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(2) If valve V2 is used, the sample probe must connect directly to valve V2. The location of optional valve V2 may not be greater than 4 feet from the exhaust duct.

(3) The location of optional valve V16 may not be greater than 24 inches from the sample pump. The leakage rate for this section on the pressure side of the sample pump may not exceed the leakage rate specification for the vacuum side of the pump.

(d) *Venting.* All vents including analyzer vents, bypass flow, and pressure relief vents of regulators should be vented in such a manner to avoid endangering personnel in the immediate area.

[42 FR 45154, Sept. 8, 1977, as amended at 46 FR 50495, Oct. 13, 1981, and 47 FR 49807, Nov. 2, 1982]

§86.311-79 Miscellaneous equipment; specifications.

(a) *Chart recorders.* (1) The minimum chart speed allowed is 3 inches per minute for gasoline-fueled engines and 0.5 inches per minute for Diesel engines.

(2) When testing gasoline-fueled engines all chart recorders (analyzers, torque, rpm, etc.) shall be provided with Automatic markers which indicate one second intervals. Preprinted chart paper (one second intervals) may be used in lieu of the automatic markers provided the correct chart speed is used.

(b) *Accuracy of temperature measurements.* (1) The following temperature measurements shall be accurate to within 1.2 °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).

(2) All other temperature measurements shall be accurate within 2.5 °C.

(c) *Intake air humidity and temperature measurements.* (1) Humidity conditioned air supply. Air that has had its absolute humidity altered is considered humidity-conditioned air. For this type of intake air supply, the humidity measurements must be made within the in-

take air supply system, and after the humidity conditioning has taken place.

(2) *Nonconditioned air supply.* Humidity measurements in non-conditioned intake air supply systems must be made in the intake air stream entering the supply system. Alternatively, the humidity measurements can be measured within the intake air supply stream.

(3) Engine intake air temperature measurement must be made within 48 inches of the engine. The measurement location must be made either in the supply system or in the air stream entering the supply system.

(d) *Sample component surface temperature.* For each component (pump, sample line section, filters, etc.) 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.

(e) If water is removed by condensation, the sample gas temperature or sample dew point must be monitored either within the water trap or downstream. It may not exceed 7 °C (45 °F).

[42 FR 45154, Sept. 8, 1977, as amended at 46 FR 50495, Oct. 13, 1981; 47 FR 49807, Nov. 2, 1982]

§86.312-79 Dynamometer and engine equipment specifications.

(a) *Dynamometer.* (1) The dynamometer test stand and other instruments for measurement of power output shall be accurate to within 2 percent of point at all power settings above 10 percent of full-scale. Below 10 percent of full-scale the accuracy shall be within 5 percent of point. The dynamometer must be capable of performing the test cycle described in §86.335 or §86.336. Dynamometers used for testing gasoline-fueled engines must have sufficient motoring capability to meet the test requirements. A 60-tooth wheel in combination with a frequency counter shall be considered an absolute standard for engine speed.

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(2) *Dynamometer calibration weights.* A minimum of 6 calibration weights for each range used are required. The weights must be equally spaced and traceable to within 0.5 percent of NBS weights. Laboratories located in foreign countries may certify calibration weights to local government bureau standards.

(b) *Engine cooling.* Means of engine cooling which will maintain the engine operating temperatures (e.g., intake air, oil, water, etc.) at approximately the same temperature as specified by the manufacturer shall be used. Auxiliary fan(s) may be used to maintain engine cooling during operation on the dynamometer.

(c) *Exhaust system.* (1) When testing gasoline-fueled engines:

(i) A chassis-type exhaust system including muffler(s) shall be used. The exhaust system must have a single tail pipe. For engines designed for a dual exhaust system, a standard or specially fabricated "Y" pipe may be used. The "Y" pipe may be located upstream of a single muffler or downstream of a single muffler or downstream of dual mufflers. The potential increase in backpressure due to the use of a single tail pipe instead of dual pipes may be compensated for by using larger than standard exhaust system components downstream of the "Y" pipe. For systems with the "Y" pipe upstream of the muffler, the backpressure at the exhaust manifold exit with the single exhaust system must be comparable to the standard dual exhaust system under the test conditions specified in § 86.335.

(ii) For all catalyst systems the distance from the exhaust manifold flange(s) to the catalyst shall be the same as in the vehicle configuration unless the manufacturer provides temperature data showing equivalent performance at another location.

(iii) For catalyst systems, the probe shall be located in the single exhaust pipe and from 2 to 10 feet downstream of the catalyst(s) and at least 2 feet downstream of the "Y" intersection of any "Y" pipe (if used).

(iv) For noncatalyst systems, the probe shall be located in the single exhaust pipe downstream of the muffler(s) and from 3 to 20 feet downstream

from the exhaust manifold flange or turbocharger exit flange. The probe shall also be at least 2 feet downstream of the "Y" intersection of any "Y" pipe (if used).

(v) For all exhaust systems, the probe shall be located at least 24 inches from the end of the tail pipe. Additional exhaust pipe may be added to the tail pipe to meet the specification.

(2) When testing Diesel engines, a noninsulated exhaust system extending 15 ±5 feet from the exhaust manifold, or the crossover junction in the case of Vee engines, shall be used. The exhaust back pressure must be within 0.2 inch Hg. of the upper limit at maximum rated horsepower, as established by the engine manufacturer in his sales and service literature for vehicle application. A conventional automotive muffler of a size and type commonly used with the engine being tested shall be employed in the exhaust system during smoke emission testing. The terminal 2 feet of the exhaust pipe shall be a circular cross section and be free of elbows and bends. The end of the pipe shall be cut off squarely. The terminal 2 feet of the exhaust pipe shall have a nominal inside diameter in accordance with the engine being tested, as specified below:

Maximum rated horsepower	Exhaust pipe inside diameter (inches)
Less than 101	2
101 to 200	3
201 to 300	4
301 or more	5

[42 FR 45154, Sept. 8, 1977, as amended at 43 FR 52922, Nov. 14, 1978]

§ 86.313-79 Air flow measurement specifications; diesel engines.

(a) The air flow measurement method used must have a range large enough to accurately measure the air flow over the engine operating range during the test. Overall measurement accuracy must be ±2 percent of full-scale value of the measurement device for all modes except the idle and 2-percent modes. For the idle and 2-percent modes, the measurement accuracy shall be ±5 percent or less of the full-scale value. The Administrator must be advised of the method used prior to testing.