SURFACE VEHICLE STANDARD

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Superseded by ISO 7876-1 thru -5

Fuel Injection Equipment Nomenclature

RATIONALE

SAE J830 has been cancelled because the content of this standard is fully covered by ISO 7876-1 thru -5. Therefore, to eliminate such redundancy and confusion in coordinating the standards between ISO and SAE, this document is declared cancelled and superseded by ISO 7876-1 thru -5.

CANCELLATION NOTICE

This Technical Report has been declared "CANCELLED" as of September 2015 and has been superseded by ISO 7876-1 thru -5. By the action, this document will remain listed in the respective index, if applicable. Cancelled Technical Reports are available from SAE.

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Foreword—Fuel injection equipment is in worldwide use and the application of such requires precise terminology.

This SAE Standard is intended to achieve a universal vocabulary for fuel injection systems and the components thereof.

1. Scope—This SAE Standard establishes a vocabulary and definitions relating to the components used in fuel injection systems for compression ignition (diesel) engines.

Definitions are separated into six sections by topic as follows:

Section 3—Fuel Injection Pumps
Section 4—Fuel Injectors
Section 5—Unit Injectors
Section 6—Governors
Section 7—Timing Devices
Section 8—High Pressure Pipes and Connections

NOTE—When the word "fuel" is used in the terms listed it may be omitted providing there can be no misunderstanding.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J347—Diesel Fuel Injector Assembly Type 7 (9.5 mm)
SAE J1949—Diesel Engines—High Pressure Fuel Injection Pipe End Connections with 60 degree Female Cone
SAE J1958—Diesel Engines—Steel Tubes for High Pressure Fuel Injection Pipes (Tubing)
SAE J1984—Diesel Fuel Injector Assembly—Type 28 (9.5 mm)

2.1.2 ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 8535-2—Compression-ignition engines—Steel tubes for high-pressure fuel injection pipes

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2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 2710—Reciprocating internal combustion engines—Vocabulary
ISO 7876—Fuel injection equipment—Vocabulary
ISO 7967—Reciprocating internal combustion engines—Vocabulary of components and systems

3. Fuel Injection Pumps

3.1 Basic Definition

3.1.1 FUEL INJECTION PUMP—A device which delivers metered volumes of fuel under pressure through a separate nozzle or nozzles.

3.2 Principle of Operation

3.2.1 JERK FUEL INJECTION PUMP—An injection pump in which the force required to move the plunger is received directly from the prime motivator.

3.2.2 ACCUMULATOR FUEL INJECTION PUMP—An injection pump in which the force required to move the plunger is drawn from an energy accumulator.

3.2.3 SERVO FUEL INJECTION PUMP—An injection pump in which the force required to move the plunger comes from an energy source external to the pump, with or without an intermediate intensifying device.

3.3 Form of Energy Input

3.3.1 MECHANICAL FUEL INJECTION PUMP—An injection pump which is actuated solely by mechanical means.

3.3.2 ELECTRICAL FUEL INJECTION PUMP—An injection pump which is actuated solely by electrical means.

3.3.3 HYDRAULIC FUEL INJECTION PUMP—An injection pump which is actuated solely by hydraulic means.

NOTE—An injection pump may be actuated by a combination of the above three energy inputs (e.g., hydromechanical, hydroelectrical, etc.)

3.4 Mode of Energy Application

3.4.1 RECIPROCATING FUEL INJECTION PUMP—A mechanical injection pump without an integral camshaft for reciprocating the plunger(s) of the pumping element(s).

3.4.2 ROLLER FUEL INJECTION PUMP (ROLLER PUMP)—A reciprocating injection pump with a roller tappet.

3.4.3 DRIVESHAFT FUEL INJECTION PUMP—A mechanical injection pump with an integral driveshaft or camshaft for actuating the plunger(s) of the pumping element(s).

Such a pump may consist also of a separate cambox having mounted on it a number of individual fuel injection pumps.

3.4.4 CAMSHAFT FUEL INJECTION PUMP—A driveshaft fuel injection pump with an integral camshaft for actuating the plunger(s) of the pumping element(s) and having any of the types of attachment defined herein.

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3.5 Cylinder Arrangement

3.5.1 SINGLE CYLINDER FUEL INJECTION PUMP—An injection pump with only one pumping element and one outlet.

NOTE—A single cylinder pump serving only one engine cylinder may be termed "individual fuel injection pump."

3.5.2 IN-LINE FUEL INJECTION PUMP—An injection pump having the axes of its pumping elements arranged parallel to each other and in one plane.

3.5.3 CYLINDRICAL FUEL INJECTION PUMP—An injection pump in which the axes of its pumping elements are arranged cylindrically and concentrically with the driveshaft axis.

3.5.4 ROTARY FUEL INJECTION PUMP—A driveshaft injection pump in which the axis (axes) of the pumping element(s) rotate about a common axis to perform the working cycles.

3.6 Type of Distribution

3.6.1 MULTICYLINDER FUEL INJECTION PUMP—An injection pump having multiple pumping elements and an equal number of outlets.

NOTE—A multicylinder pump serving more than one engine cylinder may be termed "block type fuel injection pump."

3.6.2 DISTRIBUTOR FUEL INJECTION PUMP—An injection pump in which the fuel deliveries are directed to the appropriate nozzle(s) by at least one distributing device.

3.7 Type of Attachment

3.7.1 BASE MOUNTED FUEL INJECTION PUMP—A driveshaft injection pump having a flat mounting plane which is parallel to the driveshaft axis and at right angles to the axis(es) of the pumping elements.

3.7.2 BASE FLANGE MOUNTED FUEL INJECTION PUMP—A reciprocating injection pump with a mounting flange at right angles to the axis(es) of the pumping element(s) and with the fuel inlet, fuel control mechanism and fuel outlet above the flange.

3.7.3 HIGH FLANGE MOUNTED FUEL INJECTION PUMP—A reciprocating injection pump with a mounting flange at right angles to the axis(es) of the pumping element(s) and with the fuel inlet, fuel control mechanism below the flange.

3.7.4 SIDE MOUNTED FUEL INJECTION PUMP—An injection pump with a mounting face parallel to the pumping element(s) and parallel to the axis of the camshaft (whether included in the pump or not).

3.7.5 END FLANGE MOUNTED FUEL INJECTION PUMP—A driveshaft injection pump having a mounting flange arranged perpendicular to the driveshaft.

3.7.6 CRADLE MOUNTED FUEL INJECTION PUMP—A driveshaft injection pump having a cylindrical mounting surface coaxial with the driveshaft.

3.8 Fuel Metering Process

3.8.1 METERING—The process of establishing any required fuel delivery within the operating range of the fuel injection system using various means of control.

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3.8.2 PORT AND HELIX METERING—A system of metering by means of one or more oblique grooves in the plunger and one or more ports in the barrel, or inversely.

3.8.3 SLEEVE METERING—A system of metering incorporating a movable sleeve by which port opening and/or closing is controlled.

3.8.4 INLET METERING—A system of metering by controlling the amount of fuel entering the pumping chamber during the filling or charging portion of the pump cycle.

3.8.5 VARIABLE STROKE METERING—A system of metering by controlling the plunger stroke.

3.8.6 VALVE METERING—A system of metering by cyclic operation of valve(s) to control the effective pumping stroke.

3.8.7 SHUTTLE (DISPLACEMENT) METERING—A system of metering by variable displacement of an auxiliary free piston.

3.8.8 CAM LIFT—The geometric difference between the base of the cam profile and the cam peak.

3.8.9 PLUNGER STROKE—The nominal distance through which a plunger moves between two successive reversals of its direction of motion.

3.8.10 PLUNGER LIFT TO CUT-OFF PORT CLOSING—That part of the plunger stroke from initial movement of the plunger to the position at which the cut-off port closes, determining the beginning of geometric delivery.

3.8.11 ANGLE TO CUT-OFF PORT CLOSING—The angular movement of the driveshaft equivalent to plunger lift to cut-off port closing.

3.8.12 PLUNGER LIFT TO SPILL PORT OPENING—That part of the plunger stroke from initial movement of the plunger to the position at which the spill port opens, determining the end of geometric delivery.

3.8.13 ANGLE OF SPILL PORT OPENING—The angular movement of the driveshaft equivalent to plunger lift to spill port opening.

3.8.14 CUT-OFF PORT—That port which is closed by the movement of the plunger at the beginning of geometric delivery.

3.8.15 SPILL PORT—The port which is opened by the movement of the plunger at the end of the geometric delivery.

3.8.16 INLET PORT—A port which admits fuel to the pumping chamber.

NOTE—The inlet port may or may not serve also as the cut-off and/or spill port(s).

3.8.17 GEOMETRIC FUEL DELIVERY STROKE—That part of the plunger stroke between the beginning and end of geometric fuel delivery.

3.8.18 RETRACTION VOLUME (UNLOADING VOLUME)—The volume by which the volume of the high pressure system is increased after the end of delivery.

3.8.19 GEOMETRIC RETRACTION VOLUME—The geometric volume by which the volume of the high pressure system is increased after the end of geometric fuel delivery.

3.8.20 RETRACTION STROKE—The calculated or real part of the plunger stroke corresponding to the retraction volume or the geometric retraction volume.

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3.8.21 EFFECTIVE STROKE—The difference between the delivery stroke and the retraction stroke, geometric or otherwise, respectively.

3.8.22 REMAINDER STROKE—The part of the plunger stroke, if any, between the end of geometric fuel delivery stroke and the end of the plunger stroke.

3.8.23 HEAD CLEARANCE—The distance between the top surface of a fuel injection pump plunger (or plunger assembly) at the end of the plunger stroke and the nearest component that would limit its further movement.

3.8.24 FUEL DELIVERY—The metered volume of fuel delivered by a fuel injection system during one working cycle.

3.8.25 GEOMETRIC FUEL DELIVERY—The nominal volume of fuel displaced as defined by the geometric fuel delivery stroke.

3.9 Components and Assemblies

3.9.1 INJECTION PUMP ASSEMBLY—An assembly consisting of the injection pump proper, governor, supply or feed pump, and any other additional devices which together form a unit.

3.9.2 PUMPING ELEMENT—The combination in an injection pump of a pumping plunger and its barrel.

3.9.3 PUMPING ASSEMBLY—That combination of parts in an injection pump extending between the plunger foot and the high pressure pipe (or nozzle in a pump injector).

3.9.4 METERING SPILL VALVE—A controllable valve the operation of which controls the commencement and/or termination of the geometric delivery by permitting spill from the pumping chamber.

3.9.5 SPILL VALVE—A valve which by cyclic operation permits spill from the pumping chamber and therefore controls the commencement and/or termination of the geometric delivery.

3.9.6 INLET VALVE—An automatic valve which permits fuel to enter the pumping chamber.

3.9.7 METERING INLET VALVE—A device which performs inlet metering.

3.9.8 DELIVERY VALVE—A valve located at the outlet of the pumping chamber. Various types of delivery valves, by suitable design, can perform one or more of the various functions listed as follows:

a. non-return
b. constant volume unloading
c. variable volume unloading
d. pressure time volume unloading (including reverse flow damping)
e. constant pressure unloading
f. variable pressure unloading

3.9.9 DELIVERY VALVE HOLDER—A device which retains the delivery valve and associated components and sometimes forms a pump outlet.

3.9.10 INJECTION PUMP HOUSING—The housing which contains or holds the functional components of the injection pump proper including the driveshaft or camshaft when incorporated in the pump.

3.9.11 FUEL GALLERY—The passageway(s) of an injection pump through which fuel is transferred to and/or from the pumping elements.

3.9.12 CONTROL ROD (RACK)—The rod by means of which the fuel delivery is controlled.

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3.9.13 CONTROL ARM (PINION)—An intermediate component or assembly which engages the metering device (plunger) and the control rod (rack).

3.9.14 METERING SLEEVE—A movable component by which sleeve metering is achieved.

3.9.15 MAXIMUM FUEL STOP (FULL LOAD STOP)—A device which limits the maximum fuel delivery of an injection pump for a given application.

3.9.16 HYDRAULIC HEAD ASSEMBLY—The assembly containing the pumping elements, and metering and distributing components and may include the delivery valve(s) for a distributor fuel injection pump.

3.10 Auxiliary Devices

3.10.1 EXCESS FUEL DEVICE—A device (automatic or manual) which permits, for engine starting only, a fuel delivery in excess of that controlled by the maximum fuel stop.

3.10.2 BOOST CONTROL (BOOST PRESSURE CONTROLLED MAXIMUM FUEL STOP)—A device which limits the maximum fuel delivery in relation to the engine boost (charge air) pressure.

3.10.3 ALTITUDE CONTROL (ALTITUDE CONTROLLED MAXIMUM FUEL STOP)—A device which limits the maximum fuel delivery in relation to the altitude pressure (barometric pressure) where the engine operates.

3.10.4 TORQUE CONTROL—A device which modifies the maximum fuel delivery at speeds below engine rated speed.

3.11 General Terms

3.11.1 DIRECTION OF ROTATION—The direction of rotation is designated "clockwise" or "counterclockwise" when viewing the driven end of the driveshaft.

3.11.2 FUEL INJECTION PUMP SPEED—The speed of the injection pump driveshaft when incorporated in the pump; alternatively, if the driveshaft is not incorporated in the pump, the frequency of delivery from an outlet.

3.11.3 INJECTION ORDER—The order in which the several pump outlets, with a specific direction of driveshaft rotation, deliver fuel. Where applicable the outlets shall be numbered in ascending sequence with number one nearest the driven end of the camshaft. In other cases the outlets shall be identified.

3.11.4 RESIDUAL PRESSURE—The mean pressure at the high pressure outlet of an injection pump before the start of any event related to the next working cycle.

3.11.5 PHASING—The geometric (commonly angular) relationship of the delivery periods between two or more fuel injection pump or system outlets.

3.11.6 STATIC PHASING (SPILL PHASING)—A method of phasing in which the beginning or end of delivery is established by observation of changes in spill flow.

3.11.7 DYNAMIC PHASING—A method of phasing in which a specific event in the injection cycle is established while the injection system is in operation.

4. Fuel Injectors

4.1 Main Definitions

4.1.1 FUEL INJECTOR—Assembly comprising a nozzle (4.1.2) and a nozzle holder (4.1.3) through which a metered volume of fuel under high pressure is injected into the combustion chamber.

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Specific designs of injector may include the nozzle as an integral part of the nozzle holder (which is specified in SAE J347/J1984).

4.1.2 NOZZLE—Valve comprising two principal components, namely the nozzle body and the needle (valve needle), through which the fuel is atomized when open.

4.1.3 NOZZLE HOLDER—Assembly to which the nozzle is attached for location in the cylinder head. It comprises all parts of an injector except the nozzle.

4.2 Principle of Operation

4.2.1 ATOMIZATION—Conversion of liquid fuel under high pressure into a high velocity spray(s) of very small droplets.

4.3 Method of Operation

4.3.1 (CONVENTIONAL) FUEL INJECTOR—Injector actuated solely by the pressure of the metered fuel.

4.3.2 MECHANICAL FUEL INJECTOR—Injector actuated by external mechanical means.

4.3.3 ELECTRICAL FUEL INJECTOR—Injector actuated by appropriate electrical means.

4.3.4 HYDRAULIC FUEL INJECTOR—Injector actuated by hydraulic means separate from the fuel pressure.

NOTE—An injector may be actuated by a combination of the four methods of operation given in this clause (e.g., hydromechanical, etc.).

4.4 Means of Angular Location

4.4.1 FIXED FLANGE-LOCATED INJECTOR—Injector where the angular location in the engine is determined by a fixed (integral) flange on the nozzle holder body.

4.4.2 FLATS-LOCATED INJECTOR—Injector where the angular location in the engine is determined by the flats on the nozzle holder body and the corresponding shape of the retaining flange or clamp.

4.4.3 BALL/DOWEL-LOCATED INJECTOR—Injector where the angular location in the engine is determined by a ball or dowel on the nozzle holder body and a corresponding slot in the mounting hole.

4.5 Types of Attachment

4.5.1 FLANGE-MOUNTED FUEL INJECTOR—Injector held in the engine by means of a loose or integral flange arranged perpendicular to the axis of the injector and secured with a minimum of two studs or bolt(s).

4.5.2 CLAMP-MOUNTED FUEL INJECTOR—Injector held in the engine by means of a single or double finger clamp and secured with stud(s) or bolt(s).

4.5.3 SCREW-MOUNTED FUEL INJECTOR—Injector held and secured in the engine by means of a gland nut.

4.5.4 SCREW-IN FUEL INJECTOR—Injector held and secured in the engine by means of an external thread on the nozzle holder body or nozzle retaining nut.

4.6 Nozzle Holder Types and Components

4.6.1 HIGH SPRING NOZZLE HOLDER—Design where the spring is remote from the pressure face.

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4.6.2 LOW SPRING NOZZLE HOLDER—Design where the spring is near the pressure face.

4.6.3 TWO SPRING NOZZLE HOLDER—Design which provides two stage nozzle actuation.

4.6.4 COOLED NOZZLE HOLDER—Design which contains passages through which a coolant is passed.

4.6.5 NON-LEAK-OFF NOZZLE HOLDER—Design which does not require a back-leakage connection.

4.6.6 NOZZLE HOLDER BODY—Component having integral fuel passages and to which all other components are added in forming the nozzle holder.

4.6.7 ADAPTER PLATE—Component positioned between the nozzle and the nozzle holder body to provide a lift stop for the nozzle needle.

4.6.8 NOZZLE HOLDER CAP NUT—Component which covers and seals the adjustment feature for nozzle opening pressure.

4.6.9 SPINDLE—Component of some length positioned between the spring and the needle.

4.6.10 SPRING SEAT—Short spindle used in low spring injectors.

4.6.11 PRESSURE-ADJUSTING SCREW—Screw by means of which the spring force on the needle is adjusted.

4.6.12 PRESSURE-ADJUSTING SHIM—Shim by means of which the spring force on the needle is adjusted.

4.6.13 NEEDLE LIFT ADJUSTING SHIM—Shim by means of which the needle lift stop is adjusted.

4.6.14 SPRING CAP NUT—Component which houses the spring and may function as an adjusting screw.

4.6.15 FUEL INLET CONNECTION—That part of the nozzle holder to which the high pressure pipe is attached.

4.6.16 FUEL INLET CONNECTOR; INLET STUD—Adaptor attached to the nozzle holder body which functions as an inlet connection.

4.6.17 EDGE FILTER—Type of fuel inlet filter housed in the inlet connector or nozzle body.

4.6.18 BACK-LEAKAGE CONNECTION—Part of the nozzle holder to which a pipe is attached to remove back-leakage.

4.6.19 NOZZLE RETAINING NUT (NOZZLE CAP NUT)—Component which secures the nozzle and adaptor plate where applicable to the nozzle holder body.

4.6.20 GLAND NUT—Freely rotating threaded component assembled coaxially on the nozzle holder body, used to attach an injector to the engine.

4.6.21 HEAT SHIELD (SEAL)—Component used to reduce the heating effect on the nozzle from combustion.

4.7 Nozzle Types

4.7.1 PINTLE NOZZLE—Nozzle which has a needle with a profiled protrusion (the pintle) which extends through a coaxial hole in the body.

4.7.2 DELAY (THROTTLE) PINTLE NOZZLE—Pintle nozzle with a needle protrusion profile which throttles the fuel flow during the initial lift of the needle.

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4.7.3 FLATTED PINTLE NOZZLE—Delay pintle nozzle with one or more flats on the needle protrusion profile which influences the fuel flow during the initial needle lift.

4.7.4 PINTAUX NOZZLE—Delay pintle nozzle with auxiliary hole or holes which permit fuel to bypass the throttling stage of the initial needle lift.

4.7.5 HOLE-TYPE NOZZLE—Nozzle with one or more injection/spray holes and a needle which does not affect hole area. These are commonly termed single- or multi-hole nozzles.

4.7.6 V.C.O. ("VALVE" NEEDLE COVERED ORIFICE) NOZZLE—Hole-type nozzle with injection/spray holes positioned in the body seat which are covered by the needle when closed.

4.7.7 POPPET NOZZLE—Nozzle with an outward opening mushroom-shaped needle.

4.7.8 COOLED NOZZLE—Nozzle with a body containing passages through which coolant is passed.

4.8 General Terms

4.8.1 INJECTOR SHANK DIAMETER—Diameter of the injector which determines co-axial location in the engine.

4.8.2 INJECTOR SHANK LENGTH—Distance from the primary sealing face of the nozzle retaining nut (with nozzle fitted) to a reference point on the nozzle holder determined by the particular type of injector attachment.

4.8.3 PRESSURE FACE—Faces on the nozzle body, nozzle holder body and adaptor plate where applicable which are held together in an assembled injector to form a fuel-tight seal.

4.8.4 BACK-LEAKAGE; LEAK-OFF—Fuel which leaks through the clearance between the needle and the nozzle body.

4.8.5 INJECTOR (NOZZLE) OPENING PRESSURE (NOP)—Lowest hydraulic pressure (applied at a slowly increasing rate) at which flow through the injector commences.

4.8.6 INJECTOR (NOZZLE) WORKING PRESSURE—Stabilized nozzle opening pressure for the correct function of the injector in the engine.

4.8.7 INJECTOR (NOZZLE) SETTING PRESSURE—Nozzle opening pressure at which an injector is initially set to ensure the correct working pressure after stabilization.

4.8.8 INJECTOR (NOZZLE) CLOSING PRESSURE—Highest hydraulic pressure at which the needle starts to close.

4.8.9 SEALING FACE—Face upon which the injector seats to make a gas-tight seal with the engine. Commonly this face is on the nozzle retaining nut.

4.8.10 DIFFERENTIAL ANGLE—Difference between the angles of the mating conical sealing surfaces of the needle and nozzle body.

4.8.11 DIFFERENTIAL RATIO—Ratio of the needle guide diameter to the needle seat diameter. This is expressed in terms of the diameter values in millimeters (e.g., 6 x 3).

4.8.12 SPRAY CONE ANGLE—Included angle of the cone embracing the axes of the injection/spray holes in a multi-hole nozzle. Particular nozzle designs may have more than one spray cone angle.

4.8.13 SPRAY DISPERSAL ANGLE—Included angle of the cone of fuel leaving a pintle or poppet nozzle or a single-hole injection/spray hole in a hole-type nozzle.

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4.8.14 SPRAY CONE OFFSET ANGLE; SPRAY INCLINATION ANGLE—Angle between the axis of the spray cone angle and the axis of the nozzle.

4.8.15 OVERLAP—Length of the throttling (delay) portion of the pintle penetrating the orifice in a delay pintle nozzle, measured closed.

4.8.16 NOZZLE SAC; SAC HOLE—Chamber within a hole-type nozzle tip from which the fuel enters the injection/spray holes.

4.8.17 NOZZLE SAC VOLUME—Volume within a hole-type nozzle tip between the needle and the entry to the injection/spray holes determined with the nozzle closed.

4.8.18 NOZZLE SEAT—Contact line/surface between the needle and body of a closed nozzle which prevents fuel flow to injection/spray holes.

4.8.19 INJECTOR DEAD VOLUME—High pressure volume contained inside an injector between the needle when seated and the bottom of the cone of the inlet connection.

5. Unit Injectors

5.1 Main Definition

5.1.1 UNIT INJECTOR—An assembly which combines the features of a single cylinder pump and an injector in one unit through which a metered volume of fuel under high pressure is injected into the combustion chamber.

5.2 Types of Unit Injector—Unit injectors are categorized by three principal features. These are:

a. Actuation (Energy Input)
b. Timing Control
c. Metering Control

Possible forms of these features may be mechanical, hydraulic, electrical, or electronic. A full description of a unit injector shall specify all the previously mentioned features.

Example—A mechanically actuated unit injector with electronic timing and metering control.

5.3 Components

5.3.1 TAPPET (FOLLOWER) ASSEMBLY—The component(s) that transmits linear movement to the plunger from external driving parts.

5.3.2 TAPPET HEAD—A separate part of the tappet assembly that contacts the external driving parts.

5.3.3 THRUST PAD—That part of the tappet assembly which is positioned between the tappet head and the plunger.

5.3.4 TAPPET BODY—That part of the tappet assembly which slides in contact with the tappet guide.

5.3.5 TAPPET GUIDE—The component or feature of the body that guides the movement of the tappet or tappet assembly.

5.3.6 TAPPET RETAINER—The component that retains the tappet assembly in its assembled configuration when the unit injector is not mounted in the engine.

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5.3.7 RETURN SPRING—The component(s) that maintains contact of the tappet with the external driving parts and returns the plunger to the beginning of its stroke.

5.3.8 UNIT INJECTOR BODY—An assembly or sub-assembly which contains the pumping element.

5.3.9 NOZZLE SPRING HOUSING—The component which holds the nozzle spring and has fuel passages.

5.3.10 NOZZLE SPRING—The spring which applies a predetermined force to the needle of the nozzle.

5.3.11 SPRING HOUSING RETAINING NUT (SPRING HOUSING CAP NUT)—The component which secures the spring housing and intermediate parts where applicable, to the unit injector body assembly.

5.3.12 NOZZLE RETAINING NUT (NOZZLE CAP NUT)—The component which secures the nozzle and adapter plate where applicable, to the spring housing.

5.3.13 NOZZLE AND HOUSING RETAINING NUT (NOZZLE AND HOUSING CAP NUT)—The component which secures the nozzle, spring housing, and other components to the unit injector body assembly.

5.3.14 METERING DEVICE—An integral device which determines the quantity of fuel injected. This may utilize one of the metering processes defined in 3.8 of this document.

6. Governors

6.1 Basic Definition

6.1.1 (ENGINE SPEED) GOVERNOR—A device which compares the setting speed to actual speed and, under specific operating conditions, causes a modification to the fuel delivery into the engine in order to adjust the actual speed of the engine toward the setting speed. It may or may not be part of the injection pump.

6.2 Types

6.2.1 SINGLE SPEED GOVERNOR—A governor which regulates from one specified engine speed. In cases where the specified speed is the maximum permissible operating speed, this governor may be called a Maximum Speed Governor.

6.2.2 IDLE AND LIMITING SPEED (MIN-MAX) GOVERNOR—A governor which regulates at the idling speed and the limiting speed of the engine. Intermediate speeds are determined by the control lever position and engine load.

6.2.3 MULTIPLE-SPEED GOVERNOR—A governor which regulates at one of several predetermined engine speeds.

6.2.4 ALL-SPEED (VARIABLE-SPEED) GOVERNOR—A governor which regulates at any selected engine speed, between two predetermined limits.

6.2.5 COMBINATION GOVERNOR—A governor which has similar features to an idle and limiting speed governor but with an extended upper and/or lower controlled speed range.

6.3 Governor Action

NOTE—The dynamic behavior of the governor depends upon the relationship between the output signal and the speed error value. The relationship may have differing characteristics for different values of the setting speed signal.

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6.3.1 PROPORTIONAL-ACTION GOVERNOR (P GOVERNOR)—A governor where the output signal is proportional to the speed error value. A change in load results in a change of steady-state speed.

6.3.2 PROPORTIONAL INTEGRAL GOVERNOR (PI GOVERNOR)—A governor where the output signal consists of a signal proportional to the speed error value modified by a signal which is proportional to the time integral of that speed error value. A change in load may or may not result in a change of steady-state speed.

6.3.3 PROPORTIONAL INTEGRAL DIFFERENTIAL GOVERNOR (PID GOVERNOR)—A proportional integral governor which additionally corrects the output signal proportionally to the rate of speed change.

6.4 Method of Operation

6.4.1 MECHANICAL GOVERNOR—A governor where the speed input signal is determined by the centrifugal action of a flyweight assembly and the output signal operates directly without any external amplification.

6.4.2 MECHANICAL-HYDRAULIC GOVERNOR—A mechanical governor with hydraulic amplification of the output signal.

6.4.3 MECHANICAL-PNEUMATIC GOVERNOR—A mechanical governor with pneumatic amplification of the output signal.

6.4.4 PNEUMATIC GOVERNOR—A governor where the input signal is determined by the inlet manifold pressure and the output signal operates directly.

6.4.5 HYDRAULIC GOVERNOR—A governor where the speed input signal is hydraulic pressure and the output signal operates directly.

6.4.6 ELECTRONIC/ELECTRIC GOVERNOR—A governor where the speed input signal(s) is determined by an input sensor(s) and the electrically/electronically amplified output signal operates directly.

6.4.7 ELECTROHYDRAULIC GOVERNOR—An electronic/electric governor with additional hydraulic amplification of the output signal.

6.4.8 ELECTROPNEUMATIC GOVERNOR—An electronic/electrical governor with additional pneumatic amplification of the output signal.

6.5 Characteristics/Terms

6.5.1 (GOVERNOR) INPUT SIGNAL—The signal supplied to the governor which is a measure of a system condition, e.g., speed, load, temperature.

6.5.2 (GOVERNOR) SPEED INPUT SIGNAL—The governor input signal which is a measure of the instantaneous engine speed.

6.5.3 GOVERNOR SETTING SPEED SIGNAL—The signal supplied to the governor which is a measure of the setting speed.

6.5.4 SETTING SPEED—A steady-state speed on a speed-power characteristic curve determined by the speed setting device, according to the required engine power. The setting speed may also be defined as the theoretical speed on the governor characteristic curve at which there would be zero fuel delivery.

6.5.5 SPEED-POWER CHARACTERISTIC CURVE—A curve of steady-state speeds over the engine power range for a given speed setting.

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