
International Standard



6518/2

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

**Ignition systems —
Part 2 : Test methods**

Systèmes d'allumage — Partie 2 : Méthodes d'essai

First edition — 1982-11-15

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UDC 621.43.04

Ref. No. ISO 6518/2-1982 (E)

Descriptors : internal combustion engines, ignition systems, electric diagrams, circuit diagrams, tests, test equipment.

Price based on 5 pages

Foreword

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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 6518/2 was developed by Technical Committee ISO/TC 22, *Road vehicles*, and was circulated to the member bodies in July 1981.

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

Austria	Hungary	Romania
Belgium	Italy	Spain
Bulgaria	Japan	Sweden
China	Korea, Dem. P. Rep. of	Switzerland
Czechoslovakia	Korea, Rep. of	United Kingdom
Egypt, Arab Rep. of	Netherlands	USA
France	New Zealand	USSR
Germany, F.R.	Poland	

No member body expressed disapproval of the document.

Ignition systems —

Part 2 : Test methods

1 Scope and field of application

This part of ISO 6518 specifies the methods and test conditions of battery ignition systems for spark ignited internal combustion engines, which give reproducible test results.

It is intended for any technical person or group interested in ignition system design and/or evaluation.

NOTE — Part 1 of ISO 6518 defines the terms relating to ignition systems for spark ignited internal combustion engines.

2 DC source

The source of dc voltage to be used in ignition system measurements shall be a variable dc power supply having a 10 to 90 % transient recovery time of not more than 50 μ s over the load range encountered in use. It shall have no more than 50 mV variation in average voltage from no load to full ignition system load and no more than 100 mV peak-to-peak ripple over the same load range. This power supply may be substituted by a battery and be positioned immediately adjacent to the test area.

3 Ignition system description

The ignition system as described for the tests specified in this part of ISO 6518 shall consist of :

3.1 A coil.

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

3.2 A coil external resistor or resistors, if the coil being tested requires an external resistor, or any fixed or variable means to make the voltage and/or the current in the ignition circuit vary.

3.3 A distributor.

This is a device which distributes the ignition impulses to the spark plugs. It may also contain means of triggering and/or timing adjustment, all of which have a proper angular interrelationship to themselves and, through a mechanical drive, to the engine.

3.4 High voltage, non-resistive metal conductor ignition cables, coil to distributor is 455 mm long, distributor to spark gap is 610 mm long.

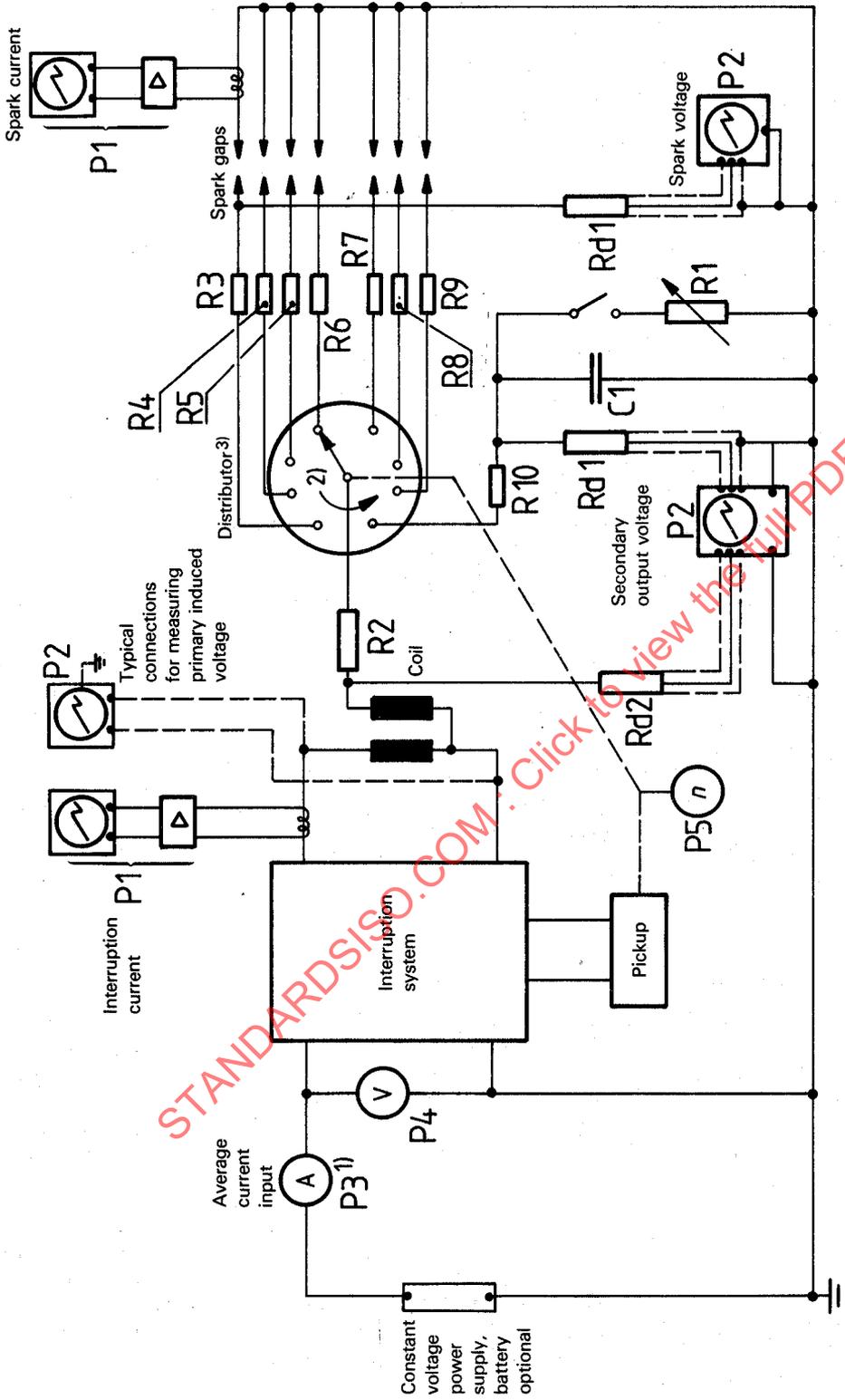
3.5 Any auxiliary switching means, implicit with the system being tested such as a transistorized control unit.

The above devices shall be interconnected as shown in figure 1 or in any other circuit which has proved to be equivalent.

4 System load

The load connected to the ignition system shall be a multi-point spark gap test stand, each gap being individually variable. The number of gaps used is one less than the number of towers on the distributor cap. Using an eight cylinder distributor as an example, seven gaps will be set to $5,5 \pm 0,1$ mm (corresponding approximately to 12 kV). The eighth tower shall be connected as shown in figure 1 by low dissipation factor (not greater than 3 % at 1 kHz), secondary ignition cable of length such that in conjunction with the capacitor the total capacitance is 50 to 55 pF (this can be a section of screened ignition cable) to simulate the capacitance of the cables and spark plugs as normally encountered on a vehicle, and at suitable times a low voltage coefficient (0,000 5 %/V max.), non-inductive approximately 10 W, $1 \text{ M}\Omega \pm 5 \%$ resistor.

The resistor simulates lead or carbon fouled spark plugs. For measuring the total capacitance, the distributor spark gaps and the impedances R2 to R10, if lumped resistors, shall be shunted and the ignition cable shall be removed from the ignition coil.



- P1 = current probe, amplifier and oscilloscope
- P2 = voltage measuring oscilloscope
- P3 = dc ammeter
- P4 = dc voltmeter
- P5 = tachometer
- C1 = load capacity
- R1 = load resistor
- R2 to R10 = suppression impedances lumped or distributed (practical implementation and values of these impedances (R1 to R10) to be agreed upon between manufacturer and user)
- Rd1 = voltage divider
- Rd2 = voltage divider

Figure 1 — Test circuit for ignition systems

- 1) P3 in positive supply rail to prevent shunting by case of interruption system. Maximum voltage drop across P3 : 100 mV.
- 2) The arrow shows the sequence of the sparks.
- 3) The distance between rotor electrode and cap electrode shall be maintained constant during spark duration or as agreed between user and supplier.

5 Measurements

5.1 Available voltage at spark plug

This measurement is fundamental to spark ignition. Comparing available voltage to voltage required to fire spark plugs (in a given engine) determines the adequacy of the ignition system (see figure 2A).

5.2 Interruption current

This measurement indicates energy into the coil and shall be verified to ensure adequate switching device life (see figure 2B).

5.3 Average current input

This measurement determines the average current draw of the system with respect to the dc source (alternator, generator, battery, etc.).

5.4 Spark voltage and spark current measurement

These measurements are necessary to calculate spark energy.

5.5 Spark duration measurement

Within limits, this measurement is indicative of the igniting capability of a spark under marginal fuel conditions. It also is an indication of the amount of erosion which will occur on spark plug electrodes due to electrical means¹⁾ (see figure 2C).

5.6 Maximum inductance spark current measurement

This is the instantaneous current from the secondary winding of the ignition coil flowing through the spark gap after breakdown (see figure 2E).

5.7 Inductive spark energy computation

Spark energy is computed by integration of spark current times spark voltage over the spark duration interval. A time can be defined where the simple product of instantaneous values of spark current, spark voltage and spark duration gives the same result. This time shall be determined for particular systems and conditions.

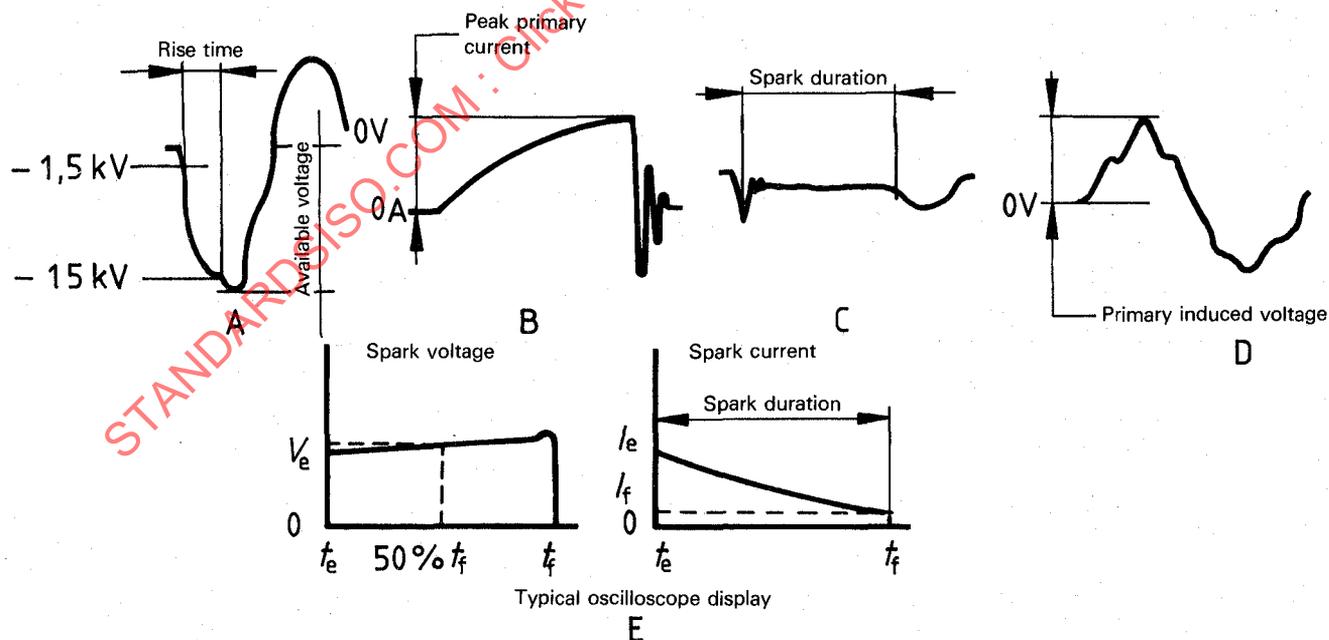
5.8 Coil secondary voltage rise time

This measurement is an indication of the ability of an ignition system to fire shunted (fouled) spark plugs. The shorter the rise time, the less system energy is lost across the fouled shunt and the more voltage is available to fire the plug (see figure 2A).

To facilitate comparison between systems, the rise time shall be determined between -1,5 kV and -15 kV or as agreed between user and manufacturer.

5.9 Coil primary induced voltage

This measurement is useful with respect to distributor contact life on conventional ignition systems and is a measure of the stress on a semiconductor power switch in inductive energy storage ignition systems (see figure 2D). If it is made, it may be



Abscissae in A, C, D and E: Time in microseconds.
Abscissa in B: Time in milliseconds.
Ordinates are as marked.

Figure 2 — Measurements effected on the ignition system

1) Because of the complexity of both of these areas, however, experience is required to use this information effectively.

necessary to use a measuring instrument with a differential input. This measurement is not applicable to capacitor discharge ignition systems.

NOTE — The primary induced voltage wave form will be preceded by a leakage induction spike. Usually this is ignored in calculations but if the area under the "spike" curve becomes significant then it is essential that it be taken into account, when considering the effect on solid state devices.

5.10 Ignition limiting load resistance

The shunt behaviour of an ignition system is also determined by its ignition limiting load resistance. It is the resistance at which the secondary available voltage falls to – 15 kV. The designation for it could be R_{15kV} . The parameters are $C_{load} = 50 \text{ pF}$, $U_{supply} = 13,5 \text{ V}$, $n = 1\ 000 \text{ min}^{-1}$.

6 Test equipment

6.1 An oscilloscope with a maximum rise time of 35 ns, with a minimum band pass of 10 MHz and measuring incertitude of less than 3 % shall be used (P1 and P2).

6.2 A voltage divider with an input capacitance smaller than or equal to 5 pF and an input resistance of more than or equal to 100 MΩ and an oscilloscope shall be used to measure the available voltage rise time and spark duration (Rd1 and Rd2). For measuring the ignition current, a current probe shall be used as shown in figure 1.

6.3 A dc ammeter shall be used to measure average current input (P3).

6.4 The same oscilloscope as described in 6.1 may be used to measure primary induced voltage.

6.5 A dc voltmeter with an input resistance of at least 10 kΩ/V and with sufficient resolution to easily indicate differences of 0,1 V.

6.6 A distributor drive stand and attached tachometer conforming to the following :

6.6.1 Drive shaft and attached tachometer shall be concentric within 0,1 mm.

6.6.2 A continuous speed adjustment, variation between 10 to 4 000 min^{-1} possible.

6.6.3 Speed stability within 5 % between 10 and 750 min^{-1} and 2 % between 1 000 and 4 000 min^{-1} .

6.6.4 A tachometer accurate within 1 % of indicated speed.

7 Procedures

7.1 The conventional circuit arrangement as shown in figure 1 with instrumentation in place can be used to measure the parameters mentioned in clause 5 under the conditions listed in the table as appropriate.

The calculation described in 5.7 plus the procedure described here determines the inductive portion of the spark energy dissipated in a spark gap as shown in figure 3 under the conditions shown in the table. This procedure can be used in relating the effective amount of spark energy required to ignite a given fuel mixture.

Table — Test conditions

Distributor min ⁻¹	Supply V	Environment temperature °C		Operating condition
		Comparative testing	Operational testing	
10 20 30 40	6,0	+ 23 ± 2	- 30 ± 3	Cold starting
50 60 70	10,0	+ 23 ± 2	+ 50 ± 2* + 80 ± 2**	Warm starting
250 500 750 1 000 1 250 1 500 1 750 2 000 2 250 2 500 2 750 3 000 3 250 3 500 3 750 4 000	13,5	+ 23 ± 2	+ 50 ± 2* + 80 ± 2**	Running

* This value applies for items mounted in vehicle cabin or similar environment.

** This value applies for items mounted on or near the engine.