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Road vehicles — Ignition systems —

Part 2: Electrical performance and function test methods

Véhicules routiers — Systèmes d'allumage —

Partie 2: Performances électriques et méthodes d'essai de fonctionnement

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 32, *Electrical and electronic components and general system aspects*.

This second edition cancels and replaces the first edition (ISO 6518-2:1995), which has been technically revised.

The main changes compared are as follows:

— test description amended to reflect the state of the art in digital technology.

A list of all parts in the ISO 6518 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The purpose of this document is to provide a compact and concise specification on ignition parameter measurements, the test equipment and the corresponding measurement procedures.

It is intended to specify equipment, conditions and methods to evaluate ignition systems for internal combustion engines.

ISO 6518-1 specifies the definitions.

Road vehicles — Ignition systems —

Part 2:
Electrical performance and function test methods

1 Scope

This document specifies the design and/or evaluation with the specific equipment, conditions and methods for distributorless battery ignition systems intended for use in various internal combustion engines including automotive, marine, motorcycle and utility engine applications. The test procedures listed in this document are limited to measurements performed on a test bench only and do not include measurements made directly on engines or vehicles. This document is not intended to supply information for battery ignition systems used in aircraft applications of any type.

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 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 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Ignition system description

This document applies to single ended coil on plug (COP) and coil near plug (CNP). This document does not propose methods to measure any advanced ignition technologies. Those advanced technologies may require advanced methodologies for collection of performance characteristics.

The ignition system as defined for the tests tabulated in this document shall consist of:

a) A coil. This can be the conventional induction coil or an air or magnetic core transformer.

b) High voltage, metal conductor ignition cables which are specified to eliminate the varying effects of the different kinds of cable with high impedance conductors. Resistance per foot, as well as inductance of spark plug cables built to suppress radiation, can be quite different from manufacturer to manufacturer.

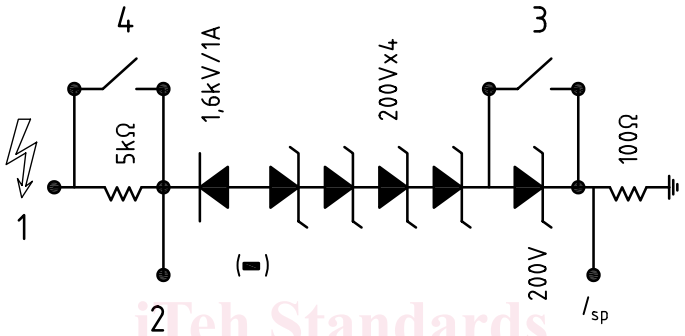
NOTE It is possible that some ignition systems do not function properly with metallic secondary cables due to EMI and can require low resistance inductance cables.

c) The standard switching device used in modern systems is the insulated gate bipolar transistor (IGBT). Other transistorized switches can be utilized too.

The preceding devices shall be interconnected as the manufacturer recommends or similar to the conventional system see Figure 15 in 7.7.

5 System load

For the purposes of this document, the assumed loads for the ignition coil are capacitance, resistance and a Zener diode string shown in Figure 1. For certain tests, as designated in Clause 6, the capacitive and resistive loads will be directly connected to the coil high voltage tower with the coil not firing. A high voltage load of 20 Picofarad (pF) or other as specified by OEM for coil-on-plug ignition system (this can be a section of shielded ignition cable) are used to simulate the capacitance of the cables and spark plugs as normally encountered on a vehicle. At suitable times, a low voltage coefficient (0,000 5 %/V max), non-inductive 1,0 MW resistor, with a power rating of approximately 10 W, should be used to represent the fouling accumulated onto the spark plug. The resistor simulates spark plug fouling due to carbon or other fuel additives. This is a standard condition, but if the user deviates from this, then it is to be documented in the test procedure. Load may vary according to customer requirements.



Key

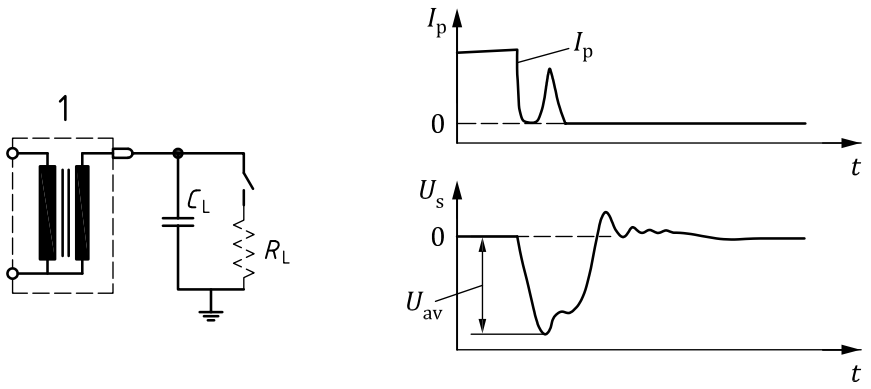
1 secondary output voltage
2 HV measurement point
3 800 V/1 000 V switch
4 5 kΩ bypass switch

Figure 1 — Representation of Zener diode string

6 Ignition parameter measurements

6.1 Available secondary (spark) voltage

The available secondary voltage is the minimum voltage at the spark plug terminal with the terminal connected to a load referenced to ground under specified conditions. This condition is usually a capacitive load representative of the engine environment around the coil and spark plug. This measurement is fundamental to spark ignition systems. Comparing available secondary voltage to the voltage that must be exceeded to fire spark plugs (in a given engine) determines the adequacy of the ignition system (see Figure 2).



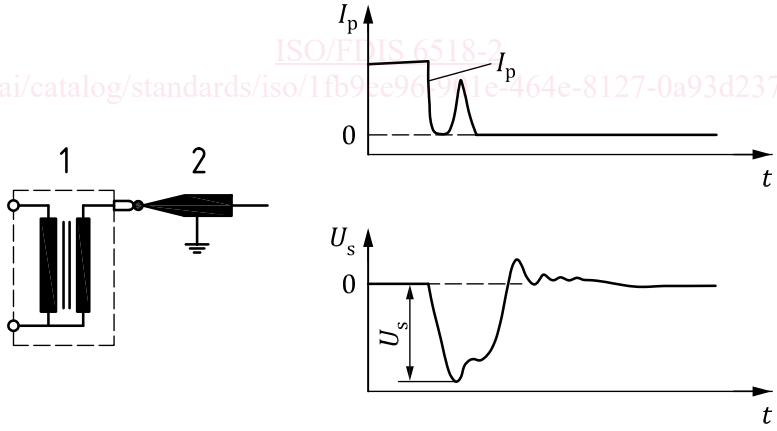
Key

1	ignication coil	t	time [µs (typ.)]
I_p	(reference) primary current [A (typ.)]	C_L	capacitive load
U_{av}	available voltage	R_L	resistance load
U_s	secondary voltage [kV (typ.)]		

Figure 2 — Example of secondary voltage waveform

6.2 Secondary output voltage (open circuit coil secondary voltage)

The secondary output voltage is the voltage measured at the coil output terminal without loading (see Figure 3). The coil is likely to be considered not installed or away from the installed capacitance due to the valve cover, the environment around the boot and the spark plug. A specified capacitance may also be placed from the high voltage terminal to ground to represent the installed system. This presents maximum voltage to the ignition coil and possible stress to IGBT clamping. This is due to the stress put upon the insulation around the windings and the stress to the driving element (IGBT) experiencing the reflected voltage from this event upon the collector. Typically, this voltage is measured with a very low capacitance HV probe.



Key

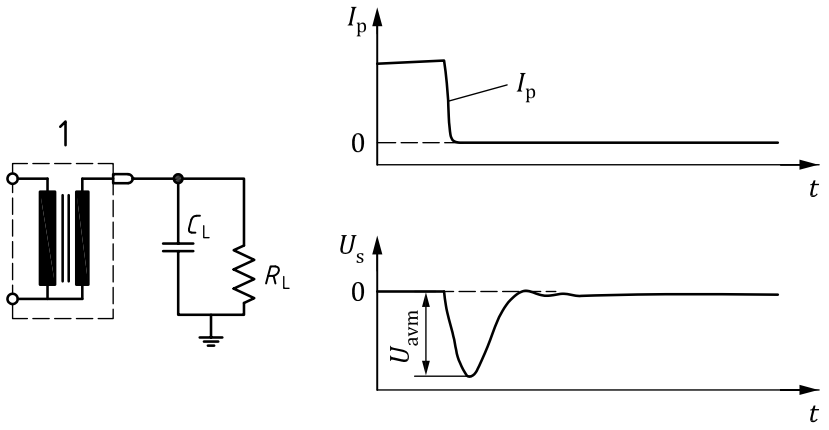
1	ignication coil	t	time [µs (typ.)] s
2	high voltage probe	U_s	secondary voltage [kV (typ.)]
I_p	primary current [A (typ.)]		

Figure 3 — Example of secondary voltage waveform

6.3 Minimum available voltage (loaded secondary voltage)

The minimum available voltage is the voltage measured at the spark plug terminal with a non-inductive (1 MΩ +/- 1 %, 10 W 0,000 5 %/V maximum voltage coefficient, dielectric strength that exceeds the system

voltage) load resistor connected to the cable spark plug terminal. This may also have a specified capacitance in parallel with the resistor. This is representative of available voltage when there is a severe plug fouling condition represented by Figure 4. This may also be called minimum available voltage requirement.



Key

1	ignition coil	t	time [µs (typ.)]
I_p	primary current [A (typ.)]	C_L	capacitive load
U_{avm}	minimum available voltage	R_L	resistance load
U_s	secondary voltage [kV (typ.)]		

Figure 4 — Example of secondary voltage waveform for a fouled spark plug with a low shunt resistance

6.4 Secondary voltage at primary current switch on (feed forward voltage)

This is the voltage induced in a secondary winding due to rate of change of the primary current at switch on (transformer effect) as shown in Figure 5. This measurement occurs at the beginning of the current ramp of the primary coil. It is the voltage that appears on the secondary output as the current changes over time on the primary coil. This is most pronounced during the moment of turning on the ignitor. This turn on can produce a peak voltage that could produce a spark before it is expected. This is measured at a specified load and battery voltage condition.