

**§ 92.122 Smoke meter calibration.**

The smokemeter shall be checked according to the following procedure prior to each test:

(a) The zero control shall be adjusted under conditions of "no smoke" to give a recorder or data collection equipment response of zero;

(b) Calibrated neutral density filters having approximately 10, 20, and 40 percent opacity shall be employed to check the linearity of the instrument. The filter(s) shall be inserted in the light path perpendicular to the axis of the beam and adjacent to the opening from which the beam of light from the light source emanates, and the recorder response shall be noted. Filters with exposed filtering media should be checked for opacity every six months; all other filters shall be checked every year, using NIST or equivalent reference filters. Deviations in excess of 1 percent of the nominal opacity shall be corrected.

**§ 92.123 Test procedure; general requirements.**

(a) The locomotive/locomotive engine test procedure is designed to determine the brake specific emissions of hydrocarbons (HC, total or non-methane as applicable), total hydrocarbon equivalent (THCE) and aldehydes (as applicable), carbon monoxide (CO), oxides of nitrogen (NO<sub>x</sub>), and particulates, and the opacity of smoke emissions. The test procedure consists of measurements of brake specific emissions and smoke opacity at each throttle position and of measurements of smoke opacity during each change in throttle position as engine power is increased. If less than 2 percent of the total exhaust flow is removed for gaseous and particulate sampling in notches 1 through 8, and if less than 4 percent of the total exhaust flow is removed for gaseous and particulate sampling at idle and dynamic brake, all measurements of gaseous, particulate and smoke emissions may be performed during one test sequence. If more than 2 percent, or 4 percent as applicable, of the total exhaust is removed for gaseous and particulate sampling, measurements of gaseous, and particulate emissions are performed during one test sequence, and a second test se-

quence is performed for the measurement of smoke.

(1) In the raw exhaust sampling procedure, sample is collected directly from the exhaust stream during each throttle setting. Particulates are collected on filters following dilution with ambient air of another raw exhaust sample. The fuel flow rate for each throttle setting is measured.

(2) For locomotives with multiple exhaust stacks, smoke testing is only required for one of the exhaust stacks provided the following conditions are met:

(i) The stack that is not tested is not visibly smokier than the stack that is tested; and

(ii) None of the measured opacity values for the stack tested are not greater than three-quarters of the level allowed by any of the applicable smoke standards.

(b) The test consists of prescribed sequences of engine operating conditions (see §§ 92.124 and 92.126) to be conducted either on a locomotive; or with the engine mounted on an engine dynamometer, or attached to a locomotive alternator/generator.

(1) *Locomotive testing.* (i) The electrical power output produced by the alternator/generator at each throttle setting is recorded as measurements of either the wattmeter or the output voltage, phase angle, and current flow through the electrical resistance bank.

(ii) The locomotive fuel supply system shall be disconnected and a system capable of measuring the net rate at which fuel is supplied to the engine (accounting for fuel recycle) shall be connected.

(2) *Engine testing.* (i) When the test is performed using a dynamometer, engine torque and rpm shall be recorded during each throttle setting.

(ii) The complete engine shall be tested, with all emission control devices, and charge air cooling equipment installed and functioning.

(iii) On air-cooled engines, the engine cooling fan shall be installed.

(iv) Additional accessories (e.g., air compressors) shall be installed or their loading simulated if typical of the in-

use application. In the case of simulated accessory loadings, the manufacturer shall make available to the Administrator documentation which shows that the simulated loading is representative of in-use operation. Power for accessories necessary to operate the engine (such as fuel pumps) shall be treated as parasitic losses and would not be included in the engine power output for purposes of calculating brake specific emissions.

(v) The engine may be equipped with a production type starter.

(vi) Means of engine cooling shall be used which will maintain the engine operating temperatures (e.g., temperatures of intake air downstream of charge air coolers, oil, water, etc.) at approximately the same temperature as would occur in a locomotive at each test point under the equivalent ambient conditions. In the case of engine intake air after compression and cooling in the charge air cooler(s), the temperature of the air entering the engine shall be within  $\pm 5$  °F, at each test point, of the typical temperatures occurring in locomotive operations under ambient conditions represented by the test. Auxiliary fan(s) may be used to maintain engine cooling during operation on the dynamometer. Rust inhibitors and lubrication additives may be used, up to the levels recommended by the additive manufacturer. If anti-freeze is to be used in the locomotive application, antifreeze mixtures and other coolants typical of those approved for use in the locomotive may be used.

(vii) The provisions of paragraph (b)(1)(i) of this section apply to engine testing using a locomotive alternator/generator instead of a dynamometer.

**§ 92.124 Test sequence; general requirements.**

(a) *Air temperature.* (1) The temperature of dilution air for the particulate sample dilution tunnel shall comply with the requirements of § 92.114 throughout the test sequence.

(2) For the testing of locomotives and engines, the ambient (test cell or out-of-door) air temperature, the temperature of the engine intake air, and the temperature of the air which provides

cooling for the engine charge air cooling system shall be between 45 °F (7 °C) and 105 °F (41 °C) throughout the test sequence. Manufacturers and remanufacturers may test at higher temperatures without approval from the Administrator, but no corrections are allowed for the deviations from test conditions.

(b) For the testing of locomotives and engines, the atmospheric pressure shall be between 31.0 inches Hg and 26.0 inches Hg throughout the test sequence. Manufacturers and remanufacturers may test at lower pressures without approval from the Administrator, but no corrections are allowed for the deviations from test conditions.

(c) No control of humidity is required for ambient air, engine intake air or dilution air.

(d) *Flow restrictions.* (1) *Locomotive testing.* Restrictions to the flow of air into the engine and of exhaust out of the engine shall be those inherent to the locomotive. No adjustments or changes shall be made to these parameters. The temperature of the inlet fuel to the engine shall not exceed 125 °F.

(2) *Engine testing.* (i) Air inlet and exhaust restrictions shall be set to represent the average restrictions which would be seen in use in a representative application.

(ii) Inlet depression and exhaust backpressure shall be set with the engine operating at rated speed and maximum power, i.e., throttle notch 8.

(iii) The locations at which the inlet depression and exhaust backpressure are measured shall be specified by the manufacturer or remanufacturer.

(iv) The settings shall be made during the preconditioning.

(e) Pre-test engine measurements (e.g., idle and throttle notch speeds, fuel flows, etc.), pre-test engine performance checks (e.g., verification of engine power, etc.) and pre-test system calibrations (e.g., inlet and exhaust restrictions, etc.) can be done during engine preconditioning, or at the manufacturer's convenience subject to the requirements of good engineering practice.

(f) The required test sequence is described in Table B124-1 of this section, as follows: