

## § 1066.315

### § 1066.315 Dynamometer road-load setting.

Determine dynamometer road-load settings for chassis testing by following SAE J2264 (incorporated by reference in § 1066.1010).

## Subpart E—Preparing Vehicles and Running an Exhaust Emission Test

### § 1066.401 Overview.

(a) Use the procedures detailed in this subpart to measure vehicle emissions over a specified drive schedule. Different procedures may apply for criteria pollutants and greenhouse gas emissions as described in the standard-setting part. This subpart describes how to—

- (1) Determine road-load power, test weight, and inertia class.
- (2) Prepare the vehicle, equipment, and measurement instruments for an emission test.
- (3) Perform pre-test procedures to verify proper operation of certain equipment and analyzers and to prepare them for testing.
- (4) Record pre-test data.
- (5) Sample emissions.
- (6) Record post-test data.
- (7) Perform post-test procedures to verify proper operation of certain equipment and analyzers.
- (8) Weigh PM samples.

(b) The overall test generally consists of prescribed sequences of fueling, parking, and driving at specified test conditions. An exhaust emission test generally consists of measuring emissions and other parameters while a vehicle follows the drive schedules specified in the standard-setting part. There are two general types of test cycles:

(1) *Transient cycles.* Transient test cycles are typically specified in the standard-setting part as a second-by-second sequence of vehicle speed commands. Operate a vehicle over a transient cycle such that the speed follows the target values. Proportionally sample emissions and other parameters and calculate emission rates as specified in subpart G of this part to calculate emissions. The standard-setting part may specify three types of transient

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testing based on the approach to starting the measurement, as follows:

- (i) A cold-start transient cycle where you start to measure emissions just before starting an engine that has not been warmed up.
- (ii) A hot-start transient cycle where you start to measure emissions just before starting a warmed-up engine.
- (iii) A hot-running transient cycle where you start to measure emissions after an engine is started, warmed up, and running.

(2) *Cruise cycles.* Cruise test cycles are typically specified in the standard-setting part as a discrete operating point that has a single speed command.

(i) Start a cruise cycle as a hot-running test, where you start to measure emissions after the engine is started and warmed up and the vehicle is running at the target test speed.

(ii) Sample emissions and other parameters for the cruise cycle in the same manner as a transient cycle, with the exception that the reference speed value is constant. Record instantaneous and mean speed values over the cycle.

### § 1066.405 Vehicle preparation and preconditioning.

Prepare the vehicle for testing (including measurement of evaporative and refueling emissions if appropriate), as described in the standard-setting part.

### § 1066.410 Dynamometer test procedure.

(a) Dynamometer testing may consist of multiple drive cycles with both cold-start and hot-start portions, including prescribed soak times before each test interval. The standard-setting part identifies the driving schedules and the associated sample intervals, soak periods, engine startup and shutdown procedures, and operation of accessories, as applicable. Not every test interval includes all these elements.

(b) Place the vehicle onto the dynamometer without starting the engine (for cold-start test cycles) or drive the vehicle onto the dynamometer (for hot-start and hot-running cycles only) and position a fan that directs cooling air

to the vehicle during dynamometer operation as described in this paragraph (b). This generally requires squarely positioning the fan in front of the vehicle and directing the airflow to the vehicle's radiator. Use good engineering judgment to design and configure fans to cool the test vehicle in a way that properly simulates in-use operation, consistent with the specifications of § 1066.105. Except for the following special cases, use a road-speed modulated fan meeting the requirements of § 1066.105(c)(2) that is placed within 90 cm of the front of the vehicle and ensure that the engine compartment cover (i.e., hood) is closed:

(1) For vehicles above 14,000 pounds GVWR, use a fan meeting the requirements of § 1066.105(d) that is placed within 90 cm of the front of the vehicle and ensure that the engine compartment cover is closed.

(2) For FTP, LA-92, US06, or HFET testing of vehicles at or below 14,000 pounds GVWR, you may use a fixed-speed fan as specified in the following table, with the engine compartment cover open:

TABLE 1 OF § 1066.410—FIXED-SPEED FAN CAPACITY AND POSITION SPECIFICATIONS FOR VEHICLES AT OR BELOW 14,000 POUNDS GVWR

Test cycle	Maximum fan capacity	Approximate distance from the front of the vehicle
FTP .....	Up to 2.50 m <sup>3</sup> /s .....	0 to 30 cm.
US06 .....	Up to 7.10 m <sup>3</sup> /s .....	0 to 60 cm.
LA-92 ...	Up to 7.10 m <sup>3</sup> /s .....	0 to 60 cm.
HFET ....	Up to 2.50 m <sup>3</sup> /s .....	0 to 30 cm.

(3) For SC03 and AC17 testing, use a road-speed modulated fan meeting the requirements of § 1066.105(c)(5) that is placed within 60 to 90 cm of the front of the vehicle and ensure that the engine compartment cover is closed. Position the discharge nozzle such that its lowest point is not more than 16 cm above the floor of the test cell.

(c) Record the vehicle's speed trace based on the time and speed data from the dynamometer at the recording frequencies given in Table 1 of § 1066.125. Record speed to at least the nearest 0.01 mph and time to at least the nearest 0.1 s.

(d) You may perform practice runs for operating the vehicle and the dynamometer controls to meet the driving tolerances specified in § 1066.425 or adjust the emission sampling equipment. Verify that the accelerator pedal allows for enough control to closely follow the prescribed driving schedule. We recommend that you verify your ability to meet the minimum dilution factor requirements of § 1066.110(b)(2)(iii)(B) during these practice runs.

(e) Inflate tires on drive wheels according to the vehicle manufacturer's specifications. The tire pressure for drive wheels must be the same for dynamometer operation and for dynamometer coastdown procedures used for determining road-load coefficients. Report these measured tire pressure values with the test results.

(f) Tie down or load the test vehicle as needed to provide a normal force at the tire and dynamometer roll interface to prevent wheel slip. For vehicles above 14,000 pounds GVWR, report this measured force with the test results.

(g) Use good engineering judgment when testing vehicles in four-wheel drive or all-wheel drive mode. (For purposes of this paragraph (g), the term four-wheel drive includes other multiple drive-axle configurations.) This may involve testing on a dynamometer with a separate dynamometer roll for each drive axle; or two drive axles may use a single roll, as described in § 1066.210(d)(1); or you may deactivate the second set of drive wheels and operate the vehicle on a single roll. For all vehicles at or below 14,000 GVWR, we will test your vehicle using the same dynamometer roll arrangement that you used. We may also test your vehicle using another dynamometer roll arrangement for information-gathering purposes. If we choose to perform additional testing that requires vehicle modifications, we will ask you to configure the vehicle appropriately.

(h) Determine test weight as follows:

(1) For vehicles at or below 14,000 pounds GVWR, determine ETW as described in § 1066.805. Set dynamometer vehicle inertia,  $I$ , based on dynamometer type, as follows:

(i) For two-wheel drive dynamometers, set  $I$  = ETW.

(ii) For four-wheel drive dynamometers, set  $I = 0.985 \cdot \text{ETW}$ .

(2) For vehicles above 14,000 pounds GVWR, determine the vehicle's effective mass as described in § 1066.310 and use this as the test weight.

(i) Warm up the dynamometer as recommended by the dynamometer manufacturer.

(j) Following the test, determine the actual driving distance by counting the number of dynamometer roll or shaft revolutions, or by integrating speed over the course of testing from a high-resolution encoder system.

**§ 1066.415 Vehicle operation.**

This section describes how to test a conventionally configured vehicle (vehicles with transmission shifters, foot pedal accelerators, etc). You may ask us to modify these procedures for vehicles that do not have these control features.

(a) Start the vehicle as follows:

(1) At the beginning of the test cycle, start the vehicle according to the procedure described in the owners manual. In the case of HEVs, this would generally involve activating vehicle systems such that the engine will start when the vehicle's control algorithms determine that the engine should provide power instead of or in addition to power from the rechargeable energy storage system (RESS). Unless we specify otherwise, engine starting throughout this part generally refers to this step of activating the system on HEVs, whether or not that causes the engine to start running.

(2) Place the transmission in gear as described by the test cycle in the standard-setting part. During idle operation, apply the brakes if necessary to keep the drive wheels from turning.

(b) If the vehicle does not start after your recommended maximum cranking time, wait and restart cranking according to your recommended practice. If you do not recommend such a cranking procedure, stop cranking after 10 seconds, wait for 10 seconds, then start cranking again for up to 10 seconds. You may repeat this for up to three start attempts. If the vehicle does not start after three attempts, you must determine and record the reason for failure to start. Shut off sampling sys-

tems and either turn the CVS off or disconnect the laboratory exhaust tubing from the tailpipe during the diagnostic period to prevent flow through the exhaust system. Reschedule the vehicle for testing. This may require performing vehicle preparation and preconditioning if the testing needs to be rerun from a cold start. If failure to start occurs during a hot-start test, you may reschedule the hot-start test without repeating the cold-start test, as long as you bring the vehicle to a hot-start condition before starting the hot-start test.

(c) Repeat the recommended starting procedure if the engine has a false start (i.e., an incomplete start).

(d) Take the following steps if the engine stalls:

(1) If the engine stalls during an idle period, restart the engine immediately and continue the test. If you cannot restart the engine soon enough to allow the vehicle to follow the next acceleration, stop the driving schedule indicator and reactivate it when the vehicle restarts.

(2) Void the test if the vehicle stalls during vehicle operation. If this happens, remove the vehicle from the dynamometer, take corrective action, and reschedule the vehicle for testing. Record the reason for the malfunction (if determined) and any corrective action. See the standard-setting part for instructions about reporting these malfunctions.

(e) Operate vehicles during testing as follows:

(1) Where we do not give specific instructions, operate the vehicle according to the recommendations in the owners manual, unless those recommendations are unrepresentative of what may reasonably be expected for in-use operation.

(2) If vehicles have features that preclude dynamometer testing, you may modify these features as necessary to allow testing, consistent with good engineering judgment, as long as it does not affect your ability to demonstrate that your vehicles comply with the applicable standards. Send us written notification describing these changes along with supporting rationale.

(3) Operate vehicles during idle as follows: