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**(R) Rated (Advertised) Fuel Capacity—Passenger Car, Multi-Purpose  
Passenger Vehicles, and Light Duty Trucks****1. Scope**

This recommended practice provides a method for establishing the rated or advertised fuel capacity for a vehicle utilizing liquid fuel at atmospheric pressure. It applies to passenger cars, multi-purpose passenger vehicles and light duty trucks (10 000 lb (4536 kg) maximum GVW) (Ref. SAE J1100). It also includes a standardized procedure for creating a full tank when another test requires that condition as a starting point. It is intended as a guide toward standard practice and is subject to change to keep pace with experience and technical advances.

**1.1 Rationale**

This document was developed to refine the procedure used to define rated capacity of a fuel tank. In addition, many other fuel tank quantities that are in common use but had no previous formal definition are now included in this document. These standardized definitions apply to emissions testing, OBD considerations as well as Customer Information related to Advertised Capacity. This level of definition has not been available to the industry prior to this.

**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 J285—Gasoline Dispenser Nozzle Spouts

SAE J703—Fuel Systems—Truck and Truck Tractors

SAE J1100—Motor Vehicle Dimensions

SAE J1140—Filler Pipes and Openings of Motor Vehicle Fuel Tanks

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#### 2.1.2 UL PUBLICATION

Available from Underwriter's Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096

UL 842—Standard for Valves for Flammable Fluids

#### 2.1.3 ISO PUBLICATION

Available from International Organization for Standardization, Case postale 56 – CH-1211, Geneva 20, Switzerland

ISO/DIS 13331—Road vehicles—Filler pipes and openings of motor vehicle fuel tanks—Vapor recovery systems

### 3. **Definitions and Symbols**

Included as Appendices to this document, are:

Appendix A—A listing of standardized terms to be used to describe various fuel volumes and fuel gage indications.

Appendix B—A graphical illustration to aid in understanding the terms.

### 4. **Technical Requirements—Fuel System Design Guidelines**

**4.1** For all vehicles, designed in accordance with ISO/DIS 13331 (Ref. obsolete SAE J1140). The design should provide vehicle body openings that permit suitable engagement of the retention feature of the fill nozzle in the filler pipe. When so engaged, the nozzle shut off sensing device will be retained below the filler pipe opening and below any restrictor opening (if present), during unattended operation.

**4.2** In designing for consistent and repeatable tank capacity, include consideration of all vehicle design and fuel-related sources of variation, including the following:

- Tank proportions (length, width, height, other unusual features).
- Offset of shutoff feature to volumetric center of fuel at Full level.
- Offset of shutoff feature to level sensor location at Full level.
- Specific Gravity of fuels vs. level sensor float if used.
- Tank strap tension.
- Foaming in the fill pipe.

#### 4.3 **Service Station Conditions**

In attempting to consistently achieve a Full tank condition and to avoid liquid losses during fueling, the designer should recognize the following service station conditions:

##### 4.3.1 FORECOURT GRADE

Vehicles may be parked in any direction on grades up to 6%.

#### 4.3.2 DISPENSER NOZZLES

Automatic nozzles approved under UL 842, Standard for Valves for Flammable Fluids, may be used.

- Consider nozzle-to-nozzle shutoff variability

4.3.2.1 Nozzle spouts for gasoline designed in accordance with SAE J285.

4.3.2.2 Nozzle spouts for diesel fuel may have a nominal O.D. up to 30 mm (1 3/16 in) and a minimum O.D. of 23.8 mm (15/16 in).

#### 4.3.3 DELIVERY RATES

Fuel may be dispensed at flow rates up to:

- 53 L/min (14 gal/min) for gasoline. Refer to SAE J703 for fuel tanks of 95L (25 gal).
- 76 L/min (20 gal/min) for diesel fuel. Consider nozzle-to-nozzle flow rate variability.

### 5. **Technical Requirements—Test Conditions**

5.1 The surface on which the vehicle is parked shall be level (within 0.5% grade).

5.2 The tank shall be positioned in nominal vehicle installed configuration at manufacturer's design curb weight attitude relative to the tire patches.

5.3 For tests to measure rated capacity, the residual "Unusable" fuel in the tank at test start shall be representative of the manufacturer's design intent at a run-out-of-fuel condition.

5.4 If the vehicle is equipped with a plastic fuel tank, it is recommended that the test vehicle or rig be "conditioned" by having the fuel tank exposed to fuel until deflection stabilizes, but at least one month) prior to testing to better assure a representative in-use condition.

5.5 The gasoline shall have a Reid Vapor Pressure (RVP) between 48 Kpa and 62 Kpa (7.0 psi and 9.0 psi) for both the dispensed and residual (unusable) components.

5.6 Number 2 diesel fuel is to be used for testing diesel fuel applications.

5.7 The dispensed fuel temperature shall be  $22\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  ( $72\text{ }^{\circ}\text{F} \pm 3\text{ }^{\circ}\text{F}$ ).

5.8 The residual fuel temperature shall be within  $2\text{ }^{\circ}\text{C}$  ( $3\text{ }^{\circ}\text{F}$ ) of the dispensed fuel temperature.

5.9 The fill nozzle used for this testing shall have an automatic shut-off feature and be commercially available, with a significant market share of actual service station usage. Verify that the fill nozzle automatic shut-off function is operational prior to testing by the following method.

5.9.1 While holding the nozzle over an electrically grounded, open vessel and engaging the operating lever, dispense fuel until at least 6 inches of depth has accumulated, then dunk the nozzle spout into the liquid to occlude the shutoff port(s) and observe for instant shutoff. Repair or replace nozzle if it fails to shutoff correctly.

**5.10** Set the desired flow rate of the fuel dispensing equipment by discharging fuel into another container or into a waste fuel disposal system. The setting is to be made with the nozzle latched in its highest flow position. The settings are:

- 38 L/min  $\pm$  0.8 L/min (10.0 gal/min  $\pm$  0.2 gal/min) for gasoline.
- 76 L/min  $\pm$  1.5 L/min (20.0 gal/min  $\pm$  0.4 gal/min) for diesel fuel.

**6. Technical Requirements—Rated Capacity Test Procedure**

The following should be used for establishing the rated (advertised) fuel capacity for a vehicle.

- 6.1** Insert the dispensing nozzle to maximum penetration into the fuel fill inlet, then allow it to assume a furthest inserted position, latched on the retention feature, representative of unattended operation in customer service (this may require backing the spout out of its fully inserted initial position.). The plane of the nozzle shall be as nearly vertical as the boundaries of the body opening around the fuel inlet permit.
- 6.2** Set and latch the dispensing nozzle lever in its maximum flow position and allow fuel to flow into the fuel tank until the nozzle shuts off automatically.
- 6.3** After 5 sec., set and latch the dispensing nozzle in its minimum flow rate position and allow fuel flow until the nozzle shuts off automatically.
- 6.4** Repeat **6.3**.
- 6.5** Record the total amount of fuel dispensed to the nearest 0.1 gal or 0.1 L.
- 6.6** Repeat this test a sufficient number of times on a sufficient number of representative vehicles until a statistically significant average value for the fuel tank rated (advertised) capacity can be established to a 90% confidence level.
- 6.7** This amount is the rated (advertised) capacity.

**7. Technical Requirements—Full Tank Test Procedure**

The following procedure should be used for obtaining a full tank, when that condition is required as a starting point.

- 7.1** The fill procedure can be started from any fuel level less than full.
- 7.2** Follow the procedures in sections: **5.1, 5.2, 5.9, 5.10, 6.1, 6.2, 6.3** and **6.4**.

**8. Notes**

- 8.1 The document was developed under the Refueling Interface Subcommittee but that subcommittee and that committee structure no longer exists. We have no subcommittee working on it now. The Technical Standard Committee is just trying to publish the excellent work completed years ago by this group.

**8.2 Marginal Indicia**

The change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

PREPARED BY THE SAE REFUELING INTERFACE SUBCOMMITTEE  
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**APPENDIX A**  
**FUEL TANK VOLUME/FUEL GAGE INDICATION DESCRIPTION AND TERMS**

**Total Tank Assembly Internal Volume:** Total of **Liquid Capacity** plus **Vapor Space** including the fuel filler pipe volume.

**Vapor Space:** The volumetric difference between **Total Tank Assembly Internal Volume** and **Liquid Capacity** including the vapor space in the filler pipe.

**Liquid Capacity:** The amount of dispensed fuel required to achieve a **Full** condition, using the procedure given in SAE J398 for determining rated (advertised) capacity, except starting from a **Dry Tank**.

**Rated (Advertised) Fuel Capacity:** The amount of dispensed fuel required to achieve a **Full** condition, using the procedure given in SAE J398 for determining rated (advertised) capacity. Also the volumetric difference between **Liquid Capacity** and the **Unusable Fuel** amount.

**Indicated Full:** The fuel level or quantity in the tank when the instrument panel fuel gage pointer is at the maximum end of the graduated scale (not necessarily "pegged") or, for a digital readout, at "F".

**Full:** The end point when fuel is added to a tank, from any starting condition less than full, using the SAE J398 procedure.

**Full Reserve:** The volumetric difference between the **Full** and the fuel quantity selected for display as **Indicated Full**.

**Top-Off:** The volumetric difference between the first automatic shutoff and the second, additional shutoff described in SAE J398.

**OBD High:** The total volume of liquid fuel in the tank at the point where 85% of the **Rated (Advertised) Capacity** is indicated. (Applicable to US / CARB OBD regulations)

**OBD Low:** The total volume of liquid fuel in the tank at the point where 15% of the **Rated (Advertised) Capacity** is indicated. (Applicable to US / CARB OBD regulations)

**Indicated Empty:** The total volume of liquid fuel in the tank at the point where the fuel gage reads "E", or the bottom of the "Reserve" range, if used.

**Perceived Capacity ( $V_p$ ):** The volumetric difference between **Full** and **Indicated Empty**.

**Low Fuel Reminder:** The fuel quantity selected to display a **Low Fuel** reminder to the vehicle operator that the amount of fuel remaining in the tank is approaching empty. This can be based on either a percentage of the **Rated (Advertised) Capacity** or an amount of fuel estimated to allow a certain driving distance to either **Indicated Empty** or **Empty (Run-Out)**.

**Empty Reserve:** The volumetric difference between **Empty** and the fuel quantity selected for display as **Indicated Empty**. Empty Reserve should always be a positive number when the **Empty** amount is subtracted from the **Indicated Empty** amount.