AFRICAN STANDARD

DARS 2044:2024

First Edition 2024

Rubber automobile radiator hoses — Specification

Reference No. WD-ARS 2044:2024(E)
ICS 43.040.30

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This African Standard was prepared by ARSO/TC 59, Automotive technology and engineering

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Introduction

<Text indicating rationale for the development/harmonization of the standard>

Rubber automobile radiator hoses — Specification

1 Scope

This Draft African Standard specifies materials and performance requirements and test methods for automobile radiator rubber hoses.

2 Normative references

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

ISO 4081, *Rubber hoses and tubing for cooling systems for internal-combustion engines — Specification*

ISO 9133, *Passenger cars — Engine cooling systems — Threaded pressure caps and their seats on filler necks*

ISO 9817, *Passenger cars — Engine cooling systems — Dimensions of pressure caps and their ramp seats on filler necks*

ISO 9818, *Passenger cars — Engine cooling systems — Test methods and marking of pressure caps*

3 Terms and definitions

For the purposes of this document, the following terms and definitions shall apply.

3.1
permanent set
residual increase in length of a test piece measured after a specified period from the release of the load after subjection to a specified strain applied for a specified period of time, and expressed as a percentage of the original length

3.2
swelling
percentage increase in volume which a test piece of given dimensions undergoes when immersed in a liquid for a given time and at a given temperature

4 Materials for radiator hoses

The material for the lining and cover of the radiator hose shall comply with the requirements given in Table 1.

Table 1 — Materials for radiator hoses

	Lining	Cover
	Resistant to ethylene glycol	Resistant to ethylene glycol
	Resistant to ethylene glycol	Resistant to mineral oil
	Resistant to mineral oil	Resistant to mineral oil
	Resistant to mineral oil	Resistant to ethylene glycol

5 Dimensions and tolerances

The dimensions and tolerances shall comply with the requirements given in Table 2.

6 Construction

6.1 Inner rubber lining

6.1.1 For hoses below 50 mm in diameter, the inner rubber lining shall be seamless, uniform, free from air blisters, porosity and other defects.

6.1.2 For hoses above 50 mm in diameter, the lining shall be built up of two or more plies of rubber sheets.

6.2 Reinforcement plies

6.2.1 For hoses below 50 mm in diameter, the reinforcement plies shall be of knitted construction fabric.

6.2.2 For hoses above 50 mm in diameter, the reinforcement plies shall be either of knitted fabric or braided yarn.

6.2.3 The fabric or yarn shall be well fractioned or suitably spread on both sides with a rubber compound.

6.2.4 For hoses with woven fabric reinforcement, the overlap of plies shall be not less than 12.5 mm if longitudinal, but if spiral the overlap shall be at least 10 % of the width.

Table 2 — Internal and external diameters of radiator hoses

Internal diameter mm	**External diameter** mm	**Tolerance on internal and external diameter** mm
10.0	16.7	± 0.75
12.5	20.0	
16.0	23.0	
20.0	28.5	
22.0	32.0	
25.0	35.0	± 1.25
28.0	38.0	
31.5	41.0	
35.0	45.0	± 1.50
38.0	48.0	
41.0	50.0	
45.0	56.0	
50.0	65.0	
56.0	70.0	
63.0	77.0	
70.0	84.0	
75.0	90.0	

6.3 Cover

The cover shall have a cloth marked finish or a smooth finish.

7 Test requirements for finished hoses

7.1 Burst pressure

When tested in accordance with Annex A, the hose test piece shall comply with the requirements given in Table 3.

Table 3 — Bursting pressure test requirements for radiator hoses

Internal diameter (mm)	Minimum bursting pressure (MPa)
10.0 12.5 16.0 20.0	2.50
22.0 25.0 28.0 31.5 35.0 38.0 41.0	1.50
45.0 50.0 56.0 63.0 70.0 75.0	0.75

7.2 Adhesion

When tested in accordance with Annex B, the adhesion between 'lining and fabric or lining and braids, or cover and braids', shall be not less than 1.5 kN/m, both in the air for 12 h at 100 ºC.

7.3 Resistance to vacuum collapse

When the finished hose is subjected to crushing under 0.03 MPa at 100 ºC for 10 min, the deformation shall not exceed 30 % of the external diameter.

7.4 Resistance to liquids

7.4.1 Resistance to ethylene glycol

When tested in accordance with Annex C, the test liquid, being a mixture of 60 % ethylene glycol and 40 % water volume, temperature being maintained at 100 ºC ± 1 ºC, for 70 h ± 20 h, the percentage change in volume of the hose specimen shall not exceed 5 % of the initial volume and the specimen shall also show no signs of separation of the lining and fabric or braided yarn on visual examination.

7.4.2 Resistance to mineral oil

When tested in accordance with Annex C, the test liquid, being mineral oil with a kinematic viscosity of 32 ± 1 centistoke at 37.8 ºC and a flash point of 165 ºC ± 3 ºC, test temperature being maintained at 100 ºC ± 1 ºC, hose specimen shall not exceed 50 %.

7.5 Low temperature test — Compression set at low temperature

When tested in accordance with Annex D, with the hose specimen at 25 ºC ± 1 ºC, and allowed to recover for 30 min after the end of the exposure time, the compression set shall not exceed 75 %.

8 Packaging

Hoses shall be so packaged or wrapped so as to prevent them from being damaged during transportation and storage.

9 Marking

The following information shall appear in legible and indelible marking on a label securely attached to each hose:

a) the manufacturer's name and/or trade mark;
b) year of manufacture;
c) Part number; and
d) country of origin.

Annex A
(normative)

Bursting pressure test

A.1 The free length of the hose test piece excluding end reinforcements or couplings shall be 1 m.

A.2 Measure the external diameter at three places along the length **(**one point at the middle and one point at each end at a distance of 20 cm from the end). Two observations have to be taken at each point at right angles to each other. Average the results of six observations and record the value as the diameter of the hose. Use a square caliper having a vernier scale and a locking device.

A.3 Fill the test piece with water prior to application of hydrostatic pressure allowing all air in it to escape through a stopcock provided for this purpose, to eliminate risk of injury to the operator due to the sudden expansion of trapped air released when the hose bursts.

A.4 Close the stopcock and increase the hydrostatic pressure at a uniform rate of 0.075 MPa per second by means of a hand or power-driven hydraulic pump or an accumulator system. The pressure shall be measured with a calibrated dial-gauge.

A.5 When the specified test pressure is reached as indicated in Table 3, maintain this pressure steadily, and measure the external diameter of the hose as done initially. Record the average value as the diameter of the hose at that pressure.

A.6 Increase the rate of application of the hydraulic pressure as specified in Table 3, the test shall be discontinued and the sample destroyed.

Annex B
(normative)

Adhesion strength test

B.1 Cut two test pieces from the hose having a length of 25.0 mm ± 0.5 mm in planes perpendicular to the axis of the hose by mounting it on a smooth, close fitting slightly tapered wooden mandrel, which may be rotated in a lathe and cutting a 25 mm section with a sharp pointed knife.

B.2 The test piece shall be conditioned immediately before testing, for a minimum of 24 h, in one of the standard atmospheres, either 20 ºC ± 2 ºC and 65 % ± 5 % relative humidity or 23 ºC ± 2 ºC and 50 % ± 5 % relative humidity. The conditions shall be selected so that the test is carried out at the same temperature and humidity as used in the conditioning procedure.

B.3 Fit a test piece tightly on a mandrel with an outside diameter substantially equal to the internal diameter of the test piece. Separate the ply to be tested sufficiently to permit the attachment of a clamp. Apply to the separated ply a load (the total load specified consisting of the combined masses of the clamp, light steel spring, together with the scale pan and mass, *M*) with the mandrel supported horizontally on the freely rotatable shaft.

B.4 Determine the rate of separation by observing the duration of the test and measuring the length stripped between the marks indicating the beginning and the end of the test after the load has been removed. Adjust the loads to maintain a steady rate of separation of 25 mm per minute.

B.5 The adhesion strength shall be expressed in newtons per metre width of the hose test piece.

Annex C
(normative)

Test for resistance to liquids — Gravimetric method

C.1 The apparatus shall be a stoppered glass bottle or a tube of such dimensions that the test pieces remain completely immersed in the test liquid and freely exposed at all surfaces without restraint.

C.2 The test piece shall be 1.0 cm^3 to 3.0 cm^3 in volume and of a uniform thickness of 2.0 mm ± 0.2 mm.

C.3 Three hose samples shall be tested. Weigh each test piece in air to the nearest milligram (m_1) and then reweigh each test piece in distilled water (m_2). Place them suitably separated, in a glass container with a volume of the immersion liquid at least 15 times the combined volume of the test piece and sufficient to keep them totally immersed. At the end of the immersion period, bring the test pieces to the standard laboratory temperature (20 ºC ± 2 ºC) by quickly transferring them to a fresh portion of the immersion liquid at this temperature for a period of not less than 180 s and not more than 3 600 s. Remove the surplus immersion liquid from the surfaces of each test piece by blotting with filter paper. Then immediately place the test piece in a tarred and stoppered weighing bottle and determine its mass in air ($m3$) to the nearest milligram. Remove the test piece from the bottle and immediately weigh in distilled water ($m4$) at the standard laboratory temperature.

C.4 The swelling is given by the following formula.

$$\frac{(m_3 - m_4) - (m_1 - m_2)}{(m_1 - m_2)} \times 100$$

Commented [a1]: move

where

m_1 is the initial mass of the hose in air;
m_2 is the initial apparent mass of the hose after immersion;
m_3 is the mass in air of the hose after immersion; and
m_4 apparent mass in water of hose after immersion.

C.5 The average of values of three test pieces shall be recorded as the swelling of the hose.

Annex D
(normative)

Test for compression set at low temperatures

D.1 The compression apparatus shall be pairs of parallel, flat and highly polished chromium-plated steel plates or highly polished stainless steel plates with a finish not less than 0.2 mm centre line average. Their transverse dimensions shall be 750 mm x 50 mm and thickness shall be 10 mm. Mild steel spacers in form of rings shall be used to provide the specified compression. The spacers shall be of such size that contact with the compressed test pieces is avoided.

D.2 A quick release device, such as a can-or air-operated vice or pliers, shall be provided for holding plates and test pieces under compression. A suitable pair of tongs shall be provided.

D.3 A cabinet in which the test pieces are exposed may be of the mechanically refrigerated type or may be cooled directly by dry ice or liquid nitrogen. Temperature in the cabinet shall be controlled within ± 1 ºC of the specified temperature, while the test temperature shall be measured directly on the plates of compression apparatus within ± 0.5 ºC.

D.4 The test piece shall be either of diameter 29.0 mm ± 0.5 mm and thickness 12.5 mm ± 0.5 mm or diameter 13.0 mm ± 0.5 mm and thickness 6.3 mm ± 0.3 mm. The thickness shall be measured by a micrometre dial gauge with two contact members having flat circular surfaces of 9.5 mm diameter.

D.5 The test pieces shall be conditioned immediately before testing for a minimum period of 3 h at a standard laboratory temperature. The compression apparatus shall also be kept at the standard laboratory temperature and the operating surfaces carefully cleaned.

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Bibliography

IS 2765, Indian Standard Specification for radiator hoses (First Revision)

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