

Environmental Protection Agency

§ 89.309

initial start-up and basic operating adjustments.

(b) Check the dynamometer torque measurement for each range used by the following method:

(1) Warm up the dynamometer following the dynamometer manufacturer's specifications.

(2) Determine the dynamometer calibration moment arm (a distance/weight measurement). Dynamometer manufacturer's data, actual measurement, or the value recorded from the previous calibration used for this subpart may be used.

(3) When calibrating the engine flywheel torque transducer, any lever arm used to convert a weight or a force through a distance into a torque must be in a horizontal position (± 5 degrees).

(4) Calculate the indicated torque (IT) for each calibration weight to be used by:

$$IT = \text{calibration weight (N)} \times \text{calibration moment arm (m)}$$

(5) Attach each calibration weight specified in § 89.306 to the moment arm at the calibration distance determined in paragraph (b)(2) of this section. Record the power measurement equipment response (N-m) to each weight.

(6) For each calibration weight, compare the torque value measured in paragraph (b)(5) of this section to the calculated torque determined in paragraph (b)(4) of this section.

(7) The measured torque must be within either 2 percent of point or 1 percent of the engine maximum torque of the calculated torque.

(8) If the measured torque is not within the above requirements, adjust or repair the system. Repeat steps in paragraphs (b)(1) through (b)(6) of this section with the adjusted or repaired system.

(c) Optional. A master load-cell or transfer standard may be used to verify the torque measurement system.

(1) The master load-cell and read out system must be calibrated with weights at each test weight specified in § 89.306. The calibration weights must be traceable to within 0.1 percent of applicable national standards.

(2) Warm up the dynamometer following the equipment manufacturer's specifications.

(3) Attach the master load-cell and loading system.

(4) Load the dynamometer to a minimum of 6 equally spaced torque values as indicated by the master load-cell for each in-use range used.

(5) The in-use torque measurement must be within 2 percent of the torque measured by the master system for each load used.

(6) If the in-use torque is not within 2 percent of the master torque, adjust or repair the system. Repeat steps in paragraphs (c)(2) through (c)(5) of this section with the adjusted or repaired system.

(d) Calibrated resistors may not be used for engine flywheel torque transducer calibration, but may be used to span the transducer prior to engine testing.

(e) Perform other engine dynamometer system calibrations as dictated by good engineering practice.

[59 FR 31335, June 17, 1994. Redesignated and amended at 63 FR 56995, 57010, Oct. 23, 1998]

§ 89.308 Sampling system requirements for gaseous emissions.

(a) For each component (pump, sample line section, filters, and so forth) in the heated portion of the sampling system that has a separate source of power or heating element, use engineering judgment to locate the coolest portion of that component and monitor the temperature at that location. If several components are within an oven, then only the surface temperature of the component with the largest thermal mass and the oven temperature need be measured.

(b) If water is removed by condensation, the sample gas temperature shall be monitored within the water trap or the sample dewpoint shall be monitored downstream. In either case, the indicated temperature shall not exceed 7 °C.

[59 FR 31335, June 17, 1994. Redesignated and amended at 63 FR 56995, 57010, Oct. 23, 1998]

§ 89.309 Analyzers required for gaseous emissions.

(a) *Analyzers.* The following instruments are required for analyzing the measured gases:

(1) *Carbon Monoxide (CO) analysis.* (i) The carbon monoxide analyzer must be

§ 89.310

40 CFR Ch. I (7-1-00 Edition)

of the non-dispersive infrared (NDIR) absorption type.

(ii) The use of linearizing circuits is permitted.

(2) *Carbon Dioxide (CO₂) analysis.* (i) The carbon dioxide analyzer must be of the non-dispersive infrared (NDIR) absorption type.

(ii) The use of linearizing circuits is permitted.

(3) [Reserved]

(4) *Hydrocarbon (HC) analysis.* (i) The hydrocarbon analyzer must be of the heated flame ionization (HFID) type.

(ii) If the temperature of the exhaust gas at the sample probe is below 190 °C, the temperature of the valves, pipework, and so forth, must be controlled so as to maintain a wall temperature of 190 °C ± 11 °C. If the temperature of the exhaust gas at the sample probe is above 190 °C, the temperature of the valves, pipework, and so forth, must be controlled so as to maintain a wall temperature greater than 180 °C.

(iii) The FID oven must be capable of maintaining temperature within 5.5 °C of the set point.

(iv) Fuel and burner air must conform to the specifications in § 89.312.

(v) The percent of oxygen interference must be less than 3 percent, as specified in § 89.319(d).

(5) *Oxides of nitrogen (NO_x) analysis.* (i) This analysis device must consist of the subsequent items, following the sample probe, in the given order:

(A) Pipework, valves, and so forth, controlled so as to maintain a wall temperature above 60 °C.

(B) A NO₂ to NO converter. The NO₂ to NO converter efficiency must be at least 90 percent.

(C) For raw analysis, an ice bath or other cooling device located after the NO_x converter (optional for dilute analysis).

(D) A chemiluminescent detector (CLD or HCLD).

(ii) The quench interference must be less than 3.0 percent as measured in § 89.318.

(b) Other gas analyzers yielding equivalent results may be used with advance approval of the Administrator.

(c) The following requirements must be incorporated in each system used for testing under this subpart.

(1) Carbon monoxide and carbon dioxide measurements must be made on a dry basis (for raw exhaust measurement only). Specific requirements for the means of drying the sample can be found in § 89.309(e).

(2) Calibration or span gases for the NO_x measurement system must pass through the NO₂ to NO converter.

(d) The electromagnetic compatibility (EMC) of the equipment must be on a level as to minimize additional errors.

(e) *Gas drying.* Chemical dryers are not an acceptable method of removing water from the sample. Water removal by condensation is acceptable. A water trap performing this function and meeting the specifications in § 89.308(b) is an acceptable method. Means other than condensation may be used only with prior approval from the Administrator.

[59 FR 31335, June 17, 1994. Redesignated and amended at 63 FR 56995, 57010, Oct. 23, 1998]

§ 89.310 Analyzer accuracy and specifications.

(a) *Measurement accuracy—general.* The analyzers must have a measuring range which allows them to measure the concentrations of the exhaust gas sample pollutants with the accuracies shown in Table 3 in Appendix A of this subpart.

(1) *Response time.* As necessary, measure and account for the response time of the analyzer.

(2) *Precision.* The precision of the analyzer must be, at worst, ±1 percent of full-scale concentration for each range used at or above 100 ppm (or ppmC) or ±2 percent for each range used below 100 ppm (or ppmC). The precision is defined as 2.5 times the standard deviation(s) of 10 repetitive responses to a given calibration or span gas.

(3) *Noise.* The analyzer peak-to-peak response to zero and calibration or span gases over any 10-second period must not exceed 2 percent of full-scale chart deflection on all ranges used.

(4) *Zero drift.* The analyzer zero-response drift during a 1-hour period must be less than 2 percent of full-scale chart deflection on the lowest range used. The zero-response is defined as the mean response including noise to a