



SURFACE VEHICLE RECOMMENDED PRACTICE

J139™

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Ignition System Nomenclature and Terminology

RATIONALE

This document was reviewed, updated, and revised to include standard nomenclature and terminology used to describe features and components of ignition systems for spark ignited internal combustion engines. The rationale to revise the document existed because of system modifications and advancements not addressed in the SAE J139 July 2014 revision.

SAE J139 has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

To provide standard terminology and definitions with regard to ignition systems for spark-ignited internal combustion engines.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publication

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J973 Ignition System Measurements Procedure

3. TYPES OF IGNITION SYSTEMS

3.1 Electronic

A system in which the coil current is controlled by semiconductors. The semiconductors can be controlled by mechanical breaker points or other means.

3.2 Breaker-less

A system like 3.1, except the semiconductors are controlled by means other than mechanical breaker points.

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3.3 Distributor-less (Static Distribution System)

A system that omits the rotating mechanical spark voltage distributor.

3.3.1 Coil-on-Plug (Single-Ended Coil)

A distributor-less system that omits ignition cables and utilizes a single-ended coil for each spark plug along with connecting devices. These device types can include: spring, short wire or cable, terminal, or combinations of these items, totally contained inside insulator boot.

3.3.2 Coil-on-Plug (Double-Ended Coil)

A distributor-less system that omits ignition cables and utilizes a double-ended coil for a pair of spark plugs (firing in unison in a single cylinder) along with connecting devices. These device types can include: spring, short wire or cable, terminal, or combinations of these items, totally contained inside insulator boot.

3.3.3 Coil-Near-Plug (Single-Ended Coil)

A distributor-less system utilizing one single-ended coil and a short ignition cable for each spark plug.

3.3.4 Coil-Near-Plug (Double-Ended Coil)

A distributor-less system that utilizes one double-ended coil for a spark plug pair in opposing cylinders firing 360 crank degrees apart. This type of ignition system is called a waste spark system (see 3.8).

3.3.5 Magneto

A system that utilizes a permanent magnet on a rotating part of the engine to generate energy. It may be conventional (3.3.7), electronic (3.1), breaker-less (3.2), or distributor-less (3.3).

3.3.6 Inductive

A system that stores energy in the primary winding (inductor) of the ignition coil. (The primary current flow can be controlled by mechanical breaker points, semiconductors, or other means.) The high voltage for the spark discharge is generated by the ignition coil (step-up transformer) when the primary current is terminated and the magnetic field collapses.

3.3.7 Conventional (Kettering)

A system that consists of a coil, rotating mechanical spark voltage distributor, battery, and mechanical breaker points to control coil current.

3.4 Capacitor Discharge (CD)

A system that stores primary energy in a capacitor. The high voltage for the spark discharge is generated by the ignition coil (step-up transformer) when the energy stored on the capacitor is discharged through the primary winding of the ignition coil.

3.4.1 AC Capacitor Discharge

A variant of a CD system that uses a bi-directional primary switch, allowing alternating current flow in the primary and secondary windings during the discharge.

3.5 Angle-Based Ignition Timing System (ABITS)

An angle-based ignition timing system uses a high resolution engine position sensing scheme (e.g., 360 pulses per revolution) for the ECU to use for spark delivery.

NOTE: As an example, an ignition system could be an electronic, breaker-less, distributor-less system; and such a system is generally either inductive or capacitor discharge although hybrid systems are known to exist. (The energy can be discharged into a coil by mechanical breaker points, semiconductors, or other means.)

3.6 Multi-Pulse/Multi-Spark Ignition Systems

An ignition system mechanization that discharges coil energy through a spark plug multiple times during one cylinder event.

3.6.1 Open Loop Multi-Pulse Control

A multi-pulse system that controls the charging and discharging of the coil following calibration values without measuring coil operating parameters. Typical calibrations include:

- Initial coil charge time (dwell)
- Initial coil discharge time (burn time)
- Subsequent coil charge time
- Subsequent coil discharge time
- Number of pulses

3.6.2 Closed Loop Multi-Pulse Control

A multi-pulse system that controls the charging and discharging of the coil using feedback from the coil primary current, coil secondary current, and/or ionization current or other combustion feedback.

3.7 Continuous Discharge Ignition System

3.7.1 Dual Coil Continuous Discharge

A dual coil per cylinder ignition system that operates in an alternating charge/discharge mode with the two coil outputs summed together to fire a single spark plug. The first coil fires the spark plug initially and then the coils alternate between charging and discharging (out of phase with one another) to support a continuous discharge for as long as the ECU continues to cycle the coils.

3.7.2 Single Coil Continuous Discharge

A single coil ignition system whereby a DC supply is used to “boost” the charge state of the primary coil between secondary discharge events, thereby supporting a continuous secondary discharge for as long as the ECU continues to cycle the coil. The DC supply voltage must be sufficiently high for the coil to act as a step-up transformer, as in a capacitive discharge system.

3.8 Waste-Spark Ignition System

A system in which both ends of a secondary winding of a high voltage transformer are connected to a spark plug each on opposing cylinders, allowing the use of one coil for every two cylinders on the engine. The coil is energized once per engine revolution, firing both spark plugs at the subsequent demand voltage for each, one on the compression stroke and one on the exhaust stroke. The compression stroke firing is intended to ignite the air/fuel mixture, while the opposing exhaust stroke firing is “wasted” as no ignitable mixture should be present.