



SURFACE VEHICLE RECOMMENDED PRACTICE

J285™

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Dispenser Nozzle Spouts for Liquid Fuels Intended for Use with
Spark Ignition and Compression Ignition Engines

RATIONALE

This revision updates SAE J285 to the latest SAE document format, modernizes definitions of gasoline and diesel fuel, and removes outdated information.

1. SCOPE

This SAE Recommended Practice provides standard dimensions for liquid fuel dispenser nozzle spouts and a system for differentiating between nozzles that dispense liquid fuel into vehicles with spark ignition (SI) engines and compression ignition (CI) engines for land vehicles. Current legal definitions only distinguish between “Unleaded Fuel” and “All Other Types of Fuel.” These definitions are no longer valid. This document establishes a new set of definitions that have practical application to current automobile liquid fuel inlets and liquid fuel dispenser nozzle spouts.

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 Publications

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 J1140 Filler Pipes and Openings of Motor Vehicle Fuel Tanks

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2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D975 Standard Specification for Diesel Fuel

ASTM D4814 Standard Specification for Automotive Spark-Ignition Engine Fuel

ASTM D5798 Standard Specification for Ethanol Fuel Blends for Flexible-Fuel Automotive Spark-Ignition Engines

2.1.3 CARB Publications

Available from California Air Resources Board, P.O. Box 2815, Sacramento, CA 95812, Tel: 916-327-0900, <https://ww2.arb.ca.gov/our-work/programs/vapor-recovery>.

CARB CP-201 Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities

CARB CP-206 Certification Procedure for Vapor Recovery Systems at Gasoline Dispensing Facilities Using Aboveground Storage Tanks

CARB CP-207 Certification Procedure for Enhanced Conventional Nozzles and Low Permeation Conventional Hoses for Use at Gasoline Dispensing Facilities

2.1.4 California Code of Regulations (CCR) Publications

Available from Office of Administrative Law, 300 Capitol Mall, Suite 1250, Sacramento, CA 95814-4339, Tel: 916-323-6225, <https://oal.ca.gov/>.

13 CCR § 1978 Standards and Test Procedures for Vehicle Refueling Emissions

2.1.5 Code of Federal Regulations (CFR) Publications

Copies of these documents are available online at <https://www.ecfr.gov>.

40 CFR Part 86 Control of Emissions from New and In-Use Highway Vehicles and Engines

40 CFR Part 1090 Regulation of Fuels, Fuel Additives, and Regulated Blendstocks

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ISO 13331 Road Vehicles - Filler Pipes and Openings of Motor Vehicle Fuel Tanks - Vapor Recovery Systems

2.2.2 UL Publications

Available from UL, 333 Pfingsten Road, Northbrook, IL 60062-2096, Tel: 847-272-8800, www.ul.com.

UL 87	Power Operated Dispensing Devices
UL 87A	Power - Operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 percent (E0-E85)
UL 87B	Power - Operated Dispensing Devices for Diesel Fuel. Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 percent (B0 -B20), Kerosene, and Fuel Oil
UL 842	Valves for Flammable Liquids
UL 2586	Hose Nozzle Valves
UL 2586A	Hose Nozzle Valves for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 percent (E0-E85)
UL 2586B	Hose Nozzle Valves for Diesel Fuel. Biodiesel Fuel, Diesel/Biodiesel Blends with Nominal Biodiesel Concentrations up to 20 percent (B0 -B20), Kerosene, and Fuel Oil

2.2.3 CARB Publications

Available from California Air Resources Board, P.O. Box 2815, Sacramento, CA 95812, Tel: 916-327-0900, <https://ww2.arb.ca.gov/our-work/programs/vapor-recovery>.

CARB D-200 Definitions for Vapor Recovery Procedures

3. DEFINITIONS

3.1 UNLEADED FUEL

Gasoline that contains no lead or other metal compounds that could poison tailpipe emission control devices.

3.2 SPARK IGNITION LIQUID FUEL

Fuel intended for use with spark ignition (SI) engines. These fuels are mixtures of C4 through C10 hydrocarbons, have a flashpoint below the normal ambient temperatures where spark ignition engines are intended to operate ($\approx 45^{\circ}\text{C}$ for winter blend), and are compounded to burn, rather than detonate, inside SI engines. These fuels can also be blended with oxygenates, such as alcohols or ethers, up to 100% oxygenate. Examples of these types of fuels are:

- a. Gasoline (petrol) meeting ASTM D4814 standard
- b. E10; gasoline plus up to 10% ethyl alcohol
- c. M15; gasoline plus up to 15% methyl alcohol
- d. Reformulated gasoline; meeting 40 CFR Part 1090
- e. E22 (Brazil); gasoline containing 22% anhydrous ethyl alcohol
- f. E100 (Brazil); gasoline containing ethyl alcohol that has not been treated to remove the last traces of water (may contain up to 7% water)
- g. E85; gasoline containing 51 to 83% ethyl alcohol meeting ASTM D5798

3.3 COMPRESSION IGNITION LIQUID FUEL

Fuel intended for use with compression ignition (CI) engines. These fuels are mixtures of C12 through C24 hydrocarbons, have a flashpoint above the normal ambient temperatures where compression ignition engines are intended to operate ($\approx 45^\circ\text{C}$), and are compounded to detonate when heated by compression inside CI engines. These fuels can also be blended with oxygenates, such as fatty acid methyl esters (FAME) up to 100% oxygenate. Examples of these types of fuels are:

- a. Diesel fuel meeting ASTM D975 standard
- b. B5; diesel fuel containing up to 5% biodiesel
- c. B20; diesel fuel containing up to 20% biodiesel
- d. B100; fuel consisting of 100% biodiesel
- e. Renewable diesel, may be known as R100, made from renewable sources meeting ASTM D975 standard

3.4 LEADED SPARK IGNITION FUEL

In or about the year 2000, leaded gasoline was eliminated by law in most of the global marketplace. For purposes of historical use and the few places that still use such fuels, the spout geometries for usage of such fuel would use low-flow compression ignition spouts.

3.5 MMT FUEL ADDITIVE (METHYLCYCLOPENTADIENYL MANGANESE TRICARBONYL)

Methylcyclopentadienyl manganese tricarbonyl (MMT) is used as a gasoline octane enhancer. U.S. gasoline meeting ASTM D4814 does not allow intentional addition of MMT. This additive can affect vehicle OBD equipment and should be treated as leaded spark ignition fuel for nozzle spout selection if this additive is utilized in higher concentration than 1/32 g/gal Mn.

3.6 CONVENTIONAL NOZZLE

A nozzle design for either spark ignition or compression ignition fuels that has no supplementary vapor recovery devices incorporated into the dispenser equipment and does not have features to control excess liquid releases such as spillage, post fueling drips, and liquid retention.

3.7 NON-SPRING/FORMED/MACHINED ANCHOR

A nozzle anchor that is created in a forming action or machined and added to the spout.

3.8 SPRING ANCHOR

A coiled spring added to the spout exterior to provide multiple anchor points.

3.9 ASPIRATOR PORT (SENSOR PORT)

A port located at the tip of the nozzle spout that leads to a sensor that activates the nozzle's primary shutoff mechanism when the port is blocked. The aspirator port is also called the sensor port or automatic shutoff port.

3.10 ENHANCED CONVENTIONAL (ECO) NOZZLE

A conventional nozzle certified by CARB per CP-207. ECO nozzles are equipped with features to control excess liquid releases such as spillage, spitting, post fueling drips, and liquid retention.

3.11 PHASE II NOZZLE (also known as Stage 2 nozzle outside the state of California)

A nozzle designed for spark ignition fuels that has a supplementary vapor recovery pathway that enables the collection and containment of vapors that are generated during the transfer of gasoline from the dispensing facility to the vehicle fuel tank. Two styles exist in the market today for this feature:

- Vacuum Assist: Nozzle uses a dedicated vapor return pathway and remote- or dispenser-mounted vacuum pump to achieve a controlled collection of vapor from the vehicle fuel tank as gasoline is dispensed from the facility storage tank.
- Balance: Nozzle uses a dedicated vapor return pathway and direct displacement to pull vapor from the vehicle fuel tank to the gasoline dispensing facility storage tank.

3.12 VAPOR-TO-LIQUID RATIO (V/L RATIO)

The amount of vapor collected divided by the amount of liquid gasoline dispensed. It pertains to Phase II nozzles, which are typically set to a range of 0.95 to 1.15 for conventional (non-ORVR equipped) vehicles. Phase II Enhanced Vapor Recovery (EVR) nozzles (both assist and balance) incorporate systems to lower the V/L ratio range to 0.3 to 0.5 when refueling vehicles equipped with an Onboard Refueling Vapor Recovery (ORVR) system.

3.13 PHASE II ENHANCED VAPOR RECOVERY (EVR) NOZZLE

A Phase II EVR nozzle certified by CARB per CP-201 and CP-206. Phase II EVR nozzles are equipped with features to discriminate if a vehicle fuel tank has ORVR and features to control excess liquid releases such as spillage, post-fueling drips, and liquid retention. Such nozzles rely upon a tight seal at the vehicle fill pipe interface to properly recognize an ORVR equipped vehicle. Additional versions exist that have the ORVR discrimination in the system versus in nozzle; these do not fall under the CARB regulations but would follow the same guidelines for dimensions.

3.14 INSERTION INTERLOCK

Any CARB-certified mechanism, which is an integral part of a bellows-equipped dispensing nozzle, which prohibits the dispensing of fuel unless the bellows is compressed.

3.15 NOZZLE BELLOWS (NOZZLE BOOT)

The flexible device round the spout of some vapor recovery nozzles, utilized to contain and direct the vapor displaced from the vehicle fill pipe.

3.16 COAXIAL VACUUM ASSIST NOZZLE

Phase II assist nozzles that utilize a rigid coaxial spout design in which an inner pathway transfers liquid fuel and an outer pathway transfers displaced vapor. Coaxial vacuum assist nozzles are typically not equipped with a nozzle bellows and do not rely on a tight seal at the nozzle to vehicle fill pipe interface.

3.17 ANCHOR RING VACUUM ASSIST NOZZLE

A style of Phase II assist that utilizes a sleeved spout that extracts vapor through the sleeved section interfacing at the anchor ring. Anchor ring vacuum assist nozzles are not equipped with nozzle bellows and do not rely on a tight seal at the nozzle to vehicle fill pipe interface.

3.18 ON-BOARD REFUELING VAPOR RECOVERY SYSTEM (ORVR)

Vehicle-based vapor recovery system required by Federal Regulations as well as California State Regulations (refer to 40 CFR Part 86 and 13 CCR § 1978 for details). ORVR fill pipes are equipped with features that allow displaced vapors during the vehicle refueling process to travel back up the fill pipe toward the nozzle interface.

3.19 VAPOR RECOVERY SYSTEM FOR GASOLINE DISPENSING FACILITY (GDF)

All equipment used at a GDF to recover, contain, store, and transfer gasoline vapors generated by refueling vehicle tanks, gasoline facility tanks, and portable fuel containers, including, but not limited to, dispensing equipment, couplers, fittings, processors, control boards, gauges, and monitors.

3.20 NON-ORVR FILL PIPE DESIGN

Non-ORVR fill pipes are not equipped with recirculation features (dynamic or mechanical seal) and allow displaced vapors during the vehicle refueling process to travel back up the fill pipe toward the nozzle interface.

3.21 BOOT FACE PROFILE TOLERANCE

Three-dimensional tolerance zone consisting of two parallel surface curves that follow the contour of the surface profile across the entire length of the surface that are the specified tolerance (2.5 mm) apart.

4. REQUIREMENTS

4.1 Nozzle Spout Diameter

This section establishes the diameter of the nozzle spout intended to enter a motor vehicle filler inlet port. Differences in diameter utilization allow design of vehicle fuel filler inlets for means to help prevent mis-fueling.

4.1.1 Nozzle Spouts for Spark Ignition Fuel

Nozzles of this style should be 20.50 to 21.34 mm (0.807 to 0.840 inch) diameter. These spouts are capable of delivering fuel at flow rates up to 56.0 L/min (15 GPM).

NOTE: Phase II EVR and ECO nozzles are designed to operate between 22.8 and 38.0 L/min (6 and 10 GPM). Many countries, including the United States, have regulations restricting the flow rate to 38.0 L/min (10 GPM) on conventional nozzles in order to reduce spillage and excessive vapor losses.

4.1.2 Nozzle Spouts for Compression Ignition Fuel

These fuels are used in vehicles ranging from passenger cars to heavy-duty trucks and off-road motorized heavy equipment. Several different nozzle spout sizes are provided based on their intended use with these types of vehicles. Spout diameters range from 23.6 to 38.5 mm (0.929 to 1.516 inches) diameter, depending on vehicle and flow rate.

4.1.2.1 Nozzle Spouts for Passenger Cars and Light-Duty Trucks (Low-Flow Diesel/Retail Diesel)

Nozzles of this style should be 23.6 to 25.5 mm (0.929 to 0.961 inch) diameter. These spouts are capable of delivering fuel at flow rates up to 60 L/min (16 GPM).

4.1.2.2 Nozzle Spouts for Heavy-Duty Trucks and Off-Road Heavy Equipment (High-Flow Diesel/Commercial Diesel)

Nozzles of this style should be 28.5 to 38.5 mm (1.122 to 1.516 inches) diameter (with anchor at the tip). These spouts are capable of delivering fuel at flow rates up to 135 L/min (35 GPM).

4.1.2.3 Other sizes, such as Urea/SCR/DEF nozzles and off-road heavy equipment with flows greater than 135 L/min (35 GPM), are not covered in this specification.

4.2 Nozzle Spout Design

Recommended design details for conventional, ECO, Phase II, Phase II EVR, low-flow compression ignition, and high-flow compression ignition nozzle spouts are shown in the tables and figures below.

- | | |
|---|--|
| • Conventional Spark Ignition Unleaded Nozzles | Table 1; Figures 1 and 2 (<i>alternate construction</i>) |
| • Phase II EVR and “Booted” Phase II Nozzles | Table 2; Figures 2 and 3 |
| • Balance and Vacuum Assist Versions | |
| • ECO Nozzles | Table 3; Figures 2 and 4 |
| • Phase II Coaxial Vacuum Assist Nozzles | Table 4; Figures 2 and 5 (<i>anchor alternate construct</i>) |
| • Phase II Nozzle Anchor Vacuum Assist Nozzles | Table 5; Figure 6 |
| • Low-Flow Compression Ignition/Leaded Spark Ignition | Table 6; Figures 1 and 2 (<i>alternate construction</i>) |
| • High-Flow Compression Ignition Nozzles | Table 7; Figures 1, 2, and 7 |

4.3 Identification

Identification is optional for unleaded spark ignition and compression ignition fluids. Leaded spark ignition identification is required. If desired, nozzle spouts intended for spark ignition fuels should be marked with the letter “G,” and nozzle spouts intended for compression ignition fuels should be marked with the letter “D.” These markings should be stamped or rolled into the OD of the spout on its top surface at any position except the first 63.5 mm (2.5 inches) from the outlet end.

4.4 Spout Diameter Disruptions

Spout diameter disruptions are allowable between L_2 to L_3 and in from spout tip to sensor location L_3 , as long as the disruption is less than 2.0 mm (0.079 inch) in diameter change with a maximum 2.5 mm (0.098 inch) length. The transition must have a smooth transition between diameters to ensure an automotive filler pipe will not be caught. Examples of these transitions are tip inserts, tip sleeves, and sleeve crimps. See Figure 8.

4.5 Phase II “Booted”/EVR Boot Calibration Holes

A spout boot design may have “calibration holes” in the nozzle bellows to avoid premature shutoff caused by excess vacuum during the refueling of ORVR equipped vehicles. Such holes shall be blocked/sealed during V/L ratio nozzle adjustments.

4.6 Phase II EVR Nozzle Bellows

Phase II EVR nozzles shall be equipped with a nozzle bellows that allows the capture, containment, and transfer of gasoline vapors that are generated during vehicle refueling operations associated with non-ORVR fill pipes (vehicles not equipped with ORVR).

4.7 Anchor Measurement

For cases where anchors are offset, measurement of the anchor diameter will be taken at the largest change of dimension from the spout diameter as an effective diameter since often these offset designs are not a full circumference of the spout.

4.8 Insertion Interlock

Phase II EVR nozzles and ECO nozzles shall be equipped with an insertion interlock, which prevents the spillage of liquid gasoline upon premature or accidental removal of the nozzle from the vehicle fill pipe during refueling operations. In the case of Phase II EVR nozzles, the insertion interlock is integrated into the nozzle bellows. In the case of ECO nozzles, the insertion interlock may be integrated into a nozzle bellows-like device or splash guard assembly. ECO nozzles shall comply with the nozzle bellows (boot) face outer diameter dimension to avoid incompatibility at the interface of vehicle fill pipes.