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International Standard



3808/1

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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**Road vehicles — Unscreened high-tension ignition  
cables —  
Part 1 : Dimensions, general requirements and test  
methods**

*Véhicules routiers — Câbles d'allumage haute tension non blindés — Partie 1 : Dimensions, spécifications générales et méthodes d'essai*

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**Descriptors** : road vehicles, electric cables, ignition cables, dimensions, specifications, tests, electrical tests, mechanical tests, thermal tests, flammability testing, oil resistance

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3808/1 was developed by Technical Committee ISO/TC 22, *Road vehicles*, and was circulated to the member bodies in October 1978.

It has been approved by the member bodies of the following countries:

Austria	Japan	Sweden
Belgium	Korea, Dem. P. Rep. of	Switzerland
Bulgaria	Korea, Rep. of	United Kingdom
Czechoslovakia	Mexico	USA
France	Netherlands	USSR
Germany, F.R.	Romania	Yugoslavia
Iran	South Africa, Rep. of	
Italy	Spain	

No member body expressed disapproval of the document.

# Road vehicles — Unscreened high-tension ignition cables — Part 1 : Dimensions, general requirements and test methods

## 1 Scope

This International Standard specifies the dimensions, general requirements and test methods for unscreened high-tension ignition cables.

NOTE — Cable classes, types, applicable tests and special requirements will be specified in ISO 3808/2.

## 2 Field of application

This International Standard applies to all types of unscreened high-tension ignition cables used in automotive vehicle applications.

## 3 Reference

ISO 1817, *Vulcanized rubbers — Resistance to liquids — Methods of test.*

## 4 Cable dimensions

The outside diameters<sup>1)</sup> of the finished cables shall be :

$$8 \pm 0,3 \text{ mm}$$

$$7 \pm 0,3 \text{ mm}$$

$$5 \begin{matrix} + 0,3 \\ 0 \end{matrix} \text{ mm}$$

## 5 Test methods

### 5.1 Test for insulation faults of the total delivery

#### 5.1.1 Principle

When the earthed dry cable is drawn through a coiled wire to which a voltage is being applied, no breakdown shall occur.

#### 5.1.2 Apparatus

Coiled wire : internal diameter equal to the cable outside diameter plus 1 mm, pitch approximately 3 mm, wire diameter 1,5 mm.

#### 5.1.3 Test voltages (root mean square)

For 8 mm cable : 30 kV(r.m.s.), 50 Hz or 60 Hz.

For 7 mm cable : 25 kV(r.m.s.), 50 Hz or 60 Hz.

For 5 mm cable : 20 kV(r.m.s.), 50 Hz or 60 Hz.

#### 5.1.4 Duration of test

At least 1 s for each part of the cable.

NOTE — For this test other types of installation may be used provided that insulation faults are detected with the same degree of certainty.

### 5.2 Thirty minute test voltage and breakdown voltage

(For test apparatus see annex, clause A.1.)

#### 5.2.1 Specimen length

Approximately 1 200 mm.

#### 5.2.2 Procedure

Immerse the specimen for 4 h in salt solution [3 % (*m/m*) of NaCl in water] at room temperature  $23 \pm 5$  °C with the ends emerging, and then immediately apply the test voltage specified in 5.2.3 for 30 min between the conductor and the solution. The cable shall not break down.

Then increase the voltage at a rate of 500 V/s until the value specified in 5.2.4 is reached. Breakdown shall not occur.

#### 5.2.3 Test voltages (root mean square)

For 8 mm cable : 20 kV(r.m.s.), 50 Hz or 60 Hz.

For 7 mm cable : 20 kV(r.m.s.), 50 Hz or 60 Hz.

For 5 mm cable : 15 kV(r.m.s.), 50 Hz or 60 Hz.

1) The outside diameter is the average value of three measurements on the circumference because during transportation and storage of the wire coils, deformations caused by pressure might have occurred.

#### 5.2.4 Breakdown voltages (root mean square)

For 8 mm cable : at least 40 kV(r.m.s.), 50 Hz or 60 Hz.

For 7 mm cable : at least 35 kV(r.m.s.), 50 Hz or 60 Hz.

For 5 mm cable : at least 25 kV(r.m.s.), 50 Hz or 60 Hz.

### 5.3 Capacity

#### 5.3.1 Specimen length

Approximately 1 200 mm.

#### 5.3.2 Procedure

Soak the specimen in salt solution [3 % (m/m) of NaCl in water] at  $70 \pm 2$  °C for 24 h, with each end of the cable emerging 100 mm from the water. Measure the cable capacity between the conductor and the water.

Immerse the specimen in a bath containing tap water at a temperature of  $23 \pm 2$  °C for 1 h, with each end of the cable emerging 100 mm from the water. Again, measure the cable capacity between the conductor and the water.

The cable capacities shall not exceed the values agreed between the engine and the cable manufacturer.

#### 5.3.3 Measuring frequency

1 000 Hz.

### 5.4 Resistance to corona effect

(For test apparatus see annex, clause A.2.)

#### 5.4.1 Specimen length

Approximately 1 200 mm.

#### 5.4.2 Procedure

Fix the specimen, at room temperature  $23 \pm 5$  °C between mandrel and sleeve and apply the voltage specified in ISO 3808/2. After 8 h under test, there shall be no breakdown of the specimen nor shall the surface of the specimen show cracks or other alterations or defects.

### 5.5 Pressure test at high temperature

(For test apparatus see annex, clause A.3.)

#### 5.5.1 Specimen length

Approximately 100 mm.

#### 5.5.2 Procedure

Mount the specimen in the test apparatus, load with the

specified mass and maintain for 4 h at the temperature specified in ISO 3808/2 in a hot-air oven with natural draught. Remove the specimen from the test apparatus and cool within 10 s by immersing in cold water. Then measure the depth of the indentation at a cross- or length-section in the area of application of the load, using a measuring microscope. The depth of the indentation shall not exceed 50 % referred to the average wall thickness, determined by six measurements distributed around the circumference of the specimen at a suitable distance from the area of indentation.

#### 5.5.3 Test masses

For 8 mm cable : 510 g (including mass of test frame)

For 7 mm cable : 450 g (including mass of test frame)

For 5 mm cable : 312 g (including mass of test frame)

### 5.6 Thermal overload test

(For test apparatus see annex, clause A.4.)

#### 5.6.1 Specimen length

Approximately 500 mm.

#### 5.6.2 Procedure

Suspend a 500 mm specimen vertically for 48 h in air at the temperature specified in ISO 3808/2 in a hot-air oven with natural draught.

After cooling to room temperature  $23 \pm 5$  °C, wind this specimen according to clause A.4 of the annex.

After this test, the specimen shall show neither cracks, fractures nor other defects.

For resistive cables, measure the resistance before and after the test with the same 500 mm specimen at a temperature of  $23 \pm 5$  °C. The difference between the two measured values shall lie within the limits defined in ISO 3808/2.

### 5.7 Shrinkage by heat

Where shrinkage of the insulation is important relative to the connector attachment, the following test shall apply.

#### 5.7.1 Specimen length

Approximately 200 mm.

#### 5.7.2 Procedure

Measure the exact length of the specimen at room temperature  $23 \pm 5$  °C prior to the test. Put the specimen in a hot-air oven with natural draught, in a horizontal position, so that air may circulate freely from all sides. Test duration shall be 15 min. Test temperatures shall be as specified in ISO 3808/2.

After cooling to room temperature, measure the length again; the insulation may have shrunk up to the percentages in length specified in ISO 3808/2. However, no cracking shall have occurred.

## 5.8 Resistance to flame propagation<sup>1)</sup>

(For test apparatus see annex, clause A.5.)

### 5.8.1 Specimen length

Approximately 500 mm.

### 5.8.2 Apparatus

For this test, a Bunsen-burner fed with appropriate gas and having a combustion tube of approximately 9 mm internal diameter and a flame of approximately 100 mm height is employed; the length of the inner blue cone of the flame shall be approximately 50 mm.

The flame temperature is correct if a bare copper wire, of  $0,7 \pm 0,03$  mm diameter, and having a free length of approximately 100 mm, inserted horizontally into the tip of the inner blue cone of the flame melts in not less than 4 s and not more than 6 s.

### 5.8.3 Procedure

Suspend the specimen in a room free of draughts and expose to the tip of the inner cone of the test flame, as shown in clause A.5 of the annex.

Times of exposure to the test flame shall be as specified in ISO 3808/2.

Any combustion flame of insulating material must extinguish within the times specified in ISO 3808/2 after removal of the burner flame.

## 5.9 Flexibility at low temperature

### 5.9.1 Specimen length

Approximately 400 mm.

### 5.9.2 Procedure

Fix the specimen on a rotatable mandrel of 25 mm diameter. Load the free end with a mass of 4,5 kg and maintain for 4 h<sup>2)</sup> hanging vertically at the temperature specified in ISO 3808/2 in a freezing chamber. Then wind at least 3 turns around the mandrel within the freezing chamber at a winding speed of 1 turn/s. The insulation shall not show cracks or fractures. The cable core shall not protrude from the insulation sheath.

## 5.10 Mechanical tensile test

(For test apparatus see annex, clause A.6.)

### 5.10.1 Specimen length

Approximately 1 200 mm.

### 5.10.2 Procedure

A specimen of the cable to be tested shall be suspended by the test apparatus specified in clause A.6 of the annex and subjected to a dead weight as specified in ISO 3808/2 for a period of time of 5 min.

For resistive cable, measure the 1 200 mm specimen before the test for its resistance per unit of length, and a minimum of 250 mm which was under stress, after the test. Values per units of length shall not vary by more than the percentage specified in ISO 3808/2.

For reactive cable, verify with approximately 12 V d.c. that no interruption has occurred in a specimen of 250 mm free length which was under stress.

Test and measurements shall be carried out at ambient temperature  $23 \pm 5$  °C.

## 5.11 Stripping of insulation

Where cables are required to be stripped, it shall be possible to remove at least 20 mm cleanly and without difficulty.

## 5.12 Resistance to oil

(For test apparatus see annex, clause A.4.)

### 5.12.1 Specimen length

Approximately 400 mm.

### 5.12.2 Procedure

Immerse the specimen for 48 h in oil No. 1 of ISO 1817 at a temperature of  $90 \pm 2$  °C with the cable ends emerging approximately 50 mm above the surface of the oil.

The oil shall be stirred during the test.

Clean the sample when removed from the oil and cool to room temperature  $23 \pm 5$  °C. Then wind as indicated in clause A.4 of the annex.

During the test, the insulating envelope shall not break or tear. Percentage alterations of the original diameter are allowed as specified in ISO 3808/2.

1) This test does not apply to cables utilizing ethylene-propylene-diene copolymer (EPDM) materials.

2) If the test device is pre-cooled, a freezing time of 2 h is sufficient.

### 5.13 Resistance to fuel

(For test apparatus see annex, clause A.4.)

#### 5.13.1 Specimen length

Approximately 400 mm.

#### 5.13.2 Procedure

Immerse the specimen in liquid C of ISO 1817 at room temperature  $23 \pm 5$  °C for 30 min with the cable ends emerging approximately 100 mm above the surface of the liquid.

Allow the specimen to dry at room temperature for approximately 30 min after removal from the liquid. Then wind as indicated in clause A.4 of the annex.

During the test, the insulation envelope shall not break or tear. Percentage alterations of the original diameter are allowed as specified in ISO 3808/2.

### 5.14 Accelerated life test

(For test apparatus see annex, clauses A.2 and A.4.)

#### 5.14.1 Specimen length

Approximately 1 200 mm.

#### 5.14.2 Procedure

Prior to testing, winding of the specimen shall be carried out according to the annex, at first as in clause A.4 and then as in clause A.2. Conditioning may be carried out with or without the sleeve.

The tests specified below shall be carried out in sequence with the same specimen. When immersed in liquids, the cable ends shall emerge approximately 100 mm above the liquid surface.

Test voltages :

For 8 mm cable : 20 kV(r.m.s.), 50 Hz or 60 Hz.

For 7 mm cable : 15 kV(r.m.s.), 50 Hz or 60 Hz.

For 5 mm cable : 12 kV(r.m.s.), 50 Hz or 60 Hz.

#### 5.14.2.1 Resistance to salt water

The test specimen shall be heated in an oven at a temperature of  $90 \pm 2$  °C for 4 h and immediately immersed in salt solution [3 % (m/m) of NaCl in water] and maintained at  $50 \pm 2$  °C for 16 h. It shall then be removed from the water, drained for 30 min at room temperature  $23 \pm 5$  °C and then tested in the metal sleeve for 30 min under the test voltage.

#### 5.14.2.2 Resistance to oil

The test specimen shall be heated in an oven at a temperature of  $90 \pm 2$  °C for 4 h and immediately immersed in oil No. 1 of ISO 1817 and maintained at  $90 \pm 2$  °C for 16 h. It shall then be removed from the oil, allowed to drain for 30 min at room temperature  $23 \pm 5$  °C and then tested in the metal sleeve for 30 min under the test voltage.

#### 5.14.2.3 Resistance to fuel

The test specimen shall be immersed in liquid C of ISO 1817 at room temperature  $23 \pm 5$  °C for 30 min. It shall then be removed from the liquid, drained for 4 h without the sleeve (in order to avoid explosion risks) and then tested in the metal sleeve for 30 min under the test voltage.

#### 5.14.2.4 Heat ageing test

The test specimen shall be kept heated at the temperature specified in ISO 3808/2 for 48 h. It shall be allowed to cool to room temperature  $23 \pm 5$  °C.

The sample shall then be tested in the metal sleeve for 30 min under the test voltage.

#### 5.14.2.5 Low temperature test

After the heat ageing test, the test piece shall be unwound from the mandrel, leaving one end secured to it, and a 4,5 kg mass shall be attached to the other end. With the mass fully supported by the test piece, the mandrel and mass shall be cooled to the temperature specified in ISO 3808/2 for 4 h<sup>1)</sup>. After this period, the test piece shall be wound on the mandrel for five complete turns at the rate of one turn in 5 s, this operation being carried out in the cold chamber at the temperature specified in ISO 3808/2. The test piece shall then be allowed to return to room temperature  $23 \pm 5$  °C.

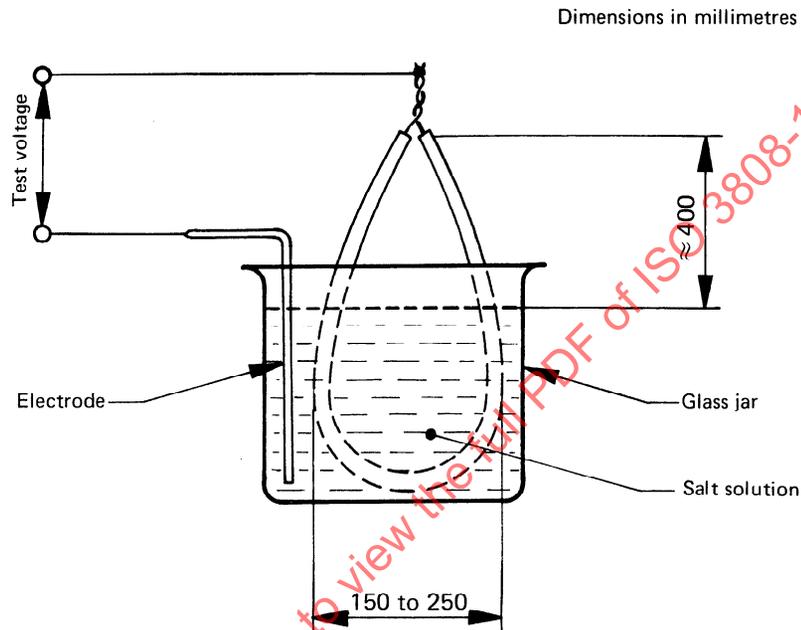
The sample shall then be tested in the metal sleeve for 30 min under the test voltage.

1) If the test device is pre-cooled, a freezing time of 2 h is sufficient.

## Annex

### Test apparatus

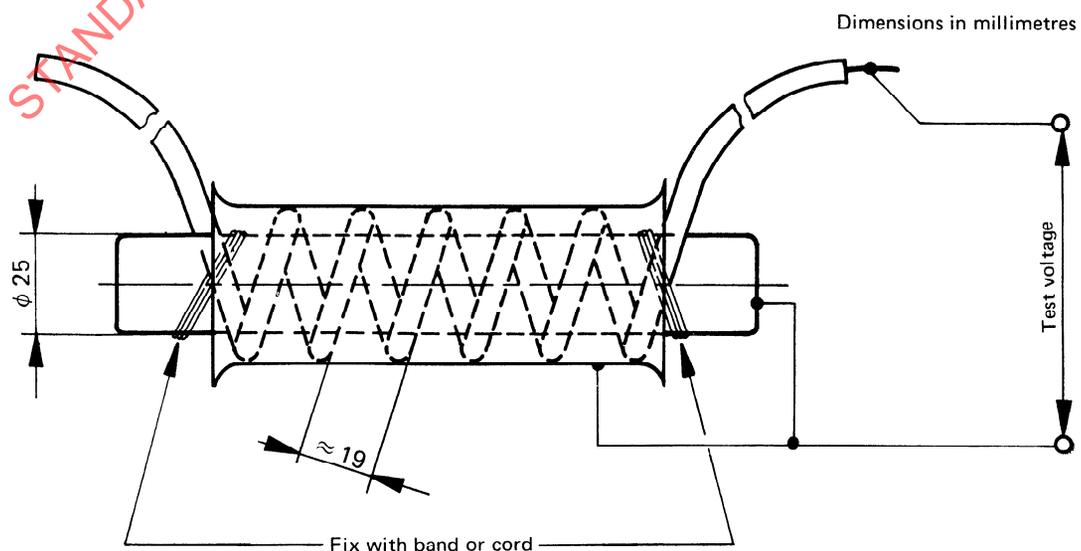
#### A.1 Test apparatus for 30 min test voltage and breakdown voltage (see 5.2)



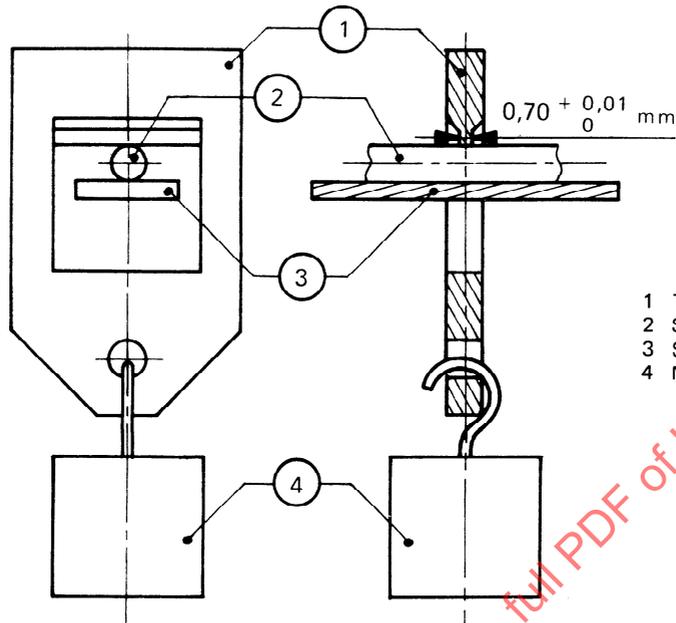
#### A.2 Test apparatus for resistance to corona effect (see 5.4 and 5.14)

Winding of the cable : attach on the cable specimen a mass of 2,5 kg. Fix the free end of the specimen to a mandrel so that the mass can hang freely. Rotate the mandrel against the force exerted by the mass so that the cable specimen is wound up in 5 complete turns at a pitch of approximately 19 mm. During winding, the specimen shall not be forced against the natural torsion. Then fix the ends of the cable, remove the mass and push a closely fitting sleeve over the specimen.

The sleeve and the mandrel shall be of non-magnetic metal. The sleeve shall have flared ends.



**A.3 Test apparatus for pressure test at high temperature (see 5.5)**



**A.4 Winding on mandrel (see 5.6, 5.12, 5.13 and 5.14)**

Fix one end of the cable specimen to a rotatable mandrel of diameter 12,5 mm, and attach a mass of 4,5 kg to the insulation at the other end.

Wind the sample clockwise and then counter-clockwise on the rotating mandrel in closely pitched turns to a minimum of four turns for each direction.

Speed of rotation : 1 turn/s.

A.5 Test apparatus for resistance to flame propagation test (see 5.8)

