
**Road vehicles — Spark-plugs and their
cylinder head housings — Basic
characteristics and dimensions**

*Véhicules routiers — Bougies d'allumage et leur logement dans la
culasse — Caractéristiques élémentaires et dimensions*

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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 28741 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 1, *Ignition equipment*.

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Introduction

The purpose of this International Standard is to provide a compact and concise specification on spark-plugs and their cylinder head housings, which will replace the large number of existing individual International Standards on each type of spark-plug.

It is intended to specify the main properties, the design requirements and the dimensions of most of the existing types of spark-plugs and their cylinder head housings. In this way, the user will be able to work with one comprehensive document valid for most types of spark-plugs, instead of a number of documents, each of which is specified for one type only.

The testing of spark-plugs is covered in ISO 11565.

It is intended to withdraw the following International Standards on spark-plugs and their cylinder head housings as soon as this International Standard is published: ISO 1919, ISO 2344, ISO 2345, ISO 2346, ISO 2347, ISO 2704, ISO 2705, ISO 8470, ISO 14508, ISO 16246, ISO 19812 and ISO 22977.

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Road vehicles — Spark-plugs and their cylinder head housings — Basic characteristics and dimensions

1 Scope

This International Standard specifies the main properties and dimensions of spark-plugs, including the terminals and the dimensions of their cylinder head housings, for use with spark-ignition engines.

This International Standard does not cover screened and waterproof spark-plugs (see ISO 3412, ISO 3895 and ISO 3896).

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 68-1, *ISO general purpose screw threads — Basic profile — Part 1: Metric screw threads*

ISO 261, *ISO general purpose metric screw threads — General plan*

ISO 965-1, *ISO general-purpose metric screw threads — Tolerances — Part 1: Principles and basic data*

ISO 965-3, *ISO general purpose metric screw threads — Tolerances — Part 3: Deviations for constructional screw threads*

ISO 4095, *Aerospace — Bihexagonal drives — Wrenching configuration — Metric series*

ISO 6518-1, *Road vehicles — Ignition systems — Part 1: Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6518-1 and the following apply.

3.1

installed height

L

distance from the contact point of the cylinder head to the top of the spark-plug terminal, including the compressed gasket thickness with the spark-plug installed at the specified installation torque

NOTE For conical seating, the contact point is defined from the gauge point of the seat.

3.2

spark-plug thread size

nominal size of the spark-plug thread used to interface between the spark-plug and the cylinder head thread

NOTE These are standard metric threads, with the exception of the M14 × 1,25 thread.

**3.3
hexagon/bi-hexagon**

feature of the spark-plug shell that is used to install the spark-plug into the cylinder head, interfacing with the installation socket while the spark-plug is installed into the cylinder head

NOTE A bi-hexagon is a 12-point installation feature, which requires that a 12-point socket wrench be used to install the spark-plug.

**3.4
conical seating**

conical section of the spark-plug shell on some spark-plug types, which is used for the seal interface between the spark-plug and the cylinder head

NOTE There is typically no gasket used between the conical mating surfaces.

**3.5
flat seating**

flat surface of some spark-plug types which is perpendicular to the spark-plug axis and is used for the seal interface between the spark-plug and the cylinder head

NOTE This seal typically uses a gasket between the flat seat of the spark-plug and the mating flat surface of the cylinder head.

**3.6
insulator diameter**

E
nominal diameter of the insulator in a defined region of the insulator between the top of the shell and the terminal of the spark-plug, which interfaces with a corresponding region of the high-voltage boot of the ignition lead or ignition coil

NOTE The fit is the key to suppression of high-voltage leakage around the spark-plug insulator (flashover).

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**3.7
high-voltage terminal**

part of the spark-plug that is used as the contact point between the high-voltage ignition source and the spark-plug

NOTE The connection between the high-voltage ignition source and the spark-plug terminal can be made with a threaded fastener, with a snap clip that interfaces with the solid terminal or by spring-loaded mechanical contact.

**3.8
installation tightening torque**

rotational force applied to the spark-plug hexagon to ensure proper seating and sealing of the spark-plug to the cylinder head

NOTE The value of the correct installation tightening torque can vary from conditions that affect the friction between the spark-plug threads and the cylinder head threads. These include cylinder head material, spark-plug shell plating, thread lubrication and contamination from combustion deposits. It is advisable to ensure that spark-plugs are not over-torqued during installation, as this can damage spark-plug integrity and can result in engine damage. Spark-plugs with smaller thread sizes require a lower installation tightening torque.

**3.9
spark-plug reach**

A
distance from the spark-plug seating surface (flat seat) or from the gauge diameter (conical seat) to the point on the shell designed to be aligned with the combustion chamber surface on the cylinder head with the spark-plug properly installed

NOTE It is advisable to design the spark-plug reach and the cylinder head housing in such a way that they match, so as to ensure correct fit of the spark-plug into the combustion chamber.

3.10**spark-plug projection**

distance that the spark-plug projects past the spark-plug reach into the combustion chamber

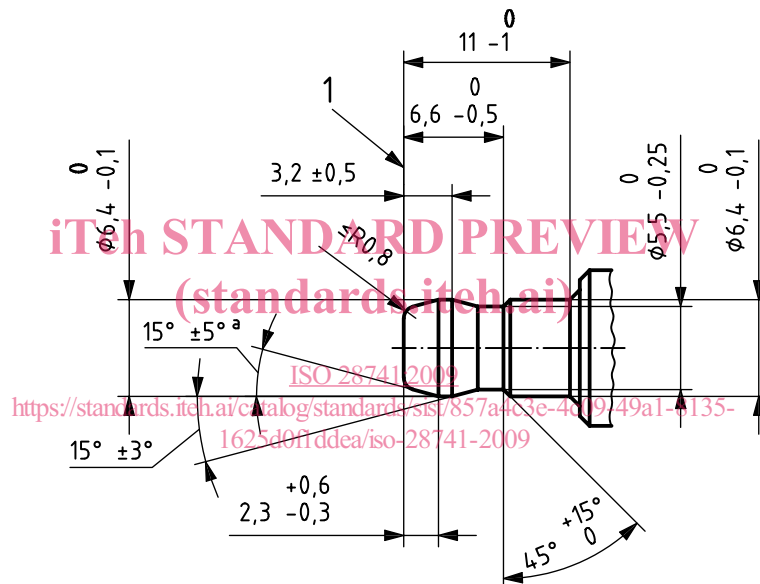
NOTE It is important to consider this dimension for possible interference with the engine piston at top dead centre.

4 Terminals**4.1 Solid post terminal dimensions**

The dimensions of solid post terminals shall be in accordance with Figures 1 and 2.

Nuts for use with threaded terminals shall have the same external dimensions as those of the solid post terminal, and shall have internal threads to 6H tolerance prior to assembly on the threaded terminals.

Dimensions in millimetres

**Key**

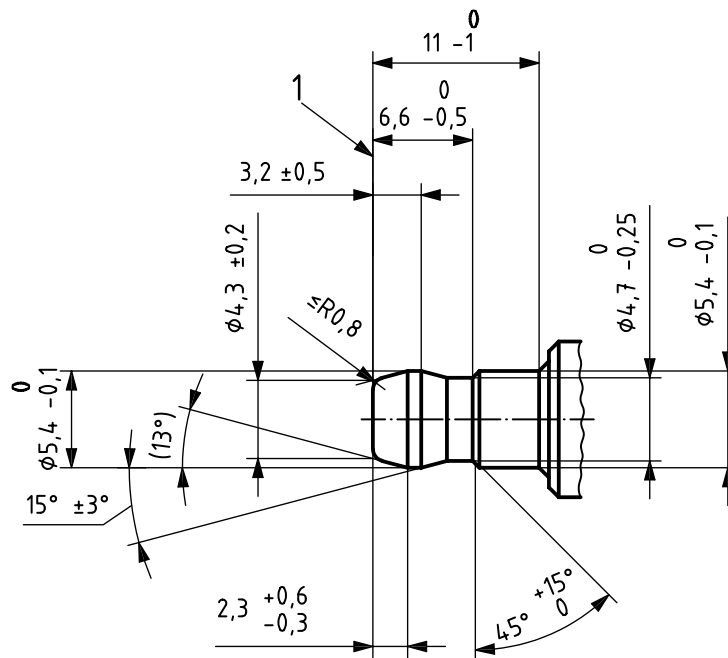
1 reference plane

^a For existing products, values between 7° and 30° are allowed.

Figure 1 — Solid post terminal

The measurement of the minimum diameter of 6,3 mm shall be taken at any or all points around the post circumference. A ring gauge shall be used for measuring the maximum diameter of 6,4 mm.

Dimensions in millimetres



Key

- 1 reference plane

Figure 2 — Solid post terminal for M10 x 1 bi-hex 12 mm spark-plugs
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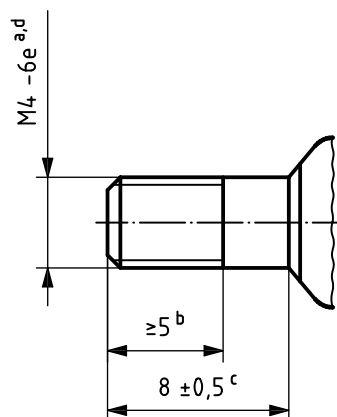
The measurement of the minimum diameter of 5,3 mm shall be taken at any or all points around the post circumference. A ring gauge shall be used for measuring the maximum diameter of 5,4 mm.

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4.2 Threaded terminal dimensions

The dimensions of threaded terminals shall be in accordance with Figure 3.

Dimensions in millimetres



Key

- a 0,7 mm pitch in accordance with ISO 68-1 and ISO 261.
- b Length of usable thread.
- c Cylindrical part.
- d Depending on manufacturing process, class 7e is acceptable on finished product.

Figure 3 — Threaded terminal

5 Dimensions, threads and related items

5.1 Spark-plug reach

The spark-plug reach shall be in accordance with Table 5 or 7 (see also Figures 4 to 15).

The following basic types of spark-plug reach are defined:

- Short: S
- Medium: M
- Long: L
- Extended long: EL
- Extra long: XL
- Extended extra long: EXL

5.2 Gasket

When unused spark-plugs with flat seating have been tightened once with a torque, as specified in Clause 7 and Table 3, on threads that are clean, smooth and dry, the gasket thickness shall be as specified in Table 3. Non-captive gaskets may be used in special cases.

5.3 Threads, limiting dimensions, tolerances

The threads of spark-plugs and the corresponding tapped holes in the cylinder heads shall conform to ISO 68-1, ISO 261, ISO 965-1 and ISO 965-3. Their limiting dimensions, minor diameters, basic profiles and initial clearances are specified in Tables 1 and 2 respectively.

Table 1 — Limiting dimensions

Dimensions in millimetres

Thread size	Tolerance class	Dimension	Major diameter		Pitch diameter		Minor diameter	
			max.	min.	max.	min.	max.	min.
M18 × 1,5	6e	Plug thread (on finished plug)	17,933	17,697	16,959	16,819	16,092	15,845 ^a
	6H	Tapped hole in the cylinder head	not specified	18,000	17,216	17,026	16,676	16,376
M14 × 1,25	6e	Plug thread (on finished plug)	13,937	13,725	13,125	12,993	12,404	12,181 ^b
	6H	Tapped hole in the cylinder head	not specified	14,000	13,368	13,188	12,912	12,647
M12 × 1,25	6e	Plug thread (on finished plug)	11,937	11,725	11,125	10,993	10,404	10,181 ^b
	6H	Tapped hole in the cylinder head	not specified	12,000	11,368	11,188	10,912	10,647
M10 × 1	6g	Plug thread (on finished plug)	9,974	9,794	9,324	9,212	8,747	8,563 ^c
	6H	Tapped hole in the cylinder head	not specified	10,000	9,500	9,350	9,153	8,917

^a With a root radius $\geq 0,150$ mm (0,1 *P*).
^b With a root radius $\geq 0,125$ mm (0,1 *P*).
^c With a root radius $\geq 0,1$ mm (0,1 *P*).

Table 2 — Minor diameters, basic profiles and initial clearances for threads used

Dimensions in millimetres

Thread size	Minor diameter ^a $d_{\text{minor}} \leq d_1 - e_s - 2(H/4 - H/6)$	Basic profile ^b	Initial clearance ^c e_s
M18 × 1,5	$d_{\text{minor}} \leq [(16,376 - 0,067 - 0,217) = 16,092]$	$(16,376 - 0,067) = 16,309$	0,067
M14 × 1,25	$d_{\text{minor}} \leq [(12,647 - 0,063 - 0,180) = 12,404]$	$(12,647 - 0,063) = 12,584$	0,063
M12 × 1,25	$d_{\text{minor}} \leq [(10,647 - 0,063 - 0,180) = 10,404]$	$(10,647 - 0,063) = 10,584$	0,063
M10 × 1	$d_{\text{minor}} \leq [(8,917 - 0,026 - 0,144) = 8,747]$	$(8,917 - 0,026) = 8,891$	0,026

^a In order that spark-plugs which comply with this International Standard can be fitted in existing cylinder heads also in extreme cases, the value for the maximum truncation of the minor diameter of the spark-plug base has been slightly reduced with respect to the ISO value. Instead of using the value given by the equation in ISO 965-1:1980, Clause 11, the maximum value of the minor diameter, d_{minor} , is calculated from a distance of $H/6$ for the maximum truncation, in accordance with the following equation:

$$d_{\text{minor}} \leq d_1 - e_s - 2(H/4 - H/6).$$

^b The value for the basic profile remains the same as for the ISO thread.

^c The initial clearance, e_s , between the pitch diameters of the thread and of the tapped hole is intended to prevent the possibility of seizure, as a result of combustion deposits on the bare threads, when removing the spark-plugs. This clearance is also intended to enable spark-plugs with threads in accordance with this International Standard to be fitted in existing tapped holes.

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6 Other dimensions of spark-plugs and their cylinder head housings

The other dimensions of spark-plugs and their cylinder head housings shall be as indicated in Figures 4 to 17, Tables 5 to 10, and Figures A.1, A.2 and C.1.

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The installed height, L , shall be measured when the spark-plug has been tightened as specified in Table 3 or 4.

The contour of the insulator is optional; however, between the reference planes defined by the dimensions C and D , its diameter shall be E , as specified in Table 5 or 7.

The non-ribbed insulator design is preferred because it provides superior protection to dielectric tracking between the spark-plug insulator and the cover.

The lengths of the cylinder head housing, Z and Z' (see Figures 16, 17, A.2 and C.1), shall be sufficient to ensure that the end of the spark-plug thread does not project into the combustion chamber at any point when the spark-plug is tightened to its maximum specified torque.

Alternative cylinder head housing with a combination of conical and flat seating is possible (see Annex C).

7 Installation tightening torque

The installation tightening torque values in Tables 3 and 4 apply to new spark-plugs without lubricant on the threads (production-related remains of lubricants are permitted). If threads are lubricated, the torque value in the table shall be reduced by approximately one third to avoid overstressing.

Engine manufacturers may specify a different torque for the first spark-plug installation.

The torque values for measuring the gasket thickness and the installed height are also given in Table 3.