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corresponding provisions of 40 CFR part 1065 otherwise required by this section. You must use good engineering judgment when testing under this paragraph (h), and must comply with the following provisions of 40 CFR part 1065:

(1) Generate a map of your engine according to 40 CFR 1065.510(b)(5)(ii) and generate test cycles according to 40 CFR 1065.610. Validate your cycle according to 40 CFR 1065.514.

(2) Follow the provisions of 40 CFR 1065.342 to verify the performance of any sample dryers in your system. Correct your measurements according to 40 CFR 1065.659, except use the value of \( K_w \) in § 86.1342–90(i) as the value of \((1 - x_{\text{H}_2\text{O}_{\text{exh}}})\) in Equation 1065.659–1.

(3) Verify your NO\(_2\)-to-NO converter according to 40 CFR 1065.378.

(4) For diesel engine testing, correct NO\(_X\) emissions for intake-air humidity according to 40 CFR 1065.670.

(5) You must comply with the provisions related to analyzer range and drift in 40 CFR 1065.550. If drift correction is required, correct your measurements according to 40 CFR 1065.672, but use the emission calculations specified in this subpart N rather than those specified in 40 CFR 1065.650.


(7) Follow the provisions of 40 CFR 1065.370 to verify the performance of your CLD analyzer with respect to CO\(_2\) and H\(_2\)O quench. You are not required to follow 40 CFR 1065.145(d)(2), 1065.248, or 1065.750, which are referenced in 40 CFR 1065.370.

(c) Approval of alternate test system.

(1) If on the basis of the information described in paragraph (d)(5) of this section, the Administrator determines that an alternate test system would consistently and reliably produce emission test results that are at least equivalent to the results produced using the test systems described in this subpart, he/she shall approve the alternate system for optional use instead of the test systems described in this subpart.

(2) Any person may submit an application for approval of an alternate test system.

(3) In approving an alternate test system, the Administrator may approve it for general use, or may approve it conditionally.

(4) The Administrator may revoke the approval on the basis of new information that indicates that the alternate test system is not equivalent. However, revocation of approval must allow manufacturers sufficient lead-time to change the test system to an approved system. In determining the amount of lead-time that is required, the Administrator will consider relevant factors such as:

§ 86.1306–96. Where a paragraph in §86.1306–96 is identical and applicable to §86.1306–07, this may be indicated by specifying the corresponding paragraph and the statement “[Reserved]. For guidance see §86.1306–96.”.

(a) and (b) [Reserved]. For guidance see §86.1306–96.

(c) Upon request, the Administrator may allow a manufacturer to use some of the test equipment allowed for model year 2006 and earlier engines instead of the test equipment required for model year 2007 and later engines, provided that good engineering judgment indicates that it would not adversely affect determination of compliance with the applicable emission standards of this part.

(d) Approval of alternate test system.

(1) If on the basis of the information described in paragraph (d)(5) of this section, the Administrator determines that an alternate test system would consistently and reliably produce emission test results that are at least equivalent to the results produced using the test systems described in this subpart, he/she shall approve the alternate system for optional use instead of the test systems described in this subpart.

(2) Any person may submit an application for approval of an alternate test system.

(3) In approving an alternate test system, the Administrator may approve it for general use, or may approve it conditionally.

(4) The Administrator may revoke the approval on the basis of new information that indicates that the alternate test system is not equivalent. However, revocation of approval must allow manufacturers sufficient lead-time to change the test system to an approved system. In determining the amount of lead-time that is required, the Administrator will consider relevant factors such as:
(i) The ease with which the test system can be converted to an approved system.

(ii) The degree to which the alternate system affects the measured emission rates.

(iii) Any relevant conditions included in the approval.

(5) The application for approval must include:

(i) An explanation of the theoretical basis of the alternate system. This technical description should explain why the detection principle of the alternate system would provide equivalent results to the detection principle of the prescribed system for the full range of emission properties being measured. This description may include equations, figures, and references. For example, a NOX measurement application should theoretically relate the alternate detection principle to the chemiluminescent detection principle of detecting nitric oxide for a typical range of NO to NOX ratios. A PM measurement application should explain the principle(s) by which the alternate system quantifies PM mass independent of PM composition, and how it is impacted by semi-volatile and volatile species’ phase distributions. For any proportioning or integrating system, the application should compare the alternate system’s theoretical response to the prescribed system’s response.

(ii) A technical description of the alternate system. This section shall detail all of the hardware and software included in the alternate system. Dimensioned drawings, flow-charts, schematics, and component specifications shall be included. Any data manipulation (i.e. calculations) that the system performs shall be presented in this section.

(iii) A description of the procedures used to operate the system including the level of training that an operator must achieve to obtain acceptable results. This section of the application shall describe all of the installation, calibration, operation, and maintenance procedures in a step-by-step format. Note that empirical calibration with respect to another prescribed or approved measurement system is not acceptable. Calibration should be performed with NIST traceable standards, or equivalent national standards. Diagrams, schematics, and other graphics may be used to enhance the description.

(iv) A comparison of results from the alternate system and from the prescribed system (or other system approved by the Administrator). The two systems must be calibrated independently to NIST traceable standards or equivalent national standards for this comparison. While other statistical analyses may be acceptable, it is recommended that the comparison be based on a minimum of 7 collocated and simultaneous tests. This comparison shall be performed over the “hot-start” portion of the FTP test cycle. If the comparison is unpaired, it must demonstrate that the alternate system passes a two-sided, paired t-test described in this paragraph. If the test is unpaired, it must demonstrate that the alternate system passes a two-sided, unpaired t-test described in this paragraph. Other statistical criteria may be set by the Administrator. The average of these tests for the reference system must return results less than or equal to the acceptable emissions standard. The t-test is performed as follows, where “n” equals the number of tests:

(A) Calculate the average of the alternate system results; this is \( \bar{A}_{ave} \).

(B) Calculate the average of the results of the system to which the alternate system was referenced; this is \( \bar{R}_{ave} \).

(C) For an unpaired comparison, calculate the “n-1” standard deviation for the alternate and reference averages; these are \( \sigma_{ad} \) and \( \sigma_{rd} \) respectively. \( \sigma_{ad} \) must be less than or equal to \( \sigma_{rd} \). If \( \sigma_{ad} \) is greater than \( \sigma_{rd} \), the Administrator will not approve the application.

(D) For an unpaired comparison, calculate the t-value:

\[
 t_{\text{unpaired}} = \frac{(\bar{A}_{ave} - \bar{R}_{ave})/((\sigma_{ad}^2 + \sigma_{rd}^2)/n)^{1/2}}
\]

(E) For a paired comparison, calculate the “n-1” standard deviation (squared) of the differences, \( d_i \), between the paired results, where “1” represents the 1st test of n number of tests:

\[
 S_{d}^2 = \frac{(S_{d}^2 - (\bar{S}_{d}^2)^2/n)}{(n-1)}
\]

(F) For a paired comparison, calculate the t-value:

\[
 t_{\text{paired}} = \frac{(\bar{A}_{ave} - \bar{R}_{ave})/(S_{d}^2/n)^{1/2}}
\]

(2) The absolute value of t must be less than the critical t value, \( t_{\text{crit}} \) at a
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90% confidence interval t values vs. n – 1 degrees of freedom for a two-sided, paired t-test:

<table>
<thead>
<tr>
<th>n – 1</th>
<th>t_{90%}</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>1.94</td>
</tr>
<tr>
<td>7</td>
<td>1.89</td>
</tr>
<tr>
<td>8</td>
<td>1.86</td>
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<tr>
<td>9</td>
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<td>19</td>
<td>1.73</td>
</tr>
<tr>
<td>20</td>
<td>1.73</td>
</tr>
</tbody>
</table>

90% confidence interval for “n – 1” degrees of freedom. The following table lists 90% confidence interval t_{90\%} values for n – 1 degrees of freedom:

(b) Fuel, analytical gas, and engine cycle specifications. Fuel specifications for exhaust emission testing are specified in §86.1313. Analytical gases are specified in §86.1314. The EPA heavy-duty transient engine cycle for use in exhaust testing are described in §86.1333 and specified in appendix I to this part.

§ 86.1308–84 Dynamometer and engine equipment specifications.

(a) Engine dynamometer. The engine dynamometer system must be capable of controlling engine torque and rpm simultaneously over transient cycles. The transient torque and rpm schedules described in §86.1333–84 and specified in appendix I ((0(l), (2), and (3)) must be followed within the accuracy requirements specified in §86.1341–84. In addition to these general requirements, the engine or dynamometer readout signals for speed and torque shall meet the following accuracy specifications:

(1) Engine speed readout shall be accurate to within ±2 percent of the absolute standard value, as defined in paragraph (d) of this section.

(2) Engine flywheel torque readout shall be accurate to either within ±3 percent of the NBS “true” value torque (as defined in paragraph (e) of this section), or the following accuracies:

(i) ±2.5 ft-lbs. of the NBS “true” value if the full scale value is 550 ft-lbs. or less.

(ii) ±5 ft-lbs. of the NBS “true” value if the full scale value is 1050 ft-lbs. or less.

(iii) ±10 ft.-lbs. of the NBS “true” value if the full scale value is greater than 1050 ft-lbs.

(3) Option. Internal dynamometer signals (i.e., armature current, etc.) may be used for torque measurement provided that it can be shown that the engine flywheel torque during the test cycle conforms to the accuracy specifications in paragraph (a) of this section. Such a measurement system must include compensation for increased or decreased flywheel torque due to the armature inertia during accelerations and decelerations in the test cycle.

(b) Cycle verification equipment. In order to verify that the test engine has