



400 Commonwealth Drive, Warrendale, PA 15096-0001

# SURFACE VEHICLE RECOMMENDED PRACTICE

Submitted for recognition as an American National Standard

SAE J1541

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## FUEL INJECTION NOMENCLATURE—SPARK IGNITION ENGINES

**Foreword**—This reaffirmed document has been changed only to reflect the new SAE Technical Standards Board format.

**1. Scope**—This SAE Recommended Practice was developed to provide a common understanding and usage of the technical terms useful in fuel injection systems for spark ignition engines. Additional nomenclature related to specific components is covered in the individual component sections.

**2. References**—There are no referenced publications specified herein.

### 3. Definitions

**3.1 Accumulator**—A device to maintain fuel system pressure after the fuel pump is turned off. The device may also dampen pressure fluctuations and fuel pump noise during normal system operation.

**3.2 Air Assisted Fuel Injection (AAFI)**—A fuel injection system where auxiliary air is mixed with the metered fuel to aid in vaporization or transport, or both, of the fuel.

**3.3 Airflow Sensor**—A sensor that provides an electrical output proportional to the flow rate of the intake air to the engine.

**3.4 Barometric Absolute Pressure (BAP)**—Absolute atmospheric air pressure.

**3.5 Camshaft/Crankshaft Position Sensor (CPS)**—Devices which supply an electrical output that indicate the given shaft reference angle.

**3.6 Central Fuel Injection (CFI)**—An electronically controlled fuel injection system in which one or more fuel injectors are located in the throttle body. The injectors may be positioned above or below the throttle plates.

**3.7 Cold Start Injectors (CSI)**—An auxiliary fuel injector which supplies additional fuel during cold cranking. Fuel injection is generally continuous and the fuel rate is based on the orifice size and fuel pressure. Normally used in conjunction with a thermo-time switch.

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- 3.8 Continuous Injection System (CIS)**—A fuel injection system in which fuel flows continuously from the injector or injectors independent of cylinder events. Fuel flow rate can be controlled by a variable orifice or fuel pressure.
- 3.9 Damper**—A device whose primary function is to attenuate pressure fluctuations in the fuel system and, thereby, reduce hydraulic and acoustic noise.
- 3.10 Direct Fuel Injection (DFI)**—Delivery of fuel directly into the combustion chamber.
- 3.11 Electronic Control Unit (ECU)**—An electronic module one function of which is to calculate a command signal for the injector driver circuit based on inputs from engine operating sensors.
- 3.12 Electronic Fuel Injection (EFI)**—A general term referring to any fuel injection system in which fuel metering is controlled electronically. Quantity of fuel delivered is scheduled by an electronic control unit. Its output signal is based on information received from several sensors that monitor the operating conditions of the engine.
- 3.13 Engine Coolant Temperature Sensor (ECTS)**—A sensor that provides an electrical output proportional to the engine coolant temperature.
- 3.14 Exhaust Gas Oxygen Sensor (EGOS)**—A sensor located in the exhaust system that provides an electrical output which indicates oxygen content.
- 3.15 Fuel Injection (FI)**—A general term referring to any type of fuel injection system, that is, CFI, CIS, EFI, MPI, PFI, SFI, SPI, TBI, etc. Fuel delivery may be mechanically or electronically controlled. Systems with fuel pressure  $>150$  kPa will be referred to as "high pressure" and those  $\leq 150$  kPa as "low pressure."
- 3.16 Fuel Injector (INJ)**—An electromagnetic or mechanical device used to direct delivery or meter pressurized fuel or both.
- 3.17 Fuel-Injector Driver (FID)**—An electronic circuit that converts the fuel control signal from the ECU into the proper voltage and current signal required. The two commonly used drivers in the industry are a peak-hold driver used with low resistance injectors as an "on-off" (saturated driver) used with high resistance injectors.
- 3.18 Fuel Pressure Regulator (REG)**—A device to maintain a controlled fuel pressure at the fuel injector or a controlled differential pressure across the injector.
- 3.19 Fuel Pump (Pump)**—A device that provides a specified fuel flow at the required system pressure.
- 3.20 Fuel Rail (Rail)**—A fuel manifold that distributes fuel to the individual fuel injectors. It is used with multi-point injection systems.
- 3.21 Group Fuel Injection (GFI)**—A multi-point delivery technique in which fuel is delivered in a predetermined sequence by groups of two or more injectors.
- 3.22 Idle Speed Control (ISC)**—A general term used to indicate any device or system which provides programmed control of engine idle speed. Speed control is usually accomplished by adjusting the amount of air bypassing the throttle plate or by adjusting the position of the throttle plate.
- 3.23 Intake Air Temperature Sensor (IATS)**—A sensor that provides an electrical output proportional to the intake air temperature. It is typically mounted within or ahead of any airflow measuring device.

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**3.24 Intake-Manifold Absolute Pressure Sensor (IMAPS)**—A sensor which provides an electrical output proportional to the absolute pressure within the intake manifold downstream of the throttle plate.

**3.25 Intake-Manifold Charge Temperature Sensor (IMCTS)**—A sensor located in the intake manifold that provides an electrical output proportional to the temperature of the air or air/fuel mixture.

**3.26 Multi-Point Injection (MPI)**—A fuel delivery system in which each cylinder is fueled by at least one injector. The injector is normally located in the intake manifold or port close to the intake valve.

**3.27 Port Fuel Injection (PFI)**—See Multi-Point Injection.

**3.28 Sequential Fuel Injection (SFI)**—A multi-point fuel delivery technique in which each injector is individually energized and timed relative to its cylinder event. Fuel is delivered to each cylinder once per two crankshaft revolutions in 4-cycle engines and once per crankshaft revolution in 2-cycle engines.

**3.29 Simultaneous Double Fire (SDF)**—A multi-point fuel delivery technique in which all injectors in a 4-cycle engine are energized simultaneously usually once per crankshaft revolution.

**3.30 Single Point Injection (SPI)**—A fuel delivery system in which the total fuel requirement of the engine is delivered at one specific location in the intake system. More than one injector may be used.

**3.31 Speed Density (SD)**—A system in which the mass air flow rate is calculated based on cylinder displacement and the measured intake manifold absolute pressure, engine speed, intake manifold air temperature, and theoretical volumetric efficiency.

**3.32 Thermo-Time Switch (TTS)**—A bi-metal switch used to control the amount of fuel delivered by the cold start injector during cold cranking.

**3.33 Throttle Body (TB)**—A device used to vary the supply of intake air to the engine by means of one or more adjustable orifices and/or throttle plates.

**3.34 Throttle Body Injection (TBI)**—See Central Fuel Injection.

**3.35 Throttle Position Sensor (TPS)**—A device that provides an electrical output as a function of throttle plate position.

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