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Environmental Monitoring Series

GUIDELINES FOR QUALITY ASSURANCE PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS:

PHASE I, LIGHT-DUTY GASOLINE-POWERED VEHICLES - TEST PROCEDURES

U.S. Environmental Protection Agency
Office of Research and Development
Washington, D. C. 20460

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PHASE I, LIGHT-DUTY GASOLINE-POWERED VEHICLES - TEST PROCEDURES

by

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EPA REVIEW NOTICE

This volume has been prepared by Olson Laboratories, Incorporated consistent with the Environmental Protection Agency Quality Assurance principles and concepts and with the Environmental Protection Agency Mobile Source Testing Practices at Ann Arbor, Michigan.

The guidelines and procedures are generally applicable to mobile source testing operations and are intended for use by those engaged in such measurement programs

It is requested that recipients and users of this document submit any comments and suggestions to the Project Officers.

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INTRODUCTION

The test procedures contained in this volume are a documentation of the 1975 light-duty gasoline emission measurement test requirements presently in use at the Ann Arbor facility of the Environmental Protection Agency. These test procedures comply with Federal Regulations as stated in the Federal Register. (See Section 3, Volume I, for the listing of applicable Federal Registers).

Section 5, Volume I outlines the development of an Operations manual which may be used as a guideline for a Quality Assurance program. A typical format of a test procedures manual is described and offers a guide for implementing and interpreting the test procedures contained in Volume II. A user may wish to modify this format to suit specific contractual obligations or accept the manual in its present form. The user will be required to make revisions as needed to assure that the manual complies with Federal Regulations. Revisions may be implemented manually, by computer updates or by magnetic card storage.

For ease of use, the test procedures are separated into nine distinct sections, numbered 100-900. The table of contents shows the major heading of each section and the test procedures contained in each. To differentiate between the light-duty and heavy-duty testing which are both included in this contract, the test procedures are numbered to correspond to Light Duty, 101-149, 201-249, etc. and Heavy Duty, 150-199, 250-299, etc. Light-duty gasoline procedures modified for light-duty diesel applications are suffixed with a -D, e.g.TP-707-D.

To assist in defining the overall scope of the light-duty testing program, the tables from Section 3, Volume I, briefly outlining the test procedures, specifications and quality provisions are included in this introduction to the test procedures manual.

This document details test procedures for light-duty gasoline-powered vehicles and a subsequent volume will cover test procedures for heavy-duty diesel engines (Phase II) with a supplement covering heavy-duty gasoline engines (Phase IV). The test procedures for light duty diesel engines (Phase III) will appear as a supplement to the light-duty gasoline vehicle procedures detailed in this volume.

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Table 1-1. FEDERAL EMISSION TEST PROCEDURE
Vehicle Preparation and Preconditioning

PROCEDURE ITEM	RECEIVE VEHICLE	PRE-CONDITIONING AMA	DRIVEABILITY	VEHICLE INSPECTION	VEHICLE & ENGINE PREPARATION	TEST FUEL ADDED	PRE-CONDITIONING FEDERAL CYCLE	11 HOUR AMBIENT SOAK
BRIEF DESCRIPTION	Visual inspection of test vehicle to verify vehicle and engine system integrity	All vehicles driven over same route to establish similar histories before test	To determine that veh.is operating satisfactorily, safely and can drive the federal cycle	To assure engine parameters are correctly set. Chk IDLE, CO, RPM, ignition timing dwell, centrifugal and vacuum advance	Leak proof fitting applied to all fuel systems. External vents to permit collection of emissions. Fuel system leak-checked.Install thermocouple & drain tank	Indolene 30 Indolene HO	The vehicle is driven on a dynamometer under controlled conditions	The vehicle is stored in a controlled environment
FEDERAL REGISTER PARAGRAPHS	85.075-5,6,7	85.075-7,10, 12 Appendix IV			85.075-11	85.075-10,11	85.075-12	85.075-13
EPA PROCEDURE NUMBER	TP-701	TP-702	TP-702	TP-701	TP-702	TP-702	TP-703	TP-703
SPECIFICATIONS AND TOLERANCES Federal Register	None	Driving Time-1 hour.Modified routes must be approved by the Administrator. Fuel-Tank fuel, unleaded fuel 0.02 grams of lead and 0.002 gm. phosphorus per gallon minimum. Leaded Fuel - 1.4 gm. lead per gallon, minimum	None	None	Fittings and tubing for canisters 5/16 I.D.	See above referenced paragraph for detailed specifications	Temp 77±9°F Speed Tolerance ±4 MPH, ±1 sec. Hot start is acceptable	1st hour 81° ±5°F.Followed by 10 hours 73° ±13°F
Engineering Practice	Refer to manufacturers specific. for engine class	Urban route approved by Administrator	Correct malfunctions when possible	Manufacturers range or specification	Fuel system should lose not more than 2" H_2O at 14" H_2O in 5 min.			

Table 1-1. FEDERAL EMISSION TEST PROCEDURE
Vehicle Preparation and Preconditioning
(Continued)

PROCEDURE ITEM	RECEIVE VEHICLE	PRE-CONDITIONING AMA	DRIVEABILITY	VEHICLE INSPECTION	VEHICLE & ENGINE PREPARATION	TEST FUEL ADDED	PRE-CONDITIONING FEDERAL CYCLE	11 HOUR AMBIENT SOAK
QUALITY PROVISIONS	Inspection form completed and signed			Calibration of engine test equipment		Color coded fuel pumps and vehicle tags and fuel inlets. Fuel analysis	Monitor temperature and inspection of drivers trace. Dyno Calibration	Monitor temperature in soak areas
TEST INVALID	Engine or vehicle parts missing or disconnected	Failure to complete route. Accident.	Engine malfunction, brake failure, vehicle unsafe.	Incorrect engine parameters	Failure to seal system. Fuel system leaks	Incorrect fuel added. Fuel out of specification	Temperature outside limits Drivers trace outside limits	Temperature outside limits Starting engine gine during soak
CORRECTIVE ACTION	Vehicle returned to manufacturer.	Reschedule vehicle. Repair or replace vehicle.	Return to manufacturer or supplier.	Adjust under manufacturers supervision	Return to manufacturer	Drain tank and refuel with correct fuel	Reschedule test	Reschedule vehicle. Correct temperature control.
TRAINING OR SKILL REQUIRED	Engine system training	Normal driving skills	Driveability characteristic training	Mechanic	Installation procedures training	None	Dynamometer cycle drivers training	None
RESPONSIBLE OPERATIONS	Receiving inspection Production Control	Testing Operations	Testing Operations	Testing Operations Support Operations	Testing Operations	Testing Operations Support Operations	Testing Operations Support Operations	Testing Operations Building Maintenance

Table 1-2. FEDERAL EMISSION TEST PROCEDURE
Evaporative Emission Collection and Measurement

PROCEDURE ITEM	DRAIN FUEL	INSTALL CARBON CANISTER	ADD TEST FUEL	DIURNAL EVAP TEST HEAT BUILD	DYNAMOMETER PREPARATION	RUNNING LOSS TEST	1 HOUR HOT SOAK LOSS	CANISTER WEIGHT
BRIEF DESCRIPTION	Residual fuel is drained from tank after 11 hour soak.	The carbon canister traps the emissions from the fuel system. Schematics A75-3, A75-4, A75-5, A75-6	A specified test fuel with known composition is added to the tank, Indolene 30 or Indolene HO	Fuel vapors emitted as a result of a specific increase in fuel tank temperatures in a specified time are collected. Record ambient and fuel temperature	The vehicle is placed on the dynamometer without starting the engine and the necessary connections are made	Fuel vapors are collected during operation of the vehicle under the specified test schedule	Fuel vapors are collected for 1 hour beginning immediately after the engine is turned off.	The collected vapors are determined by weighing the canister before and after the test.
FEDERAL REGISTER PARAGRAPHS	85.075-13	85.075-13, 21	85.002, 85.075-10, 13	85-075-13	85.075-13	85.075-13	85.075-13	85.075-27
EPA TEST PROCEDURE	TP-702	TP-702	TP-702	TP-705	TP-604	TP-706	TP-708	TP-708
SPECIFICATIONS AND TOLERANCES								
Federal Register	None	Capacity-300 ±2 ml. Length to diameter Ratio-1.4 ±0.1 Inlet and outlet tubes - 5/16 I.D., length 1 inch. leak tight at 2 PSI 30 sec., 150 ±10 gms. of charcoal conditioned at 300°F for 3 hours (1)	Charge 50-60°F Start 60 ±2°F End 84 ±2°F Time 60 ±10 min. Charge to 40% of nominal tank volume to nearest gallon	Temperature recorder, Range 50-100 ±1°F Thermocouple - Type J	Soak vehicle at 76-86°F for a min. of 1 hour before running loss test	See 1975 exhaust emission test Table 1.3 Vapors are not collected during 10 min soak or 505 second "hot" start test	Ambient temp. 76-86°F	Weighing accuracy equip ±75 mg weight determined to 20 mg.
Engineering Practice	Fuel pump cart of not more than 25 gallon capacity. Metts OSHA requirements.		Heating rate 4 ±1.5°F Per 10 min.	Heating blanket 2000 watts to cover min. 50% of liquid fuel	Max. total soak time from key off to key on - 20 hours	See Table 1.3		Metler P1200 or equivalent Readability 0.01 gram

(1) For more complete detail see Federal Register para. 85.075-21.

Table 1-2. FEDERAL EMISSION TEST PROCEDURE
Evaporative Emission Collection and Measurement
(Continued)

PROCEDURE ITEM	DRAIN FUEL	INSTALL CARBON CANISTER	ADD TEST FUEL	DIURNAL EVAP TEST HEAT BUILD	DYNAMOMETER PREPARATION	RUNNING LOSS TEST	1 HOUR HOT SOAK LOSS	CANISTER WEIGHT
QUALITY PROVISIONS	Check-off sheet signed by witness	Installation checked by team leader. Canister checked for leaks by comparing wt. before test with previous tare weight.	Ambient and fuel temp. Record checked by data validation (DV) step by step procedure check-off form signed by witness		Ambient temp. and soak time by DV.	See Table 1.3	Ambient temp. record checked by DV	Data checked by D.V.
TEST INVALID	Failure to drain tank. Starting engine.	Improper installation or canister leaks	Incorrect temperature, heating rate or time of heat application.		Failure to preset dynomometer load or warm up dynanomometer Incorrect ambient temperature	Failure to follow driving cycle within prescribed tolerances. See also Table 1.3	Failure to reconnect canisters after "hot" start test. Incorrect soak temp.	Negative weight gain is suspect.
CORRECTIVE ACTION	Reschedule	Correct installation. Reschedule if heat build had been started.	Reschedule		Reschedule	Reschedule	Reschedule evap. only.	Reschedule using freshly dried or new canister
TRAINING OR SKILL REQUIRED	Basic knowledge of fuel system.	Familiarity with EPA approved installation for engine family	Basic knowledge of heating and temp measuring equipment.		Knowledge of dyno procedures	Trained driver See Table 1.3	Knowledge of canister installation	Knowledge of balance operation.

Table 1-3. FEDERAL EMISSION TEST PROCEDURE
Exhaust Emission Test

PROCEDURE ITEM	DYNO WARM-UP AND HP SETTING	CONSTANT VOLUME SAMPLER (CVS)		DRIVING CYCLE	ANALYTICAL SYSTEM		DATA COLLECTION	DATA REDUCTION
BRIEF DESCRIPTION	The vehicle is placed on the dynamometer which has been previously warmed up and the hp set	CALIBRATION: The positive displacement pump is calibrated using a laminar flow element or equivalent.	OPERATION: An integrated portion of the total exhaust-air mix is collected during the driving cycle along with a sample of dilution air.	A driving cycle typical of urban driving is performed on the dyno according to the FR driving schedule.	CALIBRATION: Primary gas standards are used to establish the instrument curve	OPERATION: The bag samples collected by the CVS are analyzed for CO, CO_2, HC and NO_x.	Ambient conditions are recorded along with instrument outputs and operating parameters. Vehicle and test cell identification and other pertinent information.	The grams per mile are calculated for each component using the formula in the FR
FEDERAL REGISTER PARAGRAPH	Appendix II 85.075-15	Appendix III	85.075-20,-24	Appendix I 85.075-14,-15, -19,-24	85.075-23	85.075-23,-24	85.075-22,25	85.07-26
EPA PROCEDURE NUMBER	TP-604	TP-201	TP-706	TP-706	TP-203	TP-707,711	TP-707	TP-801
SPECIFICATIONS AND TOLERANCES Federal Register	Less than 2 hrs between tests - warm-up - 15 min @ 30 MPH within 1 hour of test. Hp setting - any time prior to test. For auto 1 hour prior for manual. Inflate tires to 45PSI. Use vehicle restraint to minimize rocking.	See Appendix III for equipment tolerances. Measure actual pump cavity pressure/temperature variation during calibration ±2°F gradual change. Leak-free connections.	CVS inlet pressure less than 1 in H_2O Heat exchanger ±10 degrees of set point temp acc. ±2°F. Flow rate 300-350 cfm. Dilution filters consisting of a charcoal filter between two particulate filters Press. guage ±3 mm. Bag sample flow rate 10 cfh. min. Specific sampling procedure FR-24.	Horsepower setting - see FR-15. Fan 18-12 inches in front or to provide sufficient cooling. Driving trace precision - ±2 mph within 1 sec. Shift points - see FR-16-17. Engine shutdown at 1369 seconds. Time between cold and hot tests 10 ±1 minute Engine starting FR-19 Ambient Temp 68-86°F	Calibration performed every 30 days. Zero gas impurity: 1 ppm HC 1 ppm CO 400 ppm CO_2 0.1 ppm NO_x O_2 13-21 mole% (AIR) Calibration Points: HC & NO_2 50 & 100% CO & CO_2 - 10, 23, 40, 50, 60, 70, 80, 100% of full scale. Analysis of gas ±2% of actual value. Curve construction - best judgement. Analyzer warmup - HC - 20 min. CO, CO_2, NO_x - 2 hours	Analysis performed within 20 minutes from end of sampling Zero and span instruments before and after sample measurement. Span gas should have conc of 80% of full scale.	All information is recorded according to measurement specifications.	Reported to three significant figures Density at 68° 1 atm. HC 16.33 NO_x 54.16 CO 32.97 CO_2 51.85

Table 1-3. FEDERAL EMISSION TEST PROCEDURE
Exhaust Emission Test
(Continued)

PROCEDURE ITEM	DYNO WARM-UP AND HP SETTING	CONSTANT VOLUME SAMPLER (CVS)		DRIVING CYCLE	ANALYTICAL SYSTEM		DATA COLLECTION	DATA REDUCTION
SPECIFICATIONS AND TOLERANCES (Continued) Engineering Practice	Allowable horsepower variation less than ±0.5 hp.	CALIBRATION:	OPERATION: Tailpipe ±5 in H_2O. Sample mix temp. at pump inlet 90-115°F Heat exchanger ±5°F of set point. Dilution inlet air 65°F min. P.70" H_2O max. Bag construction 5 f^3 tedlar film.	Preprinted or computer traced driving schedule. A minimum of 12 hour and maximum of 20 hour soak from key off to key on.	Calibration points: CO, CO_2 5 points & 0 across each range. Curve construction - within ±2% of each point value, smooth curve passing through zero (origin). Weekly calibration check.	Digital voltmeter readings of instrument output recorded on chart. Zero repeated after each span adjustment		NO and NO_2 reported separately corrected and uncorrected.
QUALITY CONTROL PROVISIONS	Calibration performed monthly with weekly checks. Correct setting for vehicle weight checked by data validation (DV). Time of previous test run is checked for dyno warm-up requirement.	Propane injection must agree within ±2% of calculated value. Daily propane injections plotted on control charts. Internal check of calibration data for uniformity.	Weekly performance checks of equipment Specifications DV checks each test for out-of-control operating conditions.	DV checks speed, time, trace, crank, time, amb. temp and all recorded information. Daily span check of driving aid. Driver performance audit.	Calibration gas analysis traceable to EPA gravimetric blends and/or NBS-SRM's. Inter-laboratory gas cross check. Annual restandardization of gases. Monthly instrument performance checks. CVS gravimetric injections.	Bags are leak checked before each test. NO_x converter efficiency check performed daily Analytical system given monthly performance inspection and preventative maintenance recorder checked against DVM each test.	DV inspects all recorded information for spurious results and facilitates the smooth and timely flow of test documentation.	Data reduction is usually performed by computer. Manual or independent check of the reduction program should be performed monthly & whenever change in program. Computer output checked by DV for corrections.

Table 1-3. FEDERAL EMISSION TEST PROCEDURE
Exhaust Emission Test
(Continued)

PROCEDURE ITEM	DYNO WARM-UP AND HP SETTING	CONSTANT VOLUME SAMPLER (CVS)		DRIVING CYCLE	ANALYTICAL SYSTEM		DATA COLLECTION	DATA REDUCTION
TEST INVALID	Failure to warmup dyno. Incorrect hp setting for weight. Vehicle exhaust not connected to CVS.	Calibration invalid if propane injection out of spec.	CVS flow rate too low - incorrect pump speed used. Equipment failure or out of spec. Filters plugged.	Driver outside specified limits during cycle. Improper starting - stalling procedure. Out of spec time sequence. Soak period to long or short.	Incorrect Standards or data used to construct curves.	Leak in sample bag detected may invalidate previous test. Incorrect span setting instrument malfunction such as span drift.	Incorrect data or information	Computer program or data input incorrect.
CORRECTIVE ACTION	Reschedule	Repeat propane injection. Refer to Appendix III for trouble shooting. Repeat calibration.	Reschedule	Reschedule Driver performance audit may be necessary	Repeat calibration. Generate new curve when data points out by more than ±0.5% deflection.	Repair or replace sample bag. Reschedule previous test. Reschedule if equipment fail-occurs.	Correct information when possible. Report all data and information errors. Reschedule if data is not correctable	Correct program or data input and repeat calculation.
TRAINING OR SKILL REQUIRED	Dyno operation	Special training in use of calibration equipment. Experience in emission testing.	Special training in CVS operation. Familiar with other test equipment and procedures.	Trained in special driving skills required	Special training in calibration procedure. Previous experience as system operator desirable.	Training in analytical system operation. Knowledge of test procedures	Data validation should be familiar with test procedure, basic statistical and technical knowledge is desirable.	Computer programing capability required if done in-house. Computer operations training.

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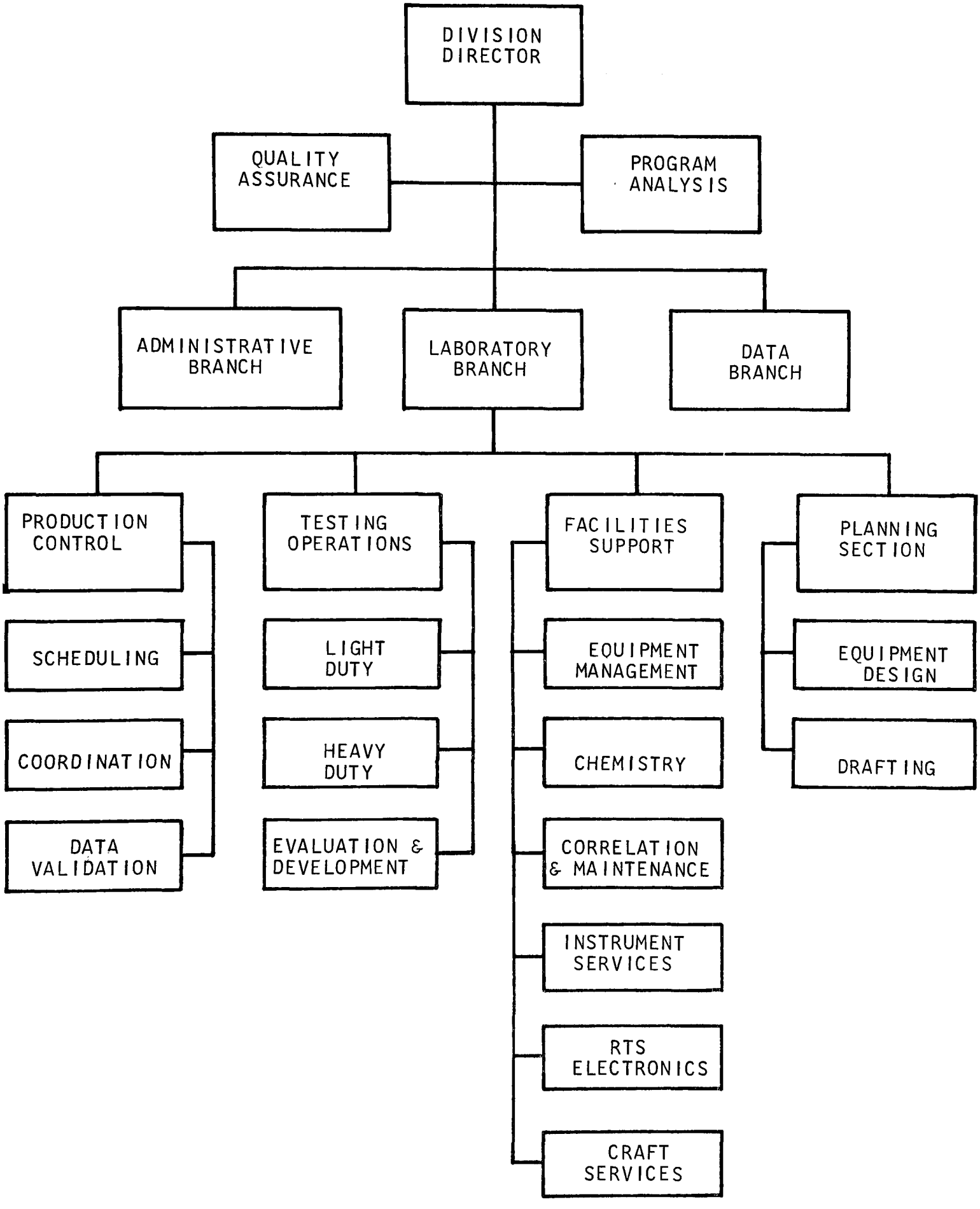

Table 1-4

Section 100

GAS BLENDING, FUEL ANALYSIS AND INVENTORY

EPA TEST PROCEDURE	Number TP-101	Page 1 of 10

SUBJECT

PREPARATION OF GRAVIMETRIC BINARY GAS MIXTURES

Reference C. D. PAULSELL DRAFT 8/1/73	**Data Form No.** 101-01, 02
Responsible Organization CHEMICAL ANALYSIS	**Computer Program** CYLBLEND
Test Witness QUALITY ASSURANCE REVIEW/REQUESTOR	**Performance Interval** AS REQUESTED
Type of Test Report GAS BLEND DATA SHEET	**Supersedes** NEW
Report Distribution QUAL. ASSUR., CORR. & MAINT., INST. SERV.	**Superseded by**

REMARKS/COMMENTS

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REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

This procedure outlines the equipment, blending process, and calculations necessary to generate binary gravimetric gas mixtures to be used as primary standards. The gravimetric technique is considered to be the most accurate method for the quantification of gases. Since the final data reported for emission measurement is in mass units it is of great importance that the primary standards be determined by mass rather than pressure or volumetric relationships.

2.0 TEST ARTICLE DESCRIPTION

Binary mixtures are prepared from pure components or blending mixtures of propane (C_3H_8), carbon monoxide (CO), carbon dioxide (CO_2) and nitric oxide (NO). Dilution of these gases is done with pure nitrogen or air.

3.0 REFERENCES

3.1 Procedure For Making Gravimetric Binary Gas Mixtures. EPA, C.D. Paulsell, 8/1/73.

3.2 Matheson Gas Data Book

3.3 "The Present State of The Art In The Preparation of Gaseous Standards", Scientific Gas Products, Inc.

3.4 "Handbook of Compressed Gases", Compressed Gas Assoc., Inc. Reinhold Publishing Corp., New York, N.Y.

4.0 REQUIRED EQUIPMENT

4.1 Cylinders: Marison 1CC3AA1800 Carbon Steel
5.25" O.D. x 13.75" Length Volume -
223 Cubic Inches

Stainless Steel NO_x Cylinders
3.75" O.D. x 13.0" Length
Volume - 110 Cubic inches

4.2 Valves: Brass, Sherwood Selpac B
G-5 3540 F9 CGA350

Stainless Steel Superior
CGA 660SS

4.3 Balance: Voland Model 1115 CDN
10Kg Capacity
1 Mg Accuracy

4.4 Weights: 2 sets (1 gram to 1 kilogram)
Calibration traceable to NBS

4.5 Blending manifold with pressure gauges to cover 0-30, 0-300, and 0-2000 PSIA and (1) vacuum gauge 0-5 PSIA

4.6 Vacuum Pump: 150 liter/min maximum capacity
Ultimate pressure 1 millitorr Hg absolute.

4.7 Pure Gases

- o Zero grade Air: 220-300 cubic feet
  2000-2600 P.S.I.G.
  Max. THC 0.1 PPMC
  0_2 19-23% Analyzed
- o Zero grade Nitrogen: 220-300 cubic feet
  2200-2600 P.S.I.G.
  Max. THC 0.1 PPMC
- o 0_2 free nitrogen for NO blend
- o Propane - Instrument Grade 99.5% minimum
- o Carbon Dioxide - Coleman - 99.8% minimum
- o Carbon Monoxide - Ultra high purity - 99.8%
  THC 1 PPMC
- o Nitric Oxide, C.P. Grade, 99.0% Min.

5.0 PRECAUTIONS

5.1 Gas blending should be attempted only by qualified personnel familiar with the chemistry of gases and blending equipment operations. Equipment damage, serious injury, or loss of life could occur from deviations from prescribed practices.

5.2 Personnel should be familiar with safe handling of compressed gases

5.3 Avoid sudden surges of gases when blending or transferring. Always "Bleed" gas slowly from one cylinder to another in order to minimize temperature changes.

5.4 Special precautions should be taken when blending combustible gases such as propane and CO with air. Only very low concentrations should be attempted i.e., less than 1000 PPM.

5.5 Attach only the diluent being used to the blending manifold (air or nitrogen).

5.6 All traces of combustible material such as oil, grease, and solvents shall be removed from the gauges, fittings, valves and tubing contained in the blending manifold. All manifold parts should be specified, "cleaned for oxygen service," when ordered.

5.7 Cylinder valves should be inserted with teflon lubricant only.

5.8 Never drop cylinder or weights onto balance pans or release quickly.

6.0 VISUAL INSPECTION

6.1 Cylinders:

- Check for valve or cylinder damage, especially the threads on the valve.
- Check the cylinder for dirt or other contamination

6.2 Blending Manifold:

- Check all tubing and the cylinder connections for loose or damaged fittings.
- Check gauges for proper atmospheric reading.

6.3 Balance:

- Check for any visual damage.
- Check weights for damage or contamination.

7.0 PREPARATION

7.1 Weights:

Remove all weights from the balance pans and case, dust them carefully and wipe any smears from the weights with a lint free cloth. Do not touch with hands.

The weights should be kept in their box when not in use and should only be handled with the transfer tool provided.

7.2 Balance:

Turn the vernier chain mechanism to zero and release the pans of the balance. Check the action of the pan arrest pads and adjust if necessary to achieve smooth operation. When the pans are stable, the indicator should read null. If it does not, adjust the zero knob to bring the needle to the null position. Arrest and release the pans several times to assure that the balance stabilizes in the null position. The balance point for the loaded pans should be within ±10 mg.

The weights are now ready to be cross checked on the balance to assure accurate determination under loaded conditions. Place the weights in the center of the pans as indicated below and note any deviations.

Left Pan	Right Pan
0	0
1	Vernier
1, 2	3
2, 3	5
2, 3, 5	10
2, 3, 5, 10	20
10, 20	30
20, 30, 2	50, 1, Vernier
20, 30, 50	100
0	0
20, 30, 50, 100	200
100, 200	300
200, 300	500
200, 300, 500	1000
0	0

7.3 Cylinders:

New cylinders or cylinders which have been recently revalved should be checked for leaks by pressurizing to 1800 PSIG with nitrogen. Some leaks are not apparent until the cylinder has reached its maximum pressur distortion. Check for leaks with "Snoop" or other device which will not leave a residue on the cylinder. Check valve stem, relief device and cylinder threads. Note results in cylinder log. Correct leaks if possible. If valve is leaking at the cylinder threads, the valve must be removed and reinserted. Do not attempt to tighten valve.

Cylinders which have previously been used for mixtures should be flushed with the diluent (air or nitrogen) as follows:

- Vent cylinder contents slowly in the hood being certain the hood blower is operating.
- Evacuate to 1.0 PSIA.
- Fill to 15 PSIG (30 PSIA) with diluent to be used.
- Vent the contents and evacuate. Repeat this purge to final evacuation 0.2 PSIA.
- Confirm that cylinder pressure is less than 0.2 PSIA.
- Close cylinder valve firmly and proceed to the blending procedure.

7.4 Blending Manifold:

With all vents closed on the manifold, pressurize all gauges to 25 PSIA and close off the manifold. Check all gauges for correlation and observe the readings for indicating leakage. Find and correct any leakage. This is especially important in preparation of NO blends. Small oxygen leaks will oxidize the NO to NO_2 and this can occur at manifold pressures above atmospheric. Leakage of the NO gas should be avoided because of its toxicity and transfer should be performed in a hood or well ventilated area.

8.0 TEST PROCEDURE

The preparation of gravimetric gas mixtures basically involves two procedures, blending and weighing. Blends are made according to the information contained on Form No. 101-01. This form must accompany the work order and be completed by the requestor. Refer to Reference 3.1 for calculation procedures. Test data is entered on Form No. 101-02.

Test Sequence	Test Description	Data Output
	Parent Blend Made From Pure Component	
101	Evacuate and purge with diluent (N_2 or Air, whichever will be used in the mixture) twice and then evacuate the cylinder to 0.2 PSIA. Close the cylinder valve and remove the vacuum line.	None
102	Wipe cylinder to remove the dust and place on the left pan of the balance.	Record cylinder number
103	Place a similar type cylinder on the right pan to compensate for buoyancy. This same cylinder must be used for all subsequent weight determinations. Record cylinder number in blending log book.	Log Book Entry
104	Add weights to right pan until null indicator shows a deflection. This will indicate that the null is within 1 gram of the weight. NOTE: If the blending cylinder should weigh less than the tare cylinder a weight must be added to the left pan. Do not remove this weight until all weighings have been completed.	None
105	Close balance door and obtain final null with vernier chain. Record sum of wts. on right balance and null vernier indicator weight. Secure and release pans to assure zero null.	Cylinder Weight Grams
106	Attach the cylinder to the minor component regulators. (This line should be equipped with a flow control valve.) Purge the line with the minor component up to the empty cylinder valve.	

Test Sequence	Test Description	Data Output
107	Set the regulator on the minor component to the pressure indicated under column shown P_1 PSIG on form 101-01. If pressure is less than atmospheric the blending manifold must be used and cylinder is filled using the pressure indicated under PSIA.	
108	With the flow control valve closed, open the cylinder valve. Bleed in the desired amount of pure component. If above atmospheric allow the cylinder to attain equilibrium with the regulated pressure.	
109	Close the cylinder valve, and shut off minor component. NOTE: To achieve 0.1% accuracy always add at least 5 grams of minor components. Reweigh the cylinder as in Sequence 102-105.	Weight after adding minor component
110	The cylinder is now ready for the addition of diluent. The cylinder is attached to the gauge manifold and the lines are purged with diluent up to the CGA fitting. When the 0-2000 PSIA gauge reaches a pressure higher than that of the cylinder (200 PSI), open the cylinder valve and fill it by regulating the diluent in 100 PSIA increment. Close the cylinder valve when the pressure gauge needle moves past the desired final pressure. The final pressure should be approximately 3% final pressure higher than desired to makeup for the pressure loss due to the cylinder cooling.	None
111	Shut off the diluent source and bleed the manifold before disconnecting the cylinder. Reweigh the cylinder as in sequence 102-105 after the cylinder has reached ambient temperature.	Weight after adding Major Comp.Grams
112	Record the three weights and submit the data for computation of mass ratio, concentration, and final pressure.	Initial Minor Final

Test Sequence	Test Description	Data Output
113	The parent blend should be mixed thermally for 1/2 hour by directing a heat lamp from a distance of 18-24 inches at the bottom of the cylinder which has been tilted 45° with the horizontal.	
114	If a dilution of the parent mixture is to be made, the same procedure is used except that the parent blend can be added to the empty cylinder by using a well purged regulator to obtain the approximate pressure needed to achieve the final concentration desired.	

9.0 DATA INPUT

Form 101-02 requires the following:

Blending Date
Components
Operators Initials
Cylinder Numbers
Cylinder weights (3) Initial, Minor, Final
Comments

10.0 DATA ANALYSIS

10.1 Submit data for analysis by "CYLBLEND" computer program.

11.0 DATA OUTPUT

11.1 Computer print out showing calculated mass ratio concentration. Forward with complete job request to requestor.

11.2 Compare specified value with calculated value. Check final cylinder pressure.

11.3 Check computer entries against original data form.

11.4 If cylinder was previously used, check to see that it has been deleted from the inventory list.

12.0 ACCEPTANCE CRITERIA

12.1 Calculated values should agree with specified within ±5%. If not determine cause and if final concentration is acceptable, correct and report the errors or failures.

13.0 QUALITY PROVISIONS

13.1 See Section 7.2 balance check.

13.2 NBS certified weights are used to check the working weights at six month intervals.

13.3 Gases used for blending are checked for purity when received from supplier.

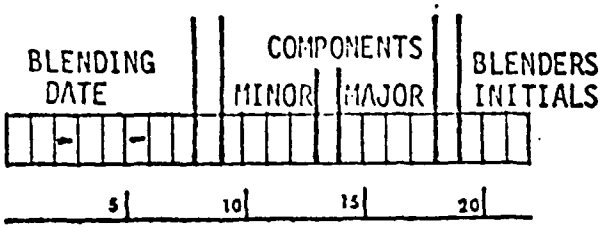
GRAVIMETRIC GAS BLENDS

SPECIFICATION DATA

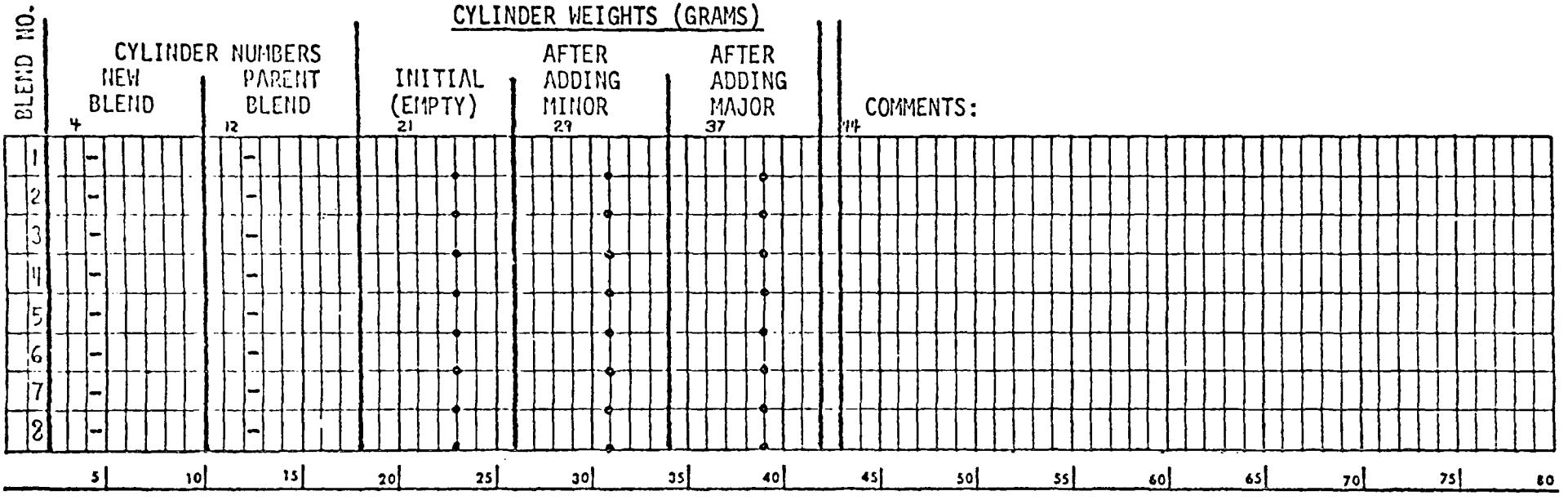
NOMINAL CONCENTRATION	COMP. MINOR / MAJOR	MINOR BLEND REQ'D.	PRESS. P_1 PSIG	PRESS. P_1 PSIA	APPROX. M_1 GRAMS		PRESS. P_2 PSIA	APPROX. M_2 GRAMS	MARISON CYL. SERIAL NO. USED

FORM 101-01

GRAVIMETRIC GAS BLENDS
INPUT DATA SHEET



COMPONENT SYMBOLS			
MINORS	C_3H_8	- PROPANE	(99.5%.MIN.)
	CO	- CARBON MONOXIDE	"
	CO_2	- CARBON DIOXIDE	"
	NO	- NITRIC OXIDE	"
	CH_4	- METHANE	"
MAJORS	AIR	- ZERO GRADE AIR	
	N_2	- ULTRA PURE NITROGEN	



NOTES: TWO SPECIAL PARENT CYLINDER NUMBERS ARE RECOGNIZED.
" -PURE " INDICATES A PARENT BLEND HAS BEEN MADE FROM PURE COMPONENTS.
" -VENT " INDICATES THAT THE CYLINDER REFERENCED HAS BEEN VENTED AND IS TO BE DELETED FROM THE FILE OF CYLINDERS.

MTS COMMAND: $ RUN SAQF: CYLBLEND. [SCARDS = *SOURCE*] [SPRINT = *SINK*]
DATA SETS MUST BE SEPARATED BY A SINGLE $ ENDFILE CARD.
TOTAL RUN TERMINATES ON TWO $ ENDFILE CARDS.

Form 101-02

EPA STANDARDS INVENTORY

GRAVIMETRIC GAS BLENDS

Propane in Air

3 ppm *
5 ppm
10 ppm *
15 ppm
25 ppm
50 ppm *
75 ppm
100 ppm *
150 ppm
200 ppm
275 ppm
350 ppm
500 ppm *
1000 ppm

Methane in Air

3 ppm
10 ppm
25 ppm
50 ppm
75 ppm
100 ppm
300 ppm
1000 ppm
20000 ppm P/N_2

Propane in N_2

100 ppm
200 ppm
400 ppm
600 ppm
800 ppm
1000 ppm
2000 ppm
3000 ppm
4000 ppm
6000 ppm
8000 ppm
10000 ppm P
15000 ppm
20000 ppm

CO in N_2

5 ppm
10 ppm
25 ppm
50 ppm*
100 ppm*
150 ppm
200 ppm
250 ppm
500 ppm*
750 ppm
1000 ppm*
1250 ppm
1500 ppm
2000 ppm
2500 ppm
3000 ppm
4000 ppm
0.5%
1.0%
1.5% P
2.5%
5.0%
7.5%
10.0%

CO_2 in N_2

0.2%
0.4%
0.6%
0.8%
1.0%*
1.5%
2.0%
2.5%
3.0%
4.0%
5.0%
7.0%
9.0%
11.0%
13.0%
15.0%*

NO in N_2

25 ppm
50 ppm *
75 ppm
100 ppm *
250 ppm *
500 ppm *
750 ppm
1000 ppm *
1500 ppm
2000 ppm
5000 ppm
20000 ppm

NOTE: The concentrations shown here are the nominal values (+0,-10%) which are to be generated, inventoried, and maintained as gravimetric standards.

SYMBOLS: P = Parent Blend
* = NBS Standard

Revision Date

*** GRAVIMETRIC GAS BLEND ANALYSIS ***

DATE: 05-11-74 MINOR COMPONENT: CO
BLENDER: JK MAJOR COMPONENT: N2

MEASURED DATA:

CYLINDER NO.	PARENT CYLINDER NO.	MEASURED CYLINDER WEIGHTS: EMPTY (GRAMS)	AFTER MINOR (GRAMS)	AFTER MAJOR (GRAMS)
G-11865	-VENT			
G-11832	-VENT			
G-11832	-PURE	79.095	85.832	430.388

CALCULATED DATA:

CYLINDER NO.	MINOR COMP. (GRAMS CO)	MAJOR COMP. (GRAMS N2)	MASS RATIO	BLEND CONC. (PPM)	CYL. PRESS. (PSIA)
G-11865					
G-11832					
G-11832	6.737	344.556	0.0191777	19181.750	1230.

COMMENTS DATA:

CYLINDER NO.	
G-11865	USED FOR CH4 / C3H8 BLEND ***CYLINDER NOT FOUND.
G-11832	ERROR IN PREVIOUS MASSES
G-11832	99.5% PURE SCOTT B-354

PROCESSED: 08:45.00 MAY 14, 1974

*** GRAVIMETRIC GAS BLEND ANALYSIS ***

DATE: 05-11-74 MINOR COMPONENT: CO
BLENDER: JK MAJOR COMPONENT: N2

MEASURED DATA:

CYLINDER NO.	PARENT CYLINDER NO.	MEASURED CYLINDER WEIGHTS: EMPTY (GRAMS)	AFTER MINOR (GRAMS)	AFTER MAJOR (GRAMS)
F-01363	-PURE	111.534	115.804	543.439
F-01364	G-11864	145.703	215.915	512.363
F-01366	G-11864	127.413	196.903	402.777
F-01367	G-11832	117.401	196.591	402.762
F-01369	-PURE	10.725	20.449	388.788
F-01370	-PURE	74.364	93.592	458.242
F-01372	-PURE	63.287	90.777	444.509
F-01374	-PURE	98.023	136.893	474.774

***MORE THAN 8 DATA CARDS.

CALCULATED DATA:

CYLINDER NO.	MINOR COMP. (GRAMS CO)	MAJOR COMP. (GRAMS N2)	MASS RATIO	BLEND CONC. (PPM)	CYL. PRESS. (PSIA)
F-01363	4.270	427.635	0.0098864	9888.500	1512.
F-01364	70.212	296.448	0.0031751	3175.768	1283.
F-01366	69.490	205.874	0.0041643	4185.219	964.
F-01367	79.190	206.171	0.0053221	5323.184	999.
F-01369	9.724	368.339	0.0257206	25725.941	1323.
F-01370	19.228	364.650	0.0500689	50099.020	1344.
F-01372	27.490	353.732	0.0721102	72124.563	1334.
F-01374	38.870	337.881	0.1031716	103191.375	1319.

COMMENTS DATA:

CYLINDER NO.	
F-01363	SCOTT 8582
F-01364	
F-01366	
F-01367	
F-01369	SCOTT 8582
F-01370	SCOTT 8582
F-01372	SCOTT 8582
F-01374	SCOTT 8582

PROCESSED: 08:45.00 MAY 14, 1974

CYLINDER	MASS RATIO	MAJOR	DILUTANT	CONCENTRATION	PRESSURE	BLENDING DATE
F-01374	1.0317E-01	CO	N2	103191.375	1319.	05-11-74
F-01372	7.2110E-02	CO	N2	72124.563	1334.	05-11-74
F-01370	5.0089E-02	CO	N2	50099.020	1344.	05-11-74
F-01369	2.5721E-02	CO	N2	25725.941	1323.	05-11-74
G-11832	1.9178E-02	CO	N2	19181.750	1230.	05-11-74
G-11842	1.6698E-02	CO	N2	16701.809	1494.	12-10-73
G-11871	1.6635E-02	CO	N2	16638.902	1505.	01-16-74
G-11864	1.6581E-02	CO	N2	16584.137	1534.	01-16-74
H-89471	1.6204E-02	CO	N2	16207.551	1526.	01-16-74
F-01363	9.8864E-03	CO	N2	9888.500	1512.	05-11-74
F-01367	5.3221E-03	CO	N2	5323.184	999.	05-11-74
F-01366	4.1843E-03	CO	N2	4185.219	964.	05-11-74
F-01364	3.1751E-03	CO	N2	3175.788	1283.	05-11-74
H-89456	2.8147E-03	CO	N2	2815.347	1595.	08-25-73
G-11841	2.4125E-03	CO	N2	2413.045	1547.	04-13-73
G-11833	1.8365E-03	CO	N2	1836.925	1512.	04-13-73
G-11831	1.4102E-03	CO	N2	1410.503	1565.	04-13-73
G-11849	1.2273E-03	CO	N2	1227.580	1516.	04-13-73
G-11829	9.9960E-04	CO	N2	999.817	1424.	04-13-73
G-11863	9.0102E-04	CO	N2	901.215	1443.	11-01-73
G-11856	7.0533E-04	CO	N2	705.482	1538.	04-13-73
H-89474	5.2208E-04	CO	N2	522.192	1447.	11-01-73
G-11828	4.8207E-04	CO	N2	482.176	1365.	11-05-73
G-11873	2.5628E-04	CO	N2	256.333	1526.	03-02-73
H-89475	1.9196E-04	CO	N2	192.006	1389.	08-25-73
G-11848	1.2663E-04	CO	N2	126.660	1475.	08-25-73
G-11838	1.0399E-04	CO	N2	104.014	1388.	11-01-73
G-11840	9.0859E-05	CO	N2	90.879	1328.	08-25-73
G-11825	5.0301E-05	CO	N2	50.312	1366.	11-01-73
H-89469	2.9838E-05	CO	N2	29.844	1023.	08-25-73
H-89460	9.1836E-06	CO	N2	9.186	1054.	08-25-73
G-11845	2.2610E-01	CO2	N2	15.682	1799.	09-25-73
G-11839	2.0178E-01	CO2	N2	13.862	1524.	09-25-73
G-11854	1.7216E-01	CO2	N2	11.691	1460.	09-25-73
G-11868	1.2928E-01	CO2	N2	8.635	1590.	09-25-73
G-11850	1.0236E-01	CO2	N2	6.768	1567.	09-25-73
G-11862	7.6649E-02	CO2	N2	5.019	1566.	09-25-73
H-89462	5.7714E-02	CO2	N2	3.753	1400.	09-25-73
G-11853	4.7014E-02	CO2	N2	3.045	1480.	09-25-73
G-11866	3.8004E-02	CO2	N2	2.453	1537.	09-25-73
G-11847	3.0567E-02	CO2	N2	1.968	1539.	09-25-73
G-11858	2.6188E-02	CO2	N2	1.683	1490.	09-25-73
H-89464	1.6787E-02	CO2	N2	1.075	1279.	09-25-73
H-89476	1.6008E-02	CO2	N2	1.025	1120.	02-22-74
G-11870	1.3044E-02	CO2	N2	0.834	1076.	02-22-74
G-11867	9.8799E-03	CO2	N2	0.631	1092.	02-21-74
H-89465	9.7052E-03	CO2	N2	0.620	1584.	09-25-73
G-11851	6.6281E-03	CO2	N2	0.423	1118.	02-21-74
G-11843	3.6106E-03	CO2	N2	0.230	1543.	02-21-74
G-11872	1.4404E-02	C3H8	AIR	9472.020	748.	03-02-73
G-11844	1.2420E-02	C3H8	AIR	8161.988	1435.	03-02-73
G-11837	1.8923E-03	C3H8	AIR	1238.997	1035.	03-02-73
H-89473	1.8520E-03	C3H8	AIR	1212.553	1639.	08-28-73
G-11846	7.0924E-04	C3H8	AIR	464.186	1023.	10-01-73
G-11860	6.5849E-04	C3H8	AIR	430.960	1247.	03-02-73

G-11861	6.2204E-04	C3H8	AIR	407.102	770.	03-02-73
G-11836	5.0664E-04	C3H8	AIR	331.554	1406.	03-02-73
G-11827	4.1203E-04	C3H8	AIR	269.635	1690.	03-02-73
G-11869	2.8330E-04	C3H8	AIR	185.388	1608.	03-02-73
H-89470	1.6471E-04	C3H8	AIR	107.778	740.	03-02-73
H-89459	1.5253E-04	C3H8	AIR	99.808	1229.	08-28-73
H-89466	1.1360E-04	C3H8	AIR	74.332	1014.	11-29-73
H-89457	9.4779E-05	C3H8	AIR	62.018	1015.	03-02-73
H-89480	6.7034E-05	C3H8	AIR	43.863	1068.	10-01-73
G-11835	3.7174E-05	C3H8	AIR	24.324	1011.	10-01-73
G-11857	2.2940E-05	C3H8	AIR	15.010	1010.	11-29-73
H-89472	1.3414E-05	C3H8	AIR	8.777	1042.	10-01-73
G-11852	9.5187E-06	C3H8	AIR	6.228	1432.	10-01-73
G-11826	4.6832E-06	C3H8	AIR	3.064	1486.	10-01-73
H-89458	1.6650E-04	C3H8	N2	105.791	1194.	08-28-73

PROCESSED: 08:45.05 MAY 14, 1974

EPA TEST PROCEDURE	Number TP-102	Page 1 of 9

SUBJECT

Calibration of Gas Mixtures (Gas Analysis)

Reference FR 85.075-23(a) (4)	**Data Form No.** 102-01
Responsible Organization Correlation & Maintenance	**Computer Program** CYLANAL
Test Witness /Review Requestor, Quality Assurance	**Performance Interval** See Below
Type of Test Report Computer Print Out	**Supersedes** New
Report Distribution Purchasing, Correlation & Maintenance	**Superseded by**

REMARKS/COMMENTS

1. Analysis of calibration gases are performed when the gases are received from a vendor, when requested by a contractor or manufacturer for correlation and traceability reasons and when an in-house gas is suspect for any reason.

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt.	Quality Assurance		
Administration	Procurement		
Lab. Branch	Supervisor		
Lab. Branch	Support Oper. Supv.		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To determine gas mixture concentrations by comparing them to known standards used as calibration gases, working gases and, in some cases, zero gases for the EPA laboratory, contractors, manufacturers.

2.0 TEST ARTICLE DESCRIPTION

A gas blend or mixture blend of two or more gases under pressure in a cylinder or other suitable container.

3.0 REFERENCES

3.1 Analytical instrument manuals

3.2 "Handbook of Compressed Gases", Compressed Gas Associaton, Inc., N.Y., N.Y., Reinhold Publishing Corp., Inc., 1966.

4.0 REQUIRED EQUIPMENT

4.1 Primary gas standards, verified, gravimetric, or NBS cylinders. Verified standards must be traceable to the EPA gravimetric standards by not more than one generation. Zero gas, air or nitrogen as required.

4.2 Analytical instruments with the following minimum specifications:

Sensitivity:	Full scale for the concentration to be determined.
Reproducibility:	1% of full scale, for successive identical samples.
Stability:	Electronic stability of $\pm$1% per 24 hours.
Response:	90% of scale in 0.5 seconds.
Dectector Type:	CO, CO_2 - NDIR: HC - FID, NO - CHEMI.

4.3 Sample handling system, manual or automatic, designed for a minimum hook up of 2 span gases, one zero gas and the gas to be analyzed. The system need not be equipped with a sample pump unless required but should have line filters, flow meters and pressure gauges. The materials of construction of the equipment prior to the instrument sample inlet should be of teflon, stainless steel and viton. Use best judgment for the instrument exhaust plumbing and equipment.

4.4 Pressure regulators, dual stage, outlet pressure to be regulated between 0-80 PSIG, inlet pressure rated at 4000 PSI with a gauge 0-3000 PSI. The regulator should be equipped with a purge port and safety relief port. Regulators used for nitrogen oxide or any other corrosive gas should be of stainless steel construction only, the other gases require brass with teflon or viton seals.

NOTE: Some regulators use a Buna N or other rubber type material for construction of the diaphragm. These should never be used for gas analysis for hydrocarbon or the zero gases.

4.5 Recorder to match the output of the analytical instrument.

4.6 Digital volt meter with the capability of reading the output to at least one significant figure (preferably two).

5.0 PRECAUTIONS

5.1 Check work order for adequate information of the sample to be analyzed such as I.D. number, nominal concentration, sample pressure, components to be analyzed and type of analysis.

5.2 Check the sample container for proper identification. Check high pressure cylinder for date of last pressure test. If longer than 5 years the cylinder should be returned to the vendor.

5.3 Be sure that the analytical system and the regulator purge lines are properly vented to a hood or other air removal system.

5.4 Excessively high flow rates or long analysis times should be avoided as this could use a large amount of span or sample gas.

6.0 VISUAL INSPECTION

6.1 Examine sample container for damage.

6.2 Check the container number against the work order for agreement.

6.3 Check the analytical system for loose lines, dirty filters or missing parts.

7.0 TEST ARTICLE PREPARATION

7.1 Attach a suitable pressure regulation device to the sample container.

7.2 Secure the container and check all fittings for leaks using liquid detector such as "Snoop".

7.3 Purge regulator and sample line through the venting system.

7.4 Turn on instrument and allow to reach temperature and electronic stability. Time will depend on instruments and previous history of use.

7.5 Select two span gases, one should indicate a value above the maximum concentration of the sample being evaluated and one below the minimal concentration of the sample. Neither span gas should exhibit values closer than ±10 percent of full scale of the sample concentration.

8.0 TEST PROCEDURE

Test Sequence	Test Description	Data Output
101	Zero instrument using the same flow, pressure and range as will be used for the span and sample gases. NOTE: Pressure should be measured closely as possible to the detector inlet.	0 ± 0.1 Reading
102	Span instrument using the highest concentration standard at 95% of scale	95.0 ± 0.2
103	Switch to zero gas. If instrument does not repeat zero, adjust and repeat 102.	0 ± 0.1
104	Repeat zero and span.	
105	Introduce second span gas and record deflection Repeat twice.	Average Deflection
106	Introduce sample gas at same flow and pressure as zero and span. Repeat twice. Reading should agree within ±0.2% of full scale.	
107	Introduce zero gas and both span gases. Previous readings should agree within 0.2% of full scale. If not repeat procedure.	None
108	Record data on form #102-01.	
109	If the sample gas deflection does not fall between the two points the gas may not be within the required tolerances. Select another set of standards, repeat #106 and 107 and document results.	

9.0 DATA INPUT

Form No. 102-01 requires the following information:

- o Data
- o Analyzer train no.
- o Mixture components
- o Analyzer vendor
- o Sample flow rate and pressure
- o FID pressure, air & fuel
- o Operators initials
- o Cylinder number analyzed
- o Nominal concentration
- o Analyzer setup data
  Low end concentration - meter deflection
  High end concentration - meter deflection
  Meter deflection of gas analyzed
- o Comments: Reference for standard gases used and zero gases.

10.0 DATA ANALYSIS

10.1 Determine if low point and high point concentrations are adequate to determine the sample concentration. Reliability of the data is a function of the separation of the two standards and the closeness to one of the two standards.

10.2 Determine that the deflection for the sample gas is between (or close to) the deflections for the bracketing standards.

10.3 Confirm that operating parameters are within normal or recommended specifications.

10.4 Check the calculated concentrations for apparent agreement with deflection.

10.5 Note comments for possible conflicts or indication of problems.

11.0 DATA OUTPUT

11.2 Data entered into cylinder inventory file.

11.3 Data sent to person or company by division representative requesting the analysis.

12.0 ACCEPTANCE CRITERIA

12.1 Instrument technician must determine that repetition of the zero gas is within ±0.1 deflection and that the span is within ±0.2 deflections.

12.2 Deflection for the sample gas must be between the deflections for the two standards.

12.3 The sample gas concentration determined must meet the blending specifications requested from vendor.

13.0 QUALITY PROVISIONS

13.1 Repetition of span and zero readings

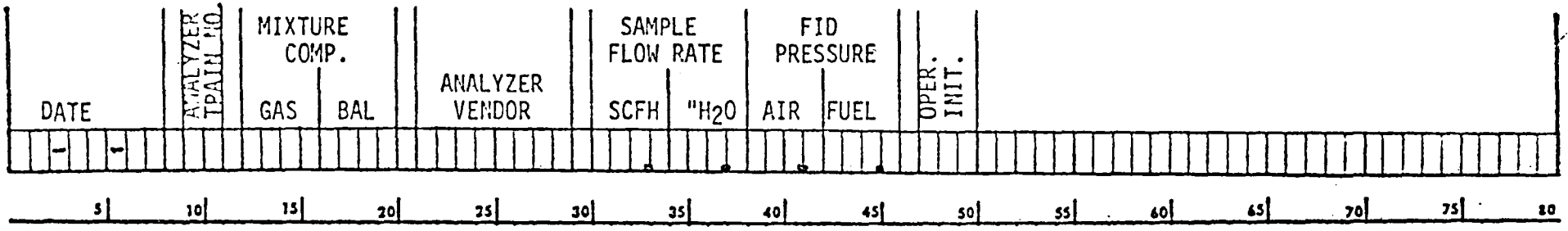
13.2 Repetition of sample readings

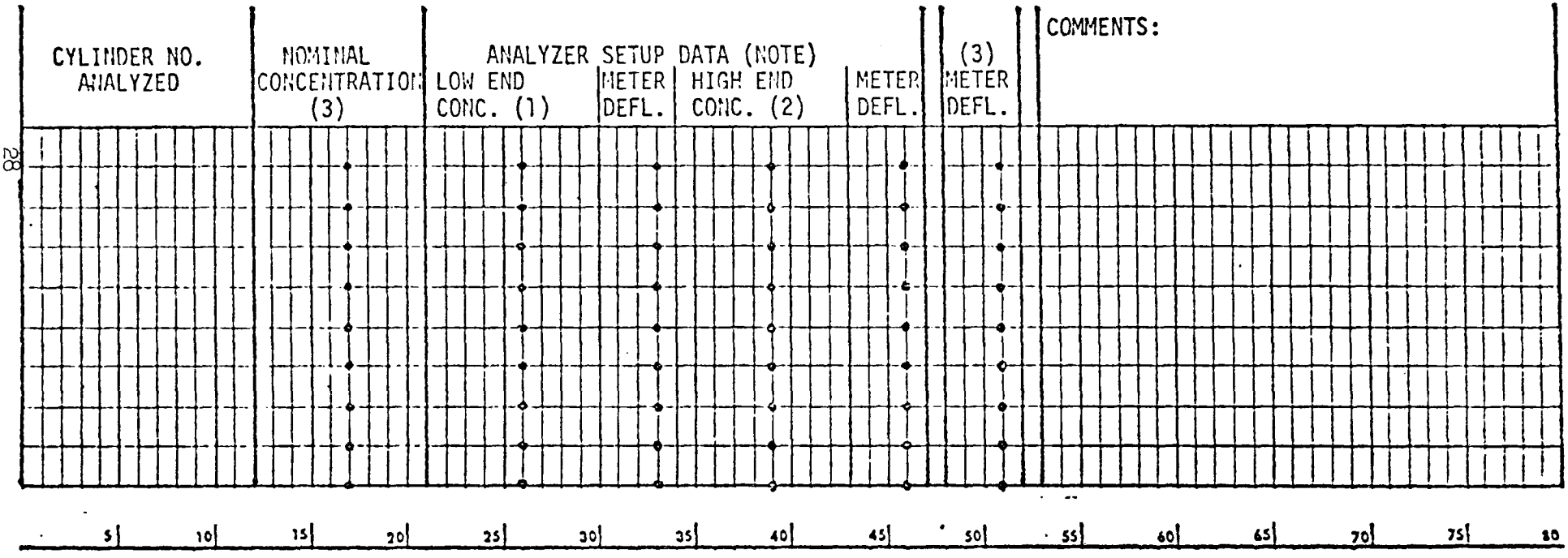
13.3 Repetition of span and zero after sample analysis

13.4 Data verification (10.0)

13.5 Acceptance criteria (12.0)

GAS BLEND ANALYSIS DATA





NOTE: Use verified, gravimetric, or NBS cylinders for analyzer setup values.

Form 102-01

Section 200

CALIBRATION

EPA TEST PROCEDURE	Number TP-201	Page 1 of 7

SUBJECT

CVS CALIBRATION PROCEDURE FOR POSITIVE DISPLACEMENT PUMP

Reference Federal Register, Vol. 38, No. 124, June 28, 1973, Appendix III, 85.075-20	**Data Form No.** 201-01
Responsible Organization Correlation and Maintenance	**Computer Program** SAQF:CALIBCVS
Test Witness Corr. and Maint. Technician/Quality Assurance	**Performance Interval** See Remarks
Type of Test Report Computer Print-Out	**Supersedes** New
Report Distribution Quality Assurance, Test Operations, Correlation & Maint.	**Superseded by**

REMARKS/COMMENTS

1.0 CVS must be calibrated every 0, 50, 100, 200, 400, 800, etc., hours of use or after major breakdown, cleaning and modification. The CVS will also be calibrated as required to meet specific contract requirements.

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt.	Quality Assurance		
Lab. Branch	Test Oper. Chief		
Lab. Branch	Facilities Support Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To measure the various parameters which must be assessed to establish the flow rate of the constant volume sampler pump. All the parameters related to the pump are simultaneously measured with the parameters related to a flowmeter which is connected in series with the pump. The calculated flow rate (ft^3/rev. @ pump inlet absolute pressure and temperature) can then be plotted versus a function that is the value of specific combinations of pump parameters.

2.0 TEST ARTICLE DESCRIPTION

A constant volume sampler which meets requirements stated in Federal Register 85.075-20.

3.0 REFERENCES

3.1 Federal Register, Vol. 38, No. 124, June 28, 1973, 85.075-20,-Appendix III

3.2 EPA, Ann Arbor, Preventive Maintenance Guidelines - Section I

4.0 REQUIRED EQUIPMENT

The following equipment is required to perform the CVS calibration:

4.1 LFE - Laminar Flow Element (calibrated by manufacturer)

4.2 Micromanometer (see 7.3 for calibration check)

4.3 Thermometer

4.4 Timing mechanism

4.5 U-tube Manometers

4.6 Temperature Indicator with "J-Type" thermocouples (see procedure #TP205 for calibration)

4.7 A variable flow restrictor with appropriate piping to connect CVS pump and LFE.

5.0 PRECAUTIONS

5.1 Special care should be taken in the initial set-up of the calibration equipment. Leaks in the system or faulty calibration equipment will void the calibration.

5.2 The variable flow restrictor valve should be placed in the "open position" at the start of the calibration. CAUTION: never completely close the valve while the pump is in operation; the motor may be damaged.

5.3 Temperature stability during the calibration is absolutely necessary. Air handling equipment must be shut off to avoid the normal 4°F oscillations. Gradual temperature increases (2°F are acceptable as long as they occur over a period of several minutes.

5.4 Thermocouples must be checked for accuracy using a laboratory grade thermometer.

6.0 VISUAL INSPECTION

6.1 Check LFE to CVS pump connections for loose fittings

6.2 Check manometers for level placement.

6.3 Check thermocouple connections for tightness.

7.0 TEST ARTICLE PREPARATION

7.1 Connect system as shown in Figure below.

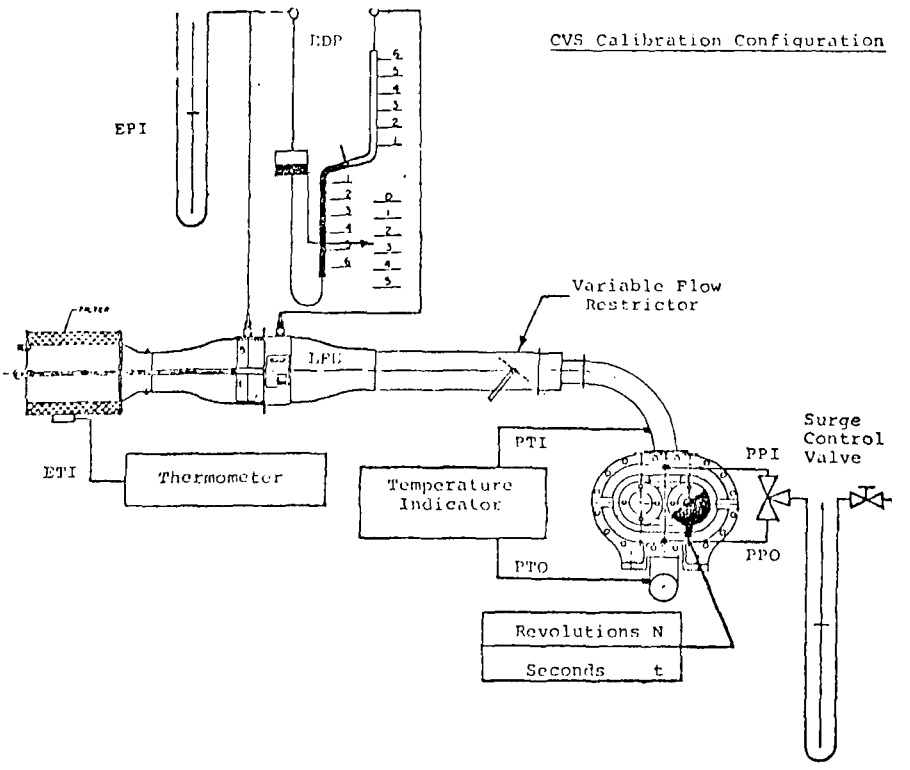


Figure 7-1

7.2 Connect the LFE and variable flow restrictor to the CVS. Carefully seal all connections to eliminate any leakage between the LFE and CVS pump. NOTE: Refer to previous LFE inlet ΔP, a major drop may indicate a leak in connection.

7.3 Position the micromanometer and level the base using the adjustable feet provided. Set the vertical and the vernier scales on zero and check the meniscus to assure that it is between the hairline reference marks. If not, adjust the fluid at the rear of the case until the meniscus is zeroed. Connect the LFE to the micromanometer and U-tube manometer with leaktight flexible tubing. (See Figure 7-1.)

7.4 Attach the thermometer to the filter of the LFE so that the temperature of the air entering the LFE is indicated.

7.5 Check that the zero level of the U-tube manometers and adjust their scales accordingly.

7.6 Check that the CVS timer starts and stops when the counter power button is pushed.

7.7 Connect the thermocouples to the CVS at the pump inlet and outlet as shown in 7.1. The fittings normally used for sampling, temperature, or sample dump connections may be used for thermocouples.

7.8 Start the CVS pump and open the U-tube manometer surge control valve 1/4 turn. Check the fluid column surge; adjust the valve to insure the fluid will not oversurge (most surge control valves have been replaced by a 20 gauge hypodermic capillary fitting.) when switched from vacuum to pressure. NOTE: Two manometers may be used to measure these differentials simultaneously.

7.9 With the CVS pump running (20 minute warmup), adjust the micromanometer to the null position by cranking the vernier down. Operate the revolution counter and timer to insure proper operation.

7.9.1 Check the revolution counter by measuring revolutions of the pump using a strobotac and comparing the total revs. indicated on the counter for a 3-minute period.

8.0 TEST PROCEDURES

The following data will be collected and recorded in order to calculate the CVS calibration curve.

Parameter	Symbol	Units	Tolerance (accuracy of data collected)
Barmetric Pressure (Corrected)	P_B	"Hg	±.01 "Hg
Ambient Temperature	T_A	°F	±.5 °F
Air Temperature into LFE	ETI	°F	±.1 °F
Pressure depression upstream of LFE	EPI	"H_2O	±.05 "H_2O
Pressure drop across LFE meeting matrix	EDP	"H_2O	±.005 "H_2O
Air temperature at CVS pump inlet	PTI	°F	±.5 °F
Pressure depression at CVS pump inlet	PPI	"Fluid	±.05 "Fluid
Specific Gravity of Manometer fluid	Sp.Gr.	"Fluid	±.05 "Fluid
Pressure differential at CVS pump outlet	PPO	"Fluid	±.05 "Fluid
Air temperature at CVS pump outlet	PTO	°F	±.5 °F
Pump revolutions during test period	N	Revs.	±0
Elapsed time for test period	t	Secs.	±.05 Secs.

Test Sequence	Test Description	Data Output
101	Set variable restrictor valve in the wide open position and run CVS pump for 20 minutes	-0-
102	Start counter and timer	
103	Read air temperature at CVS outlet	PTO, ^{o}F
104	Read pressure depression at CVS pump inlet	PPI, "Fluid
105	Read pressure differential at CVS pump outlet	PPO, "Fluid
106	Read ambient temperature	T_A, ^{o}F
107	Read barometric pressure (corrected)	P_B, "Hg
108	Read air temperature at CVS inlet	PTI, ^{o}F
109	Read pressure depression upstream of LFE	EDP, "H_2o
110	Read air temperature in LFE	ETI, ^{o}F
110A	Read ΔP across the LFE matrix	EDP, "H_2o
111	Read pump revolutions for test period	N, Revs.
112	Record elapsed time for test period	t, secs.
113	Reset the restrictor valve to a more restricted condition. A change of about 4"H_2O is adequate to yield a minimum of six data points	
114	Allow system to stabilize for a minimum of 3 minutes	-0-
115	Repeat steps 102 through 114 until sufficient data points have been established	-0-
116	Adjust temperature controller and temperature recorder on the CVS to indicate the proper inlet temperature. Disconnect the micromanometer and recheck zero setting	
117	Disassemble the calibration setup and reconnect all pipes and fittings as used in NORMAL CVS operation. Check sample flow rates and other indicators for normal operation	

9.0 DATA INPUT

9.1 Complete data form 201-01
9.2 Submit data sheet for analysis.

10.0 DATA ANALYSIS

10.1 Analyze data using SAQF:CALIBCVS
10.1.1 These are linear fits of V_o vs. X_o and RPM vs ΔP.

11.0 DATA OUTPUT

11.1 Printed computer output
11.2 CVS coefficients for storage in Instrument Data File.

12.0 ACCEPTANCE CRITERIA

12.1 Verify new curve against previous curve and tracer gas readings previously obtained.

12.2 All V_o measured values must lie within ±0.50% of the calculated V_o values. All RPM measured speeds must be within ±0.25% of the calculated RPM values.

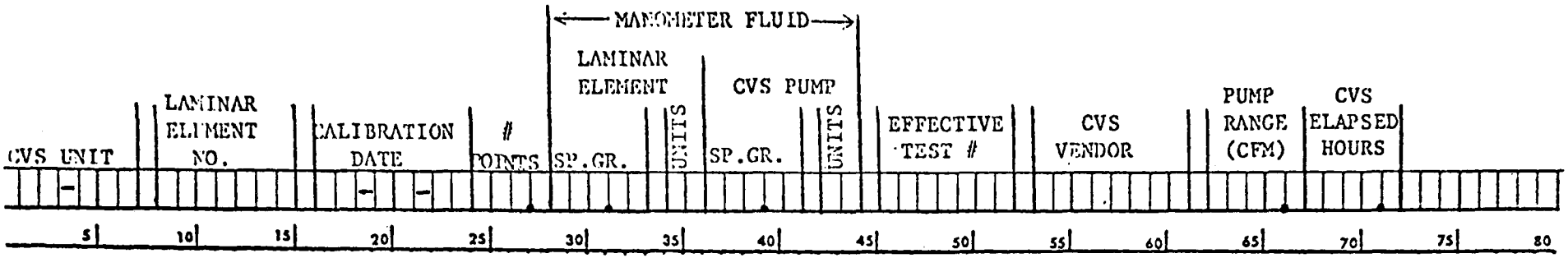
12.3 Check and verify that the V_o vs X_o intercept is approximately 350 ft^3/rev and the RPM vs ΔP intercept is related to the synchronous speed of the blower motor.

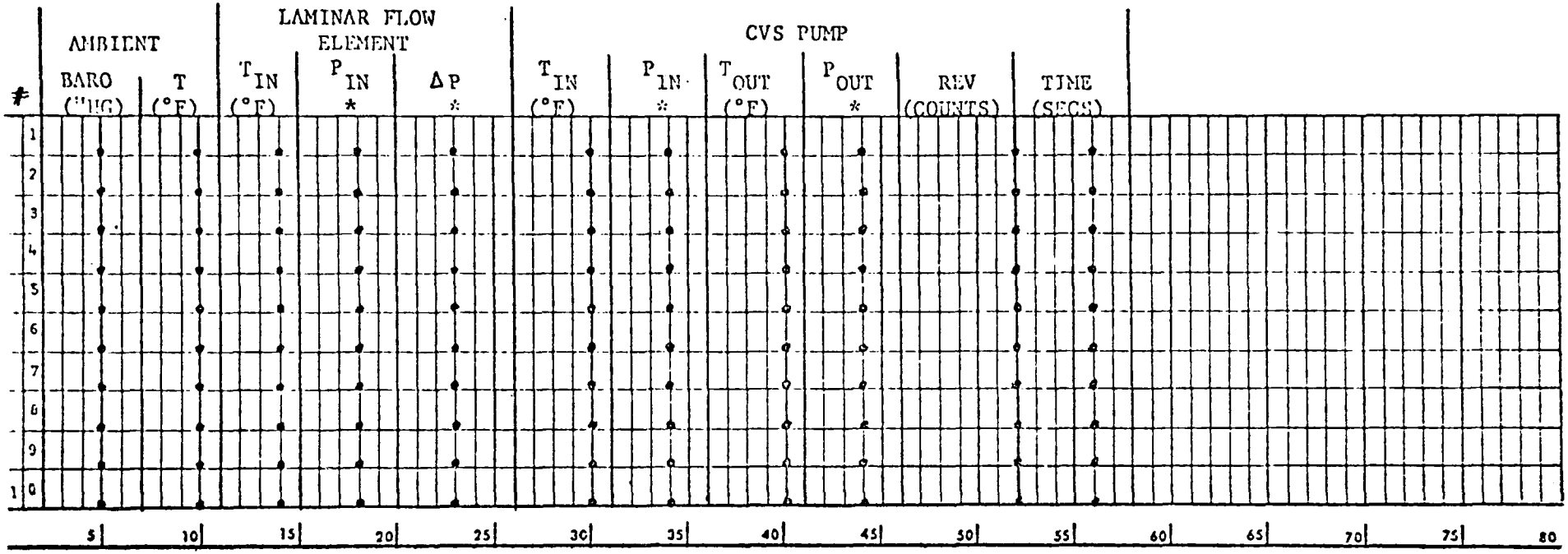
13.0 QUALITY PROVISIONS

13.1 An excessive shift from old curve to new curve may constitute an invalid test, therefore an investigation of cause should be implemented.

13.2 Corrective action must be implemented if malfunctions are found and the procedure must be repeated.

CVS CALIBRATION DATA SHEET





*NOTE: Indicate manometer units and fluid specific gravity on card one.

UNITS: IN = Inches
CM = Centimeters
MM = Millimeters

Form 201-01

CVS FLOW CALIBRATION

****
* CVS-09C *
****

LAMINAR ELEMENT: Y72291R
CVS VENDOR: AMI
PUMP RANGE: 300 CFM

CALIBRATION DATE: 07-13-74
EFFECTIVE TEST #:
CVS ELAPSED HOURS: 1080.9

MANOMETER SPECIFICATIONS:
LAMINAR ELEMENT: IN. OF 1.00 SPECIFIC GRAVITY FLUID
CVS PUMP: IN. OF 1.75 SPECIFIC GRAVITY FLUID

MEASURED DATA:

AMBIENT		LAMINAR ELEMENT			CVS PUMP					
BARO	T	T (IN)	P (IN)	DELTA P	T (IN)	P (IN)	T (OUT)	P (OUT)	REV COUNTS	TIME (SECS)
29.21	82.0	83.4	4.85	7.594	80.0	17.70	0.0	19.40	6299.	257.30
29.21	83.0	83.4	4.75	7.510	81.0	19.30	0.0	19.00	6187.	253.30
29.21	83.0	83.5	4.65	7.414	81.0	21.30	0.0	18.70	6516.	267.20
29.21	83.0	83.5	4.55	7.303	81.0	23.35	0.0	18.35	6278.	257.60
29.21	83.0	83.6	4.50	7.221	80.0	25.10	0.0	18.10	6138.	252.20
29.21	83.0	83.8	4.45	7.118	80.0	27.40	0.0	17.75	6213.	255.70
29.20	83.0	84.0	4.35	7.046	80.0	29.00	0.0	17.55	6125.	252.40

CALCULATED DATA:

X	CF/REV ACTUAL	CF/REV CALC	CALC/ACT	SCFM	PUMP DIFF	RPM ACT	RPM CALC	CALC/ACT
.000265	0.2902	0.2903	1.0003	376.0	4.78	1466.5	1466.8	1.0001
.000270	0.2901	0.2898	0.9990	372.0	4.94	1465.5	1465.4	0.9999
.000276	0.2897	0.2891	0.9981	367.3	5.16	1463.2	1463.6	1.0003
.000282	0.2886	0.2885	0.9997	362.0	5.38	1462.3	1461.7	0.9996
.000288	0.2877	0.2879	1.0008	357.9	5.57	1460.3	1460.1	0.9999
.000295	0.2872	0.2872	0.9997	352.7	5.82	1457.9	1457.9	1.0000
.000300	0.2870	0.2866	0.9986	348.9	6.00	1456.0	1456.4	1.0003

EQUATIONS:

RPM = (-.848182E 01 * DIFF) + (0.150733E 04)

CF/REV = (-.104931E 03 * X) + (0.318100E 00)

CF/REV = CUBIC FEET PER REVOLUTION @ ABSOLUTE INLET TEMP AND PRESSURE
X = (1/RPM) * SQRT(DIFF / ABSOLUTE OUTLET PRES)
DIFF = DIFFERENTIAL PRESSURE ACROSS THE CVS PUMP IN INCHES OF MERCURY

PROCESSED: 14:40.27 JUL 15, 1974

EPA TEST PROCEDURE	Number TP-202	Page 1 of 9

SUBJECT

DYNAMOMETER CALIBRATION

Reference Federal Register, Vol. 38, No. 124, June 28, 1973 Appendix II, 85.075-15(d)	Data Form No. 202-1
Responsible Organization Correlation and Maintenance	Computer Program DYNAHP
Test Witness/Review Corr. & Maint. Technician, Quality Assurance	Performance Interval Monthly
Type of Test Report Computer Print-Out	Supersedes New
Report Distribution Quality Assurance, Test Operations, Support Services, file	Superseded by

REMARKS/COMMENTS

NOTE: This procedure is in the revision phase by EPA, Ann Arbor. The final version will reflect new changes.

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Operations	Chief		
Lab Operations	Support Services Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

The purpose of the dynamometer calibration procedure is to insure that the indicated speed and the indicated absorbed power (torque) are correct and to determine the frictional loss characteristics of the dynamometer.

2.0 TEST ARTICLE DESCRIPTION

2.1 A direct drive chassis dynamometer, having the capabilities described in Federal Register 85.075-15.

2.2 Speed and torque (hp @ 50mph) meters and controls

3.0 REFERENCES

3.1 Federal Register, Vol. 38, No. 124, June 28, 1973 - Appendix II

3.2 EPA, Ann Arbor, Preventive Maintenance Guidelines, Section III.

3.3 SAE XJ1094 "Constant Volume Sampler System for Exhaust Emission Measurement," Section 3.7

4.0 REQUIRED EQUIPMENT

4.1 Test vehicle

4.2 Stroboscopic tachometer or electronic RPM counter (see manufacturer's manual for calibration procedure)

4.3 Adjustable DC power supply, upper value of at least 8 volts DC

4.4 Weight stand, Clayton

4.5 Weights, 35 pounds and 10 pounds

4.6 Tachometer generator assembly, Clayton

4.7 Varian 614A, strip chart recorder (see procedure #204 for calibration procedure)

4.8 Stopwatch or electric timer (±.1 sec.)

5.0 PRECAUTIONS

5.1 Inflate the rear tires to 45 psi to protect against blow-outs and to equalize the contact (especially important with front-wheel drive and radials)

5.2 Align vehicle on dynamometer. (Drive vehicle on to the dyno, with vehicle perpendicular to the rolls, insuring that the front wheels are centered to prevent the rear wheels from sliding off the rolls.)

5.3 Operate vehicle cooling fan within 12 inches of vehicle radiator.

5.4 Vent vehicle exhaust.

6.0 VISUAL INSPECTION

6.1 Check equipment set-up. (see sec. 7.0 and 8.0 for set-up instructions.

7.0 TEST ARTICLE PREPARATION

NOTE: Prior to calibration assure that the dynamometer is warmed up in accordance with procedure #TP-604

7.1 Speed Meter Calibration

7.1.1 Adjust mechanical zero of the speed meter with rolls stopped.

7.1.2 Place range switch to "LO" position.

7.1.3 Record dynamometer Serial Number.

7.1.4 Place vehicle on dynamometer and tie it down.

7.1.5 Engage flywheels for 4,000 pounds inertia.

7.1.6 Check index on the end of front roll for visibility.

7.1.7 Precondition the dynamometer by operating vehicle at 30 mph for 15 minutes.

7.1.8 Warm up strobotac and calibrate strobotac according to manufacturer's specifications.

7.2 Power Meter Calibration

7.2.1 All calibration steps take place with dynamometer rolls in stationary position.

7.2.2 Disconnect tachometer leads from torque bridge terminals.

7.2.3 Attach variable voltage power supply to the torque bridge terminals.

7.2.4 Adjust meter to zero with power supply off.

7.3 Determination of Actual Power Absorption

7.3.1 Inspect the dynamometer and service according to manufacturer's recommended procedure.

7.3.2 Install tachometer generator on the dynamometer frame. Line up the tach generator pulley with the shaft adaptor pulley on the front roll. Insure that the center to center pulley distance is the same as the factory installed tach generator.

7.3.3 Attach front roll tachometer generator electrical leads to Varian chart recorder.

7.3.4 Drive vehicle on dynamometer and attach vehicle restraint system.

7.3.5 Disengage roll brakes.

7.3.6 Adjust recorder zero.

8.0 TEST PROCEDURE

The dynamometer calibration is actually separated into three separate procedures. Therefore, the steps listed below are listed in three sections. Section I pertains to speed meter calibration; Section II covers power meter calibration and Section III outlines the determination of actual power absorption.

SECTION I. SPEED METER CALIBRATION

Test Sequence	Test Description	Data Output
101	Operate vehicle at front roll speed of 1,800 rpm Set strobe tach at 1,800 rpm flash rate and aim at the front roll index mark. Adjust vehicle speed to hold the mark steady at 1,800 rpm.	
102	When the front roll is steady at 1,800 check the speed meter display. ECE-50 with DD-VIF will indicate 46.3 mph if speed meter is calibrated correctly.	
103	If the meter indicates other than 46.3 mph, adjust the speed meter calibration pot in the readout instrument assembly, until speed meter indicates correct speed.	
104	Repeat steps 101 through 103. If readings will not repeat within ±0.5 mph without readjustment a malfunction must be reported. Necessary maintenance should be performed before continuing with calibration.	
105	Reduce roll speed to 900 rpm and hold steady. The speed indicated on the meter should be 23.15 (±0.5) mph. Any nonlinearity will be reported and corrected. (Perform necessary maintenance before continuing procedure.)	
106	When calibration is complete, attach calibration sticker to the back of speed meter.	

SECTION II. POWER METER CALIBRATION (TORQUE)

Test Sequence	Test Description	Data Output
201	Turn on power supply and adjust voltage to display 46.3 mph on the speed meter.	

Test Sequence	Test Description	Data Output
202	Install the weight stand (Arbor) on the Torque Arm. Tighten the attaching bolt.	
203	Level the torque arm by turning ball joints in or out of the load cell.	
204	**Place (one) 35 lb. weight and (one) 10 lb.** weight totaling 50 lbs. on the weight stand (Arbor wt. stand = 5 lbs.). Torque/ Power meter should show 50 ft. lbs. of torque. If meter does not show proper value, adjust the meter using the Torque Meter Calibration pot.	50 ft. lbs.
205	Repeat Step 204 substituting weights: (1) 10 lb. weight = 15 ft. lbs. torque and the weight stand itself 5 lbs = 5 ft. lbs. torque on meter. The nonadjusted torque readings should agree within ±1 ft. lb. of torque. If meter does not agree within limits without readjustment, a malfunction should be reported.	15 ft. lbs. 5 ft. lbs.
206	After completing the calibration with no malfunctions, a calibration sticker should be placed on the meter.	

SECTION III. ACTUAL POWER ABSORPTION CALIBRATION

Test Sequence	Test Description	Data Output
301	Accelerate vehicle to 60 mph and hold steady. Calibrate the chart recorder at 60 mph full scale.	
302	Check the calibration of chart at 55, 50, and 45 mph. Insure that 55 and 45 mph points are easily identified.	55 = __divis. 45 = __divis.
303	Bring the vehicle to a complete stop and re-zero the recorder.	

Test Sequence	Test Description	Data Output
304	Measure the recorder chart speed with a stop-watch or other timing mechanism. This should be repeated at least 3 times for an accurate measurement of the distance the paper travels in one (1) minute. NOTE: Alternate method of measuring elapsed time: Direct measurement of time elapsed between 55 mph and 45 mph can be accomplished by starting electronic timer at 55 mph and stopping at 45 mph. This method will eliminate interpolation of chart method.	Chart Speed (inches/mins)
305	Set dynamometer inertia at 1,500 lbs. (Insure that rolls are stationary.)	--
306	Accelerate vehicle to 50 mph and hold steady. Set the Hp (torque) to lowest obtainable value.	Hp
307	Increase speed to 60 mph and use a winch or alternate means to pull vehicle off the front drive roll. Release accelerator and allow vehicle to decel (caution: insure rear wheels are completely clear of drive roll).	
308	Measure and record the elapsed time it takes the front roll to slow from 55 mph to 45 mph.	Time secs., IHP
309	Loosen the winch and allow vehicle's rear wheels to contact the front roll. Match the front roll speed and vehicle speed as closely as possible to prevent tire damage.	--
310	Repeat Steps 307-309 so that two measurements are taken at even 500 lb. increments of inertia starting at 1,500 lbs. and ending with 5,500 lbs.	Elapsed Time IHP
311	Stop vehicle and check recorder zero.	
312	Operate vehicle at 50 mph and set Hp at 8.0 indicated Hp.	
313	Repeat Steps 307-309 so that two readings are taken at each inertia setting, at 8.0 indicated Hp.	Elapsed Time
314	Repeat Step 311.	

Test Sequence	Test Description	Data Output
315	At a steady 50 mph reset Hp to 14.0 indicated horsepower.	
316	Repeat Steps 307-309 in order that two readings are taken at each inertia at 14.0 indicated horsepower.	Elapsed Time
317	Remove vehicle from dyno and restore all equipment to normal operating conditions.	

9.0 DATA INPUT

9.1 Complete form No. 202-01. Submit the form and recorder charts to the Data Branch for analysis

9.2 Transfer information to data cards for computer input.

10.0 DATA ANALYSIS

10.1 If a chart speed of 6 inches/minute or faster, elapsed time measurements for coastdowns are made from the chart. To make this measurement, the distance between the point the trace crosses the 55 mph speed and the point the trace crosses the 45 mph speed is measured to the nearest 0.01 inch. This distance is then divided by the chart speed.

10.2 A manual curve plot of actual power versus indicated absorber power (P_{Hp} vs P_{ind}) is made for each inertia setting.

10.3 Final analysis is made by computer program DYNAHP.

11.0 DATA OUTPUT

11.1 Computer print-out of inertia weight (1,500 to 5,500 lbs.) and indicated horspower per Federal Register requirements shown in paragraph 85.075-15(d).

12.0 ACCEPTANCE CRITERIA

12.1 New calibration curve should be within ±1/2 horsepower of previous calibration (SAE XJ 1094)

12.2 Compare graph plots of calibration results with the computer output to insure the data is accurate.

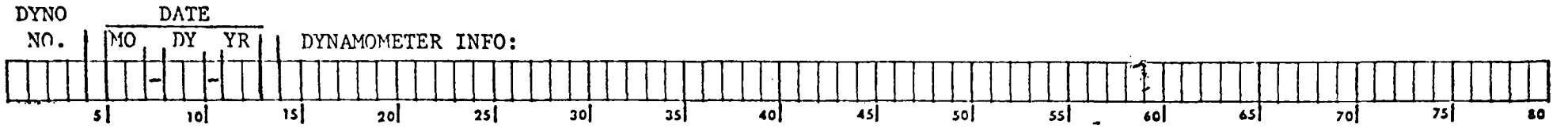
13.0 QUALITY PROVISIONS

13.1 If any malfunctions are reported for speed meter or torque meters, insure the proper corrective maintenance is performed and a repeat calibration has been accomplished.

13.2 If calibration does not agree with 12.1 above, reject calibration.

13.3 Perform necessary corrective maintenance or action and repeat the calibration.

DYNAMOMETER CALIBRATION



CARD NO.	IND HP	INERTIA WT.	TIME; SEC.
2	40	1750	
3	40	2000	
4	40	2500	
5	40	3000	
6	40	3500	
7	40	4000	
8	40	4500	
9	40	5000	
10	40	5500	
11	80	1750	
12	80	2000	
13	80	2500	
14	80	3000	
15	80	3500	
16	80	4000	
17	80	4500	
18	80	5000	
19	80	5500	
20	140	1750	
21	140	2000	
22	140	2500	
23	140	3000	
24	140	3500	
25	140	4000	
26	140	4500	
27	140	5000	
28	140	5500	

51

PROGRAM: DYNAHP

FORM 202-01

03 02-04-74 18.8 HP 1800 RPM = 46.3 MPH

PROCESSED: 17:05.48 FEB 4, 1974 -

WT.	ACT. HP	IND. HP	WITH A/C
1750.	7.7	4.9	5.5
2000.	8.3	4.9	5.6
2250.	8.8	5.2	6.0
2500.	9.4	5.7	6.5
2750.	9.9	6.2	7.1
3000.	10.3	6.5	7.4
3500.	11.2	7.0	7.9
4000.	12.0	8.0	9.1
4500.	12.7	8.2	9.3
5000.	13.4	8.9	10.1
5500.	13.9	8.9	10.1
5500.	14.4	9.3	10.5

NOTE: LAST 5500 VALUE IS FOR WTS ABOVE 5751#

INPUT VALUES FOR
03 02-04-74 18.8 HP 1800 RPM = 46.3 MPH

WT	T	IND. HP	ACT. HP	CALC. HP
1750.	16.00	4.0	6.6	4.0
2000.	17.00	4.0	7.1	3.9
2500.	20.80	4.0	7.3	3.9
3000.	25.00	4.0	7.3	3.9
3500.	27.70	4.0	7.7	4.0
4000.	32.70	4.0	7.4	3.9
4500.	35.10	4.0	7.8	3.9
5000.	38.10	4.0	8.0	4.0
5500.	40.60	4.0	8.2	3.9
1750.	9.30	8.0	11.4	8.0
2000.	9.90	8.0	12.3	8.2
2500.	12.40	8.0	12.2	8.2
3000.	15.00	8.0	12.1	8.1
3500.	17.00	8.0	12.5	8.1
4000.	20.00	8.0	12.1	8.1
4500.	21.70	8.0	12.6	8.1
5000.	24.40	8.0	12.4	8.0
5500.	25.60	8.0	13.0	8.1
1750.	5.70	14.0	18.6	14.0
2000.	6.40	14.0	19.0	13.9
2500.	8.00	14.0	19.0	13.9
3000.	9.70	14.0	18.8	13.9
3500.	10.90	14.0	19.5	14.0
4000.	13.00	14.0	18.7	13.9
4500.	14.20	14.0	19.2	13.9
5000.	16.00	14.0	19.0	14.0
5500.	16.90	14.0	19.8	14.0

EPA TEST PROCEDURE	Number TP-203	Page 1 of 6

SUBJECT

GAS ANALYZER CALIBRATION CURVE GENERATION

Reference FEDERAL REGISTER, VOL. 38 NO. 209, Oct. 31, 1973 - 85.075-23	Data Form No. 203-01
Responsible Organization CORRELATION/MAINTENANCE	Computer Program SAQF: CURVEALL
Test Witness/Review QUALITY ASSURANCE	Performance Interval See Comments
Type of Test Report COMPUTER PRINT-OUT (DEFLECTION VS CONCENTRATION)	Supersedes New
Report Distribution QUALITY ASSURANCE, TEST OPERATIONS, CORRELATION AND MAINTENANCE	Superseded by

REMARKS/COMMENTS

1.0 Calibration should be performed every 30 days, after any maintenance requiring re-alignment or when called for specifically by contract requirement.

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Support Services Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

Measurement of exhaust components requires that the deflections obtained during the analysis be converted to concentrations as accurately as possible. This document describes the procedure to be used to construct calibration curves for the instruments which measure hydrocarbons, oxides of nitrogen, carbon dioxide and carbon monoxide.

2.0 TEST ARTICLE DESCRIPTION

The instruments being calibrated are mounted in a console with provisions for: analysis of the exhaust sample; recording the instrument outputs; and suitable gas supplies for spanning and zeroing the instruments.

3.0 REFERENCES

3.1 Federal Register, Vol. 38, No. 209, Oct. 31, 1973 - 85.075-23

3.2 SAE XJ1094, "Constant Volume Sampler System for Exhaust Emission Measurement," Section 4. (Proposed)

3.3 Operators Manuals for In Use Analyzers

4.0 REQUIRED EQUIPMENT

4.1 Exhaust gas analysis console, equipped with the following instruments:

4.1.1 Hydrocarbons by flame ionization
Beckman Model 400 or equivalent

4.1.2 Carbon monoixde by non-dispersive infrared (NDIR)
Bendix Model 8501B or equivalent

4.1.3 Carbon dioxide by non-dispersive infrared (NDIR)
MSA Model 202 or Beckman Model 315B or equivalent

4.1.4 Oxides of nitrogen by chemiluminescence
Teco Model 10A or equivalent

4.1.5 Flow controls for selecting and monitoring the gases

4.2 Zero gas meeting the requirements specified in FR 85.075-23 (a)(2).

4.3 Calibration (standard) gas mixtures traceable to NBS and/or EPA primary standards.

4.4 Chart recorders capable of 0-100 deflections with accuracy of ±1 percent, and a readability of ±1 percent.

4.5 Read-out device in percent of scale.

- o Computer interface
- o DVM
- o Meter

5.0 PRECAUTIONS

5.1 Safety - Reference safety manual "Safe Handling of Compressed Gases."

5.2 Meter chart reading, D.V.M. or other output devices should have a valid calibration tag.

5.3 Check that the proper set of standards are used for the particular range being calibrated as specified by Quality Assurance.

6.0 VISUAL INSPECTION

6.1 Verify that the instrument serial number is correct for the sample train.

6.2 Check instrument gain settings against those in the instrument log book.

6.3 Check instrument response time and noise level.

7.0 TEST ARTICLE PREPARATION

7.1 Check calibration gas mixture for proper cylinder and regulation pressures.

7.2 Special checks; Converter efficiency test procedure No. 303.

7.3 Adjust analyzers to optimum performance.

7.3.1 Reference analyzer operation manuals

8.0 TEST PROCEDURE

The calibration curve is constructed from the data collected as a result of performing the following sequence of steps:

Test Sequence	Test Description	Data Output
101	Zero the instrument using zero gas flowing at the same rate used for span and sample. The HC instrument must be zeroed with air, others with nitrogen or air.	ZERO DEFL.
102	Select desired range, introduce calibration gas with highest concentration for that range. Adjust output to reading obtained in previously monthly calibration or determine theoretical percent of scale (TPS) by $\frac{\text{Cylinder Conc.}}{\text{Range Conc.}} \times 100 = \text{TPS}$ TPS should never be greater than 99 percent.	RANGE
103	Introduce zero gas. If not zero, adjust.	ZERO DEFL.
104	Introduce highest span gas	CONCENTRATION/ DEFLECTION
105	Repeat 103	
106	When steps 103 and 104 can be repeated without adjustment, go on to 107. If not within a reasonable period of time, follow instrument diagnostic and maintenance procedures. Ref. 3.3.	
107	Introduce each successively lower span gas until zero is repeated.	CONC & DEFL.
108	Introduce each successively higher span gas until highest reading is obtained.	CONC & DEFL.
109	Repeat steps 107 and 108 until all readings agree within ±0.25%. If not possible, perform instrument diagnostic and maintenance procedures. Ref. 3.3.	
110	Record average of all readings except zero on data form # 203-01	DEFLECTIONS

Test Sequence	Test Description	Data Output
111	Record the following information on the data sheet date, analyzer, train no., gas analyzer, range no., full scale concentration, analyzer vendor, NDIR cell length, units, flow rate set point, FID pressures, gain setting, recorder type used, operators initials, also cylinder numbers, and concentrations.	SEE DATA SHEET

9.0 DATA INPUT

9.1 Complete form # 203-01.

9.2 Submit the form to the Data Branch for processing.

10.0 DATA ANALYSIS

10.1 Process data using "SAQF: CURVEALL"

11.0 DATA OUTPUT

11.1 Computer print of "Curveall Super Version" Recorder Deflection vs. Concentration.

12.0 ACCEPTANCE CRITERIA

12.1 Check for linearity of NOx and HC curves.

12.2 Insure that all calibration points fit within ±2% of the point value.

12.3 Insure that no major curve shift was indicated from last calibration.

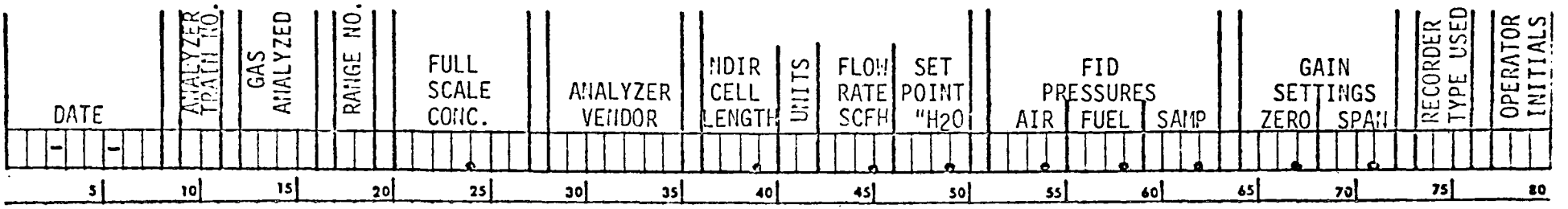
13.0 QUALITY PROVISIONS

13.1 If data does not follow "Acceptance Criteria", reject calibration and institute corrective action.

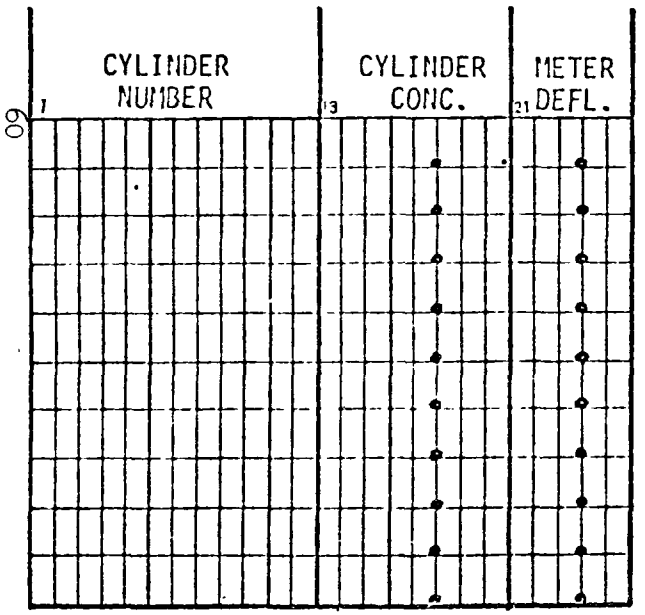
13.2 If data is acceptable and curve update is desired, check the appropriate space on the Curveall Verification sheet and return it to the Data Branch.

13.3 If data was unacceptable, upon completion of required corrective action, institute recalibration.

ANALYZER CALIBRATION CURVE GENERATION DATA



COMMENTS:



PROGRAM: SAQF:CURVEALL.
10-30-73

SYMBOLS AND ABBREVIATIONS

GASES - C_3H_8, CO, CO_2, NO_x, CH_4

CELL LENGTH UNITS - IN, CM

RECORDER TYPE - TI (Texas Instr.), HW (Honeywell), LN (Leeds & Northrup), DVM (Digital Voltmeter), MIS (Other).

RANGE NO. DESIGNATIONS

HC, CO, NO_x (PPM)

01 - 0 - 10
02 - 0 - 25
03 - 0 - 50
04 - 0 - 100
05 - 0 - 250
06 - 0 - 500
07 - 0 - 1000
08 - 0 - 2500
09 - 0 - 5000

CO, CO_2 (%)

01 - 0 - 1.0%
02 - 0 - 2.5%
03 - 0 - 5.0%
04 - 0 - 10.0%
05 - 0 - 15.0%

HEXANE NDIR

01 - 0 - 1000 PPM HEX
02 - 0 - 10000 PPM HEX

FORM 203-01

****
*** CURVEALL SUPER VERSION ***
****

CALIBRATION DATE : 05-20-75
ANALYZER TRAIN : 16
GAS ANALYZED : CO
RANGE NUMBER : 09
FULL SCALE CONC. : 5000.0
ANALYZER VENDOR : BECKMAN
NDIR CELL LENGTH : 0.0
SAMPLE FLOWRATE : 0.0 SCFH
MONITOR SET POINT: 13.0 "H20
FID AIR PRESSURE: 0.0 PSI
FID FUEL PRESSURE: 0.0 PSI
FID SAMP PRESSURE: 0.0 PSI
ZERO GAIN : 0.0
SPAN GAIN : 0.0
RECORDER TYPE : DVM
OPERATOR'S INIT. : RR
COMMENTS : 0-5000 PPM CO

EQUATION:
****

$$CO = X / (A + B*X + C*X^2 + D*X^3)$$

COEFFICIENTS:
****

(A)	3.3993E-02
(B)	-3.1195E-04
(C)	3.2324E-06
(D)	-1.7609E-08

CYLINDER NUMBER	RECORDER DEFLECTION (X)	CO CONCENTRATIONS CYLINDER	CALCULATED (Y)	% POINT DEVIATION
A2827	26.90	976.172	974.712	-0.15
MH1594	40.40	1576.669	1584.002	0.47
A8442	56.10	2396.885	2381.482	-0.64
A8397	71.80	3283.272	3302.510	0.59
A6146	83.90	4170.984	4158.727	-0.29
A9172	95.30	5182.027	5184.883	0.06

AVERAGE PERCENT OF POINT DEVIATION: 0.37

***PROCESSED: 15:43 MAY 20, 1975

***LOGGED ON LINE: 389
***ID: 16/2/09 05-20-75

RECORDER DEFLECTION : CONCENTRATION CO

0.0	0.0	25.0	894.79	50.0	2059.69	75.0	3512.82
0.5	14.78	25.5	915.68	50.5	2085.46	75.5	3546.59
1.0	29.69	26.0	936.67	51.0	2111.34	76.0	3580.62
1.5	44.73	26.5	957.76	51.5	2137.32	76.5	3614.92
2.0	59.91	27.0	978.96	52.0	2163.41	77.0	3649.49
2.5	75.23	27.5	1000.26	52.5	2189.60	77.5	3684.35
3.0	90.67	28.0	1021.67	53.0	2215.90	78.0	3719.49
3.5	106.25	28.5	1043.18	53.5	2242.32	78.5	3754.93
4.0	121.97	29.0	1064.78	54.0	2268.84	79.0	3790.68
4.5	137.81	29.5	1086.50	54.5	2295.47	79.5	3826.73
5.0	153.79	30.0	1108.31	55.0	2322.22	80.0	3863.10
5.5	169.90	30.5	1130.22	55.5	2349.09	80.5	3899.80
6.0	186.14	31.0	1152.23	56.0	2376.07	81.0	3936.84
6.5	202.51	31.5	1174.34	56.5	2403.17	81.5	3974.22
7.0	219.01	32.0	1196.54	57.0	2430.39	82.0	4011.96
7.5	235.64	32.5	1218.85	57.5	2457.74	82.5	4050.05
8.0	252.40	33.0	1241.25	58.0	2485.21	83.0	4088.52
8.5	269.29	33.5	1263.75	58.5	2512.80	83.5	4127.37
9.0	286.31	34.0	1286.35	59.0	2540.52	84.0	4166.61
9.5	303.45	34.5	1309.04	59.5	2568.38	84.5	4206.25
10.0	320.73	35.0	1331.83	60.0	2596.36	85.0	4246.30
10.5	338.12	35.5	1354.72	60.5	2624.49	85.5	4286.78
11.0	355.65	36.0	1377.70	61.0	2652.75	86.0	4327.69
11.5	373.30	36.5	1400.77	61.5	2681.15	86.5	4369.05
12.0	391.07	37.0	1423.94	62.0	2709.69	87.0	4410.87
12.5	408.97	37.5	1447.21	62.5	2738.37	87.5	4453.15
13.0	426.99	38.0	1470.57	63.0	2767.21	88.0	4495.93
13.5	445.14	38.5	1494.02	63.5	2796.20	88.5	4539.19
14.0	463.41	39.0	1517.57	64.0	2825.34	89.0	4582.97
14.5	481.80	39.5	1541.21	64.5	2854.64	89.5	4627.28
15.0	500.30	40.0	1564.95	65.0	2884.09	90.0	4672.12
15.5	518.93	40.5	1588.78	65.5	2913.71	90.5	4717.52
16.0	537.68	41.0	1612.70	66.0	2943.50	91.0	4763.49
16.5	556.55	41.5	1636.72	66.5	2973.46	91.5	4810.04
17.0	575.54	42.0	1660.83	67.0	3003.59	92.0	4857.20
17.5	594.64	42.5	1685.04	67.5	3033.91	92.5	4904.98
18.0	613.86	43.0	1709.34	68.0	3064.40	93.0	4953.40
18.5	633.20	43.5	1733.73	68.5	3095.07	93.5	5002.47
19.0	652.65	44.0	1758.22	69.0	3125.94	94.0	5052.23
19.5	672.21	44.5	1782.81	69.5	3157.00	94.5	5102.67
20.0	691.89	45.0	1807.49	70.0	3188.26	95.0	5153.83
20.5	711.69	45.5	1832.27	70.5	3219.73	95.5	5205.73
21.0	731.59	46.0	1857.15	71.0	3251.40	96.0	5258.39
21.5	751.61	46.5	1882.12	71.5	3283.28	96.5	5311.84
22.0	771.73	47.0	1907.19	72.0	3315.38	97.0	5366.09
22.5	791.97	47.5	1932.35	72.5	3347.70	97.5	5421.17
23.0	812.32	48.0	1957.62	73.0	3380.24	98.0	5477.10
23.5	832.78	48.5	1982.99	73.5	3413.02	98.5	5533.92
24.0	853.34	49.0	2008.45	74.0	3446.04	99.0	5591.65
24.5	874.01	49.5	2034.02	74.5	3479.31	99.5	5650.32

EPA TEST PROCEDURE	Number TP-204	Page 1 of 3

SUBJECT
CHART RECORDER/MAINTENANCE

Reference MANUFACTURER'S SERVICE MANUALS	Data Form No. INSTR. LOGBOOK
Responsible Organization INSTRUMENT SERVICES	Computer Program NONE
Test Witness/Review INSTRUMENT SERVICES LEADER/QUALITY ASSURANCE	Performance Interval MINIMUM: 90 DAYS
Type of Test Report CALIBRATION STICKER AND LOG BOOK ENTRY	Supersedes New
Report Distribution QUALITY ASSURANCE, INSTRUMENT SERVICES	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Support Services Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To perform periodic recalibration and maintenance after periods of use or questionable performance. Recalibration will assure accurate instrument output and prolong the useful life of the instrument.

2.0 TEST ARTICLE DESCRIPTION

2.1 Chart recorder, two channel model capable of measuring two variables on the same chart. The recorder is a continuous balance potentiometer which responds to a d-c signal representing the value of the measured quantity.

2.2 Typical chart recorders used may be:

- Honeywell 194 Electronik
- Varian G-14A-2
- Varian G-1110
- Hewlett-Packard 680
- Texas Instruments 4525-2, 7822-2 (4 pen)
- Texas Instruments 2596-2 (2 pen)

3.0 REFERENCES

Each recorder listed in 2.2 has a manual showing theory/operation, maintenance and calibration procedures. These manuals are available and should be reviewed by the instrument technicians.

4.0 REQUIRED EQUIPMENT

The list of equipment in this section represents an example of the articles needed to perform a valid calibration. It should be noted that manufacturers of specific equipment may list requirements for their own calibration items.

4.1 Example of calibration equipment

- Calibrated precision voltage source.
  Example: Honeywell Model 2746 portable potentiometer, 0-200 microvolt to 0-500 millivolt ranges.

- Test leads (preferably with banana plugs)
- Calibration screwdrivers (1/8" and 1/4" bits)

5.0 PRECAUTIONS

5.1 Calibration and adjustment of recorders should be accomplished by Instrument Service Technicians only.

5.2 Safety precautions should be observed in using electrical equipment.

6.0 VISUAL INSPECTION

6.1 Inspect slidewires for signs of wear.

6.2 Inspect RECORDER for disconnected leads and/or broken wires.

7.0 TEST ARTICLE PREPARATION

7.1 Set up calibration equipment as specified in applicable service manual.

8.0 TEST PROCEDURE

Each manufacturer of chart recorders outlines specific calibration procedures common to their product. Therefore, the test procedures for chart recorder calibration should be taken from the manufacturer's text. It is also suggested that routine maintenance should be accomplished prior to the calibration of each recorder.

9.0 DATA INPUT

9.1 The date of calibration, type of instrument, serial number, and work performed is recorded in instrument calibration log book (see attachment).

10.0 DATA ANALYSIS

10.1 Observed readings and calibration input should be compared.

11.0 DATA OUTPUT

11.1 Calibration sticker showing the date of calibration and the date the next calibration is due is attached to the recorder. Calibration data sheet shall be filed in the instrument file and logged in the record book.

12.0 ACCEPTANCE CRITERIA

12.1 Recorder must function within ±1 percent accuracy and repeatability following calibration.

13.0 QUALITY PROVISIONS

13.1 Check to assure calibration has been completed at proper time intervals.

13.2 Assure that calibration sticker has been placed on recorder.

TP-204 ATTACHMENT No. 1
INSTRUMENT SERVICES LOG BOOK

MAKE	MODEL	SERIAL NO.	DATE CALIBRATED	DATE DUE	TECH.	REMARKS
ESTERLINE	E1124E	940456	8-29-74	11-29-74	D.P	REPLACED INK PAD & PRINT WHEEL
"	"	940757	10-11-74	1-11-75	D.P.	1° LOW PRIOR TO CAL.
HONEYWELL	194 E	5103576E	12-7-74	3-7-75	J.F	GAIN HIGH PRIOR TO CAL
TEX. INSTR.	2596-2	T135701	12-9-74	3-9-75	( )	REPLACED SLIDE WIRE

EPA TEST PROCEDURE	Number TP-205	Page 1 of 4

SUBJECT

TEMPERATURE RECORDER CALIBRATION/MAINTENANCE

Reference MANUFACTURER'S SERVICE MANUAL	Data Form No. LOG BOOK
Responsible Organization INSTRUMENT SERVICES	Computer Program NONE
Test Witness/Review INSTRUMENT SERVICES LEADER, QUALITY ASSURANCE	Performance Interval MINIMUM: 90 DAYS
Type of Test Report LOG BOOK ENTRY AND CALIBRATION STICKER	Supersedes NEW
Report Distribution QUALITY ASSURANCE, INSTRUMENT SERVICES	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Support Services Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To perform periodic re-calibration and maintenance after periods of use and/or questionable performance. Re-calibration of temperature recorders will assure accurate instrument output and prolong the instrument's useful life.

2.0 TEST ARTICLE DESCRIPTION

Temperature recorders vary in make, however, the operating principles are generally the same. A temperature probe (normally iron-constantan thermocouple) senses the temperature and produces an unknown voltage which is in turn subtracted from a known voltage. The difference in voltages is amplified and displayed by the recorder

2.1 Temperature recorders vary in application, ranging from one channel to as many as 24 channels for measuring independent variables.

The following recorders are representative of the types used in emission monitoring.

- o Esterline Corp., 24-channel, Model E1124E
- o Honeywell, 24-channel, Model Elect. 19
- o Honeywell, multi-channel, Model Elect 15
- o Rustrax, single-channel, Model 2133

3.0 REFERENCES

Each recorder listed in 2.1 has a manual showing theory/operation, maintenance and calibration procedures. Manuals of this nature must be made available to the instrument technicians.

4.0 REQUIRED EQUIPMENT

The list of equipment in this section represents an example of the articles needed to perform a valid calibration. It should be noted that manufacturers of specific equipment may list requirements for their own calibration items.

4.1 Example of calibration equipment

- o Precision voltage source (used for input voltages from temperature-EMF equivalents) reference 0° C or 32° F.
- o Thermocouple extension wire
- o Ice bath for 0° C or 32° F reference.
- o Reference standard, Hewlett-Packard temperature indicator - Quartz digital

5.0 PRECAUTIONS

5.1 Dangerous stray voltages exist. Before touching connections, turn off power and check each terminal with a multimeter.

5.2 Calibration and adjustment of recorders should be accomplished by Instrument Service technicians only.

6.0 VISUAL INSPECTION

6.1 Inspect for obvious signs of wear.

6.2 Inspect for disconnected leads and/or broken wires.

7.0 TEST ARTICLE PREPARATION

7.1 Set up calibration equipment as specified in applicable service manual.

8.0 TEST PROCEDURE

Each manufacturer of temperature recorders outlines specific calibration procedures common to their product. Therefore, the test procedures for the recorder calibration should be taken from the manufacturer's text. It is also suggested that routine maintenance should be accomplished prior to the calibration of each recorder.

9.0 DATA INPUT

9.1 The date of calibration, type of instrument, serial number, and work performed is recorded in instrument calibration log book (see attachment).

10.0 DATA ANALYSIS

10.1 Compare observed temperature readings with the reference standard.

11.0 DATA OUTPUT

11.1 Calibration sticker showing the date of calibration and the date the next due calibration is attached to the recorder.

11.2 Information regarding the results of the calibration shall be filed with the instrument records.

12.0 ACCEPTANCE CRITERIA

12.1 Temperature recorder must indicate ambient temperature within ±2 degrees of the true value.

12.2 Temperature indicated must be within 1 percent of full scale at all points.

13.0 QUALITY PROVISIONS

13.1 If acceptance criteria are not met, repair instrument and/or repeat calibration.

TP-205 ATTACHMENT No. 1

INSTRUMENT SERVICES LOG BOOK

MAKE	MODEL	SERIAL NO.	DATE CALIBRATED	DATE DUE	TECH.	REMARKS
ESTERLINE	E1124E	940456	8-29-74	11-29-74	D.P	REPLACED INK PAD & PRINT WHEEL
"	"	940757	10-11-74	1-11-75	D.P.	1° LOW PRIOR TO CAL.
HONEYWELL	194 E	5103576E	12-7-74	3-7-75	J.[illegible]	GAIN HIGH PRIOR TO CAL
TEX. INSTR.	2596-2	T135701	12-9-74	3-9-75	[illegible]	REPLACED SLIDE WIRE

EPA TEST PROCEDURE	Number TP-206	Page 1 of 9

SUBJECT
BAROMETRIC PRESSURE
CALIBRATION AND CORRELATION

Reference Federal Register, Vol. 39, No. 101, May 23, 1974, 85.075-22(j)	Data Form No. Log Book
Responsible Organization Chemical Analysis	Computer Program None
Test Witness/Review Correlation and Maintenance	Performance Interval Monthly
Type of Test Report Log Book Entry	Supersedes New
Report Distribution Chemistry Section, Support Services	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt.	Quality Assurance		
Lab. Branch	Chief		
Lab. Branch	Support Services Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To calibrate the aneroid barometers used in the test call against a Fortin type barometer to assure accurate and uniform test cell readings.

2.0 TEST ARTICLE DESCRIPTION

Aneroid barometer compensated for temperature, brass, scale 25.1-31.1 inches of mercury (Hg), 0.02 subdivisions.

3.0 REFERENCES

3.1 PRINCO Barometer Instruction Booklet

3.2 W.G. Brombacher, D.P. Johnson, and J.L. Cross., "Mercury Barometers and Manometers" NBS Monograph 8, May 1960.

4.0 REQUIRED EQUIPMENT AND CONDITIONS

4.1 Fortin type barometer, 1/4 inch bore, reading by vernier to 0.01 in. Hg

4.2 Rack for hanging the aneroid barometers

4.3 Temperature controlled room of $\pm 3^{o}F$.

5.0 PRECAUTIONS

5.1 The Fortin type barometer readings are corrected for temperature and gravity. The aneroid barometer is set to the corrected barometer reading.

5.2 The aneroid barometers may indicate a slightly different reading from one cell to another due to variations in the air handling system. Large variations indicate a need for calibration or replacement.

5.3 Important factors which could affect the reading of the height of the mercury are

- Lighting - Proper illumination is essential to define the location of the crown of the meniscus. Precision meniscus sighting under optimum viewing conditions can approach $\pm$ 0.001 in. Contact between index and mercury surface in the cistern, judged to be made when a small dimple in the mercury first disappears during adjustment, can be detected with proper lighting to much better than $\pm$ 0.001 in.

- Temperature - To keep the uncertainty in height within 0.01% (0.003 in. Hg), the mercury temperature must known within

±1°F. Although it is generally assumed that the scale and mercury temperatures are identical, the scale temperature need not be known to better than ±10°F for comparable accuracy. Uncertainties caused by nonequilibrium conditions could be avoided by installing the barometer in a uniform temperature room.

- o Alignment - Vertical alignment of the barometer tube is required for an accurate pressure determination. The Fortin barometer, designed to hang from a hook, does not of itself hang vertically. This must be accomplished by a separately supported ring encircling the cistern; adjustment screws control the horizontal position.

- o Readings - The most reliable readings are obtained when the temperature has not changed greatly over the past four hours. When reading the barometer the reader's eye should be in the same horizontal plane as the top of the mercury meniscus and the lower edge of the vernier plate. This position can be checked by getting the eye in line with the bottom of the vernier plate and the bottom of the metal guide in back of the mercury column directly in back of the vernier plate.

  Readjustment to zero should be made whenever necessary in reading the barometer; i.e., the adjusting screw at the bottom of the reservoir casing should be manipulated until the surface of the mercury exactly coincides with the tip of the ivory zero point which is visible inside the reservoir.

  The height of the meniscus will be greater on a rising barometer than on a falling barometer. In order to bring the meniscus to its approximate average height, tap the barometer lightly with your fingers before taking a reading.

5.4 If it is desired to convert an english reading to a metric reading, or vice versa, always apply the temperature and gravity corrections before making conversion.

6.0 VISUAL INSPECTION

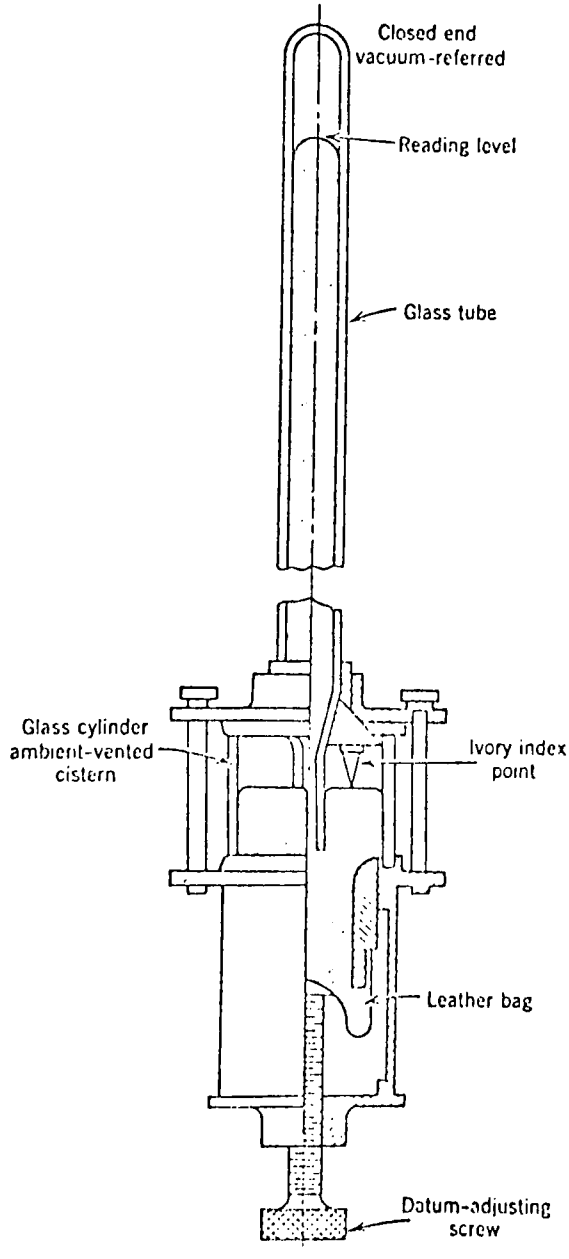
6.1 If an aneroid barometer has a cracked glass or dented case the complete barometer should be replaced. Do not attempt to recalibrate as the internal movements may have been also damaged.

6.2 If the mercury appears dull or tarnished, it is an indication that the mercury has become contaminated in some way. It frequently occurs when air, dirt, and moisture are admitted into the barometer tube. In such event the instrument will no longer give accurate readings. For proper cleaning the instrument should be returned to the factory.

7.0 TEST ARTICLE PREPARATION

7.1 The aneroid barometers to be calibrated should be hung in the ±3°F temperature controlled room for a minimum of 4 hours to allow them to come to equilibrium with the ambient conditions.

A Fortin-type barometer.



8.0 TEST PROCEDURE

The test requires three basic procedures: A. Reading the mercury barometer, B. Calibration of the aneroid barometer and C. Correlation of the test cell barometers.

Test Sequences	Test Description	Data Output
101A	In reading a barometer of the Fortin type, which is the usual laboratory precision type, first obtain the temperature of the case from the small thermometer attached midway between the top and bottom of the instrument. Then adjust the mercury in the reservoir to the fixed point (an ivory pin), so that the tip of the pin and its image upon the mercury surface coincide. Tap the barometer case gently to be sure that the mercury is not stuck in the tube and verify the zero setting. Now bring the vernier down until the white background is cut off at the highest point of the meniscus. The reading is the uncorrected barometric height.	Pressure, un-corrected
102A	The standard temperature for the English scales is 62°F.; the standard temperature for the Metric scales is 0°C. The standard temperature for the density of mercury is 0°C. or 32°F. Since the scales and the mercury have different coefficients or expansion, the pressure indications will be affected by variations in temperature; therefore, in order to obtain the true pressure every reading must be corrected for temperature. The Temperature Correction Tables combines the corrections for length of the scales and the density of mercury.	Temperature correction factor
	Further, the pressure indication will be affected by the gravity of the place at which the reading is taken. Latitudes from 0° to 45° have a subtractive correction; latitudes from 46° to 90° have an additive correction. More precise	Gravity correction factor

Test Sequence	Test Description	Data Output
	determinations of the true pressure may be made by using the Gravity Correction Tables in conjunction with the observed readings corrected for temperature. EXAMPLE; Assume the barometer reads 29.91" at a temperature of 75°F. Table 1 gives the temperature correction for every two degrees Fahrenheit and every one inch of atmospheric pressure. Interpolating, we find the correction to be -.125". The reading corrected for temperature, therefore, is 29.91" -.125', or 29.785". If the reading is being taken at a latitude of 42° the correction for gravity given in Table 2 is -.010" which makes the true pressure 29.785" -.010, or 29.775" which, if working to one hundredths of an inch, could be rounded off to 29.78".	
101B	After the aneroid barometers have attained equilibrium read the Fortin barometer and adjust the aneroid barometers at the corrected reading using the adjusting screw on the back of the barometer. Gently tap each gauge before taking the reading. Cover the adjusting screw with a piece of tape to discourage tampering.	Calib. Date Log Book Entry
101C	Correlation is accomplished by reading all the test cell barometers in their usual position once a week.	Log Book Entry By I.D. Number

TEMPERATURE CORRECTION TABLE — Table 1 — English System

To reduce the reading of the barometer to standard temperature

Temperature in Degrees F.	Observed Reading of the Barometer in Inches											
	20"	21"	22"	23"	24"	25"	26"	27"	28"	29"	30"	31"
	ALL CORRECTIONS SUBTRACTIVE											
60°	0.057	0.060	0.062	0.065	0.068	0.071	0.074	0.077	0.080	0.082	0.085	0.088
62	.060	.063	.066	.069	.073	.076	.079	.082	.085	.088	.091	.094
64	.064	.067	.070	.074	.077	.080	.083	.086	.090	.093	.096	.099
66	.068	.071	.074	.078	.081	.085	.088	.091	.095	.098	.101	.105
68	.071	.075	.078	.082	.085	.089	.093	.096	.100	.103	.107	.110
70	.075	.079	.082	.086	.090	.094	.097	.101	.105	.109	.112	.116
72	.078	.082	.086	.090	.094	.098	.102	.106	.110	.114	.118	.122
74	.082	.086	.090	.094	.098	.103	.107	.111	.115	.119	.123	.127
76	.086	.090	.094	.098	.103	.107	.111	.116	.120	.124	.128	.133
78	.089	.094	.098	.103	.107	.112	.116	.120	.125	.129	.134	.138
80	.093	.097	.102	.107	.111	.116	.121	.125	.130	.135	.139	.144
82	.096	.101	.106	.111	.116	.121	.125	.130	.135	.140	.145	.149
84	.100	.105	.110	.115	.120	.125	.130	.135	.140	.145	.150	.155
86	.104	.109	.114	.119	.124	.130	.135	.140	.145	.150	.155	.161
88	.107	.113	.118	.123	.129	.134	.139	.145	.150	.155	.161	.166
90	.111	.116	.122	.127	.133	.138	.144	.150	.155	.161	.166	.172
92	.114	.120	.126	.132	.137	.143	.149	.154	.160	.166	.172	.177
94	.118	.124	.130	.136	.142	.147	.153	.159	.165	.171	.177	.183
96	.122	.128	.134	.140	.146	.152	.158	.164	.170	.176	.182	.188
98	.125	.131	.138	.144	.150	.156	.163	.169	.175	.181	.188	.194
100	.129	.135	.142	.148	.154	.161	.167	.174	.180	.187	.193	.200

GRAVITY CORRECTION TABLE — Table 2 — English System

To reduce the reading of the barometer to standard gravity

Latitude	Observed Reading of the Barometer in Inches										
	20"	21"	22"	23"	24"	25"	26"	27"	28"	29"	30"
	LATITUDE 0° TO 45° THE CORRECTION IS TO BE SUBTRACTED LATITUDE 46° TO 90° THE CORRECTION IS TO BE ADDED										
0°	−0.054	−0.056	−0.059	−0.062	−0.064	−0.067	−0.070	−0.072	−0.075	−0.078	−0.080
5	.053	.055	.058	.061	.063	.066	.069	.071	.074	.077	.079
10	.050	.053	.055	.058	.060	.063	.066	.068	.071	.073	.076
15	.047	.049	.051	.053	.056	.058	.060	.063	.065	.067	.070
20	.041	.043	.045	.047	.050	.052	.054	.056	.058	.060	.062
25	.035	.037	.038	.040	.042	.043	.045	.047	.049	.050	.052
30	.027	.029	.030	.031	.033	.034	.035	.037	.038	.040	.041
32	.024	.025	.026	.028	.029	.030	.031	.032	.034	.035	.036
34	.021	.022	.023	.024	.025	.026	.027	.028	.029	.030	.031
36	.017	.018	.019	.020	.021	.022	.022	.023	.024	.025	.026
38	.014	.014	.015	.016	.016	.017	.018	.018	.019	.020	.020
40	.010	.011	.011	.012	.012	.013	.013	.014	.014	.015	.015
42	.006	.007	.007	.007	.008	.008	.008	.009	.009	.009	.010
44	−0.003	−0.003	−0.003	−0.003	−0.003	−0.003	−0.004	−0.004	−0.004	−0.004	−0.004
46	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001
48	.005	.005	.005	.005	.006	.006	.006	.006	.006	.007	.007
50	.008	.009	.009	.010	.010	.010	.011	.011	.012	.012	.012
55	.017	.018	.019	.020	.021	.021	.022	.023	.024	.025	.026
60	.026	.027	.028	.029	.031	.032	.033	.034	.036	.037	.038
65	.033	.035	.036	.038	.040	.041	.043	.045	.046	.048	.050
70	.040	.042	.044	.046	.048	.050	.052	.053	.055	.057	.059
75	.045	0.47	.049	.052	.054	.056	.058	.061	.063	.065	.067
80	.049	.051	.054	.056	.059	.061	.063	.066	.068	.071	.073
85	.051	.054	.056	.059	.061	.064	.067	.069	.072	.074	.077
90	+0.052	+0.055	+0.057	+0.060	+0.062	+0.065	+0.068	+0.070	+0.073	+0.075	+0.078

9.0 DATA INPUT

9.1 Enter calibration dates in log book by I.D. number. Indicate adjusted or not adjusted.

9.2 Enter the amount of deviation from true barometric pressure in the instrument log book.

10.0 DATA ANALYSIS

None required

11.0 DATA OUTPUT

11.1 A handwritten copy of the correlation data goes to Quality Assurance management.

12.0 ACCEPTANCE CRITERIA

12.1 In order to achieve 0.1% accuracy the barometer readings should correlate among themselves within $\pm$ 0.03 in. Hg.

12.2 Correlation should be established over 28.5 to 30.0 in. Hg. range.

13.0 QUALITY PROVISIONS

13.1 At the Factory the Fortin-Type Barometers are adjusted as nearly as possible to a zero correction by comparison with a certified standard. The adjustment is so made that no further correction for capillarity need be made.

Section 300

VERIFICATION

EPA TEST PROCEDURE	Number TP-301	Page 1 of 8

SUBJECT

CVS SYSTEM VERIFICATION BY TRACER GAS INJECTION

Reference FEDERAL REGISTER, VOL. 138, NO. 124, June 28, 1973 - Appendix III	Data Form No. 301-01
Responsible Organization CORRELATION/MAINTENANCE	Computer Program SAQF: CALIBCK
Test Witness/Review QUALITY ASSURANCE	Performance Interval SEE WEEKLY/SEC 13.0
Type of Test Report COMPUTER PRINT-OUT	Supersedes NEW
Report Distribution QUALITY ASSURANCE/TEST OPERATIONS/CORRELATION & MAINTENANCE	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Test Operations Chief		
Lab Branch	Support Services Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To verify that the CVS sampling system, its associated analyzers, and subsequent data analysis will determine the correct mass value of a quantity of gas injected into the system. The actual or theoretical mass value is compared to the indicated mass value to obtain the accuracy (% error) of the system.

2.0 TEST ARTICLE DESCRIPTION

2.1 A constant volume sample which meets the requirements stated in Federal Register 85.075-20 (see procedure # 201 for calibration procedure).

2.2 A gas analysis system meeting requirements in Federal Register 85.075-20.

3.0 REFERENCES

3.1 Federal Register, Vol. 38, No. 124, Appendix III and 85.075-20.

3.2 EPA, Ann Arbor, Preventive Maintenance Guideline, Section V.

4.0 REQUIRED EQUIPMENT

4.1 Equipment required for "Bomb Method"

4.1.1 Supply cylinder of pure tracer gas. Normally propane is used, however carbon monoxide (CO) may be used as an alternative.

4.1.2 Small laboratory cylinder filled with pure tracer gas from the supply cylinder. The "bombs" normally have a volume of 16,000 cubic centimeters.

4.1.3 Injection fitting.

4.1.4 Analytical balance for weighing cylinder (see procedure # 101, sec. 7.2, for calibration procedure).

4.2 Equipment required for Critical Flow Orifice (CFO) method.

4.2.1 Supply cylinder of 99.5% pure tracer gas

4.2.2 CFO kit.

4.2.3 Injection fitting.

4.2.4 Thermometer.

5.0 PRECAUTIONS

5.1 Carbon monoxide is an odorless, extremely poisonous gas. Therefore, when it is used as a tracer gas, the safety precautions outlined below must be observed.

1. Two operators experienced in pressurized gas handling should be in attendance.

2. Provide adequate ventilation in the work area. Turn on the dynamometer test cooling fan.

3. Before connecting the CFO kit to the CO bottle, prepare the SAF-CO-Meter bulb for use as specified in the instructions provided. Check storage date on the glass ampoules.

4. After connecting the CO bottle, with the CVS running and the CFO outlet line inserted into the exhaust plenum, open the CO bottle valve just enough to show full bottle pressure on the regulator high pressure gauge. Starting at the bottle valve, check for leaks at all fittings using soap solution and/or the SAF-CO-Meter. If a leak is discovered, close the CO bottle valve first before retightening or servicing.

5. Use the SAF-CO-Meter to monitor ambient air during the test.

6. Shut off the CO bottle valve before stopping the CVS.

6.0 VISUAL INSPECTION

6.1 Inspect the equipment set-up to insure the system is leak-tight.

7.0 TEST ARTICLE PREPARATION

7.1 Preparation for "Bomb" injection.

7.1.1 Fill the evacuated bomb cylinder with tracer gas from the supply cylinder. The regulator (output) should be set at 40 PSIG for propane (blue cylinder) and 80 PSIG for carbon monoxide (gray cylinder). Transfer the gas for three minutes.

7.1.2 Run the CVS for five minutes and allow the pump inlet temperature to stabilize at 100°F. Attach the injection fitting and the auxiliary temperature sensor to the spare fitting on the pump elbow.

7.1.3 Zero the CVS counters, timer and evacuate the sample/background bags. Replace sample filter and assure the filter holder is completely closed. Set the flow rates at 5.0 cfh.

7.2 Preparation for CFO method.

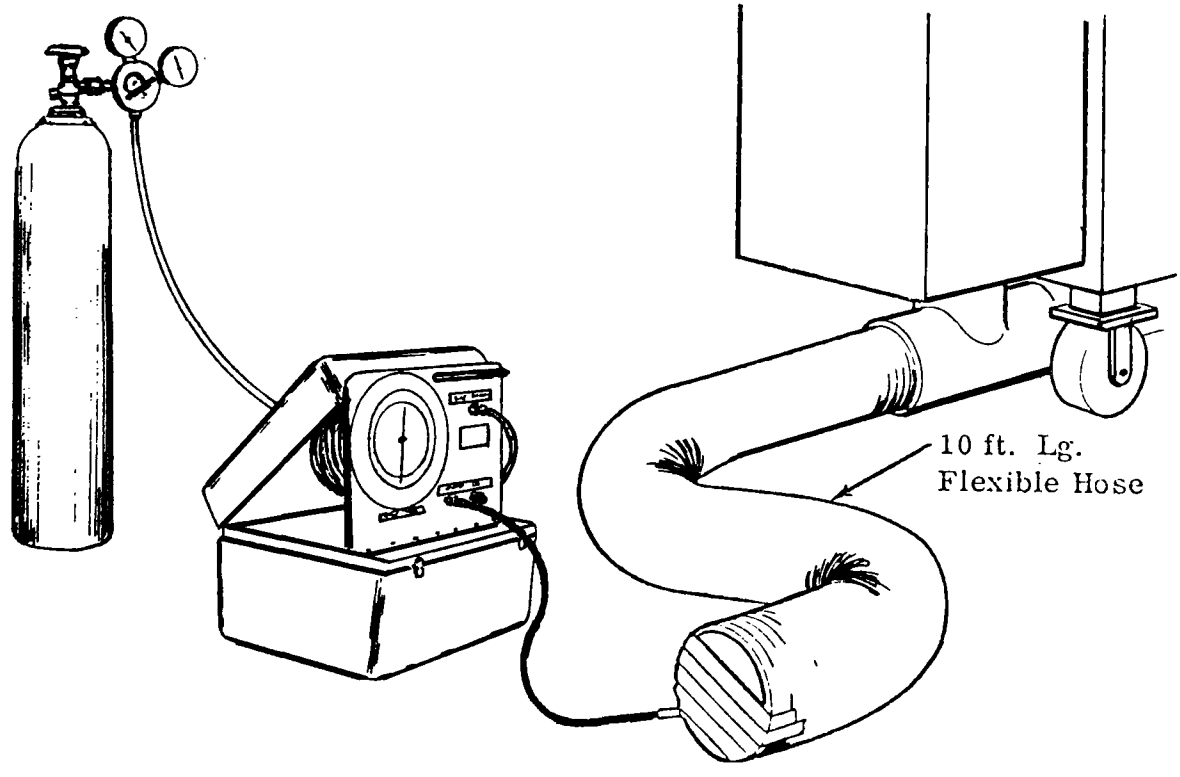
7.2.1 Connect the injection fitting to the dilution box so that the gas is injected into the dilution air stream.

7.2.2 Couple the injection fitting to the CFO apparatus.

7.2.3 Attach the thermometer in the area of the CFO temperature stabilizing coil.

7.2.4 Lock the Hiese gauge in vertical position on the CFO and set the pointer to zero.

7.2.5 Run the CVS for 3 minutes and allow the flow rate and temperature to stabilize.



CFO INJECTION SET-UP

7.2.6 Follow steps in 7.1.3.

7.2.7 Connect the CFO to the gas supply cylinder (CO or propane), open the valves and adjust the regulator to approximately 70 psig for propane and 50 psig for carbon monoxide.

8.0 TEST PROCEDURES

Two methods of CVS system verification are presently in use. Section I describes the steps for the Bomb method and Section II outlines the CFO technique.

SECTION I "THE BOMB"

Test Sequence	Test Description	Data Output
101	Weigh the bomb and record initial weight on data sheet.	gms
102	Sample the dilute mixture in the normal manner (procedure #707).	
103	Connect the bomb to the injection probe and open the bomb valve. Regulate the flow rate to 2.0 ±.25 cfh for propane or 12.0 ±.25 cfh for CO.	
104	While gas is being sampled, check and record the following:	
	o Pump inlet pressure.	P_{in} "fluid
	o Pump outlet pressure.	P_{out} "fluid
	o Barometric pressure.	P_B "Hg
	o Ambient room temperature.	T_{wb}/T_{db} ^oF
	o CVS pump inlet temperature.	T_{in} ^oF
105	After the tracer gas has been sampled for 15 minutes, close the bomb valve, purge the injection fitting with nitrogen and disconnect from the injection fitting.	
106	Stop sampling the dilute mixture. Record the pump revolutions and sample time.	Revs t, secs.
107	Analyze the sample and background bags. Record their concentrations on the data sheet.	$Conc_b$, ppm $Conc_s$, ppm
108	Have the bomb reweighed and record final weight to the nearest milligram.	gms

SECTION II CFO TECHNIQUE

Test Sequence	Test Description	Data Output
201	When CFO pressure gauge has stabilized, begin sampling the dilute mixture and background air.	
202	Monitor and record the CFO temperature and pressure several times during the sample period. NOTE: If the pressures and temperatures have not varied more than 0.3 psi and 0.5°F, record the average. If the variation is greater perform an additional CFO injection.	T_c °F P_G psi
203	While the gas is being sampled, check and record the following:	
	o Pump inlet pressure	P_{in} "fluid
	o Pump outlet pressure	P_{out} "fluid
	o Barometric pressure	P_b "Hg
	o Ambient room temperature	T_{wb}/T_{db} °F
	o CVS pump inlet temperature	T_{in} °F
204	After 10 minutes, stop the sampling mode. Record the revolutions and sample time.	revs t, secs.
205	Shut off the CFO gas supply cylinder.	
206	Analyze the sample and background bags. Record the concentration values on the data sheet.	$Conc_b$, ppm $Conc_s$, ppm

9.0 DATA INPUT

9.1 Check and assure all data has been properly entered on data sheet 301-01.

9.2 Submit data to Data Branch for computer analysis (SAQF: CALIBCK).

10.0 DATA ANALYSIS

10.1 Analysis of the "bomb" method is accomplished by the SAQF: CALIBCK computer program. This program compares the indicated mass of the tracer gas versus the actual mass determined by gravimetric difference.

10.2 Analysis of the CFO technique is also performed by the SAQF: CALIBCK program. The observed concentration is compared to the calculated concentration to determine the accuracy (% error) of the system.

11.0 DATA OUTPUT

11.1 A computer print-out indicating percent error of the system.

11.2 The results are stored in a computer file for future reference.

12.0 ACCEPTANCE CRITERIA

12.1 The acceptable error band for CVS system verification checks is ±2 percent.

13.0 QUALITY PROVISIONS

13.1 The results of the tests should be kept on file with Quality Control and analyzed statistically to determine average error/variation.

13.2 If the results of any test exceed the prescribed error band, corrective action should be initiated and the procedure repeated.

13.3 If three consecutive tests are not within the error band, the CVS shall be removed from line operation and recalibrated.

13.4 The Quality Assurance section should suggest possible cause of error by referencing the following troubleshooting guideline.

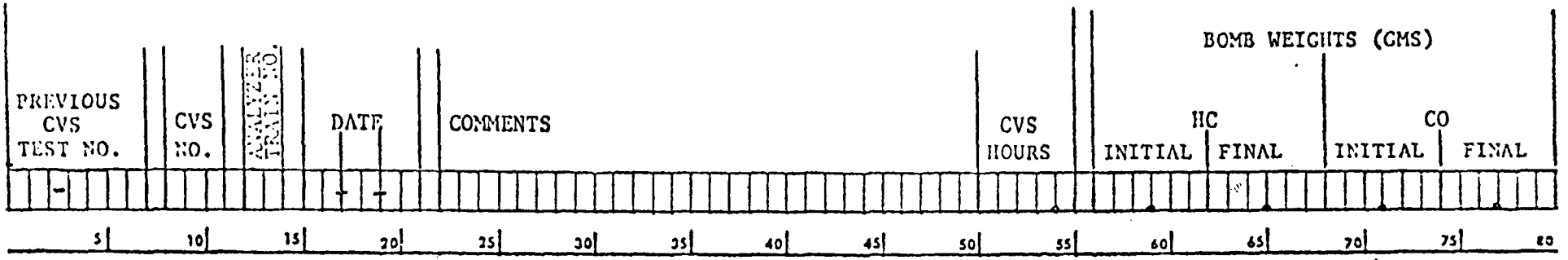
Positive Error (Indication is higher than true value)

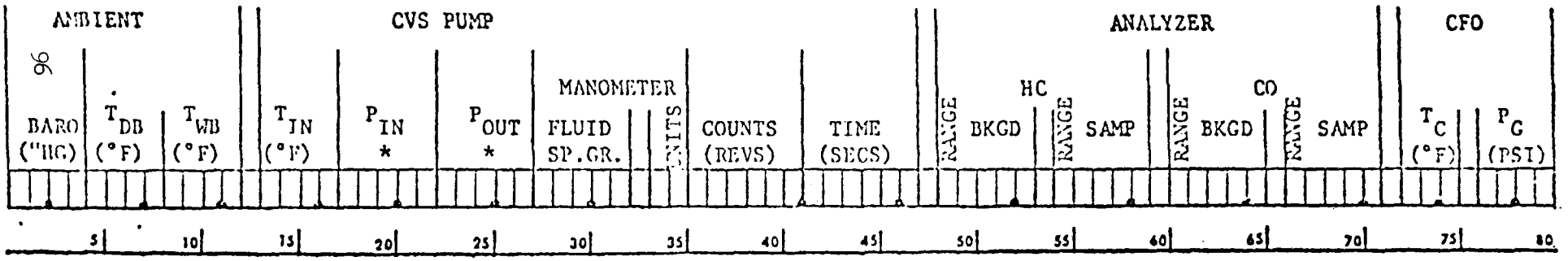
1. Calculated V_o is greater than actual V_o.
   a. Original calibration in error.
2. Pump inlet temperature recorder is reading low. A 6^oF discrepancy over the test period will give a 1% error.
3. Pump inlet indicator is reading high. A 3.5 in. H_2O high reading will give 1% error.
4. Background concentration reading is too low. Check analyzer zero. Check leakage at floor inlet.
5. Analyzer is reading high. Check span.
6. Barometer reading is in error (too high). Barometric pressure reading should be gravity and temperature corrected.
7. Revolution counter is reading high. (Check pump speed and counters.
8. Mixture is stratified causing the sample to be higher than the average concentration in the mixture.

Negative Error (Indication is lower than true value)

1. Calculated V_o is less than actual V_o.
   a. Original calibration in error.
   b. Pump clearances decreased due to influx of some surface adherent material.
2. Pump inlet temperature recorder is reading high.
3. Pump inlet pressure indicator is reading low.
4. Background concentration reading is too high.
5. Analyzer is reading low.
6. Barometer reading is in error (too low).
7. Revolution counter is reading low.
8. There is a leak into the sampling system. Pressure check the lines and fittings on the intake side of sample transfer pumps on both the CVS and analyzer console.

CVS SYSTEM VERIFICATION BY TRACER GAS INJECTION - TEST DATA SHEET





*NOTE: Specify the column height, units, and fluid specific gravity shown on the manometer.

Form 301-01

CVS SYSTEM VERIFICATION BY TRACER GAS INJECTION

PREV.CVS TEST	CVS NO.	CVS UNIT	ANALYZER TRAIN	TEST DATE	CVS HOURS	AMBIENT CONDITIONS BAROMETER	DRY BULB	WET BULB
0-	0	12C	19	3-31-75	1196.5	28.96	72.8	58.1

COMMENTS: PROPANE INJECTION RAAB

**** CVS PUMP ****

TEMP	PRESSURE IN	PRESSURE OUT	COUNTS	SECONDS	RPM	RPM RATIO	CFR	SCFM
102.7	28.75	15.35	8101.	333.2	1458.8	0.9994	0.28295	326.89

MANOMETER SPECIFICATIONS: IN OF 1.75 SPECIFIC GRAVITY FLUID

**** ANALYZER ****

GAS	METER READING SAMPLE	METER READING BACKGND	RANGE S	RANGE B	CONCENTRATION (PPM) SAMPLE	CONCENTRATION (PPM) BACKGND	CONCENTRATION (PPM) CORRECTED	CALCULATED MASS (GRAMS)
HC	84.8	0.9	4	4	254.40	2.70	251.70	8.023

**** CFO ****

GAS	TEMP	ORIFICE PRESSURE PSIG	PRESSURE PSIA	SCFM	CONCENTRATION (PPM)	% ERROR
HC	74.5	73.40	87.63	.0275395	252.74	-0.412

EPA TEST PROCEDURE	Number TP-302	Page 1 of 6

SUBJECT

DYNAMOMETER CALIBRATION VERIFICATION

Reference	Data Form No.
EPA, ANN ARBOR, MAINTENANCE MANUAL	302-01
Responsible Organization	**Computer Program**
CORRELATION/MAINTENANCE	DYNOCK:SAQE
Test Witness/REVIEW	**Performance Interval**
CORR. AND MAINT. LEADER, QUALITY ASSURANCE	WEEKLY
Type of Test Report	**Supersedes**
COMPUTER PRINT-OUT	NEW
Report Distribution	**Superseded by**
QUALITY ASSURANCE/TEST OPERATIONS/CORRELATION AND MAINT.	

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
PROGRAM MGMT	QUALITY ASSURANCE		
LAB. BRANCH	TEST OPERATIONS CHIEF		
LAB. BRANCH	SUPP. SERVICES CHIEF		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To verify the dynamometer calibration by a "short-cut method of periodic checks used for the determination of actual power absorption.

2.0 TEST ARTICLE DESCRIPTION

2.1 A chassis dynamometer, having the capabilities described in the Federal Register, Part 85, Section 85.075-15.

2.2 Associated speed and horsepower meters.

3.0 REFERENCES

3.1 Federal Register, Vol. 38, No. 124, June 28, 1973, 85.075-15.

3.2 EPA, Ann Arbor, Preventive Maintenance Guidelines, Section III.

3.3 Clayton Manual for ECE-50 chassis dynamometer, p. 3-4.

4.0 REQUIRED EQUIPMENT

4.1 Light weight test vehicle.

4.2 Tachometer generator assembly.

4.3 Strip chart recorder, Varian 614A.

4.4 Stop watch or electronic timing device.

5.0 PRECAUTIONS

5.1 Inflate tires to 45 psi to protect against overheating and wear.

5.2 Align vehicle on dynamometer.

5.3 Position vehicle cooling fan within 12 inches of vehicle radiator to prevent overheating.

5.4 Insure vehicle exhaust is properly vented.

5.5 Restrain vehicle with tie-down and safety chocks.

6.0 VISUAL INSPECTION

6.1 Check equipment set-up.

7.0 TEST ARTICLE PREPARATION

7.1 Check the speed and power meters for proper calibration. (See procedure #202).

7.2 Install tachometer generator on the dynamometer frame. Line up the tach generator pulley with the shaft adaptor pulley. Insure that the center to center pulley distance is the same as the factory installed tach generator.

7.3 Attach front roll tachometer generator electrical leads to the Varian chart recorder.

7.4 Place the vehicle on the dynamometer and attach the vehicle restraint system. (Winch and cable).

7.5 Disengage the roll brake.

7.6 Adjust recorder zero.

8.0 TEST PROCEDURES

The following steps outline the short-cut coast down method for verifying the dynamometer calibration.

TEST SEQUENCE	TEST DESCRIPTION	DATA OUTPUT
101	Accelerate vehicle to 60 mph and hold steady. Calibrate the chart recorder at 60 mph full scale.	
102	Check the calibration of chart at 55, 50, and 45 mph. Insure that the 55 and 45 mph points are easily identified.	55 = ___divs. 45 = ___divs.
103	Bring the vehicle to a complete stop. Re-zero the recorder and set dyno inertia to 4000 lbs.	
104	Measure the recorder chart speed with a stopwatch or other timing mechanism. This should be repeated at least 3 times for an accurate measurement of the distance the paper travels in one (1) minute. NOTE: Alternate method of measuring elapsed time: Direct measurement of time elapsed between 55 mph and 45 mph can be accomplished by starting electronic timer at 55 mph and stopping at 45 mph. This method will eliminate interpolation of chart method.	Chart Speed (inches/mins)
105	Operate the vehicle at a steady 50 mph and set Hp to indicated setting needed for actual power absorption of 12.0 Hp.	
106*	Increase the vehicle speed to 60 mph and use rear cable winch to pull vehicle off the front drive roll. Release accelerator and allow vehicle to slow down.	

TEST SEQUENCE	TEST DESCRIPTION	DATA OUTPUT
107	Measure the time for the roll to slow from 55 MPH to 45 mph. Record time.	t, secs.
108	Bring vehicle speed as indicated on speed meter to within ±5 mph of the front roll speed and slowly loosen winch to allow the drive tires to contact the front roll.	
109	Repeat steps 106-108 two additional times and record.	t, secs.

9.0 DATA INPUT

9.1 Complete data form 302-01 and submit it for analysis.

10.0 DATA ANALYSIS

10.1 Analyze the data using the DYNOCK:SAQE program.

11.0 DATA OUTPUT

11.1 Data sheet showing roll down times, signed by responsible technician.

12.0 ACCEPTANCE LIMITS

12.1 The average time for coastdowns should be within 1 second. (calculated)

13.0 QUALITY PROVISIONS

13.1 If coastdown times are outside of the prescribed limits corrective action and a complete re-calibration will be instituted.

COASTDOWN CHECK FOR CLAYTON DYNO

DATE_____ DYNO #_____

INERTIA WEIGHT	HORSEPOWER SET	ACT. COASTDOWN TIME IN SEC.	CALC. COASTDOWN TIME IN SEC.	DIFFERENCE IN SEC.
2000			14.63	
3000			17.68	
4000			20.24	
5000			22.66	
5500			24.02	

FORM 302-01

Signature_____

EPA TEST PROCEDURE	Number TP-303	Page 1 of 5

SUBJECT

NO_x Efficiency Check

Reference Federal Register, Vol. 39, No. 101, May 23, 1974 - Sec: 85.075-23	Data Form No. 303-01
Responsible Organization Correlation/Maintenance	Computer Program NOXCK:SAQE
Test Witness/Review Corr. and Maint. Leader, Quality Assurance	Performance Interval Weekly; Monthly
Type of Test Report Computer Print-out	Supersedes New
Report Distribution Quality Assurance, Test Operations, Correlation and Maint.	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab. Branch	Chief		
Lab. Branch	Test Operations Chief		
Lab. Branch	Supp. Services Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To determine the conversion efficiency of the NO_x converter which is used to convert NO_x to NO.

2.0 TEST ARTICLE DESCRIPTION

2.1 Chemiluminescent analyzer with a converter capable of transforming nitrogen dioxide to nitric oxide. The nitric oxide is mixed with ozone to form an excited state of nitrogen dioxide which emits light. The light energy emitted is then sensed by a photomultiplier tube into an electric current that is nearly proportional to the amount of nitric oxide present in the sample.

- o Thermo Electron (TECO) Model 10A

3.0 REFERENCES

3.1 Federal Register, Vol. 39, No. 101, - May 23, 1974. 85.075-23.

3.2 EPA, Ann Arbor, Preventive Maintenance Guidelines, Appendix B.

3.3 Matheson Gas Book, "Nitric Oxide Handling Provisions"

4.0 REQUIRED EQUIPMENT

4.1 NO_x Converter Efficiency Detector (see Figure 4-1).

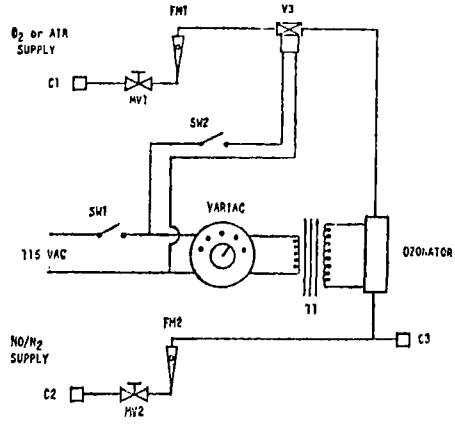


Figure 4-1. NO_x CONVERTER EFFICIENCY DETECTOR

4.2 NO/N_2 gas supply, 150 to 250 ppm.

4.3 O2 or air supply.

5.0 PRECAUTIONS

5.1 Nitrogen Oxides are TOXIC gases. Precautions should be taken to insure a safe testing environment is maintained.

5.2 Ozonator should not be pressurized above 10 psig.

6.0 VISUAL INSPECTION

6.1 Insure the test equipment set up is correct. (see diagram 4.1)

6.2 Check NO/N_2 and O_2 regulator settings @ 10 psig.

7.0 TEST ARTICLE PREPARATION

See Figure 4-1 for preparation clarification.

7.1 Connect the NO/N_2 supply at fitting C2.

7.2 Connect the O_2 or air supply at fitting C1.

7.3 Attach the analyzer inlet connection to the efficiency detector at C3.

NOTE: Better response is obtained if detector is plumbed to the normal span gas connection, rather than the bag connection.

8.0 TEST PROCEDURE

The following steps are to be performed to assure an accurate check of the converter efficiency.

Test Sequence	Test Description	Data output
101	With the efficiency detector variac in the off position, place the NO_x converter in the bypass mode and close valve V3.	
102	Open valve MV2 until stable flow and readings are indicated at the analyzer.	
103	Zero the analyzer and set span output to indicate the NO concentration being used. Record the concentration.	Conc., ppm (1)
104	Open the O_2 flow control valve (V3) and adjust the O_2 metering valve (MV1) to lower the NO concentration by 10 percent. Record the concentration.	Conc., ppm (2)
105	Turn on the ozonator and slowly increase its voltage until the NO concentration is reduced to roughly 20 percent of the reading in step 103. Record this concentration.	Conc., ppm (3)
106	When a stable reading is obtained from Step 105, place the NO_x converter in the convert mode. The analyzer will indicate the total NO_x concentration. Record the concentration.	Conc., ppm (4)
107	Turn off the ozonator and allow the analyzer reading to stabilize. This reading is the NO_x concentration of the dilute span gas. Record concentration.	Conc., ppm (5)
108	Close valve V3. The NO concentration should be equal to or greater than the reading in Step 103 indicating if the NO/N_2mixture contains NO_2.	Conc., ppm (6)
109	If values do not appear to be stable or consistent, repeat the sequence two or more times.	
110	Disconnect the detector and restore the analyzer to normal operating condition.	

9.0 DATA INPUT

9.1 Check data sheet for complete and reasonable data.

9.2 Submit data form # 303-01 for analysis

10.0 DATA ANALYSIS

10.1 Analysis of the converter efficiency is accomplished by the NOXCK:SAQE computer program.

10.2 The efficiency is calculated by substituting the concentrations obtained during the test into the following equation as a quick check prior to computer analysis.

$$\% \text{ Eff.} = \left[1 + \frac{(a-b)}{(c-d)}\right] \times 100$$

Where: a = Conc. of Step 106
b = Conc. of Step 107
c = Conc. of Step 104
d = Conc. of Step 105

11.0 DATA OUTPUT

11.1 Data format with calculation of the percentage efficiency of NO_x converter.

12.0 ACCEPTANCE CRITERIA

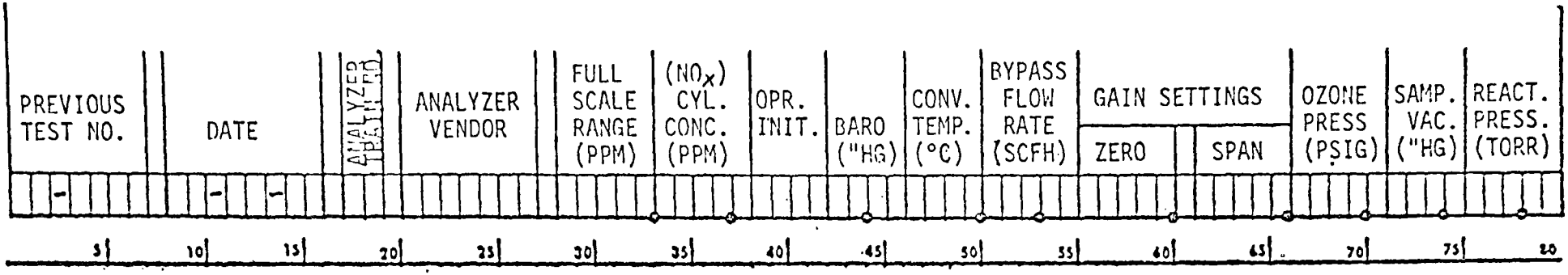
12.1 The efficiency of the converter should be above 90 percent.

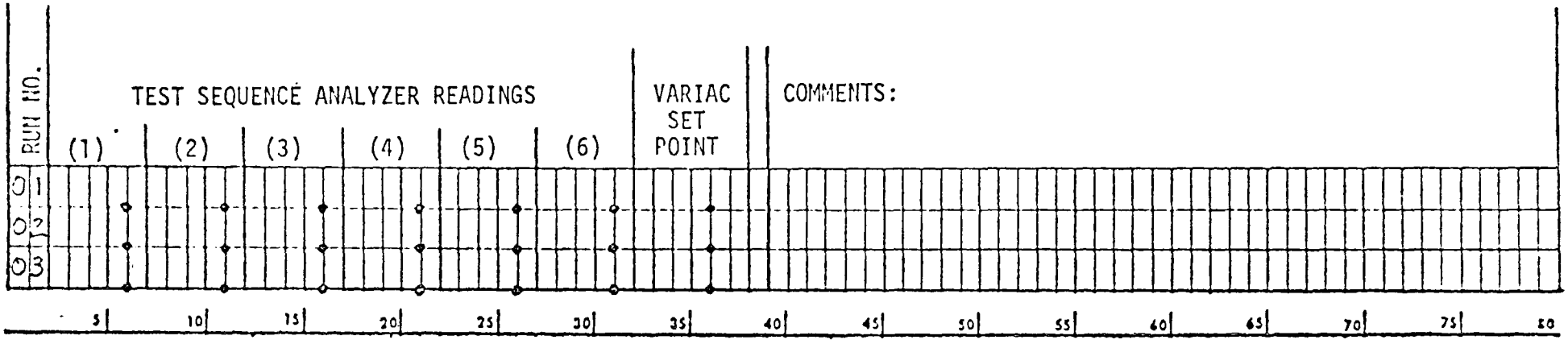
13.0 QUALITY PROVISIONS

13.1 If the efficiency of the converter is less than 90 percent, the Q.A. department should immediately determine the probable cause for the failure.

13.2 The complete procedure should be repeated with a new converter temperature setting.

NO_x CONVERTER EFFICIENCY DETERMINATION - TEST DATA SHEET





TEST SEQUENCE CODES:

(1) FLOW NO/N_2, OZONATOR OFF, CONVERTER BYPASSED

(2) FLOW $NO/N_2 + O_2$, OZONATOR OFF, CONVERTER BYPASSED (80% OF (1))

(3) OZONATOR ON, ADJUST TO GET ABOUT 10% OF (1), CONVERTER BYPASSED

(4) SWITCH TO CONVERTER MODE

(5) OZONATOR OFF, CONVERTER MODE

(6) O_2 OFF, OZONATOR OFF, CONVERT MODE (6) SHOULD BE GREATER THAN OR EQUAL TO (1).

08-01-73 CDP [redacted]

NOXCK:SAQE

form 303-01

EPA TEST PROCEDURE	Number TP-304	Page 1 of 5

SUBJECT

CARBON DIOXIDE AND WATER INTERFERENCE
CHECK FOR THE NDIR CARBON MONOXIDE ANALYZER

Reference FEDERAL REGISTER, VOL 38, November 15, 1973, 85.075-23, (a)(7)(iii)	Data Form No. 304-01
Responsible Organization CORRELATION AND MAINTENANCE	Computer Program NONE
Test Witness/Review TEAM LEADER, QUALITY ASSURANCE	Performance Interval See Below
Type of Test Report INITIAL EQUIPMENT CHECKOUT OR WEEKLY CHECK	Supersedes New
Report Distribution QUALITY ASSURANCE, CORRELATION AND MAINTENANCE, TEST OPERATION	Superseded by

REMARKS/COMMENTS

1. If the CO-NDIR meets the requirements of 85.075-20 (C)(11) without the conditioning columns the test is performed to demonstrate conformance to the criteria when the instrument is first put into service.

2. If the instrument does not meet the above criteria conditioning columns must be used and checked weekly or as determined by average column life.

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Test Operations Chief		
Lab Branch	Support Oper Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To establish conformance with the interference requirements of 85.075-20(c)(11) with new instrument trains or to assure the proper operation of those trains requiring conditioning columns for removal of CO_2 and water vapor.

2.0 TEST ARTICLE DESCRIPTION

The carbon monoxide analyzers are of the non-dispersive infrared type. Certain instruments available from vendors employ an internal optical filtering mechanism to eliminate the interference from CO_2 and water vapor.

Instruments that are not free of interference must use sample conditioning columns consisting of calcium sulfate or indicating silica gel to remove water vapor and ascarite to remove carbon dioxide.

3.0 REFERENCES

3.1 Federal Register, Vol. 38, Nov 15, 1973 85.075-23(a)(7)(iii)
Federal Register, Vol. 39, No. 101, May 23,1974 85.075-20(c)(11)

4.0 REQUIRED EQUIPMENT

4.1 Gas bubbler, sized for the flow rate used for the interference check.

4.2 Calibration gas, 3 percent carbon dioxide in nitrogen. Make tolerance on the blend should be within ±5% and the analysis for CO_2 ±2%. When ordering this blend the concentration of the CO impurity should be requested not to exceed 1 ppm and/or determined by receiving inspection.

4.3 Zero Air

4.4 Zero Nitrogen

4.5 A portable manifold with selector valves for introducing the above gases individually, wet and dry.

4.6 A hopcolite filter for removing CO from the zero air to establish a true instrument zero.

5.0 PRECAUTIONS

5.1 If a glass bubbler is used it should not be subjected to pressure above 2 PSI.

5.2 The bubbler should be contained or shielded to protect the operator in case of explosion (i.e., overpressurization or sudden surge in the glass bubbler).

5.3 Flow rates are important and should be closely controlled.

5.4 Extreme care should be taken not to introduce any water droplets or aerosol into the train or analyzer.

5.5 Leak check the manifold before each use by turning off each cylinder valve and observing any drop in regulator pressure.

6.0 VISUAL INSPECTION

6.1 Check ascarite and silica gel columns for color change, contamination, and clogging, etc., indicating need for replacement.

6.2 Check water level of the bubbler.

7.0 TEST ARTICLE PREPARATION

7.1 The CO analyzer should be on for at least 2 hours prior to test.

8.0 TEST PROCEDURE

Test Sequence	Test Description	Data Output
101	Zero instrument using zero air passed through the hopcolite to remove the CO using normal train flow rate and pressure.	Zero
102	Pass zero nitrogen through instrument to establish nitrogen zero. Use this reading for all subsequent nitrogen zeros.	Zero & CO Impurity
103	Span instrument on lowest range using same flow rate as zero flow rate.	Span Deflection
104	Repeat nitrogen zero and span until stability is reached.	Span Deflection
105	Pass zero nitrogen through water bubbler and analyzer at same flow rate.	Water vapor deflection minus N_2 zero
106	Bypass water bubbler and repeat nitrogen zero	Zero & CO Impurity
107	Bypass water bubbler and introduce 3% CO_2 gas into instrument. NOTE: If CO impurity in the CO_2 gas is less that in the nitrogen the reading may be less than the nitrogen zero deflection.	Dry CO_2 deflection
108	Repeat nitrogen zero.	
109	Pass 3% CO_2 thru water bubbler into instrument at same flow rate as the other gases	Wet CO_2 Deflection
110	Repeat nitrogen zero.	
111	Disconnect manifold, turn off cylinders, relieve regulator pressures.	

9.0 DATA INPUT

9.1 Complete form #304-01

10.0 DATA ANALYSIS

10.1 Instrument response comparison.

11.0 DATA OUTPUT

11.1 Interference levels for CO_2 and H_2O vapor.

12.0 ACCEPTANCE CRITERIA

12.1 The wet CO_2 reading on any range above 300 ppm must be less than 1% of full scale; on ranges below 300 ppm the interference must be less than 3 ppm.

13.0 QUALITY PROVISIONS

13.1 If the instrument does not meet acceptance criteria initiate corrective action.

13.2 Repeat the procedure to assure corrective action was successful.

CO_2/H_2O INTERFERENCE CHECK

Analyzer Model _____ Serial # _____

Date _____ Time _____

1. ☐ Zero Instrument

2. _____ Nitrogen zero set point

3. _____ Span deflection (repeat 2 times)

4. _____ H_2O vapor deflection

5. ☐ Nitrogen zero (bypass bubbler)

6. _____ Dry CO_2 deflection

7. _____ Wet CO_2 deflection

Operator signature _____

Form 304-01

Section 400

CORRELATION

EPA TEST PROCEDURE	Number TP-401	Page 1 of 4

SUBJECT

ANALYZER CROSSCHECK

Reference EPA, ANN ARBOR, "PREVENTIVE MAINTENANCE GUIDELINES."	Data Form No. 401-01
Responsible Organization CORRELATION/MAINTENANCE	Computer Program
Test Witness /Review CORRELATION/MAINTENANCE LEADER, QUALITY ASSURANCE	Performance Interval DAILY
Type of Test Report	Supersedes NEW
Report Distribution QUALITY ASSURANCE, TEST OPERATIONS, CORRELATION & MAINTENANCE	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Test Operations Chief		
Lab Branch	Support Services Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To assure the correlation of multiple analyzer trains used for exhaust sample analysis.

2.0 TEST ARTICLE DESCRIPTION

2.1 Gas Analysis System equipped with the following analyzers

2.1.1 Hydrocarbon - flame ionization

2.1.2 Carbon monoxide - non-dispersive infrared

2.1.3 Carbon dioxide - non-dispersive infrared

2.1.4 Oxides of Nitrogen - Chemiluminescence

3.0 REFERENCES

3.1 EPA, Ann Arbor, "Preventive Maintenance Guidelines"

4.0 REQUIRED EQUIPMENT

4.1 Composite bag sample collected from a non-test vehicle or an artificial blend from span gases.

5.0 PRECAUTIONS

5.1 Sample bag should be leak checked.

5.1.1 (Short method) Fill the bags with background air and draw through the sample system. If flow indication drops to zero the bags are good, if not replace bag.

6.0 VISUAL INSPECTION

6.1 Check flow and pressure settings prior to and during bag analysis.

7.0 TEST ARTICLE PREPARATION

7.1 Perform daily start-up on each system to be checked.

7.2 Zero and span each analyzer prior to analysis.

8.0 TEST PROCEDURE

The analyzer crosscheck is performed in the following manner.

Test Sequence	Test Description	Data Output
101	Fill a sample bag with enough composite vehicle exhaust to perform the crosscheck analysis on a minimum of 4 systems. (Approximately 3.0 cubic feet.)	
102	A representative from Correlation/Maintenance will carry the sample to the first train to be checked.	
103	The analyzer operator will analyze the collected sample in accordance with the specified analysis procedure (TP-707).	
104	The C/M rep. will collect the analyzer traces and mark the train number on each trace.	
105	The sample is taken to the remaining trains and steps 103 and 104 are repeated for each.	

9.0 DATA INPUT

9.1 Data is transcribed onto data sheet #401-01.

9.2 A complete set of analyzer traces are collected from each train, including the sample concentration.

10.0 DATA ANALYSIS

10.1 The concentration for each pollutant HC, CO, CO_2 and NO_x is computed from the analyzer traces for each train checked by computer program.

10.2 The concentrations from each train are then compared for any results outside of repeatable limits.

11.0 DATA OUTPUT

11.1 The average values and percent deviation (if any) of each train.

12.0 ACCEPTANCE CRITERIA

12.1 Results from the crosscheck should repeat by ±3 percent between each system checked.

13.0 QUALITY PROVISIONS

13.1 If "out of spec" conditions (see 12.1) exist corrective action will be initiated.

FORM NO. 401-01

ANALYZER CORRELATION DATA SHEET

Date: ___/___/___

Barometer: _____"HG.

		ZERO/SPAN DATA						CALCULATED CONCENTRATION				% DEVIATION				
Train NO.	Gas Type	Rge. NO.	Conc.	Set Point	Zero Gain	Span Gain	Sample Deflc	HC	CO	CO_2	NO_x	HC	CO	CO_2	NOx	OPERATOR
9	HC				—	—										
	CO															
	CO_2															
	NO_x				—	—										
15	HC				—	—										
	CO															
	CO_2															
	NO_x				—	—										
16	HC				—	—										
	CO															
	CO_2															
	NO_x				—	—										
19	HC				—	—										
	CO															
	CO_2															
	NO_x				—	—										
21	HC				—	—										
	CO															
	CO_2															
	NO_x				—	—										
	HC															
	CO															
	CO_2															
	NO_x			— — —	—	—										
AVERAGE VALUES																

Section 500

MAINTENANCE

ırrently no procedures are included in this section of the manual. rocedures pertaining to this section must be supplied by the user nd may be supplied by the EPA in subsequent revisions.

Section 600

DAILY OPERATION

EPA TEST PROCEDURE	Number TP-601	Page 1 of 4

SUBJECT

OPERATION, MAINTENANCE AND INSTRUMENTATION LOG BOOK ENTRY PROCEDURES

Reference	Data Form No.
EPA, ANN ARBOR "PREVENTIVE MAINTENANCE GUIDELINES" LOG BOOK	LOG BOOKS
Responsible Organization	**Computer Program**
CORRELATION/MAINTENANCE, TEST OPERATIONS, INSTRUMENT SERVICES	NONE
Test Witness /REVIEW INST. SERVICES LEADER	**Performance Interval**
CORR. & MAINT. LEADER, TESTING, TEAM LEADER	DAILY & WHEN NECESSARY
Type of Test Report	**Supersedes**
LOG BOOK ENTRY	NEW
Report Distribution	**Superseded by**
Q.A., TEST OPERATIONS, CORRELATION MAINT., INST. SERVICES	

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
PROGRAM MGMT.	QUALITY ASSURANCE		
LABORATORY BRANCH	CHIEF		
LABORATORY BRANCH	TEST OPERATIONS CHIEF		
LABORATORY BRANCH	SUPPORT SERVICES CHIEF		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To record all malfunctions, breakdowns and other items related to the CVS, Analysis System, and dynamometers that are pertinent in effecting proper maintenance and repair of each.

2.0 TEST ARTICLE DESCRIPTION

2.1 All test and measurement equipment.

3.0 REFERENCES

3.1 EPA, Ann Arbor, "Preventive Maintenance Guidelines."

4.0 REQUIRED EQUIPMENT

4.1 Log Book.

5.0 PRECUATIONS

5.1 Insure that all entries explain the problems/solutions thoroughly.

6.0 VISUAL INSPECTION

6.1 Log book entries will be checked before each weekly and monthly calibration/check-out period.

7.0 TEST ARTICLE PREPARATION

None required.

8.0 TEST PROCEDURE

In order to make clear, concise log book entries the following steps should be followed.

Test Sequence	Test Description	Data Output
101	Log the date and time of malfunction or repair and the responsible technician's initial.	Date, time
102	Identify the system or individual equipment item.	Item
103	In clear terminology state the problem encountered and repair made.	
104	If the log entry is a malfunction or maintenance description, log time and date that Correlation/ Maintenance or Instrument Services was notified. Also identify the person notified.	
105	If the entry is a repair item, state all maintenance performed, and the date and time back on line. The initials of the person responsible for the maintenance or corrective action should be shown.	Initials of responsible party

9.0 DATA INPUT

9.1 Record all pertinent items in the appropriate Log Book.

10.0 DATA ANALYSIS

10.1 A malfunctioning item can usually be diagnosed and repaired more efficiently if all aspects of the failure are known.

10.2 Daily readings of pressure and temperature of the CVS should be checked to assure repeatability from day to day.

11.0 DATA OUTPUT

11.1 Log Book becomes a permanent record of all malfunctions and repair of equipment.

12.0 ACCEPTANCE CRITERIA

N/A

13.0 QUALITY PROVISIONS

13.1 Entries shall be checked on an audit basis and data compiled on all malfunctions and repairs.

13.2 Frequency of maintenance actions shall be compiled by checking the Log Books.

13.3 Audits of the Log Book will also indicate typical maintenance/repairs of test and measurement equipment.

INSTRUMENT SERVICES LOG BOOK

MAKE	MODEL	SERIAL NO.	DATE CALIBRATED	DATE DUE	TECH.	REMARKS
ESTERLINE	E1124E	940456	8-29-74	11-29-74	D.P	REPLACED INK PAD & PRINT WHEEL
"	"	940757	10-11-74	1-11-75	D.P.	1° LOW PRIOR TO CAL.
HONEYWELL	194 E	3103576E	12-7-74	3-7-75	J.J	GAIN HIGH PRIOR TO CAL
TEX. INSTR.	2596-2	T135701	12-9-74	3-9-75	J.J	REPLACED SLIDE WIRE

ANALYZER LOG

DATE	INSTRU. TYPE	GAIN	TUNE	MAINTENANCE/REMARKS	OPER. INITIALS

CVS OPERATION LOG

DATE	IN. PRESS.	OUT. PRESS.	CVS HOURS	COUNTS: 505	867	505	REMARKS	OPER. INITIALS

EPA TEST PROCEDURE	Number TP-602	Page 1 of 4

SUBJECT	
DRIFT/NOISE/GAIN/TUNE CHECKS	
Reference SEE SECTION 3.0	Data Form No. ANALYZER OP LOG BK
Responsible Organization CORRELATION/MAINTENANCE, ANALYZER OPERATION	Computer Program NONE
Test Witness/Review ANALYZER OPERATOR, TEAM LEADER	Performance Interval DAILY
Type of Test Report ANALYZER LOG BOOK ENTRY	Supersedes NEW
Report Distribution QUALITY ASSURANCE, CORRELATION AND MAINTENANCE	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Supp Services Chief		
Lab Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To perform a daily check of the analyzers and recorders used in the analysis system.

2.0 TEST ARTICLE DESCRIPTION

2.1 An analysis system equipped with the following analyzers.

2.1.1 Hydrocarbons - Flame ionization

2.1.2 Carbon monoxide - NDIR (non-dispersive infrared)

2.1.3 Carbon dioxide - NDIR

2.1.4 Oxides of Nitrogen - Chemiluminescence

2.2 Strip chart recorders

3.0 REFERENCES

3.1 EPA, Ann Arbor, Training Manual, "Light Duty Certification Procedures"

3.2 EPA, Ann Arbor, "Preventive Maintenance Guidelines"

4.0 REQUIRED EQUIPMENT

4.1 "Working" span gases

4.2 Zero air or nitrogen gases

5.0 PRECAUTIONS

5.1 If any discrepant conditions are observed the analyzer operator shall not attempt any repair or adjustment. The condition shall be reported to Correlation/Maintenance and/or Instrument Services for investigation and disposition.

6.0 VISUAL INSPECTION

See Section 8.0

7.0 TEST ARTICLE PREPARATION

7.1 The instruments shall be warmed up to stable operating conditions (as per individual manufacturer's requirements)

8.0 TEST PROCEDURE

The following steps are to be accomplished to check the efficiency of the analyzers and recorders.

Test Sequence	Test Description	Data Input
101	Zero drift is checked in the following manner.	
A	o Introduce zero gas into the analyzer	
B	o Adjust the analyzer to read zero millivolts and set the chart recorder on zero	
C	o Allow zero gas to flow for approximately 5 to 10 min.	
D	o From the strip chart determine the difference between the highest and lowest value of the zero trace.	
E	o Record difference as C	C
102	Excessive noise is indicated on the chart recorder by signal spiking. NOTE: Noise may be caused by the recorder or the analyzer, therefore the gain adjustment of the recorder should be checked.	Noise
103	The gain setting should be checked daily to assure a major shift has not occurred. Record the analyzer gain setting and check reading from following day. Record percent change.	Gain set., % change
103A	If the chart recorder is insensitive or oversensitive to small changes in input signals (0.50% of full scale), record the problem in the log book.	Recorder gain
104	If a normal operating span point cannot be reached, or a negative read-out is indicated when a span gas is introduced to an analyzer, record out of tune. Document the type of response in the log book. (Instrument Services and/or Correlation will make final decision to the type of problem encountered)	Out of tune

9.0 DATA INPUT

9.1 Record any drift, noise, gain or tune problems in the Analyzer log book (attachment A).

10.0 DATA ANALYSIS

10.1 Determine if the problem recorded is an analyzer or recorder malfunction by comparing historical readings in the analyzer log book.

10.2 Determine if the problem is of sufficient magnitude to warrant maintenance.

11.0 DATA OUTPUT

11.1 Enter results in the analyzer log and history file.

12.0 ACCEPTANCE CRITERIA

12.1 Drift should not exceed ±1% of full scale

12.2 Noise should not exceed ±1% of full scale

12.3 Shifts in gain settings should not exceed ±1% in any 24 hour period.

12.4 Compare readings to those in the analyzer log.

13.0 QUALITY CONTROL PROVISIONS

13.1 If problem warrants maintenance submit a corrective action request.

13.2 Prepare and maintain control charts for future analysis.

ANALYZER LOG

DATE	INSTRU. TYPE	GAIN	TUNE	MAINTENANCE/REMARKS	OPER. INITIALS

EPA TEST PROCEDURE	Number TP-603	Page 1 of 5

SUBJECT

TEST VEHICLE SCHEDULING

Reference	Data Form No.
EPA, ANN ARBOR, PRODUCTION CONTROLLER	603-01 thru 07
Responsible Organization	**Computer Program**
PRODUCTION CONTROL	NONE
Test Witness /REVIEW	**Performance Interval**
TEST REQUESTOR	DAILY
Type of Test Report	**Supersedes**
DAILY AND WEEKLY LOG SHEETS	NEW
Report Distribution	**Superseded by**
REQUESTOR, PRODUCTION CONTROL, LAB SECTION CHIEF	

REMARKS/COMMENTS

1.0 THIS PROCEDURE IS BEING MODIFIED BY EPA IN CONJUNCTION WITH THE NEW DATA PROCESSING ROUTINES.

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
PROGRAM MGMT.	QUALITY ASSURANCE		
LABORATORY BRANCH	CHIEF		
LABORATORY BRANCH	PRODUCTION CONTROLLER		
LABORATORY BRANCH	TEST OPERATIONS CHIEF		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To schedule all vehicle testing to be performed by Testing Operations.

2.0 TEST ARTICLE DESCRIPTION

The vehicle to be tested may be of any type as long as it can be driven on a dynamometer, has an engine displacement of at least 50 cubic inches, meets the Federal Register requirements for a light duty vehicle and meets the criteria of acceptance in test procedure #701.

3.0 REFERENCES

Procedures Manual Section 5.3

4.0 REQUIRED EQUIPMENT

None

5.0 PRECAUTIONS

Does not apply

6.0 VISUAL INSPECTION

None

7.0 TEST ARTICLE PREPARATION

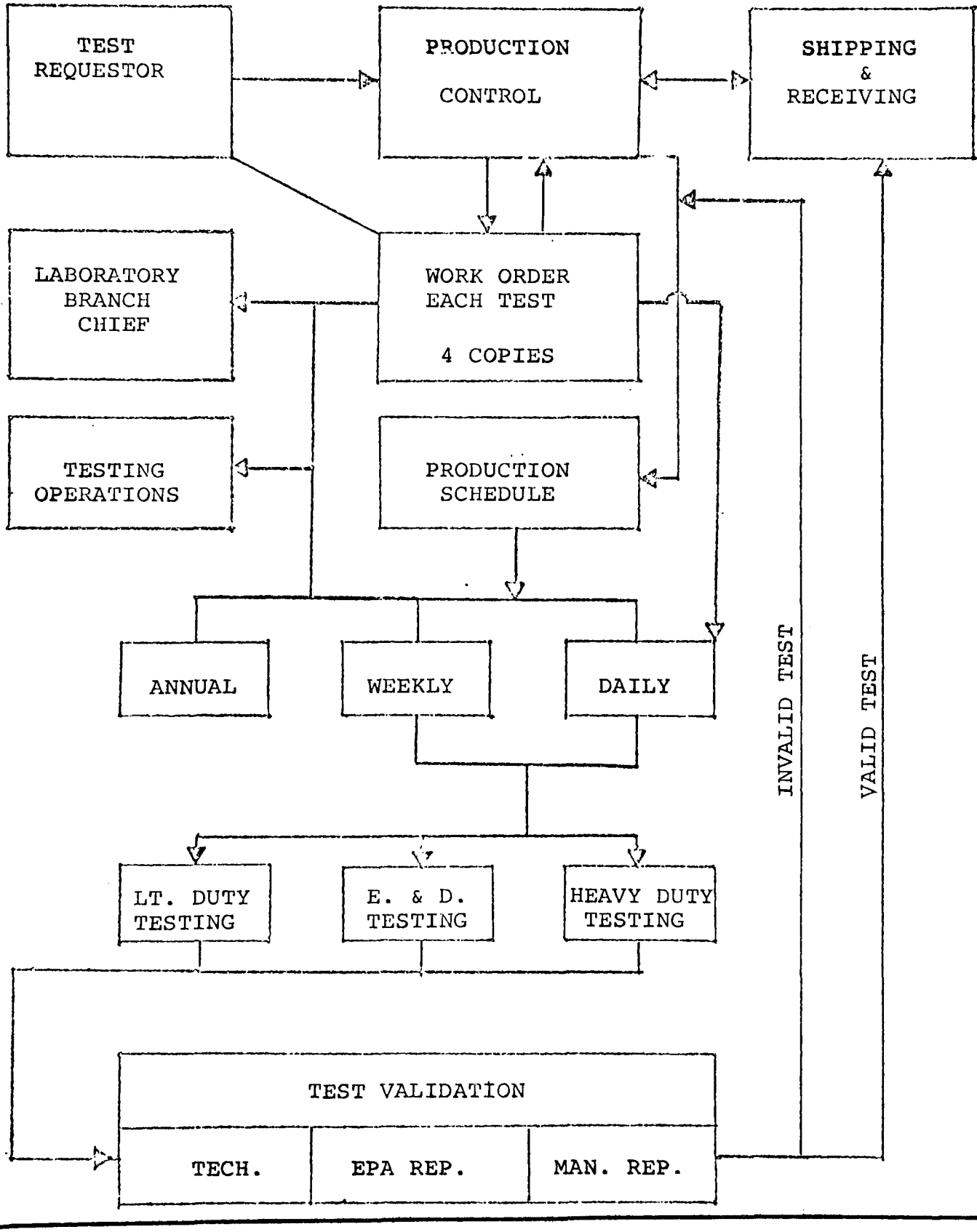
None

8.0 SCHEDULING PROCEDURE

The procedure for scheduling of a vehicle covers the period from the initial request thru the final release of the vehicle from the test area. Scheduling is done on a daily and weekly basis. Testing schedule projections are done on a yearly basis using information on testing requests obtained from Certification and other divisions.

Test Sequence	Description
101	All request for tests are sent to Production Control using a form such as 603-04. See Figure 8.1.
102	Production control schedules the test and sends verification of test time and date to the requestor. For certification tests form #603-03, Job Request, is used.
103	Production control makes out the test schedule for the week on Thursday and submits the schedule to Testing Operations and the Laboratory Branch Chief using form #603-06.
104	Confirmation of schedule is returned to Production Control on Friday.
105	Daily schedules for each test are all submitted to the Light Duty Testing Supervisor on the preceding day using form #603-06.
106	Weekly schedules are submitted to the Evaluational Development section on the preceding Friday using form #603-07.
107	The projected scheduling for the Laboratory Branch is revised and submitted to testing operations and the Laboratory Branch Chief on the first of each month.
108	Production control receives and ships the vehicle after notification of valid test using form #603-01. In addition the shipping and receiving order must be authorized by both the EPA Division Representative and the Manufacturers Representative. In cases where the above authorizations are not available the signature of the Laboratory Branch Chief is required.
109	If the test for any reason is invalid it is rescheduled at the earliest convenient date. Notification of new time and date is sent to the requestor.

Figure 8.1 Scheduling Procedure



9.0 DATA INPUT

Does not apply.

10.0 DATA ANALYSIS

None

11.0 DATA OUTPUT

Does not apply.

12.0 ACCEPTANCE CRITERIA

None

13.0 QUALITY PROVISIONS

13.1 Forms and procedure reviewed by Quality Assurance Management.

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
2565 Plymouth Road
Ann Arbor, Michigan 48105

SHIPPING AND RECEIVING ORDER

Manufacturer _____

Identifying No.(s) ① _____ ② _____ ③ _____

④ _____ ⑤ _____ ⑥ _____ ⑦ _____

⑧ _____ ⑨ _____ ⑩ _____ ⑪ _____

Description, Special Marks, and Exceptions _____

☐ The vehicle/engine(s) described above was/were RECEIVED into custody of this installation on _____ _____ 19___ at _____ AM _____PM.

☐ The vehicle/engine(s) described above is/are officially RELEASED to the manufacturer or his representative on _____ 19___ at _____ AM _____ PM.

_____
EPA Division Representative
☐ CSD ☐ ECTD ☐ AAPSD

_____
Manufacturer Representative

_____
Production Control Office

_____
Received by

Date _____ 19___
_____ AM _____ PM

EPA (XAA-303) 5-74

FORM #603-01

MSPCP(AA) 1-10-73

LABORATORY BRANCH

COMPLIANCE TEST REQUEST

Job #_____

REQUEST

Name _____ Date Submitted _____

Section _____ Extension _____

Test Type: ☐ Data ☐ Correlation ☐ 2nd Retest
☐ Durability ☐ 1st Test Reason:_____
☐ Running Change ☐1st Retest _____

Test Procedure _____

Special Test(s) Requested _____

Description:

Manufacturer _____ L.D. ☐ H.D. ☐

Identification _____

Engine Family _____ System _____

Reference No. _____

Expected Delivery Date _____

Latest Acceptable Completion Date _____

SCHEDULE

Prep Date _____

Test Date _____

RESCHEDULED FOR

Delivery Date _____

Prep Date _____

Test Date _____

Production Controller's Comments: _____

_____

Job #_____

Requestor _____ Section _____ Ext. _____

TEST TEAM REPORT

Date Received _____ Technician Assigned _____

Comments _____

TECHNICIAN REPORT

Date Began _____ Time _____ am/pm Man-Hours _____

Date Complete _____ Time _____ am/pm

Comments/Problems _____

_____

_____

_____

TEST VALIDITY

EPA Rep. _____ ☐ Valid ☐ Invalid

Technician _____ ☐ Valid ☐ Invalid

Manufacturer's Rep. _____ ☐ Valid ☐ Invalid

If invalid, why? _____

_____

FORM #603-02

WHITE: REQUESTOR'S COPY
YELLOW: PRODUCTION CONTROLLER'S COPY
PINK: LAB SECTION CHIEF'S COPY
GOLD: REQUESTOR'S IN-PROCESS COPY

MSPCP(AA) 1-10-73

LABORATORY BRANCH
JOB REQUEST

Job #_____

REQUEST

Name _____ Date Submitted _____

Branch _____ Section _____ Extension _____

Project Number/Description _____

Job Description (Attach sketches needed) _____

Special Equipment Required _____

Proprietory Item: ☐ Yes ☐ No

Craft Requested _____

Date Item To Be Delivered for Test _____

Latest Acceptable Completion Date _____

SCHEDULE

Date Request Rec'd _____

Craft(s)/Team Assigned _____

Date _____ Time _____am/pm

RESCHEDULED FOR

Date _____ Time _____am/pm

Reason _____

Job #_____

Requestor _____ Branch _____ Ext. _____

CRAFT/TEAM REPORT

#1	#2
Technician _____	Technician _____
Date Began _____ Time _____am/pm	Date Began _____ Time _____am/pm
Date Complete _____ Time _____am/pm	Date Complete _____ Time _____am/pm
Man-Hours _____	Man-Hours _____
Comments/Problems _____	Comments/Problems _____

WHITE: REQUESTOR'S COPY
YELLOW: PRODUCTION CONTROLLER'S COPY
PINK: LAB SECTION CHIEF'S COPY
GOLD: REQUESTOR'S IN-PROCESS COPY

FORM #603-03

ADVANCE TEST PROJECTION REQUEST
DIVISION OF CERTIFICATION AND SURVEILLANCE

Projection Period	Name	Branch/Section	Extension	Date Submitted

Manufacturer Name	Identification Number	Delivery Date	Test Date	Requirement (Indicate Year Below ('72, '73, '74, '75, '76, '77, '78, '79, '80)						
				Emission Data	Correlation	Durability	Surveillance	Running Change	Total	Other (Specify)
				A	B	C	D	E		F

FORM #603-04

LIGHT-DUTY TESTING SCHEDULE

Period_____ **Date Submitted**_____

Test Time	Sun. Name/ID	Mon. Name/ID	Tues. Name/ID	Wed. Name/ID	Thurs. Name/ID	Fri. Name/ID	Sat. Name/ID

FORM #603-05

ENVIRONMENTAL PROTECTION AGENCY
Office of Air Programs
Ann Arbor, Michigan 48105

Light Duty Testing Schedule for _____ Date Submitted _____

Test Number	Technician	Manufacturer of Vehicle	Vehicle Identification	Dynamometer No.	Start	Fuel Economy	Type Test	Re-Test	Job Request

FORM #603-06

ENVIRONMENTAL PROTECTION AGENCY

Ann Arbor, Michigan 48105

E & D Testing Schedule for _____ Date Submitted _____

Test Number	Technician	Manufacturer of Vehicle	Vehicle Identification	Dynamometer No.	Start	Fuel Economy	Type Test	Re-Test	Job Request

FORM #603-07

EPA TEST PROCEDURE	Number TP-604	Page 1 of 4

SUBJECT

DYNAMOMETER WARM-UP/SET

Reference Federal Register, Vol. 38, No. 209 October 31, 1973, Sec. 85.075-15	Data Form No. 705-01
Responsible Organization: Test Operations	Computer Program: --
Test Witness/Review: Team Leader	Performance Interval: Daily
Type of Test Report: Data Sheet	Supersedes: New
Report Distribution: O.A., Data Validation, Certification Branch	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
~~Program Mangmt.~~	~~Quality Assurance~~		
Laboratory Branch	Chief		
Laboratory Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To assure the Dynamometer and associated equipment has been conditioned properly. The horsepower/inertia for first vehicle is also set at this time.

2.0 TEST ARTICLE DESCRIPTION

2.1 Chassis dynamometer having the capabilities described in Federal Register 85.075-15.

2.2 Associated speed and horsepower (torque) meters.

2.3 Drivers Aid, Varian or Hewlett-Packard.

3.0 REFERENCES

3.1 Federal Register, Vol. 38, No. 209 - Oct. 31, 1973 - Sec. 85.075-15

3.2 EPA, Ann Arbor, "Light Duty Test Operations", Draft

4.0 REQUIRED EQUIPMENT

4.1 Light-weight non-test vehicle

5.0 PRECAUTIONS

5.1 Check carefully to assure that the desired Hp and Inertia is properly set.

5.2 Inflate tires to 45 psi, to protect against blow-outs

5.3 Tie down vehicle with winch cable.

6.0 VISUAL INSPECTION

6.1 Check the vehicle alignment on the dynamometer

7.0 TEST ARTICLE PREPARATION

7.1 Drive non-test vehicle onto dynamometer

7.2 Check "drivers-aid" for paper, ink and zero calibration

7.3 Position cooling fan within 12 inches of vehicle radiator, to prevent overheating

7.4 Insure vehicle exhaust is properly vented

8.0 TEST PROCEDURE

The following steps are to be performed for proper dyno warm-up and horsepower setting.

Test Sequence	Test Description	Data Output
101	Prior to the first test of the day, drive warm-up vehicle at 30 mph for 15 minutes	
102	Stop vehicle, set inertia weight and select horsepower required for next certification vehicle to be tested. Record inertia wt. and Hp. in Section II of form #705-01.	Inertia Wt, lbs. indicated horsepower
103	Accelerate to 50 mph; using the loading control switch set Hp required for next vehicle (Automatic loading system may be used).	
104	Hold steady at 50 mph/or 5 minutes. Check calibration of the "drivers-aid" against the speed meter to assure they both indicate 50 mph. If the drivers-aid is out of adjustment contact the Team Leader.	
105	Stop the warm-up vehicle disconnect exhaust vent system and remove the vehicle from the dynamometer.	

9.0 DATA INPUT

9.1 Complete Section II of data form #705-01.

9.2 Technician will sign and date form when warm-up is complete.

10.0 DATA ANALYSIS

None Required

11.0 DATA OUTPUT

11.1 Form #705-01 will remain with cert. vehicle until completion of DE-PREP.

12.0 ACCEPTANCE CRITERIA

12.1 Correct inertia and horsepower setting must be indicated in Section II of form #705-01.

12.2 Check for signature of Technician, indicating warm-up and horsepower set was performed.

13.0 QUALITY CONTROL PROVISIONS

13.1 Any equipment malfunctions (i.e., drivers-aid, dyno, meters) will be reported to Q.A. department by the Team Leader or Test Operations representative and corrective action (maintenance) should be initiated.

VEHICLE TEST AND EVAPORATIVE DATA

Vehicle Mfgr._____ No._____

Inertia Wt._____ HP_____ A/C_____ Test #_____

I. HEAT BUILD	TECH	CTA
A. Drain fuel	☐	☐
B. Plumb air cleaner	☐	☐
C. Plumb canister	☐	☐
D. Plumb bowl vent (if required)	☐	☐
E. Trap gas cap (if required)	☐	☐
F. Seal orifices/vents	☐	☐
G. Install carbon traps (record on data sheet)	☐	☐
H. Hook-up temperature recorder	☐	☐
I. Hook-up thermocouple leads	☐	☐
J. Install heat blanket	☐	☐
K. Plug in fuel tank heater (when used)	☐	☐
L. Refuel vehicle - 40% of tank capacity	☐	☐

Tech. Sig._____ Witness Sig._____

M. Replace fuel cap, plug exhaust pipe(s) Unclamp canister ☐ ☐

Heat Build Progress	Fuel Temp. Lead No. 1	Fuel Temp. Lead No. 4	Ambient Temp.
0-Min.			
15-Min.			
30-Min.			
45-Min.			
60-Min.			

II. DYNAMOMETER WARM-UP/SET

A. Drive non-test vehicle onto dyno B. Hook-up vehicle as for Hot LA-
C. Set inertia_____lbs.@_____H.P. D. Drive @50mph steady state
E. Remove vehicle from dyno

I. Tech. Sig._____ Date_____

II. Tech. Sig._____ Date_____

Section 700

EMISSION TESTING

EPA TEST PROCEDURE	Number TP-701	Page 1 of 4

SUBJECT

TEST VEHICLE INSPECTION AND ACCEPTANCE

Reference EPA Training Manual, "Light Duty Certification Procedures"	Data Form No. 701-01
Responsible Organization Production Control	Computer Program None
Test Witness/Review Manufacturer's Representative, Certification Rep., Q.A.	Performance Interval See Comments
Type of Test Report Data Sheet	Supersedes New
Report Distribution Q.A., Data Validation, Certification Branch	Superseded by

REMARKS/COMMENTS

Each vehicle must be inspected and accepted prior to each emission test.

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mangmt.	Quality Assurance		
Laboratory Branch	Chief		
Laboratory Branch	Test Operation Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To determine whether a vehicle is properly prepared and acceptable for emission testing, each vehicle will be inspected prior to vehicle preparation.

2.0 TEST ARTICLE DESCRIPTION

Test vehicle meeting manufacturer's and Federal requirements.

3.0 REFERENCES

EPA, "LIGHT DUTY CERTIFICATION PROCEDURES," TRAINING MANUAL, APPENDIX

4.0 REQUIRED EQUIPMENT

None required

5.0 PRECAUTIONS

5.1 If a vehicle being inspected does not have a required device, the team leader should be contacted.

6.0 VISUAL INSPECTION

SEE "TEST PROCEDURES."

7.0 TEST ARTICLE PREPARATION

7.1 PREPARED BY VEHICLE MANUFACTURER.

8.0 TEST PROCEDURE

The following inspection must be followed for proper vehicle acceptance.

Test Sequence	Test Description	Data Output
101	Check vehicle for valid license plate, properly mounted.	OK, NONE
102	Check for exhaust adaptor	OK, NONE
103	Is fuel drain connected	OK, NONE
104	Thermocouple lead hook-up	OK, NONE
105	Vehicle Damage, note on back of data sheet	OK, NOTE ON BACK
106	Insure equipment is connected (notify production control if disconnected equipment is found)	
107	Insure manufacturer's data sheet is clearly posted.	OK, NONE
108	Check oil level (if low, notify production control)	OK, NONE
109	Check for minimum 1/4 tank fuel level (add if required). NOTE: See Vehicle Fueling Procedure.	OK, NONE
110	Check for manufacturer's start-up procedure.	OK
111	If the above data is complete clear for AMA route.	OK

9.0 DATA INPUT

9.1 Submit completed Inspection form #701-01 to Data Validation following evaporative testing.

10.0 DATA ANALYSIS

10.1 Insure all required information is complete and correct.

11.0 DATA OUTPUT

11.1 Data form 024-01 submitted to Certification Branch for vehicle file storage.

12.0 ACCEPTANCE CRITERIA

12.1 Vehicle must follow criteria stated in Section I of Driver's Preconditioning form.

13.0 QUALITY CONTROL PROVISION

13.1 If vehicle is not within acceptable limits the manufacturer's representative should be notified prior to "AMA" preconditioning.

13.2 The inspector shall verify all conditions have been satisfied and shall enter his EPA I.D. # on the vehicle test data sheet.

F.T.P. MINUS EVAP PLUS F.E.T.

DRIVER'S PRECONDITIONING REPORT

Vehicle mfgr._____ No._____

Time Out_____ Time In_____ Odom_____

Date_____ Test#_____

I. VEHICLE INSPECTION

A.	Valid License Plate	☐OK	☐None	F.	Mfgr's Data Sheet	☐OK	☐None
B.	Exhaust Adaptor	☐OK	☐None	G.	Oil level; if low notify Prod. Cont.	☐OK	☐Note
C.	Fuel Drain	☐OK	☐None	H.	Odom Reading	☐OK	
D.	Vehicle Damage (note on reverse)	☐OK	☐Note	I.	Fuel level, 1/4-tank min,; add if required.		
E.	Equip. not connected notify Prod. Cont.	☐OK	☐Note	J.	Start-up per Mfg. instructions	☐OK	
				K.	Drive AMA route	☐OK	

II. AMA PRECONDITIONING

A.	Engine Start	☐Good		☐Hard	☐False
B.	Ignition Switch	☐OK		☐Other	
C.	Starter Motor	☐OK		☐Grinds	☐No Start
D.	Fast Idle	☐OK		☐None	☐Engine Hot
E.	Transmission	☐OK		☐Shifts Hard	
F.	Clutch	☐OK	Grabs	☐Slips	☐N/A
G.	Brakes	☐OK	Fade	☐Poor	☐None
H.	Driveability	☐Surge ☐Stumble ☐Back Fire ☐OK	Engine Miss ☐	Diesels ☐	☐Stretchy

Driver's Signature_____

FORM 701-01

EPA TEST PROCEDURE	Number TP-702	Page 1 of 7

SUBJECT

EVAPORATIVE EMISSIONS PREPARATORY PROCEDURES

Reference FEDERAL REGISTER, VOL. 38, NO. 209, Oct. 21, 1973 85.075-11 & EPA TRAINING MANUAL	Data Form No. 701-01
Responsible Organization TEST OPERATIONS	Computer Program NONE
Test Witness/Review TEAM LEADER, QUALITY ASSURANCE	Performance Interval PER CERT.VEHICLE
Type of Test Report DATA FORM OUT-PUT	Supersedes NEW
Report Distribution QUALITY ASSURANCE, DATA VALIDATION, TEST FILE, CSD	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To prepare test vehicles for the Diurnal (Heat Build) Evaporative test and the 1975 FTP.

2.0 TEST ARTICLE DESCRIPTION

Test vehicle (see Section 5.0 below)

3.0 REFERENCES

3.1 Federal Register, Vol. 38, No. 209, Oct 21, 1973, Para. 85.075-11

3.2 EPA, "Light Duty Certification Procedures," Training Manual.

4.0 REQUIRED EQUIPMENT

4.1 Engine analyzer which includes:
NOTE: See manufacturer's manual for calibration procedure.

- o Timing light
- o Tachometer
- o Dwell Meter

4.2 CO Analyzer (i.e., Mexa 300, Sun, Snap-On, etc.)
(Calibrate as shown in manufacturer's manual)

4.3 Chassis dynamometer (see procedure #202 for calibration.)

4.4 Varian, "driver's aid" (see procedure #204 for calibration

5.0 PRECAUTIONS

5.1 If the following items are not on the vehicle Do Not Continue Test!

- o Vehicle test data sheet
- o Marmon coupler
- o Evaporative plumbing
- o Thermocouples
- o Fuel drain

5.2 If the vehicles has to be weighed, lock the scale platform before moving vehicle on or off.

5.3 Use the proper fuel for each vehicle (see procedure #704)

5.4 When driving the "A.M.A." route, insure conditions are safe and do not exceed the speed limit. If road conditions are UNSAFE return to garage by shortest route.

5.5 Do not do any maintenance or adjustments and do not hook up any disconnected devices.

5.6 If vehicle does not start inform supervisor and manufacturers representative.

5.7 Be sure the "AMA" route has been driven prior to the LA-4.

5.8 If vehicle does not have sufficiently good drivability to follow LA-4 trace, report to the Team Leader.

6.0 VISUAL INSPECTION

6.1 Insure basic preliminary data is clearly posted on the vehicle.

6.2 Carefully inspect for disconnected devices.

7.0 TEST ARTICLE PREPARATION

7.1 Obtain car keys from the Production Controller.

7.2 Obtain the Preconditioning Driver's Report form #701-01

8.0 TEST PROCEDURES

The following steps must be taken to insure the proper preparation of a test vehicle for the 1975 Evaporative Emission and Federal Cycle Test.

Test Sequence	Test Description	Data Output
101	Fill out vehicle condition section of form 701-01 (Preconditioning Drivers Report)	Form Requirement
102	Insure that colored tape is attached to steering wheel/fuel cap and data sheet. (Red or Orange = indolene clear) (green = indolene 30)	--
103	Start the vehicle according to manufacturer's procedures. Check the following items on the engine start section of the preconditioning driver's report, with an "x."	
	o Satisfactory engine start	Good
	o If engine cranks for 10 seconds or more	Hard Start
	o If engine starts and then dies/record number of false starts	False Start
	o Check seat belt interlock function	
103A	o Ignition switch satisfactory	Okay
	o Ignition switch fails	Other
103B	o Starter motor engages properly	Okay
	o Starter motor grinds	Grinds
	o Starter malfunctions	Other
103C	o Car starts and fast idles without stalling	Okay
	o Car starts but does not fast idle	None
	o Car has been driven immediately prior to start (fast idle not required)	Engine Hot
104	Weigh vehicle at designated area. Record on checksheet	Curb Weight
105	Check for fuel level. If less than 1/4 full, take the vehicle to area designated for fueling (note: check for type of fuel needed by color tape)	--
105A	If fuel is added record the date, fuel type and amount on "vehicle test fuel record." This must be signed by the technician and a witness.	Date Fuel Type

Test Sequence	Test Description	Data Output
106	Drive the "A.M.A." preconditoning route. (See Attachment A to this procedure.) Note departing time on drivers form.	Date/Time
106A	After completing the AMA route, log in time and take the vehicle to the designated prep bay	Date Time
107	Evaluate drivability. If the vehicle drives well, indicate good on checksheet	Good
107A	If the vehicle does not drive well check "other" and evaluate criteria listed below	Other
	Transmisssion	
107B	o Transmission smooth	
	o Transmission (manual) difficult to operate	Shifts hard
	o Transmission (automatic) jerks between shifts	Shifts hard
	Clutch	
107C	o Clutch operates smoothly	Okay
	o Clutch grabs, slips or malfunctions	Other
	o Automatic transmission indicate "N/A" in other space	N/A
	Brakes	
107D	o Brakes function properly	Okay
	o Brakes grab, fade, squeal or malfunction	Other
108	If vehicle pulsates when driven at a constant speed, indicate surge	Surge
108A	If vehicle has a short, sharp reduction in acceleration rate, indicate stumble	Stumble

Test Sequence	Test Description	Data Output
108B	If the vehicle has a lack of anticipated throttle response, during light/moderate accels, indicate stretchy	Stretchy
108C	If any loud popping noises are detected coming from the tailpipe or carburetor, indicate backfire	Backfire
108D	If the engine continues to run when ignition is turned off, indicate diesel	Diesel
109	Following the evaluation steps listed above the driver must sign his name to the form	Signature
110	The following steps must be taken and information recorded on the Vehicle Inspection section of the preconditioning drivers report.	--
110A	Check the idle CO using an infrared analyzer such as a Mexa 300. Check/adjust the calibration settings.	% CO
110B	Follow the method for checking timing posted on the vehicle data sheet (should be posted in window of vehicle) check the timing and record under "Measured Values."	Degrees before or after TDC
110C	Insure that reading taken is within acceptable tolerance allowed by EPA. If out of tolerance contact supervisor and manufacturers representative	
110D	Record RPM at which timing was taken	RPM
110E	Check idle RPM (use manufacturer's technique) and record. Check tolerance.	RPM
110F	Check and record tire size	Tire Size
110G	Check axle ratio or N/V	
111	Record date and the technician must sign this form	Date Signature

9.0 DATA INPUT

9.1 Fill in Sections I, II, III on form 701-01

9.2 Turn form into Data Validation section for transfer of information onto CVS data sheet

10.0 DATA ANALYSIS

10.1 Data entered into Section III must be analyzed to assure that they are within specified acceptable limits.

11.0 DATA OUTPUT

11.1 Section III information becomes part of the final certification results via CVS data form

11.2 Form No. 701-01 filed in Data Validation Office.

12.0 ACCEPTANCE CRITERIA

12.1 All items must be evaluated. Tolerances: CO to be ±.5% and RPM to be ±150 RPM

13.0 QUALITY PROVISIONS

13.1 Institute corrective action if all required data is not filled in.

13.2 Notify Certification Branch representative if out of "specification limits"

F.T.P. MINUS EVAP PLUS F.E.T.

DRIVER'S PRECONDITIONING REPORT

Vehicle mfgr._____ No._____

Time Out_____ Time In_____ Odom_____

Date_____ Test#_____

I. VEHICLE INSPECTION

A.	Valid License Plate	☐OK	☐None	F.	Mfgr's Data Sheet	☐OK	☐None
B.	Exhaust Adaptor	☐OK	☐None	G.	Oil level; if low notify Prod. Cont.	☐OK	☐Note
C.	Fuel Drain	☐OK	☐None	H.	Odom Reading	☐OK	
D.	Vehicle Damage (note on reverse)	☐OK	☐Note	I.	Fuel level, 1/4-tank min,; add if required.		
E.	Equip. not connected notify Prod. Cont.	☐OK	☐Note	J.	Start-up per Mfg. instructions	☐OK	
				K.	Drive AMA route	☐OK	

II. AMA PRECONDITIONING

A.	Engine Start	☐Good	☐Hard	☐False	
B.	Ignition Switch	☐OK	☐Other		
C.	Starter Motor	☐OK	☐Grinds	☐No Start	
D.	Fast Idle	☐OK	☐None	☐Engine Hot	
E.	Transmission	☐OK	☐Shifts Hard		
F.	Clutch	☐OK	Grabs ☐Slips	☐N/A	
G.	Brakes	☐OK	Fade ☐Poor	☐None	
H.	Driveability	☐Surge ☐Stumble Engine Miss ☐ ☐OK	☐Back Fire Diesels ☐	☐Stretchy	

Driver's Signature_____

Form 701-01

II. SPECIFICATION CHECK — INITIAL

A. Idle CO Rt_____% Lt_____% _____

B. Engine RPM Idle_____ Drive_____ _____

C. Ignition Timing _____@_____in D☐/N☐ _____

D. Fuel Drain _____

E. Wheel to driveshaft ratio
10 wheel turns to _____driveshaft revs. N/V____ _____

F. Tire size _____x_____. _____

G. Vehicle Weight _____with _____ tank fuel _____

H. Add 40% evap. fuel. Witness Sig. _____ _____

IV. DYNAMOMETER HOT LA-4

A. Drive vehicle onto dyno.
Set inertia _____lbs. @_____H.P.

B. Check Varian. ☐Paper-OK ☐Pen-OK ☐Ink-OK ☐Zero-OK

C. Start Cooling Fan ☐OK ☐Release Dyno Brake-OK
☐Tire Pressure 45 P.S.I.-OK

D. Hook-up ☐Chock Blocks-OK ☐Cable Winch ☐Exhaust

E. Drive to Soak Area per schedule.

F. 11-Hour Soak Start _____ (DO NOT RE-START ENGINE AFTER SHUT DOWN).

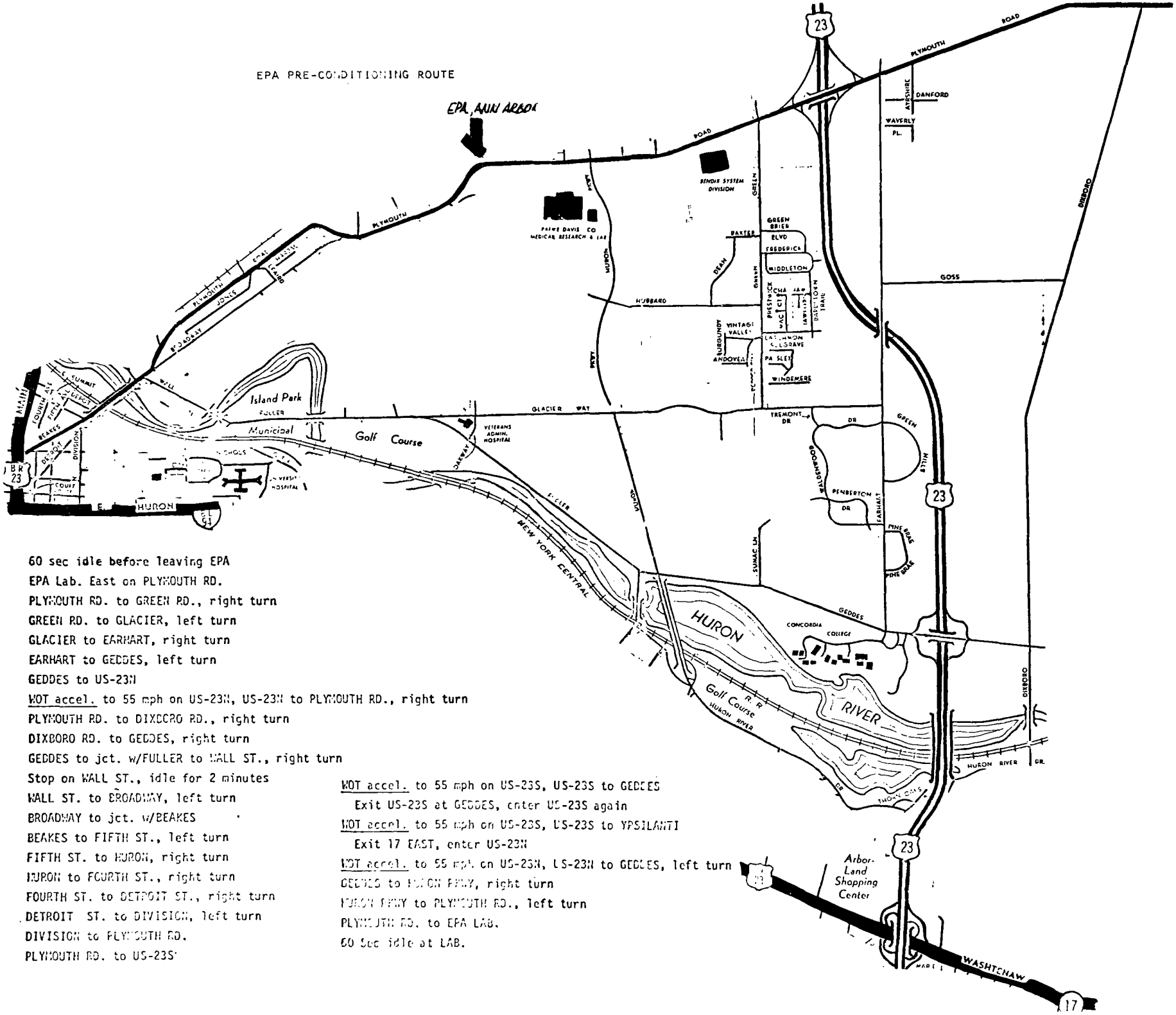
G. DO NOT START TEST BEFORE _____AM/PM. (Add 11 hours to hot soak start time).

Technician's Signature_____

Leader/Supv. Signature_____

Form 701-01 Cont.

EPA PRE-CONDITIONING ROUTE



60 sec idle before leaving EPA
EPA Lab. East on PLYMOUTH RD.
PLYMOUTH RD. to GREEN RD., right turn
GREEN RD. to GLACIER, left turn
GLACIER to EARHART, right turn
EARHART to GEDDES, left turn
GEDDES to US-23N
WOT accel. to 55 mph on US-23N, US-23N to PLYMOUTH RD., right turn
PLYMOUTH RD. to DIXBORO RD., right turn
DIXBORO RD. to GEDDES, right turn
GEDDES to jct. w/FULLER to WALL ST., right turn
Stop on WALL ST., idle for 2 minutes
WALL ST. to BROADWAY, left turn
BROADWAY to jct. w/BEAKES
BEAKES to FIFTH ST., left turn
FIFTH ST. to HURON, right turn
HURON to FOURTH ST., right turn
FOURTH ST. to DETROIT ST., right turn
DETROIT ST. to DIVISION, left turn
DIVISION to PLYMOUTH RD.
PLYMOUTH RD. to US-23S

WOT accel. to 55 mph on US-23S, US-23S to GEDDES
Exit US-23S at GEDDES, enter US-23S again
WOT accel. to 55 mph on US-23S, US-23S to YPSILANTI
Exit 17 EAST, enter US-23N
WOT accel. to 55 mph on US-23N, US-23N to GEDDES, left turn
GEDDES to HURON PKWY, right turn
HURON PKWY to PLYMOUTH RD., left turn
PLYMOUTH RD. to EPA LAB.
60 Sec idle at LAB.

EPA TEST PROCEDURE	Number TP-703	Page 1 of 4

SUBJECT

"LA-4" VEHICLE PREPARATION

Reference FEDERAL REGISTER, VOL. 38, NO. 209, OCT. 31, 1973 - 85.075-12	Data Form No. 701-01; SECTION IV
Responsible Organization TEST OPERATIONS	Computer Program NONE
Test Witness /REVIEW MANUFACTURER'S REPRESENTATIVE, EPA CERTIFICATION ENGINEER	Performance Interval PER CERT.VEHICLE
Type of Test Report DATA SHEET	Supersedes NEW
Report Distribution QUALITY ASSURANCE, DATA VALIDATION, CERTIFICATION BRANCH, TEST DATA FILE	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab. Branch	Chief		
Lab. Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To prepare certification vehicles for evaporative emission collection.

2.0 TEST ARTICLE DESCRIPTION

2.1 Test vehicle prepared by manufacturer

3.0 REFERENCES

3.1 Federal Register, Vol. 38, No. 209, Oct. 31, 1973 - 85.075-12

3.2 EPA TRAINING MANUAL, "Light Duty Certification Testing Procedures"

4.0 REQUIRED EQUIPMENT

4.1 Chassis dynamometer

4.2 Drivers aid, Varian

4.3 Cooling fan

5.0 PRECAUTIONS

5.1 Assure vehicle is tied down with winch cable

5.2 Inflate tires to 45 psi

5.3 Insure room temperature is within 68° to 86°F.

6.0 VISUAL INSPECTION

6.1 Check for proper set-up of test equipment.

7.0 TEST ARTICLE PREPARATION

7.1 Add evaporative test fuel to 20% of tank capacity
NOTE: Technician and witness must sign the "Fuel Log" located in fueling area.

7.2 Drive vehicle onto the dynamometer. Shut off engine.

7.3 Install chocks at front wheels and tie down with winch cable. Release Dyno brake first or the cable will be too taught.

7.4 Hook up exhaust vent system to vehicle.

7.5 Place cooling fan in front of vehicle and turn fan on.

8.0 TEST PROCEDURES

Test Sequence	Test Description	Data Output
101	Set inertia weight and hp per manufacturer's recommendation. Release dyno brake.	
102	Calibrate driver's aid at 50 mph and zero.	
103	Drive the hot LA-4, following tolerances stated in paragraph 85.075-14 of the Federal Register.	Driver's Chart
104	Upon completion of the LA-4 shut-off fan, engage the dyno brake, remove exhaust vent system, disconnect winch cable and remove chocks.	
105	Drive vehicle to soak area, shut-off engine, record the start time of the eleven hour soak.	Date, Time
106	Lock the vehicle and return the keys to the Production Control office.	

9.0 DATA INPUT

9.1 Insure Section IV of form 701-01 is complete.

9.2 Submit completed form and drivers trace to Data Validation.

10.0 DATA ANALYSIS

10.1 Check Section IV for missing data, and required signatures.

11.0 DATA OUTPUT

11.1 Form 701-01 becomes a permanent record of the test data package.

12.0 ACCEPTANCE CRITERIA

12.1 All entries must be complete and signed by the responsible technician and his supervisor.

12.2 Assure the LA-4 was driven within specified FTP driving limits. (see procedure #706, sec. 12.0)

13.0 QUALITY CONTROL PROVISIONS

13.1 If all entries and provisions stated in this procedure have been met, enter technician's EPA I.D. number on data sheet.

F.T.P. MINUS EVAP PLUS F.E.T.

DRIVER'S PRECONDITIONING REPORT

Vehicle mfgr._____ No._____

Time Out_____ Time In_____ Odom_____

Date_____ Test#_____

I. VEHICLE INSPECTION

A.	Valid License Plate	☐OK	☐None	F.	Mfgr's Data Sheet	☐OK	☐None
B.	Exhaust Adaptor	☐OK	☐None	G.	Oil level; if low notify Prod. Cont.	☐OK	☐Note
C.	Fuel Drain	☐OK	☐None	H.	Odom Reading	☐OK	
D.	Vehicle Damage (note on reverse)	☐OK	☐Note	I.	Fuel level, 1/4-tank min,; add if required.		
E.	Equip. not connected notify Prod. Cont.	☐OK	☐Note	J.	Start-up per Mfg. instructions	☐OK	
				K.	Drive AMA route	☐OK	

II. AMA PRECONDITIONING

A.	Engine Start	☐Good		☐Hard	☐False
B.	Ignition Switch	☐OK		☐Other	
C.	Starter Motor	☐OK		☐Grinds	☐No Start
D.	Fast Idle	☐OK		☐None	☐Engine Hot
E.	Transmission	☐OK		☐Shifts Hard	
F.	Clutch	☐OK	Grabs	☐Slips	☐N/A
G.	Brakes	☐OK	Fade	☐Poor	☐None
H.	Driveability	☐Surge ☐Stumble ☐Back Fire ☐Stretchy Engine Miss ☐ Diesels ☐ ☐OK			

Driver's Signature_____

Form 701-01

II. SPECIFICATION CHECK — INITIAL

A. Idle CO Rt_____% Lt_____% _____

B. Engine RPM Idle_____ Drive_____ _____

C. Ignition Timing _____@_____in D☐ /N☐ _____

D. Fuel Drain _____

E. Wheel to driveshaft ratio
10 wheel turns to _____driveshaft revs. N/V____ _____

F. Tire size _____x_____. _____

G. Vehicle Weight _____with _____ tank fuel _____

H. Add 40% evap. fuel. Witness Sig. _____ _____

IV. DYNAMOMETER HOT LA-4

A. Drive vehicle onto dyno.
Set inertia _____lbs. @_____H.P.

B. Check Varian. ☐Paper-OK ☐Pen-OK ☐Ink-OK ☐Zero-OK

C. Start Cooling Fan ☐OK ☐Release Dyno Brake-OK
☐Tire Pressure 45 P.S.I.-OK

D. Hook-up ☐Chock Blocks-OK ☐Cable Winch ☐Exhaust

E. Drive to Soak Area per schedule.

F. 11-Hour Soak Start _____ (DO NOT RE-START ENGINE AFTER SHUT DOWN).

G. DO NOT START TEST BEFORE _____AM/PM. (Add 11 hours to hot soak start time).

Technician's Signature_____

Leader/Supv. Signature_____

Form 701-01 Cont.

EPA TEST PROCEDURE

Number	Page
TP-704	1 of 5

SUBJECT

TEST VEHICLE FUELING PROCEDURES

Reference EPA MEMO DATED: 9-5-74	Data Form No. 704-01
Responsible Organization TEST OPERATION	Computer Program NONE
Test Witness/REVIEW PREP. TEAM LEADER	Performance Interval PER. CERT. VEHICLE
Type of Test Report DATA SHEET	Supersedes NEW
Report Distribution QUALITY ASSURANCE, TEST OPERATIONS, CERTIFICATION BRANCH	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
PROGRAM MGMT.	QUALITY ASSURANCE		
LAB. BRANCH	CHIEF		
LAB. BRANCH	TEST OPERATIONS CHIEF		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

This procedure is designed to assure that the correct fuel is put into each certification vehicle.

2.0 TEST ARTICLE DESCRIPTION

Certification vehicle.

3.0 REFERENCES

3.1 EPA MEMO, - "TEST VEHICLE FUELING PROCEDURES," 9-5-74.

3.2 EPA, ANN ARBOR, DRAFT, "LIGHT DUTY TEST OPERATIONS."

4.0 REQUIRED EQUIPMENT

4.1 Fuel Conditioning Carts and Related Equipment. (i.e., nozzles, etc.)

4.2 Fuel-Indolene HO clear (unleaded) or Indolene 30 (leaded)

4.3 Remote Control Door Openers.

5.0 PRECAUTIONS

5.1 All safety precautions for vehicle fueling must be followed.

- o No smoking
- o Electrical equipment grounded
- o Fuel carts grounded with ground cables (not to insulated bumpers)
- o Vehicle being fueled must be grounded
- o "Absorbent" material to cover fuel and oil spills

5.2 Assure lead fuel is not used for catalyst equipped vehicles.

6.0 VISUAL INSPECTION

6.1 Assure ground cables are properly connected.

6.2 Check for proper color coding of fuel used for vehicles

6.2.1 Indolene 30 "leaded" marked with green paint

6.2.2 Indolene HO-clear "unleaded' marked with red or orange paint.

7.0 TEST ARTICLE PREPARATION

7.1 All fuel nozzles, data sheets, vehicles, and fuel carts are marked a color code relating to fuel requirement.

- o Orange or red for Indolene HO clear (unleaded)
- o Green for Indolene 30 (leaded)

7.2 Before driving the "AMA" cycle, the driver must obtain the appropriate remote control unit from Production Control. NOTE: Remote controls have frequencies corresponding to the applicable fuel prep cell.

8.0 TEST PROCEDURE

The test vehicle fueling procedures specified below must be followed in all instances to assure proper fuel handling.

Test Sequence	Test Description	Data Output
101	Production Control will stamp the fuel requirements on all work sheets and check lists associated with each vehicle.	Color Code
102	The prep. technician will place appropriate orange or green label next to the fuel filler door, steering wheel area and on the side window.	
103	Fuel nozzles in each of the two prep cells is appropriately color coded. Assure the color matches that on the vehicle.	
104	Upon return from the "AMA" route enter the prep cell that opens when the remote control unit is activated.	
105	Before fueling any test vehicle, verify the type of fuel required and nozzle type. The check sheet is to be signed by the technician and EPA witness.	
106	Following the vehicle fueling the technician and EPA witness shall log the date, vehicle, vehicle number, type of fuel, and number of gallons pumped on the Vehicle Test Fuel Record," and sign it off.	Date, Vehicle, Vehicle type, Fuel, Gals.

9.0 DATA INPUT

9.1 Sign off checksheet #705-01 (Section I) and Section III of form #702-01.

9.2 Fill out the "Vehicle Test Fuel Record," form #704-01.

10.0 DATA ANALYSIS

None required

11.0 DATA OUTPUT

11.1 Forms 702-01 and 705-01 stay with vehicle until all tests are complete.

12.0 ACCEPTANCE CRITERIA

12.1 Assure the proper fuel has been dispensed for each vehicle.

12.2 All forms must be completed and signed.

13.0 QUALITY CONTROL PROVISIONS

13.1 Reject vehicle data if improper fueling has occurred and contact supervisor and manufacturers representative for disposition of the vehicle and appropriate corrective action to follow.

13.2 Institute corrective action (drain improper fuel) and repeat the procedure.

VEHICLE TEST FUEL RECORD

FUEL TYPE: 1. _____ PUMP READING: 1. _____

PREP. ROOM # _____ 2. _____ 2. _____

3. 3.

DATE	VEHICLE	VEHICLE NO.	TYPE FUEL	GALS.	SIGNATURE OF TECH.	SIGNATURE-WITNESS

· FORM 704-01

VEHICLE TEST AND EVAPORATIVE DATA

Vehicle Mfgr._____ No._____

Inertia Wt._____ HP_____ A/C_____ Test #_____

I. HEAT BUILD

	TECH	CTA
A. Drain fuel	☐	☐
B. Plumb air cleaner	☐	☐
C. Plumb canister	☐	☐
D. Plumb bowl vent (if required)	☐	☐
E. Trap gas cap (if required)	☐	☐
F. Seal orifices/vents	☐	☐
G. Install carbon traps (record on data sheet)	☐	☐
H. Hook-up temperature recorder	☐	☐
I. Hook-up thermocouple leads	☐	☐
J. Install heat blanket	☐	☐
K. Plug in fuel tank heater (when used)	☐	☐
L. Refuel vehicle - 40% of tank capacity	☐	☐

Tech. Sig._____ Witness Sig._____

M. Replace fuel cap, plug exhaust pipe(s) Unclamp canister ☐ ☐

Heat Build Progress	Fuel Temp. Lead No. 1	Fuel Temp. Lead No. 4	Ambient Temp.
0-Min.			
15-Min.			
30-Min.			
45-Min.			
60-Min.			

II. DYNAMOMETER WARM-UP/SET

A. Drive non-test vehicle onto dyno B. Hook-up vehicle as for Hot LA-
C. Set inertia_____lbs.@_____H.P. D. Drive @50mph steady state
E. Remove vehicle from dyno

I. Tech. Sig._____ Date_____

II. Tech. Sig._____ Date_____

III. MASS EXHAUST EMISSIONS TEST

A. Check Varian Paper-OK☐ Pen-OK☐ Ink-OK☐ Zero-OK☐

B. Cooling fan in place OK☐ Release dyno brake-OK☐

C. Hook up Chock blocks-OK☐ Cable winch☐ Exhaust ☐

D. Temp. recorder Connect thermocouple leads☐ Start recorder ☐

E. CVS Check fan operation☐ Bags-OK☐ Rev. Ctr. Zero ☐
Leak check-OK ☐ CVS Temp-OK ☐
Cell temp-OK ☐ Return to sample ☐

F. Drive test trace ☐ Check tire pressure (45 PSI) ☐

G. Remove vehicle to Soak Area ☐

IV. HOT SOAK EVAPORATIVE EMISSIONS TEST	TECH	CTA
A. Reseal orifices/vents	☐	☐
B. Reconnect carbon canisters and unclamp	☐	☐
C. Reconnect temp. recorder and thermocouple leads	☐	☐
D. Check gas cap	☐	☐
E. Plug exhaust pipe(s)	☐	☐
F. 1-hour soak Start time_____ End_____	☐	☐
G. Start amb. temp._____ End amp. temp._____	☐	☐
H. Check ambient temp. at 15-min. intervals	☐	☐
I. End of hot soak - reclamp canisters and remove	☐	☐
J. Shut-off temp. recorder	☐	☐
K. Weigh canisters and record on data sheet	☐	☐

V. DE-PREP AND VEHICLE REMOVAL

A. Remove all collection tubing, exhaust pipe plug(s), orifice/vent plugs, tape, foil, etc.	☐	☐
B. Disconnect temp. recorder & thermocouple leads	☐	☐
C. Return engine to Mfgr's running configuration	☐	☐
D. Move vehicle to East lot - keys to Prod. Contr.	☐	☐
E. "VOID" or "FAILED" vehicles - check with Team Leader for disposition		
F. Leave as is, if acceptable for HWFET		

III. Tech. Sig._____ Date_____

IV. Tech. Sig._____ Date_____

V. Tech. Sig._____ Date_____

EPA TEST PROCEDURE	Number TP-705	Page 1 of 6

SUBJECT

DIURNAL EVAPORATIVE TEST (HEAT BUILD)

Reference FEDERAL REGISTER, VOL. 38, NO. 209, Oct. 31, 1973, Section 85.075-13 - 85.075-21	Data Form No. 705-01.02
Responsible Organization TEST OPERATIONS	Computer Program
Test Witness/Review MANUFACTURER"S EPA REPRESENTATIVE	Performance Interval As per each Cert.Veh.
Type of Test Report DATA SHEET	Supersedes NEW
Report Distribution CERTIFICATION BRANCH, DATA VALIDATION, QUALITY ASSURANCE	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To quantify evaporative emission losses occurring during a simulated diurnal temperature rise period.

2.0 TEST ARTICLE DESCRIPTION

2.1 Certification Test Vehicle.

3.0 REFERENCES

3.1 Federal Register, Vol. 38, No. 209, Oct. 31, 1973 - Sec. 85.075-13, 85.075-21

3.2 EPA Training Manual, "Light Duty Certification Testing Procedures."

4.0 REQUIRED EQUIPMENT

4.1 Drying tubes - 3/4 in. ID, tubular, transparent

4.2 Desiccant, 8 mesh

4.3 Collection tubing, stainless or aluminum, 5/16 ID.

4.4 PVC tubing, 5/16 ID.

4.5 Hosecock clamps, rubber plugs, aluminum foil, tape

4.6 Balance - accuracy ±.075 grams

4.7 Temperature recorder, multi-channel, range 50° to 100°F, accuracy ±1°F

4.8 Type "J" thermocouples, iron-constantine

4.9 Carbon traps, activated carbon, 300 ±25 ml, capacity 150 gms activated carbon

4.9.1 Heat blanket

5.0 PRECAUTIONS

5.1 Follow vehicle fueling safety precautions

5.2 Soak temperature (ambient) must be between 76°F and 86°F.

5.3 Do not place canisters on floor or suspend from collection tubing, DO NOT KINK LINES. Place canister on a stand.

6.0 VISUAL INSPECTION

6.1 Inspect all plumbing and electrical connections.

6.2 Check color coding to insure proper evap. fuel is used.

7.0 TEST ARTICLE PREPARATION

7.1 Drain the fuel tank completely.

7.2 Install collection tube on the air cleaner.

7.3 Install collection tube on the vehicle carbon canister.

7.4 Seal all other orifices and vents to the atmosphere including exhaust pipe(s) and heat stove orifice.

7.5 Install collection tube on open bowl vent.

7.6 Seal fuel cap area for carbon trap after fuel is put in.

7.7 Install the temperature recorder.

7.7.1 Plug the thermocouple lead coming from the fuel tank into Channel 1.

7.7.2 Install a two foot thermocouple lead under the hood by taping "J" type thermocouple to the air cleaner snorkel. The connector should hang outside of the engine compartment on the right side of the vehicle. Plug into Channel 4.

7.7.3 Channel 2 of the temperature is permanently designated as the ambient room temperature hook-up.

7.7.4 Insure that all applicable switches inside of the recorder are turned on.

7.8 Install a heat-blanket on cars without one previously installed. Use one blanket on each tank if the vehicle has dual tanks. NOTE: DO NOT PLUG BLANKET IN UNTIL THE TEST IS BEGUN!

8.0 TEST PROCEDURES

The following steps are to be followed to assure proper heat build for the diurnal breathing loss test. As each step is completed check off on data form 705-01.

Test Sequence	Test Description	Data Output
101	Obtain carbon traps for each point to be sampled on the vehicle.	
102	Record the test number, date and vehicle make on the evaporative emission data sheet #705-01.	Test number Date, Vehicle make
103	Record the identification number marked on canisters and location on form #705-01. The lowest number will be placed on the air cleaner.	Canister number in descending order - location
104	Weigh each canister to the nearest 0.05 gram. If a deviation of ±.5 gram from the manufacturer's weight is discovered mark canister for return to manufacturer.	
105	Clamp, with hose-cock clamps, within 1 to 1-1/2 inches of the in/out tubes of the canisters. Cut off hose in excess of 4 inches.	
106	Weigh the canisters with the hose-cock clamps in the closed position. Mark the weight on the canisters and record on form #028-02 in the space marked initial weight.	Initial weight, grams
107	Recirculate evap. fuel in the fuel conditioning cart to allow for temperature stabilization.	
108	Add evap. fuel to the fuel tank, 40% of the fuel tank capacity.	Amount of fuel added
109	Turn on temperature recorder and monitor initial fuel temperature. Should be 60°F ±2°F, log on form #705-01 along with start time, temp. of lead #4 and ambient temp.	Fuel temp-Lead #1, Lead #4 ambient in °F start time

Test Sequence	Test Description	Data Output
110	Replace the fuel cap, plug the exhaust pipe and unclamp the canisters.	
111	Attach hose from the top (inlet) of the canisters to the evaporative collection tubing on the vehicle. The hose from the side (outlet) of the canisters are attached to a desiccant tube. The open end of tubing from desiccant shall be taped at the approximate height of the trapping point to allow for pressure equalization.	
112	Start heat build; at 15 min. intervals record fuel temp. of (fuel tank), lead 4 (under hood and ambient temperatures on evap. data sheet #705-01. NOTE: Adjust variac to approximately 40.	Lead 1, Lead 4, ambient
113	At the end of one hour, shut off the variac, unplug and remove the heat blanket, clamp off the canisters (inlet side first) and return air cleaner and vehicle carbon canister to "running" configuration.	
114	Re-route fuel to carburetor and reinstall heat stove tube. Unplug tailpipe, temperature recorder and remove.	
115	Recheck to assure all orifices/vents to atmosphere are unobstructed; air cleaner, heat stove functioning; thermocouples and heat blanket disconnected; plugs removed from tailpipe(s).	
116	Push vehicle onto dynamometer for '75 FTP Emission test.	

9.0 DATA INPUT

9.1 Fill in Test no., date, make of car, test no, canister numbers, location and initial wt. of canister on form #705-02 (Evaporative Emission Weighing Data).

9.2 Fill out section I "Heat Build" of form #705-01 (Vehicle Test and Evaporative Data).

10.0 DATA ANALYSIS

10.1 No analysis other than procedural verification is accomplished until the completion of the hot soak evap. test.

11.0 DATA OUTPUT

11.1 Form 705-01 stays with the test vehicle until the completion of the Hot Soak Evaporative Test and submitted to Data Verification following De-prep and removal.

11.2 Form 705-02 also remains with the test vehicle until the weight of the canister has been recorded for the Hot Soak Evap. Test.

12.0 ACCEPTANCE CRITERIA

12.1 During the heat build the fuel in the tank is to be heated from 60°F ±2°F to 84°F ±2°F at a constant rate of change over a 1 hour ±10 minute period.

12.2 The ambient temperature of the soak area must remain within the 76°F to 86°F band.

12.2 After a minimum of one hour in the soak area the vehicle must be moved (pushed) onto the dynamometer for the '75 FTP.

13.0 QUALITY PROVISIONS

13.1 Form #705-01 has a built in quality check in Section I. Each step performed is checked off by the technician and then checked and signed off by a witness, thus an audit is performed at the site of the test.

13.2 Heat build progress should be audited by the Q.A. department to assure the specified limits have not be exceeded.

13.3 All deviations (if any) from the prescribed procedure should be documented fully on form 705-01.

VEHICLE TEST AND EVAPORATIVE DATA

Vehicle Mfgr._____ No._____

Inertia Wt._____ HP_____ A/C_____ Test #_____

I. HEAT BUILD

	TECH	CTA
A. Drain fuel	☐	☐
B. Plumb air cleaner	☐	☐
C. Plumb canister	☐	☐
D. Plumb bowl vent (if required)	☐	☐
E. Trap gas cap (if required)	☐	☐
F. Seal orifices/vents	☐	☐
G. Install carbon traps (record on data sheet)	☐	☐
H. Hook-up temperature recorder	☐	☐
I. Hook-up thermocouple leads	☐	☐
J. Install heat blanket	☐	☐
K. Plug in fuel tank heater (when used)	☐	☐
L. Refuel vehicle - 40% of tank capacity	☐	☐

Tech. Sig._____ Witness Sig._____

M. Replace fuel cap, plug exhaust pipe(s) Unclamp canister ☐ ☐

Heat Build Progress	Fuel Temp. Lead No. 1	Fuel Temp. Lead No. 4	Ambient Temp.
0-Min.			
15-Min.			
30-Min.			
45-Min.			
60-Min.			

II. DYNAMOMETER WARM-UP/SET

A. Drive non-test vehicle onto dyno B. Hook-up vehicle as for Hot LA-4
C. Set inertia_____lbs.@_____H.P. D. Drive @50mph steady state
E. Remove vehicle from dyno

I. Tech. Sig._____ Date_____

II. Tech. Sig._____ Date_____

III. MASS EXHAUST EMISSIONS TEST

A. Check Varian Paper-OK☐ Pen-OK☐ Ink-OK☐ Zero-OK☐

B. Cooling fan in place OK☐ Release dyno brake-OK ☐

C. Hook up Chock blocks-OK☐ Cable winch☐ Exhaust ☐

D. Temp. recorder Connect thermocouple leads☐ Start recorder ☐

E. CVS Check fan operation☐ Bags-OK☐ Rev. Ctr. Zero ☐
Leak check-OK ☐ CVS Temp-OK ☐
Cell temp-OK ☐ Return to sample ☐

F. Drive test trace ☐ Check tire pressure (45 PSI) ☐

G. Remove vehicle to Soak Area ☐

IV. HOT SOAK EVAPORATIVE EMISSIONS TEST	TECH	CTA
A. Reseal orifices/vents	☐	☐
B. Reconnect carbon canisters and unclamp	☐	☐
C. Reconnect temp. recorder and thermocouple leads	☐	☐
D. Check gas cap	☐	☐
E. Plug exhaust pipe(s)	☐	☐
F. 1-hour soak Start time_____ End_____	☐	☐
G. Start amb. temp._____ End amp. temp._____	☐	☐
H. Check ambient temp. at 15-min. intervals	☐	☐
I. End of hot soak - reclamp canisters and remove	☐	☐
J. Shut-off temp. recorder	☐	☐
K. Weigh canisters and record on data sheet	☐	☐

V. DE-PREP AND VEHICLE REMOVAL

A. Remove all collection tubing, exhaust pipe plug(s), orifice/vent plugs, tape, foil, etc.	☐	☐
B. Disconnect temp. recorder & thermocouple leads	☐	☐
C. Return engine to Mfgr's running configuration	☐	☐
D. Move vehicle to East lot - keys to Prod. Contr.	☐	☐
E. "VOID" or "FAILED" vehicles - check with Team Leader for disposition		
F. Leave as is, if acceptable for HWFET		

III. Tech. Sig._____ _____ Date_____

IV. Tech. Sig._____ Date_____

V. Tech. Sig._____ _____ Date_____

EVAPORATIVE EMISSION WEIGHING DATA

TEST NO. _____

DATE _____

MAKE OF CAR _____

CANISTER NO.				
CANISTER LOCATION				
HOT SOAK WEIGHT				
INITIAL WEIGHT				
EVAP. EMISSIONS				

TOTAL EVAP. EMISSIONS _____

EPA TEST PROCEDURE	Number TP-706	Page 1 of 9

SUBJECT

1975 URBAN DYNO TEST - FTP

Reference Federal Register, Vol.38, No.209, Oct.31, 1973 - Secs. 85.075-14 thru 19 and 24, 25, Appendix I	Data Form No. 705-01
Responsible Organization Test Operations	Computer Program Analysis by SAQF: NEWCVS
Test Witness/Review Manufacturers EPA Representative	Performance Interval Per Vehicle
Type of Test Report Data Sheet	Supersedes New
Report Distribution Quality Assurance, Test Oper.,Data Validation,Cert. Branch	Superseded by

REMARKS/COMMENTS

1.0 See procedure No. TP-707 for sample analysis of the 1975 FTP.

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt.	Quality Assurance		
Lab. Branch	Chief		
Lab. Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To collect exhaust emissions utilizing a constant volume sampler. The dilute exhaust emissions are collected in sample bags. This sample is collected from a test vehicle which is being driven on a chassis dynamometer following the FTP driver's trace. The sample collected is then analyzed by the analysis system.
(Ref.TP-707).

2.0 TEST ARTICLE DESCRIPTION

2.1 Manufacturer's certification vehicle.

3.0 REFERENCES

3.1 Federal Register, Vol. 38, No. 209, Oct. 31, 1973, sections 85.075-14 through 19 and 85.075-24 through 25 and APPENDIX I.

3.2 EPA, Ann Arbor, Training Manual, "Light Duty Certification Testing Procedures."

4.0 REQUIRED EQUIPMENT

4.1 Constant Volume Sampler equipped to meet requirements in Federal Register, Sec. 85.075-20.

4.2 Chassis Dynamometer
- o Clayton model ECE-50

4.3 Drivers Aid
- o Varian
- o Hewlett-Packard

5.0 PRECAUTIONS

5.1 Perform dyno warm-up procedure (TP-604)

5.2 Ensure the hood of the test vehicle is closed and the cooling fan is turned off during the 10 minute soak.

6.0 VISUAL INSPECTION

6.1 Insure fan and tail pipe connector are in place.

6.2 Check bags for correct installation.

7.0 TEST ARTICLE PREPARATION

7.1 Insure test vehicle is aligned properly on the dynamometer and tied down.

7.2 Inflate tires to 45 p.s.i.

7.3 Daily Start-up (System Check-out); check off in section III, form #705-01.

7.4 Check Varian for Paper, Ink and calibrate zero; check off as above.

7.5 Install sample bags

7.6 When the cell technician/CVS operator have confidence that the CVS and associated equipment are operating correctly, the analyzer operator will have the manufacturer's EPA representative check and approve vehicle for the test.

8.0 TEST PROCEDURE

The Mass Emission test data is collected as a result of the following procedural steps.

Test Sequence	Test Description	Data Output
101	Push test vehicle on the dyno.	
	o Release the dyno. brake.	Dyno. brk. off
	o Secure vehicle with the down cable(s).	Cable winch
	o Place chocks on front wheels	Chocks
	o Install cooling fan 12 inches in front of vehicle and raise hood.	Cooling fan
	o Install flexible exhaust hose.	Exhaust
	o Connect thermocouple leads to temperature recorder and turn on.	Thermocouples Start recorder
	o Check form #705-01, section III.	
102	The CVS operator will:	
	o Zero counters	Rev. Ctr. Zero
	o Turn on "dia. pumps" and "blower."	
	o Inspect and install sample bags.	Bags
	o Check CVS temperature.	CVS temp.
	o Check cell temperature.	Cell temp.
103	Prior to entering the vehicle the driver will:	
	o Assure fuel is properly connected.	
	o Become familiar with the manufacturer's starting procedure.	
104	The driver will:	
	o Enter vehicle.	
	o Zero "drivers aid" and lower the pen.	
105	The operator will engage bags "1 and 3."	

Test Sequence	Test Description	Data Output
106a	Proceed with manufacturer's starting procedures: o Simultaneously start "counter" and crank engine. o If engine starts and continues to run, turn on the driver's aid.	
106b	If vehicle cranks for more than 10 seconds, take the following steps: o Cease cranking o Shut off "rev counter" o Shut off CVS o Manufacturer's representative has 30 min. to correct cause. o Repeat starting procedures in 106a.	Long crank
106c	If vehicle "false starts", repeat step 106a. o If unable to restart vehicle before first accel, shut off varian until engine starts. o If vehicle fails to start in 10 seconds, repeat step 106b. o If vehicle "false starts" repeatedly for 60 seconds, the test is voided.	False start Void
107	If vehicle starts and runs properly, but stalls when shifted into gear at 15-second point, shut off varian and re-start vehicle, shift back into gear, re-start varian and continue test.	
108	When engine is started, the driver may use any means necessary to keep engine running, i.e., "feathering" accelerator, "slipping" clutch, etc.	

Test Sequence	Test Description	Data Output
109	The driver will follow the Federal driver's trace, (see attachment A) with close attention given to the following: o Follow trace as closely as possible to avoid "out of spec" conditions. (see attachment B for operating mode instructions) o Monitor "trace" paper to assure it does not get hung up. o In case of problems, blow horn for CVS operator.	
110	At the "505 second point" the driver will initiate sampling of "bags 2 and 4" for the "stabilized" phase of the test.	
111	At 1367 seconds the final idle begins. o At 1369 sec. the ignition will be turned off. o Five seconds after the engine stops turning, shut off the sample and counter. o Read rev. counts.	rev. counts
112	After "rev. counter" has been turned off, the 10 min. soak begins. The driver will: o Close the vehicle hood. o Shut off cooling fan. o Disconnect and shut off the CVS o If fuel vents are being trapped, trap is removed during 10 min. soak and second 505. To be reconnected at beginning of hot soak.	
113	9 Min. into the 10 min. soak, the driver will: o Open hood. o Turn on fan.	

Test Sequence	Test Description	Data Output
114	The CVS operator will: o Install and evacuate "bags 1 and 2." o Zero counter. o Turn on dia. pumps and blower.	
115	The driver will perform the following: o Roll "drivers chart" to the beginning of next test. o Start the "505 Hot" portion of test. NOTE: Must be started between 10 and and 11 mins. of soak.	
116	At the end of "505" the CVS operator will turn off "rev counter."	
117	Remove tie-downs, exhaust connector, cooling fan, put hood down, dyno roll brake up and drive the vehicle off dyno into the soak area at minimum throttle.	

9.0 DATA INPUT

9.1 Fill out section III of form 705-01 as the required steps are performed and sign form.

9.2 Driver should sign and date the FTP "drivers trace."

10.0 DATA ANALYSIS

10.1 Drivers trace should be checked for "out of spec" conditions.

11.0 DATA OUTPUT

11.1 Form #705-01 is kept with vehicle until De-prep and removal has been accomplished.

11.2 Drivers trace is submitted to Data validation and becomes part of vehicle file.

12.0 ACCEPTANCE CRITERIA

12.1 Drivers trace generated from the FTP must be within the following limits. (See Figure 12-1.)

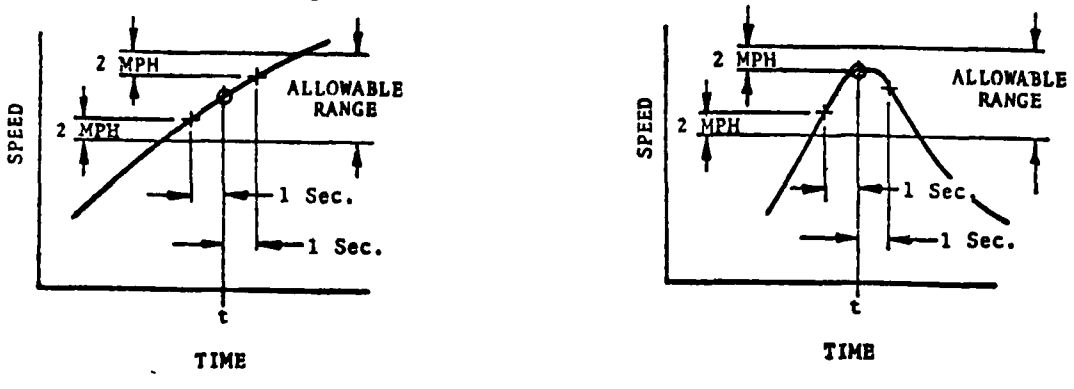


Fig. 12-1. ALLOWABLE LIMITS FOR FTP DRIVERS TRACE

12.1.1 The upper limit is 2 mph higher than the highest point being driven on the trace within 1 second of given time.

12.1.2 The lower limit is 2 mph lower than the lowest point being driven on the trace within 1 second of given time.

12.1.3 Speed variations greater than the tolerances described above (i.e., manual transmission shifting) are acceptable if they occur for less than 2 seconds on any occurrence.

12.1.4 Exceeding lower tolerance (12.1.2) is acceptable when restarting a stalled engine or if the vehicle is operated at W.O.T. (wide open throttle)

13.0 QUALITY PROVISIONS

13.1 The Quality Assurance section should inspect the drivers trace to assure the acceptable limits stated in section 12 have been followed.

13.2 If "out of limits" conditions are discovered, Quality Assurance should request corrective action. (i.e., have Production Control reschedule vehicle for test.)

VEHICLE TEST AND EVAPORATIVE DATA

Vehicle Mfgr._____ No._____

Inertia Wt._____ HP_____ A/C_____ Test #_____

I. HEAT BUILD	TECH	CTA
A. Drain fuel	☐	☐
B. Plumb air cleaner	☐	☐
C. Plumb canister	☐	☐
D. Plumb bowl vent (if required)	☐	☐
E. Trap gas cap (if required)	☐	☐
F. Seal orifices/vents	☐	☐
G. Install carbon traps (record on data sheet)	☐	☐
H. Hook-up temperature recorder	☐	☐
I. Hook-up thermocouple leads	☐	☐
J. Install heat blanket	☐	☐
K. Plug in fuel tank heater (when used)	☐	☐
L. Refuel vehicle - 40% of tank capacity	☐	☐

Tech. Sig._____ Witness Sig._____

M. Replace fuel cap, plug exhaust pipe(s) Unclamp canister ☐ ☐

Heat Build Progress	Fuel Temp. Lead No. 1	Fuel Temp. Lead No. 4	Ambient Temp.
0-Min.			
15-Min.			
30-Min.			
45-Min.			
60-Min.			

II. DYNAMOMETER WARM-UP/SET

A. Drive non-test vehicle onto dyno B. Hook-up vehicle as for Hot LA-4
C. Set inertia_____lbs.@_____H.P. D. Drive @50mph steady state
E. Remove vehicle from dyno

I. Tech. Sig._____ Date_____

II. Tech. Sig._____ Date_____

III. MASS EXHAUST EMISSIONS TEST

A. Check Varian Paper-OK☐ Pen-OK☐ Ink-OK☐ Zero-OK☐

B. Cooling fan in place OK☐ Release dyno brake-OK☐

C. Hook up Chock blocks-OK☐ Cable winch☐ Exhaust ☐

D. Temp. recorder Connect thermocouple leads☐ Start recorder ☐

E. CVS Check fan operation☐ Bags-OK☐ Rev. Ctr. Zero ☐
Leak check-OK ☐ CVS Temp-OK ☐
Cell temp-OK ☐ Return to sample ☐

F. Drive test trace ☐ Check tire pressure (45 PSI) ☐

G. Remove vehicle to Soak Area ☐

IV. HOT SOAK EVAPORATIVE EMISSIONS TEST	TECH	CTA
A. Reseal orifices/vents	☐	☐
B. Reconnect carbon canisters and unclamp	☐	☐
C. Reconnect temp. recorder and thermocouple leads	☐	☐
D. Check gas cap	☐	☐
E. Plug exhaust pipe(s)	☐	☐
F. 1-hour soak Start time_____ End_____	☐	☐
G. Start amb. temp._____ End amp. temp._____	☐	☐
H. Check ambient temp. at 15-min. intervals	☐	☐
I. End of hot soak - reclamp canisters and remove	☐	☐
J. Shut-off temp. recorder	☐	☐
K. Weigh canisters and record on data sheet	☐	☐

V. DE-PREP AND VEHICLE REMOVAL

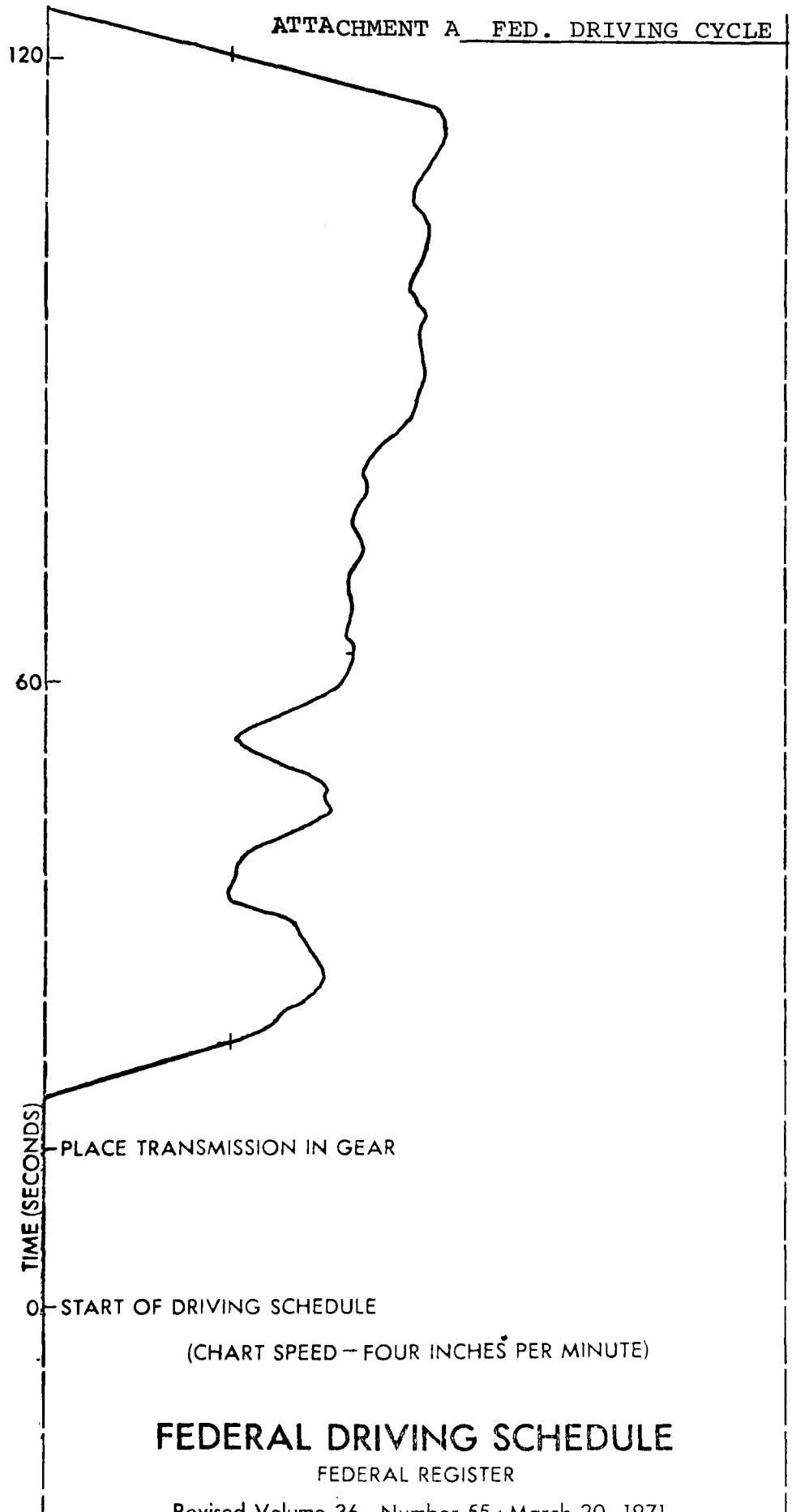
A. Remove all collection tubing, exhaust pipe plug(s), orifice/vent plugs, tape, foil, etc.	☐	☐
B. Disconnect temp. recorder & thermocouple leads	☐	☐
C. Return engine to Mfgr's running configuration	☐	☐
D. Move vehicle to East lot - keys to Prod. Contr.	☐	☐
E. "VOID" or "FAILED" vehicles - check with Team Leader for disposition		
F. Leave as is, if acceptable for HWFET		

III. Tech. Sig._____ _____ Date_____

IV. Tech. Sig._____ Date_____

V. Tech. Sig._____ _____ Date_____

ATTACHMENT A FED. DRIVING CYCLE



(CHART SPEED – FOUR INCHES PER MINUTE)

FEDERAL DRIVING SCHEDULE

FEDERAL REGISTER

Revised Volume 36 Number 55 · March 20, 1971

ATTACHMENT B - DRIVER'S OPERATING INSTRUCTIONS FOR 1975 FTP

1. ALL OPERATING MODES

   a. AUTOMATIC TRANSMISSIONS must always be in DRIVE position, except during first idle and when restarting engines.

   b. BRAKES and ACCELERATOR must NOT be used simultaneously.

   c. STEERING WHEEL must NOT be turned during a test.

   d. MINIMUM THROTTLING must be used during all modes to maintain speed indicated on driving trace.

2. IDLES

   a. MANUAL TRANSMISSIONS must always be in gear with clutch disengaged during all idles, except the first.

   b. THROTTLING is NOT PERMITTED during any idle mode, except the first, to prevent stalling.

3. ACCELERATIONS

   a. ALL accelerations must be made SMOOTHLY without using brakes.

   b. If the vehicle cannot accelerate at the specified rates, accelerate at WIDE OPEN THROTTLE (WOT) until vehicle reaches speed required at that time during the driving trace. WOT must be noted on driving trace where it occurs.

   c. Vehicles equipped with FREE-WHEELING or OVERDRIVE UNITS shall be tested with the unit locked out of operation.

   d. AUTOMATIC STICK SHIFT transmission may be shifted as manual transmissions at the requestor's option for development testing only.

4. DECELERATIONS

   a. ALL decelerations must be made SMOOTHLY using brake or accelerator to maintain required speed.

   b. ALL decelerations must be made WITHOUT DOWNSHIFTING MANUAL TRANSMISSIONS unless indicated on the driving trace.

ATTACHMENT B (continued)

c. DISENGAGE CLUTCH on manual transmissions when:

(1) Speed drops below 15 MPH.
(2) Engine ROUGHNESS is evident.
(3) Engine STALL is imminent.

5. SHIFTING

a. MANUAL transmissions must be quickly shifted during acceleration from:

(1) 1st to 2nd at 15 MPH.
(2) 2nd to 3rd at 25 MPH.
(3) 3rd to 4th at 40 MPH for 4-speed and 5-speed transmissions.
(4) 4th to 5th at requestor's option for 5-speed transmissions.

b. When shifting MANUAL transmission the ACCELERATOR PEDAL must be released as the CLUTCH is disengaged and the PEDAL depressed as necessary to maintain a smooth transition when CLUTCH is re-engaged.

c. If the FIRST GEAR RATIO exceeds 5:1 on a 4 OR 5 SPEED MANUAL TRANSMISSION, eliminate use of first gear and quickly shift during accelerations from:

(1) 2nd to 3rd at 15 MPH.
(2) 3rd to 4th at 25 MPH.
(3) 4th to 5th at 40 MPH for 5-speed transmissions.

NOTE: Requestor will specify first gear ratio if it exceeds 5:1.

d. DOWNSHIFT manual transmissions at the beginning of or during a power mode if the engine is obviously lugging. NOTE: "Lugging" on trace if downshift is required.

EPA TEST PROCEDURE	Number TP-707	Page 1 of 7

SUBJECT

SAMPLE ANALYSIS OF 1975 URBAN DYNO TEST

Reference Federal Register, Vol. 38, No. 29, Oct.31,1973 Sec. 85.075-15 & 85.075-20	Data Form No. 707-01-02
Responsible Organization Test Operations	Computer Program SAQF:NEWCVS
Test Witness/Review Manufacturer's EPA Representative, Data Validation	Performance Interval Per Vehicle
Type of Test Report Computer Print-Out	Supersedes New
Report Distribution Manufacturer/Certification Branch/ Data Validation/Quality Assurance	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt.	Quality Assurance		
Lab. Branch	Chief		
Lab. Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To measure the bag concentrations collected by a constant volume sampler. This exhaust sample is diluted to a constant volume and collected in sample bags. The collected sample is then analyzed for hydrocarbons, carbon monoxide, carbon dioxide and oxides of nitrogen by a gas analysis system.

2.0 TEST ARTICLE DESCRIPTION

2.1 Manufacturer's Certification vehicle.

3.0 REFERENCES

3.1 Federal Register. Vol. 38, No. 209, Oct. 31, 1973, sec. 85.075-15 and 85.075-20.

3.2 EPA, Ann Arbor, Training Manual "Light Duty Certification Testing Procedures."

3.3 EPA, Ann Arbor, "Light Duty Test Operations," Draft.

4.0 REQUIRED EQUIPMENT

4.1 Constant Volume Sampler.

4.2 Mass Analytical System capable of measuring the following:

4.2.1 Hydrocarbons - Flame Ionization

4.2.2 Carbon Monoxide - Infra-red (NDIR)

4.2.3 Carbon Dioxide - Infra-red (NDIR)

4.2.4 Oxides of Nitrogen - Chemiluminescence

4.3 "Working" gas mixtures analyzed using EPA Primary Standards.

4.4 "Zero Gas", nitrogen or air, and fuel cylinder for FID.

5.0 PRECAUTIONS

5.1 Safety precautions should be followed when handling compressed gases. NO and CO are toxic gases!

5.2 Insure cylinders have adequate pressure for testing.

5.3 Do not exceed maximum allowable time of 20 minutes after end of test when analyzing bag.

6.0 VISUAL INSPECTION

6.1 Check flow rates and pressures.

6.2 During the FTP and during analysis mode monitor all instruments, gauges, and recorders to assure no "out of spec" conditions exist.

7.0 TEST ARTICLE PREPARATION

7.1 Perform daily start-up on analyzer train.

7.2 Activate strip chart recorders and check zero/span.

7.3 Install sample bags and insure no leaks are present.

7.4 Change filter (sample) before FTP begins.

7.5 Start ambient temperature recorder.

8.0 TEST PROCEDURE

The 1975 Mass Emission Test results are calculated as a result of data collected from the following procedural steps.

Test Sequence	Test Description	Data Output
101	Prior to starting the first "505" of the FTP the analyzer operator will calibrate the analyzers and generate span points on the chart recorders.	
102	After the driver has switched to bags 2 and 4 upon completion of the "505" the Analyzer operator will deliver "bags 1 and 3" to the analysis transfer system.	
103	The analyzer operator will first analyze the "background" sample (bag 1) and log the numerical range and value from chart traces of HC, CO, CO_2 NO_x on form 707-02.	Bkgd. HC, Defl. CO, Defl. CO_2, Defl. NO_x, Defl.
104	Step 103 is repeated for the "sample" bag. (bag 3)	Deflections, HC, CO, CO_2 NO_x - Sample
105	Counts, mileage and seconds are recorded for first set of bags on form 707-01, CVS Data sheet.	Revs, secs., mileage
106	At the 660 point on the driver's trace for the odd numbered dyno, and 1020 sec. point for even number dyno the CVS operator will record the inlet and outlet pressure of the positive displacement pump on the CVS data sheet.	Inlet pressure out. pressure in inches of H_2O
107	Recalibrate as shown in step 101.	
108	Upon completion of the transient phase of the FTP repeat steps 103 and 104 for "bags 2 and 4." Record on form 707-02.	Deflections, HC, CO_2, and NO_x. BKGD. and sample.
109	Record counts, mileage and seconds for second set of bags on CVS data sheet.	Revs., secs., mileage

Test Sequence	Test Description	Data Output
110	Recalibrate as shown in step 101 for final "505."	
111	Upon completion of "505" hot, repeat steps 103 and 104 for "bags 1 and 3."	Deflections, HC, CO, CO_2 NO_x. Bkgd. and sample.
112	Record rev. counts, mileage and seconds for the third set of bags.	Revs., secs., mileage
113	Perform a post calibration and record on chart.	
114	Record the average wet and dry bulb temperatures, heat exchanger temperature and barometric pressure on CVS data sheet (707-01).	W_B, ^oF D_B, ^oF T_{IN}, ^oF Baro. Pressure Baro. Hg
115	Record CVS hours, Horsepower and analyzer train number.	Hours, CVS Hp-indicated train number.
116	Prepare for next test.	

9.0 DATA INPUT

9.1 Check form 707-01 (CVS data sheet) and assure that all required data has been filled in.

9.2 Assure that numerical deflections of HC, CO, CO_2 and NO_x have been recorded on form 707-02 (Analyzer read-out) for each of the three phases of the FTP.

9.3 The Certification Branch representative and the Manufacturer's representative will inspect the CVS data sheet, driver's trace and CVS temp. trace. They will then sign CVS data sheet as valid or invalid.

9.4 Data Validation will complete form 707-01 and submit to Data Branch.

10.0 DATA ANALYSIS

10.1 Data analysis is performed by the SAQF:NEWCVS program.

10.2 Analysis is performed on Drivers Trace as stated in section 12 of procedure #TP-706.

10.3 Analysis of all other supporting data is performed by Data Validation.

11.0 DATA OUTPUT

11.1 Following completion of the hot soak evap. all of the following information is entered into the vehicle test file.

- o CVS Data sheet form #707-01
- o Diurnal temp. trace
- o Analyzer trace
- o Drivers trace
- o CVS temp. trace
- o 702-01, DRIVER'S PRECONDITIONING REPORT
- o 705-01, VEHICLE TEST AND EVAPORATIVE DATA

11.2 Final copies of CVS data sheet and composite gram per mile results will go to the Certification Branch and the Manufacturer's representative.

12.0 ACCEPTANCE CRITERIA

12.1 Driver's trace must be within limits stated in section 12.0 of procedure #TP-706.

12.2 CVS temperature trace must be within $\pm 10^{\circ}F$ of set point for the entire test.

12.3 Manufacturer's representative must accept preliminary results as valid.

12.4 Analyzer post calibration must be within ±2 divisions of the initial span point.

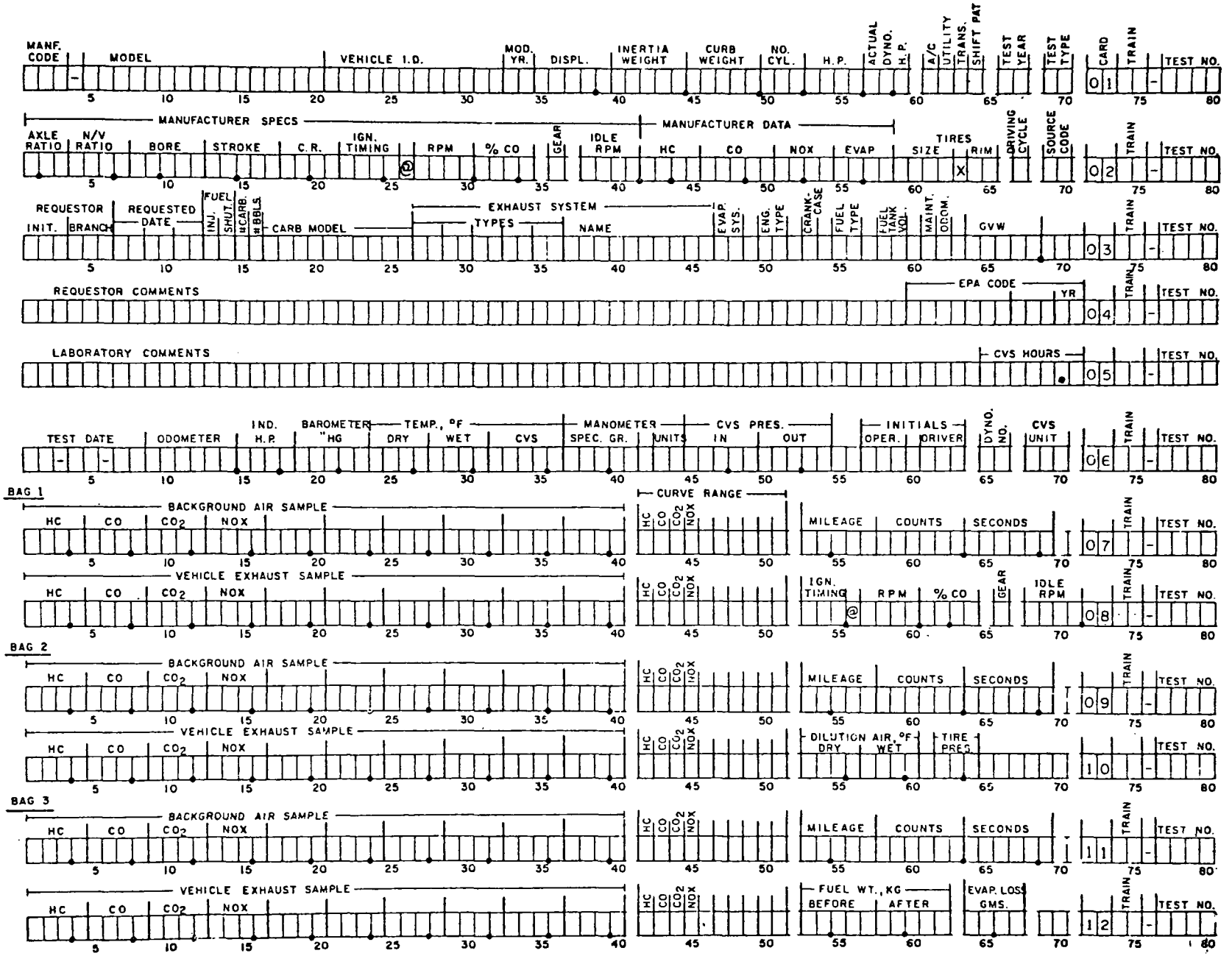
13.0 QUALITY PROVISIONS

13.1 Check tests results on an "audit" basis to assure acceptance criteria has been met.

13.2 Initiate corrective action if "out of spec" conditions are discovered. (i.e., Production Control will reschedule vehicle)

CONSTANT VOLUME SAMPLER (CVS) DATA SHEET

Form 707-01



04-10-74

CARD 1

MANF CODE (COLS 1-3)

CODE	EQUIVALENCE
010	AMERICAN MOTORS
021	(CHRYS) CHRYSLER
022	(CHRYS) DODGE
023	(CHRYS) PLYMOUTH
031	(FO MO CO) FORD
032	(FO MO CO) LINCOLN
033	(FO MO CO) MERCURY
041	(GM) BUICK
042	(GM) CADILLAC
043	(GM) CHEVROLET
044	(GM) OLDSMOBILE
045	(GM) PONTIAC
046	(GM) GMC
047	(GM) DETROIT DIESEL
050	ABARTH
060	A C CARS
064	AICHI
070	ASTON MARTIN
080	AUTO CAR
085	AUTO SPORT
090	ALFA ROMEO
095	AM GENERAL
100	AVANTI
105	AUBURN
110	AUSTIN MORRIS (BLMC)
120	BMW
125	BOLWELL
130	BRISTOL
135	BRICKLIN
140	CHECKER
150	CITROEN
160	COMMER
170	SAMCO (CORD)
175	DACIA (ARO)
180	DAF
190	DAIHATSU
200	MERCEDES BENZ
205	DE TOMASO
210	DUAL GHAI
215	DYNA TRUCK
220	FERRARI
230	FIAT
240	FORD OF ENGLAND
245	FORD OF GERMANY
250	HINO
255	HARLEY-DAVIDSON
260	HONDA
270	IHC
280	ISO
290	ISUZU
300	JAGUAR (BLMC)
310	JENSEN
320	JOHN FITCH
330	JEEP (KAISER)
340	LANCIA
350	LOTUS
360	MASERATI
365	MOHS
370	MORGAN
380	NISSAN
390	NSU
400	OPEL
405	PANTHER
410	PEUGEOT
420	PORSCHE
430	RENAULT
440	ROLLS-ROYCE
450	ROOTES
460	ROVER (BLMC)
470	SAAB
480	SHELBY
490	MITSUBISHI
495	SIAIRA
500	SIMCA
510	SKODA
520	SS AUTOMOBILE
530	TRIUMPH (BLMC)
535	STUTZ
540	SUZUKI
550	TORINO
560	TOYO KOGYO
570	TOYOTA
580	VAUXHALL
590	VOLKSWAGEN
600	VOLVO
605	WHITE
610	YENKO
615	YAMAHA
620	TVR
630	SUSPENSIONS INT (OMEGA)
640	AUDI
650	MURENA MOTORS
660	FUJI HEAVY IND
670	MONTEVERDI
680	INTERMECCANICA (ITALIA)
690	LAMBORGHINI
700	MARCOS
710	ARMY
720	WINNEBAGO
725	ALLIS CHALMERS
730	CATERPILLAR
740	CUMMINS
750	HERCULES
760	MACK
770	PERKINS
780	SCANIA-VABIS
790	GLASSIC
800	TELEDYNE CONTINENTAL
810	CASE
820	DIAMOND REO
830	HIGHWAY PRODUCTS,INC
999	EXPERIMENTAL

AIR CONDITIONING (COL 61)

CODE	EQUIVALENCE
1	WITH
2	WITHOUT

UTILITY VEHICLE (COL 62)

CODE	EQUIVALENCE
1	YES
2	NO

TRANSMISSION (COL 63)

CODE	EQUIVALENCE
1	AUTO
2	3-SPEED
3	4-SPEED
4	5-SPEED
5	SEMI-AUTOMATIC

SHIFT PATTERN (COL 64)

CODE	EQUIVALENCE
1	STANDARD
2	OPTIONAL

TEST TYPE (COLS 69-70)

CODE	EQUIVALENCE
00	VOID
01	CERT (EMISSION DATA)
02	CERT (DURABILITY)
03	CERT (CORRELATION)
04	SURVEILLANCE
05	EXPERIMENTAL
06	FIELD SURVEILLANCE
07	PARTICULATES
08	OTHER
09	CVS CORRELATION
10	RESEARCH
11	CORRELATION (LAB)
12	CERT (RUNNING CHANGE)

TRAIN (COLS 74-75)

CODE	EQUIVALENCE
1-97	AEGAS
98	PARTICULATES
99	PROP SAMPLER

CARD 2

DRIVING CYCLE (COL 67)

CODE	EQUIVALENCE
1	7-MODE
2	LA-4
3	LA-4 S3
4	ANN ARBOR
5	LA-4 S4
6	9 X 7 MODE
7	STEADY STATE
8	OTHER

SOURCE CODE (COLS 69-70)

CODE	EQUIVALENCE
01	MANUFACTURER
02	HERTZ DETROIT
03	HERTZ L.A.
04	AVIS
05	AIRWAYS CORP L.A.
06	ALPH CORP L.A.
07	GSA L.A.
08	PO DEPT DETROIT
09	PO DEPT L.A.
10	L.A. COUNTY VEH
11	STATE OF CALIFORNIA
12	BORROWED FROM CORPS
13	AMERICAN RACEWAYS, INC
14	DEALER USED CARS
15	EPA
16	GSA
17	MILITARY
18	PRIVATE OWNER
19	OTHER

CARD 3

FUEL INJECTION (COL 13)

CODE	EQUIVALENCE
1	YES
2	NO

FUEL SHUTOFF (COL 14)

CODE	EQUIVALENCE
1	YES
2	NO

EXHAUST SYSTEM TYPE (COLS 27-28), (COLS 29-30), (COLS 31-32), (COLS 33-34) AND (COLS 35-36)

CODE	EQUIVALENCE
01	AIR INJECTION
02	ENGINE MOD
03	FUEL INJECTION
04	OTHER
05	THERMAL REACTOR
06	CATALYTIC REACTOR
07	TURBOCHARGER
08	EXHAUST RECYCLE
09	NONE

EVAP SYSTEM TYPE (COLS 47-48)

CODE	EQUIVALENCE
01	CRANKCASE
02	CANISTER
03	TANK
04	NONE

ENGINE TYPE (COLS 50-51)

CODE	EQUIVALENCE
01	I-BLOCK
02	V-BLOCK
03	ROTARY
04	OPPOSED
05	TURBINE
06	EX (STEAM)
07	EX (FREON)
08	DIESEL
09	STIRLING
10	ELECTRIC
11	STRATIFIED

CRANKCASE SYSTEM TYPE (COL 53)

CODE	EQUIVALENCE
1	CLOSED
2	OTHER

FUEL TYPE (COLS 55-56)

CODE	EQUIVALENCE
01	INDOLENE 30
02	COMMERCIAL LEADED
03	LPG
04	PROPANE
05	OTHER
06	IND UNLEADED, 91 OCT
07	IND UNLEADED, 100 OCT
08	#1 FUEL OIL
09	#2 FUEL OIL
10	NATURAL GAS
11	ALCOHOL
12	INDOLENE 10
13	INDOLENE 20
14	JP-4
15	KEROSENE
16	COMMERCIAL UNLEADED

MAINTENANCE CODE (COL 61)

CODE	EQUIVALENCE
1	BEFORE
2	AFTER
3	NORMAL

ODOMETER CODE (COL 62)

CODE	EQUIVALENCE
1	MILES
2	KMS

CARD 6

MANOMETER UNITS (COLS 43-44)

CODE	EQUIVALENCE
IN	INCHES
CM	CENTIMETERS
MM	MILLIMETERS

ANALYZER TEST READ-OUT

TEST NO. _____ MFG _____ DATE _____

BAG	HC	R	CO	R	CO_2	R	NOx	R	
B/G 1									
SAM. 3									
B/G 2									
SAM. 4									
B/G 1									
SAM 3									

OPERATOR REMARKS: _____

TEST NO. _____ MFG _____ DATE _____

BAG	HC	R	CO	R	CO_2	R	NOx	R	
B/G 1									
SAM. 3									
B/G 2									
SAM 4									
B/G 1									
SAM 3									

OPERATOR REMARKS: _____

form 707-02

1975 MSPCP CONSTANT-VOLUME SAMPLER RESULTS

TEST # 16-7167 PROCESSED: 14:38:43 JAN 3, 1975

MFG. CODE	MODEL	VEHICLE I.D.	MOD. YR	DISPL.	INERTIA WEIGHT	CURB WEIGHT	NO. CYL.	H.P.	ACTUAL DYNO.H.P.	A C	UTL	TRANS	S.PAT.	TEST YEAR	TEST TYPE
999	TCS CRICKET	776-DUZ	72	141.0	2500	0	4	0	0.0	2	2	1	1	75	5

AXLE RATIO	N/V RATIO	MANUFACTURE SPECS. BORE	STROKE	C.R.	TIMING	RPM	% CO GEAR	IDLE/-----MANUFACTURE DATA--------/ RPM	HC	CO	NOX	EVAP	TIRES SIZE	RIM	DRIVE CYCLE	SOURCE CODE
0.0	0.0	0.0	0.0	0.0	0.0	0.	0.0	0.	0.0	0.0	0.0	0.0			0	0

REQUESTOR INIT.	BRANCH	DATE	FUEL INJ.	SHUT.	#CARB	#BBLS	CARB MODEL	EXHAUST SYSTEM TYPES	NAME	EVAP SYS.	EGN TYPE	CRANK CASE	FUEL TYPE	FUEL TANK	MAINT	ODOM	GVW
		0- 0- 0	0	0	0	0		0 0 0 0 0		0	0	0	7	0	0	0	0

REQUESTOR COMMENTS : *****UNOFFICIAL PRELIMINARY*****
LABORATORY COMMENTS : **********RESULTS**********
ENGINE FAMILY : 0 00
CVS HOURS :

TEST DATE	ODOMETER	IND. H.P.	BARO "HG	TEMP.,DF DRY	WET	CVS	MANOMETER SPEC.GR.	UNITS	CVS PRES. IN	OUT	INITIALS OPER.	DRIVER	DYNO. NO.	CVS UNIT
1- 3-75	6113.	6.2	28.86	76.0	57.0	100.0	1.75	IN	24.65	17.45	CFF	TAT	08	7C
		DILUTION AIR		0.0	0.0									

CUBIC FT PER REV.	CALCULATED RPM	NOX FACTOR	IGN TIMING	RPM	% CO	GEAR	IDLE RPM	EVAP. LOSS GRAMS	TIRE PRES.
0.27034	1468.	0.8593	00	0.	0.0	N	0.		45.0

BAG 1 3.590 MILES 12388. COUNTS 2710.2 CU. FT. D/FACTOR=13.829

	EXHAUST SAMPLE RANGE	METER	CONC.	BACKGROUND SAMPLE RANGE	METER	CONC.	CORRECTED CONCENTRATIONS	MASS EMISSIONS GMS	GMS/MI	MPG1
HC-FID	4	41.6	125.36	4	1.4	4.14	121.52 PPM	5.38	1.50	
CO	5	16.9	43.79	5	0.3	0.85	43.00 PPM	3.84	1.07	
CO2	2	35.4	0.952	2	1.5	0.041	0.914 %	1284.88	357.90	24.4
NOX CHEM	4	37.3	37.30	4	0.4	0.40	36.93 PPM	4.66	1.30	

BAG 2 3.910 MILES 21122. COUNTS 4621.1 CU. FT. 1376.0 SECONDS D/FACTOR=22.716 ACT RPM= 1461.2 RPM RATIO(C/A)=0.9957

	EXHAUST SAMPLE RANGE	METER	CONC.	BACKGROUND SAMPLE RANGE	METER	CONC.	CORRECTED CONCENTRATIONS	MASS EMISSIONS GMS	GMS/MI	MPG1
HC-FID	4	19.2	57.31	4	1.5	4.43	53.07 PPM	4.00	1.02	
CO	3	6.3	2.80	3	0.1	0.04	2.76 PPM	0.42	0.11	
CO2	2	22.4	0.584	2	1.3	0.035	0.550 %	1318.27	337.15	26.1
NOX CHEM	3	39.8	19.90	3	0.8	0.40	19.52 PPM	4.20	1.07	

BAG 3 3.590 MILES 13099. COUNTS 2865.8 CU. FT. 538.1 SECONDS D/FACTOR=15.908 ACT RPM= 1460.6 RPM RATIO(C/A)=0.9952

	EXHAUST SAMPLE RANGE	METER	CONC.	BACKGROUND SAMPLE RANGE	METER	CONC.	CORRECTED CONCENTRATIONS	MASS EMISSIONS GMS	GMS/MI	MPG1
HC-FID	4	33.2	99.74	4	2.1	6.21	93.92 PPM	4.40	1.22	
CO	3	37.1	18.06	3	0.0	0.0	18.06 PPM	1.71	0.48	
CO2	2	31.3	0.831	2	1.4	0.038	0.795 %	1181.30	329.05	26.6
NOX CHEM	4	34.4	34.40	4	0.4	0.40	34.03 PPM	4.54	1.26	

WEIGHTED VALUES	HC	CO	CO2	NOX	HE	75 FTP1 MPG	72-4 FTP1 MPG	75 WEIGHTED1 MPG	FUEL-WEIGHT1 MPG
GRAMS/MILE	1.18	0.406	339.	1.17	0.	25.6	25.2	25.8	0.0

TP-707 Attachment No. 1

EPA TEST PROCEDURE	Number TP-708	Page 1 of 5

SUBJECT

HOT SOAK EVAPORATIVE

Reference FEDERAL REGISTER, VOL. 39, NO. 101, MAY 23, 1974, Sec. 95-075-13 & 21	Data Form No. 705-01, Sec. IV
Responsible Organization TEST OPERATIONS	Computer Program SEE COMMENTS
Test Witness/Review MANUFACTURER'S REPRESENTATIVE, DATA VALIDATION	Performance Interval PER VEHICLE
Type of Test Report DATA FORM OUT-PUT	Supersedes NEW
Report Distribution MANUFACTURER, QUALITY ASSURANCE, DATA VALIDATION, CERTIFICATION BRANCH	Superseded by

REMARKS/COMMENTS

1.0 EVAPORATIVE DATA ANALYSIS IS ACCOMPLISHED BY SAQF:NEWCVS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To measure and quantify hydrocarbon evaporative losses after vehicle has been driven and is parked in soak area.

2.0 TEST ARTICLE DESCRIPTION

2.1 Certification Test Vehicle.

3.0 REFERENCES

3.1 Federal Register, Vol. 39, No. 101, May 23, 1974, Sec. 85.075-13, 85.075-21.

3.2 EPA Training Manual, "Light Duty Certification Testing Procedures."

4.0 REQUIRED EQUIPMENT

4.1 Drying tubes - 3/4 in. ID, tubular, transparent

4.2 Desiccant, 8 mesh

4.3 Collection tubing, stainless or aluminum, 5/16 ID.

4.4 PVC tubing, 5/16 ID.

4.5 Hosecock clamps. rubber plugs, aluminum foil, tape

4.6 Balance - accuracy $\pm$.075 grams

4.7 Temperature recorder, multi-channel, range 50° to 100°F, accuracy $\pm 1^{\circ}$F

4.8 Type "J" thermocouples, iron-constantine

4.9 Carbon traps, activated carbon, 300 $\pm$25 ml, capacity 150 gms activated carbon

5.0 PRECAUTIONS

5.1 Do not place canisters on the floor, or suspend from collection tubing. DO NOT KINK LINES.

5.2 Close the hood as soon as possible after plumbing and collection canisters have been reinstalled.

5.3 Caution should be exercised when connecting and removing canister to prevent vapor loss.

6.0 VISUAL INSPECTION

6.1 Inspect all plumbing and electrical connections.

7.0 TEST ARTICLE PREPARATION

7.1 Re-seal all orifices and vents as described in section 7.0 of procedure TP-705.

7.2 Plug exhaust pipe.

7.3 Re-seal fuel cap area.

7.4 Reconnect temperature recorder and thermocouple lead -channel 2 for ambient temperature.

7.5 Check the above items off in section IV of form #705-01.

8.0 TEST PROCEDURE

The following steps are necessary to assure proper collection of the hot soak evaporative losses. As each step is completed check off on form 705-01, sec. IV.

Test Sequence	Test Description	Data Output
101	Immediately after the engine is turned off reconnect the carbon canisters to the required trap points. Ref: TP-705. NOTE: Same canisters and placement as in diurnal evap. Remove clamps.	
103	Start one hour soak and record start time.	Start time
104	Record ambient temperature at beginning of soak.	Start temp.
105	Check ambient temperature at 15 min. intervals to insure "out of spec" conditions do not occur.	Check temp.
106	At the end of the one hour soak record end time and final ambient temperature.	End time End temp.
107	Shut off temperature recorder	Shut off recorder
108	Reclamp canisters and remove.	
109	Weigh the canisters with hose-cock clamp connected and record on form 705-02 in hot soak wt. block.	Hot weight

9.0 DATA INPUT

9.1 Complete section IV of form 705-01 (Vehicle Test and Evap.) and sign/date at the bottom of form.

9.2 Insure that final hot weight is recorded on form 705-02 (Evap. Emission Data).

9.3 Fold temperature trace and turn in to Data Validation with the above-mentioned forms.

10.0 DATA ANALYSIS

10.1 Subtract the "initial weight" for each canister from the "hot weight" and add the "evap. emissions" of each together to get the "Total Evap. Emissions."

11.0 DATA OUTPUT

11.1 Total Evaporative Emissions from the diurnal and hot soak tests.

11.2 Record on data sheet 707-01.

12.0 ACCEPTANCE CRITERIA

12.1 The soak time for evap. collection is not to exceed 1 hour.

12.2 The ambient temperature must remain between 76°F and 86°F during collection period.

12.3 The collection procedure must have been performed correctly.

13.0 QUALITY PROVISIONS

13.1 Form #705-01 has a built in Quality check in Section IV. Each step performed is checked off by the technician and then checked and signed off by a witness, thus an audit is performed at the site of the test.

13.2 The soak time and temperature should be audited by the Q.A. department to assure the specific limits have not been exceeded.

13.3 If "out of spec" conditions are discovered a request for corrective action should be submitted to Test Operations.

VEHICLE TEST AND EVAPORATIVE DATA

Vehicle Mfgr._____ No._____

Inertia Wt._____ HP_____ A/C_____ Test #_____

I. HEAT BUILD	TECH	CTA
A. Drain fuel	☐	☐
B. Plumb air cleaner	☐	☐
C. Plumb canister	☐	☐
D. Plumb bowl vent (if required)	☐	☐
E. Trap gas cap (if required)	☐	☐
F. Seal orifices/vents	☐	☐
G. Install carbon traps (record on data sheet)	☐	☐
H. Hook-up temperature recorder	☐	☐
I. Hook-up thermocouple leads	☐	☐
J. Install heat blanket	☐	☐
K. Plug in fuel tank heater (when used)	☐	☐
L. Refuel vehicle - 40% of tank capacity	☐	☐

Tech. Sig._____ Witness Sig._____

M. Replace fuel cap, plug exhaust pipe(s) Unclamp canister ☐ ☐

Heat Build Progress	Fuel Temp. Lead No. 1	Fuel Temp. Lead No. 4	Ambient Temp.
0-Min.			
15-Min.			
30-Min.			
45-Min.			
60-Min.			

II. DYNAMOMETER WARM-UP/SET

A. Drive non-test vehicle onto dyno B. Hook-up vehicle as for Hot LA-4
C. Set inertia_____lbs.@_____H.P. D. Drive @50mph steady state
E. Remove vehicle from dyno

I. Tech. Sig._____ Date_____

II. Tech. Sig._____ Date_____

FORM 705-01

III. MASS EXHAUST EMISSIONS TEST

A. Check Varian Paper-OK☐ Pen-OK☐ Ink-OK☐ Zero-OK☐

B. Cooling fan in place OK☐ Release dyno brake-OK☐

C. Hook up Chock blocks-OK☐ Cable winch☐ Exhaust ☐

D. Temp. recorder Connect thermocouple leads☐ Start recorder ☐

E. CVS Check fan operation☐ Bags-OK☐ Rev. Ctr. Zero ☐
Leak check-OK ☐ CVS Temp-OK ☐
Cell temp-OK ☐ Return to sample ☐

F. Drive test trace ☐ Check tire pressure (45 PSI) ☐

G. Remove vehicle to Soak Area ☐

IV. HOT SOAK EVAPORATIVE EMISSIONS TEST	TECH	CTA
A. Reseal orifices/vents	☐	☐
B. Reconnect carbon canisters and unclamp	☐	☐
C. Reconnect temp. recorder and thermocouple leads	☐	☐
D. Check gas cap	☐	☐
E. Plug exhaust pipe(s)	☐	☐
F. 1-hour soak Start time_____ End_____	☐	☐
G. Start amb. temp._____ End amp. temp._____	☐	☐
H. Check ambient temp. at 15-min. intervals	☐	☐
I. End of hot soak - reclamp canisters and remove	☐	☐
J. Shut-off temp. recorder	☐	☐
K. Weigh canisters and record on data sheet	☐	☐

V. DE-PREP AND VEHICLE REMOVAL

A. Remove all collection tubing, exhaust pipe plug(s), orifice/vent plugs, tape, foil, etc.	☐	☐
B. Disconnect temp. recorder & thermocouple leads	☐	☐
C. Return engine to Mfgr's running configuration	☐	☐
D. Move vehicle to East lot - keys to Prod. Contr.	☐	☐
E. "VOID" or "FAILED" vehicles - check with Team Leader for disposition		
F. Leave as is, if acceptable for HWFET		

III. Tech. Sig._____ Date_____

IV. Tech. Sig._____ Date_____

V. Tech. Sig._____ Date_____

EVAPORATIVE EMISSION WEIGHING DATA

TEST NO. _____

DATE _____

MAKE OF CAR _____

CANISTER NO.				
CANISTER LOCATION				
HOT SOAK WEIGHT				
INITIAL WEIGHT				
EVAP. EMISSIONS				

TOTAL EVAP. EMISSIONS _____

FORM 705-02

EPA TEST PROCEDURE	Number TP-709	Page 1 of 4

SUBJECT

VEHICLE DE-PREP AND REMOVAL

Reference EPA, ANN ARBOR, DRAFT "LIGHT DUTY TEST OPERATIONS"	Data Form No. 705-01 SEC.V, 709-01
Responsible Organization TEST OPERATIONS	Computer Program NONE
Test Witness/Review TECHNICIAN/CHECKER, TEAM LEADER	Performance Interval PER VEHICLE
Type of Test Report DATA FORM OUT-PUT	Supersedes NEW
Report Distribution QUALITY ASSURANCE, DATA VALIDATION, TEST FILE	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To restore vehicle to Manufacturer's running condition following the FTP and Evap. tests and assure correct disposition of the vehicle.

2.0 TEST ARTICLE DESCRIPTION

2.1 Manufacturer's certification vehicle.

3.0 REFERENCES

3.1 EPA, Ann Arbor, Draft "Light Duty Test Operations."

4.0 REQUIRED EQUIPMENT

NONE.

5.0 PRECAUTIONS

5.1 Care should be taken to assure that all equipment has been re-connected correctly.

6.0 VISUAL INSPECTION

6.1 Check for any collection equipment that may have been overlooked during removal.

7.0 TEST ARTICLE PREPARATION

NONE.

8.0 TEST PROCEDURE

The following steps are required to assure proper de-prep removal of the test vehicle. Check off items in section V of form #705-01 as completed.

Test Sequence	Test Description	Data Output
101	Remove the following articles from the vehicle: o Collection tubing o Exhaust plug (s) o Orifice/vent plugs o Tape	A.
102	Disconnect temperature recorder and thermocouples.	B.
103	Return to manufacturer's running configuration.	C.
104A	If the test is acceptable, move vehicle to parking lot and return keys to Production Control.	D.
104B	If the test is "void" or vehicle "fails" check with Team Leader for instructions.	E.
104C	Leave vehicle in soak area if HWFET is to be run.	F.

9.0 DATA INPUT

9.1 Section V of form #705-01 is completed and submitted to Data Analysis.

10.0 DATA ANALYSIS

None required.

11.0 DATA OUTPUT

11.1 Form is filed with the vehicle data with Data Validation.

12.0 ACCEPTANCE CRITERIA

12.1 Technician must sign form to verify tasks have been completed.

13.0 QUALITY PROVISIONS

13.1 A checker will witness all tasks completed by the technician, thereby performing an initial audit of the data sheet.

13.2 Final test disposition shall be indicated on the data sheet.

13.3 If the test was void, a failure report (Test Condition Report, form #709-01) shall accompany the test data sheet and the type of failure should be coded in the space provided.

VEHICLE TEST AND EVAPORATIVE DATA

Vehicle Mfgr._____ No._____

Inertia Wt._____ HP_____ A/C_____ Test #_____

I. HEAT BUILD

	TECH	CTA
A. Drain fuel	☐	☐
B. Plumb air cleaner	☐	☐
C. Plumb canister	☐	☐
D. Plumb bowl vent (if required)	☐	☐
E. Trap gas cap (if required)	☐	☐
F. Seal orifices/vents	☐	☐
G. Install carbon traps (record on data sheet)	☐	☐
H. Hook-up temperature recorder	☐	☐
I. Hook-up thermocouple leads	☐	☐
J. Install heat blanket	☐	☐
K. Plug in fuel tank heater (when used)	☐	☐
L. Refuel vehicle - 40% of tank capacity	☐	☐

Tech. Sig._____ Witness Sig._____

M. Replace fuel cap, plug exhaust pipe(s) Unclamp canister ☐ ☐

Heat Build Progress	Fuel Temp. Lead No. 1	Fuel Temp. Lead No. 4	Ambient Temp.
0-Min.			
15-Min.			
30-Min.			
45-Min.			
60-Min.			

II. DYNAMOMETER WARM-UP/SET

A. Drive non-test vehicle onto dyno B. Hook-up vehicle as for Hot LA-4
C. Set inertia_____lbs.@_____H.P. D. Drive @50mph steady state
E. Remove vehicle from dyno

I. Tech. Sig._____ Date_____

II. Tech. Sig._____ Date_____

FORM 705-01

III. MASS EXHAUST EMISSIONS TEST

A. Check Varian Paper-OK☐ Pen-OK☐ Ink-OK☐ Zero-OK☐

B. Cooling fan in place OK☐ Release dyno brake-OK☐

C. Hook up Chock blocks-OK☐ Cable winch☐ Exhaust☐

D. Temp. recorder Connect thermocouple leads☐ Start recorder☐

E. CVS Check fan operation☐ Bags-OK☐ Rev. Ctr. Zero☐
Leak check-OK☐ CVS Temp-OK☐
Cell temp-OK☐ Return to sample☐

F. Drive test trace☐ Check tire pressure (45 PSI)☐

G. Remove vehicle to Soak Area☐

IV. HOT SOAK EVAPORATIVE EMISSIONS TEST	TECH	CTA
A. Reseal orifices/vents	☐	☐
B. Reconnect carbon canisters and unclamp	☐	☐
C. Reconnect temp. recorder and thermocouple leads	☐	☐
D. Check gas cap	☐	☐
E. Plug exhaust pipe(s)	☐	☐
F. 1-hour soak Start time_____ End_____	☐	☐
G. Start amb. temp._____ End amp. temp._____	☐	☐
H. Check ambient temp. at 15-min. intervals	☐	☐
I. End of hot soak - reclamp canisters and remove	☐	☐
J. Shut-off temp. recorder	☐	☐
K. Weigh canisters and record on data sheet	☐	☐

V. DE-PREP AND VEHICLE REMOVAL

A. Remove all collection tubing, exhaust pipe plug(s), orifice/vent plugs, tape, foil, etc.	☐	☐
B. Disconnect temp. recorder & thermocouple leads	☐	☐
C. Return engine to Mfgr's running configuration	☐	☐
D. Move vehicle to East lot - keys to Prod. Contr.	☐	☐
E. "VOID" or "FAILED" vehicles - check with Team Leader for disposition		
F. Leave as is, if acceptable for HWFET		

III. Tech. Sig._____ Date_____

IV. Tech. Sig._____ Date_____

V. Tech. Sig._____ Date_____

TEST CONDITION REPORT

Failure _____ Void _____ Retest Requested _____

Name _____ Date Submitted _____

Branch _____ Section _____ Extension _____

Test Type: _____ LD _____ MD _____ HD _____ Other

Manufacturer _____ Identification Number _____

Date _____ Time _____ Operator _____

Equipment Involved in Failure:

_____ Analysis System _____ Recorder _____ Bags

_____ HC _____ CO _____ NO _____ CO_2 _____ Temp.

_____ CVS _____ Drivers Trace _____ FID

_____ CVS Counter _____ Cold Start _____ Hot Start

_____ Dynamometer _____ Other (Specify)

Failure Description _____

_____

_____

_____

Void Point _____ Hours Lost _____
(Include Prep Time)

Corrective Action Taken _____

_____

_____

_____

cc: D. Clark
M. Davis
Jesse McCall
Team Leader

_____
Signature

2/8/74

FORM 709-01

EPA TEST PROCEDURE	Number TP-710	Page 1 of 4

SUBJECT

HIGHWAY FUEL ECONOMY PRE-CONDITIONING

Reference FEDERAL REGISTER, VOL.39, NO.200, OCT.15,1974- APPENDIX "EPA REC PRAC FOR COND HIWAY FUEL ECON TESTS"	Data Form No. 710-01
Responsible Organization TEST OPERATION	Computer Program NONE
Test Witness/Review MANUFACTURER'S REPRESENTATIVE, TEAM LEADER	Performance Interval PER VEH, AS REQ
Type of Test Report DATA SHEET	Supersedes NEW
Report Distribution QUALITY ASSURANCE, CERT.BRANCH, DATA VALIDATION, TEST FILE	Superseded by

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

To prepare vehicles for the 1975 Highway Fuel Economy Test.

2.0 TEST ARTICLE DESCRIPTION

2.1 Test vehicle designated for the HWFET.

3.0 REFERENCES

3.1 Federal Register, Vol. 39, No. 200, Oct. 15, 1974 - Appendix "EPA Recommended Practices for Conducting Highway Fuel Economy Tests"

4.0 REQUIRED EQUIPMENT

4.1 Chassis dynamometer and associated meters.

4.2 Driver's aid - Hewlett-Packard, Varian.

5.0 PRECAUTIONS

5.1 Insure proper fuel is used.

5.2 Inertia setting and horsepower and shift points (unless specified) are the SAME AS THE FTP.

6.0 VISUAL INSPECTION

6.1 Check the vehicle set-up.

7.0 TEST ARTICLE PREPARATION

7.1 Drive the vehicle from the soak area and onto the dynamometer.

7.2 Tie-down vehicle with winch cable(s), place fan 12 inches in front of grill and hook-up exhaust vent system.

8.0 TEST PROCEDURE

The following steps must be taken to assure the proper preparation of a test vehicle for the Highway Fuel Economy Test.

Test Sequence	Test Description	Data Output
101	Drive vehicle from soak area immediately following the "Hot Soak Evap. Test." onto the dyno. Drive one-preconditioning HWFET.	
102	In the event the FTP and HWFET cannot be run back to back, precondition vehicle as follows:	
102A	Less than 3 hours of soak (including 1 hour hot soak) Drive one preconditioning HWFET and one for data collection. Set horsepower prior to warm-up HWFET.	
102B	Three to 24 hours of soak: Drive 5 minutes at 50 mph followed by one preconditioning HWFET and one for data collection. Set horsepower during the 50 mph cruise.	
102C	Greater than 24 hours of soak or periods of outdoor storage: Run the "AMA" preconditioning route, an LA-4 dynamometer simulation, a preconditioning HWFET and one for data. Set horsepower prior to the LA-4.	

9.0 DATA INPUT

9.1 Complete data form #710-01 to indicate Preconditioning was completed.

10.0 DATA ANALYSIS

None required.

11.0 DATA OUTPUT

11.1 Data form is entered into vehicle file.

12.0 ACCEPTANCE CRITERIA

12.1 Required preconditioning (see section 8.0) must be completed and documented prior to sample HWFET.

13.0 QUALITY CONTROL PROVISIONS

13.1 If the required preconditioning has not been performed submit a request for corrective action.

HIGHWAY FUEL ECONOMY PRECONDITIONING
CHECK SHEET

1. Check off the box corresponding to the type of HWFET preconditioning performed.

☐ Drive vehicle from soak area and immediately following the "Hot Soak Evap. Test" and onto the dyno. Drive one preconditioning HWFET.

In the event the FTP and HWFET cannot be run back to back, precondition vehicle as follows:

☐ Less than 3 hours of soak (including 1 hour hot soak): Drive one preconditioning HWFET and one for data collection. Set horsepower prior to warm-up HWFET.

☐ Three to 24 hours of soak: Drive 5 minutes at 50 mph followed by one preconditioning HWFET and one for data collection. Set horsepower during the 50 mph cruise.

☐ Greater than 24 hours of soak or periods of outdoor storage: Run the "AMA" preconditioning route, an LA-4 dynamometer simulation, a preconditioning HWFET, and one for data. Set horsepower prior to the LA-4.

Date:_____ Technician and I.D. No._____

Time:_____

Form 710-01

EPA TEST PROCEDURE	Number TP-711	Page 1 of 4

SUBJECT

HIGHWAY FUEL ECONOMY DYNO TEST

Reference	Data Form No.
FEDERAL REGISTER, VOL. 39, NO.200, Oct. 15, 1974 - Appendix	707-01
Responsible Organization	**Computer Program**
TEST OPERATIONS	ANALYSIS; SAQF:NEWCVS
Test Witness/Review	**Performance Interval**
MANUFACTURER"S REPRESENTATIVE, DATA VALIDATION	PER VEHICLE AS REQ.
Type of Test Report	**Supersedes**
DATA SHEET	NEW
Report Distribution	**Superseded by**
QUALITY ASSURANCE, DATA VALIDATION, CERT. BRANCH, FILE	

REMARKS/COMMENTS

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

The Highway Fuel Economy Test is a nonmetropolitan driving cycle, 10.2 miles long with an average speed of 48.6 mph. A vehicle is driven on a dynamometer following the cycle and emissions are collected by the same means as the FTP.

2.0 TEST ARTICLE DESCRIPTION

2.1 Test vehicle designated for HWFET

3.0 REFERENCES

3.1 Federal Register, Vol. 39, No. 200, Oct. 15, 1974 - Appendix "EPA Recommended Practices for Conducting Highway Fuel Economy Tests."

4.0 REQUIRED EQUIPMENT

4.1 Constant Volume Sampler equipped to meet requirements in Federal Register , Sec. 85.075-20.

4.2 Chassis Dynamometer

- Clayton, Model ECE-50

4.3 Computer generated driver's aid

- Hewlett-Packard, Varian

4.4 Highway Fuel Economy driver's trace (2 cycles)

5.0 PRECAUTIONS

5.1 Insure test vehicle is aligned on dynamometer correctly and tied down.

5.2 It is extremely important that the horsepower/inertia settings used for the HWFET are the same as previously used for the FTP.

6.0 VISUAL INSPECTION

6.1 Insure fan and tail pipe connector(s) are in place.

6.2 Check bags for correct installation.

7.0 TEST ARTICLE PREPARATION

7.1 Follow procedures detailed in procedure TP-707

7.2 Check driver's aid for paper and ink.

8.0 TEST PROCEDURE

The Highway Fuel Economy data is collected as a result of the following procedural steps.

Test Sequence	Test Description	Data Output
101	Following the preconditioning HWFET, the driver has 15 seconds to prepare for the actual sample period.	
102	Two seconds before the first acceleration the CVS counter button is depressed to start the sample period.	
103	The driver will drive the vehicle in the same manner as required for the FTP to insure "out of spec" conditions do not occur.	
104	Two seconds after the final decel to zero the rev. count button is depressed to end the sample period.	
105	The sample bags are delivered to the analyzer operator for analysis.	

9.0 DATA INPUT

9.1 Fill out form #707-01 and sign off after test completion.

9.2 Driver will sign HWFET trace.

10.0 DATA ANALYSIS

10.1 Driver's trace should be checked for "out of spec." conditions.

11.0 DATA OUTPUT

11.1 Driver's trace and form #707-01 are submitted to Data Validation

12.0 ACCEPTANCE CRITERIA

12.1 The driver's trace is subject to the criteria of acceptance detailed in Section 12.0 of procedure 706. (Urban Dyno. FTP)

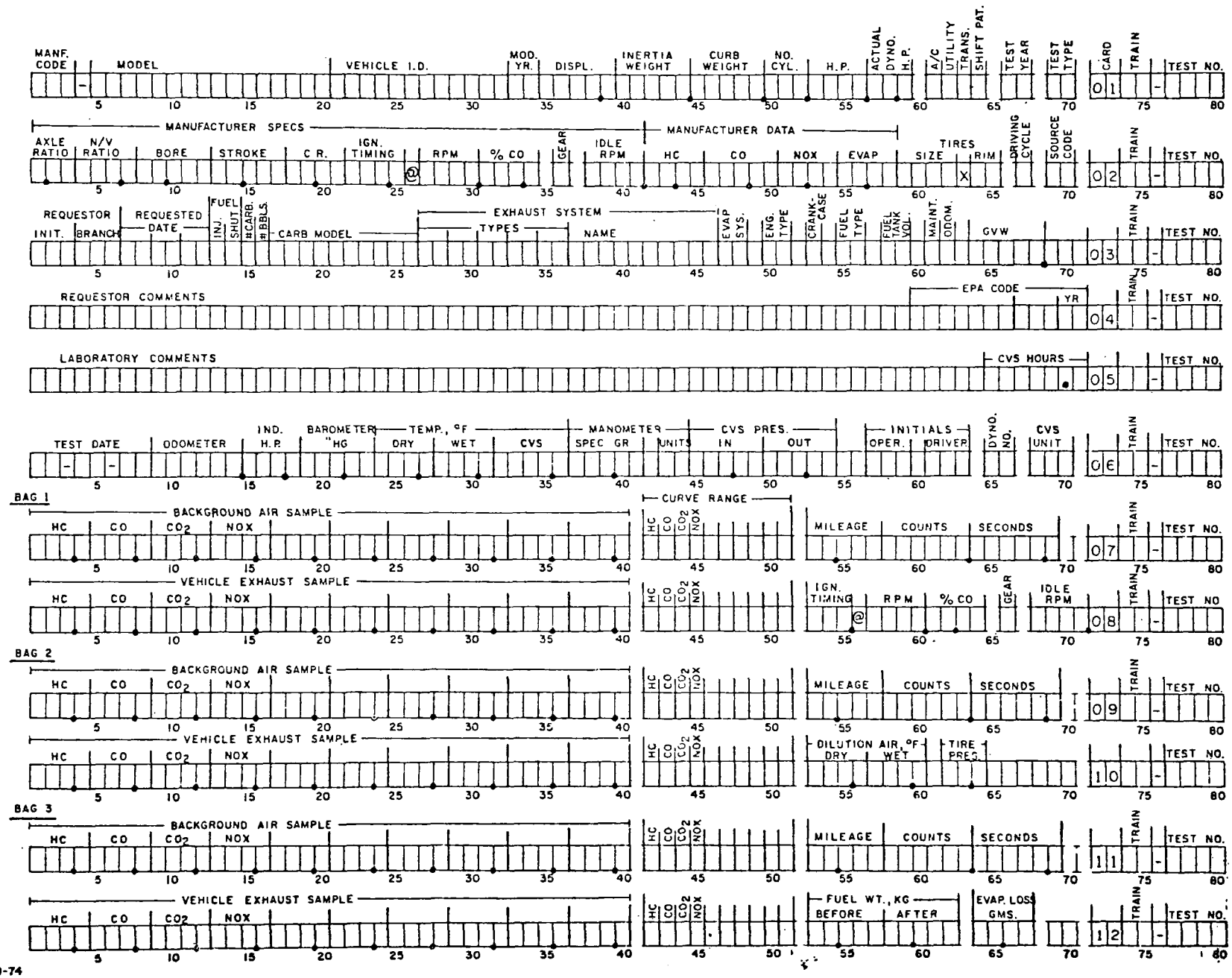
12.2 Sample period should be 765 ±2 seconds.

13.0 QUALITY CONTROL PROVISIONS

13.1 The Quality Control section should inspect the driver's trace to assure the acceptable limits stated in Section 12 have been followed.

13.2 If "out of limits" conditions are discovered, Quality Control should implement corrective action. (i.e., have Production Control reschedule vehicle for test.)

CONSTANT VOLUME SAMPLER (CVS) DATA SHEET



Form 707-01

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EPA TEST PROCEDURE	Number TP-712	Page 1 of 1

SUBJECT

SAMPLE ANALYSIS FOR HWFET

Reference FEDERAL REGISTER, VOL. 39, NO. 200, Oct.15,1974 - APPENDIX, "EPA Rec Prac for Conducting Hiway Fuel Econ Test"	Data Form No. 707-01,02
Responsible Organization TEST OPERATIONS	Computer Program SAQF:NEWCVS
Test Witness /Review TEAM LEADER, QUALITY ASSURANCE	Performance Interval PER VEH, AS REQ
Type of Test Report COMPUTER PRINT-OUT	Supersedes NEW
Report Distribution QUALITY ASSURANCE, DATA VALIDATION, CERT BRANCH	Superseded by

REMARKS/COMMENTS

1.0 The sample analysis of the HWFET is essentially the same as in procedure TP-707 with the following exceptions.

1.1 Only one background and one sample bag is analyzed. (Bag 1 entry on form #707-01.)

1.2 CO_2 will be measured on the upper two-thirds of the selected range.

1.3 Fuel economy is calculated from the composite results using program SAQF:NEWCVS.

ORIGINAL RELEASE APPROVALS

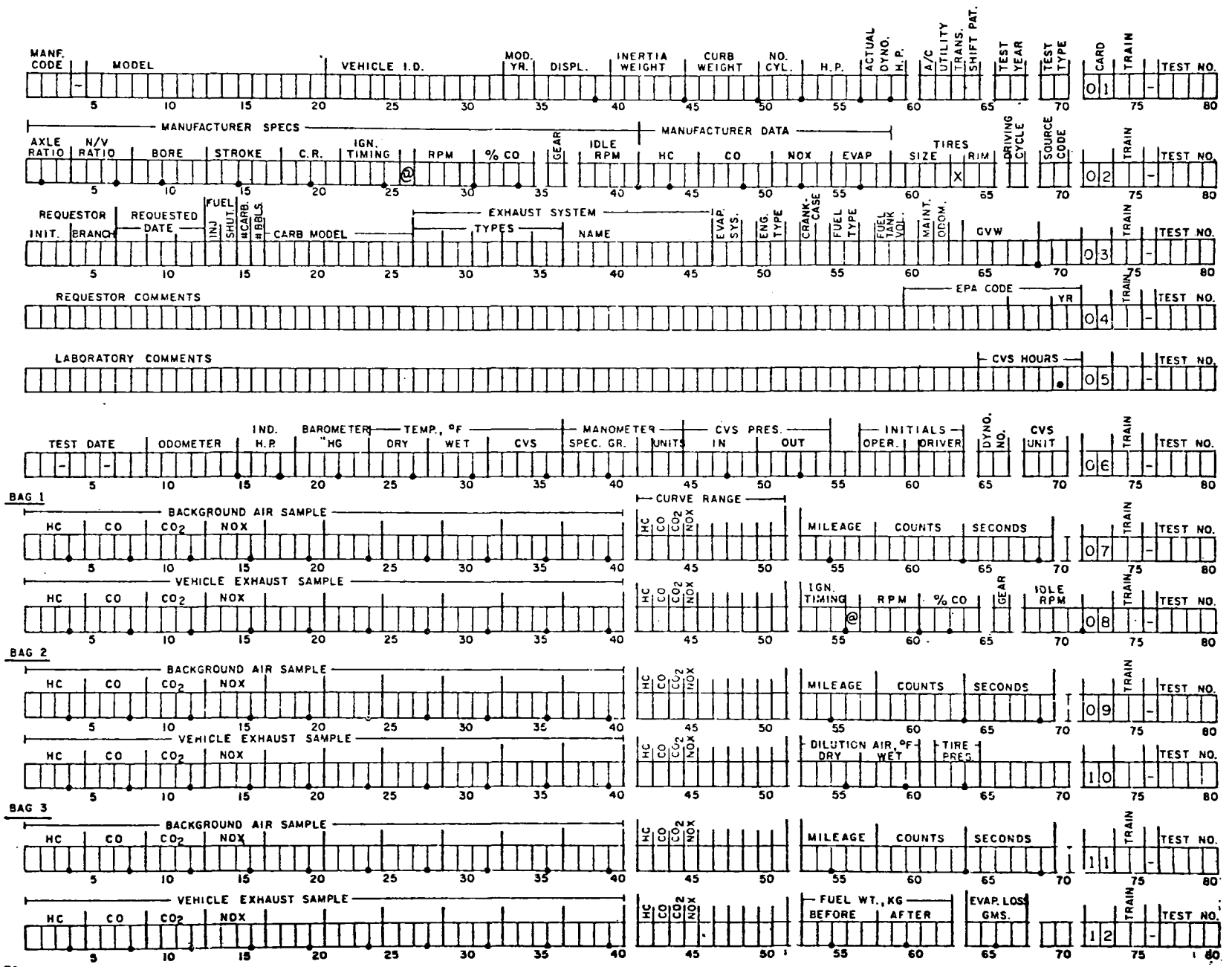
Office	Section	Signature	Date
Program Mgmt	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

CONSTANT VOLUME SAMPLER (CVS) DATA SHEET

Form 707-01



04-10-74

CARD 1

MANF CODE (COLS 1-3)

CODE	EQUIVALENCE
010	AMERICAN MOTORS
021	(CHRYS) CHRYSLER
022	(CHRYS) DODGE
023	(CHRYS) PLYMOUTH
031	(FO MO CO) FORD
032	(FO MO CO) LINCOLN
033	(FO MO CO) MERCURY
041	(GM) BUICK
042	(GM) CADILLAC
043	(GM) CHEVROLET
044	(GM) OLDSMOBILE
045	(GM) PONTIAC
046	(GM) GMC
047	(GM) DETROIT DIESEL
050	ABARTH
060	A C CARS
064	AICHI
070	ASTON MARTIN
080	AUTO CAR
085	AUTO SPORT
090	ALFA ROMEO
095	AM GENERAL
100	AVANTI
105	AUBURN
110	AUSTIN MORRIS (BLMC)
120	BMW
125	BOLWELL
130	BRISTOL
135	BRICKLIN
140	CHECKER
150	CITROEN
160	COMMER
170	SAMCO (CORD)
175	DACIA (ARO)
180	DAF
190	DAIHATSU
200	MERCEDES BENZ
205	DE TOMASO
210	DUAL GHAI
215	DYNA TRUCK
220	FERRARI
230	FIAT
240	FORD OF ENGLAND
245	FORD OF GERMANY
250	HINO
255	HARLEY-DAVIDSON
260	HONDA
270	IHC
280	ISO
290	ISUZU
300	JAGUAR (BLMC)
310	JENSEN
320	JOHN FITCH
330	JEEP (KAISER)
340	LANCIA
350	LOTUS
360	MASERATI
365	MOHS
370	MORGAN
380	NISSAN
390	NSU
400	OPEL
405	PANTHER
410	PEUGEOT
420	PORSCHE
430	RENAULT
440	ROLLS-ROYCE
450	ROOTES
460	ROVER (BLMC)
470	SAAB
480	SHELBY
490	MITSUBISHI
495	SIATRA
500	SIMCA
510	SKODA
520	SS AUTOMOBILE
530	TRIUMPH (BLMC)
535	STUTZ
540	SUZUKI
550	TORINO
560	TOYO KOGYO
570	TOYOTA
580	VAUXHALL
590	VOLKSWAGEN
600	VOLVO
605	WHITE
610	YENKO
615	YAMAHA
620	TVR
630	SUSPENSIONS INT (OMEGA)
640	AUDI
650	MURENA MOTORS
660	FUJI HEAVY IND
670	MONTEVERDI
680	INTERMECCANICA (ITALIA)
690	LAMBORGHINI
700	MARCOS
710	ARMY
720	WINNEBAGO
725	ALLIS CHALMERS
730	CATERPILLAR
740	CUMMINS
750	HERCULES
760	MACK
770	PERKINS
780	SCANIA-VABIS
790	GLASSIC
800	TELEDYNE CONTINENTAL
810	CASE
820	DIAMOND REO
830	HIGHWAY PRODUCTS,INC
999	EXPERIMENTAL

AIR CONDITIONING (COL 61)

CODE	EQUIVALENCE
1	WITH
2	WITHOUT

UTILITY VEHICLE (COL 62)

CODE	EQUIVALENCE
1	YES
2	NO

TRANSMISSION (COL 63)

CODE	EQUIVALENCE
1	AUTO
2	3-SPEED
3	4-SPEED
4	5-SPEED
5	SEMI-AUTOMATIC

SHIFT PATTERN (COL 64)

CODE	EQUIVALENCE
1	STANDARD
2	OPTIONAL

TEST TYPE (COLS 69-70)

CODE	EQUIVALENCE
00	VOID
01	CERT (EMISSION DATA)
02	CERT (DURABILITY)
03	CERT (CORRELATION)
04	SURVEILLANCE
05	EXPERIMENTAL
06	FIELD SURVEILLANCE
07	PARTICULATES
08	OTHER
09	CVS CORRELATION
10	RESEARCH
11	CORRELATION (LAB)
12	CERT (RUNNING CHANGE)

TRAIN (COLS 74-75)

CODE	EQUIVALENCE
1-97	AEGAS
98	PARTICULATES
99	PROP SAMPLER

CARD 2

DRIVING CYCLE (COL 67)

CODE	EQUIVALENCE
1	7-MODE
2	LA-4
3	LA-4 S3
4	ANN ARBOR
5	LA-4 S4
6	9 X 7 MODE
7	STEADY STATE
8	OTHER

SOURCE CODE (COLS 69-70)

CODE	EQUIVALENCE
01	MANUFACTURER
02	HERTZ DETROIT
03	HERTZ L.A.
04	AVIS
05	AIRWAYS CORP L.A.
06	ALPH CORP L.A.
07	GSA L.A.
08	PO DEPT DETROIT
09	PO DEPT L.A.
10	L.A. COUNTY VEH
11	STATE OF CALIFORNIA
12	BORROWED FROM CORPS
13	AMERICAN RACEWAYS, INC
14	DEALER USED CARS
15	EPA
16	GSA
17	MILITARY
18	PRIVATE OWNER
19	OTHER

CARD 3

FUEL INJECTION (COL 13)

CODE	EQUIVALENCE
1	YES
2	NO

FUEL SHUTOFF (COL 14)

CODE	EQUIVALENCE
1	YES
2	NO

EXHAUST SYSTEM TYPE (COLS 27-28), (COLS 29-30), (COLS 31-32), (COLS 33-34) AND (COLS 35-36)

CODE	EQUIVALENCE
01	AIR INJECTION
02	ENGINE MOD
03	FUEL INJECTION
04	OTHER
05	THERMAL REACTOR
06	CATALYTIC REACTOR
07	TURBOCHARGER
08	EXHAUST RECYCLE
09	NONE

EVAP SYSTEM TYPE (COLS 47-48)

CODE	EQUIVALENCE
01	CRANKCASE
02	CANISTER
03	TANK
04	NONE

ENGINE TYPE (COLS 50-51)

CODE	EQUIVALENCE
01	I-BLOCK
02	V-BLOCK
03	ROTARY
04	OPPOSED
05	TURBINE
06	EX (STEAM)
07	EX (FREON)
08	DIESEL
09	STIRLING
10	ELECTRIC
11	STRATIFIED

CRANKCASE SYSTEM TYPE (COL 53)

CODE	EQUIVALENCE
1	CLOSED
2	OTHER

FUEL TYPE (COLS 55-56)

CODE	EQUIVALENCE
01	INDOLENE 30
02	COMMERCIAL LEADED
03	LPG
04	PROPANE
05	OTHER
06	IND UNLEADED, 91 OCT
07	IND UNLEADED, 100 OCT
08	#1 FUEL OIL
09	#2 FUEL OIL
10	NATURAL GAS
11	ALCOHOL
12	INDOLENE 10
13	INDOLENE 20
14	JP-4
15	KEROSENE
16	COMMERCIAL UNLEADED

MAINTENANCE CODE (COL 61)

CODE	EQUIVALENCE
1	BEFORE
2	AFTER
3	NORMAL

ODOMETER CODE (COL 62)

CODE	EQUIVALENCE
1	MILES
2	KMS

CARD 6

MANOMETER UNITS (COLS 43-44)

CODE	EQUIVALENCE
IN	INCHES
CM	CENTIMETERS
MM	MILLIMETERS

ANALYZER ICO READ OUT

TEST NO. _____ MFG _____ DATE _____

BAG	HC	R	CO	R	CO_2	R	NOx	R	
B/G 1									
SAM. 3									
B/G 2									
SAM. 4									
B/G 1									
SAM 3									

OPERATOR REMARKS: _____

TEST NO. _____ MFG _____ DATE _____

BAG	HC	R	CO	R	CO_2	R	NOx	R	
B/G 1.									
SAM. 3									
B/G 2									
SAM 4									
B/G 1									
SAM 3									

OPERATOR REMARKS: _____

TEST # 16-7167 1975 FUEL ECONOMY CYCLE PROCESSED: 14:25:46 JAN 3, 1975

MFG. CODE	MODEL	VEHICLE I.D.	MOD. YR	DISPL.	INERTIA WEIGHT	CURB WEIGHT	NO. CYL.	H.P.	ACTUAL DYNO.H.P.	A C	UTL	TRANS	S.PAT.	TEST YEAR	TEST TYPE
999	TCCS CRICKET	776-DU7	72	141.0	2500	0	4	0	0.0	2	2	1	1	75	5

TEST DATE	ODOMETER	IND. H.P.	BARO "HG	/----TEMP..OF----/ DRY	WET	CVS	----MANOMETER---/ SPEC.GR.	UNITS	-----CVS PRES.----/ IN	OUT	---INITIALS---/ OPER.	DRIVER	DYNO. NO.	CVS UNIT
1- 3-75	6034.	6.2	28.86	79.4	57.7	99.5	1.75	IN	24.90	17.25	CFJ	TAT	08	7C
			DILUTION AIR	0.0	0.0									

CUBIC FT PER REV.	CALCULATED RPM	NOX FACTOR	IGN TIMING	PPM	% CO	GEAR	IDLE RPM	EVAP. LOSS GRAMS	TIRE PRES.
0.27028	1468.	0.8502		0.	0.0		0.	AA.AA	45.0

BAG 1 10.225 MILES 18630. COUNTS 4073.5 CU. FT. 765.3 SECONDS D/FACTOR=10.192 ACT PPM= 1460.6 RPM RATIO(C/A)=0.9953

	EXHAUST SAMPLE RANGE	METER	CONC.	BACKGROUND SAMPLE RANGE	METER	CONC.	CORRECTED CONCENTRATIONS	MASS EMISSIONS GMS	GMS/MI	MPG1
HC-FID	4	33.8	101.56	4	1.7	5.02	97.03 PPM	6.45	0.63	
CO	3	20.5	9.61	3	0.0	0.0	9.61 PPM	1.29	0.13	
CO2	2	46.2	1.304	2	1.5	0.041	1.267 %	2676.08	261.72	33.6
NOX CHEM	4	56.2	56.20	4	0.5	0.50	55.75 PPM	10.46	1.02	

Section 800

DATA VALIDATION

EPA TEST PROCEDURE	Number TP-801	Page 1 of 11

SUBJECT	
DATA VALIDATION	
Reference EPA, ANN ARBOR, DRAFT "LIGHT DUTY TEST OPERATIONS	**Data Form No.** SEE SECTION 2.0
Responsible Organization TEST OPERATIONS	**Computer Program** SEE SECTION 10.0
Test Witness /Review MANUFACTURER'S REPRESENTATIVE/ CERTIFICATION BRANCH REPRESENTATIVE	**Performance Interval** PER VEHICLE
Type of Test Report FINAL COMPUTER OUT-PUT OF EMISSION DATA AND COMPILED VEHICLE FILE	**Supersedes** NEW
Report Distribution QUALITY ASSURANCE, CERTIFICATION BRANCH, MANUFACTURER'S REPRESENTATIVE, TEST OPERATIONS,	**Superseded by**

REMARKS/COMMENTS DATA VALIDATION, PRODUCTION CONTROL

ORIGINAL RELEASE APPROVALS

Office	Section	Signature	Date
Division Direc	Quality Assurance		
Lab Branch	Chief		
Lab Branch	Test Operations Chief		

REVISIONS

Change Letter	Description of Change	Approval	Date

1.0 PURPOSE

Data Validation establishes a control network to assure a smooth flow of all data collected from Production Control (scheduling) and Test Operations (Acceptance, Pre-conditioning/Prep, FTP and HWFET). The Data Validation section will also check the data form to confirm the validity of the results and assure the data is within specified limits.

2.0 TEST ARTICLE DESCRIPTION

2.1 The following data sheets, chart traces and reports are required for a complete Data Validation system.

- Form 701-01, Driver's Preconditioning Report.
- Form 705-01, Vehicle Test and Evaporative Data Sheet
- Form 705-02, Evaporative Emissions Data Sheet
- Form 707-01, CVS Data Sheet
- Form 707-02, Analyzer read-out (FTP and HWFET)
- FTP driver's trace
- FTP analyzer traces
- CVS temperature trace
- Diurnal temperature trace
- Preliminary results
- Official values (1 each)
- Official values (2 each)
- CVS Data Sheet (blue copy), form 707-01
- Form 707-01, HWFET CVS Data Sheet
- HWFET re-test (if necessary)
- HWFET clearance
- HWFET driver's trace
- HWFET preliminary results
- Form 801-01, Weekly activity report
- Data processing job request

3.0 REFERENCES

3.1 EPA, Ann Arbor, Draft, "Light Duty Test Operations"

3.2 "Test Validation Procedures," Joe Belanger, EPA, Ann Arbor, 30 September 1974.

4.0 REQUIRED EQUIPMENT

4.1 Validation stamps

5.0 PRECAUTIONS

5.1 Not applicable.

6.0 VISUAL INSPECTION

6.1 Contained in Section 8.0

7.0 TEST ARTICLE PREPARATION

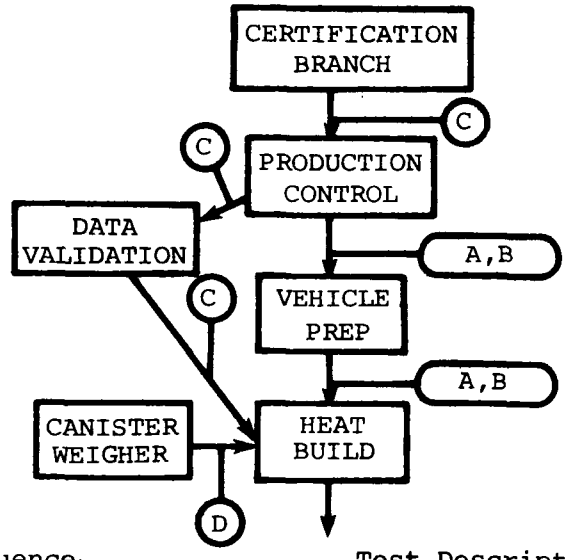
7.1 All forms and traces must be complete before submittal to Data Validation.

8.0 TEST PROCEDURE

The procedures for Test Data Validation serve a multi-purpose. First, they illustrate the functional flow of the paperwork system and the sequence of tests. Finally, it is a system for checking the validity of the test data itself.

The procedures are divided into five sections, in order to ease interpretation of the sequence. Each section has a mini-flow diagram to further illustrate the steps to be followed.

SECTION I



A. Form 705-01

B. Form 701-01

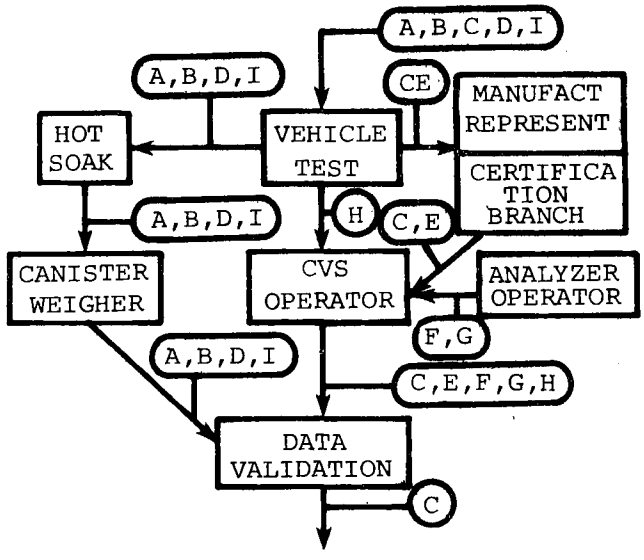
C. Form 707-01

D. Form 705-02

Test Sequence	Test Description	Data Output
101	Certification Branch representative and the Manufacturer's Representative initiate a test request.	
102	The request (CVS data sheet) is sent to Production Control for scheduling.	
103	The CVS Data Sheet (707-01) are picked up daily from Production Control by the Data Validation section along with the daily test schedule and test number assignments.	
104	The following information is recorded on form #707-01 by Data Validation and the form is placed on the corresponding test vehicle. o Date o Odometer reading o Manometer specific gravity o Test cycle mileage(s) o Tire pressure o Timing, RPM, % CO (idle) and idle RPM	

Test Sequence	Test Description	Data Output
105	The test number is also recorded on forms #701-01, 705-01 and 705-02.	
106	Twenty copies of the daily schedule are distributed as follows:	
	o 1 copy each: Data Branch Certification Branch Team Leaders Each Analyzer Train Posted on Soak billboard	
	o 1 copy and the original to Production Control.	
	o 3 copies remain in Data Validation	
	o 7 copies to lab technicians	

SECTION II



A.- D. See Sec. I

E. Driver's Trace

F. Analyzer Traces

G. Form 707-02

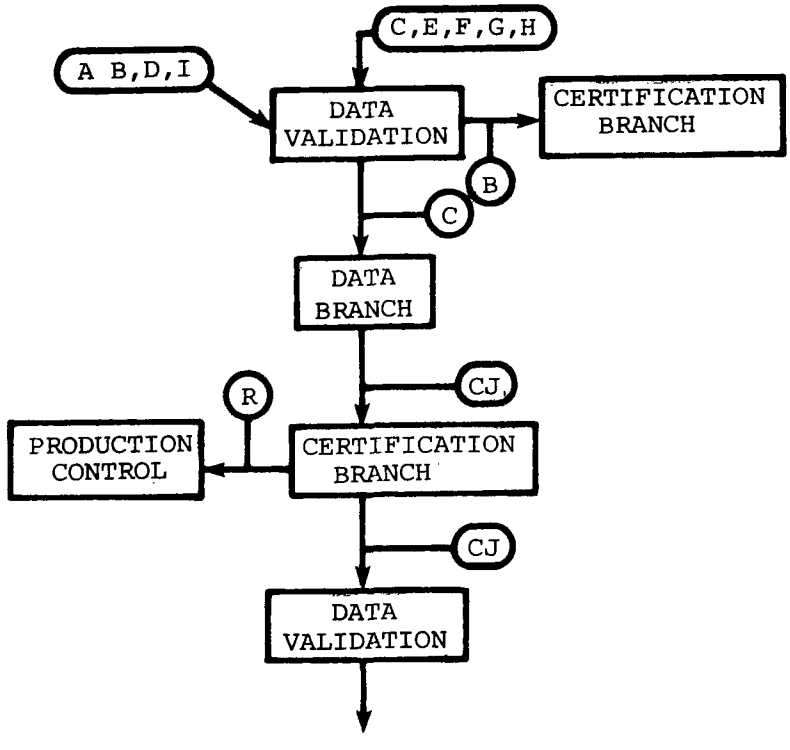
H. CVS Temp. Trace

I. Diurnal/Hot Soak Trace(s)

Test Sequence	Test Description	Data Output
201	During the 1975 Mass Emissions Test, the CVS Operator records the following on form #707-01.	
	o Indicated horsepower	I_{hp}
	o Barometric pressure	Baro.

Test Sequence	Test Description	Data Output
	o Wet and Dry bulb temperature	W_B, D_B
	o CVS temperature	Inlet Temp.
	o CVS pump inlet and outlet pressure	P_{IN}, P_{OUT}
	o Operator and driver's initials	Initials
	o Rev. counts and seconds	Revs, Secs
	o CVS hours	Hours
	o Analyzer train number	Number
202	The driver's trace and analyzer traces generated during the test are checked by the Manufacturer's Representative and the Certification Branch representative and signed as "valid" or "invalid."	Valid Invalid
203	The CVS operator delivers the traces and form 707-01 to Data Validation.	
204	Following the Mass Emission Test and hot soak evaporative, the remaining documentation is taken to the canister weigher. After recording evap. results, he delivers all documentation to Data Validation.	

SECTION III



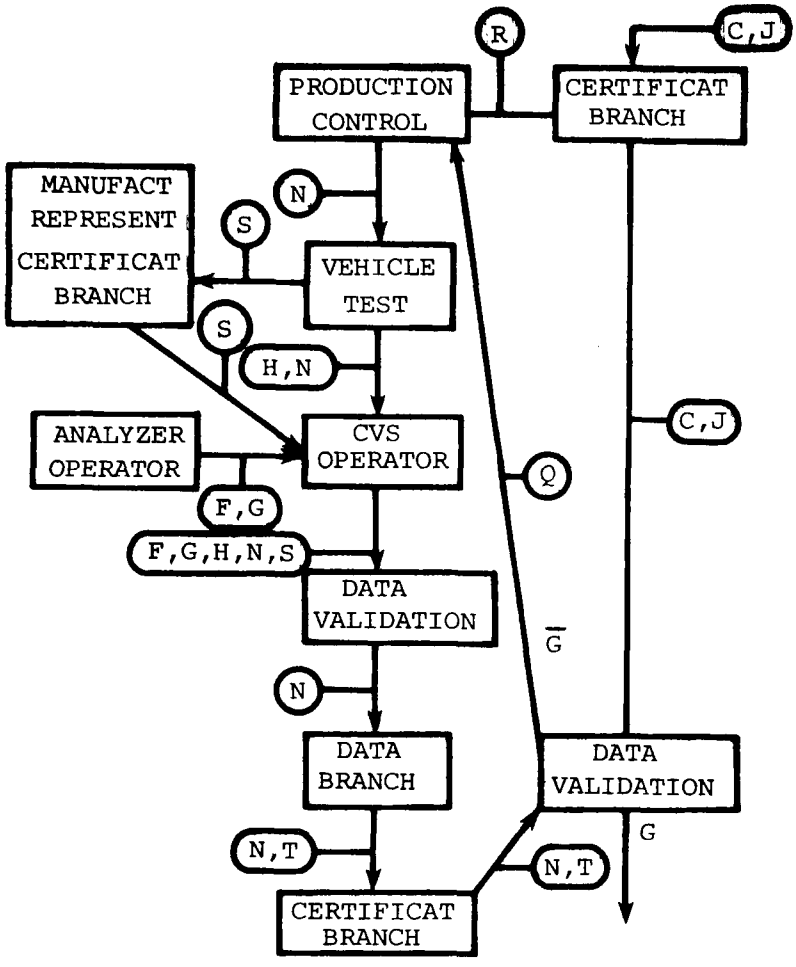
A. - I. See Sec. I and II

J. Preliminary Results

R. HWFET Clearance

Test Sequence	Test Description	Data Output
301	Data Validation receives all documentation from the CVS operator and canister weigher following the FTP and makes a file envelope for each test.	
302	The analyzer traces are checked for proper procedure and the chart values are compared with those logged on the analyzer read-out form.	
303	The concentration values are transcribed onto the CVS data sheet and all other entries are audited for obvious errors.	
304	The CVS data sheet is taken to the Data Branch (data processing job request required) for preliminary result analysis.	
305	The Certification Branch representative obtains the CVS data sheet and preliminary results from the Data Branch. The results are checked and if it is a data vehicle, Production Control is given clearance for the HWFET. The representative then logs HWFET at bottom of CVS data sheet.	
306	After the preliminary results and form #707-01 (CVS) is received from the Certification Branch representative, Data Validation section compares the results of the preliminary print-out with the analyzer read. Errors, if any, are corrected and the corrected data sheet is re-routed to the Data Branch for a new print-out.	
307	Data Validation checks off the remaining documentation and places it in the appropriate file.	

SECTION IV



C. Form 707-01

F. Analyzer Traces

G. Form 707-02

H. CVS Temp. Trace

J. Preliminary Results

N. Form 707-01

Q. HWFET re-test

R. HWFET clearance

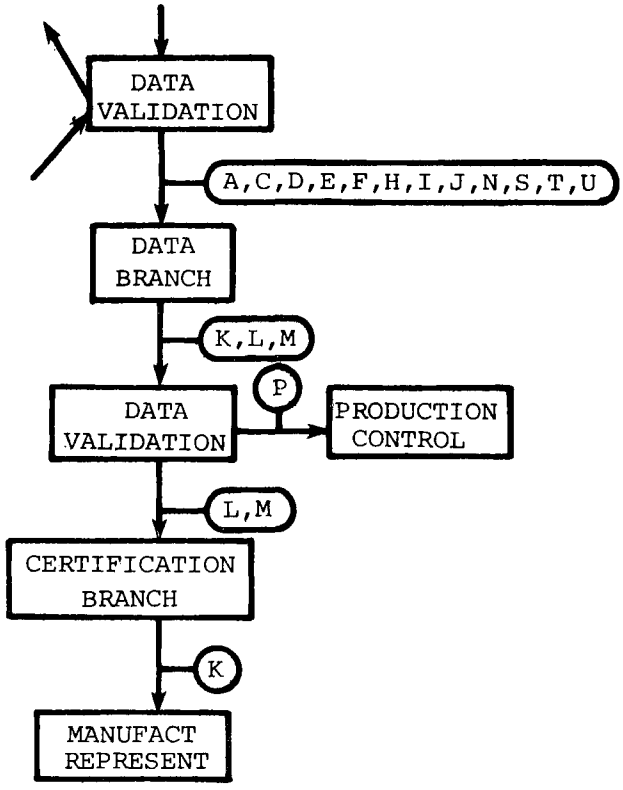
S. HWFET driver's trace

T. HWFET preliminary results

Test Sequence	Test Description	Data Output
401	The Certification Branch representative receives the preliminary FTP results from the Data Branch, checks it and clears for HWFET. Production Control initiates the HWFET.	
402	Upon completion of the HWFET, the results are submitted to Data Validation by the CVS operator.	
403	The analyzer traces are checked for errors and the concentrations are entered onto form #707-01 (HWFET CVS). The form is screened for obvious errors and submitted to the Data Branch for preliminary analysis.	

Test Sequence	Test Description	Data Output
404	The supporting documentation is checked off and entered into the FTP file for the vehicle.	
405	The Certification Branch representative obtains the HWFET preliminary results from the Data Branch. If the results are accepted as valid, the representative delivers the results to Data Validation.	
405A	If the results are rejected, the HWFET data sheet is replaced and Production Control schedules a re-test.	

SECTION V



A. Form 705-01
B. Form 707-01
C. Form 705-01
E. Driver's trace
F. Analyzer traces
H. Temp. Trace, CVS
I. Diurnal temp. trace
J. Preliminary results
K. Official values (1 each)
L. Official values (2 each)
M. Form 707-01 (blue copy)
N. Form 707-01
P. Form 801-01
S. HWFET driver's trace
T. HWFET preliminary results
U. Data processing job request

Test Sequence	Test Description	Data Output
501	Data Validation packages all documentation and preliminary results from the FTP and HWFET (if applicable) in file envelopes. The complete file is sent to the Data Branch for final processing.	
502	Following final processing, three copies of the official values print-out and the blue copy of form #707-01 are returned to Data Validation.	
503	Data Validation performs a final check to assure no obvious errors exist. The print-outs are marked with the official value stamp and two copies plus the blue CVS data sheet are delivered to the Certification Branch. The third copy is retained in the vehicle file.	
504	The Certification Branch retains one copy of the official values and the blue copy of form #707-01 in their file. One copy of the official values is sent to the Manufacturer's Representative.	
505	The weekly activity report, form #801-01, is compiled and sent to Production Control by 4:00 p.m. each Monday. One copy is sent to Test Operations file and one is retained in the Data Validation file.	

9.0 DATA INPUT

9.1 This information is contained in Section 8.0.

10.0 DATA ANALYSIS

10.1 Analysis is performed by the Data Branch using the following computer programs.

- o 1975 SAQF:NEWCVS-FTP
- o SAQF:NEWCVS-HWFET

11.0 DATA OUTPUT

11.1 This information is contained in Section 8.0.

12.0 ACCEPTANCE CRITERIA

12.1 Acceptance criteria for data input to the Data Validation section is explained in previous procedures. For acceptance limits reference Section 12.0 of the following procedures.

12.1.1 Evaps - Procedure TP-705 and TP-708

12.1.2 Prep. and Preconditioning - Procedure TP-702 and TP-703

12.1.3 Urban dyno test - Procedure TP-706 and TP-707

12.1.4 HWFET - Procedure TP-710, TP-711 and TP-712

13.0 QUALITY PROVISIONS

13.1 The Q.A. Department should audit final results to assure all entries and results are within acceptable limits.

13.2 A statistical inference study should also be made of typical problems and solutions from data compiled in the vehicle files. This study can be performed by using control charts, analysis of variance, and error analysis techniques.

F.T.P. MINUS EVAP PLUS F.E.T.

DRIVER'S PRECONDITIONING REPORT

Vehicle mfgr._____ No._____

Time Out_____ Time In_____ Odom_____

Date_____ Test#_____

I. VEHICLE INSPECTION

A.	Valid License Plate	☐OK	☐None	F.	Mfgr's Data Sheet	☐OK	☐None
B.	Exhaust Adaptor	☐OK	☐None	G.	Oil level; if low notify Prod. Cont.	☐OK	☐Note
C.	Fuel Drain	☐OK	☐None	H.	Odom Reading	☐OK	
D.	Vehicle Damage (note on reverse)	☐OK	☐Note	I.	Fuel level, 1/4-tank min,; add if required.		
E.	Equip. not connected notify Prod. Cont.	☐OK	☐Note	J.	Start-up per Mfg. instructions	☐OK	
				K.	Drive AMA route	☐OK	

II. AMA PRECONDITIONING

A.	Engine Start	☐Good		☐Hard	☐False
B.	Ignition Switch	☐OK		☐Other	
C.	Starter Motor	☐OK		☐Grinds	☐No Start
D.	Fast Idle	☐OK		☐None	☐Engine Hot
E.	Transmission	☐OK		☐Shifts Hard	
F.	Clutch	☐OK	Grabs	☐Slips	☐N/A
G.	Brakes	☐OK	Fade	☐Poor	☐None
H.	Driveability	☐Surge ☐Stumble ☐Back Fire ☐Stretchy Engine Miss ☐ Diesels ☐ ☐OK			

Driver's Signature_____

Form 701-01

II. SPECIFICATION CHECK — INITIAL

A. Idle CO — Rt_____% Lt_____% _____

B. Engine RPM — Idle_____ Drive_____ _____

C. Ignition Timing _____@_____in D☐ /N☐ _____

D. Fuel Drain _____

E. Wheel to driveshaft ratio
10 wheel turns to _____driveshaft revs. N/V____ _____

F. Tire size _____x_____. _____

G. Vehicle Weight _____with _____ tank fuel _____

H. Add 40% evap. fuel. Witness Sig. _____ _____

IV. DYNAMOMETER HOT LA-4

A. Drive vehicle onto dyno.
Set inertia _____lbs. @_____H.P.

B. Check Varian. ☐Paper-OK ☐Pen-OK ☐Ink-OK ☐Zero-OK

C. Start Cooling Fan ☐OK ☐Release Dyno Brake-OK
☐Tire Pressure 45 P.S.I.-OK

D. Hook-up ☐Chock Blocks-OK ☐Cable Winch ☐Exhaust

E. Drive to Soak Area per schedule.

F. 11-Hour Soak Start _____ (DO NOT RE-START ENGINE AFTER SHUT DOWN).

G. DO NOT START TEST BEFORE _____AM/PM. (Add 11 hours to hot soak start time).

Technician's Signature_____

Leader/Supv. Signature_____

Form 701-01 Cont.

VEHICLE TEST AND EVAPORATIVE DATA

Vehicle Mfgr._____ No._____

Inertia Wt._____ HP_____ A/C_____ Test #_____

I. HEAT BUILD

	TECH	CTA
A. Drain fuel	☐	☐
B. Plumb air cleaner	☐	☐
C. Plumb canister	☐	☐
D. Plumb bowl vent (if required)	☐	☐
E. Trap gas cap (if required)	☐	☐
F. Seal orifices/vents	☐	☐
G. Install carbon traps (record on data sheet)	☐	☐
H. Hook-up temperature recorder	☐	☐
I. Hook-up thermocouple leads	☐	☐
J. Install heat blanket	☐	☐
K. Plug in fuel tank heater (when used)	☐	☐
L. Refuel vehicle - 40% of tank capacity	☐	☐

Tech. Sig._____ Witness Sig._____

M. Replace fuel cap, plug exhaust pipe(s) Unclamp canister ☐ ☐

Heat Build Progress	Fuel Temp. Lead No. 1	Fuel Temp. Lead No. 4	Ambient Temp.
0-Min.			
15-Min.			
30-Min.			
45-Min.			
60-Min.			

II. DYNAMOMETER WARM-UP/SET

A. Drive non-test vehicle onto dyno B. Hook-up vehicle as for Hot LA-
C. Set inertia_____lbs.@_____H.P. D. Drive @50mph steady state
E. Remove vehicle from dyno

I. Tech. Sig._____ Date_____

II. Tech. Sig._____ Date_____

FORM 705-01

III MASS EXHAUST EMISSIONS TEST

A. Check Varian Paper-OK☐ Pen-OK☐ Ink-OK☐ Zero-OK☐

B. Cooling fan in place OK☐ Release dyno brake-OK ☐

C. Hook up Chock blocks-OK☐ Cable winch☐ Exhaust ☐

D. Temp. recorder Connect thermocouple leads☐ Start recorder ☐

E. CVS Check fan operation☐ Bags-OK☐ Rev. Ctr. Zero ☐
Leak check-OK ☐ CVS Temp-OK ☐
Cell temp-OK ☐ Return to sample ☐

F. Drive test trace ☐ Check tire pressure (45 PSI) ☐

G. Remove vehicle to Soak Area ☐

IV. HOT SOAK EVAPORATIVE EMISSIONS TEST	TECH	CTA
A. Reseal orifices/vents	☐	☐
B. Reconnect carbon canisters and unclamp	☐	☐
C. Reconnect temp. recorder and thermocouple leads	☐	☐
D. Check gas cap	☐	☐
E. Plug exhaust pipe(s)	☐	☐
F. 1-hour soak Start time_____ End_____	☐	☐
G. Start amb. temp._____ End amp. temp._____	☐	☐
H. Check ambient temp. at 15-min. intervals	☐	☐
I. End of hot soak - reclamp canisters and remove	☐	☐
J. Shut-off temp. recorder	☐	☐
K. Weigh canisters and record on data sheet	☐	☐

V. DE-PREP AND VEHICLE REMOVAL

A. Remove all collection tubing, exhaust pipe plug(s), orifice/vent plugs, tape, foil, etc.	☐	☐
B. Disconnect temp. recorder & thermocouple leads	☐	☐
C. Return engine to Mfgr's running configuration	☐	☐
D. Move vehicle to East lot keys to Prod. Contr.	☐	☐
E. "VOID" or "FAILED" vehicles - check with Team Leader for disposition		
F. Leave as is, if acceptable for HWFET		

III. Tech. Sig._____ Date_____

IV. Tech. Sig._____ Date_____

V. Tech. Sig._____ Date_____

EVAPORATIVE EMISSION WEIGHING DATA

TEST NO. _____

DATE _____

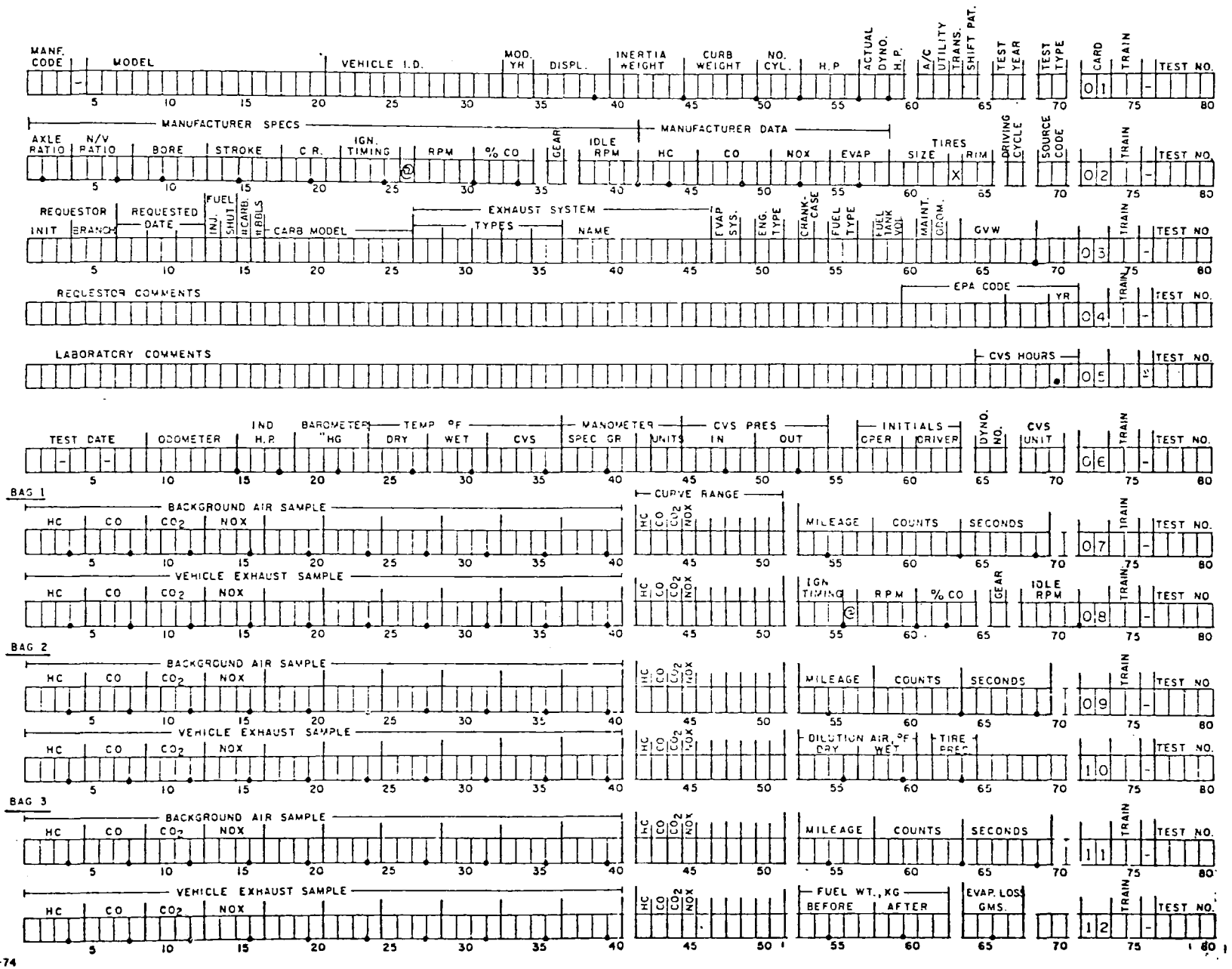
MAKE OF CAR _____

CANISTER NO.				
CANISTER LOCATION				
HOT SOAK WEIGHT				
INITIAL WEIGHT				
EVAP. EMISSIONS				

TOTAL EVAP. EMISSIONS _____

FORM 705-02

CONSTANT VOLUME SAMPLER (CVS) DATA SHEET



Form 707-01

298

04-10-74

ANALYZER TEST READ-OUT

TEST NO. _____ MFG _____ DATE _____

BAG	HC	R	CO	R	CO_2	R	NOx	R	
B/G 1									
SAM. 3									
B/G 2									
SAM. 4									
B/G 1									
SAM 3									

OPERATOR REMARKS: _____

TEST NO. _____ MFG _____ DATE _____

BAG	HC	R	CO	R	CO_2	R	NOx	R	
B/G 1									
SAM. 3									
B/G 2									
SAM 4									
B/G 1									
SAM 3									

OPERATOR REMARKS: _____

form 707-02

Form 801-01

ENVIRONMENTAL PROTECTION AGENCY

Ann Arbor, Michigan 48105

Light Duty Testing Schedule for _____ Date Submitted _____

TEST #	TECH	MANU. OF VEHICLE	VEHICLE I.D.	DYNO #	START	F.E.	TYPE TEST	RE-TEST	VOID

TP-801
Attachment No. 1

DATA PROCESSING JOB REQUEST

Job No. 01569

Submitted by: _____ Branch: _____ Section: _____

Project number: _____

IN DATE: _____ TIME: _____

OUT DATE: _____ TIME: _____

Completed by: _____

Application name: _____

Number of runs: _____

Results needed by: _____

Additional copies of results: _____

Urgency: _____

_____

Data processing section use

Program name(s): _____

Program modifications: _____

Special I/O requirements: _____

Pre-run preparation: _____

Computer usage: CCU _____

CLT _____

Job No. 01569

NAPCA (DUR) 165
7/70

Section 900

PROGRAM PLANNING AND QUALITY AUDIT

Currently no procedures are included in this Section of the manual. Those procedures pertaining to this Section must be supplied by the user and may be supplied by the EPA in subsequent revisions.

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-650/4-75-024-b		

4. TITLE AND SUBTITLE	5. REPORT DATE
Guidelines for QA Programs for Mobile Source Emissions Measurement Systems - Phase I, Light Duty Gasoline-Powered Vehicles - Test Procedures	June 1975
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Rod Pilkington, Tom Kelly and Harold Wimette	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
Olson Laboratories, Inc. 421 East Cerritos Avenue Anaheim, California 92805	1HA327
	11. CONTRACT/GRANT NO.
	68-02-1740
12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
EPA, NERC, QAEML, QAS Research Triangle Park North Carolina 27711	Final
	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES This report is one of two volumes for Light Duty Gasoline-Powered Vehicles (Phase I). Other volumes are to be issued for Phase II Heavy Duty Diesel Engines, Phase III Light Duty Diesel-Powered Vehicles, and Phase IV Heavy Duty Gasoline Engines.

16. ABSTRACT

Test Procedures for Light Duty Gasoline-Powered Mobile Source Emissions Measurement Systems are presented with the concept of a total Quality Assurance System. The Test Procedures are presented in document control format and give the detailed test procedures with Quality Assurance provisions for each part of the total testing system.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Quality Control Quality Assurance Quantitative Analysis Gas Analysis Emissions - Exhaust Gases Compliance Testing Air Pollution	Mobile Source Emission Testing	13H 14D 07D 13B

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
Unlimited	Unclassified	316
	20. SECURITY CLASS *(This page)*	22. PRICE
	Unclassified	

EPA Form 2220-1 (9-73)

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Title should indicate clearly and briefly the subject coverage of the report, and be displayed prominently. Set subtitle, if used, in smaller type or otherwise subordinate it to main title. When a report is prepared in more than one volume, repeat the primary title, add volume number and include subtitle for the specific title.

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Give name(s) in conventional order *(John R. Doe, J. Robert Doe, etc.)*. List author's affiliation if it differs from the performing organization.

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