

Environmental Protection Agency

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The balance shall be helium. The mixture shall contain less than 2 ppmC hydrocarbon.

(2) *Alternate pure hydrogen fuel.* Some HFID's are designed to operate on pure hydrogen. Generally the HFID fuel is incompatible with good relative hydrocarbon response.

(i) For Diesel engines this fuel is not recommended. However, this fuel may be used if the engine manufacturer demonstrates, on each basic combustion system (i.e., 4 cycle DI, 2 cycle DI, 4 cycle pre-cup, etc.) that an HFID using this fuel produces comparable results to an HFID using 40% H₂/60% He fuel. These data must be submitted to and approved by the Administrator prior to testing. Pure H₂ fuel, that may be allowed for testing, must contain at least 99.0 percent hydrogen and contain less than 2 ppmC hydrocarbon.

(ii) For gasoline-fueled engines, pure hydrogen fuel for the HFID is not allowed.

(e) *Hydrocarbon analyzer burner air.* The concentration of oxygen must be within 1 mole percent of the oxygen concentration of the burner air used in the latest oxygen interference check (%O₂ I). If the difference in oxygen concentration is greater than 1 mole percent, then the oxygen interference must be checked and the analyzer adjusted if necessary, to meet the %O₂ I requirements. The burner air must contain less than 2 ppmC hydrocarbon.

(f) Oxygen interference check gases shall contain propane with 350 ppmC±75 ppmC hydrocarbon. The concentration value shall be determined to calibration gas tolerances by chromatographic analysis of total hydrocarbons plus impurities or by dynamic blending. Nitrogen shall be the predominant diluent with the balance oxygen. Blends required for gasoline-fueled and Diesel engine testing are as follows:

Applicability	O ₂ concentration (percent)	Balance
Diesel	21 (20 to 22)	N ₂
Diesel and gasoline	10 (9 to 11)	N ₂
Do	5 (4 to 6)	N ₂
Gasoline	0 (0 to 1)	N ₂

(g) Proportioning and blending devices may be used to obtain required gas concentration.

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

§ 86.309-79 Sampling and analytical system; schematic drawing.

(a) Any variation from the specifications in this subpart including performance specifications and emission detection methods may be used only with prior approval by the Administrator.

(b) *Schematic drawing.* (1) An example of a sampling and analytical system which may be used for testing under this subpart is shown in Figure D79-1. All components or parts of components that are wetted by the sample or corrosive calibration gases shall be either chemically cleaned stainless steel or inert material, e.g. polytetrafluoroethylene resin. The use of "gauge savers" or "protectors" with nonreactive diaphragms to reduce dead volumes is permitted. The specific detection methods to be used for each exhaust component can be found in §86.316 for CO, §86.317 for HC, and §86.318 for NO_x. Additional components such as instruments, valves, solenoids, pumps, switches, etc. may be employed to provide additional information and coordinate the functions of the component systems.

(2) The following requirements must be incorporated in each system used for testing under this subpart.

(i) All analyzers must obtain the sample to be analyzed from the same sample line.

(ii) The sample transport system from the engine exhaust pipe to the HC analyzer and the NO_x analyzer must be heated as is indicated in Figure D79-1.

(iii) Carbon monoxide and carbon dioxide measurements must be made on a dry basis. Specific requirements for the means of drying the sample can be found in §86.309 (b)(5) and §86.311(e).

(iv) All NDIR analyzers must have a pressure gauge immediately downstream of the analyzer. The gauge tap must be within 2 inches of the analyzer exit port. Gauge specifications can be found in §86.309(b)(3).

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(v) All bypass and analyzer flows exiting the analysis system must be measured. Capillary flows such as in HFID and CL analyzers are excluded. For each ND IR analyzer with a flow meter located upstream of the analyzer, an upstream pressure gauge must be used. The gauge tap must be

within 2 inches of the analyzer entrance port.

(vi) Calibration or span gases for the NO_x measurement system must pass through the NO₂ to NO converter.

(vii) The temperature of the NO₂ to NO converter must be displayed continuously.

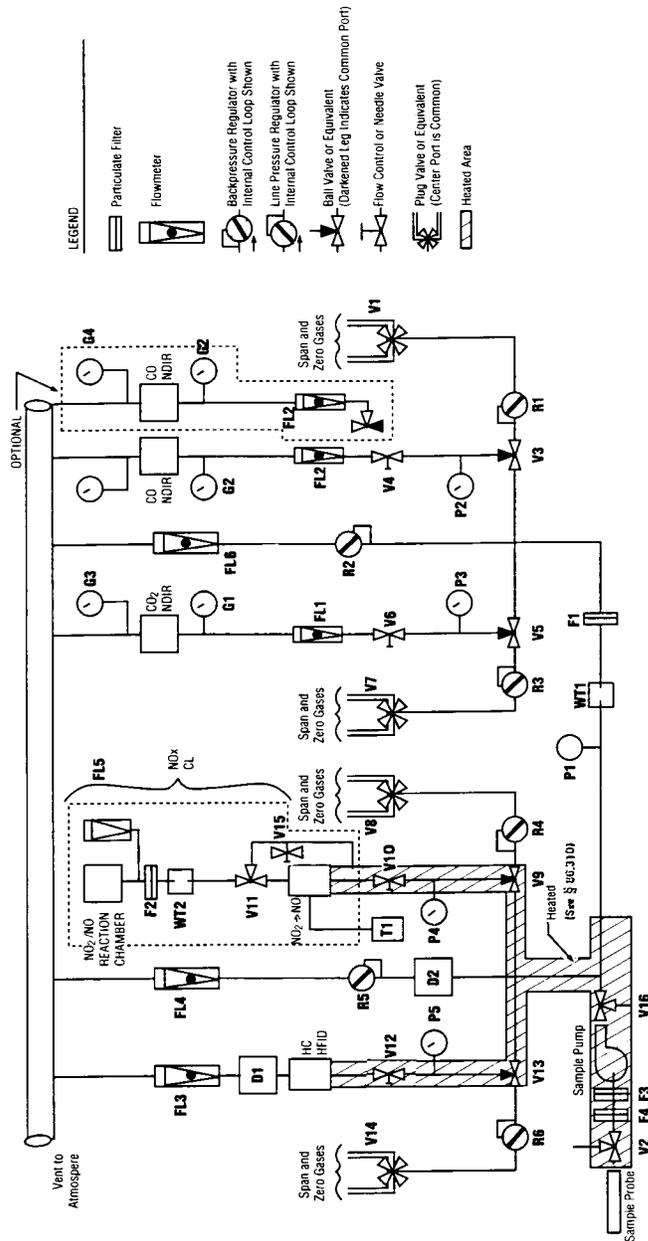


Figure D79-1 HEAVY-DUTY EXHAUST GAS SAMPLING AND ANALYTICAL TRAIN

(c) *System components list.* The following is a list of components shown in Fig. D79-1 by numeric identifier.

(1) *Filters.* Glass fiber filter paper is permitted for F1, F2, and F3. Optional filter F4 is a coarse filter for large particulates.

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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 CO₂ 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 CO₂ analyzers.
 - (ii) Downstream gauges G3 and G4 measure the exit pressure of the CO and CO₂ 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_x 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 NO₂ 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_x 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_x sample path must be maintained above 60 °C (140 °F) and shall not exceed 230 °C (446 °F).