INTERNATIONAL STANDARD

ISO 8066-2

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

Part 2: **Refrigerant 134a**

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

Partie 2: Réfrigérant 134a

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 part of ISO 8066 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 8066-2 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, B, C, D and E form a normative part of this part of ISO 8066. Annex F is for information only.

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

Part 2: **Refrigerant 134a**

WARNING — Persons using this part of ISO 8066 should be familiar with normal laboratory practice. This part of ISO 8066 does not purport to address all of 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 part of ISO 8066 specifies the requirements for rubber or thermoplastic hoses and hose assemblies used for circulating liquid and gaseous R134a (tetrafluoroethane) in the air-conditioning systems of automobiles. The hoses and hose assemblies are designed in such a way as to restrict losses of refrigerant and contamination of the system. The operational temperature range is – 40 °C to + 125 °C.

Due to the critical relationship between the hose and coupling for this application, a requirement that the coupling to be used in service be used for testing is laid down.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 8066. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 8066 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC 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 1817:1999, *Rubber, vulcanized — Determination of the effect of liquids*

ISO 3448:1992, *Industrial liquid lubricants — ISO viscosity classification*

ISO 4671:1999, *Rubber and plastics hoses and hose assemblies — Methods of measurement of dimensions*

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 8330:2001, *Rubber and plastics hoses and hose assemblies — Vocabulary*

SAE J51:1998, *Refrigerant 12 Automotive Air-Conditioning Hose*

SAE J2064:1999, *R134a Refrigerant Automotive Air-Conditioning Hose*

3 Terms and definitions

For the purposes of this part of ISO 8066, the terms and definitions given in ISO 8330 apply.

4 Classification

4.1 Grades

4.1.1 Grades A1 and A2 — Rubber, textile-reinforced

Hoses having a seamless, rubber lining, a reinforcement consisting of textile yarn, cord or fabric bonded to the lining and cover, and an outer cover of heat- and ozone-resistant rubber.

NOTE Commercial products normally offered for grade A1 hoses have a one-braid reinforcement of textile yarn and an outside diameter smaller than that of grade A2 hoses. Grade A2 hoses are a two-braid hose. Hose fittings for grade A1 and A2 hoses are not normally interchangeable.

4.1.2 Grade B — Rubber, wire-reinforced

Hoses having a seamless, rubber lining, a reinforcement consisting of wire, and a cover consisting of a heat-resistant textile yarn impregnated with a rubber cement.

4.1.3 Grade C — Thermoplastic-barrier, textile-reinforced, rubber-covered

Hoses having a lining comprising a thermoplastic barrier with a layer of rubber on each side, a reinforcement consisting of textile yarns, and a cover of heat- and ozone-resistant rubber.

4.1.4 Grade D — Thermoplastic-veneer, textile-reinforced, rubber-covered

Hoses having a rubber lining with a thin thermoplastic veneer on the inside (fluid side), a reinforcement consisting of textile yarn, cord or fabric bonded to the lining and cover, and a cover of heat- and ozone-resistant rubber.

4.1.5 Grade E — Thermoplastic, textile-reinforced, thermoplastic-covered

Hoses having a seamless thermoplastic inner lining, a reinforcement consisting of textile yarn, cord or fabric bonded to the lining and cover, and a cover of heat- and ozone-resistant thermoplastic.

4.2 Groups

4.2.1 Group 1 — Discharge/liquid, moisture-resistant

Hoses for use in discharge/liquid applications that have moisture resistance as defined in 6.15.

4.2.2 Group 2 — Discharge/liquid, medium moisture-resistant

Hoses for use in discharge/liquid applications that have medium moisture resistance as defined in 6.15.

4.2.3 Group 3 — Suction, moisture-resistant

Hoses for use in suction applications that have moisture resistance as defined in 6.15.

4.2.4 Group 4 — Suction, medium moisture-resistant

Hoses for use in suction applications that have medium moisture resistance as defined in 6.15.

5 Dimensions

5.1 Hose inside and outside diameters

When measured in accordance with method 2 of ISO 4671:1999, the hose inside diameter shall conform to the requirements given in Table 1. When measured in accordance with method 1 of ISO 4671:1999, the hose outside diameter shall conform to the requirements given in Table 2.

Table 1 — Inside diameter

Dimensions in millimetres

Nominal bore	Inside diameter											
	Grade A1		Grade A2		Grade B		Grade C		Grade D		Grade E	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
4,8					4,8	5,4					4,6	5,1
6,4	6,2	7,0									6,1	6,7
8	7,8	8,6	7,8	8,6	8,0	8,7	7,8	8,6	8,0	8,7	7,6	8,3
9,5											9,1	9,9
10	10,2	11,1	10,2	11,1	10,3	11,1	10,2	11,1	10,3	11,1	9,9	10,7
13	12,4	13,6	12,4	13,6	12,7	13,7	12,4	13,6	12,7	13,7	12,2	13,2
16	15,6	16,8	15,6	16,8	15,9	16,9	15,6	16,8	15,9	16,9	15,2	16,5
22					22,2	23,3			22,2	23,3		
29					28,6	29,8			28,6	29,8		

Table 2 — Outside diameter

Dimensions in millimetres

Nominal bore	Outside diameter											
	Grade A1		Grade A2		Grade B		Grade C		Grade D		Grade E	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
4,8					12,7	13,7						8,3
6,4	13,5	15,1										11,4
8	17,5	19,1	18,3	19,8	16,7	17,6	18,3	19,8	16,7	17,6		13,5
9,5												15,2
10	21,4	23,0	22,2	23,8	18,9	20,0	22,2	23,8	18,9	20,0		16,1
13	23,8	25,4	24,6	26,2	22,8	24,0	24,6	26,2	22,8	24,0		18,8
16	27,8	28,5	27,8	29,4	26,8	28,0	27,8	29,4	26,8	28,0		23,4
22					30,6	32,2			30,6	32,2		
29					37,3	38,9			37,3	38,9		

5.2 Hose wall thickness variation

When the wall thickness is measured in accordance with method 2 of ISO 4671:1999, the variation in the wall thickness shall not exceed the values given in Table 3.

Table 3 — Wall thickness variation

Grades A, B, C and D		Grade E	
Nominal bore	**Maximum departure from concentricity** mm	**Nominal bore**	**Maximum departure from concentricity** mm
4,8 and 6,4	0,8	4,8 and 6,4	0,5
8 to 22	1,0	8 to 13	0,6
29	1,3	16	0,8

6 Testing and performance requirements

6.1 Test conditions and test fluid

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.

Except for the extraction test in 6.10 which uses refrigerant R134a only, the refrigerant used shall be R134a containing (10 ± 1) % of poly(alkylene glycol) (PAG) lubricating oil when required. The hose shall be tested with the same couplings as those intended for end use. The end termination of the coupling may be of a convenient type for testing.

6.2 Leakage

6.2.1 Requirement

When determined in accordance with the procedure given in 6.2.2, the loss in mass of refrigerant shall be no greater than 10 % of the initial mass of the refrigerant and there shall be no visible deterioration in the hoses or hose assemblies.

6.2.2 Procedure

Test three test pieces. Fill each test piece with R134a containing (10 ± 1) % PAG oil. Maintain each test piece for 24 h at a temperature of 90 °C ± 2 °C.

NOTE This test may be carried out separately or during the 24 h pre-conditioning period for the refrigerant loss test (see 6.3) at 90 °C ± 2 °C.

In the event that the test is carried out separately from 6.3, use the procedure described in annex A.

6.3 Refrigerant loss

6.3.1 Requirement

When determined in accordance with the procedure described in 6.3.2, the loss of refrigerant from the hoses or hose assemblies shall be no greater than the values given in Table 4.

6.3.2 Procedure

Test the hoses or hose assemblies in accordance with the procedure described in annex A at the temperature specified in Table 4. Test hoses or hose assemblies used in the part of the system operating at high pressure at 90 °C ± 2 °C. Test hoses or hose assemblies used in the part of the system operating at low pressure (suction line applications) at 80 °C ± 2 °C.

Table 4 — Refrigerant loss

Test temperature °C	**Maximum allowable loss of refrigerant** [a] kg/m^2/year	
	Grades A and B	**Grades C, D and E**
80	29,0	9,7
90	40,0	30,0

[a] Based on the internal surface area of the hose.

6.4 Ageing

6.4.1 Requirement

When tested in accordance with 6.4.2, there shall be no leak or loss during the test from cracks in a test hose or hose assembly.

6.4.2 Procedure

Wind a hose or hose assembly, of length between 300 mm and 1 000 mm, on to a mandrel having a diameter eight times the outside diameter of the hose. Place the mandrel and hose or hose assembly in a circulating-air oven for 168 h at 125 °C ± 2 °C.

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

6.5 Low-temperature test

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

6.6 Reduced pressure

6.6.1 General

A hose or hose assembly shall be subjected, consecutively, to the reduced-pressure test, then the length variation test (6.7), then the burst test (6.8).

6.6.2 Requirement

The decrease in the outside diameter of the hose shall not exceed 20 % of the initial outside diameter when the hose or hose assembly is subjected to a reduced internal pressure (vacuum) of 13,3 kPa ± 6 kPa (absolute) for 2 min in accordance with 6.6.3.

6.6.3 Procedure

The test hose or hose assembly shall have a free length of from 610 mm to 1 000 mm. Bend the hose into a U-shape, whereby the internal radius of the base of the U shall be five times the mean outside diameter of the hose. Apply a vacuum of 13,3 kPa ± 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 outside diameter of the hose at the base of the U, in order to determine the minimum outside diameter at that point.

6.7 Length change under pressure (see 6.6)

6.7.1 Requirement

When subjected to a pressure of 2,4 MPa (24 bar), a hose or hose assembly shall not contract by more than 4 % or extend by more than 2 %.

6.7.2 Procedure

Subject the hose or hose assembly, in a horizontal position, to an internal hydrostatic pressure of 7 kPa (0,07 bar) and measure the length. Increase the pressure to the prescribed value and measure the length once again within the following minute. Express the length as a percentage of the length at 7 kPa (0,07 bar).

Refer to ISO 1402 for additional information.

6.8 Minimum bursting pressure (see 6.6)

When determined in accordance with the method described in ISO 1402, using test pieces that have been subjected to the test for refrigerant loss described in 6.3, the minimum bursting pressure shall be 12 MPa (120 bar) for all grades and sizes of hose and hose assembly.

6.9 Proof pressure

6.9.1 Requirement

When tested in accordance with the procedure described in 6.9.2, a hose or hose assembly shall exhibit no leakage, cracking, abrupt distortion (indicating irregularity in materials or manufacture) or other signs of failure.

6.9.2 Procedure

Hydrostatically pressurize a hose or hose assembly to 50 % of the minimum burst pressure and hold the pressure for 2 min ± 30 s. During and after the proof pressure hold period, examine the hose.

6.10 Extraction by R134a

When determined in accordance with annex C, the quantity of matter extracted from the lining of the hose by the R134a shall not exceed 118 g/m^2.

NOTE The substances extracted will be of an oily or greasy nature.

6.11 Volume change in R134a

6.11.1 General

This requirement applies only to the lining of the hose and is carried out by the method described in ISO 1817.

Place a test portion of the lining in a pressure vessel, cooled to below – 30 °C and totally immersed in R134a containing (10 ± 1) % PAG oil. Seal the vessel and place it in a circulating-air oven at 90 °C ± 2 °C.

6.11.2 Rubber materials

When the test is carried out in accordance with ISO 1817 for 70 h at 90 °C ± 2 °C in R134a containing (10 ± 1) % PAG oil, the volume change measured during the 5 min after taking the test portion out of the refrigerant shall be between – 5 % and + 35 %.

6.11.3 Thermoplastic materials

When the test is carried out in accordance with ISO 1817 for 70 h at 90 °C ± 2 °C in R134a containing (10 ± 1) % PAG oil, the volume change measured during the 5 min after taking the test portion out of the refrigerant shall be within ± 5 %.

6.12 Ozone resistance

This requirement applies only to grade A, C, D and E hoses.

Bend the hose around a mandrel with a diameter equal to eight times the mean outside diameter of the hose, and carry out the test in accordance with method 1 of ISO 7326:1991 using an ozone concentration of 50 mPa ± 5 mPa.

The hose cover shall exhibit no visible cracks when viewed under × 2 magnification.

6.13 Hose cleanliness

6.13.1 Requirement

The tube of the hose shall be dry and clean. When determined in accordance with 6.13.2, the mass of insoluble matter shall be a maximum of 270 mg/m^2 based on the internal surface area of the hose.

6.13.2 Procedure

Take a hose test piece having a minimum length of 300 mm. Bend the hose into a U-shape, with the legs of the U of equal length. Place the hose in a vertical position and fill the hose with a solvent suitable as a substitute for trichlorotrifluorethane (CFC113).

The following solvents can be used as substitutes for trichlorotrifluorethane (this is only a partial list of acceptable substitutes, and other materials may be more readily available):

— *N*-propyl bromide, which is manufactured by Amity under the trade name Leksol;

— hydrofluoroether, which is manufactured by 3M under the trade name HFE 7100;

— decafluoropentane/dichloroethylene blend, which is manufactured by DuPont under the trade name Vertrel MCA.

NOTE Trichlorotrifluorethane used to be the recommended solvent for this test, but it is not available for most applications and in many locations since it has been identified as an ozone-depleting chemical.

Immediately empty the hose, filtering the solvent 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 mass of insoluble matter by difference.

6.14 Impulse test

6.14.1 Requirement

When tested in accordance with 6.14.2, hoses or hose assemblies shall not leak or fail after 150 000 cycles.

6.14.2 Procedure

Carry out the test in accordance with ISO 6803.

Install a minimum of two hoses or hose assemblies on the test apparatus and subject them to a pulsating pressure of 500 kPa ± 500 kPa (5 bar ± 5 bar) to 2,6 MPa ± 130 kPa (26 bar ± 1,3 bar) at 30 cycles to 40 cycles per min. Use oil conforming to ISO VG 46 at 40 °C in accordance with ISO 3448. Perform the test at 125 °C ± 2 °C.

Use a minimum bend radius of five times the outside diameter of the hose.

6.15 Water ingress test

When determined in accordance with annex D, the rate of ingress of moisture shall not exceed the values listed in Table 5.

Table 5 — Rate of ingress of moisture

Hose	Maximum rate of ingress of moisture g/mm²/year
Moisture-resistant hose	$3,90 \times 10^{-4}$
Medium moisture-resistant hose	$1,11 \times 10^{-3}$

6.16 Coupling integrity (sealability)

The couplings used shall be the same as those intended for use in service.

Carry out the test in accordance with annex E.

The maximum mass loss per canister (two couplings) per 12-day test shall not exceed 10 g.

None of the four post-exposure flexing evaluations shall produce hissing or visible oil loss at any location in the coupled assembly.

7 Marking

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

a) the manufacturer's name and trademark;

b) the number of this part of ISO 8066, i.e. ISO 8066-2:2001;

c) the grade of hose;

d) the group of hose;

e) the nominal bore of the hose;

f) the name of the refrigerant, i.e. "R134a";

g) the month and year of manufacture.

EXAMPLE MAN/ISO 8066-2/A2/1/16/R134a/09/01

Annex A
(normative)

Determination of refrigerant loss

A.1 Principle

The rate of effusion 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.2 Apparatus

A.2.1 Canister, having an internal volume between 475 cm^3 and 525 cm^3, a minimum bursting pressure of 21 MPa (210 bar) and appropriate fittings to enable a hose test assembly to be connected up to it.

A.2.2 Hose fittings, enabling the refrigerant to be held under pressure in the hose without any loss between the hose and the fittings, and being the same as the fittings intended for use in service.

A.2.3 Circulating-air oven, capable of maintaining uniform test temperatures for the duration of the test.

A.2.4 Scales, weighing to ± 0,1 g.

A.3 Test assemblies

Take four assemblies, each with a free length of 1 m. Three of these assemblies shall be used for determining the refrigerant loss; the fourth shall serve as a reference for the determination of the change in mass of the body of the hose alone.

A.4 Procedure

A.4.1 Preliminary operations

Measure the free length of each hose at atmospheric pressure to the nearest 1 mm. Connect each of the four hoses to a canister and determine the mass of each hose/canister assembly, including the end-plug which will be used to plug the free end of the hose, to within ± 0,1 g. Introduce into three of the hose/canister assemblies 0,6 mg of refrigerant R134a containing (10 ± 1) % PAG oil per mm^3 volume of the assembly with a tolerance of ± 5 g.

NOTE Method 1 (see A.4.2) and method 2 (see A.4.3) are recommended for introducing the refrigerant into the assemblies.

A.4.2 Method 1

The hose/canister assemblies may be filled satisfactorily by cooling them in a refrigerator for a minimum of 4 h at a temperature of – 30 °C or lower.

From the density of refrigerant R134a and (10 ± 1) % PAG oil at the conditioning temperature, it is possible to calculate the volume of refrigerant/PAG mixture required at this temperature. Keeping the refrigerant/PAG mixture and hose at the conditioning temperature, the hose may then be filled, measuring the volume of refrigerant/PAG mixture using a graduated flask.

The filled assemblies are then plugged while still at the conditioning temperature, but may be taken out of the refrigerator to tighten the connections.

A.4.3 Method 2

The hose/canister assemblies may be filled at ambient temperature by transferring the refrigerant/PAG mixture under pressure. A suitable apparatus for this purpose is a cylinder of refrigerant, a receiver-type compressed-air system, a piston pump and a meter for measuring the quantity of liquid transferred.

A.4.4 Determination

A.4.4.1 Condition the three filled assemblies and the reference assembly by placing them together in the oven at the test temperature specified for 30 min ± 5 min to eliminate surface moisture. When in the oven, the assemblies shall not be bent to such an extent that the radius of curvature is less than 20 times the outside diameter of the hose.

A.4.4.2 Take the assemblies out of the oven and ensure that the filled assemblies are not leaking. Weigh them a minimum of 15 min and a maximum of 30 min after taking them out of the oven. Record the initial mass of each filled assembly (m_1) and the initial mass of the reference assembly (m_3).

A.4.4.3 Expose the four assemblies to a 24 h period in the oven at the test temperature specified. Weigh the assemblies at the end of this first 24 h period as specified in A.4.4.2 and record the mass of each filled assembly (m_2) and the mass of the reference assembly (m_4) for that cycle.

A.4.4.4 Repeat the 24 h exposure/weighing cycle until a steady state is reached, i.e.

a) until the values of the net loss of refrigerant $[(m_1 - m_2) - (m_3 - m_4)]$ for the last four exposure cycles are within 10 % of the lowest value

or

b) for 25 days,

whichever occurs first.

A.5 Calculation

Calculate the rate of loss of refrigerant R, in kilograms per square metre per year, for each of the filled assemblies using equation (1):

$$R = \left[\frac{(m_1 - m_2)}{l_1} - \frac{(m_3 - m_4)}{l_2} \right] \times \left(\frac{k}{d \times t} \right) \quad (1)$$

where

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

m_2 is the final mass of the filled assembly at the steady state, in grams;

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

m_4 is the final mass of the reference assembly at the steady state, in grams;

l_1 is the length of the filled assembly, in metres;

l_2 is the length of the reference assembly, in metres;

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

k is a constant (116,2) to convert *R*-values to kilograms per square metre per year;

t is the time taken to reach the steady state, in days.

A.6 Test report

The test report shall include the following information:

a) a reference to this part of ISO 8066, i.e. ISO 8066-2:2001;

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

c) all details necessary for complete identification of the coupling used;

d) the results obtained;

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

Annex B
(normative)

Low-temperature test

B.1 Principle

The test verifies that a hose filled with refrigerant R134a containing (10 ± 1) % PAG oil, aged beforehand for 48 h at 70 °C, kept at – 40 °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.2 Test assembly

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

B.3 Procedure

Fill the test assembly with a quantity of liquid R134a containing (10 ± 1) % PAG oil corresponding to 70 % of the capacity of the hose at ambient temperature. The hose assembly and the liquid may be cooled below – 30 °C so that the refrigerant is in the liquid state, thus facilitating handling.

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

Keeping the hose straight, place the assembly in a test chamber at – 40 °C and leave for 24 h. The test chamber shall be able to maintain a uniform atmosphere of cold dry air or a mixture of air and carbon dioxide at the specified temperature to within ± 2 °C. Without taking the hose out of the test chamber, bend to 180° on a mandrel of diameter 8 times the mean outside diameter of the hose in 4 s to 8 s.

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) for 5 min. Examine for any leak or loss due to cracks.

B.4 Test report

The test report shall include the following information:

a) a reference to this part of ISO 8066, i.e. ISO 8066-2:2001;

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.

Annex C
(normative)

Determination of amount of matter extracted from hoses by liquid R134a

C.1 Principle

This method measures the quantity of material extracted by liquid R134a from the tube in air-conditioning hose assemblies. The extraction is achieved by keeping the liquid refrigerant for 24 h at 70 °C inside the hose assembly.

C.2 Test assembly

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

C.3 Procedure

Fill the test assembly to capacity with one of the following solvents: *n*-propyl bromide, a hydrofluoroether or a decafluoropentane/dichloroethylene blend, then empty immediately to remove any surface contamination.

NOTE Trichlorotrifluorethane used to be the recommended solvent for this purpose, but it is not available for most applications and in many locations since it has been identified as an ozone-depleting chemical.

Fill the test assembly to 70 % of its capacity at ambient temperature with liquid R134a. For convenience, the hose assembly and refrigerant may be cooled to below − 30 °C so that the refrigerant is in the liquid state, thus facilitating handling. Place the filled assembly in a circulating-air oven at 70 °C ± 2 °C for 24 h. At the end of this ageing period, cool the hose to − 34 °C or lower, pour the liquid refrigerant into a tared beaker and allow to evaporate at ambient temperature. After the liquid refrigerant has evaporated, condition the beaker at 70 °C for 1 h to eliminate condensed moisture, then reweigh.

C.4 Expression of results

Express the result in g/m^2 of internal hose surface, based on the nominal inside diameter of the hose.

C.5 Test report

The test report shall include the following information:

a) a reference to this part of ISO 8066, i.e. ISO 8066-2:2001;

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.

Annex D
(normative)

Water ingression test

NOTE Reproduced, with permission, from Society of Automotive Engineers standard SAE J2604:1993.

D.1 Principle

Hose assemblies are subjected to a humid environment and a vacuum is drawn on the inside of the hose. The amount of water which ingresses through the hose wall is measured.

D.2 Apparatus (see Figure D.1)

D.2.1 Humidity cabinet.

D.2.2 Methanol/dry-ice bath, maintained at – 70 °C or lower.

D.2.3 Vacuum/cold-trap system.

D.2.4 Vacuum pump.

D.2.5 Nitrogen gas or dry-air supply.

D.2.6 Distilled water.

D.2.7 Circulating-air oven, capable of maintaining 80 °C.

D.2.8 Desiccator.

D.2.9 Balance, capable of 0,000 1 g accuracy.

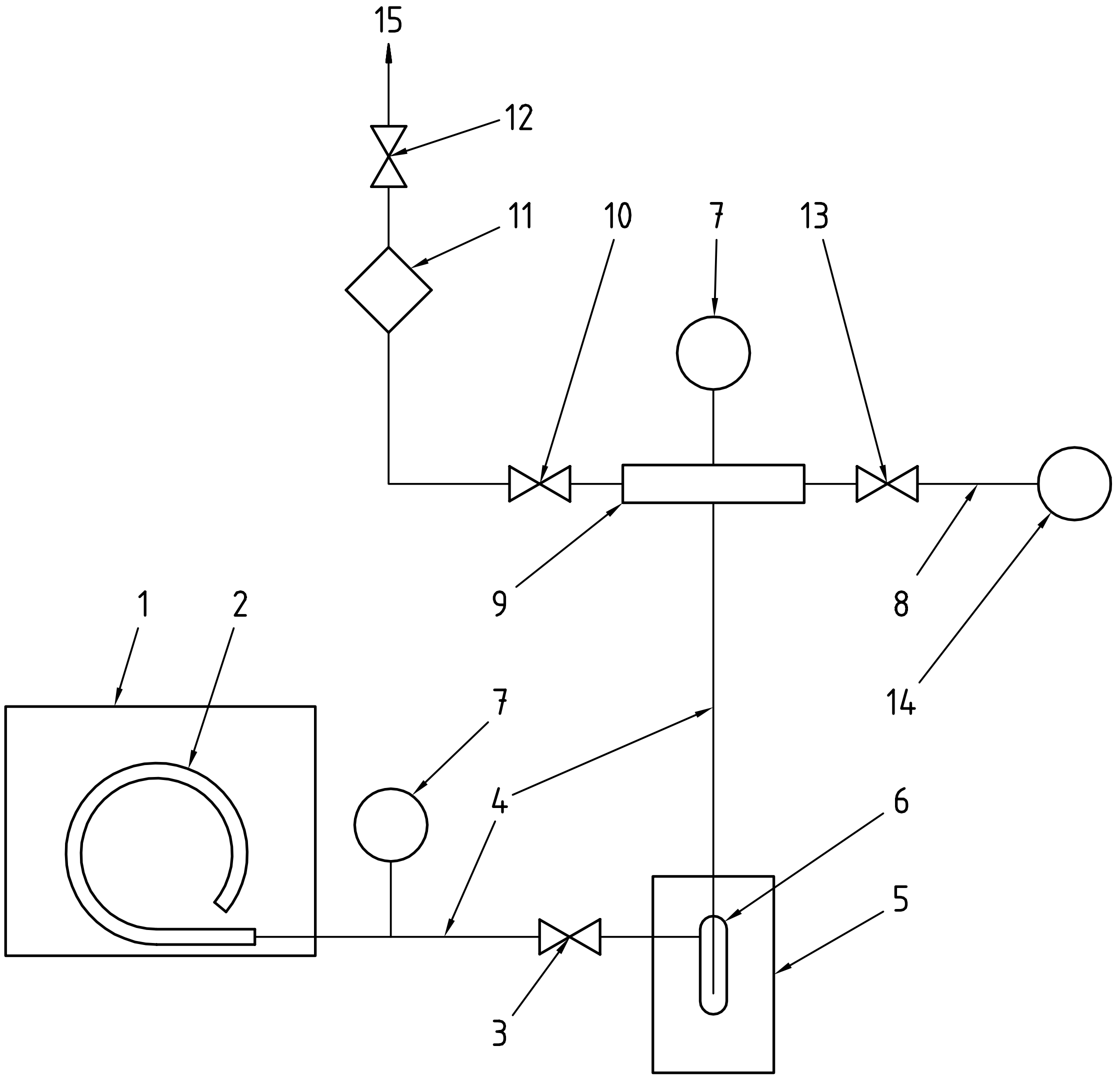
D.3 Test assemblies

Prepare a minimum of two test assemblies with couplings crimped on each end. There shall be 1 500 mm ± 25 mm of exposed hose length between the couplings.

Measure and record the inside diameter of each hose assembly in the same way as in 4.1.

Measure and record the exposed length of hose between the couplings.

Leak-check to ensure a leak-free assembly.



Key

1 Humidity cabinet
2 Hose assembly
3 Stainless-steel valve
4 Copper or stainless-steel tubing
5 Methanol/dry-ice bath
6 Glass vacuum trap
7 Vacuum gauge
8 Vacuum hose
9 Vacuum manifold
10 Stainless-steel valve
11 Desiccant (indicator silica gel)
12 Quick-open valve
13 Vacuum valve
14 Vacuum pump
15 To atmosphere

Figure D.1 — Water ingression test schematic

D.4 Procedure

D.4.1 Install the test assemblies in the humidity cabinet by plugging one end fitting and attaching the other end to one of the vacuum lines located in the cabinet. Arrange the test assemblies to maximize surface exposure to the environmental conditions (see Figure D.1).

D.4.2 Seal the humidity cabinet and set the dry-bulb temperature at 50 °C ± 2 °C and wet-bulb temperature at 47,2 °C ± 2 °C. Allow the cabinet to stabilize for at least 4 h at the specified temperatures and (85 ± 5) % relative humidity.

D.4.3 Thoroughly clean all vacuum traps, inside and out, by using dry compressed air or nitrogen and a suitable solvent.

D.4.4 Wipe off the traps and then place in an oven set at 80 °C ± 2 °C for a minimum of 1 h.

D.4.5 Upon removing the traps from the oven, immediately transfer to a desiccator for stabilization at room temperature.

D.4.6 When the traps have reached room temperature, remove them one at a time, wipe the trap exterior with a lint-free towel, and immediately weigh to the nearest 0,1 mg. Plug the end of each trap immediately after weighing. Record the mass of each trap.

D.4.7 Immediately after weighing, install the traps (item 5 in Figure D.1) in a bath maintained at (– 70 ± 2) °C and attach the traps to the connecting lines using vacuum grease on all O-ring connections.

D.4.8 After all connections are made, turn on the vacuum pump and open valve 12 and then valve 2 and valve 11. A quick vacuum check can be carried out as follows:

a) Close valve 12.

b) Shut off the pump for approximately 5 min, noting any vacuum drop. If there is any loss, seal the leak and then recheck.

c) Restart the vacuum pump and open valve 12.

d) After running system for 1 h, close valve 12 and turn off the vacuum pump for 30 min. If there is any loss of vacuum, the test shall be discontinued and the leak sealed. Return to D.4.3 to restart the test.

D.4.9 Once the system is evacuated and integrity is ensured, maintain a vacuum of 95 kPa (absolute). Record the time and temperatures.

D.4.10 After 24 h has elapsed, proceed to the sequence of operations in D.4.11. Longer periods may be used as long as the data are adjusted to the specified time period (72 h or 96 h).

D.4.11 Sequence of operations (for installation of new moisture traps):

a) Record the time and the temperatures of the wet and dry bulbs and the trap bath.

b) Close valve 2.

c) Close valve 12.

d) Turn off the vacuum pump.

e) Slowly open valve 9 and then valve 11. This sequence is necessary to ensure the traps are charged with dry nitrogen or dry air at atmospheric pressure [the regulator of the gas supply shall be set at 7 kPa (1 psi)].

f) Remove the traps one at a time and immediately plug all tubing connections.

g) Install another set of traps prepared using steps d) to g).

h) Allow the traps removed from the cold bath to return to room temperature in a desiccator.

i) Wipe the exterior of each trap with a lint-free towel, remove the plugs, and immediately weigh each.

j) Calculate the change in mass and record.

D.4.12 Repeat D.4.8, D.4.9, and D.4.11 at 72 h or 96 h intervals until steady-state conditions are reached. A steady state is taken as reached when the last four readings are within 10 % of the lowest reading of the last four.

D.5 Calculation

Calculate the average condensate mass collected during a 24 h period using equation (D.1):

$$A = \left(\frac{R_1 + R_2 + R_3 + R_4}{4}\right) \times \left(\frac{24}{t}\right) \quad \text{(D.1)}$$

where

A is the average condensate mass, in grams per 24 h;

R_1 is reading 1 (see below), in grams;

R_2 is reading 2, in grams;

R_3 is reading 3, in grams;

R_4 is reading 4, in grams;

t is the time interval between readings, in hours (i.e. 72 h or 96 h).

Reading 1, reading 2, reading 3 and reading 4 are the last four readings taken after steady-state conditions have been reached.

Calculate the water ingression rate using equation (D.2):

$$W = \frac{AY}{\pi D L} \quad \text{(D.2)}$$

where

W is the water ingression rate, in grams per square millimetre per year;

A is the average condensate mass, in grams per 24 h;

Y is 365 (to convert time from days to years);

D is the inside diameter of the hose, in millimetres;

L is the exposed hose length between the couplings, in millimetres.

D.6 Test report

The test report shall include the following information:

a) a reference to this part of ISO 8066, i.e. ISO 8066-2:2001;

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

c) all details necessary for complete identification of the couplings used;

d) the result obtained;

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

Annex E
(normative)

Coupling integrity (sealability)

E.1 Principle

This test evaluates hose performance and the compatibility between the hose and end fitting by cycling refrigerant-charged assemblies through temperature extremes from + 125 °C to – 30 °C.

E.2 Test assemblies

Take six production-coupled assemblies having 76 mm ± 3 mm of exposed hose and 56 mm ± 8 mm of straight nominal outside diameter metal tubing between the couplings and terminations. Attach each assembly to a canister having an internal volume of 1 260 cm^3 ± 25 cm^3 and equipped with a charging fitting.

E.3 Procedure

E.3.1 Charge 10 cm^3 ± 1 cm^3 of PAG oil into each canister/hose assembly. Evacuate and add 103 g ± 1 g of R134a refrigerant. Weigh the test assembly to give the original mass. Check all fittings to ensure against extraneous R134a leakage. Ensure that this weighing and all subsequent weighings are made in the temperature range 18 °C to 29 °C to the nearest 0,01 g. After charging, agitate the assembly to ensure that the refrigerant and lubricant are mixed and all internal surfaces are wetted.

E.3.2 Orient the assembly so that the canister is at 4° ± 2° to the horizontal to ensure that the liquid will always drain into the hose. Subject the canister/hose assembly to the following exposures, in the sequence given, and follow each exposure with a leakage evaluation and, when required, recharging, before the next exposure:

Exposure 1 — 96 h at 125 °C ± 2 °C with a canister pressure of 2,07 MPa (20,7 bar).

Exposure 2 — 48 h of thermal cycling between – 30 °C and + 125 °C in a timer-controlled chamber, the chamber temperature changing every 4 h and the chamber design being such that the canister/hose assembly reaches the desired temperature within 3 h of each temperature change.

Exposure 3 — 96 h at 125 °C ± 2 °C with a canister pressure of 2,07 MPa (20,7 bar).

Exposure 4 — 48 h of thermal cycling between – 30 °C and + 125 °C in a timer-controlled chamber, the chamber temperature changing every 4 h and the chamber design being such that the canister/hose assembly reaches the desired temperature within 3 h of each temperature change.

E.3.3 At the end of each exposure, as soon as the canister/hose assembly reaches room temperature (i.e. is within the range 18 °C to 29 °C), carry out the following procedure:

Weigh the assembly, and determine and record the loss in mass, in grams, for the exposure.

If the loss in mass is greater than 7 g, terminate the test.

Flex-test the coupled assembly on the canister to ±15°. Make 10 flex cycles in approximately 10 s in each of two perpendicular planes. Immediately evaluate the leakage at each coupling by

— listening for hissing (charge loss);

— looking for fluid leaking.

Reweigh and record the mass after flex-testing. If the mass is within 4 g of the original mass, continue with the next exposure. If not, recharge to the original mass before continuing.

NOTE Maintaining the mass to within 4 g of the original mass ensures that the restarting pressure in the canister is not less than 2 MPa (20 bar) at 125 °C.

E.4 Expression of results

Express the result as the average mass, in grams, lost from the six test assemblies.

E.5 Test report

The test report shall include the following information:

a) a reference to this part of ISO 8066, ISO 8066-2:2001;

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 results.

Annex F
(informative)

ISO and SAE refrigerant hose information

F.1 General

This annex provides details on the similarities and differences between refrigerant hoses in this part of ISO 8066-2 and SAE standards J51 and J2064.

F.2 Hose construction comparison

F.2.1 ISO 8066-2 grade A

Comparable SAE types: SAE J51 type A1, SAE J51 type A2 and SAE J2064 type A

Construction: All constructions have a rubber tube, textile braid and rubber cover.

Inside diameter: No conflicts between ISO 8066-2 and SAE J51; all dimensions match. SAE J2064 has no inside-diameter tolerances.

Concentricity: No conflicts between ISO 8066-2 and SAE J51. SAE J2064 has no concentricity requirements.

Outside diameter: No conflicts between ISO 8066-2 and SAE J51. SAE J2064 has no outside-diameter requirements.

F.2.2 ISO 8066-2 grade B

Comparable SAE types: SAE J51 type B2 and SAE J2064 type B

General comments: ISO 8066-2 matches the dimensions of SAE J51 type B2 hoses. J51 states that type B1 hoses are not known to be in production.

Construction: All constructions have a rubber tube, a wire reinforcement and a heat-resistant textile yarn cover impregnated with a rubber cement.

Inside diameter: IDs in ISO 8066-2 match those of SAE J51 type B2. SAE J2064 has no inside-diameter tolerances.

Concentricity: Hose concentricity in ISO 8066-2 and SAE J51 is the same. SAE J2064 has no concentricity requirements.

Outside diameter: ISO 8066-2 matches the dimensions of SAE J51 B2 hose. J51 states that B1 hose is not known to be in production.

F.2.3 ISO 8066-2 grade C

Comparable SAE types: SAE J2064 type C. There is no comparable type in SAE J51

General Comments: Since there is no comparable SAE J51 type hose and the dimensions chosen for 8066-2 match SAE J51 type A2.

Construction: ISO 8066-2 grade C and SAE type C both have a lining composed of a thermoplastic barrier between two rubber layers. The reinforcement is a textile yarn and the outer cover is a heat and ozone resistant rubber.

Inside diameter: The ID is the same as ISO 8066 grade A2 and SAE J51 type A2.

Concentricity: SAE J51 dimensions are used.

Outside diameter: The OD for ISO 8066-2 grade C is the same as SAE J51 type A2.

F.2.4 ISO 8066-2 grade D

Comparable SAE types: SAE J51 type D and SAE J2064 type E

Construction: The descriptions are similar in SAE J2064 and ISO 8066-2. Only ISO 8066-2 and SAE J2064 specifically mention a thermoplastic veneer on the fluid side of the rubber tube.

Inside diameter: Dimensions in ISO 8066-2 match SAE J51. SAE J51 Table 1A states that the 4,8 mm size is for type B2 only so a 4,8 mm size is not included in ISO 8066-2 grade D.

Concentricity: Hose concentricity in ISO 8066-2 and SAE J51 is the same. SAE J2064 has no concentricity requirements.

Outside diameter: Dimensions in ISO 8066-2 are from SAE J51.

F.2.5 ISO 8066-2 grade E

Comparable SAE types: SAE J51 type C. There is no comparable SAE J2064 type.

Construction: The descriptions are similar; SAE J51 does not state the cover is thermoplastic.

Inside diameter: Dimensions in ISO 8066-2 are from SAE J51.

Concentricity: Dimensions in ISO 8066-2 are from SAE J51.

Outside diameter: The dimensions are from SAE J51.

Only maximum ODs are given since SAE J51 contains only maximum ODs.

F.3 Moisture resistance comparison

The moisture ingression rate for ISO 8066-2 moisture-resistant hose is equal to that of SAE J2064 class I. The moisture ingression rate for ISO 8066-2 medium moisture-resistant hose is equal to that of SAE J2064 class II. There are no moisture resistance requirements in SAE J51.

ICS 43.040.60; 83.140.40

Price based on 21 pages