



SURFACE VEHICLE STANDARD	J1082™	MAY2023
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	Superseding J1082 FEB2008	
Fuel Economy Measurement Road Test Procedure		

RATIONALE

SAE J1082 is being stabilized because the technical committee cannot find users for this technical report.

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1. SCOPE

This SAE Standard incorporates driving cycles that produce fuel consumption data relating to Urban, Suburban, and Interstate driving patterns and is intended to be used to determine the relative fuel economy among vehicles and driving patterns under warmed-up conditions on test tracks, suitable roads, or chassis dynamometers.¹

1.1 Purpose

This document provides uniform testing procedures for measuring the fuel economy of light-duty vehicles (motor vehicles designed primarily for transportation of persons or property and rated at 4500 kg (10 000 lb) or less) on suitable roads.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision 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 724-776-4970 (outside USA), www.sae.org.

SAE J1263	Road Load Measurement and Dynamometer Simulation Using Coastdown Techniques
SAE J2263	Road Load Measurement Using Onboard Anemometry and Coastdown Techniques
SAE J2264	Chassis Dynamometer Simulation of Road Load Using Coastdown Techniques

¹ Though these test cycles can be run on a chassis dynamometer, this procedure cannot be used for compliance with mandatory fuel economy standards or fuel economy labelling for light-duty vehicles first established by the "Energy Policy and Conservation Act," Public Law 94-163, 94th Congress S. 622, December 22, 1975. Details of the mandatory dynamometer procedure can be obtained by contacting Environmental Protection Agency, Fourth and M Street, S.W., Washington, DC 20460. It should be noted that correlation between chassis dynamometer and road test results has not been established.

2.1.2 ASTM Publication

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

ASTM D 4814 Standards Specification for Automotive Spark-Ignition Engine Fuel

3. DEFINITIONS

3.1 Driving Cycles

3.1.1 Urban Cycle

Driving pattern defined by 8.3.4 which is similar to driving conditions in the central business district of a large city.

3.1.2 Suburban Cycle

Driving pattern defined by 8.3.5 which is similar to driving conditions in suburban areas of a large city.

3.1.3 Interstate Cycle

Driving patterns defined by 8.3.6 and 8.3.7 which are similar to driving conditions on expressways.

3.2 Test Vehicle

Passenger car or light truck prepared for test according to Section 7.

3.3 Test Vehicle Weight

Unloaded vehicle weight plus 136 kg (300 lb).

3.3.1 Unloaded Vehicle Weight (Curb Weight)

The weight of the vehicle as built to production parts list with maximum capacity of all fluids necessary for operation of the vehicle.

3.3.2 Driver and Passenger or Ballast Weight

136 kg (300 lb) includes occupants, instrumentation, and ballast, if necessary.

NOTE: This weight will be distributed to properly simulate passenger locations and vehicle attitude (one passenger in driver's position and one passenger or equivalent weight in front seat passenger position).

3.3.3 Chassis Dynamometer Inertia Weight and Horsepower Settings

These settings should be established and set in accordance with SAE J1263 or SAE J2263 and SAE J2264.

3.4 Observed Economy

Observed economy is the fuel economy measured during a driving cycle. It is determined by dividing the actual kilometers (miles) driven on the cycle by the number of liters (gallons) consumed. Economy should be expressed as kilometers per liter (miles per gallon).

3.5 Corrected Economy

Corrected economy is the observed economy multiplied by the correction factors listed in Section 10. The corrected fuel economy should be expressed as kilometers per liter (miles per gallon).²

3.6 Correction Factors

Factors which are used to adjust data to the standard ambient condition of 15.6 °C (60 °F) and 98.2 kPa (29.0 in Hg) and reference fuel properties.

3.7 Average Fuel Economy

Average fuel economy is the total distance driven divided by the total volume of fuel consumed in a series of replicate tests. When the distance driven in each of the tests is identical, as may be assumed for this procedure, the average fuel economy is determined by taking the harmonic average of the individual economies. See Equation 1.

$$\text{Average Fuel Economy} = \frac{n}{1/\text{MPG}_1 + 1/\text{MPG}_2 + \dots + 1/\text{MPG}_n} \quad (\text{Eq. 1})$$

$n = \text{the number of replicate tests}$

3.8 Test Repeatability Guidelines

These guidelines are intended to provide an estimate of repeatability of test data for replicate tests and are based on a standard deviation equal to 1.9% of the mean.

3.8.1 Estimate of the 95th Percentile Range for Replicate Tests

The 95th percentile range (R) equals 0.019Q times the average fuel economy, where Q equals the critical value obtained from a table for the Studentized³ range and the average fuel economy for n tests.

Selected value for 0.019Q are as shown in Table 1:

TABLE 1 - SELECTED VALUES FOR 0.019Q

n	0.019Q
2	0.053
3	0.063
4	0.069
5	0.073
10	0.085

- a. Example 1 (SI units)—If a vehicle obtains 6.20 km/L and 6.60 km/L on two tests on the same cycle, the average fuel economy would be 6.39 km/L and the 95th percentile range would be as shown in Equation 2:

$$R = 0.053 \times 6.39 = 0.34 \text{ km/L} \quad (\text{Eq. 2})$$

The difference between the two tests is 0.4 km/L which is greater than the difference that would be expected for 95% of the cases in which two tests were conducted. Consequently, additional tests should be conducted to provide more confidence in the average fuel economy.

² The corrected economy and average fuel economy may be expressed in terms of fuel consumption, for example, L/100 km, if the appropriate conversions are made (L/100 km = 235.265/mpg). When average fuel economy is expressed as consumption, the average fuel consumption is the arithmetic average of the individual consumptions.

³ D. B. Owen, "Handbook of Statistical Tables," Reading, MA: Addison Wesley Publishing Co., Inc., 1962, pp. 144-145.

- b. Example 2 (U.S. units)—If a vehicle obtains 14.5 mile/gal and 15.5 mile/gal on two tests on the same cycle, the average fuel economy would be 14.98 mile/gal and the 95th percentile range would be as shown in Equation 3:

$$R = 0.053 \times 14.98 = 0.79 \text{ mile/gal} \quad (\text{Eq. 3})$$

The difference between the two tests is 1.0 mile/gal which is greater than the difference that would be expected for 95% of the cases in which two tests were conducted. Consequently, additional tests should be conducted to provide more confidence in the average fuel economy.

3.8.2 Estimate of the Average Fuel Economy at a 90% Confidence Interval—(See Equation 4.)

$$\frac{\text{Average at 90\%}}{\text{Confidence Interval}} = \frac{\text{Average}}{\text{Fuel Economy}} \pm \left[\frac{0.031}{\sqrt{n}} \times \left(\frac{\text{Average}}{\text{Fuel Economy}} \right) \right] \quad (\text{Eq. 4})$$

- a. Example 1 (SI units)—If a vehicle obtained 6.29 km/L and 6.46 km/L on two tests on the same cycle, the average fuel economy would be 6.37 km/L and the 90% confidence interval would be as shown in Equation 5:

$$6.37 \pm \left[\frac{0.031}{\sqrt{2}} \times 6.37 \right] = 6.37 \pm 0.14 \text{ km/L} \quad (\text{Eq. 5})$$

- b. Example 2 (U.S. units)—If a vehicle obtained 14.8 mile/gal and 15.2 mile/gal on two tests on the same cycle, the average fuel economy would be 15.0 and the 90% confidence interval would be as shown in Equation 6:

$$15.0 \pm \left[\frac{0.031}{\sqrt{2}} \times 15.0 \right] = 15.0 \pm 0.3 \text{ mile/gal} \quad (\text{Eq. 6})$$

4. INSTRUMENTATION

All instrumentation shall be calibrated.

4.1 Fuel

The fuel measurement device must be compatible with the vehicle fuel system and should alter the fuel temperature and pressure as little as practical. The fuel measurement system must be accurate to within 0.5% of the fuel used during a driving cycle.

4.2 Speed

The speed indicating device shall indicate vehicle speed in kilometers per hour (miles per hour) and be accurate within 1 km/h (0.5 mph).

4.3 Acceleration

The acceleration indicating device must be capable of indicating both positive and negative acceleration. It shall indicate acceleration/deceleration in m/s^2 (ft/s^2) and be accurate within 0.2 m/s^2 (0.5 ft/s^2). (Refer to 6.5 for Chassis Dynamometer Testing.)

4.4 Time

The time measuring instrument must be capable of measuring the time interval to 0.1 s and be accurate within 0.1 s in 1 min.

4.5 Temperature

The temperature indicating devices must be capable of measuring to the nearest 1 °C or 2 °F. Accuracy must be within ±1 °C or ±2 °F. The sensing element shall be shielded from radiant heat sources.

4.6 Absolute Barometric Pressure

An aneroid or mercury barometer should be used. This device should be accurate within 0.3 kPa or 0.1 in Hg.

4.7 Wind

Wind speed should be measured with a device that provides an indication of wind speed that is accurate within 3 km/h (2 mph). Wind direction should also be indicated.

4.8 Distance

A distance indicating device is required if the tests are not conducted on a premarked course. This device must be capable of indicating distance to within 5 m (15 ft) and must be capable of accuracy within 6 m in 1 km (30 ft in 1 mile).

4.9 Vehicle Weight

Vehicle weight should be measured with a device that is accurate within ±0.5% with minimum resolution of 5 kg (10 lb).

4.10 Dynamometer Inertia Weight

The dynamometer inertia weight is established reflecting the inertia of the nonrotating tires and the vehicle test weight. The inertia weight should be set to the nearest flywheel increment for mechanical inertia dynamometers or within 10 lb for electrical inertia dynamometers.

5. TEST MATERIAL

5.1 Test Vehicle

The test vehicle shall be completely defined on the Test Vehicle Specifications and Preparation Form. (The test vehicle will normally be representative of a production built vehicle—any exceptions must be properly noted.)

5.2 Test Fuel

Normally, service station fuel will be satisfactory for test purposes, provided that it is consistent with the manufacturer's recommendations for the vehicle and with the ASTM D 4814 standards. Specific gravity or API gravity for both gasoline and diesels shall be recorded.

Also gasoline octane rating $\frac{R+M}{2}$ shall be recorded and other properties such as distillation and Reid vapor pressure should be recorded when available.

5.3 Lubricants

Lubricants used shall conform to the manufacturer's recommendation for the predominant weather condition in which the vehicle is being tested.

6. TEST CONDITIONS

6.1 Ambient Temperature

Tests should be conducted at ambient temperatures between -1 °C (30 °F) and 32 °C (90 °F).

6.2 Wind Velocity

Urban cycle tests must not be conducted when average wind speed exceeds 24 km/h (15 mph) or when gusts exceed 32 km/h (20 mph). For the Suburban and Interstate Cycle tests, these limits should be reduced to 16 km/h (10 mph) average and 24 km/h (15 mph) gusts.

6.3 Road Conditions

Roads must be dry, clean, smooth, and not exceed 1.0% grade. If operating on a closed track, the start and stop points should be selected such that the schedule elevation difference is 3 m (10 ft) or less.

6.4 It is recommended that roadside markers be used to indicate the points at which speed changes are to be made as indicated in 8.3.

6.5 A driver's aid is recommended for dynamometer operations reflecting the test cycles described in 8.3.

7. TEST VEHICLE PREPARATION

7.1 Break-In

The vehicle should have accumulated a minimum of 3200 km (2000 miles) of operation prior to test. At least 1600 km (1000 miles) must have been driven at cycling speeds between 64 km/h (40 mph) and maximum legal highway speeds. If a closed track is available for break-in, the maximum speed should not exceed 160 km/h (100 mph). Unless the testing is specifically evaluating lubricant effects of fuel economy, care should be taken to ensure that lubricant changes or additions do not take place over the duration of the test, and that engine oil has a minimum of 3200 km (2000 miles) use prior to testing. Chassis dynamometer break-in is acceptable. All of the tires must have operated on a road or track at least 160 km (100 miles) prior to the test. Tires must have at least 75% of the tread remaining and tread must be in good condition. For dynamometer testing, the vehicle should have experienced at least 800 km (500 miles) of cyclic break-in for the tires and brakes.

7.2 Inspection

The vehicle must be inspected and adjusted where necessary to meet manufacturer's specifications. Checks are specified on the Test Vehicle Specifications and Preparation Form (Figure 1).

7.3 Instrumentation

The fuel measuring device and other instrumentation, as necessary, must be installed in a manner not to hinder the vehicle operation or operating characteristics.

7.4 Test Weight

The vehicle weight must be adjusted to provide the test weight indicated in 3.3 (this test weight includes instrumentation and operator).

7.5 Tire Pressure

The cold tire pressure should be the minimum recommended by the manufacturer for the vehicle test weight and should be set before vehicle operation immediately prior to the vehicle warm-up at the beginning of the test.

8. TEST PROCEDURE

8.1 Warm-Up

The vehicle must be driven a minimum of 32 km (20 miles) at 90 km/h (55 mph) or maximum legal highway speed to stabilize engine and driveline operating temperatures immediately before running the first driving cycle.