Joint RCCC/SAE Fuel Consumption Test Procedure (Short Term-in-Service Vehicle) Type I—SAE J1264

SAE Recommended Practice
Approved April 1979

THIS IS A PREPRINT WHICH IS SUBJECT TO REVISIONS AND CORRECTIONS. THE FINAL VERSION WILL APPEAR IN THE 1980 EDITION OF THE SAE HANDBOOK.

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JOINT RCCC/SAE FUEL CONSUMPTION TEST PROCEDURE (SHORT TERM-IN-SERVICE VEHICLE) TYPE I—SAE J1264

SAE Recommended Practice

Report of Truck and Bus Committee approved April 1979.

1. Scope—This recommended practice provides minimum requirements for testing components or systems of the type which can be switched from one truck to another with relative ease; i.e., aerodynamic devices, clutch fans, radial tires, and the like. The test utilizes in-service fleet vehicles, operated over representative routes. The relative fuel effectiveness of the component or system under test is determined as a percentage improvement factor. This factor is calculated using the relative fuel usage of like vehicles operating with and without the specific component or system under evaluation. Accuracy capability employing this test technique is either ±1% or ±2%, depending upon the method of fuel measurement. (See paragraph 6.4.)

2. Identification—Sufficient information is to be recorded to identify the vehicles under test and the route over which the test is conducted. Minimum information required is shown in Test Data Form #1.

3. Definitions

3.1 **Test Cycle**—The test cycle is comprised of two complete round test trips with two trucks, wherein the device or component or systems under evaluation have been switched from one truck to the other between the first and second round test trip.

3.2 **Test Trip**—A test trip is one half of a complete test cycle wherein the device or component under evaluation is operating on one of the two trucks. A test trip always starts and stops at the same exact location. This may be accomplished by using either a closed loop of highways or single highway with one test leg of the test trip out, a turn-around point and one test leg of the test trip in.

3.3 **Test Leg**—A test leg is one half of a test trip during a single highway test cycle.

3.4 **Vehicles A and B**—The two vehicles being used for test purposes are randomly identified as Vehicle A and Vehicle B. This identification applies to the truck, its equipment, and driver as well as the trailer, in the case of tractor/trailer combinations.

4. Recommended Fleet Test Preparation

4.1 **Test Route Selection**—A test route of not less than an aggregate of 50 miles (80 km) for each test leg is selected for conducting the test. The test route selected must not exceed the capacity of the portable fuel tanks (if used) and should allow high probability of an uninterrupted test cycle. Both vehicles selected should be able to maintain a speed reasonably close to the posted or legal maximum speed; however, the speed selected should be representative of average fleet operations as determined by fleet conducting the test.

4.2 **Vehicle Test Speeds**—The test speeds selected should be well within the capability of both vehicles to be tested. The maximum test speed is determined by the ability of the vehicles to maintain spacing in all circumstances to be encountered. Each vehicle should be operated in the preselected engine rpm operating range.

4.3 **Vehicle Specifications and Maintenance**—Two vehicles are selected. These vehicles are to be of the same specification and in similar mechanical condition as determined by the fleet conducting the test. Enter data on Test Data Form #1 (Vehicle Identification).

4.4 **Vehicle Loads**—Load weights for the period of the test should be selected which result in gross vehicle weight within 5% of each other. Enter data on Test Data Form #1.

4.5 **Test Component**—Component or system to be tested is incorporated into Vehicle *A*.

4.6 **Fuel Measuring Device Requirement**

4.6.1 If the portable tank weight method is used, the scale must be calibrated in maximum increments of ¼ lb (0.1 kg). (Use Fuel Economy Test Data Form #2 for recording data.)

4.6.2 If vehicles are fitted with on-board flowmeters, those meters must be calibrated to an accuracy of ±½% at a flow rate of 10 U.S. gal/h (37.85 L/h). (Use Fuel Economy Test Data Form #2 for recording data.)

4.7 **Driver Selection**—Average drivers as determined by the fleet's driver records, are selected and assigned to their representative vehicles. They do not alternate between vehicles during the test cycle.

4.8 **Vehicle Designation**—Vehicle and driver combinations are designated; Vehicles *A* and *B*.

5. Recommended Fleet Test Procedure—This technique involves the following steps:

5.1 Vehicles *A* and *B* follow the same start and warm-up procedures. Start and warm-up procedures to be representative of fleet operation or not less than 45 min of operation under conditions similar to the condition used in the test cycle.

5.2 Both Vehicles *A* and *B* are moved to the same location during fueling. Both vehicles are filled from the same fuel dispenser at the same fueling point. Tanks are topped off visually, and weighed, weight (mass) to be recorded, if weighing method is used. (Enter data on Test Data Form #2.)

5.3 Record weather, road, traffic conditions, wind velocity, and wind direction before each test leg of a test trip. (Enter data on Test Data Form #2.)

5.3.1 Wind velocity may be checked with an inexpensive *marine-type*[1] hand-held wind indicator. Wind direction may be judged at start and finish points by referring to the approximate direction in relation to the basic direction of the highway, i.e., 0 deg headwind, 45 deg quartering headwind, 90 deg sidewind, 45 deg (or 135 deg) quartering tailwind, etc., or check with local weather bureau.

5.4 Vehicles *A* and *B* move to marked starting point and park with engines stopped. Fuel measuring equipment (if on-board fuel meters are used) and odometers are read and recorded. (Enter data on Test Data Form #2).

5.5 Vehicles *A* and *B* start engines simultaneously as time is recorded. (Enter data on Test Data Form #2.) Vehicles move out simultaneously on the test leg from the starting point with Vehicle *A* in the lead. Vehicle *A* accelerates to the selected top test speed while Vehicle *B* accelerates at a slower rate in order to obtain a vehicle separation of approximately 200—250 yd (180—230 m).

5.6 At a predetermined point on the test leg, suitably marked and one-half way of the total distance of the outbound test leg, Vehicle *A* reduces its speed by 5 mph (8 km/h) during the passing maneuver and allows Vehicle *B* to pass and take the lead. Vehicle *B* may accelerate 5 mph (8 km/h) during the passing maneuver but then must decelerate to the preselected maximum test speed. Vehicle *A* accelerates to maintain the 200—250 yd (180—230 m) behind Vehicle *B*.

5.7 At the end of this test leg, Vehicles *A* and *B* are stopped at a predetermined turn around point. Immediately after full stop at end of test the engines are idled for 1 min and simultaneously shut down. Time of shut down is recorded. Fuel measuring equipment, if on-board fuel meters are used, and odometers are read and recorded. (Enter data on Test Data Form #2). Tanks of Vehicles *A* and *B* are weighed, refilled, and weighed again, weights to be recorded, if weighing method is used. (Enter data on Test Data Form #2.) Record weather, road, traffic conditions, wind velocity, and wind direction. (Enter data on Test Data Form #2.) If a closed loop of highway is selected as the test route, a halfway point is to be selected for use as the turnaround measurement point.

5.8 Vehicles *A* and *B* make the turnaround and stop at predetermined start point for inbound test leg. If conditions require, all readings should be taken again and recorded. Engines are to be started and stopped simultaneously when making the turnaround.

5.9 Time is recorded as the two vehicles start the inbound test leg with Vehicle *B* in the lead. (Enter data on Test Data Form #2.)

5.10 At the midpoint on the inbound test leg, Vehicle *A* overtakes Vehicle *B* in the same manner as before (paragraph 5.6). The two test vehicles proceed in this order to the predetermined finish point which is opposite the inbound test leg starting point. Immediately after full stop at end of test trip the engines are idled for 1 min and simultaneously shut down. Time of the shut down is recorded. Fuel meters and odometers are read and recorded. (Enter data on Test Data Form #2.) Tanks of Vehicles *A* and *B* are weighed, refilled, and weighed again.

5.11 A valid test cycle is comprised of two complete round test trips. The modification or equipment being tested must be switched from one truck to the other between the two round test trips. Repeat paragraphs 5.2 through 5.10.

5.12 Drivers of Vehicles *A* and *B* to be interviewed. (See paragraph 7.7 and Test Data Form #1.)

6. Calculation Procedure (See Calculation Procedure Form #3)

6.1 Add fuel used by Vehicle *A* and Vehicle *B* for test trips when these vehicles were operating with the component or system under test.

6.2 Add fuel used by Vehicle *A* and Vehicle *B* for the test trips when these were operating **without** the component or system under test.

[1] Edmond Scientific Co., Barrington, NJ, or Dwyer Instrument, Inc., Michigan City, IN, or equivalent.

6.3 Compare paragraphs 6.1 and 6.2. If paragraph 6.1 is less than paragraph 6.2 the component or system being tested improves fuel economy. (Remember, 1–2% differences in fuel economy could be caused by inherent inaccuracies in the test and measurement procedures.)

6.4 Properly conducted tests using on-board fuel meters are considered, based on test experience, to have an overall accuracy of ±2%. The portable tank weighing method is considered, based on test experience to have an overall accuracy of ±1%. Example: Using the portable tank weighing method, computation showing a 5% fuel savings indicates that the component or system tested has saved (4–6%). A similar result with the fuel flow meter would indicate a savings of (3–7%).

7. Cautionary Notes

7.1 All auxiliary fuel tanks used in the test should be weighed on the same scale. The outside of the fuel tanks should be wiped clean of fuel and dirt each time they are weighed. The weight difference is converted into gallons at the end of the test cycle. The use of quick disconnect hose coupling is recommended with auxiliary fuel tanks.

7.2 It should be remembered that when determining percentage improvement factors of components or systems under test by comparing relative fuel usage, the effect of the combined rolling friction, aerodynamic drag, and other parasitic losses are shown. Therefore, relatively small wind changes can result in large variations in the fuel consumed by a vehicle.

7.3 All test conditions (wind velocity, wind direction, traffic, road conditions, drivers, vehicles, routes, weights, speeds, etc.) would have to be identical to achieve identical results from one test to the other. In practice, exact reproduction of conditions is virtually impossible to achieve. This test method, therefore, is generally not recommended for making exact evaluations between devices or components within a given class. Multiple tests are recommended for refining data on a single component or system operating under variable conditions. Typical multiple tests on a device or component could include among others:

7.3.1 Two or more tests for averaging purposes.

7.3.2 Two or more tests run at differing speeds.

7.3.3 Two or more tests run with differing wind conditions.

7.3.4 Two or more tests with differing temperature conditions.

7.4 This test procedure is generally not suitable for testing equipment which requires substantial time for switching such as: engines, transmissions, tag axles, rear axles, and the like. The Type II In-Service Test Procedure is recommended for the evaluation of these vehicle components.

7.5 It is strongly recommended that the two drivers of Vehicles A and B both be required to drive over the test route twice before a test cycle; practicing the passing maneuvers, spacing requirements, starting, stopping, etc., will lead to greater accuracy and reliability in test results.

7.6 To minimize test variability, it is recommended that the two vehicles under test be in similar mechanical condition and be representative of the fleet conducting the test and have (except in the case where this is the item being evaluated):

7.6.1 The same tire type, size, and pressures.

7.6.2 The same grade type and quantity of engine oil.

7.6.3 The same grade type and quantity of transmission oil.

7.6.4 The same grade type and quantity of differential oil.

7.6.5 The same grade and type of wheel hub oil or grease (tractors).

7.6.6 Each vehicle and trailer should be lubricated to fleet requirements.

7.6.7 Prior to the test each engine governor set precisely equal and at standard for the fleet conducting the test.

7.6.8 Coolant temperature equal in both vehicles which have the same temperature control device and functioning as intended. It may be desirable to avoid automatic fan operation or record total minutes of fan operation on each vehicle for comparative purposes.

7.6.9 New air cleaner elements and new fuel filters of the same make and type. Installation of new air cleaner can be waived if both vehicles' restriction does not differ by more than 5 in H_20 or (127 mm) and does not exceed 15 in H_20 (381 mm).

7.6.10 Test vehicles selected should have been driven at least 2000 miles and where possible have equal mileage ±10%.

7.6.11 Vehicle reasonably clean and free from sheet metal dents, tears, or missing body parts. Fiberglass hoods should be intact.

7.6.12 Equal fifth wheel setting and tractor-to-trailer gap and/or axle loading.

7.6.13 Cab side window opening same in each vehicle, open or closed, for entire test.

7.6.14 Electrical load on each vehicle equal as possible. Air conditioning off, lights on, etc.

7.6.15 Trailers are the same make and model free of damages to exterior surfaces.

7.6.16 Truck/tractor wheel alignment checked and proper. Trailer axle alignment checked and proper. The same grade and type of wheel hub oil or grease (trailers).

7.6.17 Axle weights of one vehicle must be reasonably close to each corresponding axle on the other vehicle.

7.6.18 Total vehicle weight difference must not be greater than 5%.

7.7 At end of each test trip, both vehicles must be checked for non-device (test components or system) related functional changes. Typical checks would include:

7.7.1 Oil pressure.

7.7.2 Coolant temperatures.

7.7.3 Exhaust gas temperature.

7.7.4 Engine air filter restriction.

7.7.5 Voltmeter or voltage ammeter.

7.7.6 Tire pressures.

7.7.7 Brake dragging.

7.7.8 Exhaust smoke.

7.7.9 Observed ability to maintain selected test speed.

Drivers of Vehicles *A* and *B* should be interviewed to ascertain any differences in the apparent handling, power, or braking characteristics of their respective vehicles when operating in the standard mode (i.e., without the component or system under test) or in the test mode (i.e., with the component or system under test). If changes occur during any test leg, the test data should be discarded and the test rerun after correction of the problem.

7.8 In order to obtain results which may be considered representative of actual fleet conditions, it is important to reproduce typical fleet conditions during the test. This applies to: load weights, routes, grades, vehicle speeds, weather, wind conditions, drivers, etc. Example: If a fleet generally operates in a part of the country and over routes where cross winds exist during a substantial part of the time, the test should be conducted in the presence of similar cross winds, in order to obtain representative results.

7.9 The accuracy of odometers and speedometers of Vehicles *A* and *B* should be determined during the trial test run over the test route selected and compensations made for error during actual test cycle. If odometer readings (total miles) (km) on Vehicle *A* and *B* differ, it is recommended that the distance reading be averaged and this value be used for calculation purposes. A chase car with know speedometer and odometer accuracy may be used for this purpose. Riders should be in each truck/trailer for recording purposes.

7.10 If deviations do occur from the preselected test route on the first test trip, the second test trip should include the exact same deviations. If the deviation occurs initially on the second test trip, then a third test trip must be run having the same test deviation so that a consecutive pair of identical test trips are available for comparison.

TYPE I TEST DATA FORM #1 (VEHICLE IDENTIFICATION)

TRUCK AND/OR TRACTOR

FLEET _____ DATE _____ TEST NUMBER _____

	VEHICLE *A*	VEHICLE *B*
Unit Number		
Make		
Model		
Year		
Number of Axles		
Number of Drive Axles		
Engine Make		
Governed RPM @ No Load		
Power Rated	_____ hp (kw)	_____ hp (kw)
Transmission Make		
Transmission Model		
Geared for:	_____ mph (kw)	_____ mph (kw)
	at _____ rpm	at _____ rpm
	in _____ Gear	in _____ Gear
Differential Make		
Differential Ratio		
Tire Size/Type	_____ / _____	_____ / _____
Tire Pressure (Cold)	_____ psi (kPa)	_____ psi (kPa)

FUEL EFFICIENT DEVICES, COMPONENTS OR SYSTEMS THAT ARE INCORPORATED INTO TEST VEHICLE SPECIFICATIONS AS FLEET STANDARDS ARE LISTED BELOW:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

DETAILED DESCRIPTION OF COMPONENT OR SYSTEM MODIFICATION BEING TESTED:

_____

_____

_____

_____

TEST ROUTE: _____

_____

_____

_____

TYPE I TEST DATA FORM #1 (VEHICLE IDENTIFICATION)

TRAILER/BODY

FLEET_____ DATE_____ TEST NUMBER_____

	VEHICLE *A*	VEHICLE *B*
Unit Number		
Make		
Model		
Year		
Type		
Type of Side		
Type of Corner		
Height		
Length		
Tire Size/Type	/	/
Number of Axles on Trailer(s)		
G. V. W.		
Fifth Wheel Setting		

DRIVER(S) INTERVIEW

HANDLING, POWER, BRAKING CHARACTERISTICS OF VEHICLES DURING TEST (See 7.7)

VEHICLE A _____

VEHICLE B _____