INTERNATIONAL STANDARD

ISO 6807

Second edition
2003-12-01

Rubber hoses and hose assemblies for rotary drilling and vibration applications — Specification

Tuyaux et flexibles en caoutchouc pour forage rotatif et amortissement des vibrations — Spécifications

Reference number
ISO 6807:2003(E)

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Published in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 6807 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

This second edition cancels and replaces the first edition (ISO 6807:1984), which has been technically revised.

Introduction

In rotary drilling for oil, fluid muds are pumped at high pressure in large volumes to drill heads. High-pressure hoses are used as flexible connectors in the mud supply circuit.

Rotary drilling hoses are used between the top of the standpipe and the swivel that allows vertical travel. They are also used between barges and offshore drilling rigs, usually in lengths greater than 13,5 m.

Rotary vibrator hoses are shorter (9 m or less) and used between the pump and the derrick or standpipe manifolds to accommodate misalignment and to isolate vibration.

Rubber hoses and hose assemblies for rotary drilling and vibration applications — Specification

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This standard 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 ensure compliance with any national regulatory conditions.

1 Scope

This International Standard specifies the requirements for textile- and steel-reinforced rubber hoses and hose assemblies for use with water-based and/or oil-based muds, up to a maximum temperature of 82 °C, which are pumped at high pressure in large volumes in rotary drilling service and which, when tested in accordance with ISO 2977, have a minimum aniline point of 66 °C.

This International Standard applies to hoses which are suitable for use at ambient temperatures between − 20 °C and + 52 °C, unless changed by a supplementary requirement on request of the purchaser, and are resistant to ageing and tropical conditions.

This International Standard does not apply to hoses which are intended for use with gases.

2 Normative references

The following referenced documents are indispensable for the application 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, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 1402:1994, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

ISO 1431-1, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static strain test*

ISO 1746:1998, *Rubber or plastics hoses and tubing — Bending tests*

ISO 1817, *Rubber, vulcanized — Determination of the effects of liquids*

ISO 2977, *Petroleum products and hydrocarbon solvents — Determination of aniline point and mixed aniline point*

ISO 4649:2002, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*

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

ISO 7233:1991, *Rubber and plastics hoses and hose assemblies — Determination of suction resistance*

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

ISO 8331, *Rubber and plastics hoses and hose assemblies — Guide to selection, storage, use and maintenance*

ISO 10422, *Petroleum and natural gas industries — Threading, gauging, and thread inspection of casing, tubing and line pipe threads — Specification*

3 Terms and definitions

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

4 Classification

Hoses and hose assemblies are classified into five grades according to the maximum working pressure at which they are intended to be used (see Table 1).

Table 1 — Grades according to maximum working pressure

Grade	Maximum working pressure bar [a]	Proof pressure bar [a]
A	103	206
B	138	276
C	276	552
D	345	690
E	517	1 034

[a] 1 bar = 0,1 MPa

5 Materials and construction

5.1 Hoses

The hose lining shall consist of an oil- and water-resistant rubber.

The hose reinforcement shall consist of layers of textile and/or steel material.

The hose cover shall consist of an oil-, abrasion- and weather-resistant rubber and have a coloured line along its length to aid laying in a straight line.

5.2 Hose assemblies

Hoses shall be connected to external couplings (built in during manufacture or swaged). These couplings shall be manufactured out of carbon steel or stainless steel traceable to the steel manufacturer. Rotary hose assemblies may be furnished with external connections threaded with line-pipe threads as specified in ISO 10422.

The marking “ISO 6807” may be retained on hose assemblies when other connections are attached, upon agreement between the manufacturer and purchaser, and provided the assembly is pressure tested in accordance with Table 1 with the connections in place.

NOTE It is the responsibility of both manufacturer and purchaser to ensure that the couplings are suitable for the intended pressures and that the connecting elements are compatible with any fixed or mobile fastenings to which the assembly will be attached.

6 Dimensions and tolerances

6.1 Internal diameters and bend radius

When measured in accordance with the method described in ISO 4671, the internal diameter of the hose shall conform to the values given in Table 2. The tolerance on the internal diameter shall also conform to the values given in Table 2.

When measured in accordance with the method described in 8.1, the bend radius shall conform to the values given in Table 2.

Table 2 — Internal diameters and minimum bend radius

Internal diameter mm	Grade	Tolerance on I.D. mm	Minimum bend radius m
51	A, B, C	± 1,20	1,0
63	A, B, C, D, E	± 1,20	1,2
76	C, D, E	± 1,40	1,2
89	C, D, E	± 1,50	1,4
102	C, D, E	± 1,60	1,5

The dimensions of the end connections for the various grades shall be in accordance with Table 3.

Table 3 — Dimensions of end connections

Internal diameter of hose *D*	Nominal thread or flange size *T*	Grade
51 mm (2 in)	63,5 mm (2½ in)	A, B, C
63 mm (2½ in)	76,2 mm (3 in)	A, B, C, D, E
76 mm (3 in)	101,6 mm (4 in)	C, D, E
89 mm (3½ in)	101,6 mm (4 in)	C, D, E
102 mm (4 in)	127 mm (5 in)	C, D, E
127 mm (5 in)	127 mm (6 in)	C, D, E

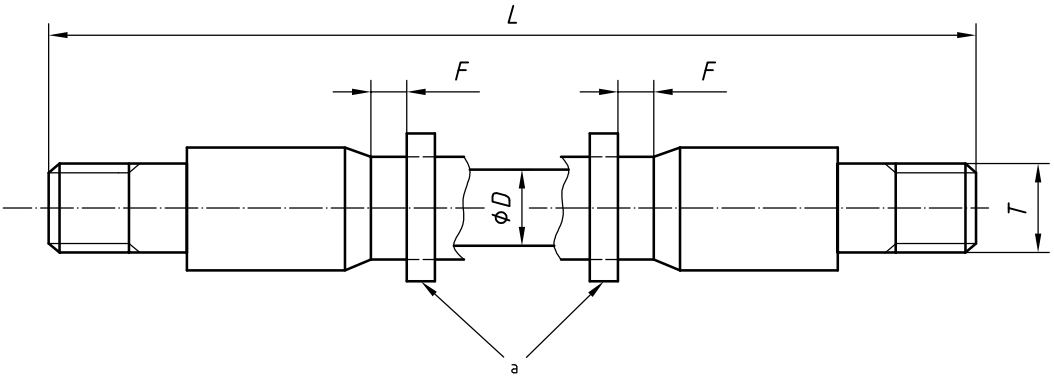
6.2 Length

The length of hose assemblies shall be the measured length from nipple end or coupling end to coupling end as appropriate (see Figure 1) and shall be determined after hydrostatic pressure testing (see 8.2).

The tolerance on the finished length shall be as follows:

assemblies up to 6 m ± 64 mm;

assemblies over 6 m ± 1 %.



T thread or flange size in accordance with Table 3;

L overall length, in mm;

D internal diameter, in mm.

F For rotary hoses, this dimension shall be 152 mm to 457 mm from the inboard end of the coupling (see 9.1).
For vibrator hoses, this dimension shall be 152 mm to 254 mm from the inboard end of the coupling (see 9.1).

a Hose manufacturers shall mark the hose with the notation “Attach safety clamp here”.

Figure 1 — Hose assembly dimensions

7 Physical properties of rubber materials

Tests shall be carried out on moulded sheets or moulded and vulcanized test pieces of compounds to be used for the lining or cover, vulcanized (in the case of vulcanized test pieces) to an equivalent state of cure to that expected to be achieved in the manufacture of the hoses.

When determined in accordance with the appropriate method given in Table 4, the physical properties shall meet the requirements given in Table 4.

Table 4 — Physical properties of compounds

Property		Unit	Requirement	Method of test
Tensile strength				ISO 37
Lining	min.	MPa	10,0	
Cover	min.	MPa	7,5	
Elongation at break				ISO 37
Lining	min.	%	300	
Cover	min.	%	250	
Change in lining and cover properties after accelerated ageing				ISO 188 7 days at 100 °C in air
Tensile strength	max.	%	− 30	
Elongation at break	max.	%	− 50	
Ozone resistance (cover only)			No cracking under × 7 magnification	ISO 1431-1 72 h, 50 pphm ozone, 40 °C, 10 % extension
Oil resistance — Volume swell				ISO 1817 Oil No. 2, 7 days at 100 °C
Lining	max.	%	40	
Cover	max.	%	75	
Abrasion resistance				ISO 4649:2002, method A Test piece: moulded test sheet or moulded test piece Reference compound No. 1
Lining	max.	Relative volume loss (mm^3)	250	
Cover	max.		250	

8 Performance requirements for hoses/hose assemblies

8.1 Bend radius (hoses and hose assemblies)

When tested in accordance with ISO 1746:1998, method A, hoses and hose assemblies shall be capable of achieving a bend radius value equivalent to the appropriate radius given in Table 2 without suffering any structural damage.

8.2 Burst pressure (hose assemblies)

When tested in accordance with ISO 1402 and Annex A, hose assemblies shall meet the requirements given in Table 5.

Table 5 — Burst pressure requirements

Grade	Minimum burst pressure bar
A	258
B	345
C	690
D	863
E	1 293

8.3 Other hydrostatic pressure tests (hose assemblies)

Each hose assembly shall be tested to the appropriate working and proof pressure corresponding to the grade given in Table 1, using the method described in Annex A. When tested in accordance with Annex A, the hose assembly shall meet the following requirements:

a) At the appropriate working pressure, the assembly shall not twist by more than 3° per metre in any direction.

b) At the appropriate working pressure, the assembly shall not move in a lateral or vertical direction by more than a distance corresponding to one hose outside diameter.

c) At the appropriate working pressure, the hose assembly shall neither contract nor elongate by more than 2 % of its original length.

d) At the appropriate proof pressure, there shall be no leaks. Evidence of dampness in the Fuller‘s earth (hydrated magnesium-aluminium silicate) after the proof pressure is reduced to zero shall be a cause for re-certification and re-test. When re-testing again shows evidence of dampness in the Fuller’s earth, the assembly shall be rejected.

e) After the hydrostatic tests, the final length shall meet the requirements of 6.2.

8.4 Vacuum test (hose assemblies)

When tested in accordance with ISO 7233:1991, method B, over a period of 10 min at – 0,8 bar, the hose lining shall show neither delamination nor blisters.

9 Marking

9.1 Hoses

The hoses shall be legibly and durably marked at both ends, and within 1 200 mm of the coupling, with at least the following information:

a) the manufacturer’s name or identification and a unique serial number;

b) the number of this International Standard;

c) the internal diameter, e.g. 63;

d) the grade letter, e.g. C;

e) the maximum working pressure, in bars, e.g. 276 bar;

f) the quarter and year of manufacture, e.g. 2Q03;

g) at the appropriate point, the words "Attach safety clamp here“ (see Figure 1);

h) the longitudinal coloured lay line for the full length of the hose/assembly.

The markings shall be vulcanized into the cover with either an embossed or a distinctly coloured printed label.

EXAMPLE Man/XXX/ISO 6807/63/C/276 bar/2Q03.

9.2 End fittings

The steel fittings, built-in or swaged, shall be marked with the fitting manufacturer’s trademark and a unique serial number, as well as the identification number of the heat of the steel.

This information shall be die-stamped on each fitting in a suitable place.

10 Storage

Guidance on the storage of hoses and hose assemblies is given in ISO 8331.

11 Design verification testing

Design verification testing shall be performed in order to supply evidence that all the material construction requirements and all the requirements of this International Standard have been met by the hose design and method of manufacture. For a given pressure rating, design verification tests shall be carried out a minimum of every five years, or whenever a change of manufacturer, design or material occurs, on the largest size of each design in the manufacturer's range.

The requirement to repeat this test every five years can be avoided if the manufacturer can supply detailed proof of certification, with a full technical description of the hose materials, the hose-building specification (including attachment of couplings) and all test results, endorsed by an independent body, and can prove that hose assembly construction, materials and building specification are still identical to that for the assembly originally tested and qualified.

12 Frequency of testing

Design verification and routine tests are specified in Annex B, together with the required frequency of such tests.

Design verification tests are those tests required to confirm that the product meets all the requirements of this International Standard.

Routine tests are those tests required to be carried out on all hose assemblies prior to dispatch.

Production acceptance tests are those tests, specified in Annex C, which should preferably be carried out to control the quality of manufacture. The frequencies specified in Annex C are given as a guide only.

13 Test report

For each assembly supplied by a manufacturer, a test report is required. This report shall include at least the following:

a) full identification of the assembly supplied, including the couplings;

b) the results of pressure testing (see A.1.9 and A.2.2), bend testing (see 8.1) (when applicable) and vacuum testing (see 8.4);

c) the date of design verification testing and the size and grade of hose assembly tested for this purpose.

Annex A
(normative)

Pressure tests

A.1 Hydrostatic pressure test

A.1.1 Lay out the hose assembly as straight as possible. Measure the overall length. Close off the ends and fill with water, venting at the exit end to remove all air. Apply a pressure of 2,0 bar to 5,5 bar (0,20 MPa to 0,55 MPa).

A.1.2 Mark the top of each coupling for subsequent observation of twist. Lightly dust couplings and the adjacent hose cover area with Fuller‘s earth (hydrated magnesium-aluminium silicate) for subsequent observation of leakage.

A.1.3 Apply a pressure of 35 bar (3,5 MPa) and check the assembly for leaks. Rectify as necessary, and continue to A.1.4.

A.1.4 Raise the pressure to the working pressure appropriate to the grade of hose assembly under test, and hold for a minimum of 3 min. Record the extent of any twist, other distortion, temporary elongation and/or leaks.

A.1.5 Continue to raise the pressure to the full proof pressure for the grade of hose assembly under test as quickly as possible. The attainment of the proof pressure shall be achieved within a period of no more than 30 min from the initial pressurization.

A.1.6 Hold this pressure for a minimum of 3 min.

A.1.7 Reduce the pressure to working pressure, hold for a further 20 min, and then reduce the pressure to zero.

A.1.8 Carry out a visual inspection for any damage to the assembly, e.g. distortion, and measure the final length (see 6.2). Calculate any permanent change in length from that measured in A.1.1.

A.1.9 Include the following in the test report (see Clause 13):

a) full identification of the hose assembly tested;

b) the measurements/observations made in A.1.1, A.1.3, A.1.4 and A.1.8.

A.2 Burst pressure test

A.2.1 After completing the hydrostatic pressure test described above, and the minimum bend radius test (see 8.1), lay out the hose assembly as straight as possible in a suitable area (a thick-walled purpose-built enclosure or large open space with the hose assembly surrounded by sandbags, especially around the coupling areas) and repeat step A.1.1.

A.2.2 Increase the pressure at a rate between approximately 1,5 bar/s and 5 bar/s in accordance with ISO 1402:1994, Subclauses 7.3 and 6.2.2, until the hose assembly fails. Record the position and mode of failure, as well as the pressure at the moment of failure, in the test report.

Annex B
(normative)

Frequency of design verification testing and routine testing

Table B.1 gives the required frequency of design verification and routine testing

Table B.1 — Design verification and routine tests

Property	See	Design verification testing	Routine testing
Tests on rubber compound			
Tensile strength and elongation at break, lining	Table 4	X	N.A.
Tensile strength and elongation at break, cover	Table 4	X	N.A.
Change in these properties after accelerated ageing	Table 4	X	N.A.
Resistance to liquids, lining	Table 4	X	N.A.
Resistance to liquids, cover	Table 4	X	N.A.
Abrasion resistance, lining	Table 4	X	N.A.
Abrasion resistance, cover	Table 4	X	N.A.
Ozone resistance, cover only	Table 4	X	N.A.
Hoses (where applicable to method of manufacture)			
Internal diameter	6.1	X	N.A.
Minimum bend radius	8.1	X	N.A.
Hose assemblies			
Hydrostatic pressure test	8.3, Clause A.1	X	X
Twist	8.3 a)	X	X
Lateral movement at working pressure	8.3 b)	X	X
Temporary elongation	8.3 c)	X	X
Permanent elongation and final length	8.3 e)	X	X
Minimum bend radius	8.1	X	X
Vacuum resistance of lining	8.4	X	X
Minimum burst pressure	Table 5, Clause A.2	X	N.A.

X = Test to be carried out; N.A. = not applicable.

NOTE Burst pressure tests require special facilities (i.e. a thick-walled enclosure with a protected observation and control post or a large open space with sandbags around the assembly under test).

Annex C
(informative)

Frequency of production acceptance testing

Production acceptance tests are those carried out per batch or 10 batches as indicated in Table C.1. A batch is defined as either 5 000 m of hose or 20 000 kg of lining and/or cover compound.

Table C.1 — Recommended frequency of production acceptance tests

Property	Production acceptance test	
	Per batch	Per 10 batches
Tests on rubber compound		
Tensile strength and elongation at break, lining	X	X
Tensile strength and elongation at break, cover	X	X
Change in these properties after accelerated ageing	N.A.	X
Resistance to liquids, lining	N.A.	X
Resistance to liquids, cover	N.A.	X
Abrasion resistance, lining	X	X
Abrasion resistance, cover	X	X
Ozone resistance, cover only	N.A.	X
Hoses (where applicable to method of manufacture)		
Internal diameter	X	X
Minimum bend radius	X	X
Hose assemblies		
Hydrostatic pressure test	X	X
Twist	X	X
Lateral movement at working pressure	X	X
Temporary elongation	X	X
Permanent elongation and final length	X	X
Minimum bend radius	X	X
Vacuum resistance of lining	X	X
Minimum burst pressure	N.A.	N.A.

X = Test to be carried out; N.A. = not applicable.

NOTE Batch tests for hose assemblies may be carried out as routine tests (see Annex B).

Bibliography

[1] ISO 14693, *Petroleum and natural gas industries — Drilling and well-servicing equipment*

ICS 75.180.10; 83.140.40

Price based on 11 pages