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Rubber hoses and hose assemblies for automobile power-steering systems — Specification

Tuyaux et flexibles en caoutchouc pour circuits de direction assistée — Spécifications

Reference number
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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.

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.

International Standard ISO 11425 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

Annexes A and B form an integral part of this International Standard. Annex C is for information only.

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Rubber hoses and hose assemblies for automobile power-steering systems — Specification

1 Scope

This International Standard specifies requirements for five types of hose and hose assembly used in automobile power-steering systems, the five types differing in their pressure ratings and volumetric expansion. They are for use with fluids in the temperature range − 40 °C to + 135 °C.

This International Standard is based on performance tests and, in order to take account of technological developments, no requirements are included for specific materials, detailed construction or manufacturing methods.

WARNING — Attention is drawn to the need to ensure that appropriate precautions are taken to ensure the safety of personnel carrying out the methods of test specified in this International Standard.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 2719:1988, *Petroleum products and lubricants — Determination of flash point — Pensky-Martens closed cup method.*

ISO 2909:1981, *Petroleum products — Calculation of viscosity index from kinematic viscosity.*

ISO 2977:—[1], *Petroleum products and hydrocarbon solvents - Determination of aniline point and mixed aniline point.*

ISO 3016:1994, *Petroleum products — Determination of pour point.*

ISO 3819:1985, *Laboratory glassware — Beakers.*

ISO 4671:1984, *Rubber and plastics hose and hose assemblies — Methods of measurement of dimensions.*

ISO 4672:—[2], *Rubber and plastics hoses — Subambient-temperature flexibility tests.*

ISO 4788:1980, *Laboratory glassware — Graduated measuring cylinders.*

ISO 4793:1980, *Laboratory sintered (fritted) filters — Porosity grading, classification and designation.*

ISO 6803:1994, *Rubber or plastics hoses and hose assemblies — Hydraulic-pressure impulse test without flexing.*

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

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

1) To be published. (Revision of ISO 2977:1989)

2) To be published. (Revision of ISO 4672:1988)

ISO 9227:1990, *Corrosion tests in artificial atmospheres — Salt spray tests.*

ISO/TR 11340:1994, *Rubber and rubber products — Hydraulic hose assemblies — External leakage classification for hydraulic systems.*

3 Definition

For the purposes of this International Standard, the following definition applies.

3.1 hose assembly: A hose with either permanent or re-usable end fittings attached.

4 Types of hose

Hoses shall be one of the following five types:

Type 1: low-pressure hydraulic fluid return hoses and hose assemblies

Type 2: medium-pressure low volumetric expansion hoses and hose assemblies

Type 3: medium-pressure medium volumetric expansion hoses and hose assemblies

Type 4: medium-pressure high volumetric expansion hoses and hose assemblies

Type 5: high-pressure low volumetric expansion hoses and hose assemblies

5 Construction and materials

The hose shall consist of

a) a rubber lining;

b) a reinforcement;

c) a rubber cover or alternatively, for type 5 only, a textile cover.

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

6 Dimensions and tolerances

6.1 The hose shall have a nominal bore in accordance with the requirements of table 1. When determined in accordance with ISO 4671, the actual bore shall be within ± 0,4 mm of the nominal bore.

Table 1 — Nominal bore

Dimensions in millimetres

Type 1	Type 2	Type 3	Type 4	Type 5
—	6,3	—	—	—
9,5	9,5	9,5	9,5	9,5
—	12,7	—	—	12,7

6.2 The concentricity based on a total indicator reading between the bore and the outside surface of the cover, determined in accordance with ISO 4671, shall be not more than 0,75 mm.

NOTE 1 Typical ranges of outside diameters available are given in annex C.

7 Performance requirements

7.1 Impulse resistance

When subjected to a pulse test carried out in accordance with ISO 6803, using the following conditions, each of at least four test pieces shall withstand a minimum of 225 000 cycles with no more than ISO/TR 11340 class 3 leakage at fittings, and no rupture or ballooning of the hose.

Test fluid temperature: 135 °C ± 2 °C

Ambient temperature during test: 100 °C ± 5 °C

Cycle rate: 30 to 40 per min

Cycle data:

Pressure rise time: 0,20 s ± 0,10 s

Pressure dwell time: 0,65 s + 0,20 s

Pressure drop time: 0,20 s ± 0,10 s

Test pressure: Design working pressure as given in table 2.

7.2 Burst pressure requirement

When tested in accordance with ISO 1402, the hose or hose assembly shall withstand the minimum burst pressure given in table 2.

Table 2 — Hydrostatic-pressure requirements

Type	Nominal bore mm	Design working pressure MPa	Proof pressure MPa	Minimum burst pressure MPa
1	9,5	1,75	3,5	7,0
2	6,3 9,5 12,7	9,0 8,0 7,0	18,0 16,0 14,0	36,0 32,0 28,0
3	9,5	10,0	20,0	40,0
4	9,5	9,0	18,0	36,0
5	9,5 12,7	15,5 14,0	31,0 28,0	62,0 56,0
NOTE — All pressure values specified are gauge pressures.				

7.3 Change in length

Hoses of types 1, 3 and 4 shall not change in length by more than + 0 % and − 8 % and hoses of types 2 and 5 shall not change in length by more than + 2 % and − 4 % at the appropriate design working pressure given in table 2.

7.4 Low-temperature flexibility

After conditioning at a temperature of − 40 °C ± 2 °C for a period of 72 h, bend a test piece around a mandrel having a diameter eight times the nominal outside diameter of the hose, using the method without torque measurements described in ISO 4672.

The test piece shall not fracture and the cover shall not show any cracks or breaks.

After this test, the test piece shall be allowed to attain ambient temperature and shall then withstand the appropriate proof pressure given in table 2, using the method described in ISO 1402, without any sign of leakage or other defect.

Following the proof pressure test, the test piece shall be sectioned and the lining shall show no evidence of cracking upon visual examination.

7.5 Adhesion

When determined in accordance with ISO 8033, for type 1, 2, 3 and 4 hoses, and for type 5 hoses supplied with a rubber cover, the adhesion between lining and reinforcement, between layers of reinforcement and between reinforcement and cover shall not be less than 1,5 kN/m.

7.6 Ozone resistance

When tested in accordance with ISO 7326:1991, method 1, the test piece shall show no sign of cracking.

7.7 Volumetric expansion

This requirement applies to type 3 and 4 hoses only.

When tested by the method described in annex A, the hose or hose assembly shall comply with the requirements of table 3.

Table 3 — Volumetric expansion

Hose type	Volumetric expansion at 9 MPa
3	10 cm^3/m to 26 cm^3/m
4	26 cm^3/m to 55 cm^3/m

7.8 Contamination

When determined by the method described in annex B, the total amount of impurities shall not exceed 100 mg/m^2 and the maximum particle size shall be 70 µm.

7.9 Corrosion of end fittings

When tested in accordance with ISO 9227 for 168 h, the hose assembly and fittings shall show no evidence of corrosion of the base metal.

7.10 Proof pressure requirement

Each length of hose or each hose assembly subjected to the appropriate proof pressure given in table 2, using the method described in ISO 1402, for a period of 1 min, shall show no sign of rupture or leakage.

7.11 Cold-start requirement (type approval test for type 4 hose assemblies only)

7.11.1 Requirement

When tested in accordance with 7.11.2, the assembly shall show no signs of cracks or leakage at the end of 15 cycles.

7.11.2 Test method

7.11.2.1 Bend the hose assembly into a U shape, fill with test fluid (see A.3) and lower the temperature to − 40 °C ± 2 °C.[3)]

7.11.2.2 Apply a pressure pulse of 11 MPa for 1,5 s, twenty times.

7.11.2.3 Allow the assembly to warm up to ambient laboratory temperature and leave for 2 h.

7.11.2.4 Apply a pressure pulse of 11 MPa for 1,5 s, twenty times.

7.11.2.5 Repeat the procedure described in 7.11.2.1 to 7.11.2.4 (starting at "lower the temperature to − 40 °C ± 2 °C") a further fourteen times.

7.11.2.6 Examine the hose assembly visually for signs of cracks or leakage, ignoring any leakage associated with the couplings.

7.12 Low-pressure burst pressure requirement (type 4 hose assemblies only)

Fill the hose assembly with test fluid (see A.3) and maintain at − 40 °C ± 2 °C[3)] for 12 h. The hose assembly shall then withstand a minimum burst pressure of 36 MPa applied in accordance with ISO 1402.

8 Marking

Each length of hose shall be legibly and indelibly marked at intervals of no more than 250 mm with the following information:

a) the manufacturer's name or identification;

b) the number of this International Standard and the hose type number;

c) the nominal bore of the hose, in millimetres;

d) the date of manufacture (at least month and year);

e) the design working pressure, in megapascals.

EXAMPLE:

MAN ISO 11425/3 9,5 10/95 15,5

3) A temperature of − 40 °C may be obtained by using methanol or ethanol with crushed dry ice (solid carbon dioxide) and maintained by carefully adding further pieces of dry ice.

Annex A
(normative)

Method of test for volumetric expansion

A.1 Principle

A measured length of hose is filled with test fluid at atmospheric pressure. The pressure is raised to the working pressure for a period of 2 min. The volume of fluid necessary to achieve this pressure is measured and expressed as cubic centimetres per metre.

A.2 Apparatus

A.2.1 Means of increasing hydraulic pressure in the hose test piece to 9 MPa ± 1 %.

A.2.2 Calibrated pressure gauge, with a range up to at least 14 MPa.

A.2.3 Two valves, of such design as to open and close with minimum displacement of fluid.

A.2.4 Laboratory measuring cylinders, complying with the requirements of ISO 4788 having capacities of at least 30 cm^3 and 60 cm^3, each cylinder capable of being read to an accuracy of 2 % of its nominal capacity.

A.2.5 Short length of 0,5 m bore stainless steel capillary tube, firmly attached to the inlet side of one of the valves.

A.3 Test fluid

The test fluid shall be water or a fully fortified hydraulic mineral oil having the following characteristics when tested by the methods indicated:

Property	Required value	Method of test
Viscosity at 40 °C	130 mm^2/s ± 20 mm^2/s	ISO 2909
Pour point, maximum	– 24 °C	ISO 3016
Flash point, closed cup, minimum	218 °C	ISO 2719
Aniline point	103 °C ± 10 °C	ISO 2977

A.4 Test piece

The test piece shall be either a length of hose connected to suitable fittings with a free length between fittings of 1 m, or a hose assembly where the free length of hose between the fittings has been measured.

A.5 Procedure

Connect the test piece to the pressure source with the valves positioned so that the test piece can be isolated.

Fill the test assembly with the test fluid, ensuring that all air is removed and that there is no external tension in the test piece. Increase the pressure in the test piece to 9 MPa ± 1 %, hold for 1 min by closing both valves and then return to atmospheric pressure.

After 2 min at atmospheric pressure, again increase the pressure to 9 MPa ± 1 % and hold for 2 min. Release the pressure and collect the test fluid discharged.

Repeat the test on two further test pieces and record the three volumes of test fluid collected.

A.6 Expression of results

Express the result as the average value of the volumes of test fluid collected per metre of test piece.

A.7 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) all details necessary for identification of the hose or hose assembly;

c) the date of test;

d) the volumetric expansion, expressed in cubic centimetres per metre;

e) the test fluid used.

Annex B
(normative)

Method of test for contamination

B.1 Principle

A sample or hose assembly is filled with petroleum ether and agitated.

The contents are collected, the insoluble impurities filtered out, dried and weighed, and the largest particle size measured.

B.2 Reagent

B.2.1 Petroleum ether (60 to 80 grade).

B.3 Apparatus

B.3.1 Glass funnel.

B.3.2 Beaker, complying with the requirements of ISO 3819.

B.3.3 Ventilated drying oven, with a temperature range controllable between 0 °C and 85 °C ± 5 °C.

B.3.4 Balance, accurate to 0,1 mg.

B.3.5 Sintered-glass filter, porosity P 4 (see ISO 4793).

B.3.6 Microscope.

B.4 Procedure

Take a sample of hose 300 mm to 500 mm in length, or a complete hose assembly, and determine its internal surface area. Fill the hose or assembly with petroleum ether (B.2.1), agitate and pour into the beaker (B.3.2). Refill the hose or assembly from the opposite end with petroleum ether, agitate and pour into the beaker. Filter the entire contents of the beaker through the tared sintered-glass filter (B.3.5) using a little fresh petroleum ether if necessary to rinse out any remaining solids. Dry the filter in the drying oven (B.3.3) at 85 °C ± 5 °C until constant mass is obtained and determine the total mass of insoluble impurities present.

Examine the residue from the filter under a microscope (B.3.6) and measure the size of the largest particles in micrometres.

B.5 Expression of results

Calculate the total mass of insoluble impurities ("dirt"), expressed in milligrams per square metre of the interior surface area of the hose or assembly under test.

B.6 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) all details necessary for identification of the hose or hose assembly;

c) the total mass of insoluble impurities and the maximum particle size;

d) the date of the test.