Subpart C—Dynamometer Specifications

§ 1066.201 Dynamometer overview.

This subpart addresses chassis dynamometers and related equipment.

§ 1066.210 Dynamometers.

(a) General requirements. A chassis dynamometer typically uses electrically generated load forces combined with its rotational inertia to recreate the mechanical inertia and frictional forces that a vehicle exerts on road surfaces (known as “road load”). Load forces are calculated using vehicle-specific coefficients and response characteristics. The load forces are applied to the vehicle tires by rolls connected to intermediate motor/absorbers. The dynamometer uses a load cell to measure the forces the dynamometer rolls apply to the vehicle’s tires.

(b) Accuracy and precision. The dynamometer’s output values for road load must be NIST-traceable. We may determine traceability to a specific international standards organization to be sufficient to demonstrate NIST-traceability. The force-measurement system must be capable of indicating force readings to a resolution of ±0.05% of the maximum forces simulated by the dynamometer or ±0.9 N (±0.2 lbf), whichever is greater, during a test.

(c) Test cycles. The dynamometer must be capable of fully simulating applicable test cycles for the vehicles being tested as referenced in the corresponding standard-setting part.

(1) For vehicles with a gross vehicle weight rating (GVWR) at or below 14,000 lbs, the dynamometer must be able to fully simulate a driving schedule with a maximum speed of 36 m/s (80 mph) and a maximum acceleration rate of 3.6 m/s² (8 mph/s) in two-wheel drive and four-wheel drive configurations.

(2) For vehicles with GVWR above 14,000 lbs, the dynamometer must be able to fully simulate a driving schedule with a maximum speed of 29 m/s (65 mph) and a maximum acceleration rate of 1.3 m/s² (3 mph/s) in either two-wheel drive or four-wheel drive configurations.

(d) Component requirements. The dynamometer must meet the following specifications:

(1) For vehicles with GVWR at or below 14,000 lbs, the nominal roll diameter must be 1.20 to 1.25 meters. The dynamometer must have an independent drive roll for each axle being driven by the vehicle during an emission test.

(2) For vehicles with GVWR above 14,000 lbs, the nominal roll diameter must be at least 1.20 meters and no greater than 3.10 meters. The dynamometer must have an independent drive roll for each axle, except that two drive axles may share a single drive roll. Use good engineering judgment to ensure that the dynamometer roll diameter is large enough to provide sufficient tire-roll contact area to avoid tire overheating and power losses from tire-roll slippage.

(3) If you measure force and speed at 10 Hz or faster, you may use good engineering judgment to convert those measurements to 1-Hz, 2-Hz, or 5-Hz values.

(4) The load applied by the dynamometer simulates forces acting on the vehicle during normal driving according to the following equation:
Environmental Protection Agency

§ 1066.215 Summary of verification and calibration procedures for chassis dynamometers.

(a) Overview. This section describes the overall process for verifying and calibrating the performance of chassis dynamometers.

(b) Scope and frequency. The following table summarizes the required and recommended calibrations and verifications described in this subpart and indicates when they must occur:

* * *

Table 1 of § 1066.215—Summary of required dynamometer calibrations and verifications

<table>
<thead>
<tr>
<th>Type of calibration or verification</th>
<th>Minimum frequency*</th>
</tr>
</thead>
<tbody>
<tr>
<td>§ 1066.220: Linearity verification</td>
<td>Speed: Upon initial installation, within 370 days before testing, and after major maintenance. Torque (load): Upon initial installation, within 370 days before testing, and after major maintenance.</td>
</tr>
<tr>
<td>§ 1066.225: Roll runout and diameter</td>
<td>Upon initial installation and after major maintenance.</td>
</tr>
<tr>
<td>§ 1066.230: Time</td>
<td>Upon initial installation and after major maintenance.</td>
</tr>
<tr>
<td>§ 1066.235: Speed measurement</td>
<td>Upon initial installation, within 370 days before testing, and after major maintenance.</td>
</tr>
<tr>
<td>§ 1066.240: Torque (load) transducer</td>
<td>Upon initial installation and after major maintenance.</td>
</tr>
<tr>
<td>§ 1066.245: Response time</td>
<td>Upon initial installation and after major maintenance.</td>
</tr>
<tr>
<td>§ 1066.250: Base inertia</td>
<td>Upon initial installation and after major maintenance.</td>
</tr>
<tr>
<td>§ 1066.255: Parasitic loss</td>
<td>Upon initial installation, within 7 days before testing, and after major maintenance.</td>
</tr>
<tr>
<td>§ 1066.260: Parasitic friction</td>
<td>Upon initial installation, within 7 days before testing, and after major maintenance.</td>
</tr>
<tr>
<td>compensation evaluation</td>
<td></td>
</tr>
</tbody>
</table>

* * *

$ FR_i = A + B \cdot S_i + C \cdot S_i^2 + M \cdot \frac{S_i - S_{i-1}}{t_i - t_{i-1}} $

Eq. 1066.210-1

Where:

$ FR = $ total road-load force to be applied at the surface of the roll. The total force is the sum of the individual tractive forces applied at each roll surface.

$i = $ a counter to indicate a point in time over the driving schedule. For a dynamometer operating at 10-Hz intervals over a 600-second driving schedule, the maximum value of $ i $ is 6,000.

$ A = $ constant value representing the vehicle’s frictional load in lbf or newtons. See subpart C of this part.

$ B = $ coefficient representing load from drag and rolling resistance, which are a function of vehicle speed, in lbf/mph or N·m/s. See subpart C of this part.

$ S = $ linear speed at the roll surfaces as measured by the dynamometer, in mph or m/s. Let $ S_{i-1} = 0. $

$ C = $ coefficient representing aerodynamic effects, which are a function of vehicle speed squared, in lbf/mph or N·s/m. See subpart C of this part.

$ M = $ mass of vehicle in lbm or kg. Determine the vehicle’s mass based on the test weight, taking into account the effect of rotating axles, as specified in §1066.310(b)(7) and dividing the weight by the acceleration due to gravity as specified in 40 CFR 1065.630, consistent with good engineering judgment.

$ t = $ elapsed time in the driving schedule as measured by the dynamometer, in seconds. Let $ t_{i-1} = 0. $

(5) The dynamometer must be designed to generally apply an actual road-load force within $ \pm 1\% $ or $ \pm 9.8 \text{ N (} \pm 2.2 \text{ lbf)} $ of the reference value, whichever is greater. Dynamometers that do not fully meet this specification may be used consistent with good engineering judgment. For example, slightly higher errors may be permissible during highly transient operation.

(e) Dynamometer manufacturer instructions. This part specifies that you follow the dynamometer manufacturer’s recommended procedures for things such as calibrations and general operation. If you perform testing with a dynamometer that you manufactured or if you otherwise do not have these recommended procedures, use good engineering judgment to establish the additional procedures and specifications we specify in this part, unless we specify otherwise. Keep records to describe these recommended procedures and how they are consistent with good engineering judgment.