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Road vehicles — Spark-plugs — Test methods and requirements

Véhicules routiers — Bougies d'allumage — Méthodes d'essai et exigences

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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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11565 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 1, *Ignition equipment*.

This second edition cancels and replaces the first edition (ISO 11565:1998), which has been technically revised.

Road vehicles — Spark-plugs — Test methods and requirements

1 Scope

This International Standard specifies the test methods and requirements for the mechanical and electrical performance of spark-plugs for use with spark ignition engines.

2 Normative references

The following referenced documents are indispensable for the application 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 1919, *Road vehicles — M14 × 1,25 spark-plugs with flat seating and their cylinder head housings*

ISO 2344, *Road vehicles — M14 × 1,25 spark-plugs with conical seating and their cylinder head housings*

ISO 2345, *Road vehicles — M18 × 1,5 spark-plugs with conical seating and their cylinder head housing*

ISO 2346, *Road vehicles — M14 × 1,25 compact spark-plugs with flat seating and 19 mm hexagon and their cylinder head housing*

ISO 2347, *Road vehicles — M14 × 1,25 compact spark-plugs with conical seating and their cylinder head housing*

ISO 2704, *Road vehicles — M10 × 1 spark-plugs with flat seating and their cylinder head housings*

ISO 2705, *Road vehicles — M12 × 1,25 spark-plugs with flat seating and their cylinder head housings*

ISO 6789, *Assembly tools for screws and nuts — Hand torque tools — Requirements and test methods for design conformance testing, quality conformance testing and recalibration procedure*

ISO 8470, *Road vehicles — M14 × 1,25 spark-plugs with flat seating and 16 mm hexagon and their cylinder head housings*

ISO 16246, *Road vehicles — M12 × 1,25 spark-plugs with flat seating and 14 mm hexagon and their cylinder head housing*

ISO 19812, *Road vehicles — M10 × 1 compact spark-plugs with flat seating and 16 mm hexagon and their cylinder head housings*

ISO 22977, *Road vehicles — M12 × 1,25 spark-plugs with flat seating and 14 mm bi-hexagon and their cylinder head housing*

IEC 60051-1, *Direct acting indicating analogue electrical measuring instruments and their accessories — Part 1: Definitions and general requirements common to all parts*

IEC 60068-2-6, *Environmental testing — Part 2: Tests — Test Fc: Vibration (sinusoidal)*

3 Test methods and requirements

3.1 General

The tests shall be carried out at an ambient temperature of (23 ± 5) °C and a relative humidity of (65 ± 20) % unless otherwise specified.

For each test sample in Table 1, the test sequence is indicated by an X from top to bottom.

Each test sequence shall be started with unused samples.

Table 1 — Test sequences

Characteristic to be checked	In accordance with subclause	Test sample						
		A	B	C	D	E	F	G
General characteristics (visual examination)	3.2	X	X	X	X	X	X	X
Dimensions	3.3	X	X	X	X	X	X	X
Resistance of incorporated element for RF suppression	3.7.1	X						X
Loading life of the incorporated resistor	3.8	X	—					
Mechanical strength of the shell	3.4.1	X		—	—			
Tear-off resistance of the high-voltage terminal	3.4.2		X					
Bending resistance	3.4.3			X		—		
Gas tightness	3.5				X		—	
Withstand voltage of the insulator	3.7.2				X			
Vibration	3.4.4				X			—
Gas tightness	3.5				X			
Withstand voltage of the insulator	3.7.2	—	—	—	X			
Thermal shock, thermal resistance	3.6					X		
Insulation resistance at ambient temperature	3.7.3				—		X	
Insulation resistance at high temperature	3.7.4					—	X	
Thermal stability of incorporated resistor	3.9							X
General characteristics (visual examination)	3.2		X	X	X		X	X

3.2 General characteristics

3.2.1 Test method

Check the following characteristics specified in 3.2.2 by visual examination. Carry out the visual examination with the naked eye, at normal strength of vision and normal colour perception, at the most favourable viewing distance, and with suitable illumination.

Visual examination shall allow identification, appearance, workmanship and finish of the item to be checked against the relevant specification.

3.2.2 Requirements

3.2.2.1 The **external gasket**, if any, shall be in accordance with the International Standard for the relevant spark-plug.

3.2.2.2 The **scavenging area** shall be clean and without any foreign body.

3.2.2.3 The **electrodes** shall be fixed in position.

3.2.2.4 The **shell** shall be properly fixed to the insulator. No visible sign of corrosion is allowed. The thread shall be free from burrs or damage.

3.2.2.5 The **insulator** shall be smooth and uniform without abnormal appearance. The insulator shall not show chips, cracks or signs of shock damage.

3.2.2.6 The **marking** shall be in accordance with the manufacturer's specification.

3.3 Dimensions

3.3.1 Test method

The dimensions shall be checked in accordance with the relevant International Standard, using random samples.

3.3.2 Requirement

All dimensions shall conform to the relevant spark-plug International Standard.

3.4 Mechanical performance

3.4.1 Mechanical strength of the shell

3.4.1.1 Test fixture

The test fixture shall have the thread and the seat according to the relevant spark-plug International Standard and have a surface finish of 1,6 µm (Ra = 1,6).

3.4.1.2 Test method

Install the fully assembled spark-plug on the test fixture specified in 3.4.1.1 and tighten it with a torque wrench, or a corresponding device, until the shell breaks.

3.4.1.3 Requirements

The measured torque shall not be less than:

— 60 Nm for M14 flat seat spark-plugs and for M18 conical seat spark-plugs;

— 40 Nm for M14 conical seat spark-plugs;

— 35 Nm for M12 spark-plugs;

— 25 Nm for M10 spark-plugs.

3.4.2 Tear-off resistance of the high-voltage terminal

3.4.2.1 Test method

The test shall be non-destructive.

Mount the spark-plug on a tensile strength test bench using a suitable device. Apply a force linearly increasing from 0 N to (400 ± 10) N with a rate of less than 500 N/s to the high-voltage terminal in the axial direction.

3.4.2.2 Requirement

After the test, the spark-plug shall be intact.

3.4.3 Bending resistance

3.4.3.1 Test method

Mount the spark-plug on a suitable test block at the maximum installation torque specified in the relevant International Standard. Apply a force perpendicular to the insulator axis and within 5 mm of the insulator's end. The moment arm shall be defined as referenced from the seating surface (gauging point for conical seating) of the spark-plug in the cylinder head. The test shall be non-destructive. The touch down velocity of the force applied shall be less than 10 mm/min to avoid impact damage.

3.4.3.2 Requirement

The spark-plug shall withstand to a bending moment of 15 Nm.

3.4.4 Resistance to vibration

3.4.4.1 Test method

Subject the spark-plug, mounted and tightened as specified, to a vibration test Fc in accordance with IEC 60068-2-6:

— frequency range: 50 Hz to 500 Hz, sinusoidal;

— sweep rate: 1 octave/min;

— acceleration: 30 g (294 m/s^2);

— vibration directions: spark-plug axis and perpendicular;

— duration: 8 h in each direction.

3.4.4.2 Requirement

After this test the spark-plug shall show no abnormalities and shall fulfil all subsequent tests listed in Table 1.

3.5 Gas tightness

3.5.1 Test method

Mount the spark-plug on a test device which represents the configuration given for mounting the spark-plug to the cylinder head and tighten it with an installation torque which shall be adapted depending on the friction factor between the test fixture material and the spark-plug as specified in Table 2.

The material of the test fixture shall be agreed between the spark-plug manufacturer and the engine manufacturer.

If the test fixture seat is not of alloy, it shall have a hardness of HRC 20 or greater. The surface roughness across the seating surface shall be *Ra* max. 0,2 µm. To cover wear of the seating surface during several tests, the spark-plug manufacturer shall test with a seating surface of *Ra* max. 1,6 µm. All threads shall be free of lubricants.

Table 2 — Installation torque

Seating	Thread	Installation torque in the test fixture (Tool adjustment value [a]) Nm		
		Alloy	Hardened copper alloy	Hardened steel
Flat	M10 × 1	15	18	20
	M12 × 1,25	25	30	35
	M14 × 1,25	30	35	45
	M14 × 1,25 compact	20	25	35
Conical	M14 × 1,25	20	20	35
	M18 × 1,25	23	23	45

[a] Tool calibrated according to ISO 6789.

Ensure the spark-plug temperature, measured close to the seat as shown in Figure 1, has reached (200 ± 10) °C. Apply a pressure of (2 ± 0,2) MPa [(20 ± 2) bar] (air, nitrogen, carbon dioxide or any other detection gas) to the spark-plug face for a duration of 5 minutes and determine the leakage rate between:

— shell and test fixture seat;

— shell and insulator;

— insulator and high-voltage terminal.

3.5.2 Requirement

The measured total leakage rate shall not exceed 2 cm^3/min. If air or nitrogen are not used, convert the leakage rate to that of air using the specific volume of the detection gas.

3.6 Thermal shock, thermal resistance

3.6.1 Test method

Cut off the shell to expose the insulator nose without damaging the insulator nose. Immerse the insulator nose for a duration of 30 s in a soldering bath with a temperature of (500^{+50}_{-20}) °C to a depth of not less than 3 mm.

Following immersion, allow the insulator to cool to ambient temperature without forced cooling.

The use of a flaw-detecting penetrating dye is recommended for visual examination. The same method shall be used for examination before and after the test.