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Document Number:

17) II-F-02

Docket Number:

A-92-02

A-92-02-II-F-02
Sent to OMB
9/92

Technical Amendments to the Test Procedures for Methanol-Fueled Vehicles

Draft Regulations

Engine and Vehicle Regulation Branch
Office of Mobile Sources
U.S. Environmental Protection Agency

August 25, 1992

DRAFT 8/25/92

Section 86.090-21 of Subpart A is proposed to be amended by adding paragraph (g) to read as follows:

§86.090-21 Application for certification

(g) For methanol-fueled vehicles, the manufacturer shall specify the blend of methanol fuel (*i.e.*, the percent gasoline) for which the vehicle was designed. In the case of FFVs, the manufacturer shall specify the range of fuels and fuel mixtures for which the vehicle was designed.

DRAFT 8/25/92

Section 86.091-21 of Subpart A is proposed to be amended by adding paragraph (g) to read as follows:

§86.091-21 Application for certification

(g) For methanol-fueled vehicles, the manufacturer shall specify the blend of methanol fuel (i.e., the percent gasoline) for which the vehicle was designed. In the case of FFVs, the manufacturer shall specify the range of fuels and fuel mixtures for which the vehicle was designed.

DRAFT 8/25/92

Section 86.094-21 of Subpart A is proposed to be amended by adding paragraph (g) to read as follows:

§86.094-21 Application for certification

(g) **For methanol-fueled vehicles, the manufacturer shall specify the blend of methanol fuel (*i.e.*, the percent gasoline) for which the vehicle was designed. In the case of FFVs, the manufacturer shall specify the range of fuels and fuel mixtures for which the vehicle was designed.**

DRAFT 8/25/92

Section 86.092-26 of Subpart A is proposed to be amended by revising paragraph (a)(4)(i)(D) to read as follows:

§86.092-26 Mileage and service accumulation; emission measurements.

(a) * * *

(4) * * *

(i) * * *

(D) **Except with the advance approval of the Administrator,** the mileage interval between test points must be of equal length except for the interval between zero miles and the first test, and any interval before or after testing conducted in conjunction with vehicle maintenance as specified in §86.090-25(g)(2).

* * * * *

DRAFT 8/25/92

Section 86.095-26 of Subpart A is proposed to be amended by revising paragraph (a)(4)(i)(D) to read as follows:

§86.095-26 Mileage and service accumulation; emission measurements.

(a) * * *

(4) * * *

(i) * * *

(D) **Except with the advance approval of the Administrator**, the mileage interval between test points must be of equal length except for the interval between zero miles and the first test, and any interval before or after testing conducted in conjunction with vehicle maintenance as specified in §86.090-25(g)(2).

* * * * *

DRAFT 8/25/92

Section 86.107-90 of Subpart B is proposed to be amended by revising paragraph (a)(2)(ii) and adding paragraph (a)(2)(iii) to read as follows:

§86.107-90 Sampling and analytical system; evaporative emissions.

(a) * * *

(2) * * *

(ii) For methanol-fueled vehicles, a methanol sampling and analyzing system is required in addition to the **HFID** analyzer. The methanol sampling equipment shall consist of impingers for collecting the methanol sample and appropriate equipment for drawing the sample through the impingers. The analytical equipment shall consist of gas chromatograph equipped with a flame ionization detector. (NOTE: For 1990 through 1994 model year methanol-fueled vehicles, a HFID calibrated on methanol may be used in place of the HFID, calibrated on propane plus the methanol impingers and associated analytical equipment).

(iii) The methanol sampling system shall be designed such that, if a test vehicle emitted the maximum allowable level of methanol (based on all applicable standards) during any 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, and 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.

Section 86.109-90 of Subpart B is proposed to be amended by revising paragraphs (a)(2), (a)(3), (a)(4), (a)(5), (b), (b)(4), (b)(5), (c), (c)(4) and (c)(5), and adding paragraphs (a)(6), (b)(4)(i) - (b)(4)(iii), (b)(6)(i) - (b)(6)(iii), (c)(4)(i) - (c)(4)(iii), (c)(6)(i) - (c)(6)(iii) and (d), and Figures B90-2 and B90-3 to read as follows:

§ 86.109-90 Exhaust gas sampling system; Otto-cycle vehicles.

(a) * * *

(2) * * *

(i) Using a duct of unrestricted length maintained at ~~235°±15°F (113°±8°C)~~ **a temperature above the maximum dew point of the exhaust, but below 250°F (121°C)**; heating and possibly cooling capabilities are required, or

(ii) Using a short duct (up to 12 feet long) constructed of smooth wall pipe with a minimum of flexible sections, maintained at ~~235°±15°F (113°±8°C)~~ **a temperature above the maximum dew point of the exhaust, but below 250°F (121°C)**, prior to the test and during the 10 minute hot soak segment and uninsulated during the test (insulation may remain in place and/or heating may occur during testing provided maximum temperature is not exceeded); or

(iii) Using smooth wall duct less than five feet long with no required heating. **A minimum number of short flexible connectors are allowed under this option.**

(iv) Omitting the duct and performing the exhaust gas dilution function at the vehicle tailpipe exit.

(3) Positive displacement pump. The Positive Displacement Pump-Constant Volume Sampler (PDP - CVS), Figure B90 - 1 satisfies the first condition by metering at a constant temperature and pressure through the pump. The total volume is measured by counting the revolutions made by the calibrated positive displacement pump. The proportional samples for the bag sample, and for methanol-fueled vehicles, the methanol sample (Figure B90 - 2) and the formaldehyde sample (Figure B90 - 3), are achieved by sampling at a constant flow rate. For methanol-fueled vehicles, the sample lines for the methanol and formaldehyde samples are heated to ~~235°±15°F (113°±8°C)~~ **prevent condensation. The sample line temperature shall be above the maximum dew point of the sample, but below 250°F (121°C)**.

Note: For 1990 through 1994 model year methanol-fueled vehicles, methanol and formaldehyde sampling may be omitted provided the bag sample (hydrocarbons and methanol) is analyzed using a HFID calibrated with methanol.

(4) Critical flow venturi. The operation of the Critical Flow Venturi -- Constant Volume Sampler (CFV - CVS) sample system, Figure B90 - 4, 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 (for methanol-fueled vehicles, one line supplies sample for the bag sample, another line supplies sample for the methanol sample, and a third line supplies sample for the formaldehyde sample.) The methanol and formaldehyde sample lines are heated to ~~235°±15°F (113°±8°C)~~ **prevent condensation. The sample line temperature shall be above the maximum dew point of the sample, but below 250°F (121°C).** ~~**with**~~ Care **should** be~~ing~~ taken to ensure that the CFVs of the sample probes are not heated since heating of the CFVs would cause loss of proportionality. The variable mixture flow rate is maintained at sonic velocity, is inversely proportional to the square root of the gas temperature, and is computed continuously. Since the pressure and temperature are the same at all venturi inlets, the sample volume is proportional to the total volume.

Note: For 1990 through 1994 model year methanol-fueled vehicles, methanol and formaldehyde sampling may be omitted provided the bag sample (hydrocarbons and methanol) is analyzed using a HFID calibrated with methanol.

(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), except that it maintains proportional sampling for methanol and formaldehyde by measuring the CVS flow rate, and electronically controlling sample flow rates. For methanol-fueled vehicles, the samples lines for the methanol and formaldehyde samples are heated to prevent condensation. The sample line temperature shall be above the maximum dew point of the sample, but below 250°F (121°C).**

(6) Other systems. Other sampling systems may be used if shown to yield equivalent results, and if approved in advance by the Administrator.

(b) Component description, PDP - CVS. The PDP - CVS, Figure B90 - 1, consists of a dilution air filter and mixing assembly, heat exchanger, positive displacement pump, sampling systems (see Figure B90 - 2 for methanol sampling system and Figure B90 - 3 for formaldehyde sampling system) sampling lines which are heated to ~~235°±15°F (113°±8°C)~~ **prevent condensation** in the case of the 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), and associated valves, pressure and temperature sensors. The PDP - CVS shall conform to the following requirements:

* * * * *

(4) The flow capacity of the CVS shall be large enough to completely eliminate water condensation in the dilution and sampling systems. (300 to 350 cfm (0.142 to 0.165 m^3/s) is

sufficient for most petroleum-fueled vehicles. Higher flow rates are required for methanol-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 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 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 vehicles).

(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.

(i) **The methanol system shall be designed such that, if a test vehicle 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. Sampling systems for all phases shall be identical.**

(ii) The formaldehyde system shall be designed such that, if a test vehicle emitted formaldehyde at a rate equal to ten percent (on a mass basis) of the maximum allowable level for methanol (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 impinger 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 concentration in the primary

impinger approaches the limit of detection.

(c) Component description, CFV - CVS. The CFV-CVS sample system, Figure B90 - 4, 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 ~~235°±15°F (113°±8°C)~~ **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 flow capacity of the CVS shall be large enough to completely eliminate water condensation in the dilution and sampling systems. (300 to 350 cfm (0.142 to 0.165 m^3/s) is sufficient for most petroleum-fueled vehicles. Higher flow rates are required for methanol-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 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 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 vehicles)

(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 CVS.

(i) The methanol system shall be designed such that, if a test vehicle 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. Sampling systems for all phases shall be identical.

(ii) The formaldehyde system shall be designed such that, if a test vehicle emitted formaldehyde at a rate equal to ten percent (on a mass basis) of the maximum allowable level for methanol (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. Sampling systems for all phases shall be identical.

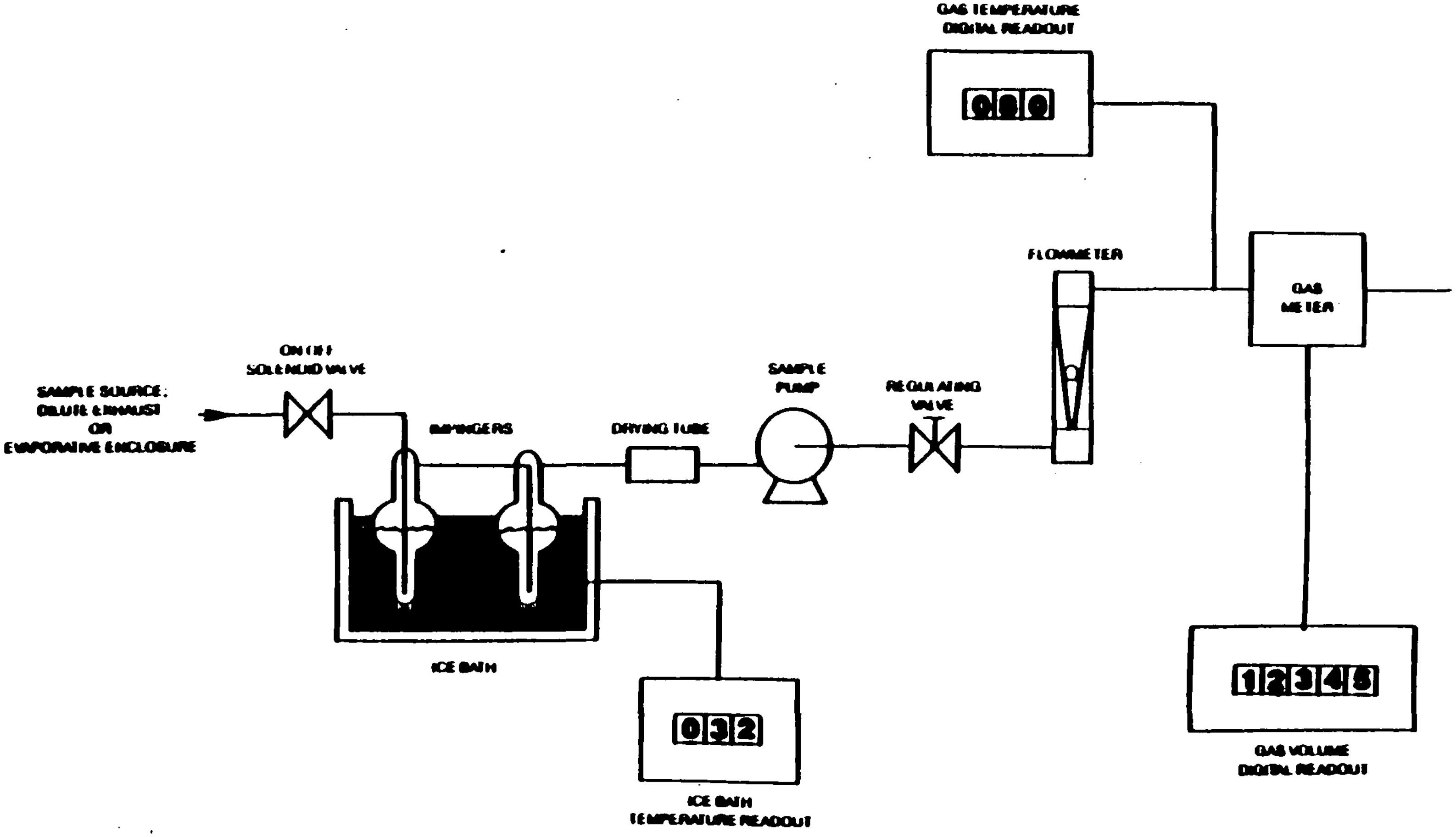
(iii) The methanol and formaldehyde systems shall be designed such that the primary impinger collects at least 90 percent of the analyte in the samples. The remaining analyte shall be collected by the secondary impinger. This requirement does not apply to dilution air samples, since they do not require secondary impingers, or to samples in which the concentration in the primary impinger approaches the limit of detection.

(d) Component description, CFV-EFC-CVS.

The CVS sample system is identical to the system described in paragraph (c), plus includes a means of electronically measuring the CVS flow rate, and electronic mass flow controllers for the methanol and formaldehyde sample lines. Separate flow meters are recommended to totalize sample flow volumes. The EFC sample system shall conform to all of the requirements listed in paragraph (c), except that the methanol and formaldehyde samples mat both be drawn from a single static probe. It also must comply with the following additional requirements:

(1) The ratio of the CVS flow rate to the sample flow rate shall not deviate from the design ratio by more than ±5 percent.

(2) Flow meters to totalize sample volumes for methanol and/or formaldehyde samples shall have an accuracy of ±2 percent. Total sample volumes may be obtained from the flow controllers, provided that the controllers can be shown to have an accuracy of no greater than ±2 percent.



NOTE FOR EVAPORATIVE ENCLOSURE
TESTING, GAS LEAVING DRY
GAS METER IS TO BE RETURNED
TO THE EVAPORATIVE ENCLOSURE

FIGURE B XI-2 METHANOL SAMPLE COLLECTION FLOW SCHEMATIC

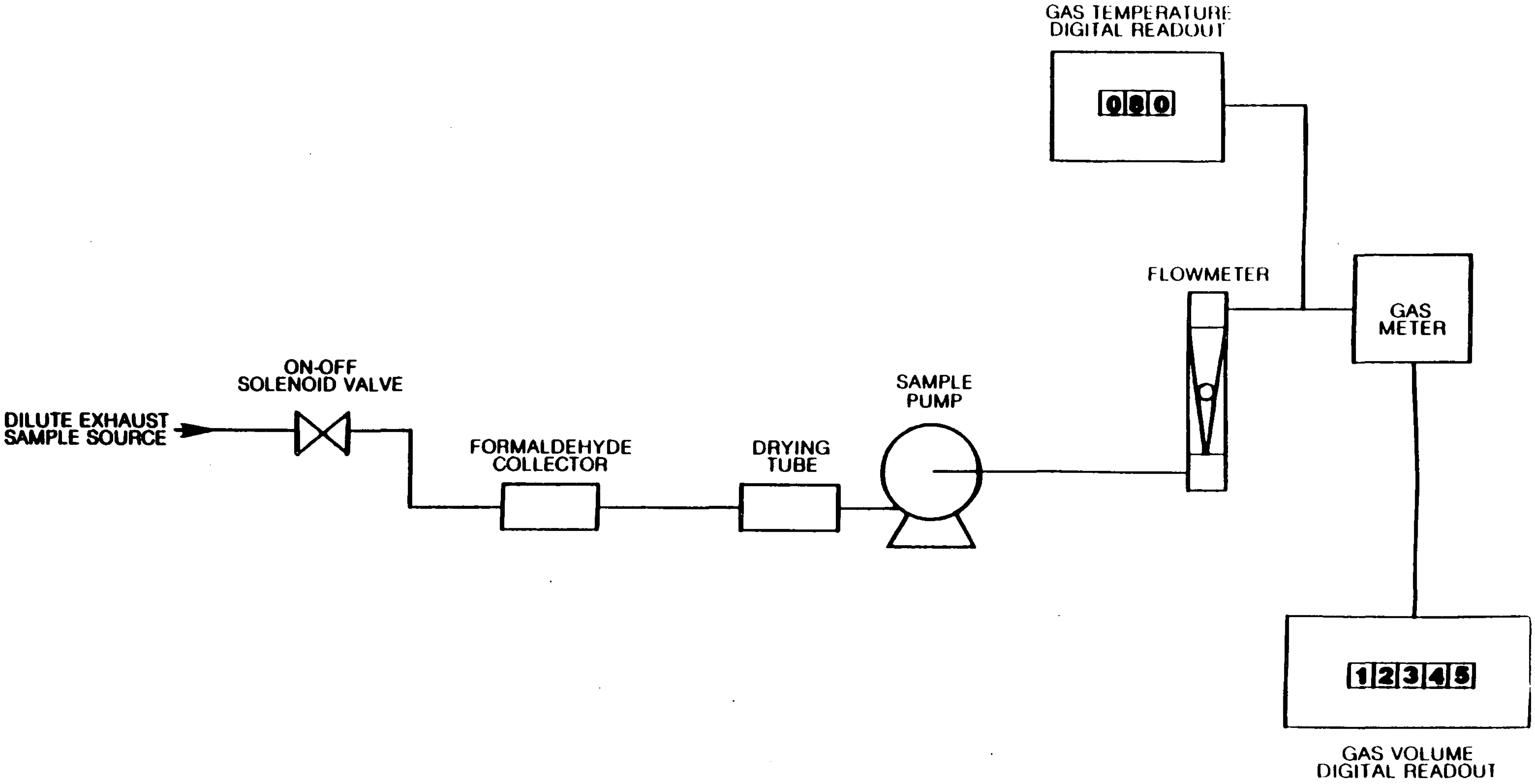


FIGURE B90-3 FORMALDEHYDE SAMPLE COLLECTION FLOW SCHEMATIC

Section 86.109-94 of Subpart B is proposed to be amended by revising paragraphs (a)(2), (a)(3), (a)(4), (a)(5), (b), (b)(4), (b)(5), (c), (c)(4) and (c)(5), and adding paragraphs (a)(6), (b)(4)(i) - (b)(4)(iii), (c)(4)(i) - (c)(4)(iii), (b)(6)(i) - (b)(6)(iii), (c)(6)(i) - (c)(6)(iii) and (d), and Figures B94-2 and B94-3 to read as follows:

§ 86.109-94 Exhaust gas sampling system; Otto-cycle vehicles not requiring particulate emissions measurement.

(a) * * *

(2) * * *

(i) Using a duct of unrestricted length maintained at ~~235°±15°F (113°±8°C)~~ **a temperature above the maximum dew point of the exhaust, but below 250°F** (121°C); heating and possibly cooling capabilities are required, or

(ii) Using a short duct (up to 12 feet long) constructed of smooth wall pipe with a minimum of flexible sections, maintained at ~~235°±15°F (113°±8°C)~~ **a temperature above the maximum dew point of the exhaust, but below 250°F (121°C)**, prior to the test and during the 10 minute hot soak segment and uninsulated during the test (insulation may remain in place and/or heating may occur during testing provided maximum temperature is not exceeded); or

(iii) Using smooth wall duct less than five feet long with no required heating. **A minimum number of short flexible connectors are allowed under this option**.

(iv) Omitting the duct and performing the exhaust gas dilution function at the vehicle tailpipe exit.

(3) Positive displacement pump. The Positive Displacement Pump-Constant Volume Sampler (PDP - CVS), Figure B90 - 1 satisfies the first condition by metering at a constant temperature and pressure through the pump. The total volume is measured by counting the revolutions made by the calibrated positive displacement pump. The proportional samples for the bag sample, and for methanol-fueled vehicles, the methanol sample (Figure B90 - 2) and the formaldehyde sample (Figure B90 - 3), are achieved by sampling at a constant flow rate. For methanol-fueled vehicles, the sample lines for the methanol and formaldehyde samples are heated to ~~235°±15°F (113°±8°C)~~ **prevent condensation. The sample line temperature shall be above the maximum dew point of the sample, but below 250°F (121°C)**.

Note: For 1990 through 1994 model year methanol-fueled vehicles, methanol and formaldehyde sampling may be omitted provided the bag sample (hydrocarbons and methanol) is analyzed using a HFID calibrated with methanol.

(4) Critical flow venturi. The operation of the Critical

Flow Venturi -- Constant Volume Sampler (CFV - CVS) sample system, Figure B90 - 4, 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 (for methanol-fueled vehicles, one line supplies sample for the bag sample, another line supplies sample for the methanol sample, and a third line supplies sample for the formaldehyde sample.) The methanol and formaldehyde sample lines are heated to ~~235°±15°F (113°±8°C)~~ **prevent condensation. The sample line temperature shall be above the maximum dew point of the sample**, **but below 250°F** (121°C). ~~with~~ Care **should** be~~ing~~ taken to ensure that the CFVs of the sample probes are not heated since heating of the CFVs would cause loss of proportionality. The variable mixture flow rate is maintained at sonic velocity, is inversely proportional to the square root of the gas temperature, and is computed continuously. Since the pressure and temperature are the same at all venturi inlets, the sample volume is proportional to the total volume.

Note: For 1990 through 1994 model year methanol-fueled vehicles, methanol and formaldehyde sampling may be omitted provided the bag sample (hydrocarbons and methanol) is analyzed using a HFID calibrated with methanol.

(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), except that it maintains proportional sampling for methanol and formaldehyde by measuring the CVS flow rate, and electronically controlling sample flow rates. For methanol-fueled vehicles, the samples lines for the methanol and formaldehyde samples are heated to prevent condensation. The sample line temperature shall be above the maximum dew point of the sample, but below 250°F (121°C).**

(6) Other systems. Other sampling systems may be used if shown to yield equivalent or superior results, and if approved in advance by the Administrator.

(b) Component description, PDP - CVS. The PDP - CVS, Figure B90 - 1, consists of a dilution air filter and mixing assembly, heat exchanger, positive displacement pump, sampling systems (see Figure B90 - 2 for methanol sampling system and Figure B90 - 3 for formaldehyde sampling system) sampling lines which are heated to ~~235°±15°F (113°±8°C)~~ **prevent condensation** in the case of the 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), and associated valves, pressure and temperature sensors. The PDP - CVS shall conform to the following requirements:

* * * * *

(4) The flow capacity of the CVS shall be large enough to

completely eliminate water condensation in the dilution and sampling systems. (300 to 350 cfm (0.142 to 0.165 m^3/s) is sufficient for most petroleum-fueled vehicles. Higher flow rates are required for methanol-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 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 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 vehicles).

(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.

(i) The methanol system shall be designed such that, if a test vehicle 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. Sampling systems for all phases shall be identical.

(ii) The formaldehyde system shall be designed such that, if a test vehicle emitted formaldehyde at a rate equal to ten percent (on a mass basis) of the maximum allowable level for methanol (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 impinger 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 concentration in the primary impinger approaches the limit of detection.

(c) Component description, CFV - CVS. The CFV-CVS sample system, Figure B90 - 4, 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 ~~235°±15°F (113°±8°C)~~ **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 flow capacity of the CVS shall be large enough to completely eliminate water condensation in the dilution and sampling systems. (300 to 350 cfm (0.142 to 0.165 m^3/s) is sufficient for most petroleum-fueled vehicles. Higher flow rates are required for methanol-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 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 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 vehicles)

(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 CVS.

(i) The methanol system shall be designed such that, if a test vehicle 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. Sampling systems for all phases shall be identical.

(ii) The formaldehyde system shall be designed such that, if a test vehicle emitted formaldehyde at a rate equal to ten percent (on a mass basis) of the maximum allowable level for methanol (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. Sampling systems for all phases shall be identical.

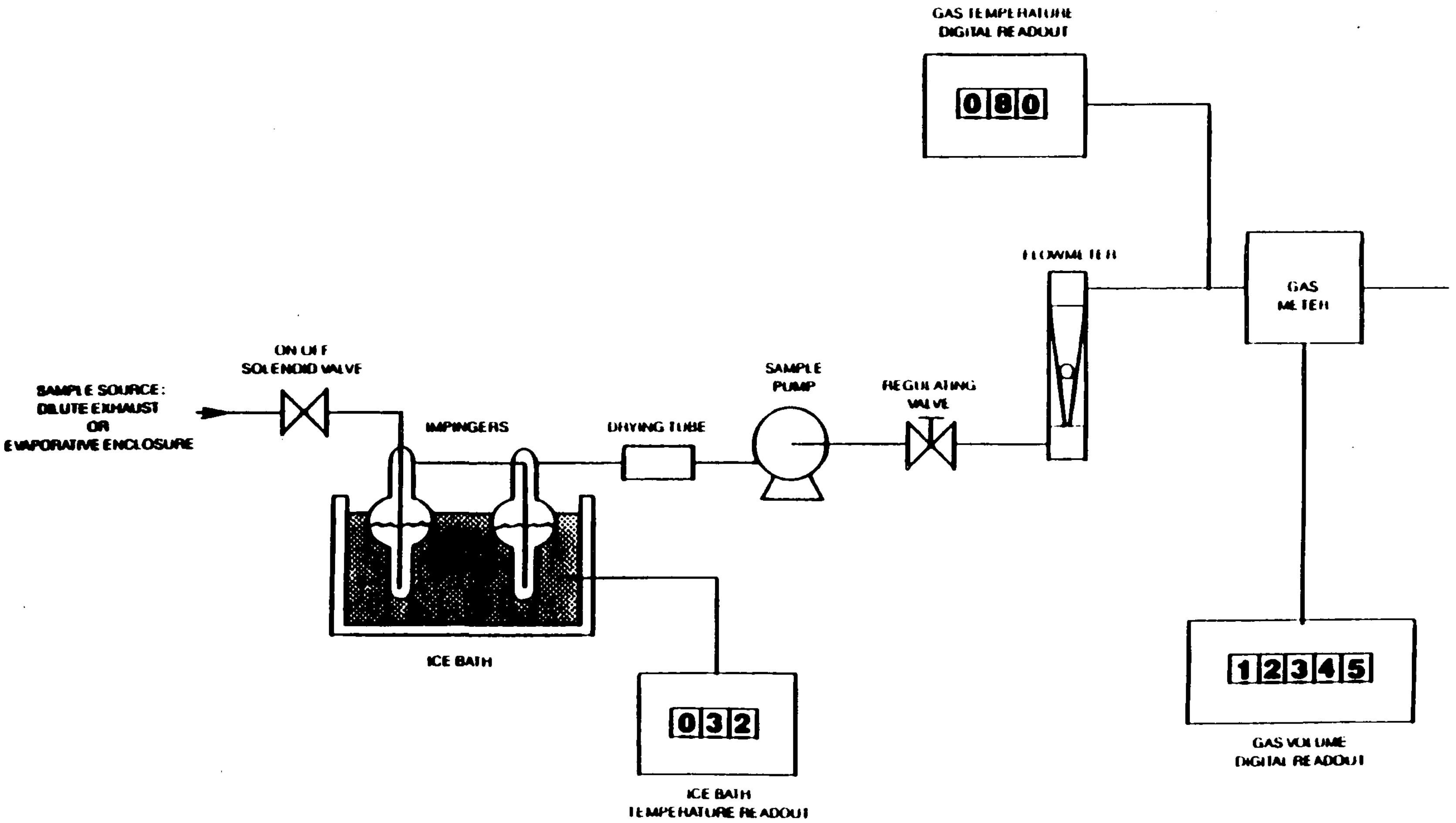
(iii) The methanol and formaldehyde systems shall be designed such that the primary impinger collects at least 90 percent of the analyte in the samples. The remaining analyte shall be collected by the secondary impinger. This requirement does not apply to dilution air samples, since they do not require secondary impingers, or to samples in which the concentration in the primary impinger approaches the limit of detection.

(d) Component description, CFV-EFC-CVS.

The CVS sample system is identical to the system described in paragraph (c), plus includes a means of electronically measuring the CVS flow rate, and electronic mass flow controllers for the methanol and formaldehyde sample lines. Separate flow meters are recommended to totalize sample flow volumes. The EFC sample system shall conform to all of the requirements listed in paragraph (c), except that the methanol and formaldehyde samples mat both be drawn from a single static probe. It also must comply with the following additional requirements:

(1) The ratio of the CVS flow rate to the sample flow rate shall not deviate from the design ratio by more than ±5 percent.

(2) Flow meters to totalize sample volumes for methanol and/or formaldehyde samples shall have an accuracy of ±2 percent. Total sample volumes may be obtained from the flow controllers, provided that the controllers can be shown to have an accuracy of no greater than ±2 percent.



NOTE: FOR EVAPORATIVE ENCLOSURE
TESTING, GAS LEAVING DRY
GAS METER IS TO BE RETURNED
TO THE EVAPORATIVE ENCLOSURE

FIGURE B94-2 METHANOL SAMPLE COLLECTION FLOW SCHEMATIC

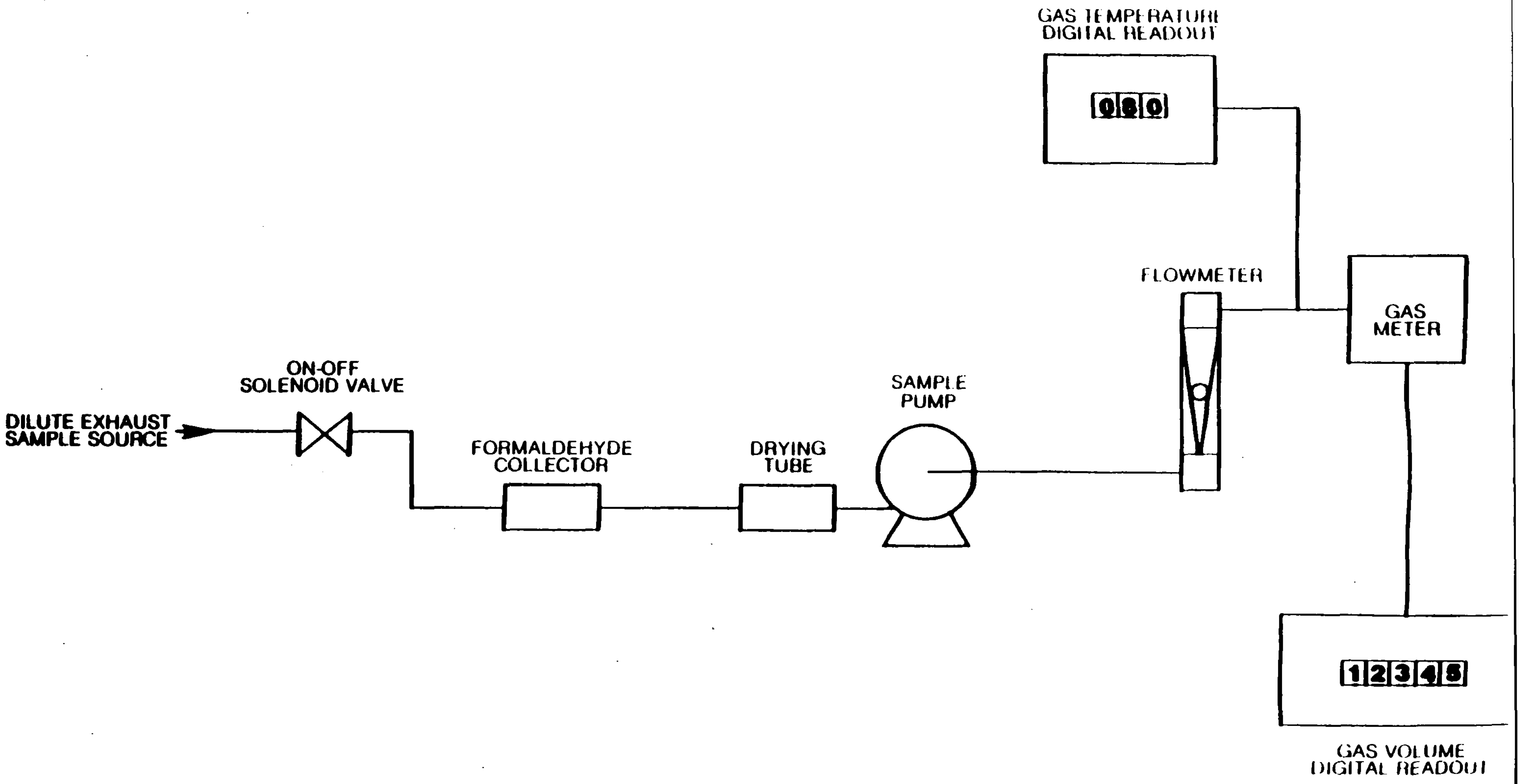


FIGURE B94-3 FORMALDEHYDE SAMPLE COLLECTION FLOW SCHEMATIC

Section 86.110-90 of Subpart B is proposed to be amended by revising paragraphs (a)(1), (a)(5)(i), (a)(5)(ii) and (c)(6), (c)(13)(iii), and (c)(14), adding paragraphs (b)(3)(i) - (b)(3)(iii) and (c)(3)(i) - (c)(3)(iii), and recodifying paragraphs (b)(3) through (b)(15) as (b)(4) through (b)(16) and (c)(3) through (c)(16) as (c)(4) through (c)(17), to read as follows:

§ 86.110-90 Exhaust gas sampling system; diesel vehicles.

(a) * * *

(1) This sampling system requires the use of a PDP-CVS, CFV **(or a CFV-EFC-CVS)**, sample system with heat exchanger connected to a dilution tunnel. Figure B90-5 is a schematic drawing of the PDP system. Figure B90-6 is a schematic drawing of the CFV system (methanol-fueled Otto-cycle vehicles may be tested using this test equipment.)

* * * * *

(5) * * *

(i) A tailpipe to dilution tunnel duct of unrestricted length maintained at ~~235±15°F (113±8°C)~~ **a temperature above the dew point of the mixture, but below 250°F (121°C)** through heating and cooling as required; or

(ii) Using a short duct (up to 12 feet long) constructed of smooth wall pipe with a minimum of flexible sections maintained at ~~235±15°F (113±8°C)~~ **a temperature above the dew point of the mixture, but below 250°F (121°C)** prior to the test and during breaks in testing (insulation may remain in place and or heating may occur during the testing provided the maximum temperature is not exceeded); or

* * * * *

(b) * * *

(3) The EFC sample system shall conform to all of the requirements listed for the exhaust gas EFC sample system (§86.109 (d)) with four exceptions:

(i) A flow rate of sufficient volume is required to maintain the diluted exhaust stream, from which the particulate sample flow is taken, at a temperature of 125 F (52 C) or less.

(ii) A heat exchanger is required.

(iii) The gas mixture temperature variation from its value at the start of the test shall be limited to ±20 F (11 C) during the entire test.

(iv) The cyclonic separator is optional.

(4) The transfer of heat from the vehicle exhaust gas shall be minimized between the point where it leaves the vehicle tailpipe(s) and the point where it enters the dilution tunnel airstream. To accomplish this, a short length (not more than 12 feet (365 cm) if uninsulated, or not more than 20 feet (610 cm) if insulated) of smooth stainless steel tubing from the tailpipe to tubing dilution tunnel is required. This tubing shall have a maximum inside diameter of 4.0 inches (10.2 cm). Short sections of flexible tubing at connection points are allowed.

(5) The vehicle exhaust shall be directed downstream at the point where it is introduced into the dilution tunnel.

(6) The dilution air shall be between 68°F (20°C) and 86°F (30°C) during the test **(unless the requirements of (b)(4) of Section 86.109-90 are also met)**.

(7) The dilution tunnel shall be:

(i) Sized to permit development of turbulent flow (Reynold's No. >>4000) and complete mixing of the exhaust and dilution air between the mixing orifice and each of the two sample probes (i.e., the particulate probe and the heated HC sample probe). It is recommended that uniform mixing be demonstrated by the user.

(ii) At least 8.0 inches (20.3 cm) in diameter.

(iii) Constructed of electrically conductive material which does not react with the exhaust components.

(iv) Grounded.

(8) The temperature of the diluted exhaust stream inside of the dilution tunnel shall be sufficient to prevent water condensation. However, the sample zone dilute exhaust temperature shall not exceed 125°F (52°C) at any time during the test.

(9) The particulate sample probe shall be:

(i) **Installed facing upstream at a point where the dilution air and exhaust are well mixed (i.e., near the tunnel centerline, approximately 10 tunnel diameter downstream from the point where the exhaust enter the dilution tunnel).**

(ii) **Sufficiently distant (radially) from the total hydrocarbon probe so as to be free from the influences of any wakes or eddies produced by the total hydrocarbon probe.**

(iii) **0.5 inch** (1.27 cm) **minimum inside diameter.**

(iv) **The distance from the sampling tip to the filter holder shall be at least 5 probe diameters (for filters located inside of the tunnel), but not more than 40.0 inches (102 cm) for filters located outside of the dilution tunnel.**

(v) Free from sharp bends.

(vi) Configured so that a clean particulate filter (including back up filter) can be selected simultaneously with the selection of an empty gaseous emissions bag.

(10) The flow rate through the particulate probe shall be maintained to a constant value within ±5 percent of the set flow rate.

(11) The particulate sample pump shall be located sufficiently distant from the dilution tunnel so that the inlet gas temperature is maintained at a constant temperature (±5.0°F (2.8°C)).

(12) The gas meters or flow instrumentation shall be located sufficiently distant from the tunnel so that the inlet gas temperature remains constant (±5.0°F (2.8°C)).

(13) The total hydrocarbon probe shall be:

(i) Installed facing upstream at a point where the dilution air and exhaust are well mixed (i.e., approximately 10 tunnel diameters downstream from the point where the exhaust enters the dilution tunnel).

(ii) Sufficiently distant (radially) from the particulate probe so as to be free from the influence of any wakes or eddies produced by the particulate probe.

(iii) Heated and insulated over the entire length to maintain a 375°±20°F (191°±11°C) wall temperature.

(iv) 0.19 in. (0.48 cm) minimum inside diameter.

(14) It is intended that the total hydrocarbon probe be free from cold spots (i.e., free from cold spots where the probe wall temperature is less than 355°F.) This will be determined by a temperature sensor located on a section of the probe wall outside of the dilution tunnel. The temperature sensor shall be insulated from any heating elements on the probe. The sensor shall have an accuracy and precision of ±2°F (1.1°C).

(15) The dilute exhaust gas flowing in the hydrocarbon sample system shall be:

(i) At 375°F±10°F (191°C±6°C) immediately before the heated filter. This will be determined by a temperature sensor located immediately upstream of the filter. The sensor shall have an accuracy and precision of ±2°F (1.1°C)

(ii) At 375°F±10°F (191°C±6°C) immediately before the HFID. This will be determined by a temperature sensor located at the exit of the heated sample line. The sensor shall have an accuracy and precision of ±2°F (1.1°C)

(16) It is intended that the dilute exhaust gas flowing in the hydrocarbon sample system be between 365°F and 385°F (185°C and 197°C).

* * * * *

(c) * * *

(3) The EFC sample system shall conform to all of the requirements listed for the exhaust gas EFC sample system (§86.109 (d) **with three exceptions**:

(i) A flow rate of sufficient volume is required to maintain the diluted exhaust stream, from which the particulate sample flow is taken, at a temperature of 125 F (52 C) or less.

(ii) A heat exchanger is required.

(iii) The gas mixture temperature variation from its value at the start of the test shall be limited to ±20 F (11 C) during the entire test.

(iv) The cyclonic separator is optional.

(4) Losses of methanol due to condensation of water in the duct connecting the vehicle tail pipe to the dilution tunnel must be ~~minimized~~ **eliminated.** This may be accomplished by:

(i) The use of a duct of unrestricted length maintained at through heating and cooling as required, or

(ii) The use of a short duct (up to 12 feet long) constructed of smooth wall pipe with a minimum of flexible sections maintained at ~~235°±15°F (113°±8°C)~~ **a temperature above the maximum dew point of the exhaust, but below 250°F**, prior to the test and during breaks in testing (insulation may remain in place and/or heating may occur during testing provided maximum temperature in not exceeded); or

(iii) Using a smooth wall duct less than five feet long with no required heating, or

(iv) Omitting the duct and performing the exhaust gas dilution function at the vehicle tailpipe exit.

(5) The vehicle exhaust shall be directed downstream at the point where it is introduced into the dilution tunnel.

(6) The dilution air shall be between 68°F (20°C) and 86°F (30°C) during the test **(unless the requirements of (b)(4) of Section 86.109-90 are also met)**.

(7) The dilution tunnel shall be:

(i) Sized to permit development of turbulent flow

(Reynold's No. >>4000) and complete mixing of the exhaust and dilution air between the mixing orifice and the particulate sample probe. It is recommended that uniform mixing be demonstrated by the user.

(ii) At least 8.0 inches (20.3 cm) in diameter.

(iii) Constructed of electrically conductive material which does not react with the exhaust components.

(iv) Grounded.

(8) The temperature of the diluted exhaust stream inside of the dilution tunnel shall be sufficient to prevent water condensation. However, the sample zone dilute exhaust temperature shall not exceed 125°F (52°C) at any time during the test.

(9) The particulate sample probe shall be:

(i) Installed facing upstream at a point where the dilution air and exhaust are well mixed (i.e., near the tunnel centerline, approximately 10 tunnel diameters downstream from the point where the exhaust enters the dilution tunnel).

(ii) Sufficiently distant (radially) from the total hydrocarbon probe so as to be free from the influence of any wakes or eddies produced by the total hydrocarbon probe.

(iii) 0.5 inch (1.27 cm) minimum inside diameter.

(iv) The distance from the sampling tip to the filter holder shall be at lest 5 probe diameters (for filters located inside of the tunnel), but not more than 40.0 inches (102 cm) for filters located outside of the dilution tunnel.

(v) Free from sharp bends.

(vi) Configured so that a clean particulate filter (including back up filter) can be selected simultaneously with the selection of an empty gaseous emissions bag.

(10) The flow rate through the particulate probe shall be maintained to a constant value within ±5 percent of the set flow rate.

(11) The particulate sample pump shall be located sufficiently distant from the dilution tunnel so that the inlet gas temperature is maintained at a constant temperature (±5.0°F (2.8°C)).

(12) The gas meters or flow instrumentation shall be located sufficiently distant from the tunnel so that the inlet gas temperature remains constant (±5.0°F (2.8°C)).

(13) The hydrocarbon probe shall be:

(i) Installed facing upstream at a point where the dilution air and exhaust are well mixed (i.e., approximately 10 tunnel diameters downstream from the point where the exhaust enters the dilution tunnel).

(ii) Sufficiently distant (radially) from the particulate probe so as to be free from the influence of any wakes of eddies produced by the particulate probe.

(iii) Heated and insulated over the entire length to maintain a ~~235°±15°F (113°±8°C)~~ wall temperature **above the maximum dew point of the sample, but below 250°F.**

(iv) 0.19 in. (0.48 cm) minimum inside diameter.

(14) It is intended that the total hydrocarbon probe be free from cold spots (i.e., free from cold spots where the probe wall temperature is less than ~~220°F~~ **the maximum dew point of the sample.**) This will be determined by a temperature sensor located on a section of the probe wall outside of the dilution tunnel. The temperature sensor shall be insulated from any heating elements on the probe. The sensor shall have an accuracy and precision of ±2°F (1.1°C).

(15) The dilute exhaust gas flowing in the hydrocarbon sample system shall be:

(i) At 235°F±15°F (113°C±8°C) immediately before the heated filter. This will be determined by a temperature sensor located immediately upstream of the filter. The sensor shall have an accuracy and precision of ±2°F (1.1°C).

(ii) At 235°±15°F (113°C±8°C) immediately before the HFID. This will be determined by a temperature sensor located at the exit of the heated sample line. The sensor shall have an accuracy and precision of ±2°F (1.1°C).

(16) It is intended that the dilute exhaust gas flowing in the hydrocarbon sample system between 220°F and 250°F (105°C and 121°C).

(17) For methanol-fueled vehicles, bag sampling procedures for the measurement of hydrocarbons as described in Section 86.109 may be employed.

* * * * *

Section 86.110-94 of Subpart B is proposed to be amended by revising paragraphs (a)(1), (a)(5)(i), (a)(5)(ii) and (c)(6), (c)(13)(iii), and (c)(14), adding paragraphs (b)(3)(i) - (b)(3)(iii) and (c)(3)(i) - (c)(3)(iii), and recodifying paragraphs (b)(3) through (b)(15) as (b)(4) through (b)(16) and (c)(3) through (c)(16) as (c)(4) through (c)(17), to read as follows:

§ 86.110-94 Exhaust gas sampling system; diesel-cycle vehicles, and Otto-cycle vehicles requiring particulate emissions measurements.

(a) * * *

(1) This sampling system requires the use of a PDP-CVS, CFV **(or a CFV-EFC-CVS)**, sample system with heat exchanger connected to a dilution tunnel. Figure B90-5 is a schematic drawing of the PDP system. Figure B90-6 is a schematic drawing of the CFV system.

* * * * *

(5) * * *

(i) A duct of unrestricted length maintained at ~~235±15°F (113±8°C)~~ **a temperature above the dew point of the mixture, but below 250°F (121°C)** through heating and cooling as required; or

(ii) A short duct (up to 12 feet long) constructed of smooth wall pipe with a minimum of flexible sections maintained at ~~235±15°F (113±8°C)~~ **a temperature above the dew point of the mixture, but below 250°F (121°C)** prior to the test and during breaks in testing (insulation may remain in place and or heating may occur during the testing provided the maximum temperature is not exceeded); or

* * * * *

(b) * * *

(3) The EFC sample system shall conform to all of the requirements listed for the exhaust gas EFC sample system (§86.109 (d) with four exceptions:

(i) A flow rate of sufficient volume is required to maintain the diluted exhaust stream, from which the particulate sample flow is taken, at a temperature of 125 F (52 C) or less.

(ii) A heat exchanger is required.

(iii) The gas mixture temperature variation from its value at the start of the test shall be limited to ±20 F (11 C) during the entire test.

(iv) The cyclonic separator is optional.

(4) The transfer of heat from the vehicle exhaust gas shall be minimized between the point where it leaves the vehicle tailpipe(s) and the point where it enters the dilution tunnel airstream. To accomplish this, a short length (not more than 12 feet (365 cm) if uninsulated, or not more than 20 feet (610 cm) if insulated) of smooth stainless steel tubing from the tailpipe to tubing dilution tunnel is required. This tubing shall have a maximum inside diameter of 4.0 inches (10.2 cm). Short sections of flexible tubing at connection points are allowed.

(5) The vehicle exhaust shall be directed downstream at the point where it is introduced into the dilution tunnel.

(6) The dilution air shall be between 68°F (20°C) and 86°F (30°C) during the test **(unless the requirements of (b)(4) of Section 86.109-90 are also met)**.

(7) The dilution tunnel shall be:

(i) Sized to permit development of turbulent flow (Reynold's No. >>4000) and complete mixing of the exhaust and dilution air between the mixing orifice and each of the two sample probes (i.e., the particulate probe and the heated HC sample probe). It is recommended that uniform mixing be demonstrated by the user.

(ii) At least 8.0 inches (20.3 cm) in diameter.

(iii) Constructed of electrically conductive material which does not react with the exhaust components.

(iv) Grounded.

(8) The temperature of the diluted exhaust stream inside of the dilution tunnel shall be sufficient to prevent water condensation. However, the sample zone dilute exhaust temperature shall not exceed 125°F (52°C) at any time during the test.

(9) The particulate sample probe shall be:

(i) Installed facing upstream at a point where the dilution air and exhaust are well mixed (i.e., near the tunnel centerline, approximately 10 tunnel diameter downstream from the point where the exhaust enter the dilution tunnel).

(ii) Sufficiently distant (radially) from the THC probe (when the THC probe is required) so as to be free from the influences of any wakes or eddies produced by the THC probe.

(iii) 0.5 inch (1.27 cm) minimum inside diameter.

(iv) The distance from the sampling tip to the filter holder shall be at least 5 probe diameters (for filters located inside of the tunnel), but not more than 40.0 inches (102 cm) for filters located outside of the dilution tunnel.

(v) Free from sharp bends.

(vi) Configured so that a clean particulate filter (including back up filter) can be selected simultaneously with the selection of an empty gaseous emissions bag.

(10) The flow rate through the particulate probe shall be maintained to a constant value within ±5 percent of the set flow rate.

(11) The particulate sample pump shall be located sufficiently distant from the dilution tunnel so that the inlet gas temperature is maintained at a constant temperature (±5.0°F (2.8°C)).

(12) The gas meters or flow instrumentation shall be located sufficiently distant from the tunnel so that the inlet gas temperature remains constant (±5.0°F (2.8°C)).

(13) The THC probe (when the THC probe is required) shall be:

(i) Installed facing upstream at a point where the dilution air and exhaust are well mixed (<u>i.e.</u>, approximately 10 tunnel diameters downstream from the point where the exhaust enters the dilution tunnel).

(ii) Sufficiently distant (radially) from the particulate probe so as to be free from the influence of any wakes or eddies produced by the particulate probe.

(iii) Heated and insulated over the entire length to maintain a 375°±20°F (191°±11°C) wall temperature.

(iv) 0.19 in. (0.48 cm) minimum inside diameter.

(14) It is intended that the THC probe be free from cold spots (<u>i.e.</u>, free from cold spots where the probe wall temperature is less than 355°F.) This will be determined by a temperature sensor located on a section of the probe wall outside of the dilution tunnel. The temperature sensor shall be insulated from any heating elements on the probe. The sensor shall have an accuracy and precision of ±2°F (1.1°C).

(15) The dilute exhaust gas flowing in the THC sample system shall be:

(i) At 375°F±10°F (191°C±6°C) immediately before the heated filter. This will be determined by a temperature sensor located immediately upstream of the filter. The sensor shall have an accuracy and precision of ±2°F (1.1°C)

(ii) At 375°F±10°F (191°C±6°C) immediately before the HFID This will be determined by a temperature sensor located at the ex of the heated sample line. The sensor shall have an accuracy a precision of ±2°F (1.1°C)

(16) It is intended that the dilute exhaust gas flowing in the THC sample system be between 365°F and 385°F (185°C and 197°C).

* * * * *

(c) * * *

(3) **The EFC sample system shall conform to all of the requirements listed for the exhaust gas EFC sample system (§86.109 (d)) with three exceptions:**

(i) A flow rate of sufficient volume is required to maintain the diluted exhaust stream, from which the particulate sample flow is taken, at a temperature of 125 F (52 C) or less.

(ii) A heat exchanger is required.

(iii) The gas mixture temperature variation from its value at the start of the test shall be limited to ±20 F (11 C) during the entire test.

(iv) The cyclonic separator is optional.

(4) Losses of methanol due to condensation of water in the duct connecting the vehicle tail pipe to the dilution tunnel must be ~~minimized~~ **eliminated.** This may be accomplished by:

(i) The use of a duct of unrestricted length maintained at through heating and cooling as required, or

(ii) The use of a short duct (up to 12 feet long) constructed of smooth wall pipe with a minimum of flexible sections maintained at ~~235°±15°F (113°±8°C)~~ **a temperature above the maximum dew point of the exhaust, but below 250°F**, prior to the test and during breaks in testing (insulation may remain in place and/or heating may occur during testing provided maximum temperature in not exceeded); or

(iii) Using a smooth wall duct less than five feet long with no required heating, or

(iv) Omitting the duct and performing the exhaust gas dilution function at the vehicle tailpipe exit.

(5) The vehicle exhaust shall be directed downstream at the point where it is introduced into the dilution tunnel.

(6) The dilution air shall be between 68°F (20°C) and 86°F (30°C) during the test **(unless the requirements of (b)(4) of Section 86.109-90 are also met).**

(7) The dilution tunnel shall be:

(i) Sized to permit development of turbulent flow (Reynold's No. >>4000) and complete mixing of the exhaust and dilution air between the mixing orifice and the particulate sample probe. It is recommended that uniform mixing be demonstrated by the user.

(ii) At least 8.0 inches (20.3 cm) in diameter.

(iii) Constructed of electrically conductive material which does not react with the exhaust components.

(iv) Grounded.

(8) The temperature of the diluted exhaust stream inside of the dilution tunnel shall be sufficient to prevent water condensation. However, the sample zone dilute exhaust temperature shall not exceed 125°F (52°C) at any time during the test.

(9) The particulate sample probe shall be:

(i) Installed facing upstream at a point where the dilution air and exhaust are well mixed (i.e., near the tunnel centerline, approximately 10 tunnel diameters downstream from the point where the exhaust enters the dilution tunnel).

(ii) Sufficiently distant (radially) from the THC probe so as to be free from the influence of any wakes or eddies produced by the THC probe.

(iii) 0.5 inch (1.27 cm) minimum inside diameter.

(iv) The distance from the sampling tip to the filter holder shall be at lest 5 probe diameters (for filters located inside of the tunnel), but not more than 40.0 inches (102 cm) for filters located outside of the dilution tunnel.

(v) Free from sharp bends.

(vi) Configured so that a clean particulate filter (including back up filter) can be selected simultaneously with the selection of an empty gaseous emissions bag.

(10) The flow rate through the particulate probe shall be maintained to a constant value within ±5 percent of the set flow rate.

(11) The particulate sample pump shall be located sufficiently distant from the dilution tunnel so that the inlet gas temperature is maintained at a constant temperature (±5.0°F (2.8°C)).

(12) The gas meters or flow instrumentation shall be located sufficiently distant from the tunnel so that the inlet gas temperature remains constant (±5.0°F (2.8°C)).

(13) The hydrocarbon probe shall be:

(i) Installed facing upstream at a point where the dilution air and exhaust are well mixed (i.e., approximately 10 tunnel diameters downstream from the point where the exhaust enters the dilution tunnel).

(ii) Sufficiently distant (radially) from the particulate probe so as to be free from the influence of any wakes of eddies produced by the particulate probe.

(iii) Heated and insulated over the entire length to maintain a ~~235°±15°F (113°±8°C)~~ wall temperature **above the maximum dew point of the sample, but below 250°F.**

(iv) 0.19 in. (0.48 cm) minimum inside diameter.

(14) It is intended that the THC probe be free from cold spots (i.e., free from cold spots where the probe wall temperature is less than ~~220°F~~ **the maximum dew point of the sample**.) This will be determined by a temperature sensor located on a section of the probe wall outside of the dilution tunnel. The temperature sensor shall be insulated from any heating elements on the probe. The sensor shall have an accuracy and precision of ±2°F (1.1°C).

(15) The dilute exhaust gas flowing in the hydrocarbon sample system shall be:

(i) At 235°F±15°F (113°C±8°C) immediately before the heated filter. This will be determined by a temperature sensor located immediately upstream of the filter. The sensor shall have an accuracy and precision of ±2°F (1.1°C).

(ii) At 235°±15°F (113°C±8°C) immediately before the HFID. This will be determined by a temperature sensor located at the exit of the heated sample line. The sensor shall have an accuracy and precision of ±2°F (1.1°C).

(16) It is intended that the dilute exhaust gas flowing in the hydrocarbon sample system between 220°F and 250°F (105°C and 121°C).

(17) For methanol-fueled vehicles, bag sampling procedures for the measurement of hydrocarbons as described in Section 86.109 may be employed.

* * * * *

Section 86.113-90 of Subpart B is proposed to be amended by revising paragraphs (d)(1)-(d)(2)(iii) and (d)(3) to read as follows:

§ 86.113-90 Fuel specifications

(d) Mixtures of petroleum and methanol fuels for flexible fuel vehicles.

(1) mixtures of petroleum and methanol fuels used for exhaust and evaporative emission testing and service accumulation for flexible fuel vehicles shall **consist of the petroleum fuel listed in either paragraph (a) or paragraph (b) of this section and a methanol fuel representative of the fuel expected to be found in use, as specified in paragraphs (a)(3) and (b)(4) of this section, and shall** be within the range of fuel mixtures for which the vehicle was designed, **as reported in §86.90-21 (g). The Administrator may use any fuel or fuel mixture within this range for testing.**

~~(2) Manufacturer testing and service accumulation_may be performed using only those mixtures (mixtures may_be different for exhaust testing, evaporative testing,_and service accumulation) expected to result in the_highest emissions, provided:~~

~~(i) The fuels which constitute the mixture will be_used in customer service, and~~

~~(ii) Information, acceptable to the Administrator,__is provided by the manufacturer to show that the_designated fuel mixtures would result in the highest_emissions, and~~

~~(iii) Written approval from the Administrator of the_fuel specifications must be provided prior to the start_of testing.~~

(2) The fuel mixtures used by the manufacturers shall be sufficient to demonstrate compliance over the full design range, and shall include:

(i) For emission testing,

(A) The petroleum fuel specified in paragraph (a) or (b),

(B) A methanol fuel representative of the methanol fuel expected to the found in use, as specified in paragraphs (a)(3) and (b)(4) of this section,

(C) A combination of the fuels specified in paragraphs (A) and (B) at a composition which represents the highest Reid Vapor Pressure of in-use mixtures. This mixture shall contain between nine and thirteen percent methanol by volume.

(ii) For service accumulation, the fuels specified in paragraphs (a)(2) and (d)(2)(i)(B) or, for diesel FFVs, paragraphs (b)(3) and (d)(2)(i)(B), shall be used alternately. The fuels

shall be alternated at mileage intervals not to exceed 5,000 **miles. The fuels shall be alternated such that the cumulative volumes** of **both the methanol fuel and the petroleum fuel used shall be at least twenty-five percent of the total fuel volume.**

(iii) **Or, other combinations which demonstrate compliance with the standards over the entire design range of the vehicle, provided that written approval is obtained from the Administrator prior to the start of testing.**

(3) The specification range of the fuels to be used under paragraph (d)~~(1)~~ of this section shall be reported in accordance with §86.090-21 (b)(3) **and (g)**.

Section 86.113-94 of Subpart B is proposed to be amended by revising paragraphs (d)(1)-(d)(2)(iii) and (d)(3) to read as follows:

§ 86.113-94 Fuel specifications

(d) Mixtures of petroleum and methanol fuels for flexible fuel vehicles.

(1) mixtures of petroleum and methanol fuels used for exhaust and evaporative emission testing and service accumulation for flexible fuel vehicles shall **consist of the petroleum fuel listed in either paragraph (a) or paragraph (b) of this section and a methanol fuel representative of the fuel expected to be found in use, as specified in paragraphs (a)(3) and (b)(4) of this section, and shall** be within the range of fuel mixtures for which the vehicle was designed, **as reported in §86.90-21 (g). The Administrator may use any fuel or fuel mixture within this range for testing.**

~~(2) Manufacturer testing and service accumulation_may be performed using only those mixtures (mixtures may_be different for exhaust testing, evaporative testing,_and service accumulation) expected to result in the_highest emissions, provided:~~

~~(i) The fuels which constitute the mixture will be_used in customer service, and~~

~~(ii) Information, acceptable to the Administrator,_is provided by the manufacturer to show that the_designated fuel mixtures would result in the highest_emissions, and~~

~~(iii) Written approval from the Administrator of the_fuel specifications must be provided prior to the start_of testing.~~

(2) The fuel mixtures used by the manufacturers shall be sufficient to demonstrate compliance over the full design range, and shall include:

(i) For emission testing,

(A) The petroleum fuel specified in paragraph (a) or (b),

(B) A methanol fuel representative of the methanol fuel expected to the found in use, as specified in paragraphs (a)(3) and (b)(4) of this section,

(C) A combination of the fuels specified in paragraphs (A) and (B) at a composition which represents the highest Reid Vapor Pressure of in-use mixtures. This mixture shall contain between nine and thirteen percent methanol by volume.

(ii) For service accumulation, the fuels specified in paragraphs (a)(2) and (d)(2)(i)(B) or, for diesel FFVs, paragraphs (b)(3) and (d)(2)(i)(B), shall be used alternately. The fuels

shall be alternated at mileage intervals not to exceed 5,000 miles. The fuels shall be alternated such that the cumulative volumes of both the methanol fuel and the petroleum fuel used shall be at least twenty-five percent of the total fuel volume.

(iii) **Or, other combinations which demonstrate compliance with the standards over the entire design range of the vehicle, provided that written approval is obtained from the Administrator prior to the start of testing.**

(3) The specification range of the fuels to be used under paragraph (d)~~(1)~~ of this section shall be reported in accordance with §86.090-21 (b)(3) **and (g)**.

DRAFT 8/25/92

Section 86.114-94 of Subpart B is proposed to be amended by revising paragraph (a)(5) to read as follows:

§86.114-94 Analytical gases.

(a) * * *

(5) Fuel for ~~the evaporative emission enclosure~~ FIDs **and HFIDs** and the methane analyzer shall be a blend of 40±2 percent hydrogen with the balance being helium. The mixture shall contain less than 1 ppm equivalent carbon response. 98 to 100 percent hydrogen fuel may be used with advance approval by the Administrator.

* * * * *

Section 86.116-90 of Subpart B is proposed to be amended by revising paragraph (c)(3) to read as follows:

§ 86.116-90 Calibrations, frequency and overview.

(c) * * *

(3) Perform ~~a hydrocarbon and methanol (if methanol fuel is used)~~ **an organic** retention and calibration on the evaporative emissions enclosure **(see paragraph (c) of §86.117)**.

* * * * *

DRAFT 8/25/92

Section 86.116-94 of Subpart B is proposed to be amended by revising paragraph (c)(3) to read as follows:

§ 86.116-94 Calibrations, frequency and overview.

(c) * * *

(3) Perform ~~a hydrocarbon and methanol (if methanol fuel is used)~~ **an organic** retention and calibration on the evaporative emissions enclosure **(see paragraph (c) of** §86.117).

* * * * *

Section 86.117-90 of Subpart B is proposed to be amended by revising paragraphs (c)(5), (c)(7), (c)(9), (d) - (d)(1)(xiv), and (d)(2)(iii) to read as follows:

§ 86.117-90 Evaporative emission enclosure calibrations

(c) *Hydrocarbon and methanol* ***(organic)*** *retention check and calibration.* The hydrocarbon and methanol (if the enclosure is used for methanol-fueled vehicles) retention check provides a check upon the calculated volume and also measures the leak rate. Prior to its introduction into service and at least monthly thereafter **(the methanol check can be performed less frequently, provided it is performed at least twice annually)** the enclosure leak rate shall be determined as follows:

* * * * *

(5) Inject into the enclosure a known quantity of pure propane (4g is a convenient quantity) and a known quantity of pure methanol (4g is a convenient quantity) in gaseous form; i.e., at a temperature of at least 150-155°F (65-68°C). The propane and methanol may be measured by volume flow or by mass measurement. The method used to measure the propane and methanol shall have an accuracy ~~and precision~~ of ±0.5 percent of the measured value **(less accurate methods may be used only with the advanced approval of the Administrator). The methanol and propane tests do not need to be conducted simultaneously.**

* * * * *

(7) To verify the enclosure calibration, calculate the mass of propane and the mass of methanol using the measurements taken in steps (4) and (6). See paragraph (d) of this section. This quantity must be within ±2 percent of that measured in step 5 above. **(For 1991-1995 calendar years, the difference may exceed ±2 percent for methanol, provided it does not exceed ±8 percent for 1991 testing and ±6 percent for 1992-1995 testing.)**

* * * * *

(9) Calculate, using the equations in paragraph (d) of this section and the readings taken in step (8), the hydrocarbon and methanol mass. It may not differ by more than ±4 percent of the value in step (6). **(For 1991-1995 calendar years, the difference may exceed ±4 percent for methanol, provided it does not exceed ±8 percent for 1991 testing and ±6 percent for 1992-1995 testing. If these wider tolerances are used, then all subsequent data shall be corrected by multiplying by the inverse of the fractional retention, or by one if the measured recovery exceeds 100 percent. The retention used for this correction can be estimated by subtracting from one the loss indicated by the calibration test multiplied by the ratio of the emission test length to the calibration test length.)**

* * * * *

(d) <u>Calculations</u>. (1) The calculation of net methanol and hydrocarbon mass change is used to determine enclosure background and leak rate. It is also used to check the enclosure volume measurements. The methanol mass change is calculated from the initial and final methanol samples, temperature and pressure according to the following equation:

$$M_{CH_3OH} = \frac{V \times \cancel{C}_{\cancel{MR}}}{\cancel{A}_{\cancel{MR}}} \times$$

$$\frac{T_{Ef}}{V_{Ef} \times T_{SHEDf}} (\overset{\mathbf{C}}{\cancel{A}}_{MS1i} \times AV_{1f}) + (\overset{\mathbf{C}}{\cancel{A}}_{MS2f} \times AV_{2f}) -$$

$$\frac{T_{Ei}}{V_{Ei} \times T_{SHEDi}} (\overset{\mathbf{C}}{\cancel{A}}_{MS1i} \times AV_{1i}) + (\cancel{A}_{MS2i} \times AV_{2i})$$

Where:

(i) M_{CH3OH} = Methanol mass change, µg.

(ii) V = Enclosure volume, ft^3, as measured in paragraph (b)(1) of this section.

~~(iii) C_{MR} = Concentration of methanol in standard sample for calibration of GC, /m/g/ml.~~

~~(iv) A_{MR} = GC peak area of standard sample.~~

(iii) ~~(v)~~ T_E = Temperature of sample withdrawn, °R.

(iv) ~~(iv)~~ T_{SHED} = Temperature of SHED, °R.

(v) ~~(vii)~~ V_E = Volume of sample withdrawn, ft^3.

(vi~~ii~~) P_B = Barometric pressure at time of sampling, in. Hg.

(vii) ~~(ix)~~ ~~A~~**C**$_{MS}$ = GC ~~peak area~~ **concentration** of test sample.

(viii) ~~(x)~~ **AV = Volume of absorbing reagent in impinger (ml).**

(ix~~i~~) i = Initial sample.

(x~~ii~~) f = Final sample.

(xii~~i~~) 1 = First impinger.

(xi~~v~~**ii**) 2 = Second impinger.

* * * * *

(2) * * *

(iii) C_{CH3OH} = Methanol concentration as ppm carbon

DRAFT 8/25/92

$$= \frac{1.501 \times 10^{-3} \cancel{C}_{\cancel{MR}} \times T_E}{\cancel{A}_{\cancel{MR}} \cancel{\times} P_B \times V_E} \left[(\overset{C}{\cancel{A}}_{S1} \times AV_1) + (\overset{C}{\cancel{A}}_2 \times AV_2) \right]$$

* * * * *

DRAFT 8/25/92

Section 86.119-90 of Subpart B is proposed to be amended by revising paragraph (c)(1), (c)(4), and (c)(7) to read as follows:

§86.119-90 CVS calibration.

(c) * * *

(1) Obtain a small cylinder that has been charged with pure propane or carbon monoxide gas (CAUTION - carbon monoxide is poisonous). ~~Obtain another small cylinder which has been charged with pure methanol if the system is to be used for methanol fueled vehicle testing. Since this cylinder will be heated to 150-155°F, care must be taken to ensure that the liquid volume of methanol placed in the cylinder does not exceed approximately one-half of the total volume of the cylinder.~~

* * * * *

(4) Following completion of step (3) above **(if methanol injection is required)**, continue to operate the CVS in the normal manner and release a **known** quantity of pure methanol **(in gaseous form)** into the system during the sampling period (approximately 5 minutes). **This step does not need to be performed with each verification, provided that it is performed at least twice annually**.

* * * * *

(7) The cause for any discrepancy greater than ±2 percent must be found and corrected. **(For 1991-1995 calendar years, discrepancies greater than ±2 percent are allowed for the methanol test, provided that they do not exceed ±8 percent for 1991 testing or ±6 percent for 1992-1995 testing.)**

DRAFT 8/25/92

Section 86.121-90 of Subpart B is proposed to be amended by revising paragraph (c)(1) and Figure B90-11 to read as follows:

§ 86.121-90 Hydrocarbon analyzer calibration.

* * * * *

(c) * * *

(1) The bag sample of methanol for analysis in the FID shall be prepared using the apparatus shown in Figure B90-11. A known volume of methanol is injected, using a microliter syringe, into the heated mixing zone (250°F (121°C) of the apparatus. The methanol is vaporized and swept into the sample bag with a known volume of zero grade air measured by a ~~dry~~ gas **flow** meter **with an accuracy of ±2 percent**.

* * * * *

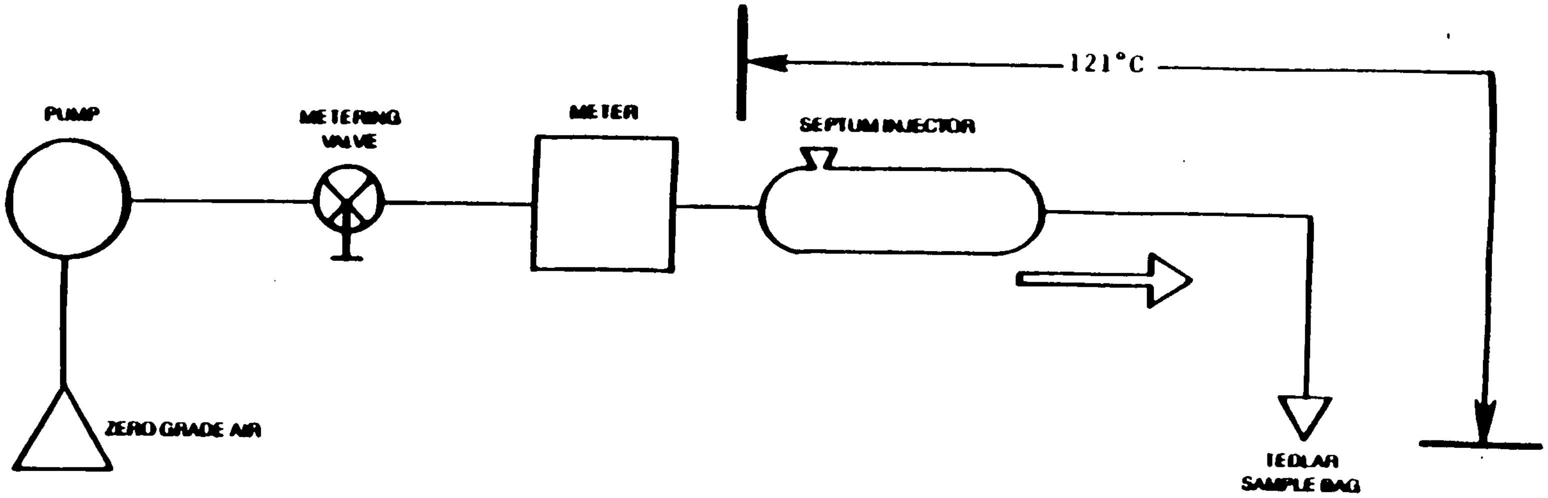


FIGURE B91-11 APPARATUS FOR PREPARATION OF FID METHANOL RESPONSE CALIBRATION MIX

DRAFT 8/25/92

Section 86.123-78 of Subpart B is proposed to be amended by adding paragraph (c) to read as follows:

§ 86.123-78 Oxides of nitrogen analyzer calibration.

(c) **When testing methanol-fueled vehicles, it may be necessary to clean the analyzer frequently to prevent interference with NOx measurements. (See EPA/600/S3-88/040.)**

Section 86.137-90 of Subpart B is proposed to be amended by revising paragraph (b)(6)(iii), (b)(6)(iv), (b)(15), and (b)(20) to read as follows:

§ 86.137-90 Dynamometer test run, gaseous and particulate emissions.

(b) * * *

(6) * * *

~~(iii) For methanol samples, the minimum flow rate is_0.14 cfm (0.067 l/sec).~~

~~(iv) For formaldehyde samples, the minimum flow rate_is 0.036 cfm (0.017 l/sec) with capsule collector and_0.14 cfm (0.067 l/s) with impinger~~

(iii) **For methanol samples, the flow rates shall be set such that the system meets the design criteria of §86.109 and §86.110. For samples in which the concentration in the primary impinger exceeds 0.5 mg/l, it is recommended that the mass of methanol collected in the secondary impinger not exceed ten percent of the total mass collected. For samples in which the concentration in the primary impinger does not exceed 0.5 mg/l, analysis of the secondary impingers is not necessary.**

(iv) **For formaldehyde samples, the flow rates shall be set such that the system meets the design criteria of §86.109 and §86.110. For impinger samples in which the concentration of formaldehyde in the primary impinger exceeds 0.1 mg/l, it is recommended that the mass of formaldehyde collected in the secondary impinger not exceed ten percent of the total mass collected. For samples in which the concentration in the primary impinger does not exceed 0.1 mg/l, analysis of the secondary impingers is not necessary.**

* * * *

(15) Five seconds after the engine stop running, simultaneously turn off gas flow measuring device No. 2 and if applicable, turn off the petroleum-fueled diesel hydrocarbon integrator No. 2, mark the hydrocarbon recorder chart, turn off the No. 2 particulate sample pump and close the valves isolating particulate filter No. 2, and position the sample selector valves to the "standby" position (and open the valves isolating particulate filter No.1, if applicable). Record the measured roll or shaft revolutions (both gas meter of flow measurement instrumentation readings), and re-set the counter. As soon as possible, transfer the "stabilized" exhaust and dilution air samples to the analytical system and process the samples according to §86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain methanol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the

sample period. **(If it is not possible to perform analysis on the methanol and formaldehyde samples within 24 hours, the samples should be stored in a dark cold (4-10°C) environment until analysis. The samples should be analyzed within fourteen days.).** If applicable, carefully remove both pairs of particulate sample filters from their respective holders, and place each in a separate petri dish, and cover.

* * * * *

(20) As soon as possible, transfer the hot start "transient" exhaust and dilution air samples to the analytical system and process the samples according to §86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain methanol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period (if it is not possible to perform analysis on the methanol and formaldehyde samples, within 24 hours, the samples should be stored in a dark cold (**4-10**°C) environment until analysis **The samples should be analyzed within fourteen days.).**

Section 86.137-94 of Subpart B is proposed to be amended by revising paragraph (b)(6)(iii), (b)(6)(iv), (b)(15), and (b)(20) to read as follows:

§ 86.137-94 Dynamometer test run, gaseous and particulate emissions.

(b) * * *

(6) * * *

~~(iii) For methanol samples, the minimum flow rate is 0.14 cfm (0.067 l/sec).~~

~~(iv) For formaldehyde samples, the minimum flow rate is 0.036 cfm (0.017 l/sec) with capsule collector and 0.14 cfm (0.067 l/s) with impinger~~

(iii) For methanol samples, the flow rates shall be set such that the system meets the design criteria of §86.109 and §86.110. For samples in which the concentration in the primary impinger exceeds 0.5 mg/l, it is recommended that the mass of methanol collected in the secondary impinger not exceed ten percent of the total mass collected. For samples in which the concentration in the primary impinger does not exceed 0.5 mg/l, analysis of the secondary impingers is not necessary.

(iv) For formaldehyde samples, the flow rates shall be set such that the system meets the design criteria of §86.109 and §86.110. For impinger samples in which the concentration of formaldehyde in the primary impinger exceeds 0.1 mg/l, it is recommended that the mass of formaldehyde collected in the secondary impinger not exceed ten percent of the total mass collected. For samples in which the concentration in the primary impinger does not exceed 0.1 mg/l, analysis of the secondary impingers is not necessary.

* * * *

(15) Five seconds after the engine stop running, simultaneously turn off gas flow measuring device No. 2 and if applicable, turn off the hydrocarbon integrator No. 2, mark the hydrocarbon recorder chart, turn off the No. 2 particulate sample pump and close the valves isolating particulate filter No. 2, and position the sample selector valves to the "standby" position (and open the valves isolating particulate filter No.1, if applicable). Record the measured roll or shaft revolutions (both gas meter of flow measurement instrumentation readings), and re-set the counter. As soon as possible, transfer the "stabilized" exhaust and dilution air samples to the analytical system and process the samples according to §86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain methanol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period. **(If it is not possible to perform**

analysis on the methanol and formaldehyde samples within 24 hours, the samples should be stored in a dark cold (4-10°C) environment until analysis. The samples should be analyzed within fourteen days.). If applicable, carefully remove both pairs of particulate sample filters from their respective holders, and place each in a separate petri dish, and cover.

*   *   *   *   *

(20) As soon as possible, transfer the hot start "transient" exhaust and dilution air samples to the analytical system and process the samples according to §86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain methanol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period (if it is not possible to perform analysis on the methanol and formaldehyde samples, within 24 hours, the samples should be stored in a dark cold (**4-10**°C) environment until analysis **The samples should be analyzed within fourteen days**.).

Section 86.140-90 of Subpart B is amended by revising paragraphs (c) and (d), and deleting paragraphs (c)(1), (c)(2), (d)(1), and (d)(2) to read as follows:

§86.140-90 Exhaust sample analysis.

(c) For CH_3OH (methanol-fueled vehicles)~~:~~

~~(1) Introduce a reference sample of methanol (the concentration of methanol in deionized water is known and is~~ ~~C_{MR}~~ ~~in the calculations) into the gas chromatograph and measure the area of the response peak. This reference sample peak area is~~ ~~A_{MR}~~ ~~in the calculations.~~

~~(2) I~~, introduce test samples into the gas chromatograph and measure the ~~area of the response peak~~ **concentration**. This ~~peak area~~ **concentration** is ~~A~~C_{MS} in the calculations.

(d) For HCHO (methanol-fueled vehicles)~~:~~

~~(1) Introduce a reference sample of formaldehyde (the concentration of formaldehyde as a dinitrophenylhydrazine derivative in acetonitrile is known (~~~~C_{FR}~~~~)) into the high pressure liquid chromatograph (HPLC) and measure the area of the response peak. This reference sample peak area is~~ ~~A_{FR}~~ ~~in the calculations.~~

~~(2) I~~, introduce **formaldehyde** test samples into the high pressure liquid chromatograph and measure the **concentration of formaldehyde as a dinitrophenylhydrazine derivative in acetonitrile** ~~area of the responses peak~~. This ~~peak area~~ **concentration** is ~~A~~C_{FS} in the calculations.

DRAFT 8/25/92

Section 86.140-94 of Subpart B is amended by revising paragraphs (c) and (d), and deleting paragraphs (c)(1), (c)(2), (d)(1), and (d)(2) to read as follows:

§86.140-94 Exhaust sample analysis.

(c) For CH_3OH (methanol-fueled vehicles)~~:~~

~~(1) Introduce a reference sample of methanol (the concentration of methanol in deionized water is known_and is C_{MR} in the calculations) into the gas_chromatograph and measure the area of the response_peak. This reference sample peak area is A_{MR} in the calculations.~~

~~(2) I~~, introduce test samples into the gas chromatograph and measure the ~~area of the response peak~~ **concentration**. This ~~peak area~~ **concentration** is ~~A~~C_{MS} in the calculations.

(d) For HCHO (methanol-fueled vehicles)~~:~~

~~(1) Introduce a reference sample of formaldehyde__(the concentration of formaldehyde as a__dinitrophenylhydrazine derivative in acetonitrile is_known (C_{FR})) into the high pressure liquid_chromatograph (HPLC) and measure the area of the_response peak. This reference sample peak area is A_{FR}_in the calculations.~~

~~(2) I~~, introduce **formaldehyde** test samples into the high pressure liquid chromatograph and measure the **concentration of formaldehyde as a dinitrophenylhydrazine derivative in acetonitrile** ~~area of the responses peak~~. This ~~peak area~~ **concentration** is ~~A~~C_{FS} in the calculations.

* * * * *

DRAFT 8/25/92

Section 86.142-90 of Subpart B is proposed to be amended by revising paragraph (r)(1) - (r)(6), and adding (r)(7), to read as follows:

§ 86.142-90 Records required.

(r) * * *

(1) Specification of the methanol-fuel **or methanol-fuel mixtures** used during the test.

(2) Volume of sample passed through the methanol sampling system and the volume of deionized water in each impinger.

(3) ~~The methanol concentration in the reference_sample and the peak area from the GC analysis of the_reference sample.~~

~~(4)~~ The ~~peak area~~ **concentration** of the GC analyses of the test samples (methanol).

~~(5)~~ **(4)** Volume of sample passed through the formaldehyde sampling system.

~~(6) The formaldehyde concentration in the_reference sample and the peak area from the HPLC_analysis of the reference sample.~~

~~(7)~~ **(5)** The ~~peak area~~ **concentration** of the HPLC analysis of the test sample (formaldehyde).

~~(8)~~ **(6)** The temperatures of the sample lines before the HFID and the impinger, **the temperature of the exhaust transfer duct (as applicable)**, and the temperature of the control system of the heated hydrocarbon detector.

(7) A continuous measurement of the dew point of the raw and diluted exhaust, or engineering analysis demonstrating that the temperature of the heated systems remains above the maximum dew point of the gas stream throughout the course of the test. This requirement may be omitted if the temperatures of all heated lines are kept above 220°F.

Section 86.143-90 or Subpart B is proposed to be amended by revising paragraph (a)(1) - (a)(1)(xiv) and (a)(2)(iii), to read as follows:

§86.143-90 Calculations; evaporative emissions.

(a) * * *

(1) For methanol:

$$M_{CH_3OH} = \frac{V_n \times \cancel{C_{MR}}}{\cancel{A_{MR}}} \times$$

$$\frac{T_{Ef}}{(V_{Ef} \times T_{SHEDf})} \times [(\overset{C}{\cancel{A}}_{MS1f} \times AV_{1f}) + (\overset{C}{\cancel{A}}_{MS2f} \times AV_{2f})] -$$

$$\frac{T_{Ei}}{(V_{Ei} \times T_{SHEDi})} \times [(\overset{C}{\cancel{A}}_{MS1i} \times AV_{1i}) + (\overset{C}{\cancel{A}}_{MS2i} \times AV_{2i})]$$

Where:

(i) M_{CH3OH} = Methanol mass change, µg.

(ii) V_n = Net enclosure volume, ft^3, as determined by subtracting 50 ft^3 (1.42 m^3) (volume of vehicle with trunk and windows open) from the enclosure volume. A manufacturer may use the measured volume of the vehicle (instead of the nominal 50 ft^3) with advance approval by the Administrator: Provided, the measured volume is determined and used for all vehicles tested by that manufacturer.

(iii) ~~C_{MR} = Concentration of methanol in standard_sample for calibration of GC, m g/ml.~~

~~(iv)~~ ~~A_{MR} = GC peak area of standard sample.~~

~~(v)~~ T_E = Temperature of sample withdrawn, °R.

(iv~~i~~) V_E = Volume of sample withdrawn, ft^3.

(v~~ii~~) T_{SHED} = Temperature of SHED, °R

(vi~~ii~~) ~~A~~C_{MS} = GC ~~peak area~~ **concentration** of sample, **µg/ml**.

(~~ix~~**vii**) AV = Volume of absorbing reagent in impinger.

(~~x~~**viii**) P_B = Barometric pressure at time of sampling, in. Hg.

(**ix**~~i~~) i = Initial sample.

(x~~ii~~) f = Final sample.

(xi~~ii~~) 1 = First impinger.

(xi~~v~~**i**) 2 = Second impinger.

(2) * * *

(iii) C_{CH3OH} = Methanol concentration as ppm carbon.

$$= \frac{1.501 \times 10^{-3} \cancel{C}_{\cancel{MR}} \times T}{\cancel{A}_{\cancel{MR}} \times P_B \times V_E} \times [(\overset{C}{\cancel{A}}_{S1} \times AV_1) + (\overset{C}{\cancel{A}}_{S2} \times AV_2)]$$

* * * * *

DRAFT 8/25/92

Section 86.144-90 of Subpart B is proposed to be amended by revising paragraphs (c)(5)(iv)(A) - (c)(5)(xiv), (c)(7)(ii) and (e) - (e)(1)(viii), to read as follows:

§86.144-90 Calculations; exhaust emissions.

(c) * * *

(5) * * *

(iv)(A) C_{CH3OHe} = Methanol concentration in the dilute exhaust, ppm.

(B) C_{CH3OHe} =

$$\frac{3.813 \times 10^{-2} \cancel{\times C}_{\cancel{CH3OHR}} \times T_{EM}\,[(\overset{C}{\cancel{A}}_{S1} \times AV_{S1}) + (\overset{C}{\cancel{A}}_{S2} \times AV_{S2})]}{\cancel{A}_{\cancel{CH3OHR}} \cancel{\times} P_{B} \times V_{EM}}$$

(v)(A) C_{CH3OHd} = Methanol concentration in the dilution air, ppm.

(B) C_{CH3OHd} =

$$\frac{3.813 \times 10^{-2} \cancel{\times C}_{\cancel{CH3OHR}} \times T_{DM}\,[(\overset{C}{\cancel{A}}_{D1} \times AV_{D1}) + (\overset{C}{\cancel{A}}_{D2} \times AV_{D2})]}{\cancel{A}_{\cancel{CH3OHR}} \cancel{\times} P_{B} \times V_{DM}}$$

(vi) ~~C_{CH3OHR} = Concentration of methanol in_standard sample for calibration of GC, mg/ml.~~

~~(vii) A_{CH3OHR} = GC peak area of standard sample.~~

~~(viii)~~ T_{EM} = Temperature of methanol sample withdrawn from dilute exhaust, °R.

(~~ix~~**vii**) T_{DM} = Temperature of methanol sample withdrawn from dilution air, °R.

(~~x~~**viii**) P_B = Barometric pressure during test, mm Hg.

(**ix**~~i~~) V_{EM} = Volume of methanol sample withdrawn from dilute exhaust, ft^3.

(x~~ii~~) V_{DM} = Volume of methanol sample withdrawn from dilution air, ft^3.

(**xi**~~ii~~) ~~**A**~~**C**$_S$ = GC ~~peak area~~ **concentration** of sample drawn from dilute exhaust, **µg/ml**.

(xi~~v~~i) **C**~~**A**~~$_D$ = GC ~~peak area~~ **concentration** of sample drawn from dilution air, **µg/ml**.

* * * * *

(7) * * *

(ii)
$$DF = \frac{(100)\left|\dfrac{x}{x + y/2 + 3.76(x + y/2 - z/2)}\right|}{CO_{2e} + (HC_e + CO_e + CH_3OH_e + \mathbf{HCHO_e})}$$

for methanol-fueled vehicles, where fuel composition is $C_xH_yO_z$ as measured, **or calculated**, for the fuel used.

* * * * *

DRAFT 8/25/92

(e) For methanol-fueled vehicle with measured fuel composition of $CH_{3.14}O_{0.6}$ example calculation of exhaust emissions using positive displacement pump:

(1) For the "transient" phase of the cold start test assume the following:

V_o = 0.29344 ft^3/rev; N = 10,485; R = 48.0 pct; R_a = 48.2 percent; P_B = 762 mm Hg; P_d = 22.225 mm Hg; P_4 = 70 mm Hg; T_p = 570°R; FID HC_e = 81.6 ppm, carbon equivalent; r = 0.75; ~~C_{CH3OHR} = 71 ug/ml;~~ T_{EM} = 567°R; ~~A_{CH3OHR} = 3660;~~ V_{EM} 1.18 ft^3; ~~A~~C_{S1} = ~~4460~~ **180μg/ml**; AV_{s1} = 25.2 ml; ~~A~~C_{s2} = ~~360~~ **10μg/ml**; AV_{s2} = 24.9 ml; T_{DM} = 532°R; V_{DM} = 1.17 ft^3; ~~A~~C_{D1} = ~~110~~**15 μg/ml**; AV_{D1} = 25.0 ml; ~~A~~C_{D2} = ~~10~~ **1μg/ml**; AV_{D2} = 25.1 ml; C_{FDE} = 20 ug/ml; V_{AE} = 5.0 ml; Q = 0.1429; T_{EF} = 569°R; V_{SE} = 0.30 ft^3; C_{FDA} = 1 ug/ml; V_{AA} = 5.0 ml; T_{DF} = 532°R; V_{SA} = 0.31 ft^3; NOx_e = 11.2 ppm; CO_{em} = 306.6 ppm; CO_{2e} = 1.43 pct; FID HC_d = 12.1 ppm; NOx_d = 0.8 ppm; CO_{dm} = 15.3 ppm; CO_{2d} = 0.032 percent; D_{ct} = 3.598 miles.

Then:

* * * * *

$$\text{(vi) } C_{CH3OHe} = \frac{(3.813\times10^{-2})\cancel{(71)}(567)[(\cancel{4460}\mathbf{180})(25.2)+(\cancel{360}\mathbf{10})(24.9)]}{\cancel{(3660)}(762)(1.18)}$$

$$= \cancel{56.60}\ \mathbf{115.05\ ppm.}$$

$$\text{(vii) } DF = \frac{100(1/[1+(3.14/2)+3.76(1+(3.14/4)-(0.6/2))])}{1.43+10^{-4}[(81.6+291.9+(1-0.75)(\cancel{56.60}\mathbf{115.05})]}$$

$$= 8.3\cancel{50}\mathbf{42}$$

$$\text{(viii) } C_{CH3OHd} = \frac{(3.813\times10^{-2})\cancel{(71)})(532)[(\cancel{110}\mathbf{15})(25.0)+(10)(25.1)]}{\cancel{(3660)}(762)(1.17)}$$

$$= \cancel{1.32}\ \mathbf{9.10\ ppm.}$$

* * * * *

DRAFT 8/25/92

Section 86.509-90 of Subpart F is proposed to be amended by revising paragraphs (a)(2), (a)(3), (a)(4), (a)(5), (b), (b)(4), (b)(5), (c), (c)(4) and (c)(5), and adding paragraphs (a)(6), (b)(4)(i) - (b)(4)(iii), (c)(4)(i) - (c)(4)(iii), (b)(6)(i) - (b)(6)(iii), (c)(6)(i) - (c)(6)(iii) and (d) to read as follows:

§ 86.509-90 Exhaust gas sampling system.

(a) * * *

(2) * * *

(i) Using a duct of unrestricted length maintained at ~~113°±8°C (235°±15°F)~~ **a temperature above the maximum dew point of the exhaust, but below 121°C (250°F)**; heating and possibly cooling capabilities are required, or

(ii) Using a short duct (up to 12 feet long) constructed of smooth wall pipe with a minimum of flexible sections, maintained at ~~113°±8°C (235°±15°F)~~ **a temperature above the maximum dew point of the exhaust, but below 121°C (250°F)**, prior to the test and during any breaks in the test and uninsulated during the test (insulation may remain in place and/or heating may occur during testing provided maximum temperature is not exceeded); or

(iii) Using smooth wall duct less than five feet long with no required heating. **A minimum number of short flexible connectors are allowed under this option.**

(iv) Omitting the duct and performing the exhaust gas dilution function at the motorcycle tailpipe exit.

(3) Positive displacement pump. The Positive Displacement Pump-Constant Volume Sampler (PDP - CVS), Figure F90 - 1 satisfies the first condition by metering at a constant temperature and pressure through the pump. The total volume is measured by counting the revolutions made by the calibrated positive displacement pump. The proportional samples are achieved by sampling at a constant flow rate. For methanol-fueled motorcycle sample lines for the methanol and formaldehyde samples are heated to ~~121°±8°C (235°±15°F)~~ **prevent condensation. The sample line temperature shall be above the maximum dew point of the sample, but below 121°C (250°F)**.

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.

(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 ~~121°±8°C (235±15°F)~~ **prevent condensation. The sample line temperature shall be 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) <u>Electronic Flow Control</u> **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), 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 methanol-fueled motorcycles, the samples lines for the methanol and formaldehyde samples are heated to prevent condensation. The sample line temperature shall be 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 methanol-fueled motorcycles, are heated to ~~121°±8°C (235°±15°F)~~ **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 test-cell 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. 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 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 monoxide) 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.

(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 ten percent (on a mass basis) of the maximum allowable level for methanol (or the maximum formaldehyde level allowed by a specific formaldehyde standard, whichever is less), the concentration of formadehyde 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.

(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 ~~121°±8°C (235°±15°F)~~ **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 test-cell 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. 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 250oF.

(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 monoxide) 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 CVS.

(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 ten percent (on a mass basis) of the maximum allowable level for methanol (or the maximum formaldehyde level allowed by a specific formaldehyde standard, whichever is less), the concentration of formadehyde 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.

(d) Component description, CFV-EFC-CVS.

The CVS sample system is identical to the system described in paragraph (c), plus includes a means of electronically measuring the CVS flow rate, and electronic mass flow controllers for the methanol and formaldehyde sample lines, and separate flow meters to totalize sample flow volumes. The EFC sample system shall conform to all of the requirements listed in paragraph (c), except that the methanol and formaldehyde samples mat both be drawn from a single static probe. It also must comply with the following additional requirements:

(1) The ratio of the CVS flow rate to the sample flow rate shall not deviate from the ratio at the start of the test by more than ±5 percent.

(2) Flow totalizers for methanol and/or formaldehyde samples shall have an accuracy of ±2 percent. Total sample volumes may be obtained from the flow controllers, with the advance approval of the administrator, provided that the controllers can be shown to have an accuracy of no greater than ±2 percent.

DRAFT 8/25/92

Section 86.513-90 of Subpart B is proposed to be amended by revising paragraph (h) to read as follows:

§ 86.513-90 Fuel and engine lubricant specifications.

(h) Mixtures of petroleum and methanol fuels for flexible fuel motorcycles.

(1) mixtures of petroleum and methanol fuels used for exhaust and evaporative emission testing and service accumulation for flexible fuel motorcycles shall **consist of the petroleum fuel listed in either paragraph (a) or paragraph (b) of this section and the methanol fuel listed in paragraph (c), and shall** be within the range of fuel mixtures for which the vehicle was designed, **as reported in §86.90-21 (g). The Administrator may use any fuel or fuel mixture within this range for testing.**

~~(2) Manufacturer testing and service accumulation may be performed using only those mixtures (mixtures may be different for exhaust testing, evaporative testing, and service accumulation) expected to result in the highest emissions, provided:~~

~~(i) The fuels which constitute the mixture will be used in customer service, and~~

~~(ii) Information, acceptable to the Administrator, is provided by the manufacturer to show that the designated fuel mixtures would result in the highest emissions, and~~

~~(iii) Written approval from the Administrator of the fuel specifications must be provided prior to the start of testing.~~

(2) The fuel mixtures used by the manufacturers shall be sufficient to demonstrate compliance over the full design range, and shall include:

(i) For emission testing,

(A) The petroleum fuel specified in paragraph (a) or (b),

(B) A methanol fuel representative of the methanol fuel expected to the found in use, as specified in pargraph (c),

(ii) For service accumulation, an alternating combination of the fuels specified in paragraphs (b)(2) and (h)(2)(i)(B) will be used to demonstrate the durability of the emission control systems based on good engineering judgement. The combination shall be selected such that the cumulative volumes of both the methanol fuel and the petroleum fuel used shall be at least twenty-five percent of the total fuel volume. The fuels shall be alternated at mileage intervals not to exceed 1,000 kilometers.

(3) The specification range of the fuels to be used under paragraph (h)~~(1)~~ of this section shall be reported in accordance with §86.090-21 (b)(3) **and (g).**

DRAFT 8/25/92

Section 86.537-90 of Subpart B is proposed to be amended by revising paragraph (b)(6)(iii), (b)(6)(iv), (b)(12), and (b)(14) to read as follows:

§ 86.537-90 Dynamometer test runs.

(b) * * *

(6) * * *

~~(iii) For methanol samples, the minimum flow rate is 0.14 cfm (0.067 l/sec).~~

~~(iv) For formaldehyde samples, the minimum flow rate is 0.036 cfm (0.017 l/sec) with capsule collector and 0.14 cfm (0.067 l/s) with impinger~~

(iii) For methanol samples, the flow rates shall be set such that the system meets the design criteria of §86.509. For samples in which the concentration in the primary impinger exceeds 0.5 mg/l, it is recommended that the mass of methanol collected in the secondary impinger not exceed ten percent of the total mass collected. For samples in which the concentration in the primary impinger does not exceed 0.5 mg/l, secondary impingers do not need to be analyzed.

(iv) For formaldehyde samples, the flow rates shall be set such that the system meets the design criteria of §86.509. For impinger samples in which the concentration of formaldehyde in the primary impinger exceeds 0.1 mg/l, it is recommended that the mass of formaldehyde collected in the secondary impinger not exceed ten percent of the total mass collected. For samples in which the concentration in the primary impinger does not exceed 0.1 mg/l, secondary impingers do not need to be analyzed.

* * * * *

(12) At the end of the deceleration which is scheduled to occur at 505 seconds, simultaneously switch the sample flows from the "transient" bags and samples to "stabilized" bags and samples, switch off gas flow measuring device No. 1 and, start gas flow measuring device No. 2. Before the acceleration which is scheduled to occur at 510 seconds, record the measured roll or shaft revolutions and reset the counter or switch to a second counter. As soon as possible, transfer the "stabilized" exhaust and dilution air samples to the analytical system and process the samples according to §86.540, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain methanol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period. **(If it is not possible to perform analysis on the methanol and formaldehyde samples within 24 hours, the samples should be stored in a dark cold (4-10°C) environment until analysis. The samples should be analyzed within fourteen days.)**

* * * * *

(14) Five seconds after the engine stop running, simultaneously turn off gas flow measuring device No. 2 and position the sample selector valves to the "standby" position (and open the valves isolating particulate filter No.1, if applicable). Record the measured roll or shaft revolutions (both gas meter of flow measurement instrumentation readings), and re-set the counter. As soon as possible, transfer the "stabilized" exhaust and dilution air samples to the analytical system and process the samples according to §86.540, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain methanol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period. **(If it is not possible to perform analysis on the methanol and formaldehyde samples within 24 hours, the samples should be stored in a dark cold (4-10°C) environment until analysis. The samples should be analyzed within fourteen days.)**

* * * * *

DRAFT 8/25/92

Section 86.540-90 of Subpart F is proposed to be amended by revising paragraph (b) - (b)(2) and (c) - (c)(2), to read as follows:

§86.540-90 Exhaust sample analysis.

(b) For CH_3OH (methanol-fueled vehicles)~~:~~,

~~(1) Introduce a reference sample of methanol (the concentration of methanol in deionized water is known, and is C_{MR} in the calculations) into the gas chromatograph and measure the area of the response peak. This reference sample peak area is A_{MR} in the calculations~~.

~~(2)~~ ~~I~~introduce test samples into the gas chromatograph and measure the **concentration** ~~area of the response peak.~~ This **concentration** ~~peak area~~ is ~~A~~C_{MS} in the calculations.

(c) For HCHO (methanol-fueled vehicles)~~:~~,

~~(1) Introduce a reference sample of formaldehyde (the concentration of formaldehyde as a dinitrophenylhydrazine derivative in acetonitrile (C_{FR}) is known) into the high pressure liquid chromatograph and measure the area of the response peak. This reference sample peak area is A_{FR} in the calculations.~~

~~(2)~~ ~~I~~introduce test samples into the high pressure liquid chromatograph and measure the ~~area of the responses peak.~~**concentration of formaldehyde as a dinitropheylhydrazine derivative in acetonitrile**. **This concentration** ~~peak area~~ is ~~A~~C_{FS} in the calculations.

Section 86.542-90 of Subpart F is proposed to be amended by revising paragraph (p), to read as follows:

§86.542-90 Records required.

(p) Additional required records for methanol-fueled vehicles:

(1) Specification of the methanol fuel, **or fuel mixtures**, used during testing.

(2) Volume of sample passed through the methanol sampling system and the volume of deionized water in each impinger.

(3) The methanol **calibration information** ~~concentration in the reference sample and the peak area~~ from the GC **standards** ~~analysis of the reference sample.~~

(4) The **concentration** ~~peak area~~ of the GC analyses of the test samples (methanol).

(5) Volume of sample passed through the formaldehyde sampling system.

(6) The formaldehyde **calibration information** ~~concentration in the reference sample and the peak area~~ from the HPLC **standards** ~~analysis of the reference sample.~~

(7) The **concentration** ~~peak area~~ of the HPLC analysis of the test sample (formaldehyde).

DRAFT 8/25/92

Section 86.544-90 of Subpart F is proposed to be amended by revising paragraphs (c)(5), (c)(7) and (e)(1), to read as follows:

§86.544-90 Calculations; exhaust emissions.

(c) * * *

(5) * * *

(iv)(A) C_{CH3OHe} = Methanol concentration in the dilute exhaust, ppm.

(B) C_{CH3OHe} =

$$\frac{3.813 \times 10^{-2} \cancel{\times C_{CH3OHR}} \times T_{EM} [(\overset{C}{\cancel{A}}_{S1} \times AV_{S1}) + (\overset{C}{\cancel{A}}_{S2} \times AV_{S2})]}{\cancel{A_{CH3OHR} \times} P_B \times V_{EM}}$$

(v)(A) C_{CH3OHd} = Methanol concentration in the dilution air, ppm.

(B) C_{CH3OHd} =

$$\frac{3.813 \times 10^{-2} \cancel{\times C_{CH3OHR}} \times T_{DM} [(C\cancel{A}_{D1} \times AV_{D1}) + (C\cancel{A}_{D2} \times AV_{D2})]}{\cancel{A_{CH3OHR}} \times P_B \times V_{DM}}$$

(vi) ~~C_{CH3OHR} = Concentration of methanol in_standard sample for calibration of GC, /m/g/ml.~~

~~(vii)~~ ~~A_{CH3OHR} = GC peak area of standard sample.~~

~~(viii)~~ T_{EM} = Temperature of methanol sample withdrawn from dilute exhaust, °R.

~~(ix)~~(vii) T_{DM} = Temperature of methanol sample withdrawn from dilution air, °R.

~~(x)~~(viii) P_B = Barometric pressure during test, mm Hg.

~~(xi)~~(ix) V_{EM} = Volume of methanol sample withdrawn from dilute exhaust, ft^3.

(x~~ii~~) V_{DM} = Volume of methanol sample withdrawn from dilution air, ft^3.

(xi~~ii~~) **CA_s** = GC ~~peak area~~ **concentration** of sample drawn from dilute exhaust, **µg/ml**.

(xi~~v~~i) **CA_D** = GC ~~peak area~~ **concentration** of sample drawn from dilution air, **µg/ml**.

(**xiii**~~v~~) AV_s = Volume of absorbing reagent (deionized water) in impinger through which methanol sample from dilute exhaust is drawn, ml.

(**xiv**) AV_D = **Volume of absorbing reagent** (deionized **water) in impinger through which methanol sample from dilution air is drawn, ml.**

(**xiiv**) **1 = first impinger.**

(**xiiiv**) **2 = second impinger.**

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DRAFT 8/25/92

(7) * * *

(ii)
$$DF = \frac{(100)\ \frac{x}{x + y/2 + 3.76(x + y/2 - z/2)}}{CO_{2e} + (HC_e + CO_e + CH_3OH_e + \mathbf{HCHO_e})}$$

for methanol-fueled vehicles, where fuel composition is $C_xH_yO_z$ as measured, **or calculated**, for the fuel used.

* * * * *

(e) For methanol-fueled vehicle with measured fuel composition of $CH_{3.14}O_{0.6}$ example calculation of exhaust emissions using positive displacement pump:

(1) For the "transient" phase of the cold start test assume the following:

V_o = 0.29344 ft^3/rev; N = 10,485; R = 48.0 pct; R_a = 48.2 pct; P_B = 762 mm Hg; P_d = 22.225 mm Hg; P_4 = 70 mm Hg; T_p = 570°R; FID HC_e = 81.6 ppm, carbon equivalent; r = 0.75;~~C_{CH3OHR} = 71 ug/ml~~; T_{EM} = 567°R; ~~A_{CH3OHR} = 3660;~~ V_{EM} 1.18 ft^3; C~~A~~$_{S1}$ = ~~4460~~ **180 µg/ml**; AV_{s1} = 25.2 ml; C~~A~~$_{s2}$ = ~~360~~ **10 µg/ml**; AV_{s2} = 24.9 ml; T_{DM} = 532°R; V_{DM} = 1.17 ft^3; C~~A~~$_{D1}$ = ~~110~~ **15 µg/ml**; AV_{D1} = 25.0 ml; C~~A~~$_{D2}$ = ~~10~~ **1 µg/ml**; AV_{D2} = 25.1 ml; C_{FDE} = 20 ug/ml; V_{AE} = 5.0 ml; Q = 0.1429; T_{EF} = 569°R; V_{SE} = 0.30 ft^3; C_{FDA} = 1 ug/ml; V_{AA} = 5.0 ml; T_{DF} = 532°R; V_{SA} = 0.31 ft^3; NOx_e = 11.2 ppm; CO_{em} = 306.6 ppm; CO_{2e} = 1.43 pct; FID HC_d = 12.1 ppm; NOx_d = 0.8 ppm; CO_{dm} = 15.3 ppm; CO_{2d} = 0.032 pct; D_{ct} = 3.598 mi.

Then:

(i) V_{mix} = (0.29344)(10,485)(762-70)(528)/(760)(570)
= 2595.0 ft^3 per test phase.

(ii) H = (43.478)(48.2)(22.225)/[762-(22.225x48.2/100)]
= 62 grains of water per pound of dry air.

(iii) K_H = 1/[1 - 0.0047(62-75)] = 0.9424

(iv) CO_e = [1-(0.01 + 0.005x3.14x1.43)-0.000323(48)] 306.6
= 291.9 ppm.

(v) CO_d = (1 - 0.000323(48)) 15.3 = 15.1 ppm.

(vi) C_{CH3OHe} =
$$\frac{(3.813\times10^{-2})\cancel{(71)}(567)[(\cancel{(4460}180)(25.2)+(\cancel{360}10)(24.9)])}{\cancel{(3660)}(762)(1.18)}$$

=~~56.60~~**115**.05 ppm.

(vii)
$$DF = \frac{100 \times \frac{1}{1 + (3.14/2) + 3.76(1 + 3.14/4 - 0.6/2)}}{}$$

$$1.43 + [81.6 + 291.9 + (1 - 0.75)(\cancel{56.60}\mathbf{115}.05)] \times 10^{-4}$$

$$= 8.3\cancel{50}\mathbf{42}$$

(viii) C_{CH3OHd} =

$$\frac{(3.813\times10^{-2})\cancel{(71)}(532)[(\cancel{110}\mathbf{15})(25.0)+(\cancel{10}\mathbf{1})(25.1)]}{\cancel{(3660)}(762)(1.17)}$$

$$= \cancel{1.32}\mathbf{9}.10 \text{ ppm}$$

* * * * *

Section 86.1207-90 of Subpart M is proposed to be amended by revising paragraph (b)(2) and (c)(2), and adding (b)(2)(i) to read as follows:

§86.1207-90 Sampling and analytical systems; evaporative emissions

(b) * * *

(2) For methanol-fueled vehicles, a methanol sampling and analyzing system is required in addition to the HFID analyzer. The methanol sampling equipment shall consist of impingers for collecting the methanol sample and appropriate equipment for drawing the sample through the impingers. The analytical equipment shall consist of a gas chromatograph equipped with a flame ionization detector. (Note: For 1990 through 1994 model year methanol-fueled vehicles, a HFID, calibrated on methanol may be used in place of the HFID calibrated on propane plus the methanol impingers and associated analytical equipment.)

(i) The methanol sampling system shall be designed such that, if a test vehicle emitted the maximum allowable level of methanol (based on all applicable standards) during any 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, and 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.

(c) * * *

(2) For the methanol sample, permanent records shall be made of the following: the volumes of deionized water introduced into each impinger, the rate and time of sample collection~~, the volumes of each sample introduced into_the gas chromatograph, the flow rate of carrier gas__through the column, the column temperature,~~ and the chromatogram of the analyzed sample.

* * * * *

Section 86.1213-90 is proposed to be amended by revising paragraph (f) - (f)(3) to read as follows:

§ 86.1213-90 Fuel specifications.

(f) Mixtures of petroleum and methanol fuels for flexible fuel vehicles. (1) Mixtures of petroleum and methanol fuels used for exhaust and evaporative emission testing and service accumulation for flexible fuel vehicles **shall consist of the gasoline listed in paragraph (a) or (b) and the methanol fuel listed in paragraph (c), and** shall be within the range fuel mixtures for which the vehicle was designed **as reported** in §86.90-21 (g). **The Administrator may use any fuel within this range for testing.**

~~(2) Manufacturer testing and service accumulation may be performed using only those mixtures (mixtures may be different for exhaust testing, evaporative testing, and service accumulation) expected to result in the highest emissions, provided:~~

~~(i) The fuels which constitute the mixture will be used in customer service, and~~

~~(ii) Information, acceptable to the Administrator, is provided by the manufacturer to show that the designated fuel mixtures would result in the highest emissions, and~~

(2) The fuel mixtures used by the manufacturers shall be sufficient to demonstrate compliance over the full design range, and shall include:

(i) For emission testing,

(A) The petroleum fuel specified in paragraph (a).

(B) A methanol fuel representative of the methanol fuel expected to be found in use, as specified in paragraph (c), and

(C) A combination of the fuels specified in paragraphs (A)and (B) that represents the composition which results in the highest Reid Vapor Pressure for the mixture. The mixture shall contain between nine and thirteen percent methanol.

(ii) For service accumulation, an alternating combination of the fuels specified in paragraphs (b)(1) and (f)(2)(i)(B) that, based on good engineering judgement, demonstrates the durability of the emission control system. The fuels may be used as a single mixture or alternated.

(iii) Or, other combinations which demonstrate compliance with the standards over the entire design range of the vehicle, provided that written approval is obtained from the Administrator prior to the start of testing.

(3) The specification range of the fuels to be used under

paragraph (f)~~(2)~~ of this section shall be reported in accordance with §86.090-21(b)(3) **and (g)**.

Section 86.1214-85 of Subpart M is proposed to be amended by revising paragraph (a)(2) to read as follows:

§ 86.1214-85 Analytical gases.

(a) * * *

(2) Fuel for the evaporative emission enclosure FID **(or HFID for methanol-fueled vehicles)** shall be a blend of 40±2 percent hydrogen with the balance being helium. The mixture shall contain less than 1 ppm equivalent carbon response. ≥98 to 100 percent hydrogen fuel may be used with advance approval by the Administrator.

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DRAFT 8/25/92

Section 86.1216-90 of Subpart M is proposed to be amended by revising paragraph (c)(3) and adding paragraph (d) to read as follows:

§ 86.1216-90 Calibrations, frequency and overview.

(c) * * *

(3) Perform a hydrocarbon ~~and, if applicable, a methanol~~ retention check and calibration on the evaporative emission enclosure (see §86.1217).

(d) At least twice annually or after any maintenance perform a methanol retention check and calibration on the evaporative emission enclosure (see §86.1217).

DRAFT 8/25/92

Section 86.1217-90 of Subpart M is proposed to be amended by revising paragraphs (c)(5), (c)(7) and (c)(9) and (d) - (d)(2)(iii) to read as follows:

§86.1217-90 Evaporative emission enclosure calibrations.

(c) * * *

(5) Inject into the enclosure a known quantity of pure propane (4g is a convenient quantity) and a known quantity of pure methanol (4g is a convenient quantity) in gaseous form; i.e., at a temperature of at least 150-155°F (65-68°C). The propane and methanol may be measured by volume flow or by mass measurement. The method used to measure the propane and methanol shall have an accuracy ~~and precision~~ of ±0.5 percent of the measured value. **(Less accurate methods may be used only with the advanced approval of the Administrator.) The methanol and propane tests do not need to be conducted separately.**

* * * * *

(7) To verify the enclosure calibration, calculate the mass of propane and the mass of methanol using the measurements taken in steps (4) and (6). See paragraph (d) of this section. This quantity must be within ±2 percent of that measured in step 5 above. **(For 1991-1995 calendar years, the difference may exceed ±2 percent for methanol, provided it does not exceed ±6 percent.)**

* * * * *

(9) Calculate, using the equation in paragraph (d) of this section and the readings taken in step (8), the hydrocarbon and methanol mass. It may not differ by more than ±4 percent of the value in step (6). **(For 1991-1995 calendar year methanol-fueled vehicles, the difference may exceed ±4 percent for methanol, provided it does not exceed ±6 percent. If these wider tolerances are used, then all subsequent data shall be corrected by multiplying by the inverse of the fractional retention, or by one if the measured recovery exceeds 100 percent. The retention used for this correction can be estimated by subtracting from one the loss indicated by the calibration test multiplied by the ratio of the emission test length to the calibration test length.)**

(d) Calculations. (1) The calculation of net methanol and hydrocarbon mass change is used to determine enclosure background and leak rate. It is also used to check the enclosure volume measurements. The methanol mass change is calculated from the initial and final methanol samples, temperature and pressure according to the following equation:

$$V\ \underline{\cancel{x\ C}}_{\cancel{MR}}$$

$$M_{CH3OH} = \cancel{A_{MR}} \quad x$$

$$\frac{T_{Ef}}{V_{Ef} \text{ x } T_{SHEDf}} [(C\cancel{A}_{MS1f} \text{ x } AV_{1f}) + (C\cancel{A}_{MS2f} \text{ x } AV_{2f})] \quad -$$

$$\frac{T_{Ei}}{V_{Ei} \text{ x } T_{SHEDi}} [(\overset{C}{\cancel{A}}_{MS1i} \text{ x } AV_{1i}) + (\overset{C}{\cancel{A}}_{MS2i} \text{ x } AV_{2i})]$$

Where:

(i) M_{CH3OH} = Methanol mass change, µg.

(ii) V = Enclosure volume, ft^3, as measured in paragraph (b)(1) of this section.

(iii) ~~C_{MR} = Concentration of methanol in standard_sample for calibration of GC, mg/ml.~~

~~(iv) A_{MR} = GC peak area of standard sample.~~

~~(v)~~ T_E = Temperature of sample withdrawn, °R.

~~(vi)~~(iv) V_E = Volume of sample withdrawn, ft^3.

(v~~ii~~) P_B = Barometric pressure at time of sampling, in. Hg.

(vi~~ii~~) $C\cancel{A}_{MS}$ = GC ~~peak area~~ **concentration** of test sample.

(~~ix~~vii) AV = Volume of absorbing reagent in impinger.

(~~x~~viii) i = Initial sample.

DRAFT 8/25/92

(~~xi~~ix) f = Final sample.

(x~~ii~~) 1 = First impinger.

(xi~~ii~~) 2 = Second impinger.

(2) The hydrocarbon mass change is calculated from the initial and final FID readings of hydrocarbon concentration, methanol concentration with FID response to methanol, temperature, and pressure according to the following equation:

$$M_{HC} = kV \times 10^{-4} \quad \frac{(C_{HCf} - rC_{CH3OHf}) \times P_{Bf}}{T_f} - \frac{(C_{HCi} - rC_{CH3OHi}) \times P_{Bi}}{T_i}$$

Where:

(i) M_{HC} = Hydrocarbon mass change, g.

(ii) C_{HC} = FID hydrocarbon concentration as ppm carbon including FID response to methanol in the sample.

(iii) C_{CH3OH} = Methanol concentration as ppm carbon

$$= \frac{1.501 \times 10^{-3} \cancel{C_{MR}} \times}{\cancel{A_{MR}} \cancel{\times} P_B \times V_E} \times [(\overset{C}{\cancel{A}}_{S1} \times AV_1) + (\overset{C}{\cancel{A}}_{S2} \times AV_2)]$$

* * * * *

Section 86.1221-90 of Subpart M is proposed to be amended by revising paragraph (c)(1) and Figure M90-1 to read as follows:

§ 86.1221-90 Hydrocarbon analyzer calibration.

* * * * *

(c) * * *

(1) The bag sample of methanol for analysis in the FID shall be prepared using the apparatus shown in Figure M90-1. A known volume of methanol is injected, using a microliter syringe, into the heated mixing zone (250°F (121°C) of the apparatus. The methanol is vaporized and swept into the sample bag with a known volume of zero grade air measured by a ~~dry~~ gas **flow** meter **with an accuracy of ±2 percent**.

* * * * *

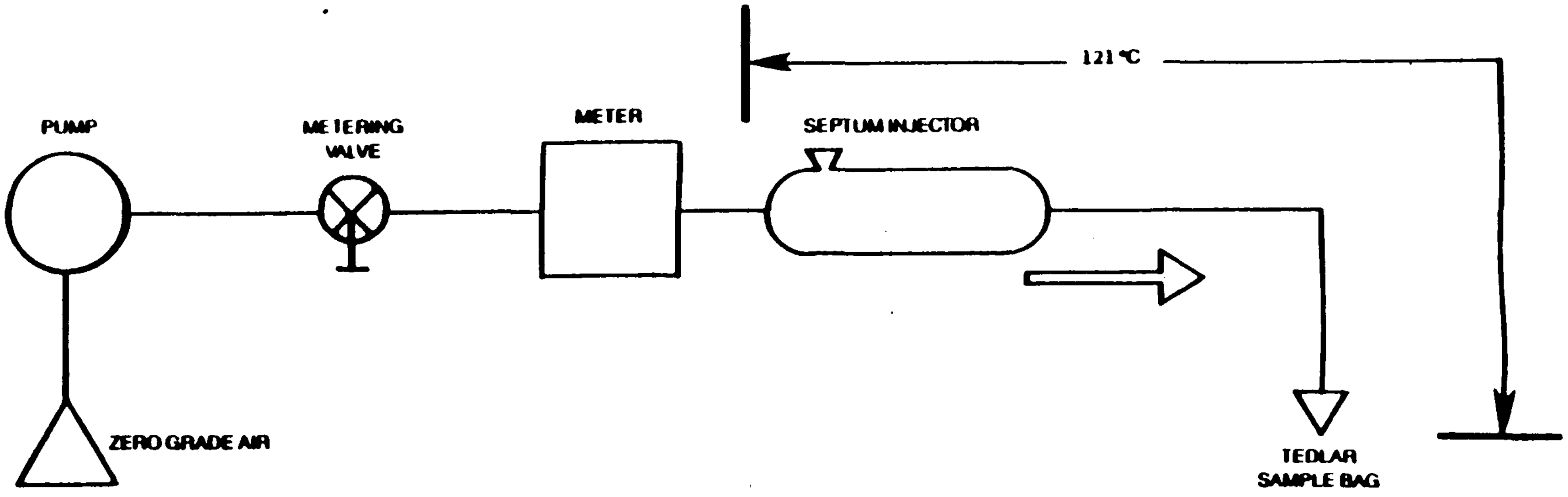

FIGURE M91-1 APPARATUS FOR PREPARATION OF FID METHANOL RESPONSE CALIBRATION MIX

DRAFT 8/25/92

Section 86.1242-90 of Subpart M is proposed to be amended by revising paragraphs (l) - (l)(3), to read as follows:

§86.1242-90 Records required.

(l) For methanol-fueled vehicles:

(1) Volume of sample passed through the methanol sampling system and the volume of deionized water in each impinger.

(2) ~~The methanol concentration in the reference_sample and the peak area from the GC analysis of the_reference sample.~~

~~(3)~~ The ~~peak area~~ **concentration** of the GC analyses of the test samples (methanol).

DRAFT 8/25/92

Section 86.1243-90 of Subpart M is proposed to be amended by revising paragraphs (a) - (a)(2)(iii) to read as follows:

§86.1243-90 Calculations; evaporative emissions.

(a) The calculation of the net hydrocarbon, methanol and hydrocarbon plus methanol mass change in the enclosure is used to determine the diurnal and hot soak mass emissions. The mass changes are calculated from initial and final hydrocarbon and methanol concentrations in ppm carbon, initial and final enclosure ambient temperatures, initial and final barometric pressures, and net enclosure volume using the following equations:

(1) For methanol:

$$M_{CH_3OH} = \frac{V_n \cancel{\text{x } C_{MR}}}{\cancel{A_{MR}}} \text{ x }$$

$$\frac{T_{Ef}}{(V_E \text{ x } T_{SHEDf})} \text{ x } [(\overset{C}{\cancel{A}}_{MS1f} \text{ x } AV_{1f}) + (\overset{C}{\cancel{A}}_{MS2f} \text{ x } AV_{2f})] -$$

$$\frac{T_{Ei}}{(V_E \text{ x } T_{SHEDi})} \text{ x } [(\overset{C}{\cancel{A}}_{MS1i} \text{ x } AV_{1i}) + (\overset{C}{\cancel{A}}_{MS2i} \text{ x } AV_{2i})]$$

Where:

(i) M_{CH3OH} = Methanol mass change, μg.

(ii) V_n = Net enclosure volume, ft^3, as determined by subtracting 50 ft^3 (1.42 m^3) (volume of vehicle with trunk and windows open) from the enclosure volume. A manufacturer may use the measured volume of the vehicle (instead of the nominal 50 ft^3) with advance approval by the Administrator: Provided, the measured volume is determined and used for all vehicles tested by that manufacturer.

(iii) ~~C_{MR} = Concentration of methanol in standard_sample for calibration of GC, mg/ml.~~

~~(iv)~~ ~~A_{MR} = GC peak area of standard sample.~~

~~(v)~~ T_E = Temperature of sample withdrawn, °R.

(~~vi~~iv) V_E = Volume of sample withdrawn, ft^3.

(v~~ii~~) T_{SHED} = Temperature of SHED, °R

(vi~~ii~~) P_B = Barometric pressure at time of sampling, in. Hg.

(~~ix~~vii) ~~AC~~$_{MS}$ = GC ~~peak area~~ **concentration** of sample.

(~~x~~viii) AV = Volume of absorbing reagent in impinger.

(~~xi~~ix) i = Initial sample.

(x~~ii~~) f = Final sample.

(xi~~ii~~) 1 = First impinger.

(xi~~v~~i) 2 = Second impinger.

(2) For hydrocarbons:

$$M_{HC} = (kV_n \times 10^{-4}) \quad \frac{(C_{HCf} - rC_{CH3OHf})P_{Bf}}{T_f} - \frac{(C_{HCi} - rC_{CH3OHi})P_{Bi}}{T_i}$$

Where:

(i) M_{HC} = Hydrocarbon mass change, g.

(ii) C_{HC} = FID hydrocarbon concentration as ppm carbon including FID response to methanol in the sample.

(iii) C_{CH3OH} = Methanol concentration as ppm carbon.

$$= \frac{1.501 \times 10^{-3} \cancel{C}_{\cancel{MR}} \times T}{\cancel{A}_{\cancel{MR}} \cancel{\times} P_B \times V_E} \times [(\overset{C}{\cancel{A}}_{S1} \times AV_1) + (\overset{C}{\cancel{A}}_{S2} \times AV_2)]$$

* * * * *

Section 86.1309-90 of Subpart N is proposed to be amended by revising paragraphs (a)(2) - (a)(2)(iv), (a)(3), (a)(4), (b), (b)(4) (b)(5) (c), (c)(4) and (c)(5), adding paragraphs (a)(2)(v), (a)(5), (b)(4)(i) - (b)(4)(iii), (b)(6)(i) - (b)(6)(iii), (c)(4)(i) - (c)(4)(iii), (c)(6)(i) - (c)(6)(iii) and (d) - (d)(3), and recodifying paragraphs (a)(5) and (a)(6) as (a)(6) and (a)(7), and Figures N90-2 and N90-3 to read as follows:

§ 86.1309-90 Exhaust gas sampling system; gasoline-fueled and methanol-fueled Otto-cycle engines.

(a) * * *

(2) Engine exhaust to CVS duct. For methanol-fueled engines, ~~cooling~~ **reactions** of the exhaust gases in the **exhaust** duct ~~connecting the engine exhaust~~ 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 ~~235±15 °F (113±8 °C)~~ **a temperature below 599°F** (315°C). (~~Heating and possibly~~ Cooling capabilities as required,) or

(ii) Using a short up to 12 feet long, duct constructed of smooth wall pipe with a minimum of flexible sections, maintained at ~~235±15 °F (113±8 °C)~~ **a temperature above the maximum dew point of the exhaust, but below 250°F** prior to the test and during periods when the engine is not in operation (insulation may remain in place and/or heating may occur during testing provided maximum temperature is not exceeded), or

(iii) Using a smooth wall duct less than five feet long with no required heating, or

(iv) 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.**

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

(3) Positive displacement pump. The Positive Displacement Pump Constant Volume Sampler (PDP - CVS), Figure N90 - 1 satisfies the first condition by metering at a constant temperature and pressure through the pump. The total volume is measured by counting the revolutions made by the calibrated positive displacement pump. The proportional samples for the bag sample and for methanol fueled vehicles, the methanol sample (Figure N90 - 2) and the formaldehyde sample (Figure N90 - 3), are achieved by sampling at a constant flow rate. For methanol-fueled engines, the sample lines for the methanol and formaldehyde samples are heated to ~~235±15 °F (113±8 °C)~~ **prevent condensation**. Note: For 1990 through 1994 model year

methanol-fueled engines, methanol and formaldehyde sampling may be omitted provided the bag sample (hydrocarbons and methanol) is analyzed using a HFID calibrated with methanol.

(4) Critical flow venturi. The operation of the Critical Flow Venturi Constant Volume Sampler (CFV - CVS), Figure N90 - 4 is based upon the principles of fluid dynamics associated with critical flow. The CFV system is commonly called a constant volume system (CVS) even though the flow varies. It would be more proper to call the critical flow venturi (CFV) system a constant proportion sampling system since proportional sampling throughout temperature excursions is maintained by use of a small CFVs in the sample lines. For methanol-fueled engines, one line supplies sample for the bag sample, another line supplies sample for the methanol sample, and a third line supplies sample for the formaldehyde sample. The lines for the methanol and formaldehyde samples are heated to ~~235±15 °F (113±8 °C)~~ **prevent condensation** with care being taken to ensure that the CFVs of the sample probes are not heated.

Note: For 1990 through 1994 model year methanol-fueled engines, methanol and formaldehyde sampling may be omitted provided the bag sample (hydrocarbons and methanol) is analyzed using a HFID calibrated with methanol. The variable mixture flow rate is maintained at choked flow, which is inversely proportional to the square root of the gas temperature, and is computed continuously. Since the pressure and temperature are the same at all venturi inlets, the sample volume is proportional to the total volume.

5) **<u>Electronic Flow Control</u>. The Electronic Flow Control Critical Flow Venturi Constant Volume Sampler (EFC-CFV-CVS) is identical to the CFV-CVS system, except that it uses electronic mass flow meters to maintain proportional sampling for methanol and formaldehyde. The flow rate of the exhaust plus dilution air and the sample flow rate are measured electronically. Proportionality is maintained by electronically controlled metering valves in the methanol and formaldehyde sample lines. Control of the valves is based on the electronic response of the flow meters. It is recommended that total flow sample volumes be measured by separate flow meters. For methanol-fueled engines, one line supplies sample for the bag sample, another line supplies sample for the methanol sample, and a third line supplies sample for the formaldehyde sample. The sample lines for methanol and for formaldehyde may both draw samples from a single static probe. The lines for the methanol and formaldehyde samples are heated to prevent condensation.**

(~~5~~**6**) <u>Other systems</u>. Other sampling and/or analytical systems including the systems described in §86.1310 for petroleum-fueled diesel engines may be used if shown to yield equivalent results, and if approved in advance by the Administrator.

(~~6~~**7**) Since various configurations can produce equivalent results, exact conformance with these drawings is not required.

Additional components such as instruments, valves, solenoids, pumps and switches may be used to provide additional information and coordinate the functions of the component systems. Other components such as snubbers, which are not needed to maintain accuracy on some systems, may be excluded if their exclusion is based upon good engineering judgment .

(b) Component description, PDP - CVS. The PDP CVS, Figure N90 - 1, consists of a dilution air filter and mixing assembly, heat exchanger, positive displacement pump, sampling systems (see Figure N90 - 2 for methanol sampling system and Figure N90 - 3 for formaldehyde sampling system) including sampling lines which are heated to ~~235±15 °F (113±8 °C)~~ **prevent condensation** in the case of the methanol-fueled engine ~~(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 temperature of the sample lines shall be between the maximum dew point of the mixture and 250°F. (It is recommended the they be maintained at 235±15 °F (113±8 °C)). 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.** The PDP - CVS shall conform to the following requirements:

* * * * *

(4) The flow capacity of the CVS shall be large enough to eliminate water condensation in the system. (300 to 350 cfm (0.142 to 0.165 m^3/s) is sufficient for most petroleum-fueled vehicles. Higher flow rates are required for methanol-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 is also allowed, provided:**

(i) The air (or air plus exhaust gas) temperature does not exceed 250°F, or 125°F if particulate emissions are measured,

(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 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 engines).

(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.

(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 ten percent (on a mass basis) of the maximum allowable level for methanol (or the maximum formaldehyde level allowed by a specific formaldehyde standard, whichever is less) during the first phase of the test, the concentration of formadehyde 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.

(c) Component description, CFV. The CFV sample system, Figure N90 - 4, consists of a dilution air filter (optional) and mixing assembly, cyclone particulate separator (optional), unheated sampling venturies for the bag, methanol and formaldehyde samples from methanol-fueled engines, heated sample lines ~~(235±15 °F (113±8 °C))~~ **to prevent condensation** in the case of the methanol-fueled engine ~~(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)~~, critical flow venturi, and associated valves, pressure and temperature sensors. **The temperature of the sample lines shall be between the maximum dew point of the mixture and 250°F. (It is recommended the they be maintained at 235±15 °F (113±8 °C)). -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.** The CFV sample system shall conform to the following requirements:

* * *

(4) The flow capacity of the CVS shall be large enough to eliminate water condensation in the system. (300 to 350 cfm (0.142 to 0.165 m^3/s) is sufficient for most petroleum-fueled vehicles. Higher flow rates are required for methanol-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 is also allowed, provided:**

(i) The air (or air plus exhaust gas) temperature does not exceed 250°F, or 125°F if particulate emissions are measured.

(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 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 engines).

(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 CFV.

(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 ten percent (on a mass basis) of the maximum allowable level for methanol (or the maximum formaldehyde level allowed by a specific formaldehyde standard, whichever is less) during the first phase of the test, the concentration of formadehyde 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 100 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), 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).

(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 have an accuracy of ±2 percent. Total sample flow volumes may be obtained from the flow controllers, with advance approval of the Administrator, provided that they can be shown to have an accuracy of ±2 percent.

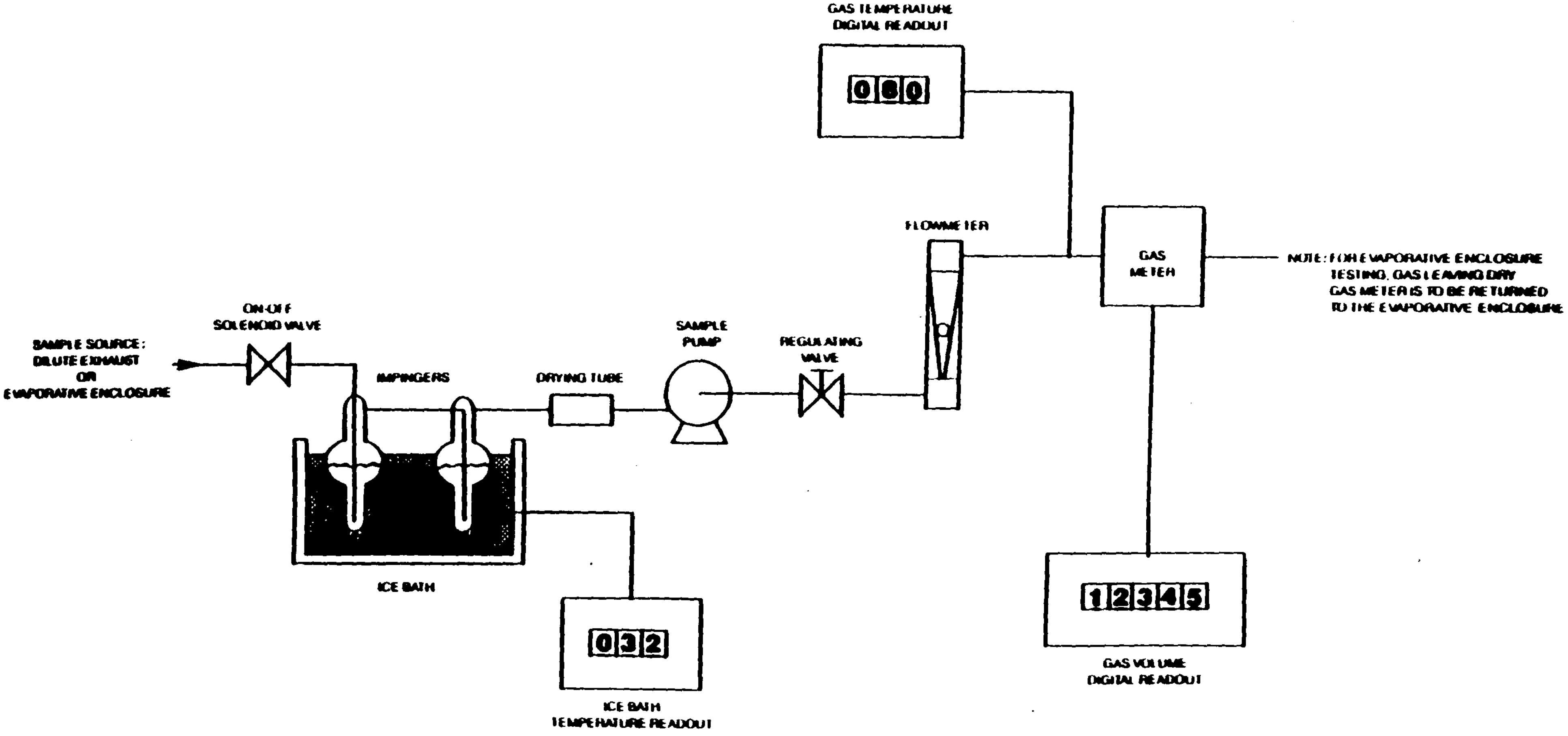

FIGURE N90-2 METHANOL SAMPLE COLLECTION FLOW SCHEMATIC

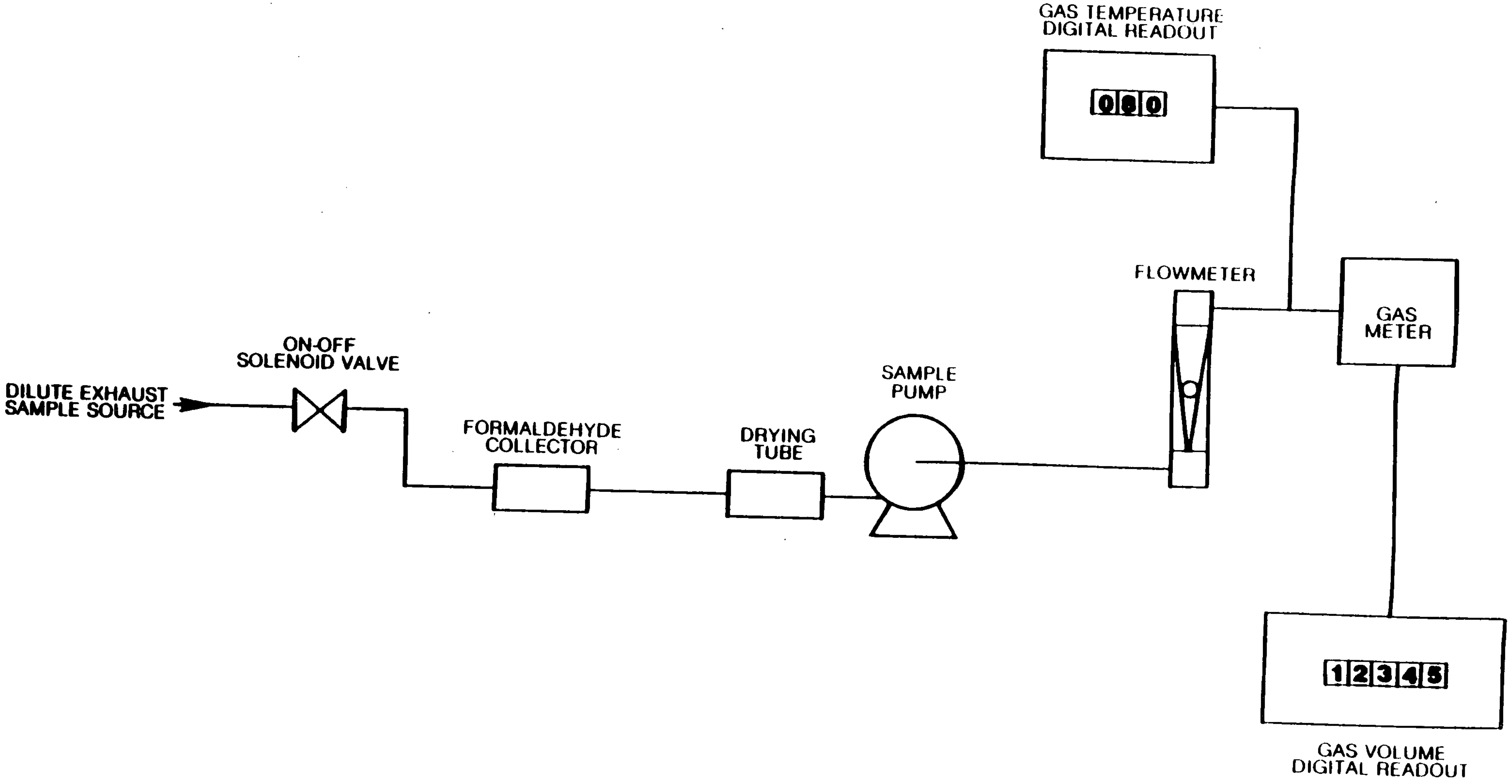

FIGURE N90-3 FORMALDEHYDE SAMPLE COLLECTION FLOW SCHEMATIC

Section 86.1310-90 of Subpart N is proposed to be amended by revising paragraphs (a)(1), (a)(4) - (a)(4)(iv), and (b)(1), (b)(1)(i), (b)(1)(ii), (b)(1)(iii), and adding (a)(4)(v), to read as follows.

§ 86.1310-90 Exhaust gas sampling and analytical system; petroleum-fueled and methanol-fueled diesel engines.

(a) * * *

(1) This sampling system requires the use of a PDP-CVS and a heat exchanger, ~~or~~ 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 system.

* * * * *

(4) For methanol-fueled engines, cooling **or reaction** of the exhaust gases in the **exhaust** duct ~~connecting the engine exhaust~~ 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 ~~235±15 °F (113±8 °C)~~ **a temperature below 599°F (315°C)**. (~~Heating and possibly~~ Cooling capabilities as required,) or

(ii) Using a short up to 12 feet long, duct constructed of smooth wall pipe with a minimum of flexible sections, maintained at ~~235±15 °F (113±8 °C)~~ **a temperature above the maximum dew point of the exhaust, but below 250°F** prior to the test and during periods when the engine is not in operation (insulation may remain in place and/or heating may occur during testing provided maximum temperature is not exceeded), or

(iii) Using a smooth wall duct less than five feet long with no required heating, or

(iv) 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.**

(v) Partial dilution of the exhaust gas prior to entering the dilution tunnel, which lowers the duct temperature below 599oF (315oC).

(5) Heated sample lines are required for the methanol and formaldehyde samples for methanol-fueled engines (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 ~~235±15 °F (113±8 °C)~~ **a temperature above the maximum dew point of the mixture, but below 250oF.**

* * * * *

(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** ~~below~~, 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 ±20°F (±11°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 ±3.4°F (1.9°C). For systems utilizing a flow compensator to maintain proportional sampling, the requirement for maintaining constant temperature is not necessary.

* * * * *

DRAFT 8/25/92

Section 86.1313-90 of Subpart N is proposed to be amended by revising paragraph (d) to read as follows:

§86.1313-90 Fuel Specifications

(d) Mixtures of petroleum and methanol fuels for flexible fuel vehicles.

(1) Mixtures of petroleum and methanol fuels used for exhaust ~~and evaporative~~ emission testing and service accumulation for flexible fuel vehicles shall **consist of the the methanol and petroleum fuels listed in paragraph (a) or (b), and shall** be within the range of fuel mixtures for which the vehicle was designed, **as reported in §86.90-21 (g). The Administrator may use any fuel mixture within this range for testing**.

~~(2) Manufacturer testing and service accumulation_may be performed using only those mixtures (mixtures may_be different for exhaust testing, evaporative testing,_and service accumulation) expected to result in the_highest emissions, provided:~~

~~(i) The fuels which constitute the mixture will be_used in customer service, and~~

~~(ii) Information, acceptable to the Administrator,__is provided by the manufacturer to show that the_designated fuel mixtures would result in the highest_emissions, and~~

~~(iii) Written approval from the Administrator of the_fuel specifications must be provided prior to the start_of testing.~~

(2) The fuel mixtures used by the manufacturers shall be sufficient to demonstrate compliance over the full design range, and shall include:

(i) For emission testing,

(A) A petroleum fuel specified in paragraph (a), or paragraph (b)

(B) A methanol fuel representative of the methanol fuel expected to the found in use,

(ii) For service accumulation, an alternating combination of the fuels specified in paragraphs (a)(2) or (b)(3), and (d)(2)(i)(B) that, based on good engineering judgement, demonstrates the durability of the emissions control system. The combination shall be selected such that the cumulative volumes of both the methanol fuel and the petroleum fuel used shall be at least twenty-five percent of the total fuel volume. The fuels shall be or alternated at intervals not to exceed 500 hours.

(iii) Or, other combinations which demonstrate compliance with the standards over the entire design range of the vehicle, provided that written approval is obtained from the Administrator

prior to the start of testing.

(3) The specification range of the fuels to be used under paragraph (d) of this section shall be reported in accordance with §86.090-21 (b)(3) **and (g).**

DRAFT 8/25/92

Section 86.1313-91 of Subpart N is proposed to be amended by revising paragraph (d) to read as follows:

§86.1313-91 Fuel Specifications

(d) Mixtures of petroleum and methanol fuels for flexible fuel vehicles.

(1)Mixtures of petroleum and methanol fuels used for exhaust ~~and evaporative~~ emission testing and service accumulation for flexible fuel vehicles shall **consist of the the methanol and petroleum fuels listed in paragraph (a) or (b), and shall** be within the range of fuel mixtures for which the vehicle was designed, **as reported in §86.91-21 (g). The Administrator may use any fuel mixture within this range for testing.**

~~(2) Manufacturer testing and service accumulation_may be performed using only those mixtures (mixtures may_be different for exhaust testing, evaporative testing,_and service accumulation) expected to result in the_highest emissions, provided:~~

~~(i) The fuels which constitute the mixture will be_used in customer service, and~~

~~(ii) Information, acceptable to the Administrator,_ is provided by the manufacturer to show that the_designated fuel mixtures would result in the highest_emissions, and~~

~~(iii) Written approval from the Administrator of the_fuel specifications must be provided prior to the start_of testing.~~

(2) The fuel mixtures used by the manufacturers shall be sufficient to demonstrate compliance over the full design range, and shall include:

(i) For emission testing,

(A) A petroleum fuel specified in paragraph (a), or paragraph (b)

(B) A methanol fuel representative of the methanol fuel expected to the found in use,

(ii) For service accumulation, an alternating combination of the fuels specified in paragraphs (a)(2) or (b)(3), and (d)(2)(i)(B) that, based on good engineering judgement, demonstrates the durability of the emissions control system. The combination shall be selected such that the cumulative volumes of both the methanol fuel and the petroleum fuel used shall be at least twenty-five percent of the total fuel volume. The fuels shall be or alternated at intervals not to exceed 500 hours.

(iii) Or, other combinations which demonstrate compliance with the standards over the entire design range of the vehicle, provided that written approval is obtained from the Administrator

prior to the start of testing.

(3) The specification range of the fuels to be used under paragraph (d) of this section shall be reported in accordance with §86.091-21 (b)(3) **and (g)**.

Section 86.1313-94 of Subpart N is proposed to be amended by revising paragraph (d) to read as follows:

§86.1313-94 Fuel Specifications

(d) Mixtures of petroleum and methanol fuels for flexible fuel vehicles.

(1)Mixtures of petroleum and methanol fuels used for exhaust ~~and evaporative~~ emission testing and service accumulation for flexible fuel vehicles shall **consist of the the methanol and petroleum fuels listed in paragraph (a) or (b), and shall** be within the range of fuel mixtures for which the vehicle was designed, **as reported in §86.94-21 (g). The Administrator may use any fuel mixture within this range for testing.**

~~(2) Manufacturer testing and service accumulation_may be performed using only those mixtures (mixtures may_be different for exhaust testing, evaporative testing,_and service accumulation) expected to result in the_highest emissions, provided:~~

~~(i) The fuels which constitute the mixture will be_used in customer service, and~~

~~(ii) Information, acceptable to the Administrator,__is provided by the manufacturer to show that the_designated fuel mixtures would result in the highest_emissions, and~~

~~(iii) Written approval from the Administrator of the_fuel specifications must be provided prior to the start_of testing.~~

(2) The fuel mixtures used by the manufacturers shall be sufficient to demonstrate compliance over the full design range, and shall include:

(i) For emission testing,

(A) A petroleum fuel specified in paragraph (a), or paragraph (b)

(B) A methanol fuel representative of the methanol fuel expected to the found in use,

(ii) For service accumulation, an alternating combination of the fuels specified in paragraphs (a)(2) or (b)(3), and (d)(2)(i)(B) that, based on good engineering judgement, demonstrates the durability of the emissions control system. The combination shall be selected such that the cumulative volumes of both the methanol fuel and the petroleum fuel used shall be at least twenty-five percent of the total fuel volume. The fuels shall be or alternated at intervals not to exceed 500 hours.

(iii) Or, other combinations which demonstrate compliance with the standards over the entire design range of the vehicle, provided that written approval is obtained from the Administrator

prior to the start of testing.

(3) The specification range of the fuels to be used under paragraph (d) of this section shall be reported in accordance with §86.094-21 (b)(3) **and (g)**.

DRAFT 8/25/92

Section 86.1319-90 of Subpart N is proposed to be amended by revising paragraph (e)(1), (e)(4), and (e)(7) to read as follows:

§86.1319-90 CVS calibration.

(e) * * *

(1) Obtain a small cylinder that has been charged with pure propane or carbon monoxide gas (CAUTION - carbon monoxide is poisonous). ~~Obtain another small cylinder which has been charged with pure methanol if the system is to be used for methanol-fueled vehicle testing. Since this cylinder will be heated to 150-155°F, care must be taken to ensure that the liquid volume of methanol placed in the cylinder does not exceed approximately one-half of the total volume of the cylinder.~~

* * * * *

(4) Following completion of step (3) above **(if methanol injection is required)**, continue to operate the CVS in the normal manner and release a **known** quantity of pure methanol **(in gaseous form)** into the system during the sampling period (approximately 5 minutes). **This step does not need to be performed with each verification, provided that it is performed at least twice annually**.

* * * * *

(7) The cause for any discrepancy greater than ±2 percent must be found and corrected. **(For 1991-1995 calendar years, discrepancies greater than ±2 percent are allowed for the methanol test, provided that they do not exceed ±6 percent.)**

Section 86.1321-90 of Subpart N is proposed to be amended by revising paragraphs (a)(3)(ii) - (a)(3)(iii) and (c)(1) and Figure N90-10 and adding paragraph (a)(3)(iv) to read as follows:

§86.1321-90 Hydrocarbon analyzer calibration.

(a) * * *

(3) * * *

(ii) ~~The HFID optimization procedures outlined in 40 CFR Part 86, Subpart D.~~ **The procedure listed in Subpart D, which is:**

(A) If necessary, follow manufacturer's instructions for instrument start-up and basic operating adjustments.

(B) Set the oven temperature 5°C hotter than the required sample-line temperature. Allow at least one-half hour after the oven has reached temperature for the system to equilibrate.

(C) Initial fuel flow adjustment. With the fuel and air-flow rates set at the manufacturer's recommendations, introduce a 350 ppmC±75 ppmC span gas to the detector. Determine the response at a given fuel flow from the difference between the span-gas response and the zero-gas response. Incrementally adjust the fuel flow above and below the manufacturer's specification. Record and plot the span and zero response at these fuel flows. Adjust the fuel-flow rate to the rich side of the curve. This is initial flow-rate setting and may not be the final optimized flow rate.

(E) Linearity check. For each range used, check linearity as follows:

(*1*) Zero the analyzer.

(*2*) Span the analyzer using a calibration gas that will provide a response of approximately 90 percent of full-scale concentration.

(*3*) Recheck the zero response. If it has changed more than 0.5 percent of full scale, repeat steps (*1*) and (*2*).

(*4*) Record the response of calibration gases having nominal concentrations of 30, 60, and 90 percent of full-scale concentration. It is permitted to use additional concentrations.

(*5*) Perform a linear least square regression on the data generated. Use an equation of the form y=mx, where x is the actual chart deflection and y is the concentration.

(*6*) Use the equation z=y/m to find the linear chart deflection (z) for each calibration gas concentration (y).

(7) Determine the linearity (%L) for each calibration gas by:

Percent L= (z-x) X 100

Full-scale linear chart deflection

(*8*) The linearity criterion is met if the %L is less than ±2 percent for each data point generated. Below 40 ppmC the linearity criterion may be expanded to ±4 percent. For each emission test, a calibration curve of the form y=mx is to be used. The slope (m) is defined for each range by the spanning process.

(*9*) If the %L for any point exceeds the specifications in step (*8*), the air, fuel, and sample-flow rates may be varied.

(*10*) If the %L for any data point still exceeds the specifications, repair or replace the analyzer, FID fuel, burner air, or calibration bottles prior to testing. Repeat the procedures of this section with the repaired or replaced equipment or gases.

(F) Optimized flow rates. The fuel-flow rate, air-flow rate and sample-flow rate are defined as ''optimized'' at this point.

(iii) The procedures specified by the manufacturer of the FID or HFID.

(iv) Alternative procedures may be used if approved in advance by the Administrator.

* * * * *

(c) * * *

(1) The bag sample of methanol for analysis in the FID shall be prepared using the apparatus shown in Figure N90-10. A known volume of methanol is injected, using a microliter syringe, into the heated mixing zone (250°F (121°C) of the apparatus. The methanol is vaporized and swept into the sample bag with a known volume of zero grade air measured by a ~~dry~~ gas **flow** meter **with an accuracy of ±2 percent.**

* * * * *

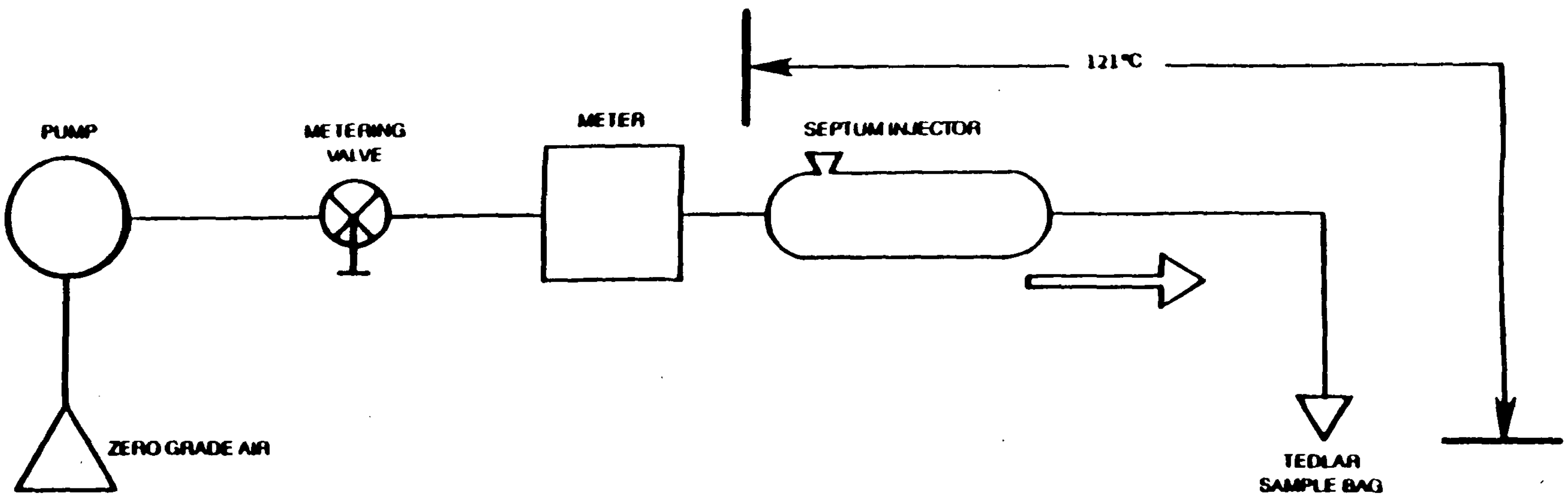

FIGURE N90-10 APPARATUS FOR PREPARATION OF FID METHANOL RESPONSE CALIBRATION MIX

DRAFT 8/25/92

Section 86.1323-84 of Subpart N is proposed to be amended by adding paragraph (d) to read as follows:

§86.1323-84 Oxides of Nitrogen analyzer calibration.

(d) **When testing methanol-fueled engines it may be necessary to clean the analyzer frequently to prevent interference with NOx measurements. (See EPA/60/S3-88/040.)**

DRAFT 8/25/92

Section 86.1330-90 of Subpart N is proposed to be amended by revising paragraphs (b)(1) and (c), and adding paragraphs (b)(i) - (b)(iii), to read as follows:

§86.1330-90 Test Sequence; general requirements.

(b) Control of air temperature. (1) The temperature of the CVS dilution air shall be maintained at greater than 68°F(20°C) throughout the test sequence, except as permitted by §86.1335-90. **Heating of the dilution air above 86°F is allowed provided:**

(i) The air (or air plus exhaust gas) temperature does not exceed 250°F, or 125°F if particulate emissions are measured,

(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 insulation 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.

* * * * *

(c) No control of ambient air, engine intake or CVS dilution air humidity is required, **(Dehumidification of the dilution air prior to entering the CVS is allowed).**

* * * * *

Section 1337-90 of Subpart N is proposed to be amended by revising paragraph (a)(13) and (a)(26) to read as follows:

§86.1337-90 Engine dynamometer test run.

(a) * * *

(13) Immediately after the engine is turned off, turn off the engine cooling fan(s) if used, and the CVS blower (or disconnect the exhaust system from the CVS). As soon as possible, transfer the "cold start cycle" exhaust and dilution air bag samples to the analytical system and process the samples according to §86.1340. A stabilized reading of the exhaust sample on all analyzers shall be obtained within 20 minutes of the end of the sample collection phase of the test. Analysis of the methanol and formaldehyde samples shall be obtained within 24 hours of the end of the sample collection period. **(If it is not possible to perform the analysis within 24 hours, the samples should be stored in a cold (4-10°C) dark environment until analysis can be performed. Thew samples should be analyzed within fourteen days.)** For petroleum-fueled and methanol-fueled diesel engines, carefully remove the filter holder from the sample flow apparatus, and remove each particulate sample filter from its holder and place each in a petri dish and cover.

* * * * *

(26) As soon as possible, transfer the "hot start cycle" exhaust and dilution air bag samples to the analytical system and process the samples according to §86.1340. A stabilized reading of the exhaust sample on all analyzers shall be obtained within 20 minutes of the end of the sample collection phase of the test. Analysis of the methanol and formaldehyde samples shall be obtained within 24 hours of the end of the sample collection period. (If it is not possible to perform the within 24 hours, the samples should be stored in a cold (approximately 4-10°C) dark environment until analysis can be performed.) For petroleum-fueled and methanol-fueled diesel engines, carefully remove the assembled filter holder from the sample flow lines and remove each particulate sample filter from its holder and place each in a petri dish and cover as soon as possible. Within 1 hour after the end of the hot start phase of the test, transfer the four particulate filters to the weighing chamber for post-test conditioning

DRAFT 8/25/92

Section 86.1340-90 of Subpart N is proposed to be amended by revising paragraphs (g) - (h)(2) to read as follows:

§86.1340-90 Exhaust sample analysis.

(g) For CH_3OH (methanol-fueled vehicles)~~:~~,

~~(1) Introduce a reference sample of methanol (the concentration of methanol in deionized water is known, and is C_{MR} in the calculations) into the gas chromatograph and measure the area of the response peak. This reference sample peak area is A_{MR} in the calculations.~~

~~(2)~~ introduce test samples into the gas chromatograph and measure the ~~area of the response peak~~ **concentration**. This ~~peak area~~ **concentration** is ~~A~~C_{MS} in the calculations.

(h) For HCHO (methanol-fueled vehicles)~~:~~,

~~(1) Introduce a reference sample of formaldehyde (the concentration of formaldehyde as a dinitrophenylhydrazine derivative in acetonitrile (C_{FR}) is known) into the high pressure liquid chromatograph and measure the area of the response peak. This reference sample peak area is A_{FR} in the calculations.~~

~~(2)~~ introduce test samples into the high pressure liquid chromatograph and measure the ~~area of the response peak~~ **the concentration of formaldehyde as a dinitrophenylhydrazine derivative in acetonitrile**. This ~~peak area~~ **concentration** is ~~A~~C_{FS} in the calculations.

Section 86.1342-90 of Subpart N is proposed to be amended by revising paragraph (d)(5)(iv)(A) - (d)(5)(xviii), (d)(7)(ii), and (d)(8)(ii) to read as follows:

§86.1342-90 Calculations; exhaust emissions.

(d) * * *

(5) * * *

(iv)(A) C_{CH3OHe} = Methanol concentration in the dilute exhaust, in ppm.

(B) C_{CH3OHe} =

$$\frac{3.813 \times 10^{-2} \cancel{\times C_{CH3OHR}} \times T_{EM} [(\overset{C}{\cancel{A}}_{S1} \times AV_{S1}) + (\overset{C}{\cancel{A}}_{S2} \times AV_{S2})]}{\cancel{A_{CH3OHR} \times} P_B \times V_{EM}}$$

(v)(A) C_{CH3OHd} = Methanol concentration in the dilution air, in ppm.

(B) C_{CH3OHd} =

$$\frac{3.813 \times 10^{-2} \cancel{\times C_{CH3OHR}} \times T_{DM} [(\overset{C}{\cancel{A}}_{D1} \times AV_{D1}) + (\overset{C}{\cancel{A}}_{D2} \times AV_{D2})]}{\cancel{A_{CH3OHR} \times} P_B \times V_{DM}}$$

(vi) ~~C_{CH3OHR} = Concentration of methanol in_standard sample for calibration of GC, /m/g/ml.~~

~~(vii) A_{CH3OHR} = GC peak area of standard sample.~~

~~(viii)~~ T_{EM} = Temperature of methanol sample withdrawn from dilute exhaust, °R.

(~~ix~~viii) T_{DM} = Temperature of methanol sample withdrawn from dilution air, °R.

(~~x~~viii) P_B = Barometric pressure during test, mm Hg.

(~~xi~~ix) V_{EM} = Volume of methanol sample withdrawn from dilute exhaust, ft^3.

(x~~ii~~) V_{DM} = Volume of methanol sample withdrawn from dilution air, ft^3.

(xi~~ii~~) ~~A~~C_S = GC ~~peak area~~ **concentration** of sample drawn from dilute exhaust.

(xi~~v~~**i**) ~~A~~C_D = GC ~~peak area~~ **concentration** of sample drawn from dilution air.

(x~~v~~**iii**) AV_S = **Volume of absorbing reagent (deionized water) in impinger through which methanol sample from dilute exhaust is drawn, ml.**

(x~~vi~~iv) AV_D = **Volume of absorbing reagent (deionized water) in impinger through which methanol sample from dilution air is drawn, ml.**

(xv~~ii~~) 1 = first impinger.

(xvi~~ii~~) 2 = second impinger.

* * * * *

(7) * * *

(ii)
$$DF = \frac{(100)\left(\dfrac{x}{x + y/2 + 3.76(x + y/2 - z/2)}\right)}{CO_{2e} + (HC_e + CO_e + CH_3OH_e + \mathbf{HCHO_e})}$$

for methanol-fueled vehicles, where fuel composition is $C_xH_yO_z$ as measured, **or calculated**, for the fuel used.

* * * * *

(8) * * *

(ii) For gasoline-fueled and methanol-fueled ~~diesel~~ **Otto-cycle** engines: $K_H = 1/[1-0.0047(H-75)]$ (or for SI units, $K_H = 1/[1-0.0329(H-10.71)]$).

* * * * *

DRAFT 8/25/92

Section 86.1344-90 of Subpart N is proposed to be amended by revising paragraph (e)(18)(ii) - (e)(18)(vii), to read as follows:

§86.1344-90 Required information.

(e) * * *

(18) * * *

(ii) ~~The methanol concentration in the reference_sample and the peak area from the GC analysis of the_reference sample.~~

~~(iii)~~ The ~~peak area~~ **concentration** of the GC analyses of the test samples (methanol), **µg/ml**.

* * * * *

(**i~~v~~ii**) Volume of sample passed through the formaldehyde sampling system.

~~(v) The formaldehyde concentration in the reference_sample and the peak area from the LC analysis of the_reference sample.~~

(**~~vi~~iv**) The ~~peak area~~ **concentration** of the LC analysis of the test sample (formaldehyde), **µg/ml**.

(v~~ii~~) Specification of the methanol test fuel, **or fuel mixtures**, used during testing.

The Title of Subpart P is proposed to be amended to read as follows:

Subpart P -- Emission Regulations for New Gasoline-Fueled and Methanol-Fueled Otto-Cycle Heavy-Duty Engines, **New Methanol-Fueled Diesel-Cycle Heavy-Duty Engines** and New Gasoline-Fueled and Methanol-Fueled Otto-Cycle Light-Duty Trucks; Idle Test Procedures.

Section 86.1501-90 of Subpart P is proposed to be amended to read as follows:

§86.1501-90 Scope; applicability.

This subpart contains gaseous emission idle test procedures for gasoline-fueled and methanol-fueled Otto-cycle heavy-duty engines, **methanol-fueled Diesel-cycle heavy-duty engines**, and for gasoline-fueled and methanol-fueled Otto-cycle light-duty trucks. It applies to 1990 and later model years.

DRAFT 8/25/92

Section 86.1504-90 of Subpart P is proposed to be amended by revising paragraph (c) to read as follows:

§86.1504-90 Section numbering;construction.

(c) All provisions in this subpart apply to gasoline-fueled and methanol-fueled Otto-cycle heavy-duty engines, **methanol-fueled Diesel-cycle heavy-duty engines** and gasoline-fueled and methanol-fueled Otto-cycle light-duty trucks.

Section 86.1505-90 of Subpart P is proposed to be amended by revising paragraph (a) to read as follows:

§86.1505-90 Introduction; structure of subpart.

(a) This subpart describes the equipment and the procedures required to perform idle exhaust emission tests on gasoline-fueled and methanol-fueled Otto-cycle heavy-duty engines, **methanol-fueled Diesel-cycle heavy-duty engines**, and gasoline-fueled and methanol-fueled Otto-cycle light-duty trucks. Subpart A sets forth the testing requirements, reporting requirements and test intervals necessary to comply with EPA certification procedures.

Section 86.1509-84 of Subpart P is proposed to be amended by revising paragraph (c) to read as follows:

§86.1509-84 Exhaust gas sampling system.

(c) A CVS sampling system with bag analysis as specified in §86.1309 ~~-84~~ or §86.109 ~~-82~~ **or with continuous analysis as specified in §86.1310 is permitted as applicable**. The inclusion of an additional raw carbon dioxide (CO2) analyzer as specified in §§86.309 - 79 and 86.316 - 79 is required if the CVS system is used, in order to accurately determine the CVS dilution factor. The heated sample line specified in §86.309 - 79 and §86.310 - 79 for raw emission requirements is not required for the raw CO2 measurement.

Section 86.1511-84 of Subpart P is proposed to be amended by revising paragraphs (a)(1) and (a)(8)(iii) to read as follows:

§86.1511-90 Exhaust gas analysis system.

(a) * * *

~~(1) The analyzers used must have a range such that_the carbon monoxide (CO) idle standard specified in__§86.084 - 10 for heavy duty engines or specified in_§86.084 - 9 for light duty trucks will provide an_analyzer response between 45 and 90 percent of_full scale deflection on the CO analyzer.~~

(1) The analyzer used shall conform to the emission measurement accuracy provisions of §86.1338.

* * * * *

(8) * * *

(iii) During ~~flow~~ variations of ±50 percent **of nominal sample flow**.

* * * * *

DRAFT 8/25/92

Section 1514-84 of Subpart P is proposed to be amended by adding paragraph (c) to read as follows:

§86.1514-84 Analytical gases.

(c) **If a CVS sampling system is used, the analytical gases specified in §86.1314 shall be used.**

Section 86.1537-84 of Subpart P is proposed to be amended by revising paragraphs (d), (e)(1), (e)(2), and (e)(5) - (e)(7) to read as follows:

§86.1537-84 Idle test run.

(d) Operate the warm engine at 2500 ±50 rpm, **or rated torque speed for methanol-fueled diesel engines**, and zero load for a minimum of 30 seconds and a maximum of 6 minutes.

(e) * * *

(1) **If bag samples are drawn**, with the sample selector valves in the standby position connect evacuated sample collection bags to the dilute exhaust and dilution air sample collection systems.

(2) Start the CVS (if not already on), the sample pumps, **integrators**, and the raw CO2 analyzer, **as applicable**. (The heat exchanger of the constant volume sampler, if used, shall be running at operating temperature before sampling begins.)

* * * * *

(5) Begin ~~CO bag sampling and~~ raw **and dilute** ~~CO2~~ sampling.

(6) **For bag sampling**, sample idle emissions long enough to obtain a sufficient bag sample, but in no case shorter than 60 seconds nor longer than 6 minutes. Follow the sampling and exhaust measurements requirements of §86.340 - 79(e) for the conducting of the raw CO2 measurement.

(7) As soon as possible, transfer the idle test exhaust and dilution air samples to the analytical system and process the samples according to §86.1540-84. Obtain a stabilized reading of the exhaust sample on all analyzers within 20 minutes of the end of the sample collection phase of the test.

* * * * *