

Environmental Protection Agency

§ 92.106

engine is operated in the locomotive under similar ambient conditions. Auxiliary fan(s) may be used to maintain engine cooling during operation on the dynamometer.

(iii) The engine air inlet system used during testing shall have an air inlet restriction within 1 inch of water of the upper limit of a typical engine as installed with clean air filters, as established by the manufacturer or remanufacturer for the engine being tested.

(2) Testers performing engine testing under this subpart shall not use test procedures otherwise allowed by the provisions of this subpart where such procedures are not consistent with good engineering practice and the regulatory goal specified in paragraph (b)(1) of this section.

(c) Provisions that specify different requirements for locomotive and/or engine testing are described in §§ 92.106, 92.108(a) and (b)(1), 92.111(b)(2) and (c), 92.114(a)(2)(ii), (b)(3)(ii), (c)(2)(iii)(A) and (d), 92.115(c), 92.116, 92.123(a)(2) and (b), 92.124(d), 92.125(a) and (b), 92.126(a)(7)(iii)(A).

§ 92.105 General equipment specifications.

(a) *Chart recorders.* (1) The recommended minimum chart speed for gaseous measurements is 1 cm per minute. (Higher chart speeds are required for smoke measurements during the acceleration phases of the test sequence.)

(2) All chart recorders (analyzers, torque, rpm, etc.) shall be provided with automatic markers which indicate ten second intervals. Preprinted chart paper (ten second intervals) may be used in lieu of the automatic markers provided the correct chart speed is used. (Markers which indicate 1 second intervals are required for smoke measurements during the acceleration phases of the test sequence.)

(b) *Automatic data collection.* (1) In lieu of the use of chart recorders, automatic data collection equipment may be used to record all required data. The automatic data collection equipment must be capable of sampling at least two records per second.

(2) Other means may be used provided they produce a permanent visual data

record of a quality equal to or better than those required by this subpart (e.g., tabulated data, traces, or plots).

(c) *Temperature measurements.* (1) The following temperature measurements shall be accurate to within 1.0 °F (0.6 °C):

(i) Temperature measurements used in calculating the engine intake humidity;

(ii) The temperature of the fuel, in volume measuring flow rate devices;

(iii) The temperature of the sample within the water trap(s);

(iv) Temperature measurements used to correct gas volumes (e.g., to standard conditions) or to calculate mass or moles of a sample.

(2) All other temperature measurements shall be accurate within 3.0 °F (1.7 °C).

(d) *Electrical measurements.* (1) Voltmeters shall have accuracy and precision of 1 percent of point or better.

(2) Ammeters shall have accuracy and precision of 1 percent of point or better.

(3) Wattmeters shall have accuracy and precision of 1 percent of point or better.

(4) Instruments used in combination to measure engine power output shall comply with the requirements of § 92.106.

(e) *Pressure measurements.* (1) Gauges and transducers used to measure any pressures used to correct gas volumes (e.g., to standard conditions) or to calculate mass or moles of a sample shall have an accuracy and precision of 0.1 percent of absolute pressure at point or better.

(2) Gauges and transducers used to measure any other pressures shall have an accuracy and precision of 1 percent of absolute pressure at point or better.

§ 92.106 Equipment for loading the engine.

For purposes of placing the required load on the engine during an emissions test, either the equipment specified in paragraph (a) of this section, or the equipment specified in paragraph (b) of this section may be used.

(a) *Locomotive testing.* (1) The equipment required for loading the locomotive engine-alternator/generator assembly electrically, and for measurement of the electrical power output from the alternator/generator consists of the following, either in total or in part: electrical resistance load bank; fans or other means for cooling of the load bank; wattmeter, including phase angle compensation; meter(s) for measurement of the current through the load bank (a calibrated electrical shunt and voltmeter is allowed for current measurement); meter(s) to measure the voltage across the load bank; and electrical cable to connect the alternator/generator to the load bank. Many locomotives are equipped with an internal electrical resistance load bank and fans for cooling of the load bank; when so equipped, the locomotive load bank may be used for purposes of loading the engine during emissions tests.

(2) The combination of instruments (meters) used to measure engine or alternator/generator power output (wattmeter, ammeter, voltmeter) shall have accuracy and precision such that the accuracy of the measured alternator/generator power out is better than:

(i) 2 percent of point at all power settings except idle and dynamic brake; and

(ii) Less accuracy and precision is allowed at idle and dynamic brake, consistent with good engineering practice. Equipment with accuracy or precision worse than 20 percent of point is not allowed.

(3) The efficiency curve for the alternator/generator, shall specify the efficiency at each test point. The manufacturer or remanufacturer shall provide EPA with a detailed description of the procedures used to establish the alternator/generator efficiency.

(b) *Engine testing.* (1) For engine testing using a dynamometer, the engine dynamometer system must be capable of controlling engine torque and speed simultaneously under steady speed operation, during accelerations where the rate of change in torque and speed is representative of those changes which occur when the engine is operating in a locomotive. It must also be capable of performing the test sequence described

in this subpart. In addition to these general requirements, the engine or dynamometer readout signals for speed and torque shall meet the following accuracy specifications:

(i) Engine speed readout shall be accurate to within ± 2 percent of the absolute standard value, as defined in § 92.116 of this part.

(ii) Engine flywheel torque readout shall be accurate to either within ± 3 percent of the NIST "true" value torque, or the following accuracies, whichever provides the most accurate readout:

(A) ± 20 ft.-lbs. of the NIST "true" value if the full scale value is 9000 ft.-lbs. or less.

(B) ± 30 ft.-lbs., of the NIST "true" value if the full scale value is greater than 9000 ft.-lbs.

(C) *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 sequence conforms to the accuracy specifications in paragraph (b)(1)(ii)(A) or (b)(1)(ii)(B) of this section. Such a measurement system must include compensation for increased or decreased flywheel torque due to the armature inertia during accelerations between throttle notch (test mode) settings in the test.

(2) For engine testing using a locomotive alternator/generator instead of a dynamometer, the equipment used shall comply with the requirements of paragraph (a) of this section.

§ 92.107 Fuel flow measurement.

(a) *Fuel flow measurement for locomotive and engine testing.* The rate of fuel consumption by the engine must be measured with equipment conforming to the following:

(1) The fuel flow rate measurement instrument must have a minimum accuracy of ± 2 percent of measurement flow rate for each measurement range used. An exception is allowed at idle where the minimum accuracy is ± 10 percent of measured flow rate for each measurement range used. The measurement instrument must be able to comply with this requirement with an averaging time of one minute or less, except for idle, dynamic brake, and