(4) Critical flow venturi. The operation of the Critical Flow Venturi-Constant Volume Sampler (CFV–CVS) sample system, Figure F90-2, is based upon the principles of fluid dynamics associated with critical flow. Proportional sampling throughout temperature excursions is maintained by use of small CFVs in the sample lines, which respond to the varying temperatures in the same manner as the main CFV. For methanol-fueled motorcycles, the methanol and formaldehyde sample lines are heated to prevent condensation. The temperature of the sample lines shall be more than 3°C $(5^{\circ}F)$ above the maximum dew point of the sample, but below 121°C (250°F). Care must be taken to ensure that the CFVs of the sample probes are not heated since heating of the CFVs would cause loss of proportionality. (Note: For 1990 through 1994 model year methanol-fueled motorcycles, methanol and formaldehyde sampling may be omitted provided the bag sample (hydrocarbons and methanol) is analyzed using a HFID calibrated with methanol.) Total flow per test is determined by continuously computing and integrating instantaneous flow. A low response time temperature sensor is necessary for accurate flow calculation.

(5) Electronic Flow Control. The Critical Flow Venturi—Electronic Flow Control—Constant Volume Sampler (CFV-EFC-CVS) system is identical to the CFV-CVS system described in paragraphs (a)(4) and (c) of this section, except that it maintains proportional sampling for methanol and formaldehyde by measuring the CVS flow rate, and electronically controlling sample flow rates. It is recommended that sample volumes be measured by separate flow meters. For methanolfueled motorcycles, the samples lines for the methanol and formaldehyde samples are heated to prevent condensation. The temperature of the sample lines shall be more than 20 °F (11 °C) above the maximum dew point of the sample, but below 121 °C (250 °F).

(b) Component description, PDP-CVS. The PDP–CVS, Figure F90–1, consists of a dilution air filter and mixing assembly, heat exchanger, positive displacement pump, sampling systems including, probes and sampling lines which, in the case of the methanolfueled motorcycles, are heated to prevent condensation (heating of the sample lines may be omitted, provided the methanol and formaldehyde sample collection systems are close coupled to

the probes thereby preventing loss of sample due to cooling and resulting condensation in the sample lines), and associated valves, pressure and temperature sensors. The PDP-CVS shall conform to the following requirements:

(4) The location of the dilution air inlet shall be placed so as to use testcell air for dilution and the flow capacity of the CVS shall be large enough to completely eliminate water condensation in the dilution and sampling systems. Control of water condensation with methanol-fueled vehicles is critical. Additional care may also be required to eliminate water condensation when testing natural gas and liquefied petroleum gas-fueled vehicles. (Procedures for determining CVS flow rates are detailed in "Calculation of Emissions and Fuel Economy When Using Alternative Fuels," EPA 460/3-83-009.) Dehumidifying the dilution air before entering the CVS is allowed. Heating the dilution air is also allowed, provided:

(i) The air (or air plus exhaust gas) temperature does not exceed 121°C (250°F)

(ii) Calculation of the CVS flow rate necessary to prevent water condensation is based on the lowest temperature encountered in the CVS prior to sampling. (It is recommended that the CVS system be insulated when heated dilution air is used.)

(iii) The dilution ratio is sufficiently high to prevent condensation in bag samples as they cool to room temperature.

(5) Sample collection bags for dilution air and exhaust samples (hydrocarbons and carbon monoide) shall be of sufficient size so as not to impede sample flow. A single dilution air sample, covering the total test period, may be collected for the determination of methanol and formaldehyde background (methanol-fueled motorcycles).

(6) The methanol sample collection system and the formaldehyde sample collection system shall each be of sufficient capacity so as to collect samples of adequate size for analysis without significant impact on the volume of dilute exhaust passing through the PDP. 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 motorcycle continuously emitted the maximum allowable level of methanol (based on all applicable standards) 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 motorcycle continuously emitted formaldehyde at a rate equal to twenty percent of the maximum allowable level of THCE (i.e., 1.0 g/km for a 5.0 g/km standard), or the maximum formaldehyde level allowed by a specific formaldehyde standard, whichever is less, 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. This requirement does not apply to dilution air samples, since they do not require secondary impingers, or to samples in which the concentrations approach the limit of detection.

(c) Component description, CFV-CVS. The CFV-CVS sample system, Figure F90-2, consists of a dilution air filter and mixing assembly, a cyclone particulate separator, unheated sampling venturies for the bag samples, and for the methanol and formaldehyde samples from methanol-fueled vehicles, samples lines heated to prevent condensation for the methanol and formaldehyde samples from methanol fueled vehicles (heating of the sample lines may be omitted provided, the methanol and formaldehyde sample collection systems are close coupled to the probes thereby preventing loss of sample due to cooling and resulting condensation in the sample lines), a critical flow venturi, and assorted valves, and pressure and temperature sensors. The CFV sample system shall conform to the following requirements: * * * *

(4) The location of the dilution air inlet shall be placed so as to use testcell air for dilution and the flow capacity of the CVS shall be large enough to completely eliminate water condensation in the dilution and sampling systems. Control of water condensation with methanol-fueled vehicles is critical. Additional care may also be required to eliminate water condensation when testing natural gas and liquefied petroleum gas-fueled vehicles. (Procedures for determining CVS flow rates are detailed in