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SAE J1491 JUN85

Vehicle Acceleration Measurement

SAE Recommended Practice
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VEHICLE ACCELERATION MEASUREMENT—SAE J1491 JUN85

SAE Recommended Practice

Report of the Light Duty Vehicle Fuel Economy Accelerations Measurement Committee, approved June 1985.

1. Purpose—This SAE Recommended Practice provides a standardized means of measuring acceleration performance of passenger cars and light duty trucks.

2. Scope—To define significant driving situations involving acceleration, establish meaningful measures of such accelerations, and develop test procedures that will measure a vehicle's maximum performance capabilities during those driving situations.

3. Definition

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

4. Instrumentation (All instrumentation must be calibrated.)

4.1 Speed-Time—An instrument to measure vehicle speed as a function of elapsed time is used in this procedure. The device must meet the following specifications:

Time:

Accuracy ± 0.1 s

Resolution 0.1 s

Vehicle Speed:

Accuracy ± 0.50 mph (0.8 km/h)

Resolution 0.25 mph (0.4 km/h)

Engine Speed (tachometer):

Accuracy ± 50 rpm

Resolution 25 rpm

4.2 Temperature—The ambient temperature indicating devices must have a resolution of 2°F or 1°C and an accuracy of $\pm 2^{\circ}\text{F}$ or $\pm 1^{\circ}\text{C}$. The sensing elements must be shielded from radiant heat sources.

4.3 Atmospheric Pressure—A barometer with an accuracy of ± 0.2 in Hg or 0.7 kPa.

4.4 Wind—Wind speed and direction during the test should be continuously monitored. Wind measurements should permit the determination of average longitudinal and cross wind components to within ± 1 mph (± 2 km/h).

4.5 Vehicle Weight—Vehicle weight should be measured to an accuracy of ± 10 lb (± 5 kg) per axle.

4.6 Tire Pressure—Should be measured to an accuracy of ± 1.0 psi (± 7 kPa).

4.7 Distance—A distance indicating device is required. This device must be capable of indicating distance to within 1 ft and must be capable of accuracy within 5 ft in 1 mile.

5. Test Material¹

5.1 Test Vehicle—The test vehicle shall be completely defined on the test vehicle specifications and preparation list. The test vehicle will normally be representative of a standard production built vehicle; any optional or non-standard equipment must be noted (i.e., roof racks, optional mirrors, fog lamps, spoilers, optional axle ratio, etc.). Record any equipment that is removed for test.

5.2 Test Fuel—Commercially available fuel as recommended by the manufacturer will normally be used for test purposes. If the information is available or if a special test fuel is used, the fuel specifications should be recorded, such as: fuel generic type, gasoline octane rating or diesel cetane rating, brand name, specific gravity, Reid vapor pressure.

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

6.2 Fog, or Rain—Tests may not be run during foggy, rainy, or snowy conditions.

6.3 Wind Velocity—Tests may not be conducted when wind speeds average more than 15 mph (24 km/h) (or when peak wind speeds are more than 20 mph (32 km/h)). The component of the average wind velocity perpendicular to the test road may not exceed an average of 10 mph (16 km/h).

6.4 Road Conditions—Roads must be dry, clean, smooth, and must not exceed 0.5% grade. In addition, the grade should be constant and the road should be straight. The road surface should be concrete or rolled asphalt (or equivalent) and in good condition; testing should not be conducted on slippery roads.

6.5 Speed Limitation—These tests should be run on a controlled track or proving grounds. If run on public roads or highways, speed should not exceed posted speed limit, and vehicle should not interfere with traffic flow or otherwise operate in a manner that would be hazardous.

7. Vehicle Preparation

7.1 Break-In—The vehicle should have at least 2000 miles of operation before test. Tires must have at least 75% of the tread remaining and tread must be in good condition. All tires must have at least 100 miles of run in before test.

7.2 Vehicle Check List

7.2.1 The vehicle must be inspected and adjusted where necessary to meet manufacturer's specifications, particularly if vehicle is exhibiting abnormal performance characteristics during acceleration. Tune and time engine, and make all other adjustments, such as front end alignment, and functional checks in accordance with manufacturer's published procedures.

7.2.2 Operate, observe, and reset, if necessary, the throttle linkage to ensure wide open throttle occurs.

7.2.3 If vehicle is equipped with automatic transmission, ensure that automatic transmission shift points are within manufacturer's published specifications.

7.2.4 Ensure that brake drag is not excessive.

7.3 Instrumentation—The speed-time measurement device and other necessary test equipment must be installed so that they do not hinder vehicle operation or alter the operating characteristics of the vehicle.

7.4 Test Weight—Unloaded Vehicle Weight +300 lb (includes driver and all instrumentation).

7.5 Tire Pressure—The cold tire pressure should be the standard recommended by the manufacturer for the Vehicle Test Weight and installed tires.

7.6 Vehicle Warm-Up—The vehicle must be driven a minimum of 20 miles at an average speed of 55 ± 5 mph (88 km/h) immediately prior to the test. Alternative schedules that provide equivalent vehicle warm-up can be substituted. There should not be more than a 5 min time lapse between the warm-up and the start of test.

7.7 Vehicle Data—Record all information as specified on the attached Vehicle Specification Sheet.

8. Test Procedure

8.1 Test Schedules—Perform wide open throttle (WOT) accelerations from a standing start and record the following:

0-30 mph	Record Elapsed Time
0-50 mph	Record Elapsed Time
0-60 mph	Record Elapsed Time
$\frac{1}{4}$ mile	Record Elapsed Time and Terminal Speed
0-5 s	Record Distance Covered and Terminal Speed

Also, perform the following test at wide open throttle:

40-60 mph	Record Elapsed Time
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8.2 Automatic Transmission Operating Procedure—From a standing start with engine at idle (braked if necessary), with the shift selector in the "drive" position, accelerate with wide open throttle. The vehicle should be operated to achieve maximum performance with minimum wheel spin. Time zero starts at the instant the driver's foot moves the accelerator pedal.

8.3 Manual Transmission Operating Procedure—From a standing start, the vehicle should be operated to achieve maximum performance with minimum wheel spin. Clutch operation, as well as shift point selection, should be optimized for performance without exceeding the maximum specified engine rpm. Time zero starts at the instant of clutch pedal movement.

8.4 40-60 Test Procedure—Starting from a stabilized 40 mph, accelerate with wide open throttle to 60 mph. Manual transmissions should be run both in top gear and top gear less one, with 4 or 5-speed transmissions. Three speed manual transmission should be run in top gear only. Manual transmissions should not be downshifted during this test.

Automatic transmissions will be allowed to downshift as determined by the vehicle transmission controls.

8.5 Test Data—Run a minimum of six individual runs, three in each direction. When difficulty is experienced in one run, the pair is excluded. Record all data specified on the Vehicle Data Sheet.

¹ Reference attached Vehicle Specification Sheet.

8.6.1 Headlamps are to be off. If the vehicle is equipped with pop-up lamps, the lamp pods should be in the down position. Lights should be on if required for safe vehicle operation, and so noted under remarks on Vehicle Data Sheet.

8.6.3 Vehicles equipped with air conditioning should have the compressor clutch wire disconnected before the start of test.

8.6.5 All other electrical accessories must be in the off position.

8.6.6 Windows should remain closed during test runs.

9.1 Data Calculation—Simple averages will be calculated for all valid multiple test observations (pairs of data).

9.3 General

The coefficient of variation (standard deviation of the paired runs)/mean of individual runs should not be greater than 3%. On the 40–60 mph acceleration, the coefficient of variation should not exceed 6%.

9.3.2 WEATHER CORRECTION—No provision for weather correction is made in this procedure. Variables such as temperature, humidity, barometric pressure, wind speed, and direction should be considered by the tester in evaluating the test results.

* Times (or speed or distance) should be averaged in pairs of 1-2, 3-4, 5-6, then collectively averaged. Two valid paired runs are considered adequate. When difficulty is experienced in one run, the pair should be excluded.