hose have been changed (see [Annex A](#));
- [Annexes A](#) and [B](#) have been combined into one [Annex A](#).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Rubber hoses and hose assemblies for transferring anhydrous ammonia — Specification

WARNING — Persons using this document should be familiar with normal laboratory practice. This document does not purport to address all the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate health and safety practices and to determine any applicable national regulatory conditions.

CAUTION — All personnel working with anhydrous ammonia and its delivery systems should be familiar with and utilize the necessary safety precautions to minimize the potential for personal injury and property damage. Do not use anhydrous-ammonia hose assemblies at temperatures or pressures above those recommended by the hose manufacturer. Never recouple an anhydrous-ammonia hose. Hoses manufactured to this specification are suitable for use with anhydrous ammonia only.

1 Scope

This document specifies the minimum requirements for rubber hoses used for transferring ammonia, in liquid or in gaseous form, at ambient temperatures from $-40\text{ }^{\circ}\text{C}$ up to and including $+55\text{ }^{\circ}\text{C}$ at a working pressure of 2,5 MPa (25 bar). It does not include specifications for end fittings and is limited to the performance of the hoses and hose assemblies.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 188:2023, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 1307, *Rubber and plastics hoses — Hose sizes, minimum and maximum inside diameters, and tolerances on cut-to-length hoses*

ISO 1402, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

ISO 4671, *Rubber and plastics hoses and hose assemblies — Methods of measurement of the dimensions of hoses and the lengths of hose assemblies*

ISO 7326:2016, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 8033, *Rubber and plastics hoses — Determination of adhesion between components*

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

ISO 10619-2, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 2: Bending tests at sub-ambient temperatures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8330 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 Pressure rating

The pressure rating shall conform with the requirements of [Table 1](#).

Table 1 — Pressure requirements

Parameter	Pressure requirements	
	bar	MPa
Maximum working pressure	25	2,5
Proof pressure	63	6,3
Minimum burst pressure	125	12,5

5 Materials and construction

5.1 Lining

The lining shall be of uniform thickness of at least 1,5 mm, measured in accordance with ISO 4671, and free from holes, porosity and other defects. The finished hose lining shall conform with the performance requirements specified in [Table 3](#). The material used shall be resistant to hardening or other deterioration due to the action of ammonia.

5.2 Reinforcement

The reinforcement shall consist of a material not adversely affected by permeating ammonia. It shall be applied evenly and uniformly, and in such a way that the finished hose complies with the relevant performance requirements specified in [Table 4](#).

A suitable material is corrosion-resistant stainless steel.

5.3 Cover

The rubber cover, when used, shall be uniform in quality and thickness and shall be free from injurious defects. It shall comply with the relevant performance requirements specified in [Table 3](#). It shall also be resistant to deterioration due to exposure to ammonia and exposure to the external environment. A gas-tight rubber cover shall be pin-pricked during manufacture to permit the release of any permeating gas during service. The pinholes shall not penetrate the lining and there shall be at least 40 effective pinholes per metre of hose.

5.4 Hose assemblies

Hose assemblies shall be made only from hoses complying with the performance requirements specified in [Table 4](#). Only permanently attached ferrous-metal fittings shall be used. Specific information can be obtained from the hose manufacturer. In addition, guidance can be found in ISO/TR 17784.

6 Dimensions

6.1 Inside diameters and tolerances

When measured in accordance with ISO 4671, inside diameters shall conform to the values and tolerances specified in [Table 2](#).

Table 2 — Nominal size and permitted ID range

Nominal size	Minimum ID mm	Maximum ID mm
12,5	12,1	13,5
16	15,3	16,7
19	18,5	19,9
25	24,6	26,6
31,5	31,0	33,4
38	37,3	39,7
51	49,6	52,0
64	62,3	64,7
76	75,0	77,4

6.2 Outside diameter

Although no required outside diameters, or required tolerances on such diameters, are specified, it is necessary that they be selected by the hose manufacturer to be in keeping with users' needs and to provide complete fitting compatibility, meeting the performance requirements of this specification.

6.3 Concentricity

When determined in accordance with ISO 4671, the concentricity, based on a total indicator reading between the internal diameter and the outside surface of the cover, shall be no greater than 1,0 mm for hoses of internal diameter up to and including 76 mm.

6.4 Tolerances on length

Tolerances on cut lengths shall be as specified in ISO 1307. Recommendations for the lengths of hoses supplied in bulk and for tolerances on the lengths of hose assemblies are given in [Annex B](#).

7 Physical properties

7.1 Rubber compounds

When tested by the methods listed in [Table 3](#), the physical properties of the compounds used for the lining and cover shall conform to the required values.

Tests shall be carried out on test pieces taken either from the hose or from separately vulcanized sheets 2 mm in thickness and vulcanized to the same cure state as production hoses.

Table 3 — Physical properties of the rubber compounds used for the lining and cover

Property	Requirements		Test method
	Lining	Cover	
Minimum tensile strength	7,0 MPa	7,0 MPa	ISO 37 (dumb-bell test pieces)
Minimum elongation at break	250 %	250 %	ISO 37 (dumb-bell test pieces)
Change in tensile strength from original value after oven ageing	—	±25 %	Age in accordance with ISO 188:2023, method A for 72 h ± 2 h at 70 °C ± 1 °C using a cell-type oven or a cabinet oven Test in accordance with ISO 37 (dumb-bell test pieces)
Change in elongation at break from original value after oven ageing	—	±50 %	Age in accordance with ISO 188:2023, method A for 72 h ± 2 h at 70 °C ± 1 °C using a cell-type oven or a cabinet oven Test in accordance with ISO 37 (dumb-bell test pieces)

7.2 Finished hose

When tested by the methods listed in [Table 4](#), the physical properties of the finished hose shall conform to the required values.

Table 4 — Finished-hose performance requirements

Property	Requirement	Method of test
Proof test pressure	6,3 MPa (63 bar)	ISO 1402
Minimum burst pressure	12,5 MPa (125 bar)	ISO 1402
Change in length at maximum working pressure, maximum	±5 % at 2,5 MPa (25 bar)	ISO 1402
Low-temperature flexibility	No breaks or cracks in cover or lining at -40 °C	ISO 10619-2
Adhesion of the lining to reinforcement, minimum ^a	1,75 N/mm	ISO 8033
Adhesion of the reinforcement between reinforcement layers, min. ^a	1,50 N/mm	ISO 8033
Adhesion of the cover to reinforcement, minimum ^a	1,75 N/mm	ISO 8033
Ozone resistance of the cover	No cracks	ISO 7326:2016, method 4 using 100 pphm ozone ^b
Ammonia resistance tests:		
ammonia conditioning	No blistering, cracking or leakage	7.3.2
flexing	No blistering, cracking or leakage	7.3.3
minimum burst pressure after conditioning and flexing	12,5 MPa (125 bar)	ISO 1402 and 7.3.4
change in tensile strength of cover after conditioning and flexing, maximum	±20 %	ISO 37 and 7.3.5
change in elongation at break of cover after conditioning and flexing, maximum	±50 %	ISO 37 and 7.3.5
^a Test pieces for adhesion testing shall be taken from hoses which have been conditioned for 30 days with ammonia as described in 7.3.2 .		
^b pphm is parts per hundred million.		

7.3 Ammonia resistance tests

WARNING — The operator in charge of the test installation and inspection shall ensure compliance with all safety precautions concerning the handling of ammonia.

7.3.1 Test lengths

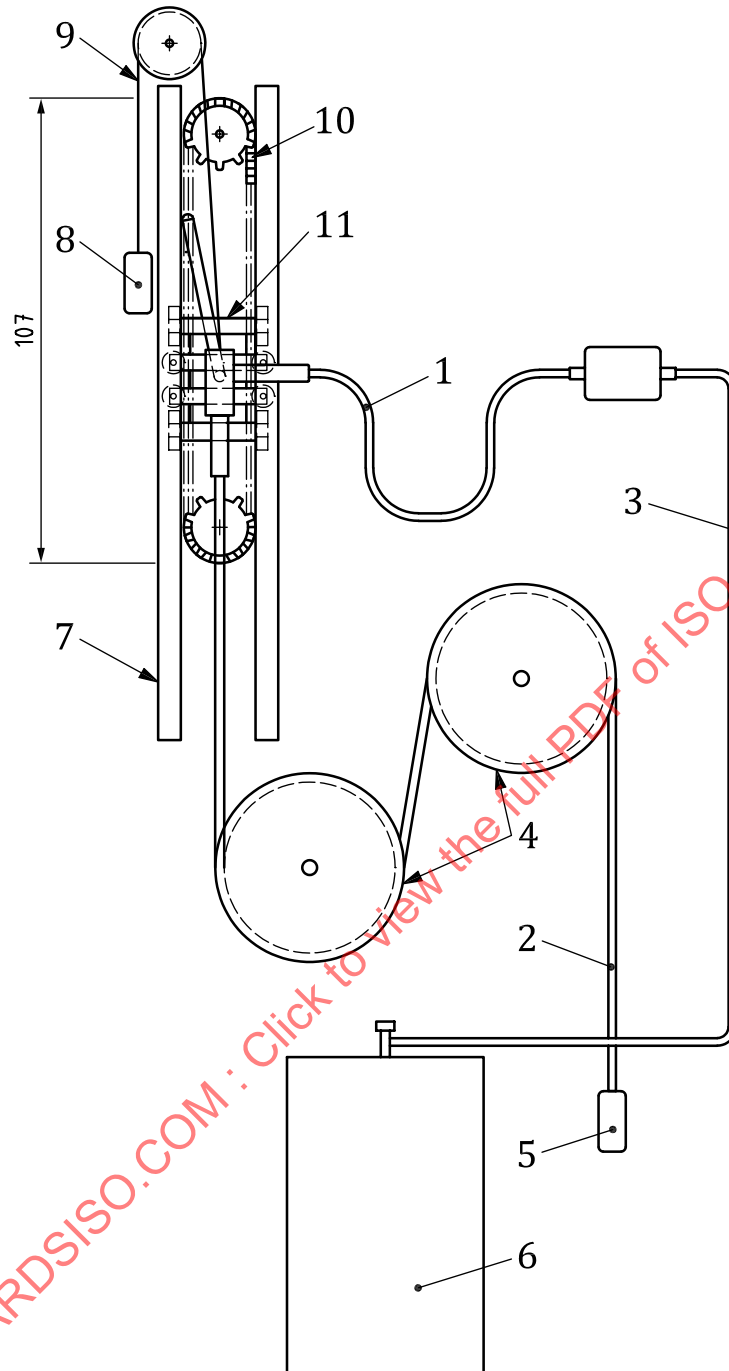
The total length of hose conditioned shall be sufficient to carry out the flexing, burst and physical-property tests in [Table 4](#). The hose length required for flexing (hose B in [Figure 1](#)) will depend on the flex unit design and the hose size, but should preferably be from 3 m to 6,2 m. A test piece of length 600 mm is required for the burst test. The length of the feed hose (hose A in [Figure 1](#)) shall be 910 mm unless otherwise specified.

7.3.2 Ammonia conditioning

Fill a length or lengths of hose with liquid anhydrous ammonia by connection to a tank and flushing out with ammonia to remove all the air. Seal one end of each length and leave the other end connected to the liquid space of the tank of anhydrous ammonia. Condition the hose for 30 days in this way at standard laboratory temperature. Any valve between the ammonia tank and the hose may be closed, providing it is opened completely at least once each day to fill the hose with liquid anhydrous ammonia. If the hose is closed off by means of stop valves at each end when full of liquid, a hydrostatic relief valve should preferably be provided between the stop valves. Examine the hose each day for visible defects. There shall be no evidence of blistering of the cover or perceptible leakage. Upon completion of the 30 days conditioning, there shall be no evidence of blistering or cracking of the inside bore.

Upon completion of the 30 days conditioning, the adhesion values between all components of the hose shall meet the requirements in [Table 4](#).

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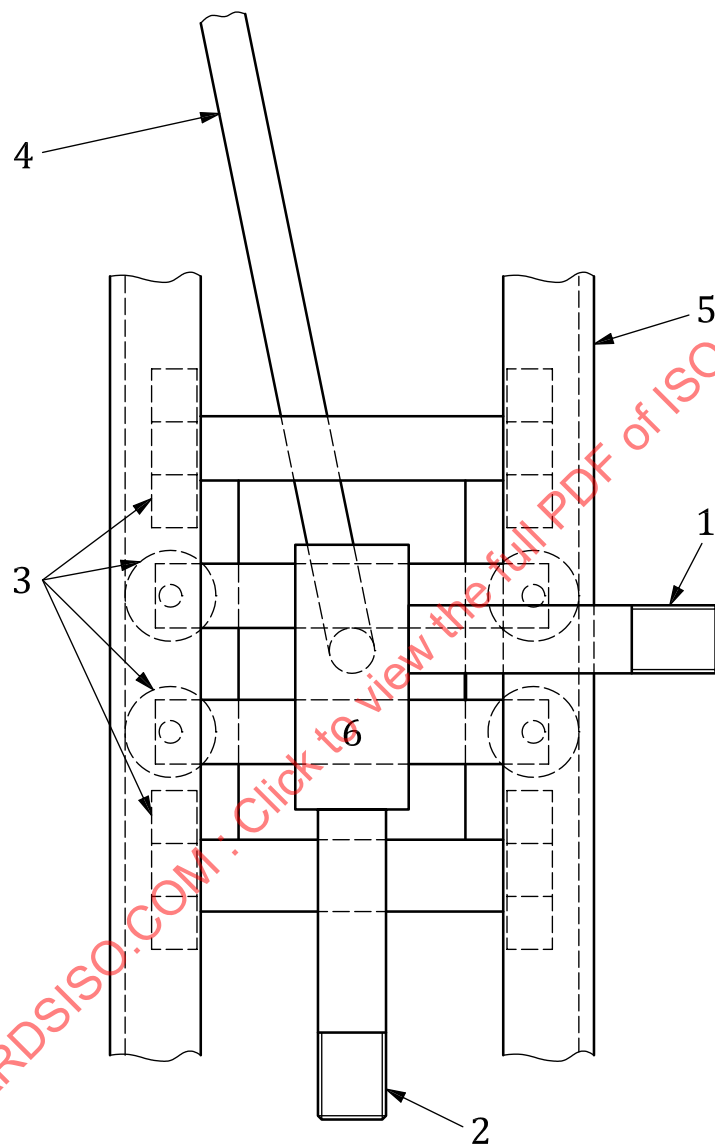
Key

- | | | | |
|---|------------|----|---|
| 1 | hose A | 7 | track |
| 2 | hose B | 8 | optional counterweight |
| 3 | pipe | 9 | steel cable |
| 4 | pulleys | 10 | chain, driven by electric motor |
| 5 | weight | 11 | trolley (see detail in Figure 2) |
| 6 | water tank | | |

Figure 1 — Typical hose-flexing machine

7.3.3 Flexing of conditioned hose

Place a length of conditioned hose (see 7.3.2) in a flex-testing machine (hose B in Figure 1). Connect one end of the hose to the travelling block (see Figure 2) and pass the free end around two pulleys of the diameters shown in Table 5. Then attach to the free end a weight of just sufficient mass to cause the hose to conform to the circumference of the pulleys. This hose shall be long enough to prevent the weight on the free end from contacting the nearer of the two pulleys when the hose is pressurized and the travelling block is in the “up” position.



Key

- 1 connection for hose A
- 2 connection for hose B
- 3 ball bearings
- 4 rod attached to the chain
- 5 U-shaped track
- 6 travelling block

Figure 2 — Details of trolley and track

Place a 910 mm length of conditioned hose in the feeder line of the flex-testing machine (hose A in [Figure 1](#)). Connect one end to the vertical travelling block as shown in [Figure 2](#) and connect the other end to a water source with pressure of 2,5 MPa (25 bar).

Flexing shall begin within 6 h to 8 h of completion of the 30 day conditioning period.

Carry out the flexing for 72 h at a rate of approximately 0,13 Hz with a vertical movement of the travelling block of 1 m. Examine the hose each day for visible defects. There shall be no evidence of blistering, cracking or leakage.

Table 5 — Pulley diameters and feeder hose lengths for flexing

Hose size	Pulley diameter mm	Feeder hose length mm
12,5	350 ± 6,0	910
16	350 ± 6,0	910
19	350 ± 6,0	910
25	350 ± 6,0	910
31,5	350 ± 6,0	— ^a
38	460 ± 6,0	— ^a
51	610 ± 6,0	— ^a
64	760 ± 6,0	— ^a
76	920 ± 6,0	— ^a

^a The test on the feeder hose does not apply to sizes over 25 mm. To conduct flexing on larger sizes, any convenient hose may be used as the feeder hose.

7.3.4 Burst-pressure test on conditioned and flexed hoses

At the conclusion of the flexing period, cut a 600 mm test piece from the middle of hose A and from the middle of hose B and subject each test piece to the hydrostatic burst test specified in ISO 1402. The minimum burst pressure shall be as required in [Table 4](#).

7.3.5 Physical-property tests on conditioned and flexed hoses

Determine the physical properties as required in [Table 4](#) on each flexed test piece in accordance with ISO 37.

8 Hose assembly delivery test and annual in-use test requirements

Hose assemblies shall be tested before delivery and during use in accordance with [Table 6](#).

Table 6 — Delivery and annual proof-pressure testing requirements for hose assemblies

Proof-pressure test on hose assemblies	Requirement	Test method
Before delivery	6,3 MPa (63 bar)	ISO 1402
Annual in-use test	6,3 MPa (63 bar)	ISO 1402

NOTE The delivery test is designed to ensure that each hose assembly delivered meets the minimum proof-pressure requirement and the annual in-use test is designed to ensure that hose assemblies in use continue to meet this requirement.

9 Frequency of testing

Type and routine testing shall be as specified in [Annex A](#).

Type tests are those tests required to confirm that a particular hose design, manufactured by a particular method, meets all the requirements of this document. 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. They shall be performed on all sizes, and on all classes and types except those of the same size and construction.

Routine tests are those tests required to be carried out on each production lot of finished hose prior to dispatch.

Delivery tests are those tests required to be carried out on each hose or hose assembly delivered (see [Table 6](#)).

Annual tests are those tests required to be carried out on each hose assembly every 12 months while in use (see [Table 6](#)).

10 Marking

The hose shall be marked at least once every 1,5 m with the following information and with such additional information as may be agreed between manufacturer and purchaser:

- a) the manufacturer's name or trademark XXX;
- b) the number of this document, i.e. ISO 5771;
- c) the hose size, e.g. size 12,5;
- d) the maximum working pressure, i.e. MWP 2,5 MPa (25 bar);
- e) the quarter and last two digits of the year of manufacture, e.g. 3Q23;
- f) the words: "Only for use with anhydrous ammonia".

EXAMPLE XXX/ISO 5771/size 12,5/MWP 2,5 MPa (25 bar)/3Q23/Only for use with anhydrous ammonia.

For [10 b](#)), the hose manufacturer shall use the latest publication of this document, otherwise the year of publication used shall be included in the marking.

11 Packaging and storage

Recommendations for packaging and storage of hoses and hose assemblies are given in ISO 8331.

12 Test certificate

A test certificate giving the results of the type tests shall be supplied if requested.

Annex A

(normative)

Type frequency for type tests and routine tests

Property	Type tests Type approval (for each hose size and type): at initial product qualification, in the event of product changes after initial qualification and after 5 years	Routine tests Performed on each production lot ^a of finished hose prior to warehousing or sale
Visual examination	X	X
Dimensions		
Measurement of inside diameter (see Table 2)	X	X
Measurement of concentricity (see 6.3)	X	X ^d
Measurement of lining thickness (see 5.1)	X	N/A
Hose tests		
Proof-pressure test ^b (see Table 4)	X	X ^c
Burst-pressure test ^b (see Table 4)	X	X ^c
Change in length test ^b (see Table 4)	X	X ^c
Ozone resistance test (see Table 4)	X	N/A
Low-temperature flexibility test ^b (see Table 4)	X	N/A
Adhesion (cover) (see Table 4)	X	N/A
Adhesion (lining) (see Table 4)	X	N/A
Adhesion (reinforcement) (see Table 4)	X	N/A
Minimum tensile strength (lining and cover) (see Table 3)	X	N/A
Minimum elongation at break (lining and cover) (see Table 3)	X	N/A
Ammonia resistance tests (see 7.3 and Table 4)		
Burst-pressure test on both test pieces after conditioning and flexing	X	N/A
Maximum change in tensile strength after conditioning and flexing (lining and cover)	X	N/A
Maximum change in elongation at break after conditioning and flexing (lining and cover)	X	N/A
X = Test shall be carried out.		
N/A = Test not applicable.		
^a A production lot is defined as a continuously produced length. Single hoses of one type and size produced with rigid mandrels may be considered one lot.		
^b These tests may be carried out with hose assemblies.		
^c The manufacturer of the hose and hose assembly should define the number of samples to be carried out.		
^d This test shall not be carried out on each length. At least two measurements should be taken per production lot, preferably at the beginning and end of the lot.		