samples of adequate size for analysis without significant impact on the volume of dilute exhaust passing through the CFV. The systems shall also comply with the following requirements that apply to the design of the systems, not to individual tests:

(i) The methanol system shall be designed such that, if a test engine emitted the maximum allowable level of methanol (based on all applicable standards) during the first phase of the test, the measured concentration in the primary impinger would exceed either 25 mg/l or a concentration equal to 25 times the limit of detection for the GC analyzer.

(ii) The formaldehyde system shall be designed such that, if a test engine emitted formaldehyde at a rate equal to twenty percent of the maximum allowable level of THCE (i.e., 0.2 g/Bhphr for a 1.1 g/Bhp-hr THCE standard), or the maximum formaldehyde level allowed by a specific formaldehyde standard, whichever is less, during the first phase of the test, the concentration of formaldehyde in the DNPH solution of the primary impinger, or solution resulting from the extraction of the DNPH cartridge, shall exceed either 2.5 mg/l or a concentration equal to 25 times the limit of detection for the HPLC analyzer.

(iii) The methanol and formaldehyde systems shall be designed such that the primary impinger collects at least 90 percent of the analyte in the samples. The remaining analyte shall be collected by the secondary impinger. Sampling systems shall be identical for all phases of the test.

(d) *Component description, EFC-CFV.* The EFC-CFV sample system, is identical to the CFV system described in paragraph (c) of this section, with the addition of electronic flow controllers, metering valves, separate flow meters to totalize sample flow volumes (optional), for methanol and formaldehyde samples. Both samples may be drawn from a single static probe. The EFC sample system shall conform to the following requirements:

(1) All of the requirements of paragraph (c) of this section.

(2) The ratio of sample flow to CVS flow must not vary by more ± 5 percent from the setpoint of the test.

(3) The sample flow totalizers shall meet the accuracy specifications of § 86.1320. Total sample flow volumes may be obtained from the flow controllers, with advance approval of the Administrator, provided that they can be shown to meet the accuracy specifications of § 86.1320.

60. Section 86.1310–90 of Subpart N is amended by revising the section

heading, paragraph (a) introductory text, the text of paragraph (a)(1) preceding the figures, paragraphs (a)(4), (a)(5), (b)(1)introductory text, (b)(1)(i)introductory text, (b)(1)(ii), and (b)(1)(iii), to read as follows.

§86.1310–90 Exhaust gas sampling and analytical system; diesel engines.

(a) General. The exhaust gas sampling system described in this paragraph is designed to measure the true mass of both gaseous and particulate emissions in the exhaust of petroleum-fueled, natural gas-fueled, liquefied petroleum gas-fueled and methanol-fueled heavyduty diesel engines. This system utilizes the CVS concept (described in §86.1309) of measuring the combined mass emissions of HC, CH₃OH and HCHO from methanol-fueled engines and CO, CO₂ and particulate from all fuel types. A continuously integrated system is required for THC (petroleumfueled, natural gas-fueled, and liquefied petroleum gas-fueled engines) and NO_X (all engines) measurement, and is allowed for all CO and CO₂ measurements plus the combined emissions of CH₃OH, HCHO, and HC from methanol-fueled engines. Where applicable, separate sampling systems are required for methanol and for formaldehyde. The mass of gaseous emissions is determined from the sample concentration and total flow over the test period. The mass of particulate emissions is determined from a proportional mass sample collected on a filter and from the sample flow and total flow over the test period. As an option, the measurement of total fuel mass consumed over a cycle may be substituted for the exhaust measurement of CO₂. General requirements are as follows:

(1) This sampling system requires the use of a PDP–CVS and a heat exchanger, a CFV–CVS (or an EFC–CFV–CVS) with either a heat exchanger or electronic flow compensation. Figure N90–5 is a schematic drawing of the PDP system. Figure N90–6 is a schematic drawing of the CFV–CVS system.

(4) For methanol-fueled engines, cooling or reaction of the exhaust gases in the exhaust duct connected to the dilution tunnel (for the purposes of this paragraph, the exhaust duct excludes the length of pipe representative of the vehicle exhaust pipe) shall be minimized. This may be accomplished by:

(i) Using a duct of unrestricted length maintained at a temperature below 599°F (315°C). (Heating and possibly cooling capabilities as required); or (ii) Using a smooth wall duct less than five feet long with no required heating (a maximum of two short flexible connectors are allowed under this option); or

(iii) Omitting the duct and performing the exhaust gas dilution function at the engine exhaust manifold or immediately after exhaust aftertreatment systems, or after a length of pipe representative of the vehicle exhaust pipe; or

(iv) Partial dilution of the exhaust gas prior to entering the dilution tunnel, which lowers the duct temperature below 599°F (315°C).

(5) Heated sample lines are required for the methanol and formaldehyde samples (care must be taken to prevent heating of the sample probes unless compensation for varying flow rate is made). The sample collection lines shall be heated to a temperature more than $5^{\circ}F$ ($3^{\circ}C$) above the maximum dew point of the mixture, but below $250^{\circ}F$ ($121^{\circ}C$).

* * (b) * * *

(1) Exhaust dilution system. The PDP– CVS shall conform to all of the requirements listed for the exhaust gas PDP–CVS in § 86.1309(b). The CFV– CVS shall conform to all of the requirements listed for the exhaust gas CFV–CVS in § 86.1309(c). The EFC– CFV–CVS shall conform to all of the requirements listed for the exhaust gas EFC–CVS in § 86.1309(d). In addition, the CFV–CVS and EFC–CFV–CVS must conform to the following requirements:

(i) The flow capacity of the CVS must be sufficient to maintain the diluted exhaust stream at or below the temperatures required for the measurement of particulate and hydrocarbon emission noted below and at, or above, the temperatures where condensation of water in the exhaust gases could occur. This may be achieved by either of the following two methods:

(ii) For the CFV–CVS or EFC–CFV– CVS, either a heat exchanger or electronic flow compensation (which also includes the particulate sample flows) is required (see Figure N90–6).

(iii) For the CFV–CVS or EFC–CFV– CVS when a heat exchanger is used, the gas mixture temperature, measured at a point immediately ahead of the critical flow venturi, shall be within $\pm 20^{\circ}$ F ($\pm 11^{\circ}$ C) of the average operating temperature observed during the test with the simultaneous requirement that condensation does not occur. The temperature measuring system(sensors and readout) shall have an accuracy and precision of $\pm 3.4^{\circ}$ F (1.9°C). For systems utilizing a flow compensator to maintain proportional sampling, the