



SAE J2263 Road Coastdown Preparation and Test

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. To determine the road load of a vehicle using SAE J2263 Road Load Measurement Using Onboard Anemometry and Coastdown Techniques.

1.2 Applicability. This procedure applies to passenger cars, multipurpose passenger vehicles, and trucks requiring SAE J2263 road coastdown testing.

1.3 Remarks. This procedure is to be used if certifying a vehicle for the US market using SAE J2263 Road Load Measurement using Onboard Anemometry and Coastdown Techniques. The United States Environmental Protection Agency (EPA) allows other methods besides SAE J2263 to be used if equivalent. However, any alternate method must be approved by Tech Team One: Fuel Economy and Technology Integration.

1.3.1 Summary. This procedure describes:

- Requirements for vehicle and components, i.e., vehicle break-in, tires, brakes, etc.
- What information is needed and how to obtain it, i.e., weights, tire information, etc.
- How to prepare a vehicle for an SAE J2263 coastdown test.
- How the test shall be conducted.

1.3.2 SAE J2263 Notes. SAE J2263 incorporates advances in test equipment and data analysis over the SAE J1263 method of coast measurement. Major changes are:

- Inclusion of real-time anemometry to measure and compensate for wind conditions directly in front of the vehicle. SAE J1263 relied on average wind conditions measured at distances up to several kilometers from the vehicle.
- Generation of a three-term equation to model road force over a 115 km/h to 15 km/h (71.5 mph to 9.3 mph) range. SAE J1263 generated a two-term equation and the road coastdown force was modeled by and simulated on a hydro-kinetic dynamometer capable of being adjusted to reproduce this force at only one speed. Performance at other speeds was a function of dynamometer characteristics.

1.3.3 The final result is a model of road coastdown force as a function of speed during operation on a dry, level road under these reference conditions:

- 20 °C (68 °F).
- 98.21 kPa (29.00 in Hg).
- No wind.
- No precipitation.
- Transmission in Neutral.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

FMVSS 135

SAE J1263

SAE J2263

SAE J2452

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February 2018

Page 1 of 16

Documents

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2.2 GM Standards/Specifications.

GMW15006

GMW15007

GMW15474 (ID)

GMW15887

(ID) = This standard is limited to internal distribution within General Motors and shall not be distributed outside this company. Contact the GM Lead Engineer for further instructions.

2.3 Additional References.

- CG3030 Regional Road Load Coastdown Summary (ID)
- EPA Advisory Circular 55C, describing various test requirements
- EPA Guidance Letter VPCD-98-16, to select the test model
- GM derived SAE Coastdown Program Test Instructions
- GM derived SAE Coastdown Program User Manual
- Vehicle Technical Specification (VTS)

3 Resources

3.1 Facilities.

Road: See CG3030. (Reference GMW15007.)

Soak Area: A facility to keep the test vehicle dry during the soak.

Note: The vehicle 4 h soak is required in SAE J2263 if the tire pressures are not stable or the vehicle will not be tested right after preparation. This allows tire temperatures to stabilize to a soak temperature so that the tires can be adjusted to the track air temperature, if required. It is best to soak in an enclosed facility with a stable temperature.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Alignment Equipment. Equipment to align vehicle during preparation is required.

3.2.2 Instrumentation. The following instrumentation requirements are documented in SAE J2263:

- Time.
- Vehicle speed (do not use fifth wheel).
- Ambient temperature.
- Atmospheric pressure.
- Relative wind speed.
- Relative wind direction, or yaw.
- Tire pressure gauges.
- Vehicle mass scales.
- Tire depth gauge.

3.2.3 Equipment to Measure Vehicle Heights. Measurement equipment varies with region.

3.2.4 Vehicle Hoist. A hoist which enables access to install an anemometer boom on the underside of the vehicle may be required. GM North America (GMNA) uses a hoist which does not have posts under the axles. This allows clear access to the middle of the vehicle and cradle area where the boom attachments are made.

3.2.5 Test Equipment.

- **Data Recording Device.** A Data acquisition system to record data is required. Data recording systems must have the output converted *.csv or *.txt for software input format.
- **Wind Monitor or Anemometer.** A modified Young Model 05305 or 5305V or equivalent is required. Young Model 5305V has analog output. The modification consists of a reversed potentiometer to move the

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February 2018

Page 2 of 16



Documents

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potentiometer dead band to face the rear of the vehicle. This eliminates the wind monitor from passing through the dead band during test.

- **Speed Sensor.** Used to measure vehicle speed.
- **Computer.** Used to run GM derived SAE Coastdown Program and store data from test.
- **Thermocouple.** Type K or equivalent to measure ambient temperature at vehicle soak area.
- **Wind Monitor Fixture.** A boom attached to the vehicle to hold the wind monitor in the front of the vehicle as specified in SAE J2263 is required. Drawings are available from GMNA.

3.2.6 GM derived SAE Coastdown Program. GM derived SAE Coastdown Program has been developed by GM and is an update of the current EPA software. A User Manual is available from GMNA.

3.3 Test Vehicle/Test Piece. See CG3030. (Reference GMW15007.)

Note: These requirements are established for testing to obtain official EPA certification data. Requirements for development testing may deviate from these requirements by engineering judgment to save preparation time.

3.3.1 Vehicle. Certification Only: Per EPA Guidance Letter VPCD-98-16, "Manufacturers shall select a vehicle for coastdown testing from within the population that satisfactorily represents each vehicle design within the population. It is the expectation that if any production vehicle is tested within the population, the road force would be similar to that reported for the representative vehicle."

3.3.1.1 A coastdown vehicle is identified based on the following:

- Model (i.e., sedan, trim level, etc.)
- Tires.
- Powertrain (engine, transmission, axle ratio, etc.)
- Options (e.g., luggage rack).

3.3.1.2 Some of the items to consider for coastdown are:

- Vehicle mileage.
- Vehicle model.
- Vehicle suspension level.
- Wheels and wheel covers.
- Mirrors.
- Vehicle trim level.
- Vehicle options affecting coastdown results (e.g., luggage rack, exterior spare, running boards, moldings).
- Engine, transmission, axle ratio, etc.
- Proper fit and assembly of sheet metal.
- Spoilers.
- Air dams, fascia.
- Engine, transmission, etc., calibration levels.
- Any other components affecting road load horsepower.

3.3.1.3 The test vehicle should be checked for a misaligned cradle or an exhaust built too low.

3.3.2 General Break-In. The vehicle and tires should have accumulated a minimum of 3500 km (2175 mi) and preferably 6500 km (4039 mi) of road service prior to testing. Reference SAE J2263.

3.3.3 Axle. Axle must be broken-in, preferably with vehicle break-in. Limited slip or locking differential option may need to be considered.

3.3.4 Drivetrain. The drivetrain shall have design-intent lubricants. The transmission calibration should be reviewed if it is expected to affect the test results.

3.3.5 Tire Requirements.

3.3.5.1 All tires shall be within rolling-resistance design specifications, or test-intent. This is verified by the Tire Development Engineer when coastdown tires are ordered. This is a GM practice. SAE J2452 is the standard

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February 2018

Page 3 of 16

Documents
Document Sharing Hub

used to measure rolling resistance. GMNA typically conducts this test at the Tire-Wheel Systems Lab or approved manufacturer. Rolling resistance must be defined as 5-term coefficients.

3.3.5.2 Tires must be < 36 months old as tire rolling resistance may change with age. This is a GM-US practice. There is no SAE J2263 requirement. Changing coastdown test tires throughout a coastdown program can be a source of variability.

3.3.5.3 Tires shall be design-intent with respect to size, vendor, and construction. See SAE J2263.

3.3.5.4 Tires should have a minimum of 3500 km (2175 mi) and preferably 6500 km (4039 mi) of road service to obtain the proper tire rolling resistance. Tire break-in may be done with the test vehicle break-in, or it may be done using a different vehicle using similar load conditions as the coast down vehicle. (Reference SAE J2263). Other tire break-in methods **approved by the Global Energy Center** may be used to obtain equivalent rolling resistance as an on-road method.

3.3.5.5 Tires shall have at least 50% of their original tread depth remaining, an SAE J2263 requirement.

3.3.6 Chassis Requirements.

3.3.6.1 Alignment, Heights, etc. The following items are to be design-intent.

- Wheel alignment shall be set to design nominal. This is a GM practice.
- Wheels and wheel covers. **Note:** Design-intent wheels are not required for tire rolling resistance measurements but are required for the actual coastdown test. Long lead times may be required to obtain wheels.
- Wheel bearings shall be adjusted to design nominal specifications, if applicable.
- Wheel bearing lubricants.
- Wheel bearings.
- Wheelbase shall be the same from left to right side to verify vehicle is built square.
- Any other components affecting road load.

3.3.6.2 Brakes. Brake requirements are as follows.

- Rotors and/or drums shall be within design specifications.
- Disc brake lining and caliper assemblies shall be to design intent.
- Drum brakes. Linings shall be set to design nominal running clearance.
- Parking brake shall be set to design nominal specifications. If preparing for certification, parking brake must operate.
- GM Practice. If new brake linings are installed just prior to delivery for coastdown testing, burnish brakes using the FMVSS 135 burnish method for GMNA; or equivalent method elsewhere. Vehicles that have been inactive for a time should be reviewed for brake burnishing.

3.3.7 Body Requirements.

- P-R heights. For certification, P-R heights shall be at design nominal values at wind tunnel mass. The intent is to match heights that vehicle was at when aero was measured in the wind tunnel. For development, P-R heights should be within design range since they may affect aerodynamic drag. (See 3.1.) **Note:** Best Practice: Modify heights by changing spring length or struts, if possible. Other Methods: Changing spring rate, clamping, or blocking to adjust heights but these may affect vehicle on-road attitude and thus aerodynamic drag. Do not heat springs to change heights.
- External body panels, not loose or damaged.
- Spoilers.
- Air dams, fascia.
- Door, hood, and deck lid fits.
- Underbody pans, deflectors, etc., that may affect aero must be present.
- Grille shutters.
- All other components affecting road load horsepower.

3.3.7.1 The exterior should be washed. This is a GM practice.

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February 2018

Page 4 of 16



Documents

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3.3.7.2 Vehicle will be tested with all camouflage that affects aero removed by the test facility. Checkerboard/Zebra Stripe stickers would not be removed. A plan for security must be made as camouflage will be removed.

3.4 Test Time. Consult the test facility for the actual time.

3.4.1 GMNA. The following is an estimate on the amount of time (work-hours) needed to perform this procedure. Preparation, weather, actual test, calculation of data, and other downtime are considered in capturing a total calendar time.

Calendar time:	2 d to 7 d
Test time:	12 h to 16 h
Coordination time:	8 h to 16 h

3.5 Test Required Information.

3.5.1 RPO Codes. Obtain Regular Production Option (RPO) codes when identifying tires, engine, axle, options, etc., in the test request. These RPO codes are important to the Compliance and Certification Data Operations Group. RPO codes accurately describe the vehicle options, and are available from:

- Vehicle build book for non-production vehicles.
- RPO label found on the production vehicle.
- Vehicle Fleet Group databases, including mainframe.
- GM Customer Care and Aftersales for each production year, including descriptions.

3.5.2 Vehicle Configuration Instructions. The desired setting of accessories must be considered and communicated. See 4.2.2 for the default conditions. If there are any deviations or special instructions, they must be noted on a test request.

3.5.3 Tire Pressures For Test. Record and communicate the desired tire pressure for test. SAE J2263 states "inflated to the vehicle manufacturer's minimum recommended inflation pressure".

3.5.4 GM-US: Obtain C_d and Frontal Area.

3.5.4.1 C_d and Frontal Area are used:

- To calculate certification coast results for C_d -constrained analysis. Constrained analysis helps to reduce variation in the 3 coefficients.
- By the Certification Group to adjust other platform models that have different C_d values, e.g., 2-door vs. 4-door.
- Use the GM Aero Lab (GMAL) Continuity value.

3.5.4.2 C_d .

For certification, the C_d should be measured in the wind tunnel as follows:

- Using the actual coast vehicle and at nominal heights at Curb Mass plus 2 occupants or Adjusted Loaded Vehicle Mass as determined by 3.5.6.
- This allows the Certification Group to calculate more accurate Road Load Coefficients when adjusting data to another vehicle.

Note: For development, having the C_d is optional.

Note: Important. Wind tunnel time may require up to two and a half months advance scheduling. Contact the Aero Test Facility to schedule.

3.5.4.3 Frontal Area. Frontal Area can be measured at the same time that the C_d is measured in the tunnel, or the aero test facility can measure Frontal Area separately from C_d .

3.5.5 Calculate Estimated Road Load Coefficients. Calculate the **estimated** road load (F_0 , F_1 , and F_2) coefficients of the vehicle using current practice modeling techniques. This data will be used for:

- Data quality checks prior to removing instrumentation from the coastdown vehicle after test.
- Determination of the accuracy of coastdown modeling programs.

The following information is typically required:

- Measured tire coefficients.
- Front and rear axle weights.

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February 2018

Page 5 of 16

Documents
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