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- (i) F1—Fine particulate filter.
- (ii) F2—Fine particulate filter.
- (iii) F3—Fine heated particulate filter.
- (iv) F4—Coarse heated particulate filter.
- (2) *Flowmeters.* (i) Flowmeters FL 1 and FL 2 indicate sample flow rates through the CO and CO<sub>2</sub> analyzers.
- (ii) Flowmeters FL 3, FL 4, FL 5, and FL 6 indicate bypass flow rates.
- (3) *Gauges.* Downstream gauges are required for any system used for testing under this subpart. Upstream gauges may be required under this subpart per § 86.309(b)(2)(v).
  - (i) Upstream gauges G1 and G2 measure the input to the CO and CO<sub>2</sub> analyzers.
  - (ii) Downstream gauges G3 and G4 measure the exit pressure of the CO and CO<sub>2</sub> analyzers. If the normal operating range of the downstream gauges is less than 3 inches of water, then the downstream gauges must be capable of reading both pressure and vacuum.
- (4) *Pressure gauges.* (i) P1—bypass pressure.
  - (ii) P2, P3, P4 and P5—sample or span pressure at inlet to flow control valves.
- (5) *Water traps.* Water traps WT1, and WT2 to remove water from the sample. A water trap performing the function of WT1 and meeting the specifications in § 86.311(e) is required for any system used for testing under this subpart. Chemical dryers are not an acceptable method of removing the water. Water removal by condensation is acceptable. Means other than condensation may be used only with prior approval from the Administrator.
- (6) *Regulators.* (i) R1, R3, R4, and R6—linepressure regulators to control span pressure at inlet to flow control valves.
  - (ii) R2 and R5—back pressure regulators to control sample pressure at inlet to flow control valves.

- (7) *Valves.* (i) V1, V7, V8, and V14—selector valves to select zero or calibration gases.
  - (ii) V2—optional heated selector valve to purge the sample probe, perform leak checks, or to perform hang-up checks.
  - (iii) V3 and V5—Selector valves to select sample or span gases.
  - (iv) V4, V6, and V15—flow control valves.
  - (v) V9 and V13—heated selector valve to select sample or span gases.
  - (vi) V10 and V12—heated flow control valves.
  - (vii) VII—Selector valve to select NO<sub>x</sub> or bypass mode in the chemiluminescence analyzer.
  - (viii) V16—heated selector valve to perform leak checks.
- (8) *Pump.* Sample transfer pump to transport sample to analyzers.
- (9) *Temperature sensor.* A temperature sensor (T1) to measure the NO<sub>2</sub> to NO converter temperature is required for any system used for testing under this subpart.
- (10) *Dryer.* Dryers D1 and D2 to remove the water from the bypass flows to prevent condensation in flowmeters FL3, FL4, and FL6.

§ 86.310-79 Sampling and analytical system; component specifications.

- (a) *Temperature.* (1) For gasoline-fueled engines any heated component;
  - (i) In the HC sample path must be maintained above 110 °C (230 °F) and shall not exceed 230 °C (446 °F).
  - (ii) In the NO<sub>x</sub> sample path must be maintained above 60 °C (140 °F) and shall not exceed 230 °C (446 °F).
- (2) *For Diesel engines any heated component;*
  - (i) In the HC sample path must be maintained above 180 °C (356 °F) and shall not exceed 230 °C (446 °F).
  - (ii) In the NO<sub>x</sub> sample path must be maintained above 60 °C (140 °F) and shall not exceed 230 °C (446 °F).

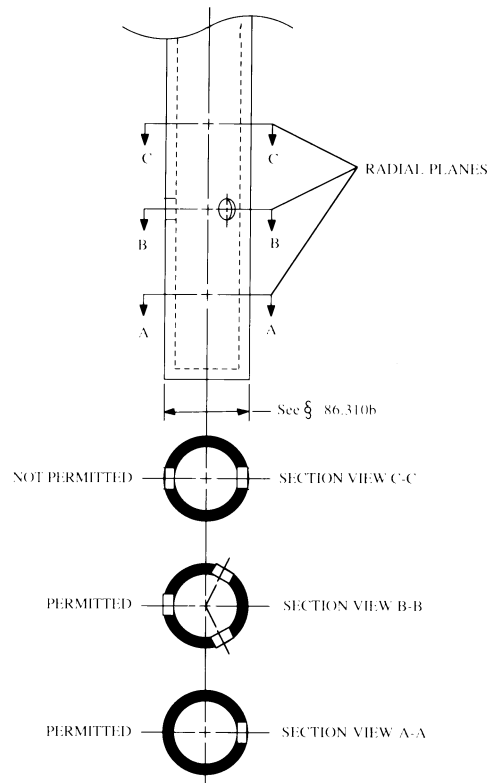


Figure D79-2 SAMPLE PROBE AND TYPICAL HOLE SPACINGS

(3) The sample line outside wall temperature must be maintained at the temperature specified in this paragraph. An exception is made for the first 4 feet of sample line from the exhaust duct. The upper temperature tolerance for this 4 foot section is waived and only the minimum temperature specification applies.

(b) *Sample probe.* (1) The sample probe shall be a straight, closed end, stainless steel, multi-hole probe. The Inside Diameter (I.D.) shall not be greater than the I.D. of the sample line ( $\pm .010$  in.). The wall thickness of the probe shall not be greater than .040 inch. The fitting that attaches the probe to the exhaust pipe shall be as small as practical in order to minimize heat loss from the probe.

(2) There shall be a minimum of three holes in the probe. The spacing of the

radial planes for each hole in the probe must be such that they cover approximately equal cross-sectional areas of the exhaust duct. The angular spacing of the holes must be approximately equal. The angular spacing of any two holes in one plane may not be  $180^\circ \pm 20^\circ$  (i.e., section C-C of Figure D79-2). The holes should be sized such that each has approximately the same flow. If only three holes are used, they may not all be in the same radial plane. See Figure D79-2.

(3) The probe shall extend radially across the exhaust duct. The probe must pass through the approximate center and must extend across at least 80 percent of the diameter of the duct.

(c) *Sample transfer.* (1) The maximum I.D. of the sample line shall not exceed 0.52 inch.

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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.