INTERNATIONAL STANDARD

ISO 8066-1

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Rubber and plastics hoses and hose assemblies for automotive air conditioning — Specification —

Part 1: Refrigerant 12

Tuyaux et flexibles en caoutchouc et en plastique pour climatisation des automobiles — Spécifications —

Partie 1: Frigorigène 12

Reference number
ISO 8066-1:1997(E)

Contents

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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 8066-1 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics).*

ISO 8066 consists of the following parts, under the general title *Rubber and plastics hoses and hose assemblies for automotive air conditioning — Specification*:

— *Part 1: Refrigerant 12*

— *Part 2: Refrigerant 134a*

Annexes A to C form an integral part of this part of ISO 8066.

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Rubber and plastics hoses and hose assemblies for automotive air conditioning — Specification —

Part 1:
Refrigerant 12

1 Scope

This International Standard provides a specification for reinforced rubber or thermoplastic hoses and hose assemblies used for circulating liquid and gaseous refrigerant 12 (dichlorodifluoromethane) in the air-conditioning systems of automobiles, designed in such a way as to restrict losses of refrigerant and contamination of the system, in the operational temperature range -30 °C to +125 °C.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8066. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8066 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 471:1995, *Rubber — Temperatures, humidities and times for conditioning and testing.*

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

ISO 1817:—[1], *Rubber, vulcanized — Determination of the effect of liquids.*

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.*

3 Constructional requirements

Six types of hose are specified.

3.1 Types A1 and A2 — Rubber, textile-reinforced

The hose shall be built having a seamless oil-resistant synthetic-rubber tube. The reinforcement shall consist of textile yarn, cord or fabric adhered to the tube and cover. The outer cover shall be heat- and ozone-resistant synthetic rubber.

NOTE — Commercial products normally offered for type A1 hoses are a one-braid reinforcement of rayon textile yarn with a smaller outside diameter than type A2 hoses. Type A2 hose is a two-braid hose. Hose fittings for type A1 and A2 hoses are not normally interchangeable.

[1] To be published. (Revision of ISO 1817:1985)

3.2 Types B1 and B2 — Rubber, wire-reinforced

The hose shall be built having a seamless oil-resistant synthetic-rubber tube. The reinforcement shall consist of steel wire adhered to the rubber tube. The cover shall consist of a heat-resistant textile yarn impregnated with a synthetic-rubber cement.

3.3 Type C — Thermoplastic, textile-reinforced

The hose shall have a thermoplastic tube. The reinforcement shall consist of suitable textile yarn. The outer cover shall be a heat- and ozone-resistant thermoplastic material. The cover may be pin-pricked.

3.4 Type D — Thermoplastic, textile-reinforced, rubber-covered

The hose shall be a thermoplastic tube. The reinforcement shall consist of textile yarn, cord or fabric adhered to the tube and cover. The cover shall be a heat- and ozone-resistant synthetic rubber. It may be pin-pricked.

4 Dimensions

4.1 Hose diameters shall conform with the requirements given in table 1.

4.2 The variation in wall thickness shall not exceed the values given in table 2.

NOTE — Fittings for thermoplastic hoses may not be interchangeable. It is recommended that such fittings be properly matched.

Table 1 — Hose diameters

Dimensions in millimetres

Nominal bore	Internal diameter						Outside diameter								
	Types A1, A2 and B1		Type C		Types B2 and D		Type A1		Type A2		Type B1		Type C	Types B2 and D	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Max.	Min.
4,8	-	-	5,1	4,6	5,4[1)]	4,8[1)]	-	-	-	-	-	-	8,3	13,7[1)]	12,7[1)]
6,4	7,0	6,2	6,7	6,1	-	-	15,1	13,5	-	-	16,5	15,3	11,4	-	-
8	8,6	7,8	8,3	7,6	8,7	8,0	19,1	17,5	19,8	18,3	18,8	17,7	13,5	17,6	16,7
9,5	-	-	9,9	9,1	-	-	-	-	-	-	-	-	15,2	-	-
10	11,1	10,2	10,7	9,9	11,1	10,3	23,0	21,4	23,8	22,2	21,2	20,0	16,1	20,0	18,9
13	13,6	12,4	13,2	12,2	13,7	12,7	25,4	23,8	26,2	24,6	23,8	22,2	18,8	24,0	22,8
16	16,8	15,6	16,5	15,2	16,9	15,9	28,5	27,0	29,4	27,8	27,0	25,4	23,4	28,0	26,8
22	23,1	22,0	-	-	-	-	-	34,1	32,5	-	-	-	-	-	-
29	29,8	28,2	-	-	-	-	-	40,9	38,5	-	-	-	-	-	-

1) These values apply only to type B2.

Table 2 — Wall thickness variation

Types A, B and D		Type C	
Nominal bore	**Maximum variation in wall thickness** mm	**Nominal bore**	**Maximum variation in wall thickness** mm
Up to 6,4	0,8	Up to 6,4	0,5
From 8 to 22	1	From 8 to 13	0,6
29	1,3	Greater than 13	0,8

5 Performance requirements

5.1 Test conditions

The testing room shall be kept at standard temperature in accordance with ISO 471. The temperature of the hoses or hose assemblies shall be stabilized for 24 h before testing.

5.2 Refrigerant loss

The hoses or hose assemblies tested at the temperatures specified below in accordance with the method given in annex A shall not suffer loss of refrigerant greater than the values given in table 3.

The hoses or hose assemblies used in the part of the system operating at high pressure shall be tested at 100 °C ± 2 °C (discharge and liquid-line applications). Those used in the low-pressure part (suction-line applications) shall be tested at 80 °C ± 2 °C.

Table 3 — Refrigerant loss

Test temperature °C	Reference pressure MPa (bar)	Maximum allowable loss of refrigerant kg/m² per year[1)]	
		Types A and B	**Types C and D**
80	2,21 (22,1)	58	14
100	3,24 (32,4)	93	22
1) Based on the internal surface area of the hose.			

5.3 Leakage

When a hose filled with refrigerant (see 5.2) is maintained for 24 h at a temperature of 107 °C ± 2 °C, there shall be no sign of deterioration. Three test pieces shall be tested. This test may be carried out separately or during the 24 h pre-conditioning period for the refrigerant loss test (5.2) at 107 °C ± 2 °C. The hose shall be rejected if the mass loss is greater than 20 % of the initial mass of the refrigerant.

5.4 Ageing

5.4.1 Requirement

When the test is carried out in accordance with the procedure in 5.4.2, there shall be no leak or loss during the test due to cracks.

5.4.2 Procedure

Wind the hose, of length between 300 mm and 1 000 mm, on to a mandrel with a diameter equal to eight times the nominal external diameter of the hose for types A, B and D or twice the minimum bending radius given in table B.1 for type C. Place the mandrel in a circulating-air oven for 168 h at 125 °C ± 2 °C.

Take the hose assembly out of the oven, cool it to ambient temperature, unwind the hose and examine it externally to reveal any cracks, disintegration or any other defect. Subject it to an internal hydrostatic pressure of 2,4 MPa (24 bar) for 5 min, to show any leak or loss of liquid.

5.5 Low-temperature requirement

When the test is carried out in accordance with the method described in annex B, there shall be no leak or loss due to cracks or splits.

5.6 Vacuum requirement

5.6.1 General

The hose shall be subjected first to the vacuum test, then to the length variation test (5.7), then to the burst test (5.8).

5.6.2 Requirement

The collapse of the outside diameter of the hose shall not exceed 20 % of the initial outside diameter when it is subjected to a reduced internal pressure (vacuum) of 81 kPa (absolute) for 2 min as described in 5.6.3.

5.6.3 Procedure

The test hose assembly shall have a free length of from 610 mm to 1 000. Bend the hose into a U-shape, whereby the internal radius of the base of the U is five times the nominal external diameter of the hose. Apply a vacuum of 81 kPa (absolute) to the bent hose for 2 min. At the end of this period and while the vacuum is still being applied, measure the external diameter of the hose at the base of the U, in order to determine the minimum diameter at any point.

5.7 Length variation under pressure

5.7.1 Requirement

The hose shall not contract by more than 4 %, or extend by more than 2 %, when subjected to a pressure of 2,4 MPa (24 bar) as described in 5.7.2.

5.7.2 Procedure

Subject the hose, in a horizontal position, to an internal hydrostatic pressure of 70 kPa (0,7 bar) and measure the length. Increase the pressure to 2,4 MPa (24 bar) and measure the length once again within the following minute. The length variation is expressed as a percentage of the length at 70 kPa (0,7 bar).

5.8 Minimum bursting pressure

For all types and sizes of hose, the minimum bursting pressure shall be 12 MPa (120 bar) when tested in accordance with the method in ISO 1402.

5.9 Proof requirements

The hoses shall meet the requirements, without deterioration, of a proof test, consisting of hydrostatic pressure equal to 50 % of the minimum bursting pressure for a time of 2 min ± 30 s. During and after the proof pressure hold test, examine the hose which shall show no evidence of leakage, cracking or abrupt distortion (indicating irregularity in materials or manufacture), or other signs of failure.

5.10 Extraction

The quantity of substances extracted from the tube of the hose by the refrigerant shall not exceed 118 g/m^2 when tested in accordance with annex C. The substances extracted shall only be of an oily or greasy nature.

5.11 Volume change in oil No. 3

5.11.1 General

This requirement only applies to the inner tube of the hose.

5.11.2 Rubber materials

The test shall be carried out in accordance with ISO 1817, for 70 h at 100 °C ± 2 °C in oil No. 3. The volume change measured in the 5 min after taking the test piece out of the oil shall be between -5 % and +35 %.

5.11.3 Thermoplastic materials

The test shall be carried out in accordance with ISO 1817 for 70 h at 100 °C ± 2 °C in oil No. 3. The volume change measured in the 5 min after taking the test piece out of the oil shall be between -35 % and +5 %.

5.12 Tensile strength

The minimum force required to separate the hose from the coupling shall not be less than the values given in table 4. The test shall be carried out on a minimum free hose length of 300 mm.

Table 4 — Tensile strength of the hose assembly

Nominal bore	Types A, C and D N	Type B N
4,8	910	-
6,4	1 130	1 810
8	1 590	2 720
9,5	2 040	-
10	2 270	3 290
13	2 490	3 290
16	2 490	3 290
22	2 490	3 290
29	2 490	3 290

5.13 Ozone resistance

This requirement is not applicable to type B hose because type B hose is textile-covered. The test shall be carried out in accordance with ISO 7326:1991, method 1, with the hose bent around a mandrel with a diameter equal to eight times the outside diameter of the hose. The hose cover shall show no visible cracks.

5.14 Cleanliness

5.14.1 Requirement

The tube of the hose shall be dry and clean. The maximum quantity of foreign matter in the hose shall be 270 mg/m^2 when the test is carried out in accordance with 5.14.2. The minimum length of hose tested shall be 300 mm.

5.14.2 Procedure

Bend the hose or hose assembly into a U-shape, with the legs of the U of equal length. Place the hose in a vertical position and fill the hose to capacity with trichlorotrifluoroethane. Then empty the hose, filtering the trichlorotrifluoroethane through a prepared Gooch crucible, a sintered-glass crucible or a 0,4 μm filter of known mass.

After drying the filter and residue at approximately 70 °C for 20 min, determine the quantity of insoluble material by difference in mass.

5.15 Impulse test

The test shall be carried out in accordance with ISO 6803.

A minimum of two hose assemblies shall be installed on the test apparatus and subjected to a pulsating pressure of 170 kPa ± 170 kPa (1,7 bar ± 1,7 bar) to 2,6 MPa ± 170 kPa (26 bar ± 1,7 bar) at 30 to 40 cycles per minute, using a petroleum-base hydraulic oil having a viscosity at 107 °C ± 2 °C of 5 x 10^{-6} m^2/s to 10 x 10^{-6} m^2/s (5 cSt to 10 cSt). The test shall be performed at 107 °C ± 2 °C.

For types A, B and D, the minimum bend radius shall be five times the outside diameter of the hose. For type C, the minimum bend radius shall be in accordance with table B.1.

The hoses shall not leak or fail after 150 000 cycles.

6 Marking

Except where it is too small to label, the hose or hose assembly shall be marked with the following information:

a) the manufacturer's name or trademark;

b) the number of this part of ISO 8066 (i.e. ISO 8066-1);

c) the type of hose;

d) the nominal bore of the hose;

e) the refrigerant (i.e. R12);

f) the month and year of manufacture.

Example: MN;ISO 8066-1;A2;10;R12;08/1997

Annex A
(normative)

Test for measuring refrigerant loss

A.1 Scope

This annex specifies a method of measuring the loss of refrigerant from hose for automotive air conditioning.

A.2 Principle

The effusion rate of refrigerant through the walls of the hose is determined by measuring the change in mass of refrigerant-filled test pieces over a given period of time.

A.3 Apparatus

A.3.1 Canister, of internal volume between 475 cm^3 and 525 cm^3 and minimum bursting pressure 21 MPa (210 bar). It shall have appropriate fittings to enable four hose test pieces to be connected up to it.

A.3.2 Hose fittings, designed to enable the refrigerant to be held under pressure in the hose without any loss between the hose and the fittings.

A.3.3 Halogen detector, with a sensitivity of 11 g/year.

A.3.4 Circulating-air oven, capable of maintaining uniform test temperatures (see A.5.4) for the duration of the test.

A.3.5 Scales, accurate to 0,1 g.

A.4 Test pieces

Four test pieces, each with a free length of 1 m, are required. Three of these test pieces shall be used for determining gas loss; the fourth shall serve as a reference for the determination of the change in mass of the body of the hose alone. One of the ends of each test piece shall be plugged.

A.5 Procedure

A.5.1 Preliminary operations

Measure the free length of each test piece at atmospheric pressure to the (A.3.1) nearest 1 mm. Weigh each of the four test pieces, including the end plug. Connect the four test pieces to the canister and determine the mass of each, including the end plug, to 0,1 g. Fill three with 0,6 mg of refrigerant 12 per mm^3 volume of the test piece, with a tolerance of ± 5 g (any appropriate method whereby the hoses can be safely filled may be used; the methods in A.5.2 and A.5.3 are recommended).

Check the tightness of each with the halogen detector (A.3.3).

A.5.2 Method 1

Cool the test pieces and the refrigerant in a refrigerator for 4 h minimum at a temperature of -34 °C or less.

From the density of the refrigerant at the conditioning temperature and the length and internal diameter of the hose, it is possible to calculate the mass of refrigerant required in the test piece at this temperature. Keeping the refrigerant and hose at the conditioning temperature, the hose may be filled, measuring the volume of liquid refrigerant calculated using a graduated flask.

The filled test pieces shall be corked while still at the conditioning temperature, but may be taken out of the refrigerator to tighten them to ensure true tightness.

A.5.3 Method 2

The hoses and canister may be filled at ambient temperature by transferring refrigerant under pressure. Adequate apparatus for this purpose is a cylinder of refrigerant, a receiver-type compressed-air system, a piston pump and a control device for measuring the quantity of liquid transferred.

A.5.4 Determination

Place the three filled test pieces and the filled reference test piece in the circulating-air oven (A.3.4) at the specified test temperature for 30 min ± 5 min to eliminate surface moisture.

Once a test piece has been placed in the oven, the bend imposed on it shall not exceed 20 times the nominal external diameter of the hose.

Remove the test pieces from the oven and check that they are not leaking.

Replace the hoses in the oven, at the specified test temperature, for 24 h. At the end of this period, take the hoses out and weigh them within a minimum of 15 min and a maximum of 30 min. Record the mass obtained as the initial mass of the test piece (this 24 h period is a conditioning period, and no account is taken of any variation in mass during this period in the final calculation).

Replace the hoses in the oven for another 72 h. At the end of this period, reweigh in the same way as before and record the mass obtained as the final mass.

A.6 Calculation

Calculate the rate of loss of refrigerant from each test piece as follows:

$$R = \left(\frac{m_1 - m_2}{l_1} - \frac{m_3 - m_4}{l_2} \right) \frac{k}{d}$$

where

m_1 is the initial mass, in grams, of the filled test piece after the conditioning period;

m_2 is the final mass, in grams, of the filled test piece after 72 h;

m_3 is the initial mass, in grams, of the reference test piece after the conditioning period;

m_4 is the final mass, in grams, of the reference test piece after 72 h;

R is the rate of loss of refrigerant, in kilograms per m^2 per year;

l_1 is the length of the test piece, in metres;

l_2 is the length of the reference test piece, in metres;

d is the internal diameter of the hose, in millimetres;

k is a constant (38,7).

A.7 Test report

The test report shall include the following information:

a) a reference to this part of ISO 8066;

b) all details necessary for complete identification of the hose tested;

c) the results obtained;

d) any incident which is likely to have affected the results.

Annex B
(normative)

Low-temperature test

B.1 Scope

This method assesses the behaviour at low temperature (-30 °C) of hose for automotive air conditioning.

B.2 Principle

The test verifies that a hose filled with liquid refrigerant 12, aged beforehand for 48 h at 70 °C, kept at -30 °C for 24 h, then bent to 180° on a mandrel, withstands a pressure of 2,4 MPa (24 bar) for 5 min without leaking.

B.3 Test piece

The length of the test piece shall be between 450 mm and 1 000 mm.

B.4 Procedure

Fill the test piece with a quantity of liquid refrigerant 12 corresponding to 70 % of the capacity of the hose at ambient temperature. The hose assembly and the liquid may be cooled to below -34 °C to facilitate handling.

Place the hose in a circulating-air oven at 70 °C for 48 h. Take the hose out and allow to cool to ambient temperature.

Keeping the hose straight, leave in a refrigerator at -30 °C for 24 h. The refrigerator shall be able to maintain a uniform atmosphere of cold dry air or a mixture of air and carbon dioxide at the specified temperature, with a tolerance of ± 2 °C. Without taking the hose out of the refrigerator, bend to 180° on a mandrel of suitable diameter (see below) in 4 s to 8 s.

For hose types A, B and D, the mandrel diameter shall be equal to eight times the nominal external diameter. For type C, the diameter of the mandrel shall be equal to twice the minimum bend radius shown in table B.1. Allow the hose to warm up to ambient temperature and remove the liquid refrigerant.

Subject the connected hose to a hydrostatic pressure of 2,4 MPa (24 bar) or 5 min. Detect any leak or loss due to cracks.

B.5 Test report

The test report shall include the following information:

a) a reference to this part of ISO 8066;

b) all details necessary for complete identification of the hose tested;

c) the results obtained;

d) any incident which is likely to have affected the result.

Table B.1 — Minimum bend radius for type C hoses

Nominal bore	Minimum bend radius mm
4,8	50
6,4	76
8	90
9,5	102
10	114
13	127
16	165
19	203

Annex C
(normative)

Determination of amount of matter extracted from hoses by liquid refrigerant 12

C.1 Scope

This method measures the quantity of material extracted by liquid refrigerant 12 from the tube in air-conditioning hose assemblies.

C.2 Principle

The extraction is achieved by keeping the liquid refrigerant for 24 h at 70 °C inside the hose assembly.

C.3 Test piece

The free length of the hose assembly shall be between 450 mm and 1 000 mm.

C.4 Procedure

Fill the test piece to capacity with trichlorotrifluoroethane to remove any surface contamination, then empty immediately. Fill the test piece to 70 % of its capacity, at ambient temperature, with liquid refrigerant 12. For convenience, the hose assembly and refrigerant may be cooled to below -34 °C to facilitate handling. Weigh the loaded hose assembly and then place it in a circulating-air oven at 70 °C ± 2 °C for 24 h. At the end of this period, cool the hose to -34 °C or lower and pour the liquid refrigerant into a tared beaker and allow to evaporate at ambient temperature. After evaporating the liquid refrigerant, maintain the beaker at 70 °C for 1 h to eliminate the condensed moisture, then reweigh.

C.5 Expression of results

Express the result in grams per m^2 of internal hose surface, based on the internal diameter of the hose.

C.6 Test report

The test report shall include the following information:

a) a reference to this part of ISO 8066;

b) all details necessary for complete identification of the hose tested;

c) the result obtained;

d) any incident which is likely to have affected the result.

ICS 43.040.60; 83.140.40

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