

(11)(i) Check zero and reset if necessary.

(ii) Check span response (*linearity*) of the smokemeter by inserting neutral density filters.

(iii) If either zero drift *or the linearity check* is in excess of two percent opacity, the results shall be invalidated.

[48 FR 52203, Nov. 16, 1983, as amended at 49 FR 48141, Dec. 10, 1984; 52 FR 47870, Dec. 16, 1987; 70 FR 40437, July 13, 2005]

§ 86.884-13 Data analysis.

The following procedure shall be used to analyze the test data:

(a) Locate the modes specified in § 86.884-7(a)(1) through (a)(4) by applying the following starting and ending criteria:

(1) The idle mode specified in § 86.884-7(a)(1) starts when engine preconditioning or the lugging mode of a preceding cycle has been completed and ends when the engine speed is raised above the idle speed.

(2) The acceleration mode specified in § 86.884-7(a)(2)(i) starts when the preceding idle mode has been completed and ends when the throttle is in the fully open position, as indicated by the throttle position trace as specified in § 86.884-7(a)(2)(ii).

(3) The acceleration mode specified in § 86.884-7(a)(2)(ii) starts when the preceding acceleration mode has been completed and ends when the engine speed reaches 85 percent of the rated speed.

(4) The transition period specified in § 86.884-7(a)(2)(iii) starts when the preceding acceleration mode has been completed and ends when the throttle is in the fully open position as indicated by the throttle position trace, as specified in § 86.884-7(a)(2)(iv).

(5) The acceleration mode specified in § 86.884-7(a)(2)(iv) starts when the preceding transition period has been completed and ends when the engine speed reaches 95 percent of the rated speed.

(6) The transition period specified in § 86.884-7 (a)(3)(i) starts when the preceding acceleration mode has been completed and ends when the engine speed is 50 rpm below the rated speed and the provisions of § 86.884-7 (a)(3)(i) are met.

(7) The lugging mode specified in § 86.884-7(a)(3)(ii) starts when the pre-

ceding transition period has been completed and ends when the engine speed is at the intermediate speed.

(b) Determine if the test requirements of § 86.884-7 are met by applying the following modal criteria:

(1) Idle mode as specified in § 86.884-7(a)(1):

(i) Duration: 5 to 5.5 minutes.

(ii) Speed: within specification during the last four minutes of the mode.

(2) Acceleration mode as specified in § 86.884-7(a)(2)(i).

(i) Duration: three seconds or less.

(ii) Speed increase: 200±50 rpm.

(3) Acceleration mode as specified in § 86.884-7(a)(2)(ii);

(i) Linearity: ±100 rpm as specified in paragraph (c) of this section.

(ii) Duration: 3.5 to 6.5 seconds.

(iii) Throttle position: fully open until speed is at least 85 percent of the rated speed.

(4) Transition period as specified in § 86.884-7(a)(2)(iii):

(i) Throttle position: moved rapidly to, and held in, the fully closed position.

(5) Acceleration mode as specified in § 86.884-7(a)(2)(iv):

(i) Duration: 8 to 12 seconds.

(ii) Throttle position: fully open when speed is at intermediate speed.

(6) Transition period as specified in § 86.884-7(a)(3)(i):

(i) Duration: 50 to 60 seconds.

(ii) Average speed during the last 10 seconds shall be within ±50 rpm of rated speed.

(iii) Average observed power during the last 10 seconds shall be at least 95 percent of the horsepower developed during the preconditioning mode.

(7) Lugging mode as specified in § 86.884-7(a)(3)(ii):

(i) Linearity: ±100 rpm as specified in paragraph (c) of this section.

(ii) Duration: 30 to 40 seconds.

(iii) Speed at end: intermediate speed.

(c) Determine if the linearity requirements of § 86.884-7 were met by means of the following procedure:

(1) For the acceleration mode specified in § 86.884-7(a)(2)(ii), note the maximum deflection of the rpm trace from a straight line drawn between the starting and ending points specified in paragraph (a)(3) of this section.

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(2) For the lugging mode specified in § 86.884-7(a)(3)(ii), note the maximum deflection of the rpm trace from a straight line drawn from the starting and ending points specified in paragraph (a)(7) of this section.

(3) The test results will be invalid if any deflection is greater than 100 rpm.

(4) This linearity check may be performed by direct analysis of the recorder traces, or by computer analysis of data collected by automatic data collection equipment.

(d) Analyze the smoke trace by means of the following procedure:

(1) Starting at the beginning of the first acceleration, as defined in paragraph (a)(2) of this section, and stopping at the end of the second acceleration, as defined in paragraph (a)(3) of this section, divide the smoke trace into half-second intervals. Similarly, subdivide into half-second intervals the third acceleration mode and the lugging mode as defined by paragraphs (a)(5) and (7) respectively, of this section.

(2) Determine the average smoke reading during each half-second interval.

(3) Locate and record the 15 highest half-second readings during the acceleration mode of each dynamometer cycle.

(4) Locate and record the five highest half-second readings during the lugging mode of each dynamometer cycle.

(5) Examine the average half-second values which were determined in paragraphs (d)(3) and (d)(4) of this section and record the three highest values for each dynamometer cycle.

(6) This smoke trace analysis may be performed by direct analysis of the recorder traces, or by computer analysis of data collected by automatic data collection equipment.

[48 FR 52203, Nov. 16, 1983, as amended at 49 FR 48141, Dec. 10, 1984; 62 FR 47123, Sept. 5, 1997]

§ 86.884-14 Calculations.

(a) If the measured half-second opacity values were obtained with a smokemeter with an optical path length different than shown in the table in § 86.884-8(c), then convert the measured half-second values or the original instantaneous values to the appropriate equivalent optical path

length values specified in the table. Convert the opacity values according to the following equations:

$$N_s = 100 \times (1 - (1 - N_m / 100)^{L_s / L_m})$$

L_m and L_s must use consistent units in the above equation

Where:

N_m =Measured half-second value for conversion, percent opacity

L_m =Measuring smokemeter optical path length, meters

L_s =Standard optical path length corresponding with engine power, n

N_s =Standard half-second value, percent opacity

(b) Average the 45 readings in § 86.884-13(d)(3) or the equivalent converted values from paragraph (a) of this section if appropriate, and designate the value as "A". This is the value for the engine acceleration mode.

(c) Average the 15 readings in § 86.884-13(d)(4) or the equivalent converted values from paragraph (a) of this section if appropriate, and designate the value as "B". This is the value for the engine lugging mode.

(d) Average the 9 readings in § 86.884-13(d)(5) or the equivalent converted values from paragraph (a) of this section if appropriate, and designate the value as "C". This is the value for the peaks in either mode.

(e)(1) If multiple smokemeters were used, the half-second values for each mode from each smokemeter shall be combined and the calculated average based upon the total number of combined values.

(2) For example, if two smokemeters were used for acceleration mode data, 45 half-second values in each data set from both smokemeters would be combined to form a data set of 90 values, which would then be averaged.

[62 FR 47123, Sept. 5, 1997, as amended at 69 FR 2441, Jan. 15, 2004]