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Operation of a Pilot Motor Vehicle Inspection Station in Houston, Texas

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OPERATION OF A PILOT MOTOR VEHICLE INSPECTION STATION IN HOUSTON, TEXAS

By

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Phoenix, Arizona 85016

Contract No. 68-03-2894

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Prepared for:

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Office of Air, Noise and Radiation

Office of Mobile Source Air Pollution Control

Emission Control Technology Division

Characterization and Applications Branch

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ABSTRACT

In conjunction with an EPA project to assess methods, costs, projected effectiveness and acceptability of various motor vehicle exhaust emissions inspection and maintenance (I/M) alternatives, and to support the State of Texas in complying with its implementation plan, the Office of Mobile Source Air Pollution Control of the U. S. Environmental Protection Agency assisted the Texas Air Control Board in establishing a pilot motor vehicle emissions inspection and maintenance program in Houston, Texas. A portion of the program involved the operation of a centralized vehicle emissions inspection station which performed idle tests, underhood inspections of emission control systems and components, and physical/functional I/M tests to simulate the operation of the various alternative configurations for the legislatively mandated I/M program. The contract for the centralized concept was conducted by Hamilton Test Systems, Inc. of Phoenix, Arizona.

The purpose of the contract was to assist the Texas Air Control Board in evaluating the cost and technical details of operating a centralized vehicle emissions inspection station using an underhood inspection of emission control systems and components with either an idle mode tail pipe emission test or a "physical/functional" test procedure. A total of 4,647 vehicles was tested using one or both procedures during the span of the contract. Each vehicle was to be determined to have "passed" or "failed" using criteria established by the EPA. Specific instructions regarding test procedures, cutpoints, data handling and reporting was also provided by EPA. Hamilton Test Systems (HTS) was responsible only for the set up and operation of the inspection station. HTS was not responsible for soliciting vehicles for participation in the pilot I/M program, or for evaluation and analysis of test data.

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1.0 INTRODUCTION

This document represents the final report in fulfillment of the requirements of Contract 68-03-2894 and summarizes the work performed under the subject contract by Hamilton Test Systems, Inc. for the U. S. Environmental Protection Agency (EPA).

The Clean Air Act Amendments of 1970 made each State responsible for assuring air quality within its boundaries. The State was to do this by preparing and following an Implementation Plan specifying the manner in which national air quality standards would be achieved by 1975 and maintained thereafter. The State's Plan for each air quality control region was made subject to the approval of the EPA Administrator.

In conjunction with an EPA project to assess methods, costs, projected effectiveness and acceptability of various motor vehicle exhaust emissions inspection and maintenance (I/M) alternatives, and to support the State of Texas in complying with its implementation plan, the Office of Mobile Source Air Pollution Control of the U. S. Environmental Protection Agency assisted the Texas Air Control Board in establishing a pilot motor vehicle emissions inspection and maintenance program in Houston, Texas. A portion of this program involved the operation of a centralized vehicle emissions inspection station which performed idle tests, underhood inspections of emission control systems and components, and physical/functional I/M tests to simulate the operation of the various alternative configurations for the legislatively mandated I/M program. The contract for the centralized concept was of twelve (12) months' duration, and was conducted by Hamilton Test Systems, Inc. of Phoenix, Arizona. The twelve-month period was divided into a Start-Up Phase and an Operational Phase. The Start-Up Phase commenced September 29, 1979, and the Operational Phase March 3, 1980.

The purpose of the contract was to assist the Texas Air Control Board in evaluating the cost and technical details of operating a centralized vehicle emissions inspection station using an underhood inspection of emission control systems and components with either an idle mode tailpipe emission test or a "physical/functional" test procedure. A total of 25,000 vehicles was to be tested using one or both procedures during the span of the contract. Each vehicle was to be determined to have "passed" or "failed using criteria established by the EPA." Specific instructions regarding test procedures, cutpoints, data handling and reporting was also provided by EPA. Hamilton Test Systems (HTS) was responsible only for the set up and operation of the inspection station. HTS was not responsible for soliciting vehicles for participation in the pilot I/M program, or for evaluation and analysis of test data.

The details of the implementation and operation of the Houston pilot inspection program are contained in Sections 2 through 8. The following paragraphs briefly summarize the vehicle testing.

The Operational Phase for vehicle testing commenced on March 3, 1980 and ended on August 30, 1980. During this time 4674 vehicles were inspected. On each vehicle the following inspections were performed:

1. vehicle identification/registration data entry

2. test suitability inspection

3. tire inflation

4. emission inspection - HC, CO, CO_2, and rpm measured at idle, 2500 rpm and again at idle

5. steering alignment (toe-in, toe-out)

6. visual inspection of ECS equipment

   a) PCV
   b) air injection
   c) EGR
   d) fuel evaporative system
   e) catalytic converter
   f) leaded fuel restrictor

7. propane enrichment check

8 ignition timing check

9. inspection report generation and presentation to motorist.

All test data were recorded on floppy disks and then transcribed to a magnetic tape for transmittal to the EPA for analysis.

2.0 FACILITY

2.1 FACILITY SELECTION

Facility selection criteria consisted mainly of location, availability, cost of lease and ease of refurbishment and modification. Specific site location in Houston was highly important due to the vast sprawl of the city and heavy traffic congestion in many areas. The short period allotted for the start-up phase required a site that could be leased and occupied rapidly without extensive and costly modification. Other items considered were queue line capacity, test lane configuration and participant waiting and information areas.

2.2 FACILITY AS SELECTED

The scarcity of leasable commercial property was evident from the beginning. Fortunately, HTS located a building at 4303 San Felipe Street that was well suited for the Houston Pilot Emissions Test Program. Fronting on San Felipe Street, a major heavily travelled arterial close to the Galeria Mall and the Interstate 610 Loop, the area site was easily identified and accessible. The original construction was for an auto dealership, providing HTS with a spacious testing and office area.

The office complex consisted of a reception and waiting room, manager's office, conference room, employees' lounge, computer room and restrooms. The eventual testing area was comprised of a large workshop, a parts department, and the paint shop. This large building was selected because of the initial requirement to design a high technology emissions test lane with capability of adding safety inspection. However, safety inspection was never implemented.

2.3 FACILITY MODIFICATIONS

To prepare the building for proper test lane operation several modifications were required.

A. Due to test lane area configuration, four test positions were established for optimum thruput. Exhaust removal systems were installed in three of the test positions including excavating a pit at Position 2 for the underground exhaust system louvers. Large holes were cut in two walls to allow vehicles to enter and exit Position 3. Electrical wiring was added to service the test equipment and interconnect the computers with their respective terminals. Existing auto service equipment such as lifts were removed. After all major modifications were completed the entire shop interior was steam cleaned and painted, and traffic lane stripes added.

B. Modifications to the office complex included enlarging the participant waiting room by removing an office wall, painting the remaining walls, and installing new carpeting. The employees lounge and conference room were cleaned and painted. New carpeting was installed in the lounge and computer room. Reducting of the air conditioning system was also required for adequate cooling of the computer room.

C. To facilitate employee parking and traffic ingress to the test lane, a portion of the adjacent vacant lot was also leased, and a small asphalt parking lot and queue lane area was added to the exterior of the facility.

D. Solar sunscreen sheeting was applied to the showroom windows and the roof was patched to stop several water leaks.

Figure 2.3-1 shows the facility exterior. Figure 2.3-2 shows the final layout of the facility, and Figure 2.3-3 shows the facility positions and equipment layout.

FIGURE 2.3-1 FACILITY EXTERIOR

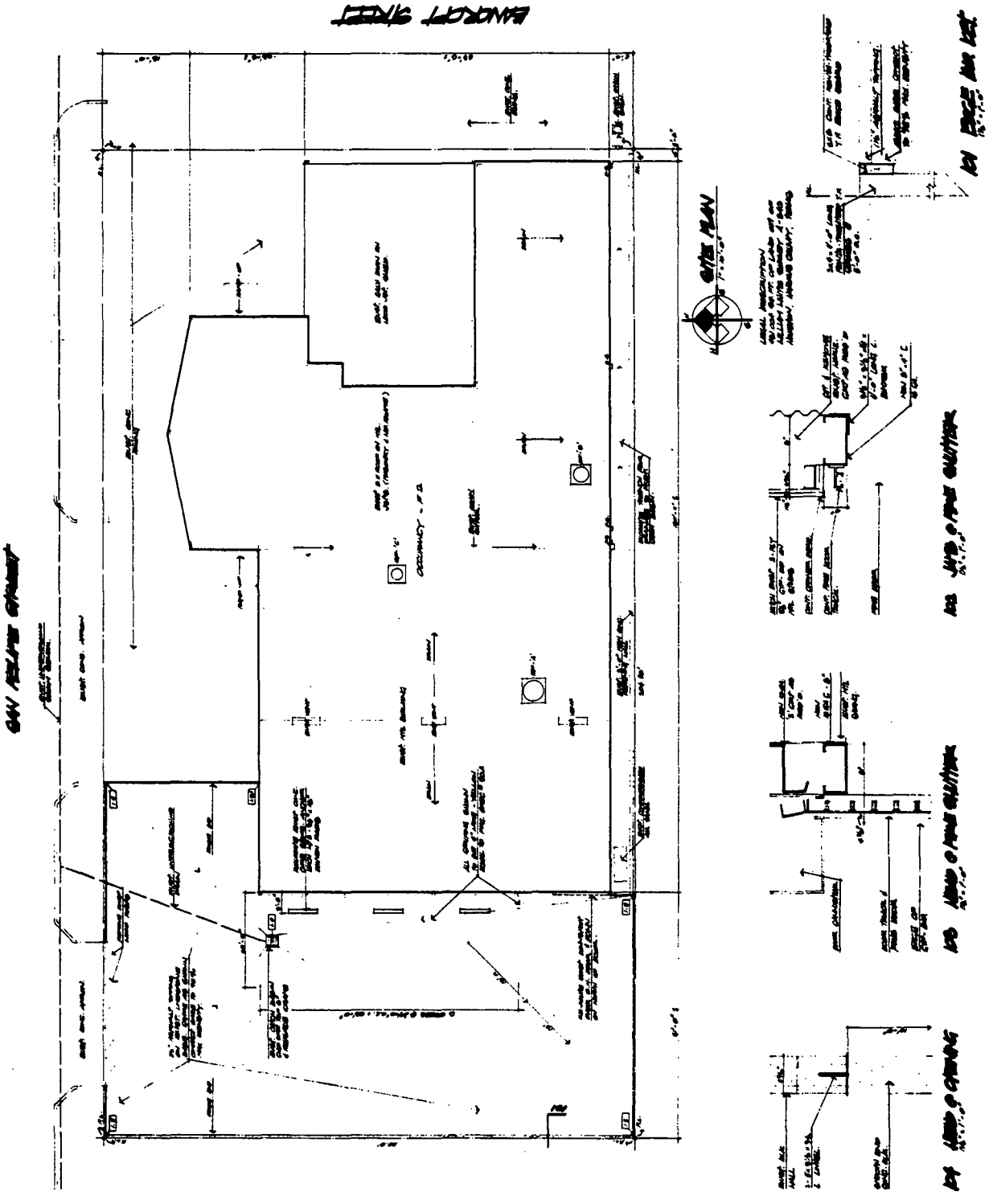


FIGURE 2.3-2 FACILITY LAYOUT

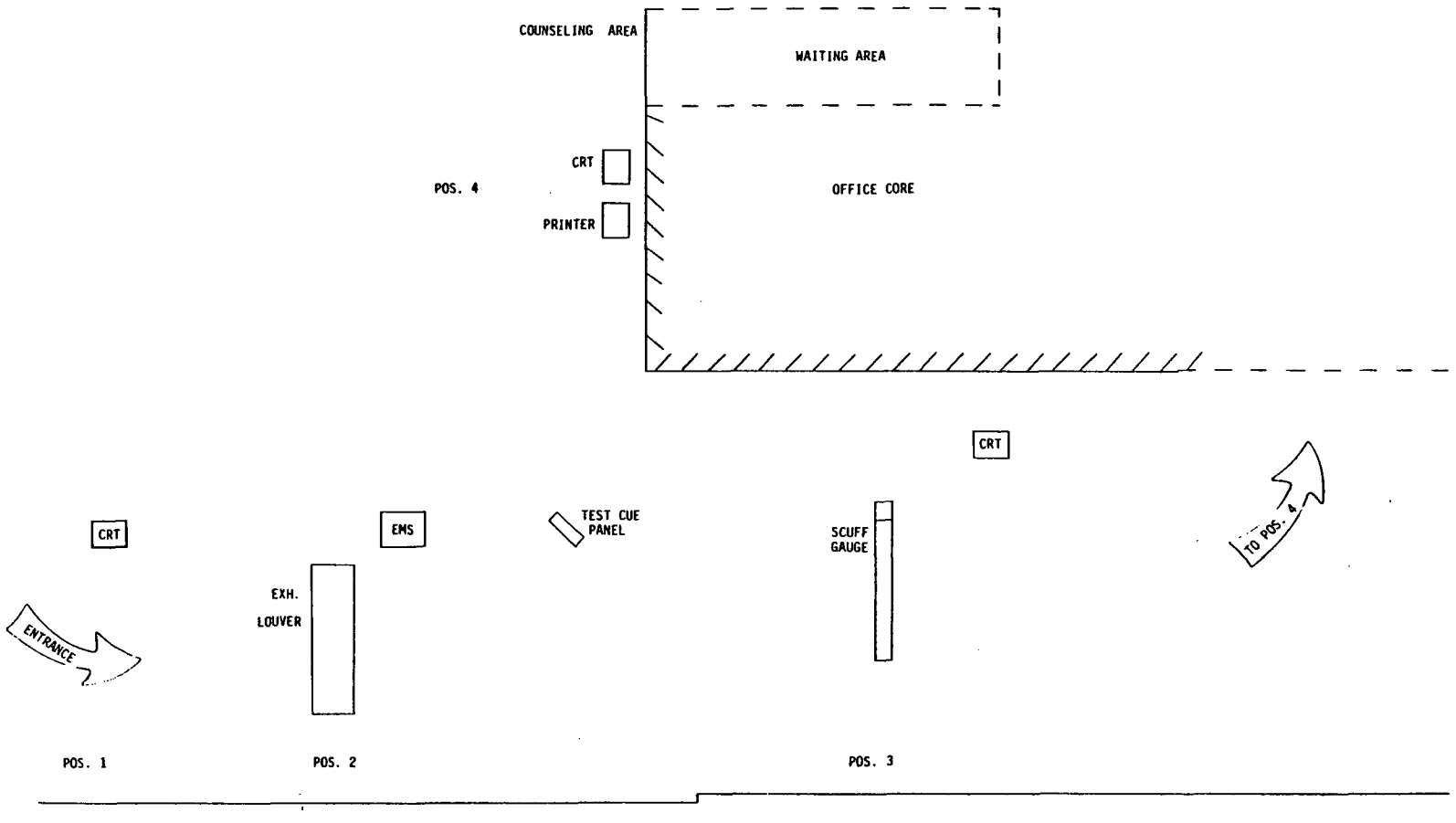


FIGURE 2.3-3 FACILITY POSITIONS AND EQUIPMENT LAYOUT

3.0 EQUIPMENT

This section describes the various equipment used in the Houston pilot emission program. It concentrates on technical aspects since the use of this equipment is described in the Inspection Procedure section of this report, and the Inspector Training Manual attached.

3.1 LIST OF EQUIPMENT

The following lists the equipment used in the program by type, manufacturer, model or part number, and quantity.

	Type	Manufacturer	Model or P/N	Quantity
1.	Emission Computer	Digital Equipment Corp.(DEC)	11/34	1
2.	Auxiliary Computer	Alpha Micro	AM-100	1
3.	Emission CRT	Applied Digital Data Systems (ADDS)	Regent 100	2
4.	Auxiliary CRT	ADDS	Regent 100	1
5.	Emission Measurement System (EMS)	Hamilton Test Systems (HTS)	HT200600-1	1
6.	Test Cue Panel	HTS	HT200840-1	1
7.	Exhaust Louvers	Clayton Manufacturing Co.	3-DES/0	1
8.	VIR Printer	DEC	LA-35	1
9.	Scuff Gauge	Applied Power	BEAR 240	1
10.	Timing Light	Mac Tools	TL-86	3
11.	Tire Pressure Gauge	Sears Roebuck	-	3
12.	CO Monitor (Ambient)	Scientific Engineering	Ecolizer 4000	1

	Type	Manufacturer	Model or P/N	Quantity
13.	Digital Engine Analyzer	Heathkit	CM-1550	1
14.	Stand-Alone Analyzer	HTS	CEA-610	1

Figure 3.1-1 shows the equipment interconnect and the data flow.

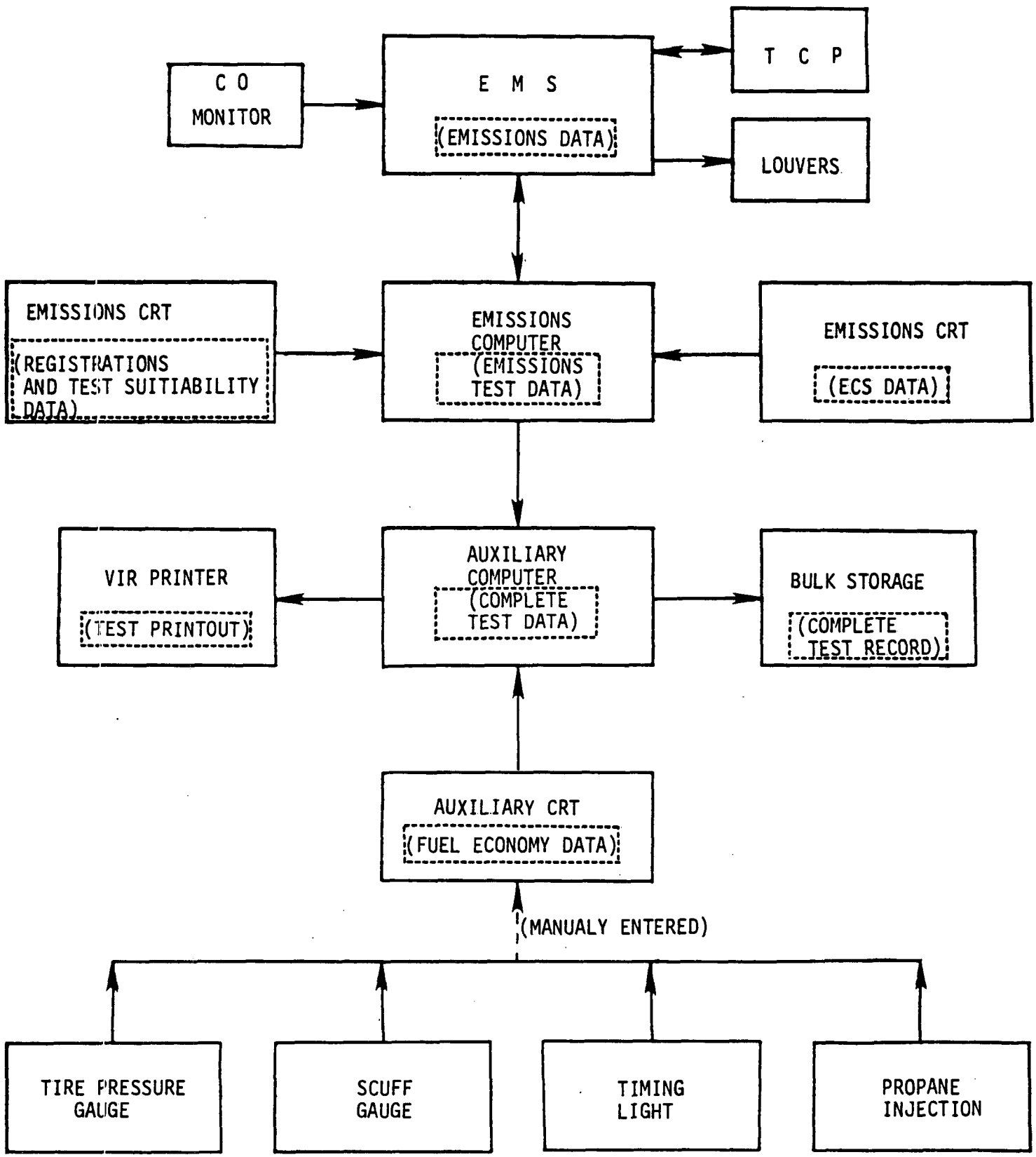


FIGURE 3.3-1 EQUIPMENT INTERCONNECT AND DATA FLOW

3.2 EQUIPMENT SPECIFICATION

3.2.1 Emission Computer

The emission computer used was Digital Equipment Corporation PDP 11/34 configured as follows:

A. CPU & Memory

- 16-bit word direct addressing of 32K word memory
- hardware implemented multiply and divide instruction
- parity detection on each 8-bit byte

B. Peripherals Interface

- 20 MA current loop multiplexer

C. Mass Storage

- dual RK05, random access data storage of 1.2 million words each
- dual RX01 floppy disk, random access data storage of 256K words each.

D. System Console

- DEC LA-36 printer

3.2.2 Auxiliary Computer

The auxiliary computer used was Alpha Micro AM-100 configured as follows:

A. CPU & Memory

- general purpose micro-programmed
- 8-bit word of 64K RAM byte

B. Peripheral Interface

- 6 RS-232 compatible I/O ports
- 1 parallel and 2 serial I/O ports

C. System Console

- standard CRT

3.2.3 Emission CRT & Auxiliary CRT

The emission and auxiliary CRT used were Applied Digital Data System model Regent 100 with the following features:

A. Display Characteristics

- 64 displayable characters
- character size of 0.20" high and 0.11" wide
- 5 X 7 dot matrix
- nondestructive cursor
- 80 characters per line
- 24 lines on a full screen
- 2400 baud transmission speed

B. Operating Functions (Software Control)

- field protection (to prevent operator keyboard data entry to protected fields)
- tab to unprotected fields
- overstrike editing
- cursor wraparound

3.2.4 Emission Measurement System

The Emission Measurement System used was Hamilton Test Systems part number HT200600-1 containing:

A. Emission Processor (PN HT200830-1)

- 8K word of random access memory
- data for operation (emission limit and analyzer curves were stored and loaded via magnetic tape cassette)

B. Sample System

- sample probes
- water separator
- air dryer
- sample pumps
- filter
- solenoid valve
- interconnect tubing

C. Gas Analyzers (PN HT200850-1 and HT200067-1)

- NDIR temperature control optical benches
- analyzer ranges:

  HC: 0-2000 ppm n-hexane

  CO: 0-10% CO

  CO_2: 0-20% CO_2

D. Maintenance/Relay Panel (PN HT200810-1)

- status lights
- control switches

E. Filter Panel (PN HT200820-1)

- flow control valve
- analyzer flow meters

F. Emission Data Entry Panel (PN HT200835-1)

- keyboard entry
- innunciation lights
- display windows

3.2.5 Test Cue Panel

The Test Cue Panel used was Hamilton Test Systems unit part number HT200840-1 with the following features:

- test status lights
- display windows
- special message display lights

3.2.6 Louvers

The louvers used were Clayton model 3-DES/O with the following features:

- pneumatic-hydraulic driven actuators
- 2 independently operated louver panels for accommodation of various length vehicles
- adjustable louver opening/closing time

3.2.7 VIR Printer

The VIR printer used was DEC LA-35, Receive only, with the following device characteristics:

- RS-232 interface
- 64 ASCII printable characters
- 30 characters per second print speed
- 80 characters per line

3.2.8 Scuff Gauge

The scuff gauge used was Applied Power model Bear 240 with the following features:

- surface mounted

- up to 16,000 lbs. per axle capability
- mechanically operated
- automatic reset

3.2.9 Timing Light

The timing light used was Mac Tools model TL-86 with the following features:

- timing advance
- adjustable flash from 0-60 degrees
- linear Xeon flash tube

3.2.10 Tire Pressure Gauge

The tire pressure gauge used was Sears Roebuck with following features:

- pencil type
- 10- 60 lb. scale

3.2.11 CO Monitor

The CO monitor used was Scientific Engineering model Ecolizer 4000 with the following features:

- calibration meter
- visual alarm
- 0-500 ppm range
- adjustable set point
- explosion proof housing

3.2.12 Digital Engine Analyzer

The digital engine analyzer used was Heathkit model CM-1500 with the following features:

- 4-digit liquid crystal display
- inductive pickup rpm probe
- 2 rpm ranges
- additional engine analyzing capability (dwell, volts, amp, ohms)

3.2.13 Stand-Alone Emissions Analyzer

The stand-alone analyzer used was Hamilton Test Systems computerized emission analyzer model CEA-610 with the following features:

- microprocessor logic
- digital readout of HC, CO and rpm
- auxiliary hand-held digital display panel
- paper tape printer
- flow fault indicator

3.3 EQUIPMENT DESCRIPTION

The concept used for the equipment in this program was based on a proven approach to the operation of an automated vehicle inspection station. The following is a brief description of the equipment used.

3.3.1 Computer Equipment

The computer equipment was required to control the automated inspection test process and to ensure proper real-time validation of the

inspection data accumulated for subsequent storage. The responsibility for these tasks was divided between three levels of system computer control: the emissions computer, the auxiliary computer and the lane Emissions Measurement System (EMS) processor.

The emissions computer was responsible for orchestrating the automated emissions inspection process. It had the primary responsibility for performing the real-time data acquisition and performance monitoring aspects of all automated emissions inspection. The emissions computer had the capacity for simultaneous handling of all real-time system interrupt requests and for performing data transfers from and to its associated lane peripherals located in all positions of the lane.
The auxiliary computer had the responsibility of receiving the real-time inspection data from the emissions computer and the manually-entered test data for the fuel economy tests performed. The auxiliary computer had the capacity of performing the logic required for the VIR printout and the storage of the completed inspection data.

The EMS processor was fully self-sufficient, being capable of executing an emissions test cycle as an independent, stand-alone piece of emissions test equipment, or in conjunction with the emissions computer.

3.3.2 CRT's

All CRT's used in the program had the capability of supporting a full-screen format that was generated by the appropriate computer as a "background form" for which the operator had to "fill in the blanks." The data acquired in this manner was transferred to the appropriate computer when the test operator was satisfied that the data entries were correct and signalled the terminal to transmit the data.

3.3.3 Emissions Measurement System

The Emissions Measurement System used in the program was an HTS designed, fully developed, production vehicle emissions test system. This was the same system that has proven itself in the high-volume vehicle emissions testing facilities operated by HTS in California and Arizona.

Operated by an inspector, the EMS measured vehicle emissions for compliance with the advisory emissions standards established for this program. The EMS passed samples of the vehicle exhaust through gas analyzers to measure the HC and CO concentrations. The results were automatically compared with permissible levels for the type and model year of vehicle under test. In addition, results were stored and transmitted to the emissions computer from which they were ultimately transferred to the auxiliary computer. CO_2 emissions were also measured to establish sample validity and became part of the vehicle's test record. In addition to the gas analysis, the EMS also measured the vehicle's engine rpm for conformance to the idle rpm limits.

The Emissions Measurement System included two main subsystems: the emissions processor and the emissions analysis subsystem. The emissions analysis subsystem was comprised of various subsystems which included: sample system, gas analyzers, maintenance/relay panel and filter panel. In addition to the above, the Emissions Data Entry Panel and the Test Cue Panel were connected and interfaced to the EMS system.

3.3.3.1 Emissions Processor Subsystem

The Emission Processor, a small digital computer, performed the following functions:

A. Controlled the emissions analysis subsystem.

B. Prompted and cued inspector during measurement.

C. Converted raw analog measurement and status data to digital information.

D. Performed necessary calculations.

E. Compared results to the established emissions standards.

F. Displayed emissions values and compared results.

H. Transmitted data to the emissions computer.

3.3.3.2 Emissions Analysis Subsystem

A. Sample System

The Sample System drew a sample of exhaust via a probe(s). The sample was dried, filtered and a portion was pumped via a special pump through the NDIR gas analyzers which detected hydrocarbons, carbon monoxide, and carbon dioxide concentrations in the exhaust gas sample.

B. Gas Analyzers

The emissions analyzers were a nondispersive infrared (NDIR) device specifically developed for interfacing with digital control electronics. As a result of this digital implementation, several factors were incorporated which were unique to this approach.

- The use of digital techniques enabled automatic analyzer zero compensation.

- Enabled precise compensation for the non-linearities associated with the gas absorption properties.

- enabled ambient pressure and gas temperature compensation.

A digital display for backup mode operation eliminated operator interpretation errors, as compared to an analog meter display.

The basic analyzers had a range of 0-2000 ppm HC and 0 to 10% CO which adequately covered the ranges required for this application for all four-stroke gasoline vehicles.

C. Maintenance/Relay Panel

The Maintenance/Relay Panel was a subsystem which provided the interface between the emissions processor and controlled devices that operated on 110 VAC. It also provided the system fault indicators, manual control switches and fuses.

D. Filter Panel

The filter panel contained the ambient air and fine analyzer filters. It also provided selection of various gases during calibration and for adjustment of correct individual analyzer flow.

3.3.3.3 Emissions Data Entry Panel

The Emissions Data Entry Panel was the interface between the inspector and the emissions processor. This panel provided inputs and displays. A computer type keyboard with sixteen keys and an ENTER key enabled the inspector to feed data into the processor and provided the inspector with certain operating options for the EMS.

A series of lights were used by the processor to: prompt and inform the inspector to ENTER QUEUE NUMBER, ENTER VEHICLE CLASS, and ENTER INSPECTION NO./CODE. Other lights (HC and CO LIMIT)

indicated when these gas concentrations had exceeded permissible limits. SAMPLE ERROR, KEYBOARD ERROR, and SYSTEM ERROR lights indicated when a mistake or malfunction existed.

Four-digit displays were used to display readings of gas concentrations during testing.

3.3.3.4 Test Cue Panel

The function of the Test Cue Panel was to provide test status and sequencing information to the test operator. The message displays on the panel were the primary means for giving instructions to the inspector. The messages were labeled to conform to test lane operation. Three message indicators were provided to inform the inspector of the overall test status. Other prompts indicated: (1) the vehicle/test mode condition ; (2) a diluted sample condition (low CO_2 reading) ; (3) the Emissions Measurement System is in the backup mode (not communicating with the emission computer); and (4) there is an ambient CO message on the emission computer console.

3.3.4 Exhaust Removal Louvers

Behind the emissions inspection position in the test lane, a set of exhaust removal louvers were installed. Each louver extended across the test lane and covered a pit that was vented to the exterior of the facility by an exhaust system capable of maintaining safe lane ambient air levels. The louvers were lowered as the vehicle under test moved into the test position. Then at the start of the test the inspector selected one of the louvers to be opened by the EMS. This selection was based on the vehicle's exhaust system configuration in order to achieve maximum exhaust removal from the facility. The actuators that raised and lowered the louvers were only powerful enough to raise the louvers, thus eliminating any danger of personnel injury or vehicle damage.

3.3.5. Vehicle Inspection Report (VIR) Printer

The VIR printer, which was a "receive only" device, was used to print the double continuous VIR. It was connected to the auxiliary computer and, therefore, all inspection related data on the VIR was computer generated.

3.3.6 Scuff Gauge

The scuff gauge used was Applied Power Bear-240. This was a floor-mounted wheel alignment tester capable of measuring side slip or drag. The check was performed by driving the vehicle over the floor-mounted plate. Vehicles were driven at a slow speed of 1-3 mph.

As each tire rolled across the platform, it came into contact with a sensitive blade that moved freely in a lateral direction. If the wheel was out of alignment and thus had a side drag or scuff action, it moved the blade in the direction of the scuff.

The amount of lateral movement of the blade was instantly recorded on the dial. The reading remained on the dial until reset. The trip mechanism reset the pointer to zero as the next pair of wheels moved across the trip plate.

3.3.7 Timing Lights

The timing light used was the gun type light with the light trigger mounted at the handle. The ignition timing was picked up by the inductive pickup arm attached to the plug wire. The amount of timing advance was determined by reading a round adjustable dial at the back end of the timing light.

3.3.8 Ambient CO Monitors

The ambient CO monitor was installed on the side of the EMS, 5 feet above the floor, with the pickup pointed toward the vehicle's line of travel. The output of the CO monitor was an electrical signal indicative of the concentration of ambient CO in the test lane at that point. That signal was used by the emissions processor in the EMS to compute: (1) the current concentration level, (2) the accumulative level (ppm-hrs), and (3) the rate of accumulation.

This data was transmitted to the emissions computer which monitored the readings to ensure ambient CO levels were within established safety levels.

3.3.9 Propane Injection

The equipment used for the propane injection test consisted of: (1) a propane cylinder connected to a hose and a middle valve, and (2) a digital rpm meter. The propane cylinders were 3-lb. cylinders used by recreational type vehicles.

The digital rpm meter was connected to any engine spark plug wire using the inductive pickup. By setting the digital analyzer to the 0-2000 rpm scale, the change in engine rpm, due to the propane injection, was detected.

3.3.10 Stand-Alone Analyzer

The stand-alone analyzer was available whenever the EMS could not be used for emissions testing. Accuracy of measurement was not compromised since the CEA-610 was a micro-processor control analyzer. Before any vehicle exhaust measurements were taken, an automatic zero and electrical span was performed by the micro-processor. The HC range of 0-2000 ppmh and 0-10% CO, plus the rpm measurement, were comparable to the EMS.

All measurements were recorded on the built-in paper tape.

4.0 INSPECTION PROCEDURES

4.1 TEST DESCRIPTION - AUTOMATIC MODE

4.1.1 Position # 1 Test Description

When a vehicle arrived at the test facility for inspection, it entered the station and was directed to stop at Position # 1.

A. The inspector detached a queue card from the queue card pad and entered the queue card number into the CRT. This entry, which was the "Log-On" function, allocated the vehicle test file in the emissions computer memory and enabled the emissions computer to track the vehicle data sent to it through the various test positions. The inspector then gathered and entered vehicle information data which identified the vehicle and determined how the vehicle was to be tested. This function was called "Registration Information Entry."

The data entered was:

- vehicle model year
- vehicle make
- retest counter number
- vehicle plate number
- vehicle identification number (VIN)
- vehicle odometer readings
- number of engine cylinders
- air injection/catalytic converter (AIC) code for the vehicle.

In addition to the above, if the vehicle was tested previously and the current inspection was a retest, the inspector entered the following data (related to the previous test) from the original test VIR:

- Previous test station code and lane number (were always: DB1, the Houston program station code and lane - 1).
- The station operation mode at the time the previous test was performed.
- The test number for the previous test.
- The date and time when the previous test was conducted.
- Repair information (if available) as it was presented on a repair order form such as parts and labor costs, vehicle rpm and rpm gain.

B. Once all the above information was entered into the CRT, the inspector visually checked the vehicle for conditions which would have made it unsafe or unsuitable for testing. The conditions under which vehicles were deemed unsafe or unsuitable for testing were:

- fuel leaks
- excessive oil leaks
- excessive coolant leaks
- severely damaged or deteriorated exhaust system
- inaccessible exhaust system
- symptoms which would indicate possible imminent mechanical failure.

If any of the above conditions were found, the inspector informed the vehicle owner about them and then entered an appropriate code identifying the unsafe condition in the vehicle test file. Since those vehicles were precluded from further testing, the driver was instructed to walk to the consulting area where he received the vehicle and the VIR specifying the unsafe or unsuitable test conditions found on the vehicle.

C. Once the inspector finished all his entries into the CRT, he then "logged off" signalling the emissions computer that all Position # 1 entries for the vehicle were completed. The inspector then requested the driver's permission for checking and inflating (if needed) the vehicle tires.

For those vehicles where the driver granted permission for the tire pressure inspection, the inspector checked and recorded the individual tire pressure on the queue card and inflated the tires if he found them to be below the tire pressure criteria.

Where driver permission was not granted for the tire pressure check, this was marked as "not tested" on the queue card.

D. Once all functions were performed on the vehicle, the queue card was placed on the vehicle's windshield or dashboard, and the driver was requested to leave the vehicle and walk to the designated waiting area. The Position # 2 inspector then entered the vehicle and drove it to Position # 2 for the emissions portion of the test.

4.1.2 Position # 2 Test Description

A. Once the vehicle was driven to Position # 2, the inspector exited the vehicle, chocked it, raised the hood and connected the EMS

rpm pickup to a spark plug wire. The inspector then selected the appropriate probe(s) and inserted it into the vehicle's tailpipe. The inspector then entered the queue number into the EMS via the Emission Data Entry Panel (EDEP). The EDEP then displayed the weight class (year, weight, number of cylinders and AIC code) that the EMS received from the emissions computer.

Once the inspector verified and accepted the weight class, he observed the vehicle and selected the correct louver opening according to the vehicle's length.

B. At this point the EMS started the first idle portion of the test. Exhaust and rpm were sampled, HC, CO and CO_2 were analyzed and stored by the EMS while the Test Cue Panel (TCP) displayed the engine's rpm.

C. At the end of the first idle mode the TCP enunciated to the inspector to accelerate the vehicle to 2500 rpm. The inspector accelerated the vehicle until the TCP display of actual engine rpm was between 2300-2700 rpm. Once the vehicle's rpm had reached this band, HC, CO and CO_2 were again automatically sampled by the EMS.

D. At the end of the 2500 rpm mode the TCP instructed the inspector to bring the vehicle to a second idle. After a built-in delay (to allow the vehicle to reach stable idle conditon) the EMS again measured the HC, CO, CO_2 and rpm of the vehicle. The inspector then observed the vehicle for tail pipe smoke and entered a Smoke Failure into the EMS if excessive smoke was observed.

E. At this point the EMS automatically compared the measurement taken at each mode to the limits (where applicable) and

transmitted this data to the emissions computer. The inspector meanwhile exited the vehicle, disconnected the rpm pickup, lowered the hood, and removed the exhaust probe(s). The Position # 3 inspector entered the vehicle and proceeded to Position # 3.

4.1.3 Position # 3 Test Description

A. The Position # 3 inspector drove the vehicle at a speed of about 1-3 mph over the scuff gauge ensuring that only the front wheels cleared the floor plate (in order not to reset the meter readout).

B. He then exited the vehicle, recorded the scuff gauge reading on the queue card and proceeded to check the Emission Control System (ECS) devices.

The ECS check results were entered into the emissions computer via the CRT located at this position by entering the queue number followed by the letter "E." The CRT then displayed the ECS devices to be checked and a device condition code, as follows:

ECS Devices

- positive crankcase ventilation
- air injection
- exhaust gas recirculation
- fuel evaporative
- exhaust converter
- leaded fuel restrictor

Device Condition Code

- modified
- disconnected or bypassed
- missing
- not inspected

C. When the inspector finished the ECS check and his entries (if all devices passed, inspector only entered his inspector number), he "logged-off" the CRT, entered the vehicle and drove it to Position #4. The "log-off" function at this position initiated the transfer of all the data stored at the emissions computer memory into the auxiliary computer memory for further data processing.

4.1.4 Position #4 Test Description

A. When the vehicle arrived at Position #4 it was placed in one of the two inspection bays located at this position. The vehicle was placed in "park" or "neutral" with the parking brakes applied and the exhaust removal hose connected over the tail pipe. The engine was shut off in preparation for verification and connection of test equipment for the subsequent tests.

B. The inspector then performed the following in preparation for the propane injection and timing tests.

- If the intake port of the air cleaner was accessible without the use of tools, the rpm pickup from the digital engine analyzer was connected to a spark plug wire and the propane cylinder hose with the middle valve shut off was inserted into the intake port of the air cleaner.

- If timing marks were clean and visible and vehicle emissions label present, the timing light was connected to the vehicle battery terminals and the inductive pickup was connected to a spark plug wire.

- If the intake port of the air cleaner was not accessible or timing marks and emissions label were not present, the queue card was marked as "no test performed" in the appropriate place.

C. Once all connections were in place the vehicle was started and allowed to reach stable idle condition. The rpm value was recorded on the queue card as "propane gain initial rpm." The inspector then opened the needle valve on the propane cylinder hose and recorded the vehicle rpm changes as "final rpm" as follows:

- Rpm increased to a peak and then decreased, inspector recorded peak value.

- Rpm increased to a steady value - inspector recorded steady value.

- Rpm decreased until vehicle stalled - inspector recorded the same rpm as initial rpm value.

D. The inspector then performed timing checks by recording on the queue card the degrees of advance or retard as was determined by aiming and adjusting the timing light to the top dead center mark.

The vehicle timing specifications as appeared on the emissions label were also recorded on the queue card.

E. Following the propane and timing tests, the inspector would determine if the EGR vacuum hose was accessible to accomplish the EGR test. If so, he would clamp off the hose and hold it. From inside the vehicle another inspector would increase the engine RPM to the specified test value while observing the digital analyzer (2500 rpm for GM-L4 engines, 2000 rpm for all others).

When the specified rpm was reached and allowed to stabilize, the under-hood inspector was signalled to immediately release the hose. The inspector observing the digital analyzer, while holding a steady throttle position for at least 5 seconds, and then noted the drop, if any, in engine rpm. Later this was recorded on the EGR test form.

When the above testing was completed, the vehicle was shut off and all equipment disconnected.

F. The inspector then "logged-on" on the auxiliary CRT located at Position # 4 by entering the queue number from the queue card. The auxiliary CRT then provided the inspector with a screen format to enter all the test information recorded on the queue card, as follows:

- tire pressure
- alignment
- propane gain
- ignition timing

Once all the information was entered and verified by the inspector as being correct, the auxiliary computer generated the VIR on a double N.C.R. 14" X 8 1/2" paper. The inspector then separated the second copy of the VIR, attached the queue card to

it and placed it for storage. The vehicle, with the top copy of the VIR, was then moved by the counselor to the counseling area.

4.1.5 Counseling Area Procedure Description

Once the vehicle arrived at the counseling area the counselor located the vehicle owner, presented the VIR and informed him/her of the test results. The different sections of the form were described noting the vehicle test limits and readings. Limited diagnostic information was provided from the back of the VIR and any questions were answered. After completing the counseling conversation, the vehicle and owner departed from the station.

4.2. SPECIAL OPERATION MODES

In order to ensure vehicle testing at all times, special operation modes were designed to allow vehicle testing without the use of one of the major pieces of equipment due to failure. A brief description of these special operating modes follows:

4.2.1 Backup Mode

Vehicle tests were performed in this mode whenever the emissions computer was not operational.

A. The emissions computer console (LA-36 printer) was placed at Position # 3 and connected directly to the EMS through a special data link. The "temporary VIR" was placed in the printer.

B. The Position # 1 inspector performed only test suitability checks and tire pressure checks. If vehicle was unsuitable for testing, the appropriate code(s) was hand-written on the queue card instead of being entered into the CRT. Vehicle was then driven into Position # 4.

C. The emissions test was performed as normal except the weight class (year, weight, number of cylinders, AIC code) which the EMS was to receive from the emissions computer was entered into EMS by the inspector. When the emissions test was over the EMS generated the "temporary VIR" which contained the emissions readings and limits.

D. The vehicles then were processed at Position # 3 as normal, with the exception that ECS failure codes (if applicable) were hand-written on the queue card. Position # 4 testing was performed as normal.

E. At the end of all testing the inspector at Position # 4 entered the registration data (that was not entered at Position # 1) and all the data from the "temporary VIR" into the auxiliary computer via a special screen format on the auxiliary CRT. Those entries allowed the auxiliary computer to have the same data that normally was transmitted from the emissions computer. Once this process was completed and the data from the queue card entered, printing of the VIR and data storage on the data file were performed as normal by the auxiliary computer.

4.2.2 Semiautomatic Mode

Vehicle tests were performed in this mode whenever the EMS was non-operational. The stand-alone computerized emissions analyzer, model CEA-610 was used to perform the emissions tests.

A. The Position # 1 inspector performed all test functions as normal. At the end of the test the vehicle was moved to Position # 2 and the stand-alone analyzer was used to perform the first, 2500 rpm and 2nd idle emissions test. Measured values for HC, CO, CO_2 and rpm for each section of the test were printed on the paper tape of the CEA-610.

B. At the end of the emissions test the Position # 3 functions were performed as normal. The ECS failure code (if applicable) and the measured values for the emissions test (printed on the CEA-610 paper tape) were entered into the emissions computer via a special screen format on the CRT at Position # 3.

C. The Position # 4 test, queue card data entry, VIR generation and data storage were performed as normal.

4.2.3 Deferred Mode

Vehicle tests were performed in this mode whenever the auxiliary computer was non-operational. The VIR printer (LA-35) was connected directly to the emissions computer via a special data link located at Position # 4. The "temporary VIR" was placed in the printer.

A. All testing and entries at Position # 1 through Position # 3 were performed normally. At the end of Position # 3 test, the emissions computer generated the "temporary VIR". All data that normally was to be transmitted from the emissions computer to the auxiliary computer was printed on the "temporary VIR".

B. Position # 4 testing was performed as normal, however, since a VIR could not be generated due to the non-availability of the auxiliary computer and, in order to eliminate erroneous information on the VIR if it were to be hand-filled, the mailing address of the vehicle owner was recorded.

C. The vehicle driver was informed of the station equipment malfunction and that the VIR would be mailed to him as soon as possible. Once the auxiliary computer became operational the data from the "temporary VIR" and the queue card was entered into it, a VIR was generated and mailed to the vehicle owner.

4.3 EXPERIMENTAL TESTS

4.3.1 Propane Injection

The test was easily performed on almost any vehicle. Access to any plug wire and the engine air intake opening was all that was required. The most significant step in performing the test was to slowly inject propane into the air intake, while observing the digital analyzer. This would allow detection of even the smallest increase in rpm. A small needle valve with an .080 inch diameter orifice was used for this purpose to finely meter the propane.

Engines with an unstable idle RPM were difficult to test. It was necessary to mentally average both the initial and final RPM readings before these values could be recorded.

It was noted by Hamilton Test Systems that many vehicles with catalytic convertors passed the tail pipe emissions test and were out of limits on the propane test. This may suggest that the vehicles curburetor was set too rich, with the exhaust being "cleaned" as it passed through the convertor. The test could have future diagnostic use in fuel economy testing by easily detecting this over-rich condition.

4.3.2 Basic Timing

This test was difficult to perform as well as time consuming. It required knowledge of the location of a great many timing marks that were both difficult to see and interpret. Many marks were so dirty or rusted that even cleaning could not render them identifiable. To clean the marks on some engines the crankshaft first had to be rotated so that the marks were accessible.

In accordance with manufacturer's procedures, the distributor vacuum advance hose is disconnected on most engines while the basic timing was checked. This was not integrated into the testing procedure in order to shorten test time and avoid broken hoses. However, this made the test invalid as a measure of basic timing for the many vehicles that had vacuum advance at idle.

Checking basic timing seemed to be an impractical test to incorporate in a high throughput test lane operation.

4.3.3 Alignment Checks

The Bear model 240 scuff gauge was an efficient unit for measuring toe-in or front wheel side drag. Calibration was simple and it required little maintenance. Approaching and crossing the unit in a direct straight line was the most important factor in the test. The manufacturer recommended the vehicle be driven forward a minimum of 20 feet with no steering wheel movement before crossing the floor plate. This allowed the tire tread to conform to its normal shape. HTS found this to be more critical with radial tires than conventional ones. The only problem encountered was a general misunderstanding of the test by the public, which perceived it as a complete front end alignment check. People were confused when their front tire tread wear was uneven but the vehicle passed the test. A more detailed explanation was required which extended counseling time and slowed thruput.

4.3.4 Tire Pressure Measurement and Inflation

Participants were pleased to have their tire air pressure checked and adjusted if it was found to be low. HTS found many tires with incorrect air pressure. Most were underinflated due to neglect, but some were deliberately overinflated to an unsafe level by people trying for better gas mileage. The qualification of not testing any vehicle with an unaccessible valve stem made the test run smoothly and no problems were encountered.

4.3.5 EGR Test

An EGR functional check was added to the inspection procedure, per EPA request, in mid-July. The test involved clamping the EGR vacuum hose, raising and holding the engine rpm, then releasing the hose and noting the effect on the rpm. To keep test time to a minimum and avoid complications, the air cleaner was not removed. This made the EGR hose inaccessible on many engines, especially Ford and American Motors products. Access to the throttle from under the hood was also made impossible on most engines ; therefore, the test required two inspectors: one inside the vehicle to control the throttle and observe engine rpm and one under the hood to operate the clamp on the EGR vacuum hose.

The test as performed showed a high rate of EGR system failures. HTS conducted several experimental tests to determine if the EGR system or the operational procedure was at fault. A visual check of the valve and vacuum supply operation was first tested by the "goose" acceleration method. In this method, the inspector momentarily snapped the vehicle throttle to the wide open position while observing the EGR stem for movement. As a second check manifold vacuum was applied to the valve with the engine at the required rpm and the rpm drop noted. Only a small random sample of vehicles (10-15) were tested in this manner but they showed the test procedure to be at fault in all cases. The 2000 rpm test speed was too low for most 4-cylinder models since it required only a slight throttle opening. Many valves were made to open on acceleration, while under sustained light throttle operation they did not function.
These findings suggest that the test method be reviewed for procedural changes.

5.0 DATA HANDLING

This section describes the test data collection and submission to the vehicle owner, and the EPA.

5.1 DATA TRANSMITTAL PROCEDURES

At the test facility, for each vehicle that was tested, a Vehicle Information Report (VIR) was generated on a double NCR paper. The top copy of the VIR was handed to the vehicle owner, the bottom copy was retained by HTS for the duration of the program, at which time they were submitted to the EPA. In addition, for each vehicle tested the complete set of test data items was recorded on floppy disks.

At the end of each day the data floppy disk used that day contained a record of all tests performed during that day's testing. A copy of this floppy disk was made each day and the copy was maintained at the test facility for a minimum of 31 days, as a backup of the primary data source.

On a weekly basis the original test floppies were accumulated and converted to one IBM compatible floppy.

At the end of each reporting period the IBM compatible floppies were sent to HTS Headquarters in Phoenix, Arizona, where the data was merged onto a 9-track magnetic tape. This merging was performed by a service bureau under contract to HTS. Three copies of this IBM magnetic tape were made ; two were delivered to the EPA via Federal express, and one was retained by HTS as the final test data backup medium. Once the IBM magnetic tapes had been generated and verified to contain all the data, the original floppy disks retained at the station were reused.

5.2 DATA FORMAT

All test data was delivered to EPA on magnetic tapes with the following specifications:

- IBM compatible
- 1600 BPI
- vehicle test record encoded in EBCDIC character format in unpacket form.
- tapes were unlabeled and blocked 10 VTR's (Vehicle Test Record) per block with interblock gap.
- each VTR record was 256 bytes in length with the last 58 bytes blanks.

Table 5.2-1 defines the content of the VTR as it appeared on the magnetic tapes.

TABLE 5.2-1 - VTR FORMAT

ITEM NO.	NO.OF BYTES	DESCRIPTION	E X P L A N A T I O N
			Terms: A) "character" = any keyboard character B) "alpha character" = "A" to "Z", "-", blank C) "numeric character" - "0" TO "9" D) "alpha-numeric character" = "A" TO "Z", "-", blank, "0" to "9"
1	3	Queue No.	Three numeric characters. Number as appears on queue card assigned to each vehicle for the duration of the inspection.
2	1	Mode	One alpha character. Mode under which the vehicle was inspected. Possible values: "A" = automatic "S" = backup mode "M" = semiautomatic mode
3	6	Date	Six numeric characters. Date on which the vehicle was inspected. Stored in the form MMDDYY. Date must be less than or equal to current date. Where: MM= month DD= day YY= year
4	5	Time	Five characters. Time of test expressed as HH:MM
5	3	Station	Three characters. Station identification name (always DB1).
6	1	Lane	One numeric character. Lane number on which the vehicle was inspected (always 1).
7	8	Plate	One to eight characters. License plate number, left justified, with no spaces between character license plates with two characters in a vertical column shall be stored with the upper character first. Out of state license plates shall be stored as "*OS*".

ITEM NO.	NO.OF BYTES	DESCRIPTION	E X P L A N A T I O N
8	3	Test No.	Three numeric characters. Number assigned by the computer for the inspection. Test numbers are assigned sequentially starting at "001". The queue number is the test number for semiautomatic or backup testing.
9	3	Model Year	One alpha character ("M") followed by two numeric characters. The numeric characters are the model year. The maximum model year shall be the current year plus one.
10	16	Vehicle I.D. No. (VIN)	One to sixteen alpha numeric characters. Number is left justified with no spaces between characters.
11	5	Make	One to five alpha-numeric characters. Vehicle make, left justified, with no spaces between characters.
12	1	Retest No.	One numeric character. A zero value signifies the first test performed on the vehicle. A value of one to nine indicates the nth retest. The retest number will be the retest number appearing on the old vehicle report (VIR) plus one.
13	3	Odometer	Three numeric characters. Odometer reading in thousands of miles ("000" TO "999").
14	2	Cylinders	Two numeric characters. Number of cylinders for the inspected vehicle.
15	1	Air Injection Code (AIC)	One numeric character. Possible values: "0"= No air injection, no catalytic converter "1"= air injection, no catalytic converter "2"= no air injection, normal catalytic converter "3"= air injection, normal catalytic converter.
16	3	Customer	One to three alpha numeric characters. Normal test will have a customer value of"---". Tests conducted for equipment checks will have a value of "HTS".
17	8	Reject Reason Codes	4 groups of 2 character numeric codes possible. Values for each group: "00"= No code entered "01-13"= reject reason

ITEM NO.	NO.OF BYTES	DESCRIPTION	E X P L A N A T I O N
18	1	Smoke	One alpha character. Smoke failure indicator. Possible values: "N"= Passed smoke test "Y"= Failed smoke test
19	12	ECS Failure Code	Six groups of two alpha numeric characters. If no code entered, then group will contain "blank"
20	4	HC Limit (Idle)	Four numeric characters that define the HC diagnostic value used for this vehicle's test. Form = XXXX
21	5	CO Limit (Idle)	Five numeric characters that define the CO diagnostic value used for this vehicle's test. Form = XX.XX
22	5	1st Idle HC reading	The HC reading expressed as XXXXI Where: XXXX= HC reading in ppm I= "blank" when reading _ limit I- "*" when reading limit
23	6	1st Idle CO reading	The CO reading expressed as XX.XXI Where: XX.XX= CO reading in % I= "blank" when reading _ limit I= "*" when reading limit
24	5	1st Idle CO_2 reading	The CO_2 reading expressed as XX.XX in % CO_2
25	5	2500 rpm HC reading	same as item 22
26	6	2500 rpm CO reading	same as item 23
27	5	2500 rpm CO_2 reading	same as item 24
28	5	2nd Idle HC reading	same as item 22
29	6	2nd Idle CO reading	same as item 23
30	5	2nd Idle CO_2 reading	same as item 24

NO.	BYTES	DESCRIPTION	E X P L A N A T I O N
31	5	Idle speed	The idle speed as measured during the 2nd idle emission test. Expressed as XXXXI Where: XXXX= rpm I= "blank" when reading _ limit I= "*" when reading limit
32	1	Propane gain Results (P/F)	The result of the Propane gain test. Valid Values are: "P"= gain _ limit "F"= gain ¯ limit "blank"= no test (see item 33)
33	4	Initial rpm Propane Gain	The rpm at the outset of the Propane gain test. Four numerics (XXXX) define the rpm. An alpha entry of "NT" signifies no test, an entry of "AB" signifies an aborted test.
34	4	Final rpm Propane	The rpm at the completion of injection of Propane. Four numerics (XXXX) define the rpm. "blank"= no test (see item 33).
35	4	Rpm Gain Propane	Three numerics plus sign (SXXX). Where: XXX = final rpm - initial rpm S = sign.
36	3	Propane rpm gain limit	Three numerics that define the limit used to determine Propane gain Pass/Fail.
37	2	Tire Pres. Right Front	Two characters that define the "as received" Right front tire pressure. Possible values are: XX= pressure in psig TR= inflation refused by owner NT= no measurement made for all other reasons
38	2	Tire Pres. Right Rear	Two characters that define the "as received" pressure for the referenced tire. Possible values are: XX= pressure in psig "blank"= no test (see item 37)
39	2	Tire Pres. Left Rear	same as item 38
40	2	Tire Pres. Left Front	same as item 38

ITEM NO.	NO.OF BYTES	DESCRIPTION	E X P L A N A T I O N
41	1	Tire Pres. Result R.F.	Single character tire pressure Pass/Fail Indicator for referenced tire. Possible values are: "P"= Pass "F"= Fail "Blank"= no test
42	1	Tire Pres. Result R.R.	same as item 41
43	1	Tire Pres. Result L.R.	same as item 41
44	1	Tire Pres. Result L.F.	same as item 41
45	3	Scuff test data	Three numeric characters (XXX) define the amount of scuff. An alpha entry of "NT" signifies no test.
46	3	Scuff test Spec.	Three characters that define the specification that the scuff data is compared to for Pass/Fail determination. Possible entries are: "XXX"= Spec. "blank"= no test (see item 44)
47	1	Scuff test result	This character defines the scuff test result. Possible values are: "P"= Pass (data _ spec.) "F"= Fail (data ¯ spec.) "blank"= no test (see item 44)
48	3	Timing data	Ignition timing in crankshaft degrees. Possible entries are: "SXX= Timing data Where: S = (+) for BTDC, (-) for ATDC XX= data in degrees "NT"= no test "NA"= specification not available "AB"= aborted test
49	3	Timing specifi-cation	Ignition timing specification obtained from vehicle emission label. The form is SXX. Where: S= (+) for BTDC, (-) for ATDC XX= numerical value of spec.

NO.	BYTES	DESCRIPTION	E X P L A N A T I O N
50	3	Timing limit	The limit on the difference between the timing data and the timing spec. Pass if: spec. - data $\_$ limit Fail if: spec. - data $\bar{}$ limit
51	3	ECS ID	One to three characters. Inspector identification required with ECS entry/exit.
52	3	EMS ID	One to three characters. Inspector identification required for weight class override and abort. If less than three characters, then dashes ("-") will fill out the remaining characters.

Total 198 bytes of 256 used (last 58 bytes blanks)

C. The values used for the various limits were:

- Reject Reason Codes (Item 17)

  01 oil system leak

  02 oil system light on

  03 oil system transmission leak

  04 coolant system leak

  05 coolant system light on

  06 exhaust system excessive leak/noise

  07 exhaust system loose/dragging

  08 exhaust system inaccessible

  09 fuel system leak - engine

  10 fuel system leak - underbody

- Emission Limits (Items 20 & 21)

Year	HC - PPM	CO - %
Prior to '68	1200	7.5
'68 - '69	700	5.0
'70 - '74	500	4.0
'75 - '77	400	3.5
'78 - 79	300	3.0
'80	200	2.0

- RPM Limits (Item 31)

Year	RPM Limits
Prior to '68	1000
'68 - '80	1200

- Propane RPM Gain Limits (Item 36)

Year	RPM Gain
Prior to '74	0
'75 - '80	10

- Tire Pressure Limit (Items 41 - 43)

"Pass" if tire pressure were equal to or greater than 20 psi

"Fail" if tire pressure were less than 20 psi

"Pass" if reading were equal to or less than 10 ft/mile

"Fail" if reading were greater than 10 ft/mile

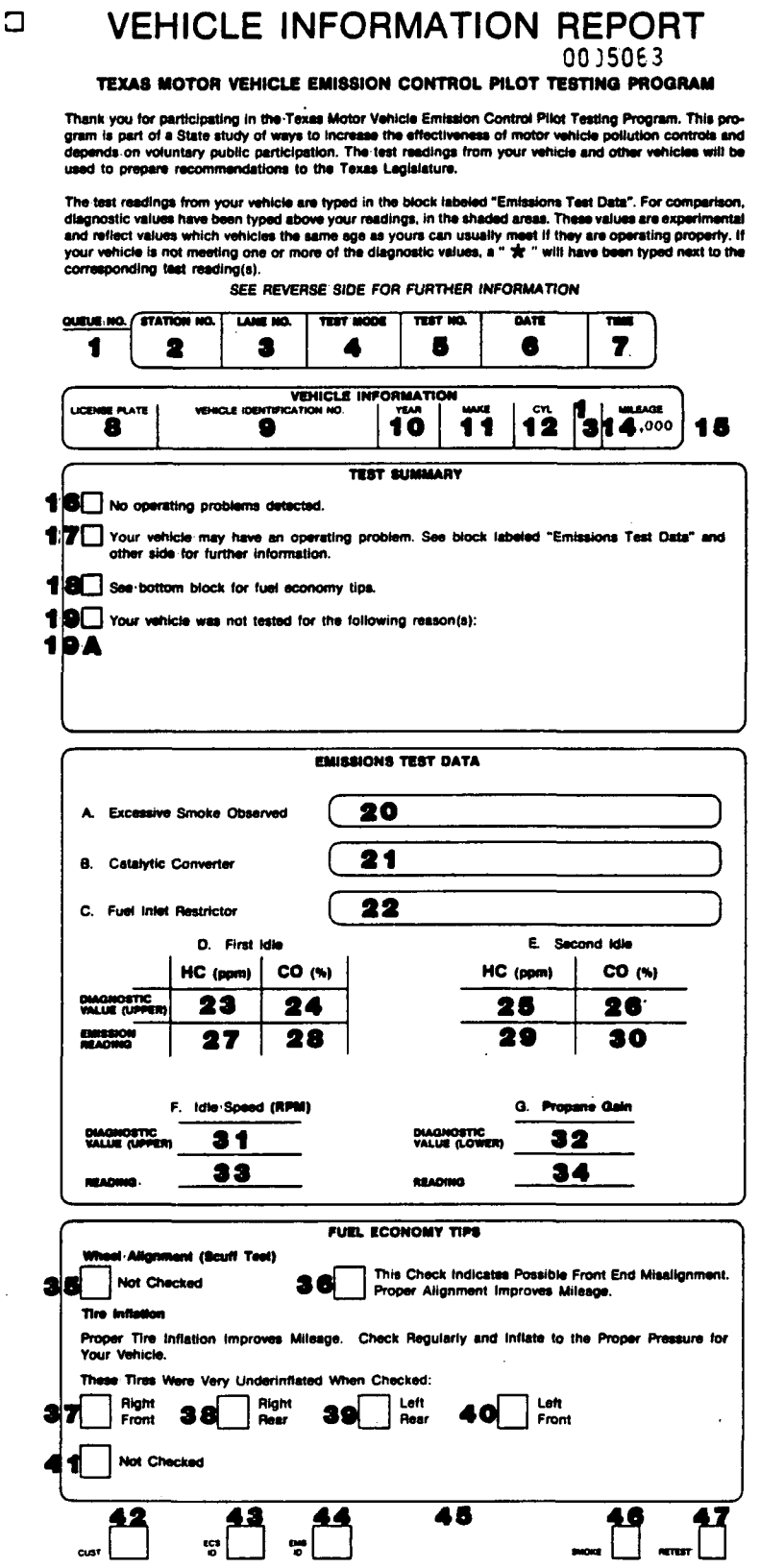
- Timing Limits (Item 49)

"Pass" if reading were advanced, or less then or equal to 5^{o} retarded. "Fail" if reading were greater than 5^{o} retarded.

5.3 VIR PRINTOUT LOGIC

Figure 5.3-1 A. presents field numbers (e.g., 1, 2, 3, etc.) referred to in Table 5.3-1 which lists the information and the explanation or logic for the data printed on the VIR.

Figure 5.3-1A
(front of VIR form)



VEHICLE INFORMATION REPORT

00150E3

TEXAS MOTOR VEHICLE EMISSION CONTROL PILOT TESTING PROGRAM

Thank you for participating in the Texas Motor Vehicle Emission Control Pilot Testing Program. This program is part of a State study of ways to increase the effectiveness of motor vehicle pollution controls and depends on voluntary public participation. The test readings from your vehicle and other vehicles will be used to prepare recommendations to the Texas Legislature.

The test readings from your vehicle are typed in the block labeled "Emissions Test Data". For comparison, diagnostic values have been typed above your readings, in the shaded areas. These values are experimental and reflect values which vehicles the same age as yours can usually meet if they are operating properly. If your vehicle is not meeting one or more of the diagnostic values, a " ★ " will have been typed next to the corresponding test reading(s).

SEE REVERSE SIDE FOR FURTHER INFORMATION

QUEUE NO. 1	STATION NO. 2	LANE NO. 3	TEST MODE 4	TEST NO. 5	DATE 6	TIME 7

VEHICLE INFORMATION

LICENSE PLATE 8	VEHICLE IDENTIFICATION NO. 9	YEAR 10	MAKE 11	CYL 12	1	MILEAGE 13 14,000	15

TEST SUMMARY

16 ☐ No operating problems detected.

17 ☐ Your vehicle may have an operating problem. See block labeled "Emissions Test Data" and other side for further information.

18 ☐ See bottom block for fuel economy tips.

19 ☐ Your vehicle was not tested for the following reason(s):

19A

EMISSIONS TEST DATA

A. Excessive Smoke Observed — 20

B. Catalytic Converter — 21

C. Fuel Inlet Restrictor — 22

	D. First Idle		E. Second Idle	
	HC (ppm)	CO (%)	HC (ppm)	CO (%)
DIAGNOSTIC VALUE (UPPER)	23	24	25	26
EMISSION READING	27	28	29	30

F. Idle Speed (RPM)		G. Propane Gain	
DIAGNOSTIC VALUE (UPPER)	31	DIAGNOSTIC VALUE (LOWER)	32
READING	33	READING	34

FUEL ECONOMY TIPS

Wheel Alignment (Scuff Test)

35 ☐ Not Checked

36 ☐ This Check Indicates Possible Front End Misalignment. Proper Alignment Improves Mileage.

Tire Inflation

Proper Tire Inflation Improves Mileage. Check Regularly and Inflate to the Proper Pressure for Your Vehicle.

These Tires Were Very Underinflated When Checked:

37 ☐ Right Front 38 ☐ Right Rear 39 ☐ Left Rear 40 ☐ Left Front

41 ☐ Not Checked

42 CUST ☐ 43 ECS ID ☐ 44 EMIS ID ☐ 45 46 SMOKE ☐ 47 RETEST ☐

FIGURE 5.3-1A FRONT OF VIR FORM

Figure 5.3-1B
(back of VIR form)

CONTINUED FROM FRONT OF REPORT

Texas currently has no laws which place emission limits on vehicles after sale. Therefore, your car is not required to meet any specific legal limits on the test preformed on it as part of the Pilot Testing Program. The readings from your vehicle and the diagnostic values in the shaded areas are for your information only.

If a "*" appears next to one of your vehicle's readings there is a good chance that your vehicle is not operating properly. Below you can find some advice which may assist you in improving the operation of your vehicle. Repair of your vehicle as a result of this test is strictly voluntary. Repair also may lower the emissions from your vehicle.

If you decide to have your vehicle repaired in order to correct problems which may be keeping it from meeting the diagnostic values, you are welcome to bring the vehicle back for a second test. By doing so, you can check whether the repairs have resulted in lower emissions. You will also be contributing useful data to the study.

As a service to participants like yourself, and to collect information on the condition of vehicles in Texas, some checks related to fuel economy are being performed on many vehicles in addition to the emission tests. The bottom section of the front of this form shows the results from these checks, along with some tips for better mileage.

TEST PROCEDURE

Tailpipe emissions of Carbon Monoxide **(CO)** and Hydrocarbons **(HC)** from your vehicle were measured twice during the test. First, the emissions were measured while your vehicle was at idle. The readings from this first step are shown on the front of the form under the heading "D. First Idle."

Next, your vehicle's engine was accelerated to about 2500 RPM while parked. This evacuated any excess emissions that may have accumulated in the exhaust system while you were waiting in the test line. The vehicle was then returned to idle and the emissions were measured again. The readings are shown under the heading "E. Second Idle". This second idle measurement may represent more accurately the operation of your vehicle. Therefore the "Test Summary" block is based on the second idle measurement only.

The idle speed **(RPM)** of your vehicle was checked during the second idle measurement. The inspector also watched for the presence of excessive smoke in your vehicle's exhaust.

A visual check was made for the presence of a catalytic converter and an appropriate restrictor in the fuel filler neck for those vehicles on which these are standard equipment.

Where appropriate, a propane gas enrichment procedure has been carried out to evaluate the air/fuel mixture provided by your carburetor. If the mixture is set properly, the engine speed should show an increase **(Propane Gain)** when the propane gas is injected into the carburetor. The results of this propane enrichment procedure will be used at the end of the study to determine how much of an increase is typical with a properly set carburetor. Meanwhile, diagnostic values for the increase have been chosen for use during the study.

Following are diagnostic values which vehicles can usually meet if they are operating properly. If the readings from your vehicle are higher than the **HC, CO,** or **RPM** diagnostic values or lower than the **propane gain** diagnostic value shown in the table for your vehicle's model year, this indicates that your vehicle may not be operating properly. You can find in the block labeled "DIAGNOSTIC INFORMATION" some advice concerning steps you may want to consider to improve operation of your vehicle.

Model Year	HC (ppm)	CO (%)	RPM	Propane Gain
pre-1968	1200	7.5	1000	0
1968-1969	700	5.0	1200	0
1970-1974	500	4.0	1200	0
1975-1977	400	3.5	1200	10
1978-1979	300	3.0	1200	10
1980-later	200	2.0	1200	10

DIAGNOSTIC INFORMATION

Hydrocarbon **(HC)** readings which are higher than the **HC** diagnostic value generally are caused by one or more of the following problems:

1) Faulty Ignition or Misfire
2) Air/Fuel Mixture Set Too Rich, Too Lean, or Unbalanced
3) Improper Ignition Timing
4) Vacuum Leaks
5) Worn Piston Rings or Valves

Carbon Monoxide **(CO)** readings which are higher than the **CO** diagnostic value are generally caused by one or more of the following problems:

1) Air/Fuel Mixture Set Rich
2) Dirty Air Filter
3) Choke Stuck
4) PCV System Plugged
5) Air Pump or Control Valve Inoperative

Propane gain readings which are lower than the **propane gain** diagnostic value are generally caused by one or more of the following problems.

1) Air/Fuel Mixture Set Rich
2) Idle Speed Set Too High
3) Dirty Air Cleaner
4) Choke Stuck
5) PCV System Plugged

Excessive smoke generally is caused by worn piston rings or valves.

Usually a simple tuneup in which defective parts are replaced and settings are put to manufacturer specifications will correct the pollution problem.

FIGURE 5.3-1B BACK OF VIR FORM

TABLE 5.3-1

VIR PRINTOUT

Figure 5.3-1 Ref.#	VIR Field Name	Explanation or Logic
1	Queue No.	Three numeric characters. Number as appeared on queue card assigned to each vehicle for the duration of the test.
2	Station No.	Three characters. Station identification name always DB1.
3	Lane No.	One numeric character. Lane number on which the vehicle was inspected - always 1.
4	Test Mode	One alpha character. Mode under which the vehicle was inspected. "A"= Automatic (normal) "S"= Backup "M"= Semiautomatic
5	Test No.	Three numeric characters. Numbers were assigned by the computer for the inspection. Test numbers were assigned sequentially starting at 001. For backup and semiautomatic mode Test Number = Queue Number.

Figure 5.3-1 Ref.#	VIR Field Name	Explanation or Logic
6	Date	Six numeric characters. Date on which the vehicle was inspected. Date printed in the form of MMDDYY. Where: MM = Month DD = Day YY = Year
7	Time	Time of test expressed in 24-hr.clock. Time printed in the form HH:MM. Where: HH = Hours MM = Minutes
8	License Plate	The vehicle license plate number. Out-of-State license plates were denoted by "*OS*".
9	Vehicle Identification No.	1-16 alpha numeric characters with no Identification spaces between characters.
10	Year	The letter "M" followed by the last two numeric characters of the vehicle model year
11	Make	1-5 alpha numeric characters with no space in between characters.

Figure 5.3-1 Ref.#	VIR Field Name	Explanation or Logic
12	Cyl.	Two numeric characters. Number of cylinders for the inspected vehicle.
13	___	Vehicle weight code always = 0
14	Mileage	Three numeric characters. Vehicle odometer readings in thousands of miles.
15	___	Air injection code as follows: "0" = no air injection, no catalytic converter. "1" = Air injection, no catalytic converter. "2" = no air injection, normal catalytic converter. "3" = air injection, normal catalytic converter.
16	Test Summary: "No Operating problem detected"	"X" was printed in this block if: a) vehicle was not rejected, and b) Excessive smoke was not observed, and c) catalytic converter was not missing, and d) fuel restrictor was not modified or missing, and

Figure 5.3-1 Ref.#	VIR Field Name	Explanation or Logic
		e) vehicle passed emission measurement (2nd idle) and f) propane injection test was "pass" or "not tested."
17	Test Summary: "Your vehicle may have an operating problem."	"X" was printed in this block if: a) catalytic converter was missing, or b) excessive smoke was observed, or c) fuel restrictor was modified or missing, or d) vehicle failed emission measurement (2nd idle), or e) vehicle failed propane injection test.
18	Test Summary: "See bottom block for fuel economy tips."	"X" was printed if: a) vehicle failed alignment test, or b) any tire pressure was below 20 psi
19	Test Summary: "Your vehicle was not tested for the following reasons."	"X" was placed in the block if: vehicle was not tested due to unsafe conditions. Up to 4 reasons for reject were printed, as applicable in the space below it (Ref.# 19 a.).

Figure 5.3-1 Ref.#	VIR Field Name	Explanation or Logic
19 a.	____	. Oil system leak . Oil system light on . Oil system transmission leak . Coolant system leak . Coolant system light on . Exhaust system excessive leak/noise . Exhaust system loose/dragging . Exhaust system inaccessible . Fuel system leak - engine . Fuel system leak - underbody . Others
20	"Excessive Smoke Observed"	a) The word "YES" was printed in the blue shaded area if excessive smoke was observed during the emissions test. b) The work "NO" was printed in the blue shaded area if excessive smoke was not observed during the emission test.
21	"Catalytic Converter"	a) The word "MISSING" was printed in the blue shaded area if it was determined as part of the ECS check that the catalytic convertor was missing.

Figure 5.3-1 Ref.#	VIR Field Name	Explanation or Logic
		b) In all other cases the message "PRESENT OR NOT REQUIRED ON YOUR VEHICLE" was printed.
22	"Fuel Inlet Restrictor"	a) The words "MODIFIED" or "MISSING" were printed in the blue shaded area according to the determination during the ECS checks.
		b) The words "NOT INSPECTED" were printed in the blue shaded area if it was entered as part of the ECS checks as not inspected.
		c) In all other cases the message "PRESENT OR NOT REQUIRED ON YOUR VEHICLE" was printed in the shaded area.
23	1st idle, HC diagnostic value	This field was left blank.
24	1st idle, CO diagnostic value	This field was left blank.

Figure 5.3-1 Ref.#	VIR Field Name	Explanation or Logic
25	2nd Idle, HC Diagnostic Value	4 numeric characters that defined the HC diagnostic value (limit) used for the vehicle test. Printout was in the form XXXX.
26	2nd Idle, CO Diagnostic Value	5 numeric characters that defined the CO diagnostic value (limit) used for the vehicle test. Printout was in the form XX.XX.
27	1st Idle, HC Emission Reading	The 1st idle HC readings as measured. Printout was in the form XXXXI. Where: XXXX-HC readings in ppm I= "blank" if reading below or equal to the diagnostic value I= "*" if reading above the diagnostic value
28	1st Idle, CO Emission Reading	The 1st idle CO reading as measured. Printout was in the form XX.XXI. Where: XX.XX CO reading in % I= "blank" if reading below or equal to the diagnostic value. I= "*" if reading above the diagnostic value.

Figure 5.3-1 Ref.#	VIR Field Name	Explanation or Logic
29	2nd Idle, HC Emission Reading	Same as Item 27.
30	2nd Idle, CO Emission Reading	Same as Item 28.
31	Idle Speed (rpm) Diagnostic Value	4 numeric characters that defined the 2nd idle rpm diagnostic value for the vehicle. Printout was in the form XXXX.
32	Propane Gain Diagnostic Value	2 numeric characters that defined the diagnostic value for rpm gain during the fuel injection test. Printout was in the form of XX.
33	Idle Speed (rpm) Readings	The idle rpm as measured during the 2nd idle emission test printout was in the form of XXXXI. Where: XXXX= rpm I= "blank" if reading below or equal to diagnostic value I= "*" if readings above the diagnostic value.

Figure 5.3-1 Ref.#	VIR Field Name	Explanation or Logic
34	Propane Gain Readings	5 numeric characters that are the value readings of "final rpm" - "initial rpm" as recorded during the propane injection test. Printout was in the form of SXXXI. Where: S = sign (+) or (-) XXX rpm value I= "blank" if rpm gain equal or greater to diagnostic value I= "*" if rpm gain less than diagnostic value.
35	Fuel Economy Tips - Wheel Alignment	a) "X" was printed in the box if wheel alignment test was not performed (equipment malfunction) b) In all other cases this block was left blank.
36	Fuel Economy Tips - Wheel Alignment	a) "X" was printed in the box if wheel alignment test "fail". (readings greater than limit). b) In all other cases this block was left blank.

Figure 5.3-1 Ref.#	VIR Field Name	Explanation or Logic
37-40	Fuel Economy Tips - Tire Inflation	a) "X" was printed for each tire checked that had less than 20 psi pressure b) In all other cases these blocks were left blank.
41	Fuel Economy Tips - Tire Inflation	a) "X" was printed in this this block whenever tire pressure checks were refused or could not be performed. b) In all other cases this block was left blank.
42	Customer	One to three alpha numeric characters as follows: All normal tests were printed as "---" Tests conducted for equipment checks were printed as "HTS".
43	ECS I.D.	3 numeric characters which specified the I.D. number of the inspector who performed the ECS checks on the vehicle.

Figure 5.3-1 Ref.#	VIR Field Name	Explanation or Logic
44	EMS I.D.	3 numeric characters which specified the I.D. number of the inspector who performed the emission test on the vehicle.
45	____	a) The code "TTT" was printed in this space whenever the vehicle failed the timing test. b) In all other cases this space was left blank.
46	Smoke	a) One alpha character specifying smoke observation as follows: "N" was printed if smoke OK "Y" was printed if smoke was excessive. b) In all other cases "-" was printed in this field.
47	Retest	One numeric character. A zero value signified the first test performed on the vehicle. A value of one to nine indicated the nth retest. The retest number was the retest number which appeared on the old vehicle report (VIR) plus one.

6.0 PROGRAM RELATED ACTIVITIES

6.1 INSPECTOR RECRUITMENT AND TRAINING

After a survey of the Houston labor market by the HTS Personnel Manager, a Job Order was filed with the Texas Employment Commission and an advertisement placed in the local newspaper. The facility operations required a staff of nine: seven inspectors, one group supervisor, and one manager. All employees except the manager were hired from the local job market. The Inspector job qualifications required individuals with a high school education and light automotive background. Group Supervisor qualifications were a minimum of two years electronic technical/college training plus some supervisory experience. The Group Supervisor was advertised for in November, 1979, and filled in December of that year. There were no responses from the Texas Employment Commission. The person hired was a response to the newspaper advertisement. The Group Supervisor was immediately placed on a temporary assignment to Hamilton Test Systems, California, for training on the maintenance and repair of the Emissions Measurement System. The individual hired for Group Supervisor, when he returned to Houston, was utilized to assemble instrumentation necessary in the performance of the inspection system.

In January, 1980, a Job Order was filed with the Texas Employment Commission for Emission Control Systems (ECS) Inspectors. A newspaper advertisement was also placed which resulted in approximately twenty-five responses which ultimately filled the seven requirements. During the course of the program, four of the original seven remained on the payroll. To maintain a full operational staff five additional inspectors (ECS) were subsequently hired as others terminated their employment for various reasons.

The inspector training period consisted of four weeks, two in the classroom and two on the job. The first week in the classroom was spent on orientation and inspection procedural training. The second week covered emission control systems identification using a slide presentation with a cassette recording and manual. The final two weeks were spent with "hands-on" operations, testing employees' vehicles.

Appendix "A" presents the detailed Inspector Operation Manual utilized for the inspector training program.

6.2 MAINTENANCE AND CALIBRATION

6.2.1 Maintenance

Equipment maintenance was divided into two groups. Those items which were serviceable by HTS and items serviced by the equipment manufacturer only.

A. HTS-Serviced Equipment:

1. Emission Measurement System and related subsystems
2. Clayton exhaust louvers
3. Bear scuff gauge
4. Heathkit digital analyzer and timing light
5. Ecolizer ambient CO monitor
6. CEA-610 stand-alone analyzer

The Group Supervisor and Station Manager provided the technical service for the equipment in this category. They were also supported by the HTS California maintenance and repair facility. A complete inventory of electronic parts was kept in stock at the station for the repair or replacement of all EMS subassemblies and related components.

General maintenance was performed in accordance with the HTS Periodic Maintenance Manual (see Appendix "B"). Preventive maintenance service was performed with daily, weekly and monthly checklists.

B. Manufacturer-Serviced Equipment

1. ADDS CRT
2. Alpha Micro computer
3. DEC computer and printers

The ADDS CRT's and Alpha Micro computer were serviced respectively by their local representatives on an "as-needed" basis. HTS purchased a DEC Service Contract for the DEC computer providing for a bimonthly periodic maintenance check and immediate repair if necessary.

6.2.2 Calibration

All calibration was performed by the Group Supervisor. The items of test equipment associated with test parameter measurement were:

1. tire pressure gauges
2. scuff tester
3. engine rpm tachometer
4. timing light
5. exhaust gas analyzers (HC, CO, CO_2)

The tire pressure gauges were not calibrated per se, but were cross-checked against each other as a check for improper operation. The scuff tester, tachometer and timing light were periodically calibrated per the manufacturers' procedures.

The final and most important item was the exhaust analyzers. These analyzers (HC, CO, CO_2) were calibrated weekly in accordance with the procedures defined by the Periodic Maintenance Manual. The weekly calibration interval was established as adequate to maintain the analyzers well within their accuracy specifications by extensive experieince in the HTS programs in Arizona and California.

Calibration gases for this project have their named concentration traceable to NBS standards. The procedure for naming these gases is outlined below.

1. Certified gases, NBS traceable, were supplied to Hamilton test Systems California, Inc. by the Air Resources Board, State of California, from their laboratory in El Monte, California.

2. Monthly, the certified gases were used to run a curve check on each of the three ranges of the Beckman 865 gas analyzer which is used by Hamilton Test Systems California, Inc. for gas naming.

3. Gases to be named for calibration purposes were initially 5% named gases supplied by Liquid Carbonic. Based on the manufacturer's concentration, a suitable range was selected on the Beckman 865.

4. A certified gas is selected which will give approximately the same meter deflection (digital meters used) as the gas to be named, and the instrument is spanned at this point. In this way the maximum measurement accuracy is assured for establishing the concentration of the gas to be named.

5. The gas to be named is then introduced to the analyzer and the concentration recorded.

6. Steps 4. and 5. are repeated two more times and the average of the three concentration readings is used as the bottle concentration. The naming accuracy is within ± 1%.

Two other pieces of equipment not normally associated with vehicle testing required calibration - the ambient CO monitor and the backup HC, CO analyzer (CEA 610). These devices were calibrated at least monthly per the Periodic Maintenance Manual.

Records of each calibration were maintained at the station and kept available for EPA review.

6.3 VEHICLE RECRUITMENT

In the first month and a half of operations, the Texas Air Control Board (TACB) their own advertising campaign. They contacted local newspaper columnists, placed ads in different sections of the newspaper, and ran public service announcements on the radio. The Public Relations firm, Rasco & Co., was hired a month and a half after test operations began, and TACB released all advertising responsibility to them. Rasco started a basic "grass roots" campaign contacting local business and industry through the Chamber of Commerce and other organizations. High schools and social service clubs were also contacted. As vehicle testing proceeded and the low test volume did not significantly increase, TACB responded again with more ads and media articles. During the final two months they ran an effective direct mail campaign to local ZIP code areas using addresses from the August and September registration renewals.

HTS conducted an informal poll on participant response for the last 19 weeks of testing. People who entered the station were asked the question, "How did you hear about the program?" The poll represented over half the test vehicle owners (2434 people). It was separated into

two time frames because of the later addition of the direct mail category. The breakdown on public response was as follows:

	Week 8-26 (2130 vehicles)	Week 19-26 (1089 vehicles)
Newspaper	33%	24%
Automotive Testing Laboratories	22%	18%
Walk-ins	16%	12%
TV & Radio	12%	6%
Other	17%	12%
Mail	-	28%

The high response from the newspaper was generated mainly by one columnist (Harold Scarlett) writing four different articles. These articles caused the three abnormally high peaks in test volume.

Automotive Testing Laboratories, the EPA subcontract CVS test facility, provided a large number of vehicles for inspection.

Walk-ins were people who saw the facility or sign and came in for the inspection.

TV and radio advertising consisted mostly of public service announcements and news broadcasts.

The "other" category included government vehicles, word-of-mouth advertising, and all other forms of solicitation.

The direct mail effort involved "Dear Citizen" letters and statement stuffers mailed with local water bills. This method of vehicle solicitation, though only used for a short period, proved to work very well.

6.4 PROGRESS REPORTING

In compliance with the contract, HTS submitted various reports during the program as follows:

A. A Weekly Status Report listing the tests performed and categorizing them for various Pass/Fail criteria was mailed to EPA on a weekly basis.

B. A Monthly Progress Report which included:

- Statement of work accomplished prior to the start of the current reporting period.

- A statement of the work performed during the reporting period, including difficulties encountered and remedial actions taken. Also reported were any technical problems and scheduled changes.

- An Organization Chart indicating the personnel assigned to the program.

- The Station Daily Operations Log which indicated operating hours for each day, personnel at work, and visitor information.

- Hourly Test Work Sheet which indicated, for the month reported, the average inspection rate as a function of the hour of the day, and for all of the months since the start of the Operational Phase taken together, the average inspection rate as a function of the hour of the day.

- Hourly Queue Work Sheet which indicated for the month reported, the average queue as a function of the hour of the day and,

- for all of the months since the start of the Operational Phase taken together, the average queue as a function of the hour of the day.

Appendix "C" presents the Reporting Guidelines. This document detailed the procedures for preparing and submitting the various reports.

7.0 INSPECTION SUMMARY

7.1 PATTERN OF INSPECTION

7.1.1 Total Inspection

The inspection program Operational Phase was operated for 26 weeks. The program provided 125 days of testing due to a total of 5 holidays when the station was closed.

A total of 4674 vehicles were tested in which 4501 tests were Initial tests and 173 were Retests (3.84% of initial test volume).

Table 7.1.-1 lists the weekly testing volume for each operational week. Figure 7.1-1 shows the weekly test volume for each testing week.

TABLE 7.1-1

TOTAL INSPECTION PER OPERATION WEEK

Week #	Operating Dates	Operating Days	Total Inspections
1	3/3/80 - 3/7/80	5	295
2	3/10/80 - 3/14/80	5	358
3	3/17/80 - 3/21/80	5	231
4	3/24/80 - 3/28/80	5	163
5	3/3/80 - 4/4/80	5	197
6	4/7/80 - 4/11/80	5	147
7	4/14/80 - 4/18/80	5	147
8	4/21/80 - 4/25/80	4	117
9	4/28/80 - 5/2/80	5	146
10	5/5/80 - 5/9/80	5	141
11	5/12/80 - 5/16/80	5	131
12	5/20/80 - 5/24/80	5	314
13	5/27/80 - 5/31/80	4	218
14	6/3/80 - 6/7/80	5	190
15	6/10/80 - 6/14/80	5	177
16	6/17/80 - 6/21/80	5	149
17	6/24/80 - 6/28/80	5	100
18	7/1/80 - 7/5/80	3	42
19	7/8/80 - 7/12/80	5	155
20	7/15/80 - 7/19/80	5	121
21	7/21/80 - 7/26/80	5	125
22	7/29/80 - 8/2/80	5	203
23	8/5/80 - 8/9/80	5	135
24	8/12/80 - 8/16/80	5	152
25	8/19/80 - 8/23/80	5	196
26	8/26/80 - 8/30/80	4	324
Total	3/3/80 - 8/30/80	125	4674

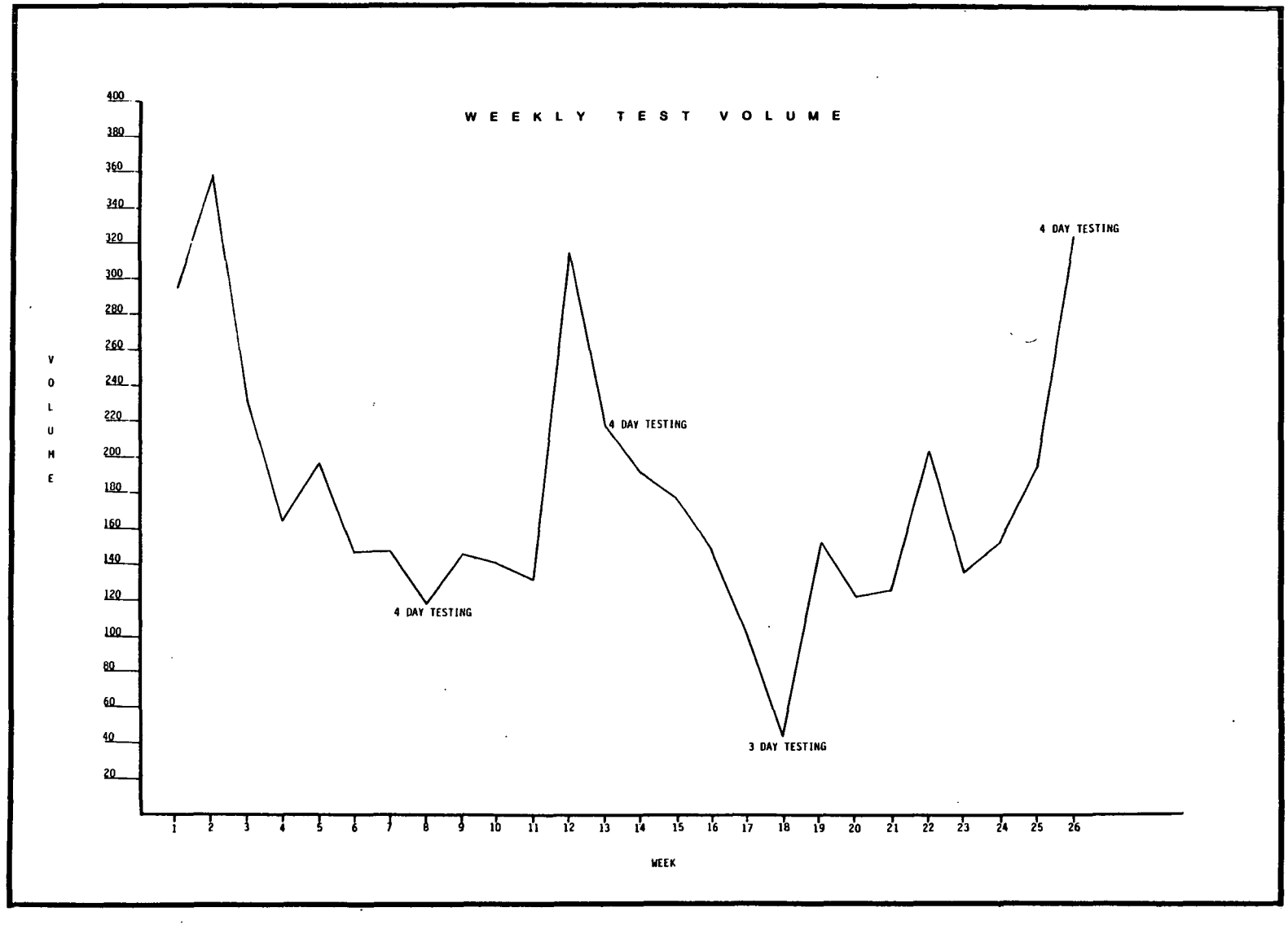


FIGURE 7.1-1 WEEKLY TEST VOLUME GRAPH

7.1.2 Capacity Evaluation

A. In compliance with the contract requirement, the station and equipment were designed for a throughput capacity of 20 vehicles per hour. Based on this design criteria the program's weekly testing capacity was (45 hours/week) X (20 vehicles/hour) = 900 v/week. Table 7.1-2 shows the weekly percentage of actual capacity usage for each of the testing weeks. Figure 7.1-2 shows the above in graph form.

B. As can be seen from Table 7.1-2 and Figure 7.1-2, testing volume ranged from as low as 7.0% of actual weekly capacity (Week # 18) to a high of 45.0% of actual weekly capacity (Week # 26). Testing exceeded 25% of actual weekly capacity only 6 times (Weeks # 1, 2, 3, 12, 13, 26).

C. An examination of the Hourly Test report (submitted to EPA as part of the Monthly Progress Report) reveals that out of 125 days (1125 hours) of operation:

- only 52 times (4.6%) did actual testing exceed 50% (11 vehicles/hour) of the hourly testing capacity of 20 vehicles/hour.

- only 3 times actual testing exceeded 100% hourly design capacity when in 3 consecutive hours the station processed 27, 28 and 22 vehicles/hour.

TABLE 7.1.2-1

PERCENTAGE CAPACITY USED

Week #	% Capacity	Week #	% Capacity
1	32.8	14	21.1
2	39.8	15	19.7
3	25.7	16	16.5
4	18.1	17	11.1
5	21.9	18	7.0 (see Note 3.)
6	16.4	19	17.2
7	16.4	20	13.4
8	16.3 (see Note 1.)	21	13.9
9	16.2	22	22.5
10	15.7	23	15.0
11	14.5	24	16.9
12	34.9	25	21.8 (see Note 4.)
13	30.3 (see Note 2.)	26	45.0

Notes: The following weeks' capacity was adjusted as follows:

1. Less 9 testing hours on Monday, capacity equal to 720 vehicles/week.

2. Less 9 testing hours on Monday, capacity equal to 720 V/Week.

3. Less 9 testing hours on Friday and 6 testing hours on Saturday, capacity equal to 600 vehicles/week.

4. Less 9 testing hours on Wednesday, capacity equal to 720 vehicles/week.

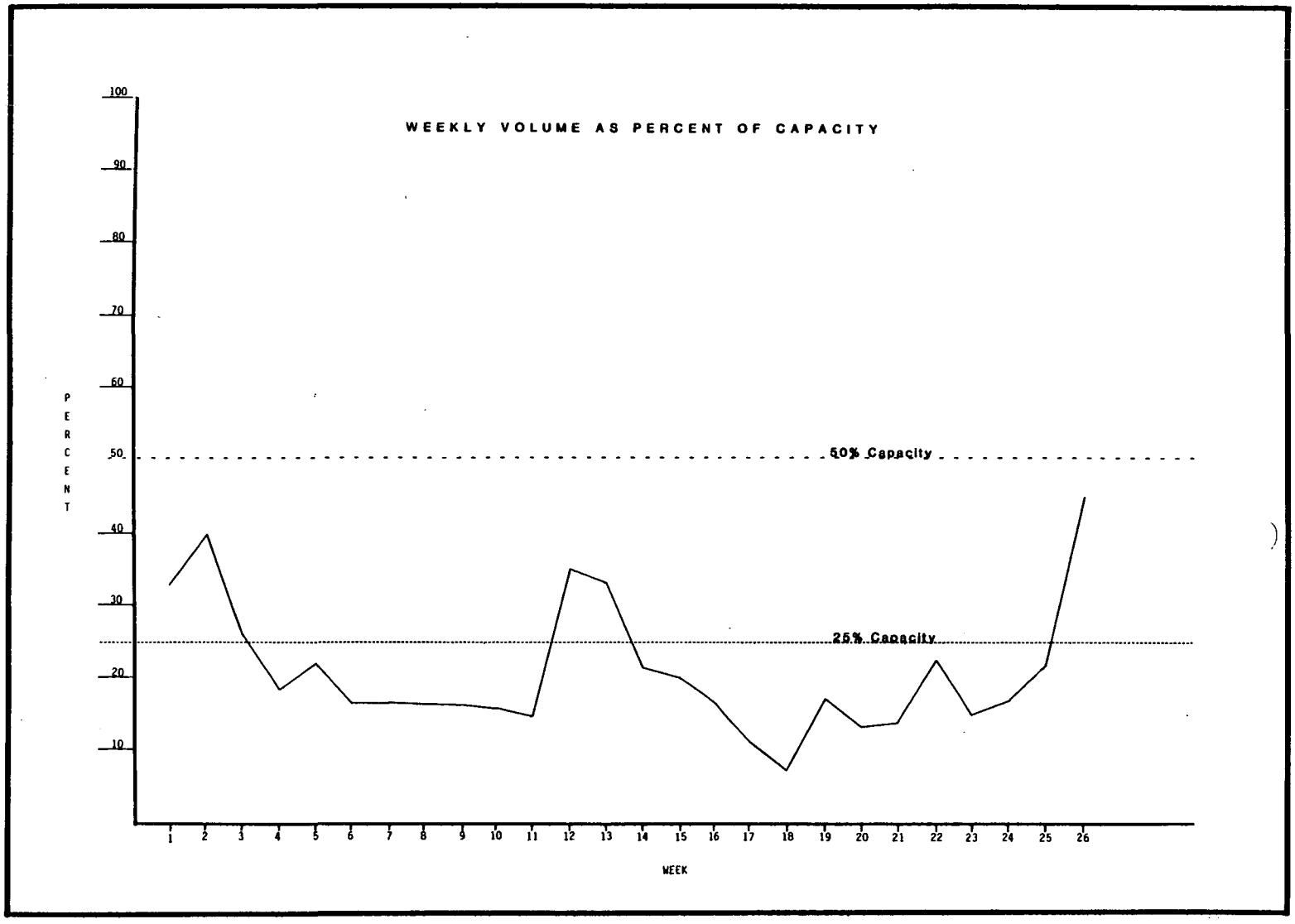


FIGURE 7.1-2 WEEKLY VOLUME AS PERCENT OF CAPACITY

7.1.3 Testing Hours Evaluation

At the start of the testing program commencing Monday, March 3, 1980, the facility was opened for testing Monday through Friday between the hours of 8:00 A.M. and 5:00 P.M. (including lunch periods) for a total of 45 inspection hours per week.

At the request of the TACB the operating hours were changed on Tuesday, May 20, 1980 as follows:

Tuesday	8:00 A.M. to 5:00 P.M.
Wednesday	8:00 A.M. to 5:00 P.M.
Thursday	8:00 A.M. to 8:00 P.M.
Friday	8:00 A.M. to 5:00 P.M.
Saturday	8:00 A.M. to 2:00 P.M.

Table 7.1-3 shows the overall inspections per day of the week. Total days are adjusted for holidays and operation schedule changes.

Table 7.1.3-1 Test Volume per Day of the Week

Day of Week	Vehicles Tested	Test Days	Average Inspection Per Week Day
Monday	358	10	35.8
Tuesday	854	25	34.2
Wednesday	827	25	33.1
Thursday	1171	26	45.0
Friday	986	25	39.5
Saturday	478	14	34.1
Total	4674	125	---

Further analysis shows that total volume during Thursday extended hours (5:00 P.M. to 8:00 P.M.) was only 94 tests or 6.7 vehicles per each Thursday extended hours, which tends to suggest that those extended hours were not effective in drawing vehicles for inspection.

In addition, average inspections per weekdays between Monday and Saturday showed that the Monday testing average was slightly higher than Saturday's average. However, since Saturday testing hours were only 8:00 A.M. to 2:00 P.M. (6 hours of testing) vs Monday 8:00 A.M. to 5:00 P.M. (9 hours for testing), it appears that response for the testing was slightly better on Saturday than on Monday.

7.2 DIFFICULTIES ENCOUNTERED AND RESOLUTIONS

7.2.1 Station Visibility

The initial signs gave the facility a very low profile for public recognition. A blue and white rectangular 4' X 8' sign mounted high on a 25' pole was the only identification available. The sign read "State Vehicle Emission Test Center" and was difficult to make out from a distance while traveling either direction on San Felipe Road. Several ideas were implemented by HTS and the PR firm contracted by TACB to attract greater attention to the station. A large portable sign was leased to display messages, at eye level, by the queue lane entrance. Blue and white pennant flags were strung in front of the building. Later, banners were hung on the building's sides, a large "Open" sign was placed out front and the outlined word "State" on the high rectangular sign was colored in.

7.2.2 Low Test Volume

The extremely low test volume caused several problems in the station. It affected work quality and the general station atmosphere. The inspectors' morale suffered when the work load was light over an extended period.

Employee turnover stemming from job dissatisfaction consisted of 5 inspectors. The employees were kept busy as often as possible under the circumstances. Team spirit was promoted, additional training classes given, and work quality was frequently checked. Errors or bad habits were discussed in meetings at appropriate times. Overall, the inspectors presented a professionalism in their work, and the public seemed satisfied, as evidenced by many compliments on the job performed.

7.2.3 Public Participation

There were many causes for lack of participation in the program. The following are listed, and are based on comments expressed by participants as to why others did not participate:

- Apathy and disinterest in more Federal controls.
- The fear of penalties for test failure, or being contacted by the State later on.
- Houston's traffic congestion; the test was not worth competing in cross-town traffic.

Since there was no scientific poll taken by HTS, these comments, pro and con, cannot be deemed to reflect public opinion as a whole.

It can be stated, however, that the majority of participants appeared to be supportive of the program. A comment that was often heard was, "More people need to be made aware of the testing program"

APPENDIX "A"

EPA/HOUSTON

DEMONSTRATION PROGRAM

INSPECTOR OPERATION MANUAL

PREPARED BY: Naftali Amir
NAFTALI AMIR

APPROVED BY: A. J. Arrigo
A. J. ARRIGO

RELEASE DATE: 2/8/80

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APPENDIX

INTRODUCTION

This manual is intended to serve as a training and operation guide for the lane operation of the EPA/Houston Demonstration Program.

The manual is divided into three (3) sections:

SECTION A. - EQUIPMENT. This section describes the inspector-related functions on equipment associated with the vehicle testing.

SECTION B. - INSPECTION TASKS. This describes the step-by-step inspection procedures for all tasks to be performed by the inspectors.

SECTION C. - OPERATION PROCEDURES. This lists the order of the inspection tasks for various operational modes.

GLOSSARY

The following are some of the terms which will appear throughout this manual:

1. EQUIPMENT

Emission-CRT	. Cathode Ray Terminal - remote computer input terminal and display screen connected to the emission computer located at Positions 1 and 3.
Auxiliary CRT	. Cathode Ray Terminal - remote computer input terminal and display screen connected to the auxiliary computer and located at Position 4.
EMS	. Emissions Measurement System - the cabinet housing all the emissions testing subassemblies.
TCP	. Test Cue Panel - meter type device remotely connected to the EMS for indicating the actual emissions test sequence; it prompts the driver through the testing sequence.
Emission Computer	. The device (DEC 11/34) that receives, stores and controls all the emission test data; it is connected to the EMS computer.
Auxiliary Computer	. The device (Alpha Micro) that receives, stores and controls the printing of all test data performed in the facility. It is connected to the emission computer.
Scuff Gauge	. The device that checks front wheel alignment as a drag in feet/mile.
RPM Gauge	. The device that, when attached to the vehicle ignition system will measure engine RPM.
Timing Gauge	. The device that with the use of light, shows measurement of engine timing.

2. GENERAL

VIR	. Vehicle Information Report - the form with all the inspection data printed thereon.
Temporary VIR	. The temporary form used in the printer connected to the EMS in backup mode.
Field	. Information block on the CRT - all fields have a name and dashes to indicate the field length.
Queue Number	. A 3-digit number which is used to "track" a test between all the equipment, through each test position.

2. GENERAL (cont'd)

Queue Card	• The card with the queue number preprinted on it and the fields for manual recording some of the test data. (Figure A, page 4)
Special Timing Handout	• EPA supplied form to be given to all vehicles that failed basic timing checks. (Code "TTT" appears on bottom line of VIR.)
Address Label	• Pressed-on label to be filled-in by vehicle owner with his mailing address (used in deferred mode of operation).

QUEUE CARD 0 0 1

DATE ___ ___ ___ ___ ___ ___

PLATE ___ ___ ___ ___ ___ ___ ___ ___

TIRE PRESSURE

RIGHT FRONT ___ ___

RIGHT REAR ___ ___

LEFT REAR ___ ___

LEFT FRONT ___ ___

TEST REFUSED = TR
NO TEST = NT

ALIGNMENT

DATA ___ ___ ___

SPEC ___ ___ ___

NO TEST = NT

PROPANE GAIN

INITIAL RPM ___ ___ ___ ___

FINAL RPM ___ ___ ___ ___

NO TEST = NT
ABORT = AB

IGNITION TIMING

TIMING ___ ___ ___

SPEC ___ ___ ___

NO TEST = NT
ABORT = AB

BTDC = +
ATDC = −

FIGURE A

SECTION A. - EQUIPMENT

1.0 EMISSION CATHODE RAY TERMINAL (CRT)

The CRT (ADDS Regent 100) located at Positions 1 and 3, is the device which allows the inspector to receive and send emission information to the main computer (DEC 11/34).

The following is inspector-related information:

1.1 Keyboard

Keyboard characters, with a few exceptions noted below, are standard upper-case-only characters associated with typewriters.

1.2 Cursor

The cursor is a blinking block which designates the location of the next character to be entered in the CRT.

1.3 Cursor Wrap

If an incomplete or incorrect entry has been made in a data field and the NEW LINE key has been depressed to advance the cursor, the cursor will return to the first point of entry within the same data field. This is termed a "cursor wrap."

1.4 Special Control Functions

1.4.1 Pressing the ESCAPE (ESC) key plus a predesignated numeric key (see below) will provide the following:

CRT Key	Function Name	Description
ESC+1	PRE LOG-ON	Prepare CRT to receive information (queue number). (See Figure 1, page A-3) Note: 1. In normal operation the CRT is already in this state. 2. This function should be used only if CRT is not in its normal stage at start of operation.
ESC+2	LOG OFF	Terminate entries to CRT, reverts CRT to starting stage PRE LOG-ON.

CRT Key	Function Name	Description
ESC+3	BACKFIELD	Backs cursor up to previous data field.
ESC+4	HOME	Returns cursor to the first data field in the plate field (first entry on CRT).
ESC+5	PAGE	To call up "Test Suitability" screen and "Manually Entered Emission Data" screen.
ESC+6	EXIT	Terminate emission computer entries. Tasks - send information to auxiliary computer.
ESC+8	CANCEL	Cancels all information currently displayed on CRT - reverts CRT to PRE LOG-ON state.

1.4.2 Pressing the following keys by themselves will provide for:

NEW LINE — Causes cursor to be advanced to the next data field.

DELETE  — Causes cursor to move to the left within the data field.

BACKSPACE  — Causes cursor to move one space to the left to permit re-entering the previous character.

1.5 Validation

Upon LOG-OFF the computer will check that all necessary entries are present and correct; if a mistake is found the cursor will indicate the field with the error.

Note: 1. If more than one field is in error the cursor will show the first error field in the entry sequence.

2. Should the cursor "lock up" and not advance or move, it has found an invalid entry and is waiting for a correction.

1.6 CRT Display

There are four applicable CRT displays:

a. basic registration entry display (Figure 2, page A-4)

b. safety code (test suitability) display (Figure 3, page A-5)

c. visual ECS display (Figure 4, page A-6)

d. manually-entered emission data (Figure 5, page A-7)

Note: If any other display appears on the CRT, call manager.

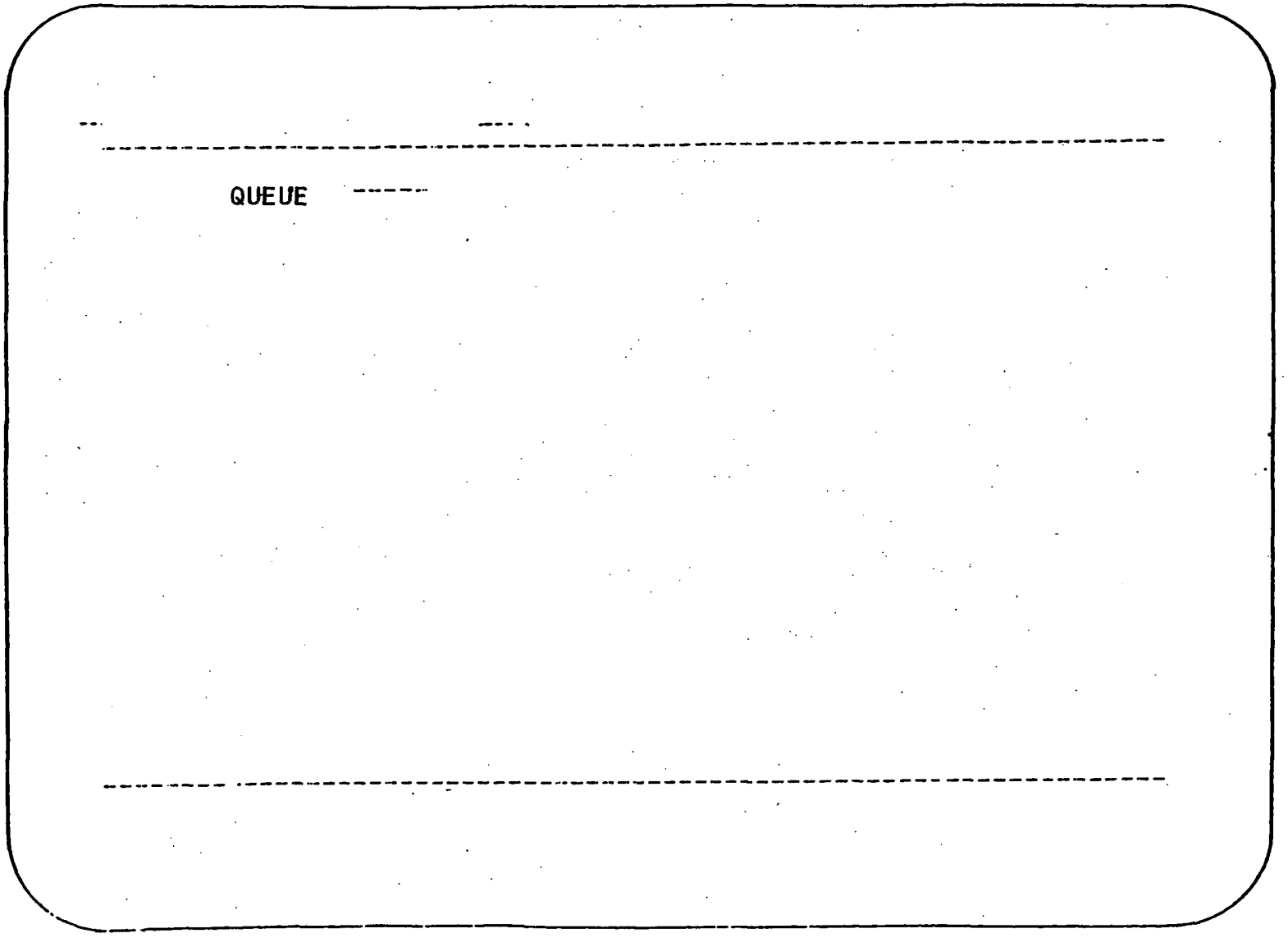


FIGURE 1

EMISSION CRT

"PRE LOG-ON SCREEN FORMAT"

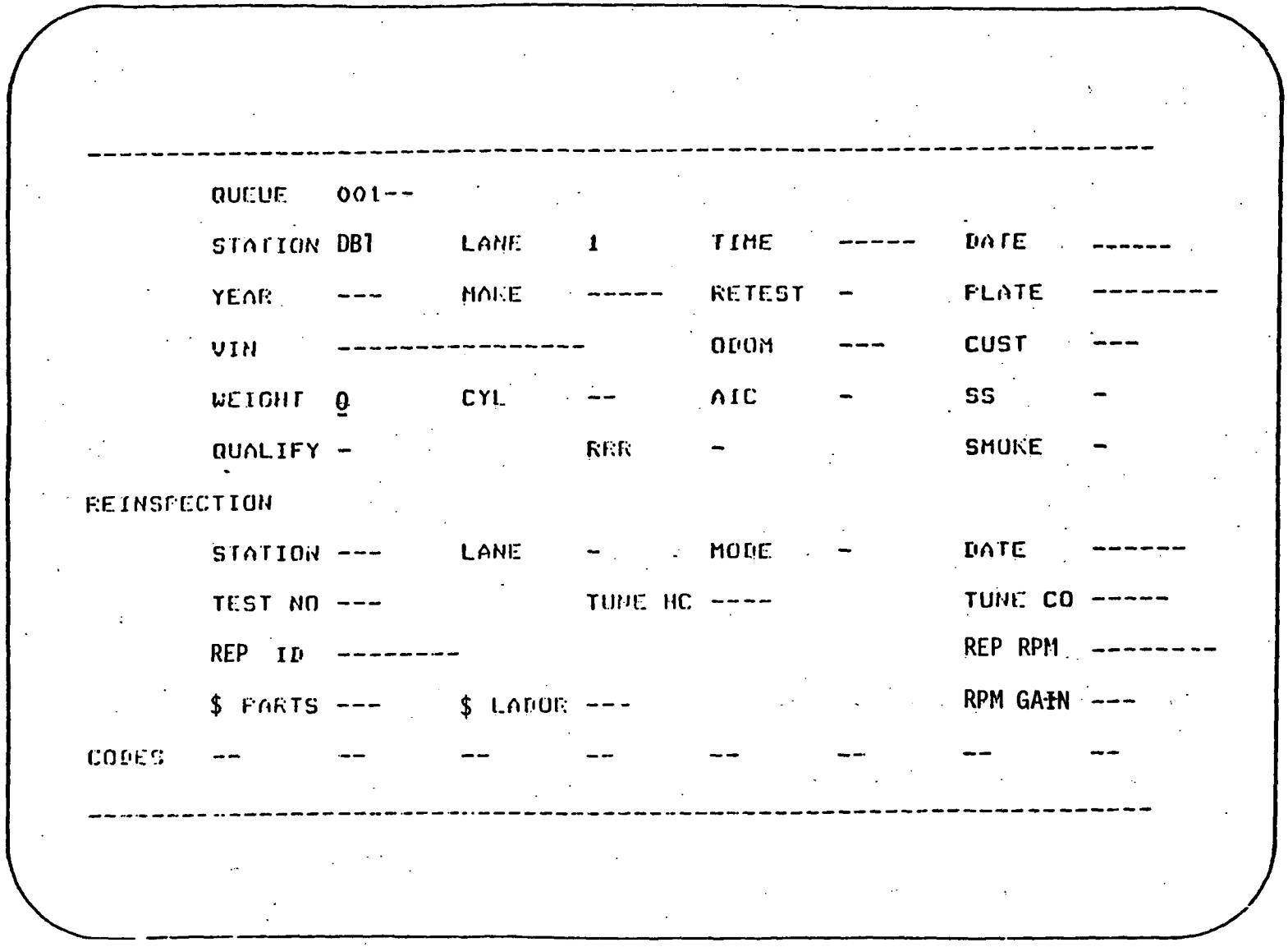


FIGURE 2

EMISSION CRT

REGISTRATION ENTRY SCREEN FORMAT

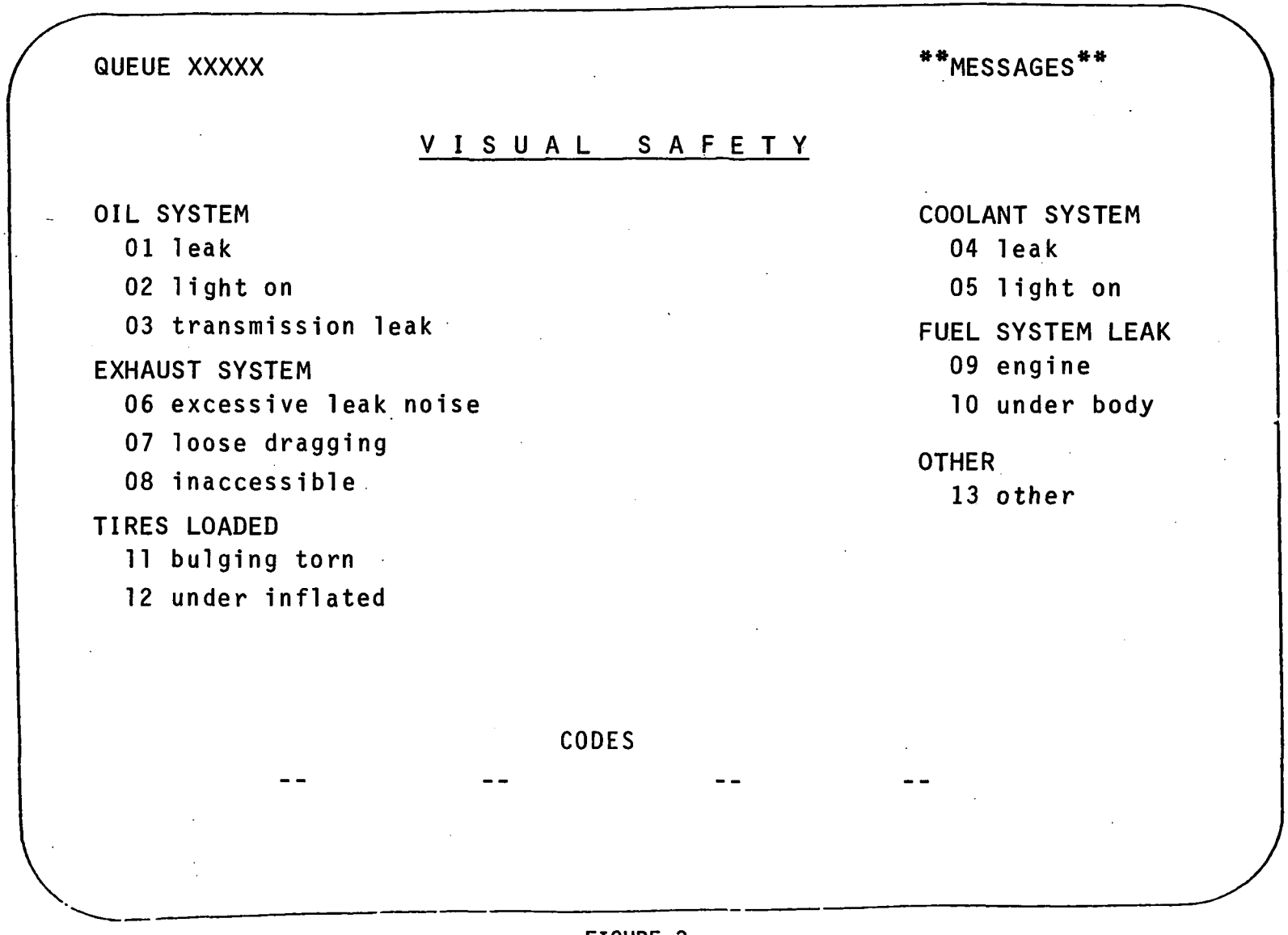


FIGURE 3

EMISSION CRT
SAFETY SCREEN DISPLAY

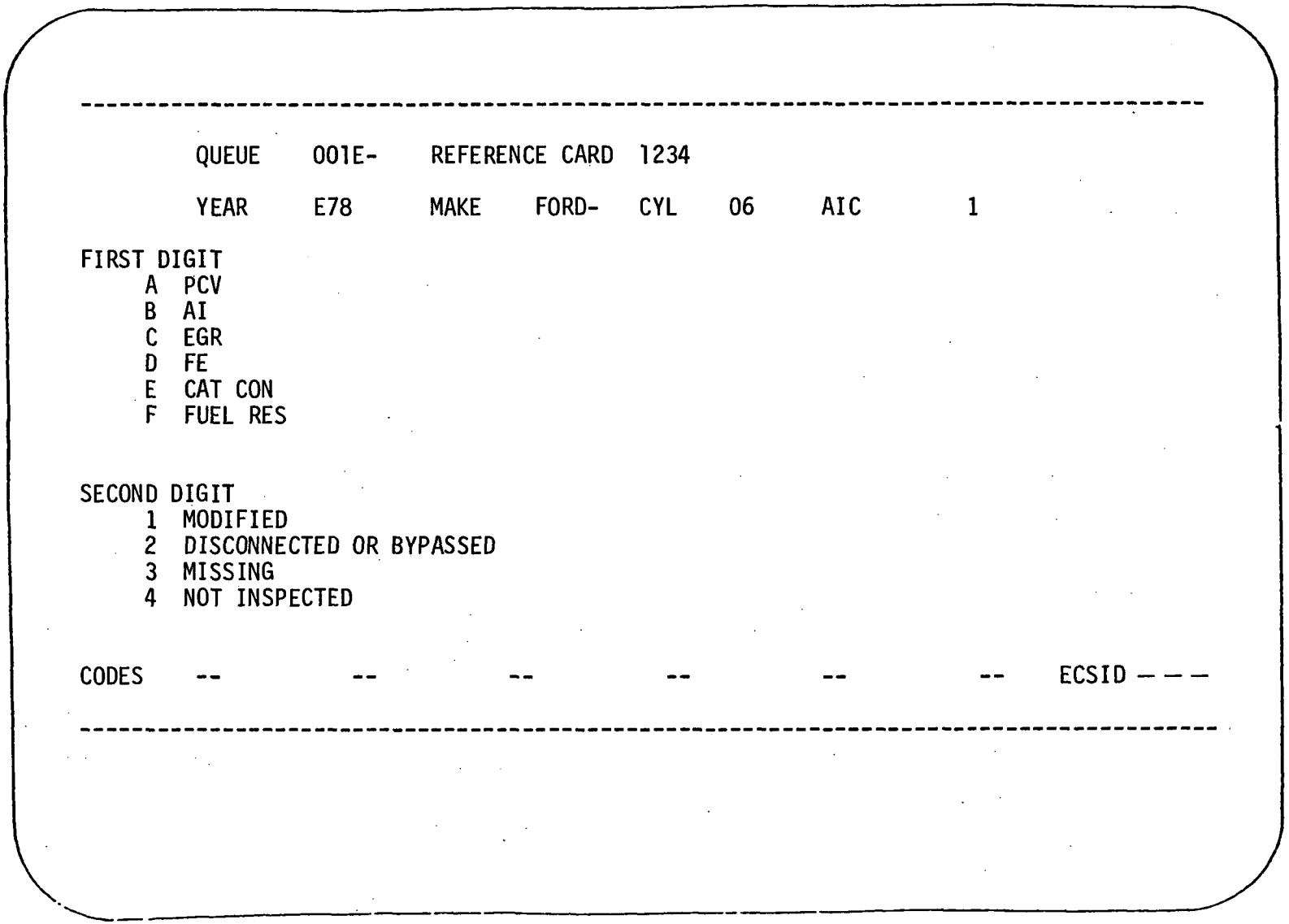


FIGURE 4

EMISSION CRT

VISUAL ECS SCREEN DISPLAY

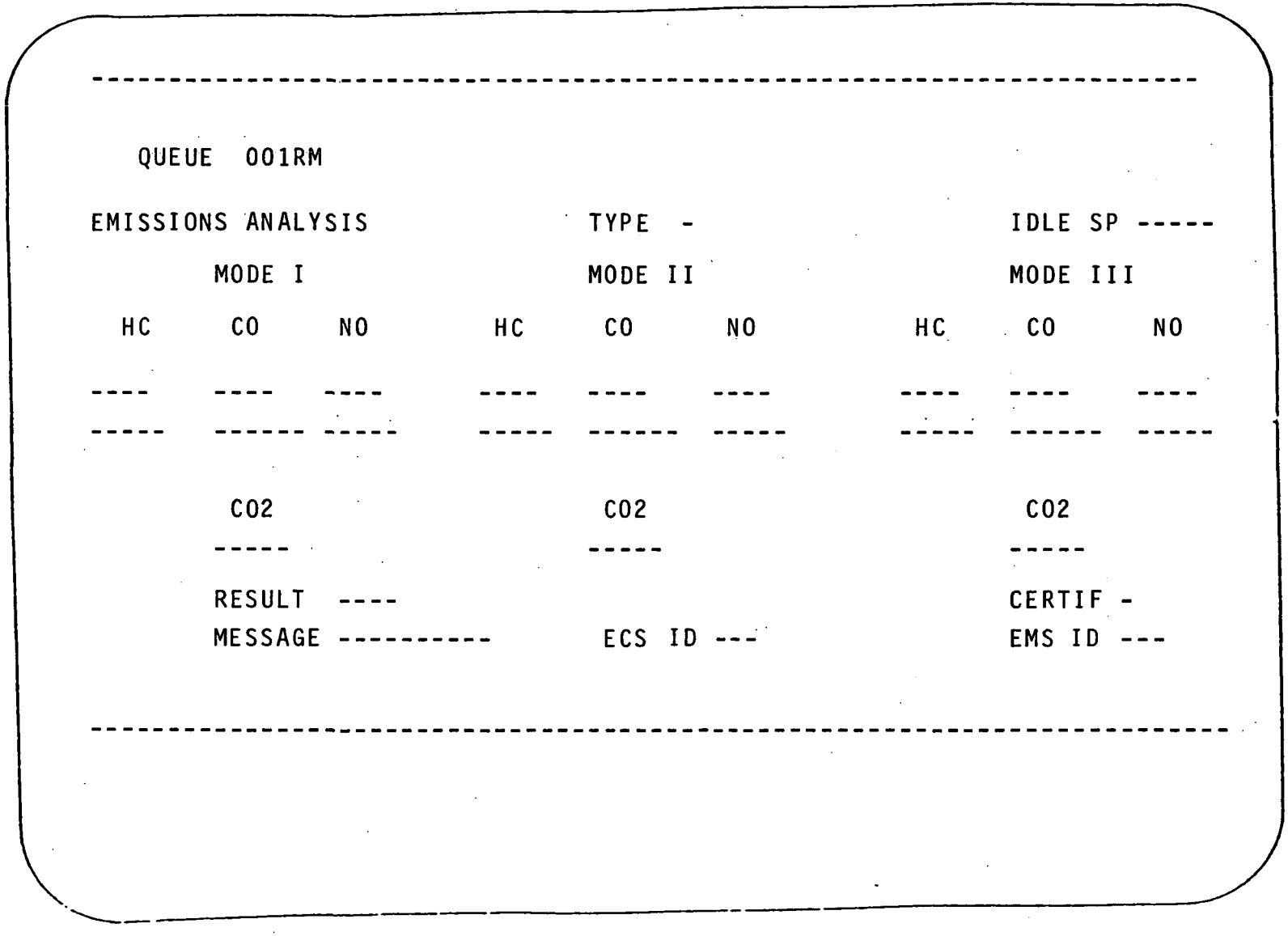


FIGURE 5

EMISSION CRT

MANUALLY-ENTERED EMISSION DATA SCREEN DISPLAY

2.0 EMISSIONS DATA ENTRY PANEL (EDEP)

2.1 The EDEP is the device by which the inspector receives and sends information to the EMS (Figure 6, page A-9).

Note: Unlike the CRT, all information needed for the emissions test has to be entered via the EDEP in special sequence. This sequence is controlled by the EMS program and will be enunciated on the EDEP.

2.2 The main parts of the EPEP are:

10 numeric keys 0 - 9 (white)

5 special control keys (blue)

1 enter key (red)

1 tape load key (green)

8 instruction (enunciation) lights - LED

3 display windows

2.3 The following is inspector-related information:

2.3.1 Keys:

Button ID	Color	Function
0-9	white	Numerals 0 to 9 allows inspector to enter numeric combinations.
A,B,N	white	Allows inspector to select louver opening when the ENTER LOUVER LED is on, as follows: A - closer louver opening B - further louver opening N - no louver opening
RESTART	blue	Allows inspector to restart emissions test after the test sequence has started.
CLEAR	blue	Allows operator to change certain information received from the EMS by erasing the current information and re-entering the correct data.
OVERRIDE	blue	Allows test to continue after it was stopped due to an error detected by the EMS. Note: This button should be activated by the manager only.
ABORT	blue	Terminates (erases) all record of emissions test. Note: This button should be activated by the manager only when vehicle malfunction occurs during testing.

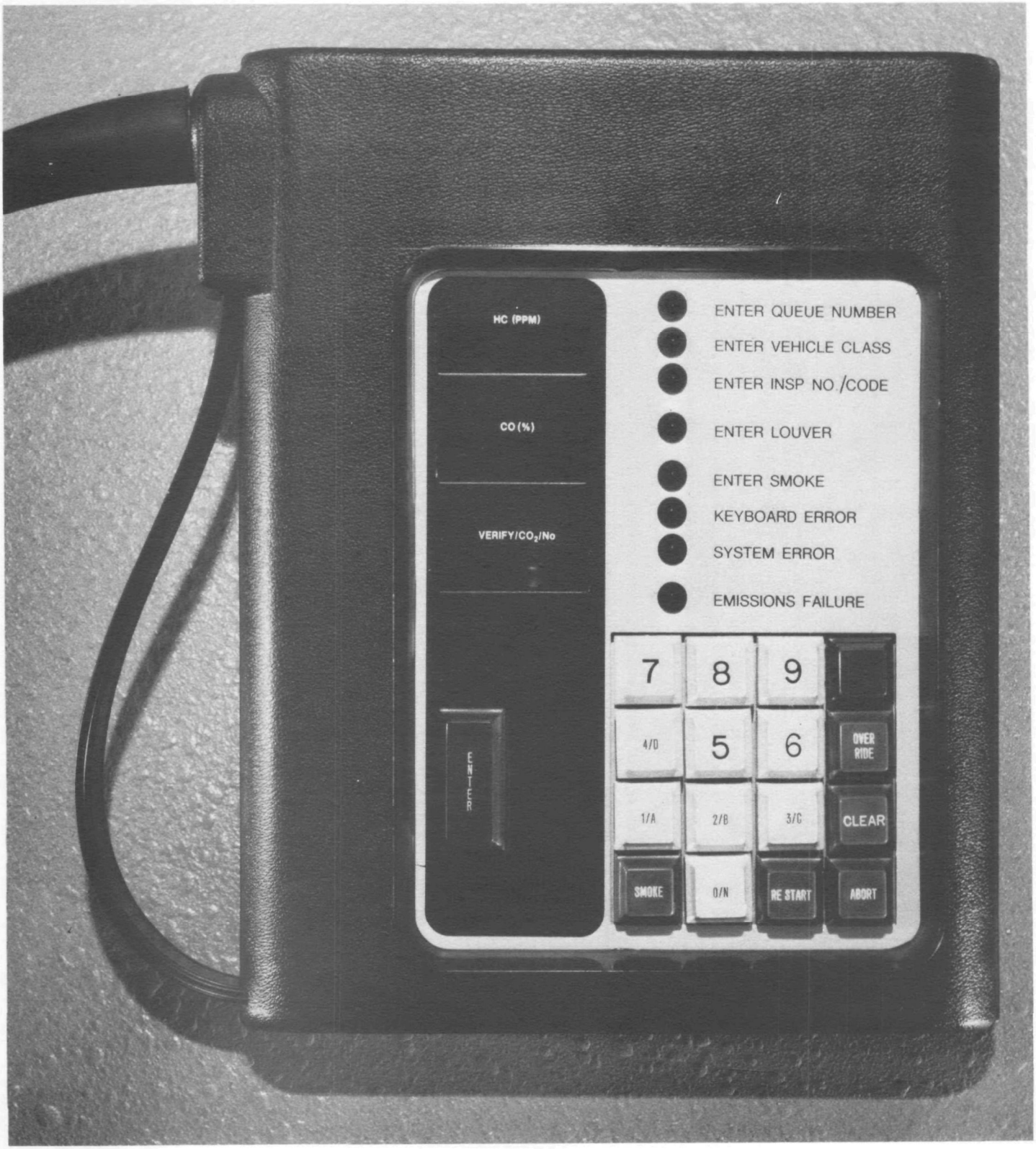


FIGURE 6

EMISSIONS DATA ENTRY PANEL

Button ID	Color	Function
SMOKE	blue	Allows operator to: a) inform EMS that smoke test information is forthcoming b) indicates smoke failure.
ENTER	red	Signals inspector acceptance of the information display; allows EMS to proceed in the test sequence.
NONE	green	Loads EMS programs. Note: This button should be activated by manager only.

2.3.2 Instruction (enunciation) Lights:

Light Name	Function
Enter Queue Number	. Prompts operator to enter or accept vehicle queue number. A. Automatic Mode - inspector has to enter number via numeric keys. B. In Backup Mode queue number will be displayed automatically (previous test queue number +1). See section B 3.2 for Operation Procedures.
Enter Vehicle Class	. Prompts operator to enter or accept vehicle class. A. Automatic Mode - number is displayed - inspector presses ENTER button to accept. B. In Backup Mode, inspector enters class code via numeric keys.
Enter Inspector Number	. Prompts operator to enter his inspector number in special cases
Enter Louver	. Prompt operator to select louver opening.
Enter Smoke	. Prompt operator to enter smoke test results, as follows: . Fail Smoke - press SMOKE key . Pass Smoke - press CLEAR key
Keyboard Error	. Indicates to operator an incorrect keyboard entry has been made - operator must press CLEAR button to extinguish "keyboard error" light and enter correct information.
System Error	. Prompts operator to a system malfunction - test will stop. Testing cannot continue unless this light is extinguished.
Emissions Failure	. Will indicate emissions failure upon special request - normally does not apply.

2.3.3 Numeric Display Windows:

Display Name	Location	Function
HC PPM	top	a. Displays vehicle HC concentration in PPM - upon special request.
		b. Displays queue number entered when class code is being entered.
CO %	middle	a. Displays vehicle CO concentration in % upon special request.
		b. Displays the year portion of the class code.
CO_2%	bottom	a. Displays the numeric keys entry as they are being activated.
		b. Displays vehicle CO2 concentration when "sample" dilution error occurs.
		c. Displays #Cyl, Wt.Class, and AI/CAT code portion of class code.

3.0 TEST CUE PANEL (TCP)

3.1 The TCP (Figure 7, page A-13) is the operator/vehicle driver interface with the EMS. The TCP's function is to indicate the actual emissions test sequence.

3.2 The main parts of the TCP are:

- 4 "test sequence" instruction displays:
  - READY
  - TESTING
  - SET SPEED
  - TEST COMPLETE
- Two RPM Instruction Displays:
  - SET SPEED
  - ACTUAL SPEED
- Three Enunciation Lights:
  - SAMPLE DILUTION
  - BACKUP MODE
  - CONTROL MESSAGE

Note: The display marked "horsepower" is not being used.

3.3 The following is inspector-related information:

3.3.1 Test Sequence Displays:

Display Name	Condition	Function
READY	ON/OFF	ON indicates system is "ready" to begin an emissions test. Emissions test can not begin unless READY is illuminated.
TESTING	ON/OFF	ON indicates actual emissions test is proceeding as normal.
SET SPEED	ON/OFF	ON indicates operator must change test RPM. Engine RPM value is not correct and needs to be increased or decreased for current test mode. (See Section B.3.0)
TEST COMPLETE	ON/OFF	ON indicates emissions test has been concluded.

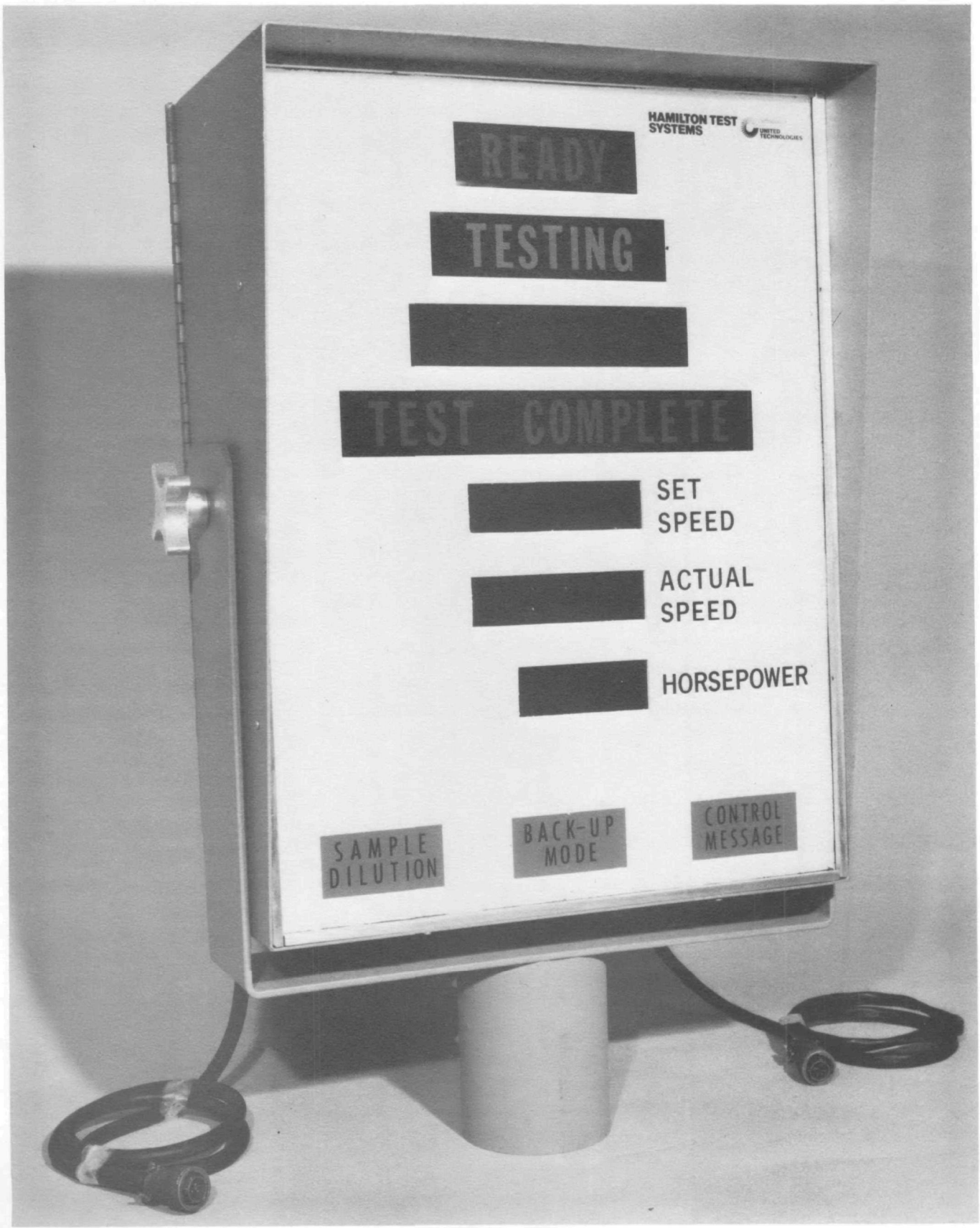


FIGURE 7

TEST CUE PANEL (TCP-FRONT VIEW)

3.3.2 RPM Instruction Display:

Display Name	Units	Function
SET SPEED DISPLAY	RPM	Display number is "target" speed of engine. 2500 display means "target" engine speed is 2500 RPM. No display means Idle RPM.
ACTUAL SPEED DISPLAY	RPM	Displays real-time engine RPM value.

3.3.3 Enunciation Lights:

Display Name	Condition	Function
CONTROL MESSAGE	ON/OFF	ON indicates there has been an "ambient CO' violation. Inspector to call manager.
SAMPLE DILUTION	ON/OFF	1. ON indicates the sum of CO and CO2 gas concentrations is less than a predetermined value. 2. Can indicate exhaust probe(s) have not penetrated the exhaust pipe adequately. 3. Can indicate exhaust system is leaky (i.e.; holes).
BACKUP MODE	ON/OFF	1. ON indicates EMS in the "backup" mode. The emissions computer is off-line. Operator must manually enter information with the EDEP at position #2. 2. Emission printer is driven from EMS. Note: When the EMS detects an error in any of its subsystems during testing, the TCP will be totally blank - inspector to call manager.

4.0 SCUFF GAUGE

4.1 The scuff gauge, Figure 8, below, is the device which will be used for measuring vehicle front end alignment during the alignment checks.

4.2 The main parts of the scuff gauge are:

a. Driving plates - which will measure the vehicle front-end side drag.

Note: Activate switch is built into the driving plate, unit is activated by the vehicle's front wheels and deactivated by the vehicle's rear wheels.

b. Meter and control unit - will interpret driving plates movement into displayed meter needle movement. Meter scale is in ft./mile.

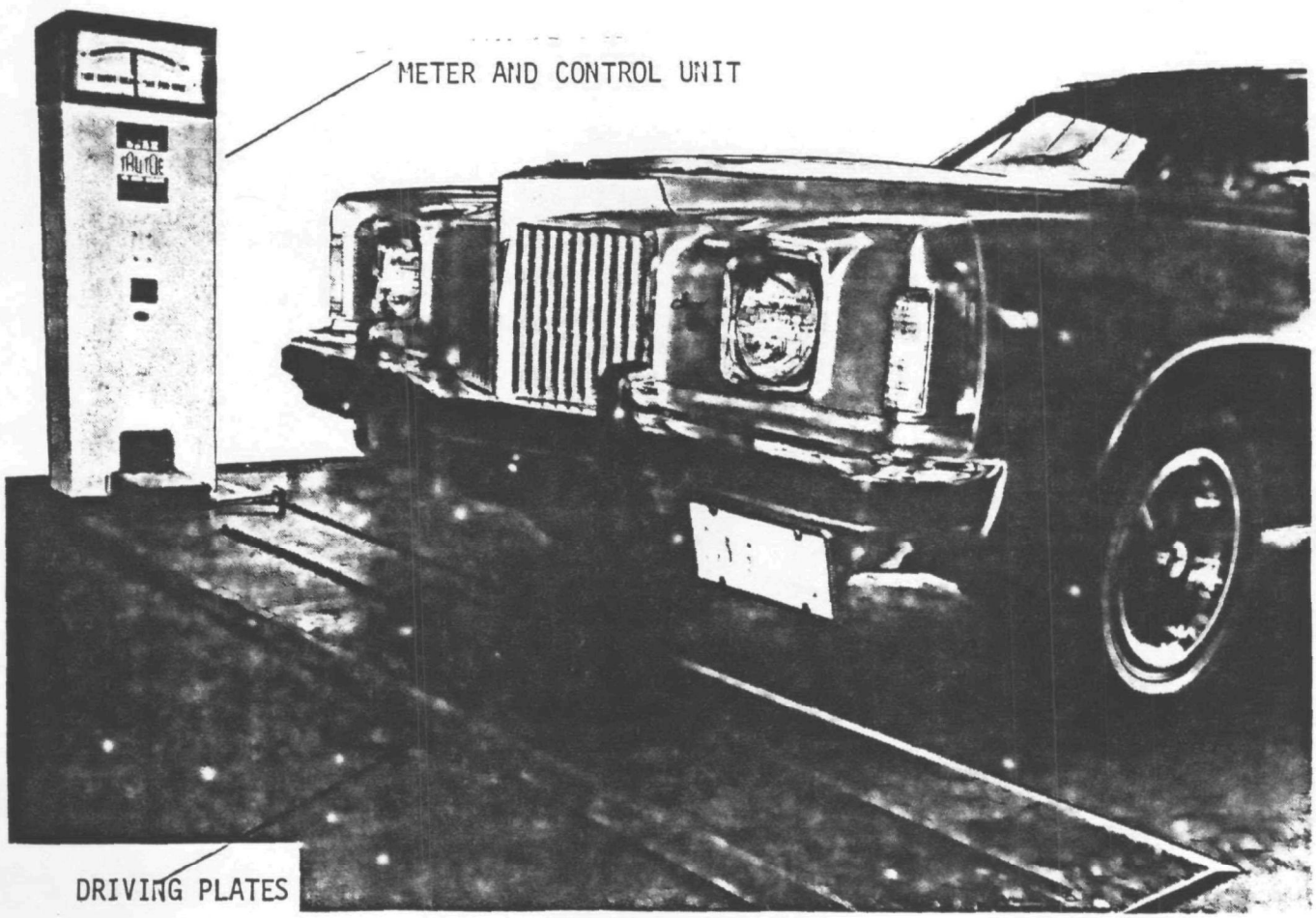


FIGURE 8
SCUFF GAUGE

5.0 DIGITAL ANALYZER

5.1 The digital analyzer (Figure 9, page A-17) is the device which is used for measuring vehicle RPM during the propane injection checks.

5.2 The main parts of the digital analyzer are:

a. Control unit and meter.

b. RPM pickup.

5.3 Setup Procedures:

a. Switch "SW1" is placed in the RPM 2000 position.

b. Switch SW2 is used for other type of test - ignore.

c. Display window will display zeros.

d. RPM pickup is clamped to any plug wire.

Notes: 1. Unlike the EMS tach pickup,"digital analyzer" RPM pickup can be clamped to the plug wire at any orientation.

2. Make sure RPM pickup does not come into contact with metal while it is connected to vehicle.

e. Actual RPM reading will be displayed in the control unit display window.

f. At the end of each test, switch "SW1" is to be placed in the OFF position to preserve unit's battery.

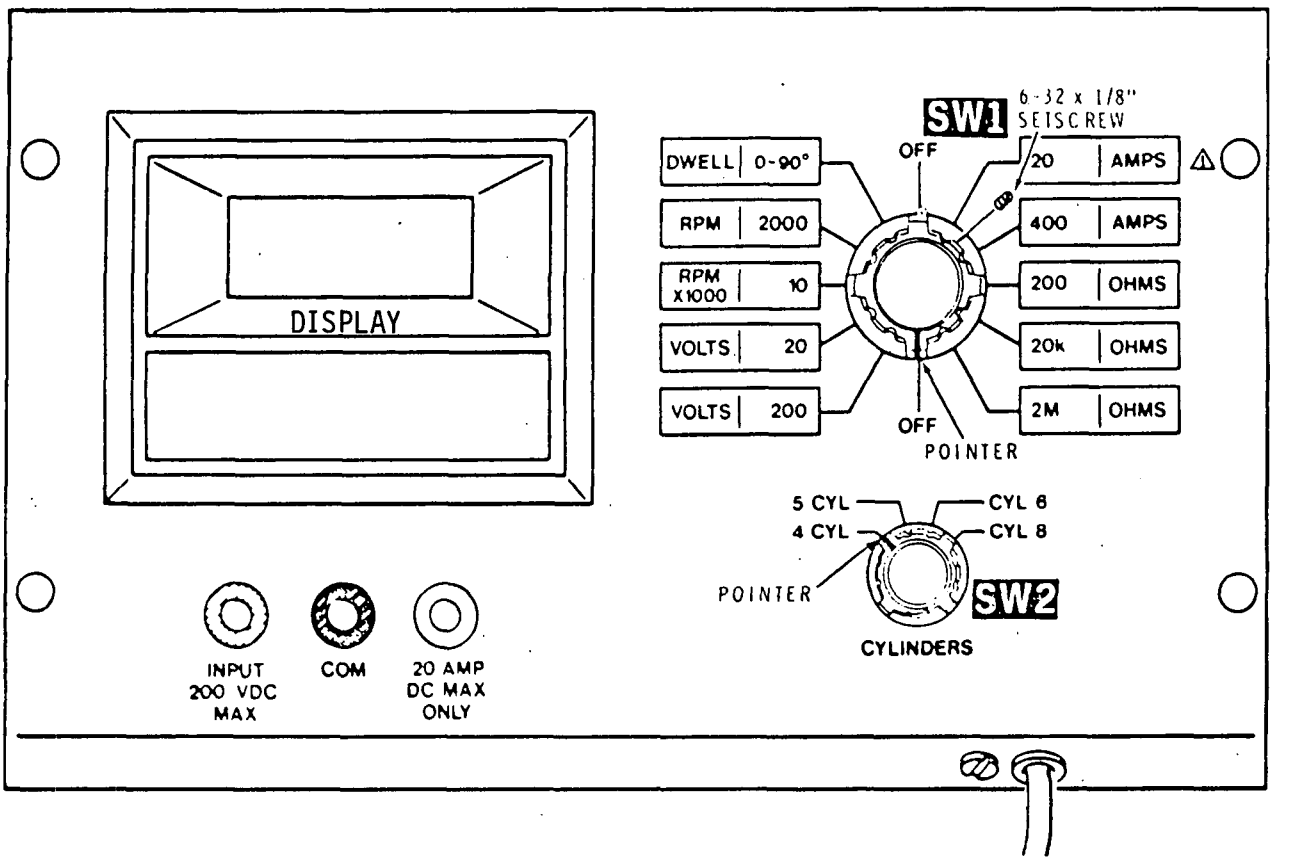


FIGURE 9

DIGITAL ANALYZER CONTROL UNIT AND METER

6.0 TIMING LIGHT

6.1 The timing light, Figure 10, page A-19, is the device which is used for measuring the vehicle's ignition timing during the basic timing checks.

6.2 The main parts of the timing light are:

a. Timing light and meter.

- Strobe light source.
- Meter located at the back with 2 circular scales, outer scale - degree advance, inner scale RPM - not used.

b. Push bottom switch - "SW1" - located at the top of the timing light and meter handle; used to activate the light.

c. Advance control "R3" - located on the top right side of timing light and meter handle; used to advance light strobing frequency.

d. Battery cable - used for applying power to unit via vehicle's battery. Red clip is to be connected to positive battery terminal; black clip is to be connected to negative battery terminal.

e. Inductive pickup - used for timing light firing pulse. Pickup is clamped to No. 1 plug wire - no orientation needed.

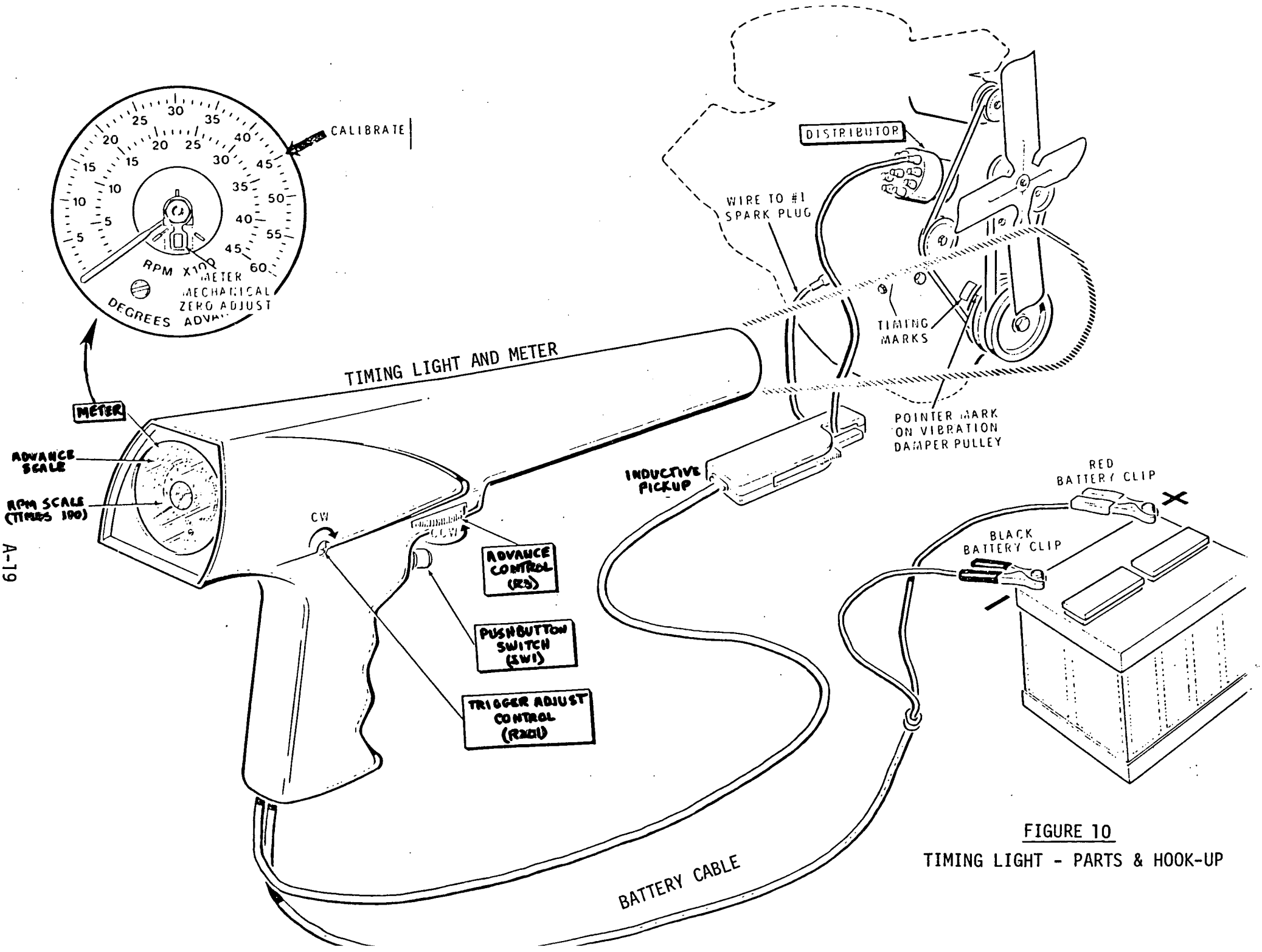


FIGURE 10

TIMING LIGHT - PARTS & HOOK-UP

7.0 AUXILIARY CATHODE RAY TERMINAL (CRT)

The CRT (ADDS Regent 100) located at Position #4 is the device which allows the inspector to receive and send information to the auxiliary computer (Alpha Micro).

7.1 Keyboard

Same as emission CRT.

7.2 Cursor

Same as emission CRT

7.3 Special Control Functions

CRT Key	Function Name	Description
Shift + Delete	back space	causes cursor to move to the left within data field
Bar Line	space/blank	causes cursor to move to the next entry within a data field
New Line	-	causes cursor to move to the first entry on the next field

Note: Special Function applicable to the emission CRT should not be used on the auxiliary CRT.

7.4 CRT Display

There are four (4) applicable CRT displays:

a. PRE LOG-ON (Figure 11, page A-21)

b. LOG-ON screen display - Automatic Mode (Figure 12, page A-22)

c. LOG-ON screen display - Backup Mode (Figure 13, page A-23)

d. Queue card test information entry (Figure 14, page A-24)

e. Emission information entry screen display (Figure 15 , page A-25)

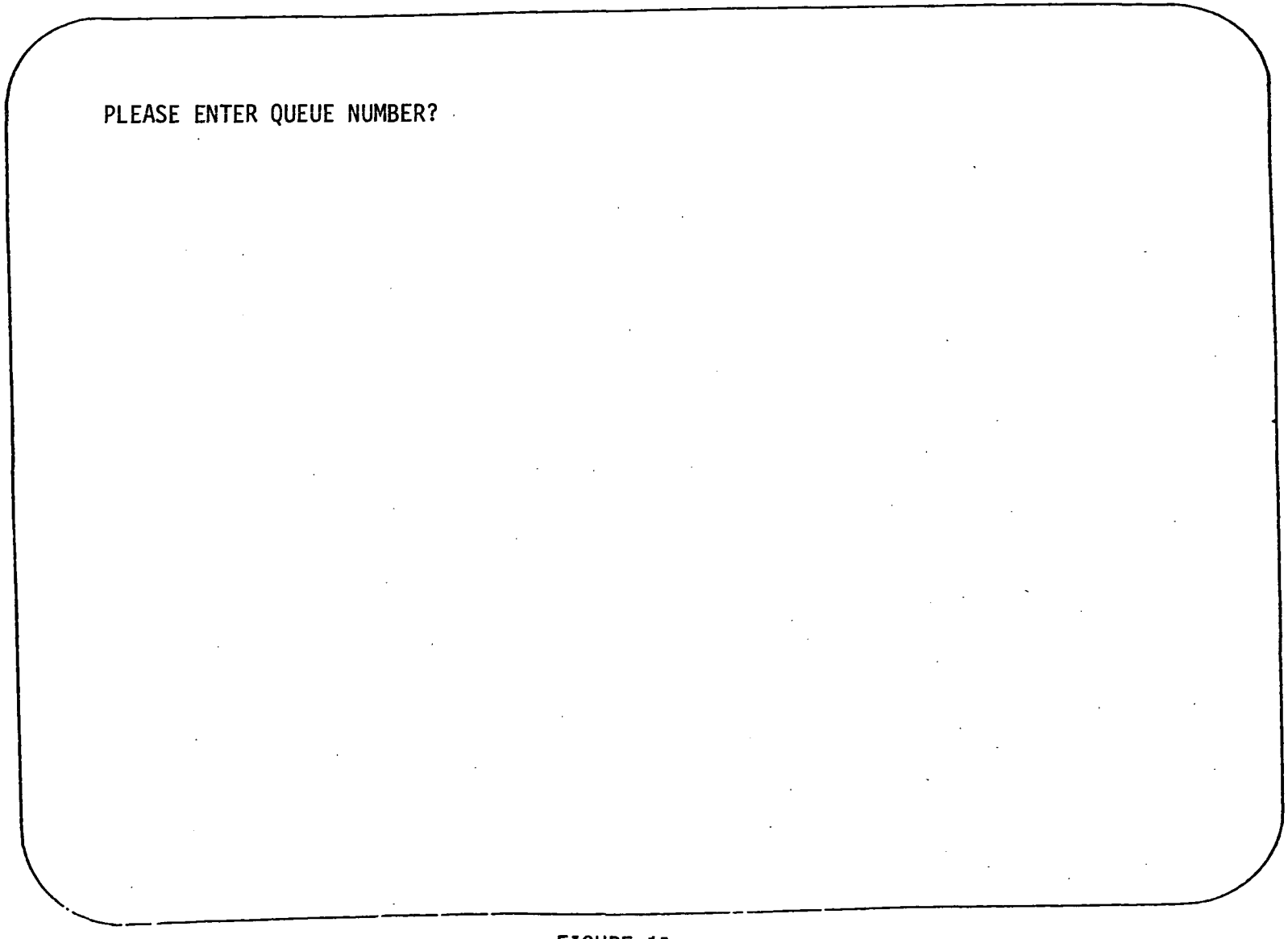


FIGURE 11

AUXILIARY CRT

PRE LOG-ON SCREEN DISPLAY

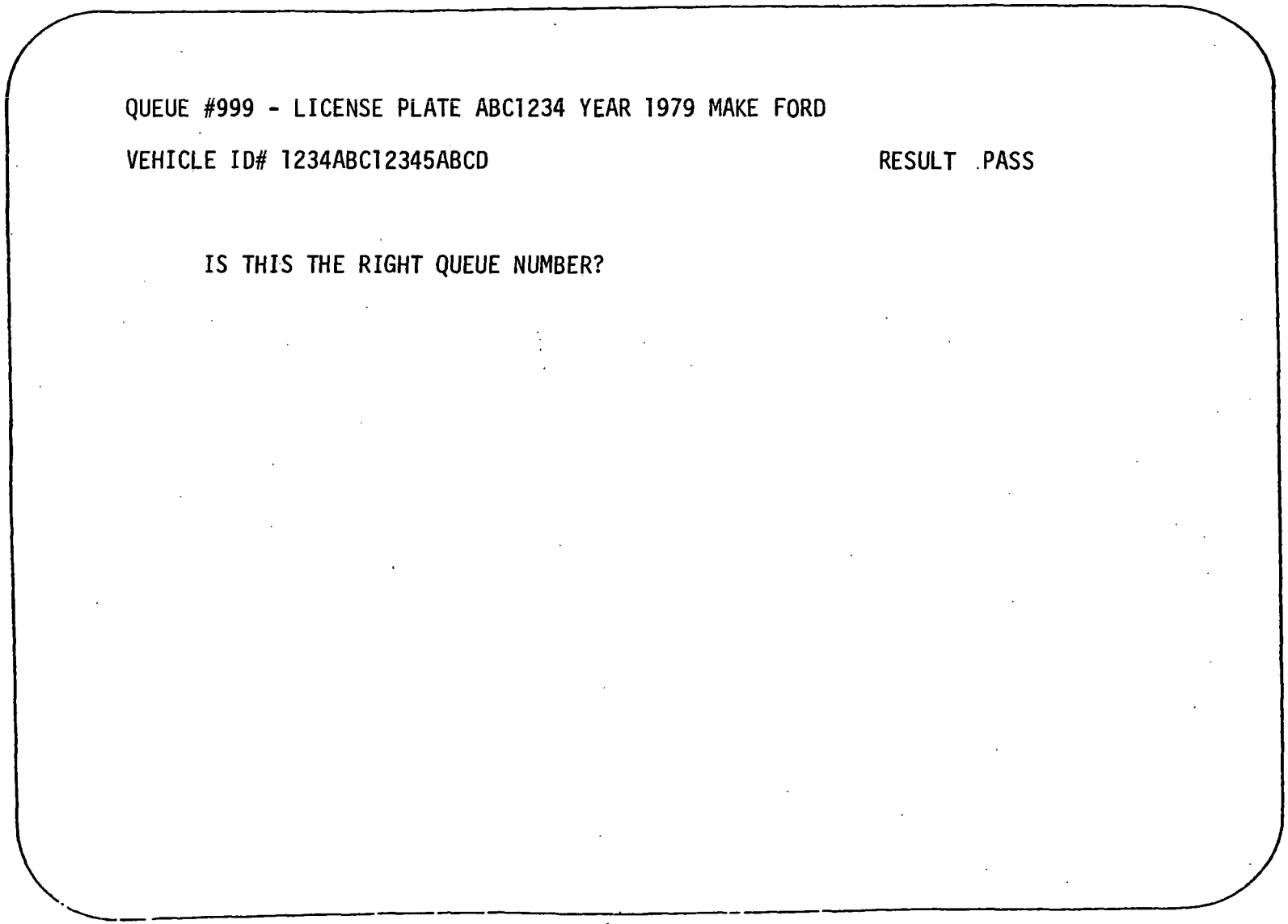


FIGURE 12

AUXILIARY CRT

LOG-ON SCREEN DISPLAY (AUTOMATIC MODE)

PLEASE ENTER QUEUE NUMBER 002

QUEUE NUMBER NOT FOUND

DO YOU WISH TO INPUT EMISSION DATA?

FIGURE 13

AUXILIARY CRT

LOG-ON SCREEN DISPLAY (BACKUP MODE)

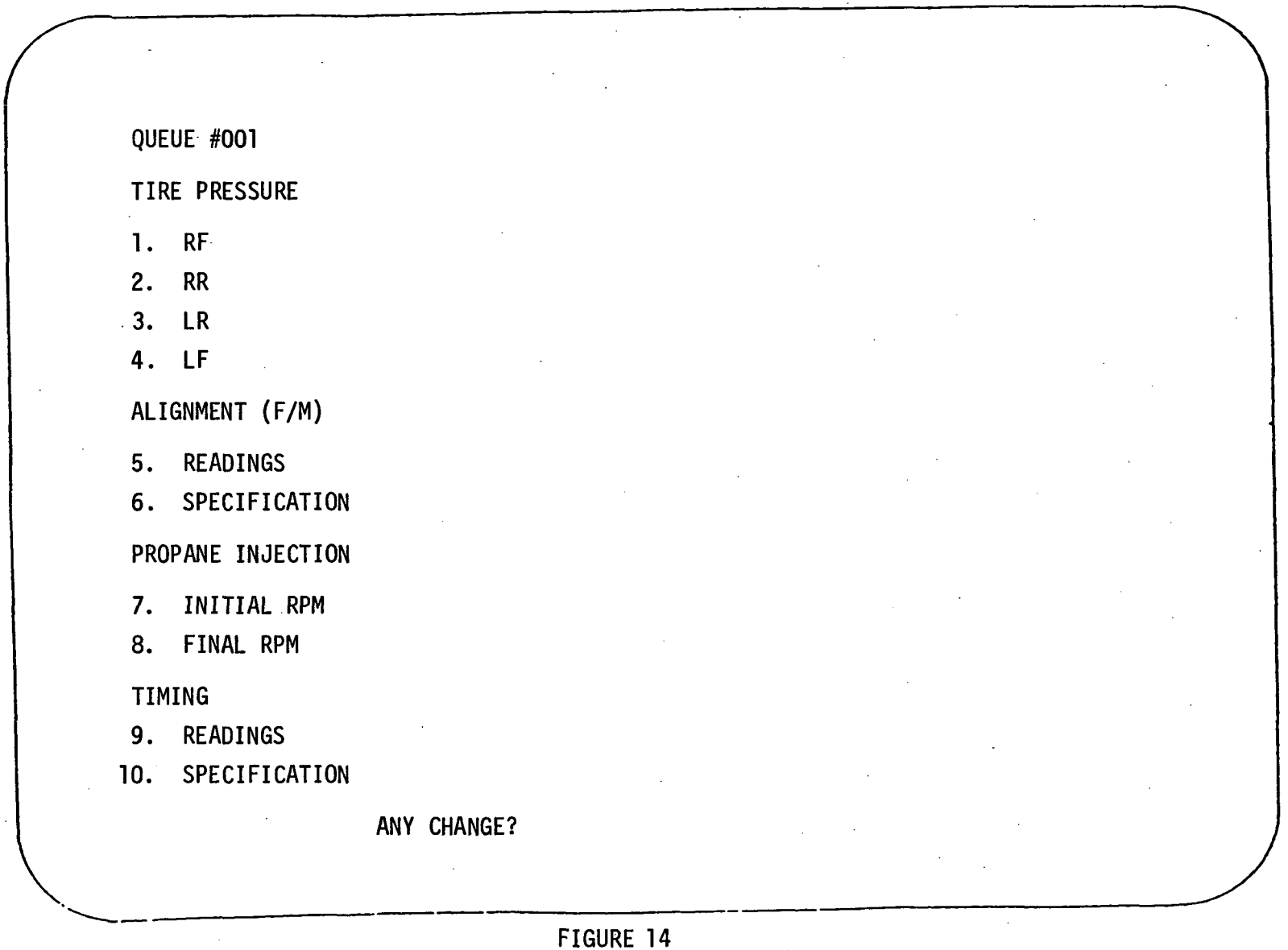


FIGURE 14

AUXILIARY CRT

QUEUE CARD TEST INFORMATION ENTRY SCREEN DISPLAY

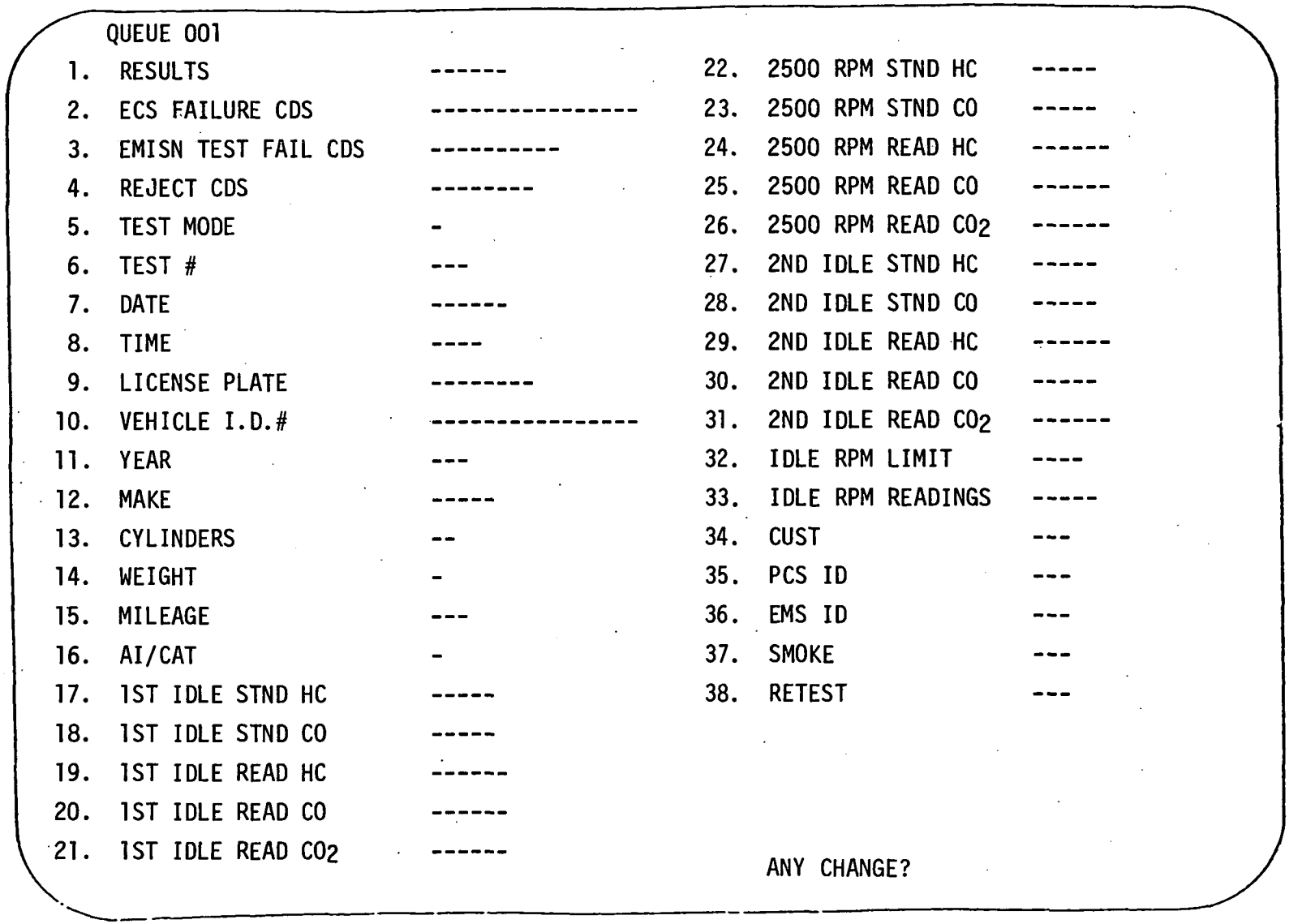


FIGURE 15

AUXILILARY CRT

EMISSION INFORMATION ENTRY SCREEN DISPLAY

SECTION B. - INSPECTION TASKS

1.0 REGISTRATION INFORMATION AND TEST SUITABILITY ENTRY

The following procedures are performed on the emission CRT at Position 1:

1.1 Required Conditions:

a. Emission computer operational

b. Emission CRT operational

c. CRT in PRE LOG-ON state (Figure 1, page A-3).

1.2 Log-On:

a. Key in the 3-digit queue card number.

b. Press the NEW LINE key.

c. CRT displays registration entry format (Figure 2, page A-4).

Note: 1. If CRT does not display registration format, a message will appear on the screen.

2. Possible messages and inspector responses are:

Message	Explanation	Inspector Response
INVALID	Queue number entered is not a 3-digit number (000 is an invalid entry).	1) press ESC+1 2) repeat step 1.2
WAIT	Computer cannot receive another test.	call manager
BUSY	Queue number is being used by other equipment.	1) log-off (ESC+2) 2) change queue card 3) repeat step 1.2
NOT FOUND	Not applicable	call manager
CAL FILE FULL	Not applicable	call manager
FLOPPY ERROR	Not applicable.	call manager

Note: If the queue number displayed does not agree with the queue card (wrong number entered) and the data field is empty, 1) depress ECS+8 keys - this "cancels" the queue number. 2) repeat step 1.2.

1.3 Entries of Registration Information:

Note: A marker on the display of the CRT called a "cursor" indicates where the next keyed-in entry will go. The control of the cursor is explained in Section A paragraphs 1.1 thru 1.4.

1. "YEAR" Field

   a. Key in the letter "M" followed by the last two digits of the model year. Example: "1979 vehicle - M79"

   b. Verify the display.

   c. Depress the "NEW LINE" key.

2. "MAKE" Field

   a. Key in the vehicle make as listed in Appendix #1 (Vehicle Make Abbreviation List).

   b. Verify the display.

   c. Depress the "NEW LINE" key.

   Note 1: If vehicle is a truck, "MAKE" entry is to have the letter "T" inserted at the end of this field.

   2: If vehicle is a van, "MAKE" entry is to have a letter "V" inserted at the end of this field.

3. "RETEST" Field

   a. Key in one numeric digit, as follows:

      . A zero value (Ø) signifies test to be performed on vehicle is the first test.

      . A numeric value "1-9" signifies retest value.

      Note 1: For vehicles returning for retests, owners must have previous test VIR forms.

      2. The retest value entered should be the value that appears on the previous VIR form incremented by one (1). Example: Previous VIR has 1" in retest block - enter "2" in this field.

b. Verify the display.

c. Depress the "NEW LINE" key.

4. "PLATE" Field

a. Key in the license plate number as follows:

License Plate	Key In
ABC 123	A B C 1 2 3 _ _
AB 123	A B 1 2 3 _ _ _
out of state	* O S * _ _ _ _ _
no plate on vehicle	N O N E _ _ _ _

Note: If license plate consists of more than eight digits or letters, enter only the first eight.

b. Verify the display.

c. Depress the "NEW LINE" key.

5. "VIN" Field

a. Key in the VIN number.

Note: One to sixteen alpha numeric characters with no spaces between characters.

b. Verify the display.

c. Depress the "NEW LINE" key.

Note: If VIN number cannot be obtained, key in "999" in this field.

6. "ODOMETER" Field

a. Obtain odometer reading as follows:

Read vehicle's odometer to the lowest thousands of miles and enter in the "ODOM" field as follows:

Examples of Readings	Key In
00,999	0 0 0
38,800	0 3 8
138,800	1 3 8

Note: The actual odometer reading is to be used at all times even if vehicle is suspected of having gone over 100,000 miles.

b. Verify the display.

c. Depress the "NEW LINE" key.

7. "CUST" Field

Depress "NEW LINE" key to pass this field.

8. "WEIGHT" Field

This field will always display the digit zero (Ø).

9. "CYL" Field

a. Ask driver the number of cylinders in his vehicle.

b. If driver does not know, request driver to open hood latch.

c. Lift hood and verify number of cylinders.

d. Lower hood. Do not close shut.

e. Key in the number of cylinders.

Note: Two numeric characters represent the number of cylinders for the inspected vehicle Possible values "0 4" up to "1 2".

f. Verify the display.

g. Depress the "NEW LINE" key.

10. "AIC" Field (Air Injection/Catalytic Converter)

a. Key in the appropriate numeric character based on the table below:

0 = no air injection, no catalytic converter

1 = air injection, no catalytic converter

2 = no air injection, catalytic converter

3 = air injection, catalytic converter

b. Verify the display.

c. Depress the "NEW LINE" key.

Note: All other fields should be left with no entries (---) after the field name, unless retest field has an entry other than zero (Ø).

1.4 Entries of Reinspection Information

Notes: 1. The following fields should be entered only if "RETEST" field is other than zero (Ø):

2. If retest field is "Ø" proceed to Section 1.5 - "Test Suitability Checks".

3. Use previous test VIR form as data base.

4. For the location of the information to be entered from the VIR, refer to Figure 16, page B-6.

1. "STATION" (Field 1 - see Figure 16)

   a. Key in the three (3) alpha numeric station code - this should always be "DB1".

   b. Verify the display.

   c. Depress "NEW LINE".

2. "LANE" (Field 2 - see Figure 16)

   a. Key in the one-digit lane number - this should always be "1".

   b. Verify the display.

   c. Press "NEW LINE".

3. "MODE" (Field 3 - see Figure 16)

   a. Key in the one (1) mode code - this should always be "A" or "S".

   b. Verify the display.

   c. Press "NEW LINE".

4. "DATE" (Field 5 - see Figure 16)

   a. Key in the six (6) digit date.

   b. Verify the display

   c. Press "NEW LINE".

5. "TEST NO." (Field 4 - see Figure 16)

   a. Key in the three (3) digit test number.

      Note: If test number is "1" key in "001".

VEHICLE INFORMATION REPORT

0000001 & UP

TEXAS MOTOR VEHICLE EMISSION CONTROL PILOT TESTING PROGRAM

Thank you for participating in the Texas Motor Vehicle Emission Control Pilot Testing Program. This program is part of a State study of ways to increase the effectiveness of motor vehicle pollution controls and depends on voluntary public participation. The test readings from your vehicle and other vehicles will be used to prepare recommendations to the Texas Legislature.

The test readings from your vehicle are typed in the block labeled "Emissions Test Data". For comparison, diagnostic values have been typed above your readings, in the shaded areas. These values are experimental and reflect values which vehicles the same age as yours can usually meet if they are operating properly. If your vehicle is not meeting one or more of the diagnostic values, a " * " will have been typed next to the corresponding test reading(s).

SEE REVERSE SIDE FOR FURTHER INFORMATION

QUEUE NO.	STATION NO.	LANE NO.	TEST MODE	TEST NO.	DATE	TIME
(FIELDS)	1	2	3	4	5	6

VEHICLE INFORMATION

LICENSE PLATE	VEHICLE IDENTIFICATION NO.	YEAR	MAKE	CYL		MILEAGE
						,000

TEST SUMMARY

- ☐ No operating problems detected.
- ☐ Your vehicle may have an operating problem. See block labeled "Emissions Test Data" and other side for further information.
- ☐ See bottom block for fuel economy tips.
- ☐ Your vehicle was not tested for the following reason(s):

FIGURE 16

VIR - TOP HALF

b. Verify the display.

c. Press "NEW LINE".

6. "TUNE HC" - "TUNE CO" Fields

a. Press "NEW LINE" one at a time to move cursor through these fields. Do not enter any code.

Note: Steps 7-11 information is to be entered if available from a repair facility's paper work; if no paper work available do not enter.

7. "REP ID" Field

a. Key in the repair facility numeric code.

Note: If you enter any numbers, make sure that the number is 8 digits long - add zeros (Ø) before the number.

Example: Facility code 123, enter "ØØØØØ123"

b. Verify the display.

c. Press "NEW LINE".

8. "REP RPM" Field

a. Key in the vehicle RPM after repair.

Note: This field should also be 8 digits. Follow example above.

b. Verify the display.

c. Press "NEW LINE".

9. "$ PARTS" Field

a. Key in the amount (whole number) spent on parts.

b. Verify the display.

c. Press "NEW LINE".

10. "$ LABOR" Field

a. Key in the amount (whole number) spent on repair labor.

b. Verify the display.

c. Press "NEW LINE".

11. "RPM GAIN" Field

a. Key in the RPM gain for mechanic propane injection check.

b. Verify the display.

c. Press "NEW LINE".

1.5 Test Suitability Check

1. Visually observe vehicle and determine if the following conditions exist:

a. Excessive oil or fuel leaks.

Note: Fluids dripping should be identified as to their content; water, oil, or gas. If it is water or oil or nonhazardous material, the vehicle should be tested. If there is fuel leaking in any quantity, the vehicle should be rejected. Should the fuel leak be a continuous stream, notify the supervisor for a final decision on whether the vehicle should be tested or rejected.

b. Defective tire.

c. Excessive leaking or inaccessible exhaust systems.

d. Any condition, in the inspector's supervisor's opinion, that will invalidate the vehicle test results.

Note: If you are unsure about the vehicle's test suitability, call manager.

2. If any of the above conditions exist, vehicle is unsuitable for testing. Proceed to step 3. If vehicle is suitable for testing, proceed to step 1.6 (Log-off).

3. Safety Failure Entry

a. Press "ESC+5".

b. Verify that CRT displays the "SAFETY SCREEN", Figure 3, page A-5.

c. Identify the code which describes why the vehicle is unsuitable for testing.

d. Enter above code.

e. Verify entry.

f. Press "NEW LINE".

g. Repeat steps c-f if vehicle is unsuitable for test due to additional items.

1.6 Log-Off

a. Press ESC+2.

b. Verify that CRT screen is in the "PRE LOG-ON" state.

c. If CRT does not revert to "PRE LOG-ON" the cursor will point to the field with the error - correct and repeat step 1.6.

Note 1: Any correction has to be followed by "NEW LINE" before Log-Off can be performed. In addition, the entire field must be completely re-entered.

2.0 TIRE PRESSURE CHECKS

The following procedures are performed on each vehicle. All data entries are manually recorded on the queue card.

2.1 Required Conditions

a. Registration and test suitability successfully completed.

2.2 Prior to actual check, perform the following:

a. Record the date and vehicle plate number in the appropriate place on the queue card.

b. Briefly verify that all tire stems are accessible for checking.

- If one or more tires are inaccessible, check is bypassed - record the code "NT" - No Test - in the field marked "RIGHT FRONT".
- If all tire stems are accessible, proceed to step c.

c. Inform driver of the tire pressure check and ask permission to:

- Check tires.
- Inflate tires to the upper pressure limit of 28 psi if they are below the lower limit of 20 psi.

d. If driver refuses either of the above conditions, bypass tire pressure check and record the code "TR" - Test Refused - in the field marked "RIGHT FRONT".

- If driver agrees to the above, perform the check.

2.3 Tire Checks

a. Use the stand-alone tire pressure gauge to check and record the tire pressure in psi in the appropriate place on the queue card.

b. On all tires found to have less than the lower pressure limit of 20 psi, add air up to the upper pressure limit of 28 psi using the facility's air supply hose and gauge.

Note 1: Air is to be added to both front or rear tires, even if only one of the pairs is below the lower limit.

2. Some small vehicles are exempt from tire pressure testing (Table B-1). Enter the code "NT" in the field marked "RIGHT FRONT".

TABLE B-1

VEHICLES EXEMPT FROM
TIRE CHECKS

1. Volkswagen (Beetle)
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

3.0 EMISSIONS TESTING

This section will cover the emissions testing procedure for two operational modes:

- AUTOMATIC Mode
- BACKUP Mode

3.1 Automatic Mode

3.1.1 Required Equipment:

a. Emission computer operational.

b. EMS, EDEP and TCP operational.

c. Registration information entered prior to emissions test.

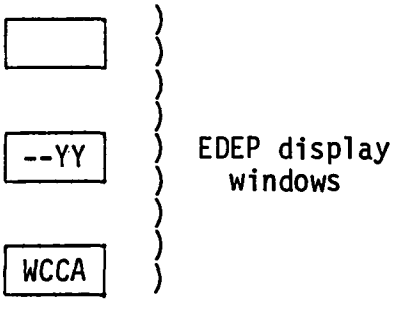
3.1.2 Pretest Conditions

a. TCP indicates READY.

b. EDEP "ENTER QUEUE NUMBER" enunciation light is on.

3.1.3 Test Procedure:

Step	Response
a. Raise vehicle hood and secure it in the "open" position.	none
b. Locate spark plug wire and make tach connection. CAUTION: Be sure tach pickup is connected to a spark plug wire and not the coil wire or vacuum hose.	none
c. Examine tail pipe configuration to determine if any special tail pipe adapters are required. Note: For a valid exhaust sample the probe must be inserted a minimum of 6 inches. Any less than this and an exhaust extension adapter is required.	none
d. Remove probe from holder and insert probe(s) into tail pipe(s) using adapters as required.	none
e. On the EDEP, key in the numeric queue number from the queue card.	On the EDEP the queue number appears in display #3 (lower)

Step	Response
f. On the EDEP, depress the following key: "SMOKE" - if vehicle's excessive smoke is to be checked. "ENTER" - if no smoke observation needed.	On the EDEP: 1. The queue number moves to display #1 (upper). 2. The vehicle class appears in display #3. 3. The "ENTER VEHICLE CLASS" enunciator light is on.
Note: If the "KEYBOARD ERROR" enunciator is on, depress the "CLEAR" key and start again at step "e.".	
g. Verify the "VEHICLE CLASS" is correct.	On the EDEP the correct vehicle class code is displayed in displays #2 and #3, as follows:  Where YY = last digits of model year W always = Ø CC = number of cylinders 04-12 A = AIC code (Ø-3) Note: If "VEHICLE CLASS" display is incorrect, call manager.
h. Press "ENTER".	On EDEP the "ENTER LOUVER" enunciator light is on.

Step	Response
h. Observe vehicle and press the louver selection key as follows: "A" - closest louver opening "B" - furthest louver opening "N" - no louver opening Press "ENTER".	Appropriate louver action.
i. First Idle Test Notes: 1. The first idle test mode has started. CAUTION: Maintain an idle condition in neutral. Do not accelerate. 2. The cue to operate the vehicle at idle is the "TESTING' light on and the "SET SPEED" display blank. 3. If vehicle is to be observed for excessive smoke, it should be done during the emissions test.	On the Test Cue Panel (TCP) 1. The "READY" light goes out. 2. The "TESTING" indicator light is on. 3. "ACTUAL SPEED" display shows engine's RPM. Note: a) If "SET SPEED" light illuminates on the TCP the EMS is not receiving RPM signal; verify tach connection. b) If light still illuminates, select a different plug wire. c) If light still illuminates, call manager.
j. 2500 RPM Test	• On the TCP the "TESTING" light continues to illuminate. • The "SET SPEED" light will illuminate. • "2500" will appear on the "SET SPEED" display. • "ACTUAL SPEED" window displays engine RPM.
k. Accelerate engine (in "neutral") until indicated actual RPM, as shown on the TCP, is between 2300-2700 RPM. Note: If during the "2500 RPM Test" engine RPM is out of the above values, the "SET SPEED" will illuminate and the test will be stopped until RPM is corrected.	• When proper RPM has been obtained, "SET SPEED" light will extinguish.

Step	Response
l. Second Idle Decelerate engine until the engine has established a normal idle condition; and with footbrake on, put transmission in "drive" for automatic transmissions.	. On the TCP "SET SPEED" will illuminate. . The "SET SPEED" will extinguish . The "TESTING" light continues to illuminate. . "ACTUAL SPEED" displays engine RPM.
m. When Emission Test Finished (and no smoke observation was selected in step f.)	. The "TESTING" light will extinguish and the "TEST COMPLETE" light will come on.
n. When Emission Test Finished (and smoke observation was selected in step f.)	. On EDEP the "SMOKE" enunciator light is on.
o. Press the following: . "SMOKE" if vehicle failed smoke observation. . "CLEAR" if vehicle passed smoke observation.	
p. When All Testing at EMS Finished Remove probe(s) from tailpipe(s) and place probe(s) on holder.	. The "TESTING" light will extinguish and the "TEST COMPLETE" light will come on. . After the purge cycle, the "ENTER QUEUE NUMBER" indicator on the EDEP light will illuminate, and "READY" light on TCP will illuminate.
q. Remove RPM probe, lower hood and secure on first latch.	

General Notes: 1. If at any time during the emissions test the "SAMPLE DILUTION" indicator should illuminate:

. Check to see if probe is properly installed.

. If probe is properly installed, call manager.

2. If the vehicle malfunctions in some way which prevents start or completion of the testing, call manager.

3. If "TESTING" light extinguishes during any portion of the test, call manager.

3.2 Backup Mode

3.2.1 Required Equipment:

a. EMS, EDEP and TCP operational.

b. Emission computer and console printer connected to EMS. Temporary VIR is used in this printer.

3.2.2 Prestest Conditions:

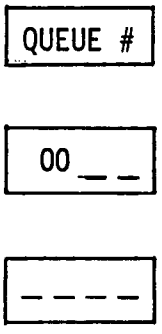
a. EMS in backup mode.

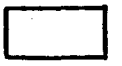
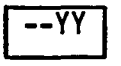
b. EDEP "ENTER QUEUE NUMBER" enunciation light is on.

c. The number "1" appears in the lower EDEP display.

3.2.3 Test Procedure:

Step	Response
a. Raise vehicle hood and secure it in the "open" position.	none
b. Locate spark plug wire and make tach connection. CAUTION: Be sure tach pickup is connected to a spark plug wire and not the coil wire or vacuum hose.	none
c. Examine tailpipe configuration to determine if any special tailpipe adapters are required. Note: For a valid exhaust sample the probe must be inserted a minimum of 6 inches. Any less than this and an exhaust extension adapter is required.	none
d. Remove probe from holder and insert probe(s) into tailpipe(s) using adapters as required.	none
e. Clear display and enter Queue Card Number.	EDEP displays an internal queue number in the lower window. Note: Number will start at "1" for first test.

Step	Response
f. On EDEP press the following: • "SMOKE" if vehicle's excessive smoke is to be checked. • "ENTER" if no smoke observation needed.	EDEP will display the following: 

Step	Response
g. On EDEP press "CLEAR".	EDEP displays are blank.
h. On EDEP enter Vehicle Weight Class as follows: YY last digit of model year W always = Ø CC number of cylinders A AIC code (Ø-3) Note: Refer to Section B1.3, step 10 for AIC code selection.	EDEP displays:   
i. Verify EDEP display and press "ENTER".	Notes: 1. If vehicle class display is incorrect, press "CLEAR" and repeat step h. 2. If the "KEYBAORD ERROR" enunciator is on, depress the "CLEAR" key and repeat step e. On EDEP the "ENTER INSPECTOR NUMBER" enunciation light is on.
j. Enter your inspector number (no more than 3 digits). Press "ENTER".	On EDEP the "ENTER LOUVER" enunciator light is on.
k. Observe vehicle and press the louver selection key as follows: "A" - closest louver opening "B" - furthest louver opening "N" - no louver opening Press "ENTER".	Appropriate louver action.

Step	Response
1. First Idle Test	
Press "ENTER" on EDEP.	On the Test Cue Panel (TCP):
Notes: 1. The first idle test mode has started. CAUTION: Maintain an idle condition in "neutral". Don't accelerate.	1. The "READY" light goes out.
	2. The "TESTING" indicator light is on.
2. The cue to operate the vehicle at idle is the "TESTING" light on and the "SET SPEED" display blank.	3. "ACTUAL SPEED" display shows engine's RPM.
3. If vehicle is to be observed for excessive smoke, it should be done during the emissions test.	Note: a) If "SET SPEED" light illuminates on the TCP, the EMS is not receiving RPM signal; verify tach connection.
	b) If light still illuminates, select a different plug wire.
	c) If light still illuminates, call manager.
m. 2500 RPM Test	. On the TCP the testing light continues to illuminate.
	. The "SET SPEED" light will illuminate.
	. "2500" will appear in the "SET SPEED" display.
	. "ACTUAL SPEED" window displays engine RPM.
n. Accelerate engine (in "neutral") until indicated actual RPM as shown on the TCP, is between 2300-2700 RPM.	. When proper RPM has been obtained, "SET SPEED" light will extinguish.
Note: If during the "2500 RPM Test" engine RPM is out of the above values, the "SET SPEED" will illuminate and the test will be stopped until RPM is corrected.	. When proper RPM has been obtained, "SET SPEED" light will extinguish.

Step	Response
o. Second Idle Decelerate engine until the engine has established a normal idle condition; and with footbrake on, put transmission in "drive" for automatic transmissions.	. On the TCP "SET SPEED" will illuminate. . The "SET SPEED" will extinguish . The "TESTING" light continues to illuminate. . "ACTUAL SPEED" displays engine RPM.
p. When Emission Test Finished (and no smoke observation was selected in step f.).	. The "TESTING" light will extinguish and the "TEST COMPLETE" light will come on after the printer finishes the temporary VIR print.
q. When Emission Test Finished (and smoke observation was selected in step f.).	. On EDEP the "SMOKE" enunciator light is on.
r. Press the following: "SMOKE" if vehicle failed smoke observation. "CLEAR" if vehicle passed smoke observation.	
s. When All Testing at EMS Finished Remove probe(s) from tailpipe(s) and place probe(s) on holder.	. The "TESTING" light will extinguish and the "TEST COMPLETE" light will come on after the printer finishes the temporary VIR print. . After the purge cycle, the "ENTER QUEUE NUMBER" indicator on the EDEP will illuminate, and "READY" light on TCP will illuminate.
t. Remove RPM probe, lower hood and secure on first latch.	

Step	Response
u. Close hood. Be sure hood is closed firmly and secured!	

General Notes: 1. If at any time during the emissions test the "SAMPLE DILUTION" indicator should illuminate:

- Check to see if probe is properly installed.
- If probe is properly installed, call manager.

2. If the vehicle malfunctions in some way which prevents start or completion of the testing, call manager.

3. If "TESTING" light extinguishes during any portion of the test, call manager.

4.0 ALIGNMENT CHECKS

This section will describe the alignment checks performed on each vehicle.

4.1 Required Conditions

a. Scuff gauge operational.

b. Scuff gauge is reset - meter needle at center.

4.2 Checks and Data Recording

a. Drive vehicle at a speed not to exceed 3 MPH until front wheels clear the scuff gauge.

b. Stop vehicle before rear wheels are on scuff gauge.

Note: If rear wheels are on gauge they will reset the reading.

- Move vehicle cautiously until front wheels clear the gauge.
- Repeat step a.

c. Observe the scuff gauge meter and record the side drag to the nearest multiple of 5's (5, 15, etc.) as indicated by the scuff gauge meter needle (readings are in ft./mile). Record reading on the queue card under the header "Alignment Data".

Note: You do not have to indicate the direction of the side drag.

d. Record the alignment test specification (ex.- Ø1Ø [10 ft/mile] on the queue card under the header "Alignment - Specs".

5.0 EMISSION CONTROL SYSTEM (ECS) CHECKS

The following procedures are performed on the emission CRT at Position 3:

5.1 Required Conditions

a. Emission - computer operational

b. Emission CRT operational and in PRE-LOG on state (Figure 1, page A-3)

c. Test at Position 1 and 2 is completed.

5.2 Log-On

a. Key in the 3-digit queue number followed by the letter "E".

b. Press NEW LINE key,

c. CRT will display ECS SCREEN DISPLAY (Figure 4, page A-6).

Note: If any other display appears, refer to Section B, step 1.2.

5.3 Verify that the vehicle information displayed on line 2 of the screen matches vehicle.

. If not, verify queue number display. If queue number OK, call manager.

Note: The screen display has 2 sections:

. First Digit - (letters A - F) identify items that have to be checked on every vehicle. These items are as follows:

A. PCV - Positive Crankcase Ventilation

B. AI - Air Injection

C. EGR - Exhaust Gas Recirculation Valve

D. FE - Fuel Evaporative

E. CAT CON - Catalytic Converter

F. FUEL RPS - Fuel Restrictor

. Second Digit (numbers 1-4) identifies the condition of the items listed above. These items are as follows:

1. Modified

2. Disconnected or Bypass

3. Missing

4. Not Inspected

5.4 With the aid of the ECS Reference Table, locate the items that are part of the original equipment for this vehicle.

5.5 Check if the above items were:

- modified
- disconnected or bypassed
- missing
- not inspected

5.6 Code Entry

a. Select the appropriate first digit and second digit for all "failed" items checked.

b. Key in the appropriate code selected above.

c. Press "NEW LINE".

d. Repeat steps a. - c. for additional "failed" items.

e. Enter your inspector number in the field marked "ECS ID".

f. Press "NEW LINE".

Notes: 1. You must enter your inspector number even if all items are found to be OK and no failure code is entered.

2. When checking the fuel restrictor, enter the code "F4" (Fuel Restrictor - not inspected) if fuel tank nozzle is inaccessible due to a locked cap or door.

5.7 Emission Inspection - Termination

a. Press the "ESC+6" (exit) key.

b. Verify screen reverts to PRE-LOG on condition.

6.0 PROPANE INJECTION CHECKS

6.1 The following procedures are performed on each vehicle. All data entries are manually recorded on the queue card.

6.1 Required Conditions

a. All testing at Position 1 - 3 successfully completed.

b. "Digital analyzer" operational.

c. Propane gas cylinder and related hardware operational.

6.2 Prior to actual checks, perform the following:

a. Verify that "digital analyzer" and propane gas cylinder are operational.

- If one or both not operational, test cannot be performed. Record the code "NT" (no test) on the queue card under the header "Propane Gain - Initial PPM".
- If above equipment operational, proceed to step b.

b. Open vehicle hood and locate intake port of air cleaner housing.

- If intake port is not readily accessible without use of tools, test will not be performed. Record the code "AB" (abort) on the queue card under the header "Propane Gain - Initial RPM".
- If intake port is accessible directly or can be made accessible by disconnecting and reconnecting of an air duct without use of tools and probable damage to any part of the vehicle, test is to be performed. Proceed to step 6.3.

6.3 Perform the following steps for the propane injection checks:

a. Connect exhaust removal hose(s) to vehicle tailpipe(s).

b. Connect the "digital analyzer" RPM pickup to any spark plug wire.

Note: Make sure RPM pickup does not come in contact with any metal.

c. Verify that switch SW1 on "digital analyzer" is in the "RPM 2000" position.

d. Place vehicle in "park" or "neutral" with parking brake applied and air conditioning off.

e. Start engine - momentarily press and release accelerator pedal to stabilize engine RPM.

f. Record stabilized engine RPM on the queue card under the header "Propane Gain - Initial RPM".

g. Turn on main valve of propane cylinder and insert injection tube into air cleaner intake port.

h. Slowly open the needle valve at the air cleaner end of injection tube.

i. Observe RPM as it is being displayed on the "digital analyzer display". Record displayed RPM on the queue card under the header "Propane Gain - Final RPM" as follows:

   - RPM increases - reaches a peak then decreases. Record peak RPM value.
   - RPM decreases (never any RPM gain). Record lowest value of RPM.

     Note: If vehicle stalls, RPM display will be zero. Record the value displayed prior to vehicle stall.
   - RPM increases and stays at a constant RPM level. Record constant RPM value.
   - RPM increases until vehicle stalls. Record RPM value prior to vehicle stall.

j. Shut off needle valve and main propane cylinder valve. Remove injection tube from air cleaner intake port.

k. Turn engine off.

l. Disconnect RPM pickup. Place switch SW1 on "digital analyzer" in the OFF position.

m. Reconnect all tubes or hoses removed from air cleaner prior to test.

n. If timing test is to be performed, do not disconnect exhaust removal hose. Do not close hood.

o. If timing test is not being performed, disconnect exhaust removal hose, close hood and verify that it is latched properly.

7.0 BASIC TIMING CHECKS

7.1 The following procedures are performed on each vehicle. All data entries are manually recorded on the queue card.

7.2 Required Conditions

a. All testing at Position 1 - Position 3 successfully completed.

b. Timing light operational.

7.2 Prior to actual checks, perform the following:

a. Verify with manager if timing test is to be performed and that equipment is operational.

- If test is not to be performed, record "NT" (no test) on the queue card under the header "Ignition Timing - Timing".
- If test is to be performed, proceed to b.

b. Open vehicle hood (hood may be open already from propane injection checks).

c. With the use of "Mitchell Manual" locate:

- emission label
- timing indicator

Note: Clean area if necessary and identify "TDC" (top, dead center) or Ø marks.

d. If emission label is not present (or cannot be located), record the code "NA" (not available) on the queue card under the header "Ignition Timing - Timing".

- If the timing marks or the TDC marks cannot be cleaned or located, record the code "AB" (abort) on the queue card under the header "Ignition Timing - Timing".
- If above is present and identified, proceed to step 7.3.

7.3 Perform the following steps for the basic timing checks:

a. Record the vehicle ignition timing specification as it appears on the timing label under the header "Ignition Timing - Specs".

Note: 1. Timing advance is recorded with (+) sign.
2. Timing retard is recorded with (-) sign.

b. Connect exhaust removal hose(s) to vehicle's tailpipe(s).

c. With the use of "Mitchell Manual" identify spark plug No. 1.

d. Connect timing light per setup in Section A. 6.0 (Figure 10, page A-19).

Note: 1. Make sure to route all cables away from any moving engine parts.

2. Vehicle is to be tested with all vacuum hoses connected as received.

e. Place vehicle in "park" or "neutral" with parking brake applied and air conditioning off.

f. Start engine; momentarily press and release accelerator pedal to stabilize engine "idle RPM".

g. Aim timing light toward timing mark and press the "pushbutton switch SW1".

h. Rotate the "advance control knob R-3" until timing marks on engine is aligned with the TDC or Ø mark.

i. Observe at outer scale on the timing light meter and record the timing advance, as indicated by the meter needle, on the queue card under the header "Ignition Timing" on line labeled "Timing".

Note: 1. If vehicle has a retarded timing specification, advance control knob R-3 is to be moved to zero advance and the actual degrees of engine retardation are to be read directly from the vehicle timing marks. Remember to place a (-) sign before readings.

2. If vehicle's timing cannot be determined, record the code "AB" (abort) on the queue card under the header "Ignition Timing - Timing".

j. Turn engine off and disconnect timing light hookup.

k. Close hood and verify that it is latched properly.

l. Disconnect exhaust removal hose(s).

8.0 QUEUE CARD TEST INFORMATION ENTRY

8.1 Required Conditions

a. Emission computer operational.

b. Auxiliary computer operational.

c. Auxiliary CRT operational and in PRE LOG-ON state (Figure 11, page A-21).

d. All testing at Position 1 - 3 completed (EXIT at Position 3).

8.2 Log-On

a. Key in the 3-digit queue card number.

b. Press "NEW LINE".

c. CRT will display the LOG-ON SCREEN FORMAT - AUTOMATIC MODE (Fig. 12, page A-22

d. Verify that the following information as displayed matches the vehicle:

- queue number
- license plate
- year
- make

e. If above information matches vehicle, enter "Y" (yes) following the displayed question, "IS THIS THE RIGHT QUEUE NUMBER?". CRT will display "QUEUE CARD TEST INFORMATION DISPLAY" (Figure 14, page A-24). Proceed to step 8.3.

f. If above information does not match vehicle:

- Check queue number display for entry error.
- Enter "N" (no) following the displayed question, "IS THIS THE RIGHT QUEUE NUMBER?".
- Repeat steps a. - e.
- If queue number displayed is correct and information displayed <u>does not</u> match vehicle, <u>call manager</u>.

  <u>Note</u>: If CRT display in step c. above, the LOG-ON SCREEN DISPLAY BACKUP Mode (Figure 13, page A-23, proceed as follows:

- Enter "N" following the displayed question, "DO YOU WISH TO INPUT EMISSION DATA?".
- Screen will revert to PRE-LOG-ON state.
- Verify correct entry of Queue # by repeating steps a. - b. above.
- Request Position 3 inspector to LOG-ON and "EXIT" (ESC 6) if Position 3 CRT displays valid data.
- If CRT display continues to be the LOG-ON SCREEN DISPLAY-BACKUP, call manager.

8.3 Test Data Entry

a. Enter the information that appears on the queue card into the CRT.

Note: Each field entry is followed by "NEW LINE".

b. Verify the entries as they appear on the screen:

- If all entries are correct and present:
  - Enter "N" (no) following the displayed question, "ANY CHANGE?".
  - CRT screen will display "PRINTING, WRITING TO FLOPPY" and then will revert to PRE-LOG on state.
- If any correction is to be made:
  - Enter "Y" (yes) following the displayed question, "ANY CHANGE?".
  - Enter the line number (1-10) following the display "WHAT #?".
  - Make correction.
  - Repeat step b.

9.0 MANUALLY-ENTERED EMISSION DATA

This section will cover the manually-entered emission data procedures for two cases:

- Into the Emission computer (lane operation is SEMI AUTOMATIC MODE).
- Into the Auxiliary computer (lane operation is BACK-UP MODE).

9.1 Emission Data Entries Into the Emission Computer

9.1.1 Required Condition

a. Emission computer and CRT OK.

b. EMS not operational.

c. Auxiliary computer and CRT OK.

d. Position 1 test and entries as normal (queue number entry followed by RM).

e. Emission test performed using Back-up analyzer "Computerized Emission Analyzer CEA 600".

Note: ECS checks and entries are part of this section's entries when operating under the above conditions.

9.1.2 Log-On

a. Enter the 3-digit queue number followed by RM. Example: "001RM".

b. Press "NEW LINE".

c. Verify display (REGISTRATION ENTRY SCREEN WITH DATA) matches vehicle.

- If not, LOG-OFF and repeat step a.

d. Press "ESC+5". CRT will display the MANUALLY-ENTERED EMISSION DATA SCREEN (Figure 5, page A-7).

9.1.3 Data Entries

a. Press "ESC+7" - CRT will display the appropriate limits for the vehicle under the three test modes as follows:

- MODE I - 1st Idle
- MODE II - 2500 RPM
- MODE III - 2nd Idle

b. Press "ESC+4" (home). Cursor will move to the field marked "TYPE".

c. Enter "I" plus "NEW LINE".

Note: 1. The data for the entries in steps d.-g. appears on the paper tape generated by the "CEA 600" during the emission test.

2. All field entries are followed by "NEW LINE".

d. Enter the 2nd idle RPM into the field marked "IDLE SP".

e. Perform the following for the Mode I HC readings:

- Advance cursor to the field marked "HC" by pressing "NEW LINE".
- Identify reading on paper tape.
- Enter reading.
- Compare reading entered to displayed limit.
- Enter "*" if reading is above limits.
- Press "NEW LINE."

f. Repeat step e. for:

- Mode I - CO
- Mode II - HC and CO
- Mode III - HC and CO

g. Repeat step e. for Mode I - III CO_2 readings.

Note: There are no limits for CO_2, therefore no "*" entries are to follow any CO_2 entries.

h. Press "ESC+7" and verify that "RESULT" field shows PASS or FAIL.

i. Verify the "MESSAGE" field contains codes if results field marked "FAIL".

j. Enter your ID number in the field marked "ECS ID".

k. Perform ECS checks (Section 5.0) with the following exceptions:

- Refer to Figure 4, page A-6 for ECS Failure Code Identification.
- Enter failure code(s) on the CRT display used in this section.
- Do not EXIT (ESC-6).

l. Press "ESC+7" and verify that results are:

. PASS - only if no ECS code or readings above limits are displayed.

m. Press "ESC+6" (Exit). CRT will revert to PRE LOG-ON state.

9.2 Emission Data Entries Into the Auxiliary Computer

9.2.1 Required Conditions

a. Emission computer and CRT not operational.

b. EMS operational and in BACK-UP mode.

c. Emission computer printer connected to EMS; temporary VIR is used in the printer.

d. Auxiliary computer and CRT operational.

e. All entries to the emission computer are by-passed.

Note: Refer to Section C for detailed operation.

f. Auxiliary CRT in PRE LOG-ON state (Figure 11, page A-21).

9.2.2 LOG-ON

a. Key in the 3-digit queue number.

b. Press "NEW LINE".

c. CRT will display the "LOG-ON SCREEN DISPLAY-BACK-UP" mode (Figure 13, page A-23).

d. Verify queue number displayed is correct.

. If correct, continue.

. If not correct, enter "N" (no) following the displayed question, "DO YOU WISH TO ENTER EMISSION DATA?". Repeat step a.

f. CRT will display the "EMISSION INFORMATION ENTRY SCREEN" (Figure 15 , page A-25).

9.2.3 Data Entries

a. Follow the table below in order to identify the "SOURCE ENTRY" for each field.

Note 1: All fields which have a "SOURCE ENTRY" marked "REG/VEH" (Registration or Vehicle) should be entered with the same guidelines specified in Section B-1.0 (Registration Information and Test Suitability Entry).

Note 2: All fields which have a "SOURCE ENTRY" marked "TEMP VIR-#" should be entered as appears on the Temporary VIR (Figure 17, page B-36).

Note 3: CRT display will be bright on the line where the next entry is expected.

CRT FIELD NUMBER	CRT FIELD NAME	SOURCE ENTRY	C O M M E N T S
1	RESULTS	Temp VIR -#1	Pos.3 manually recorded
2	ECS FAILURE CDS	Temp VIR - 2	" " "
3	EMISSION TEST FAILURE CODES	Temp VIR - 3	-
4	REJECT CODES	see note following table	Pos.1 manually recorded code
5	TEST MODE	Temp VIR - 8	-
6	TEST #	Temp VIR - 9	-
7	DATE	Temp VIR -10	-
8	TIME	Temp VIR -11	-
9	LICENSE PLATE	Reg/Veh	-
10	VEHICLE ID #	Reg/Veh	-
11	YEAR	Reg/Veh	-
12	MAKE	Reg/Veh	-
13	CYLINDERS	Temp VIR -16	-
14	WEIGHT	Temp VIR -17	Always Ø
15	MILEAGE	Reg/Veh	-
16	AI/CAT	Temp VIR -19	-
17	1ST IDLE STND HC	Temp VIR -20	-
18	1ST IDLE STND CO	Temp VIR -21	-
19	1ST IDLE READ HC	Temp VIR -24	Including "*" if present
20	1ST IDLE READ CO	Temp VIR -25	"
21	1ST IDLE READ CO_2	Temp VIR -26	-
22	2500 RPM STND HC	Temp VIR -22	-
23	2500 RPM STND CO	Temp VIR -23	-
24	2500 RPM READ HC	Temp VIR -27	Including "*" if present

CRT FIELD NUMBER	CRT FIELD NAME	SOURCE ENTRY	C O M M E N T S
25	2500 RPM READ HC	Temp VIR -28	Including "*" if present
26	2500 RPM READ CO_2	Temp VIR -29	-
27	2ND IDLE STND HC	Temp VIR -30	-
28	2ND IDLE STND CO	Temp VIR -31	-
29	2ND IDLE READ HC	Temp VIR -33	Including "*" if present
30	2ND IDLE READ CO	Temp VIR -34	"
31	2ND IDLE READ CO_2	Temp VIR -35	-
32	IDLE RPM LIMIT	Temp VIR -32	-
33	IDLE RPM READINGS	Temp VIR -36	-
34	CUST	Reg/Veh	-
35	ECS ID	Temp VIR -38	Pos. 3 Manually recorded
36	EMS ID	Temp VIR -39	-
37	SMOKE	Temp VIR -40	-
38	RETEST	Reg/Veh	-

Note: a) If vehicle is rejected, only the following lines are to be entered: 1, 4-16, 34, 38.

b) When all entries are completed, CRT will display (lower right) "ANY CHANGE?".

c) Verify the displayed entries:

- If no entry changes required, enter "N" (no). CRT will display the queue card test information entry screen.
- If entry changes required, enter "Y" (yes) and the line number where corrections are needed following the question, "WHAT #?".

d) Repeat step c.

FIGURE 17 - TEMPORARY VIR

EMISSION CONTROL SYSTEMS (ECS) FAILURE CODES

FIRST CHARACTER		SECOND CHARACTER	
A	Crankcase Ventilation System	1	Modified; Device or System not ARB-approved
B	Air Injection System	2	Disconnected/By-passed
C	Engine Modification	3	Missing
D	Air Preheat/Air Cleaner	4	Inoperative EGR Valve
E	Ignition Spark Control		
F	Exhaust Gas Recirculation		
G	Fuel Evaporative System		
H	Exhaust Converter		
I	Retrofit Exhaust Control		
J	Retrofit NOX Control		

EMISSION TEST FAILURE CODES

1 Excessive Smoke
2 Perform Low Emission Tune-up
3 Idle RPM Excessive
4 Idle Air Fuel Mixture Rich
5 Misfire at Idle

FINAL RESULTS	ECS FAILURE CODES	EMISSION TEST FAILURE CODE
1	2	3

REJECT REASON

4

QUEUE NO.	STATION NO.	LANE NO.	TEST MODE	TEST NO.	DATE	TIME
5	6	7	8	9	10	11

VEHICLE INFORMATION

LICENSE PLATE	VEHICLE IDENTIFICATION NO.	YEAR	MAKE	CYL	WT	MILEAGE	AI/CAT
12	13	14	15	16	17	18 ,000	19

EMISSION INSPECTION INFORMATION

1ST IDLE

	HC (ppm)	CO (%)	OFFICIAL USE ONLY
STATE STANDARD	20	21	
EMISSION READINGS	24	25	26

2500 RPM

	HC (ppm)	CO (%)	OFFICIAL USE ONLY
STATE STANDARD	22	23	
EMISSION READINGS	27	28	29

2ND IDLE

	HC (ppm)	CO (%)	OFFICIAL USE ONLY
STATE STANDARD	30	31	
EMISSION READINGS	33	34	35

IDLE RPM

LIMIT	32
READING	36

CUST 37 . LI 38 ECS ID 39 EMS ID [ ] QUAL [ ] CERT [ ] RRR [ ] SMOKE 40 RETEST 41

10.0 EGR FUNCTIONAL CHECK

The EGR functional check will be performed on vehicles at Position 4, the propane check position. It will be performed whenever the arrival rate of cars is low enough that the propane inspectors can perform the EGR functional check after the propane and spark timing check without causing the queue outside the station to exceed two cars. The Contractor will consult with the Project Officer as to other circumstances under which the EGR functional check may be omitted. The Project Officer will supply a standard form to be filled in by the inspector whenever a vehicle is given an EGR functional check.

The EGR functional check need only be done on 1973 and later model year light duty vehicles which have as part of their original equipment an exhaust gas recirculation (EGR) system. In addition, any vehicle determined by the inspector to have an EGR system which is disconnected need not be inspected. Such instances will be noted by the inspector on the standard form provided by the Project Officer.

With a tachometer attached and the engine idling in neutral or park gear, the vacuum supply line to the EGR valve will be completely closed off by pinching the vacuum supply hose with a smooth jaw clamping device, i.e.; a pair of smooth jaw pliers. (CAUTION - The use of serrated jaw pliers may rupture the vacuum hose.) The Contractor will keep a limited supply of a variety of vacuum hoses commonly used for EGR systems in the event that a hose is damaged by this procedure. The inspector will note instances of hose damage on the standard form provided by the Project Officer. If the rate of this type of damage becomes significant, the Contractor will notify the Project Officer.

All effort will be made to avoid damage to any hoses, wires, etc. as the result of this check. If in the opinion of the inspector the EGR vacuum supply hose appears to be easily damaged by clamping, then the EGR functional check will

not be performed on that vehicle and its omission will be noted on the form. The standard form, with the appropriate data filled in and the appropriate boxes checked, will be filled out for each vehicle on which an EGR functional check is attempted.

With the vacuum supply line to the EGR valve completely closed off, the inspector will increase the engine speed to 2000 rpm (3000 rpm on GM L-4 engines). While holding the throttle position steady at that engine speed the inspector will release the clamping device and observe and record the resulting change in engine speed in the appropriate space on the form supplied by the Project Officer.

EGR FUNCTIONAL CHECK

(All 1973 and Later Model Year Light Duty Vehicles)

Date: _____

License No: _____

Queue No.: _____

1. Connect tachometer to engine.

2. With engine idling in neutral or park, completely close-off the vacuum supply to the EGR valve by pinching the vacuum supply hose with a smooth jaw clamping device, e.g., pair of smooth jaw pliers. CAUTION - The use of serrated jaw pliers may rupture vacuum hose.

3. Increase engine speed to 2000 rpm.*

4. Hold the throttle steady, release clamp, record engine speed: _____

5. Comments:

- ☐ L-4 General Motors (use 3000 rpm)
- ☐ Other (use 2000 rpm)
- ☐ Vacuum hose not flexable enough to clamp, test aborted
- ☐ Test aborted due to fragile-looking vacuum hose
- ☐ Vacuum hose disconnected, test aborted
- ☐ Vacuum hose damaged during test attempt
- ☐ EGR Vacuum lines inaccessable

*L-4 General Motors vehicles use 3000 rpm

SECTION C - OPERATION PROCEDURES

INTRODUCTION

A. This section will cover the tasks to be performed under four basic operational modes as follows:

B. The operational modes are based on the operation of the three (3) main units in the inspection facility:

- emission computer
- EMS
- auxiliary computer

C. The following table will describe the conditions for each mode.

MODE	EMISSION COMPUTER	E.M.S	AUXILIARY COMPUTER
AUTOMATIC	Operational	Operational	Operational
BACK-UP	-	Operational	Operational
SEMI-AUTOMATIC	Operational	-	Operational
DEFERRED	Operational	Operational	-

1.0 AUTOMATIC MODE

1.1 Required Conditions

a. emission computer - operational

b. EMS - operational

c. auxiliary computer - operational

1.2 The following is the position-related tasks sequence:

1.2.1 Position 1

a. Registration information and test suitability entries (Section B. 1.0).

b. Tire pressure checks (Section B. 2.0).

1.2.2 Position 2

a. Emission testing - Automatic Mode (Section B. 3.1).

1.2.3 Position 3

a. Alignment checks (Section B. 4.0).

b. ECS checks (Section B. 5.0).

1.2.4 Position 4

a. Propane injection checks (Section B. 6.0).

b. Basic timing checks (Section B. 7.0).

c. Queue card test information entry (Section B. 8.0).

d. EGR Functional test (Section B. 10.0).

1.3 Comment

a. Position 4 inspector is to observe VIR; if the code "TTT" appears on the bottom line, Vehicle Failed Timing Checks, hand driver "Special Timing" handout.

b. Position 1 inspector is required to collect returned VIR whenever test is a retest.

c. Position 4 inspector is required to attach queue card to copy of VIR.

d. Position 4 inspector is required to keep above copy until end of day.

2.0 BACK-UP MODE

2.1 Required Conditions

a. emission computer down

b. EMS operational

c. auxiliary computer operational

d. emission computer console printer is connected to EMS, Temporary VIR is used in this printer.

2.2 The following is the position-related task sequence:

2.2.1 Position 1

a. Perform only the "Test Suitability" portion of the Registration Information and Test Suitability entry (Section B. 1.5).

- Use Figure 3, page A-5 for code identification.
- Record Failure code on lower part of queue card - vehicle to proceed directly to Position 4.

b. Tire pressure checks (Section B. 2.0).

2.2.2 Position 2

a. Emission testing Back-up mode (Section B. 3.2).

2.2.3 Position 3

a. Alignment checks (Section B. 4.0).

b. ECS checks (Section B. 5.0).

- Use Figure 4, page A-6, for ECS code identification.
- Record ECS Failure codes on Temporary VIR (block marked "ECS Failure Codes").
- Calculate and record "Final Results" as follows:

  Final Result - PASS if

  i. No ECS Failure code

  ii. HC and CO readings below limit (No "*") for the 2nd Idle.

  Final Result FAIL if ECS codes are present or either HC or CO above limit on 2nd Idle.
- Record your ID# in the block marked "EMSID".

2.2.4 Position 4

a. Propane injection checks (Section B. 6.0).

b. Basic timing checks (Section B. 7.0).

c. Manually-entered emission data - into auxiliary computer (Section B. 9.2).

d. Queue card test information entries (Section B. 8.0).

e. EGR functional checks (Section B. 10.0).

2.2.5 Comment

a. Position 4 inspector is to observe VIR. If the code "TTT" appears on the bottom line, Vehicle Failed Timing Checks. Hand driver "Special Timing" handout.

b. Position 4 inspector is required to collect returned VIR.

c. Position 4 inspector is required to attach queue card and Temporary VIR to copy of Final VIR.

d. Position 4 inspector is required to keep above copy until end of day.

3.0 SEMI-AUTOMATIC MODE

3.1 Required Conditions

a. emission computer - operational

b. EMS down

c. auxiliary computer operational

d. emission testing is performed with the "CEA-600".

3.2 The following is the position-related task sequence:

Position 1

a. Registration information and test suitability entries (Section B. 1.0).

b. Tire pressure checks (Section B. 2.0).

Position 2

a. Emission testing - refer to Operating Procedure for "CEA-600".

Position 3

a. Alignment checks (Section B. 4.0).

b. Manually-entered emission data - into emission computer (Section B. 9.1).

Note: ECS checks and entries are part of Section 9.1 in this operational mode.

Position 4

a. Propane injection checks (Section B. 6.0).

b. Task timing checks (Section B. 7.0).

c. Queue card test information entries (Section B. 8.0).

d. EGR functional checks (Section B. 10.0).

3.3 Comments

a. Position 4 inspector is to observe VIR. If the code "TTT" appears on the bottom line, Vehicle Failed Timing Checks, hand driver "Special Timing" handout.

b. Position 4 inspector is required to collect returned VIR.

c. Position 4 inspector is required to attach queue card to copy of VIR.

d. Position 4 inspector is required to keep above copy until end of day.

4.0 DEFERRED MODE

4.1 Required Conditions

a. emission computer operational

b. operational

c. auxiliary computer down

d. VIR printer is connected to the emission computer at Position 3. Temporary VIR is used.

4.2 The following is the position-related task sequence:

Position 1 - Position 3

a. Perform tasks in the same order as Automatic Mode (Section C. 1.0).

Note: When ECS check (Section B. 5.0) is completed, Temporary VIR will be printed via the Position 3 printer.

Position 4

a. Propane injection checks (Section C. 6.0).

b. Basic timing checks (Section C. 7.0).

c. EGR functional test (Section B. 10.0).

d. Position 4 inspector is to perform the following additional tasks:

- Inform driver of equipment malfunction and notify him that Final Test Results will be mailed.
- Request driver to write his mailing address on the mailing label.
- Collect returned VIR.
- Attach mailing label to Temporary VIR, Queue Card (and returned VIR).
- Keep above paperwork until the end of the day.

4.3 Prior Test VIR Handling

This procedure is to be followed when the auxiliary computer is operational and available for prior test VIR printing and mailing.

a. Perform manually-entered emission data into auxiliary computer (Section B. 9.2).

b. Perform queue card test information entries (Section B. 8.0).

c. Place white copy of VIR and all handout material in an envelope.

d. Place driver's address label and stamp on envelope and mail.

e. Attach copy of VIR to test paperwork.

APPENDIX #1

VEHICLE-MAKE ABBREVIATION LIST

The following table defines the vehicle make and the corresponding code to be entered in the Make Field (Section A., 1.0, number 2.).

DOMESTIC CARS

MAKE	ABBV. CODE
AMC	AMC
RAMBLER	RAMB
AMX	AMX
REBEL	REBE
AMERICAN	AMER
AMBASSADOR	AMBA
JAVELIN	JAVE
GREMLIN	GREM
HORNET	HORN
MATADOR	MATA
PACER	PACE
BUICK	BUIC
ELECTRA	ELEC
RIVIERA	RIVI
LE SABRE	LESA
SKYHAWK	SKYH
SPECIAL	SPEC
SKYLARK	SKYL
APOLLO	APOL
REGAL	REGA
D-50 PICKUP	DODM
DODGE	DODG
DART	DART
CHALLENGER	CHAL
CHARGER	CHAR

MAKE	ABBV. CODE
CADILLAC	CADI
CHEVROLET	CHEV
CAMARO	CAMA
CHEVELLE	CHEL
CORVETTE	CORV
NOVA	NOVA
MALIBU	MALI
MONTE CARLO	MONT
VEGA	VEGA
MONZA	MONZ
CHEVETTE	CHEV
CHRYSLER	CHRY
CROWN	CORW
IMPERIAL	IMPE
LE BARON	LEBA
CORDOBA	CORB
MONI	OMNI
CHECKER	CHEC
MARATHON	MART
TAXI	TAXI
STUDEBAKER	STUD
CHEVROLET TRUCK	CHEV
DODGE TRUCK	DODG

DOMESTIC CARS (cont'd)

M A K E	ABBV. CODE
ASPEN	ASPE
MONACO	MONC
FORD	FORD
MAVERICK	MAVE
FALCON	FALC
MUSTANG	MUST
TORINO	TORI
PINTO	PINT
THUNDERBIRD	THUN
GRANADA	GRAN
FAIRMONT	FAIR
FIESTA	FIES
MERCURY	MERC
COMET	COME
COUGAR	COUG
ZEPHER	ZEPH
MONTEGO	MONG
BOBCAT	BOBC
MONARCH	MONA
MARQUIS	MARQ
LINCOLN	LINC
OLDSMOBILE	OLDS
OMEGA	OMEG
CUTLASS	CUTL
TORONADO	ORO
STARFIRE	STAR

M A K E	ABBV. CODE
FORD TRUCK	FORD
GMC TRUCK	GMC
INTERNATIONAL TRUCK	INTE
JEEP TRUCK	JEEP
PLYMOUTH TRUCK	PLYM
AUSTIN AMERICA	AUSA
AUSTIN HEALEY SPRINT	AUSH
AUSTIN MARINA	AUSM
ALFA ROMEO	ALFA
AUDI	AUDI
ARROW	ARRO
BMW	BMW
CAPRI	CAPR
CITROEN	CITR
COLT	COLT
CORTINA	CORT
COURIER	COURT
CRICKET	CRIC

DOMESTIC CARS (Cont'd)

M A K E	ABBV. CODE	M A K E	ABV. CODE
PONTIAC	PONT	PLYMOUTH	PLYM
TEMPEST	TEMP	VALIANT	VALI
FIREBIRD	FIRE	BARRACUDA	BARR
VENTURA	VENT	BELVEDERE	BELV
LE MANS	LEMA	FURY	FURY
ASTRE	ASTR	DUSTER	DUST
SUNBIRD	SUNB	VOLARE	VOLA
PHOENIX	PHOE	HORIZON	HORI
		CHAMP	CHAM

FOREIGN CARS

DATSUN	DATS	PEUGEOT	PEUG
DATSUN TRUCK	DATS	PANTERA	PANT
FIAT	FIAT	PORSCHE	PORS
HONDA	HOND	RENAULT	RENA
JAGUAR	JAGU	ROLLS	ROLL
JENSEN-HEALEY	JENH	BENTLY	BENT
JENSEN-INTERCEPTOR	JENI	ROVER	ROVE
LANCIA	LANC	SAAB	SAAB
LOTUS	LOTU	SIMCA	SIMC
LUV	LUV	SUBARU	SUBA
MAZDA TRUCK	MAZD	TOYOTA TRUCK	TOYO
MAZDA	MAZD	TOYOTA	TOYO
MERCEDES-BENZ	MERB	TRIUMPH	TRIU
MG	MG	VOLKSWAGON	VOLK
OPEL	OPEL	VOLVO	VOLV

NOTE: Remember - above entries are to be followed with

1) "T" for trucks
2) "V" for vans

APPENDIX "B"

EPA/HOUSTON DEMO PROGRAM

PERIODIC MAINTENANCE MANUAL

DAILY
*
WEEKLY
*
MONTHLY

PREPARED BY:

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RELEASE DATE: 2/1/80

INTRODUCTION

1. This manual covers the step-by-step procedures for the periodic maintenance to be performed in the EPA/Houston Demo Program.

2. Whenever a scheduled maintenance is performed, the appropriate check list is to be initialed and approved by the Operations Administrator.

3. Each scheduled periodic maintenance check list is unique and does not eliminate the performance of other check lists. Example: Performing Monthly periodic maintenance does not exclude the performance of the Weekly periodic maintenance and the Daily periodic maintenance.

EPA/HOUSTON DEMO PROGRAM

DAILY CHECK LIST

Initial

E.M.S.

1. Check tape load operation . . . . . _____
2. Check Maintenance Relay Panel for proper indications . . . . _____
3. Check sample system for proper flow . . . . . _____
4. Check for proper gas and ambient temperatures . . . . . _____
5. Check for proper filter and gas pressure . . . . . _____

D.E.C.

1. Vacuum all LA-35 and LA-36 printers . . . . . _____
2. Check and adjust VIR forms line-out on printer . . . . . _____

CLAYTON EQUIPMENT

1. Check louvers for proper operation . . . . . _____

MISCELLANEOUS

1. Vacuum all CRTs and check for proper operation . . . . . _____
2. Check CO monitor operation . . . . . _____
3. Check probes and external hoses . . . . . _____
4. Check facility air systems . . . . . _____
5. Drain any condensation from air compressor . . . . . _____

C O M M E N T S: _____

_____

_____

Date performed: __/__/__ By: _____

Approved: _____

STEP	PROCEDURE	INDICATION
E.M.S. 1.	Check tape load operation	
	a. Insert the tape into the drive with the label facing away from the EMS, and the notch at the top off center to the right.	If the tape is not installed properly, the small tape drive wire will not fall into the tape cassette notch on top.
2.	Check Maintenance Relay Panel	"ON-EMISSIONS PROCESSOR OK". LED should be on. All other LEDs must be off. All switches should be in the "AUTO" position. The "LOUVER MANUAL" switch should be in the "CLOSE, NONE" position.
3.	Check sample system for proper flow	
	a. Load latest revision of "Lane" tape. *Note:* Be sure the "MODE' switch on the EMS Relay Maintenance Panel is in the "AUTO" position. If not, all system data will have to be manually entered.	
	b. "WAKE UP" EMS by pressing #1, 2, 3, 4, 5 pushbuttons.	EDEP will display blank blank "2345"
	c. Press "ENTER" pushbutton.	EDEP will display "IDLE" " PR" "01.07" (or latest tape revision)
	d. Press "ENTER" pushbutton.	EDEP will display "SYS" blank lane ID#
	e. Press "ENTER" pushbutton.	EDEP will display "DATE" month day and year
	f. Press "ENTER" pushbutton.	"ENTER QUEUE NUMBER". LED will light on EDEP.
	g. Press #9, 9, 6, 6 pushbuttons	EDEP will display blank blank "9966"
	h. Press "ENTER" pushbutton.	EDEP will display "FUNC" blank blank
	i. Press #9 pushbutton.	EDEP will display "FUNC" blank " 9"

STEP	PROCEDURE	INDICATION
E.M.S.		
3.	Check sample system (cont'd)	
	j. Press "ENTER" pushbutton *Note:* The difference between Gas and Filter pressure should be within 1.0 inches of mercury (in. Hg.). Normal readings should be between 29.0 and 31.0 in. Hg.	EDEP will display blank Gas pressure Filter pressure Pumps will shut off.
	k. Press #2, 3, 8, and "SMOKE" pushbuttons.	EDEP will display approximately 18.5 in. Hg. Filter pressure in window #3. FLOW INDICATORS will indicate 8.0 ± 1.0 SCFH. VACUUM GAUGE will indicate approximately 10.5 in. Hg.
	l. Press #2, 3, 8, 9 push-buttons.	EDEP will indicate filter pressure in window #3. It should not change more than 0.5 in. Hg. from the previous step. *Note:* If the conditions in steps "K." and "l." cannot be met, refer to step 5. "Check for proper filter and gas pressure".
4.	Check for proper gas and ambient temperatures	
	a. Press #0 pushbutton.	"ENTER QUEUE NUMBER" LED will light on the EDEP.
	b. Press #9, 9, 6, 6 push-buttons.	EDEP will display "9966" in window #3.
	c. Press "ENTER" pushbutton.	EDEP will display "FUNC" in window #1.
	d. Press #1 pushbutton.	EDEP will display "1" in window #3.
	e. Press "ENTER" pushbutton.	EDEP will display "DISP" in window #1.
	f. Press #1 pushbutton.	EDEP will display "1" in window #3.
	g. Press "ENTER" pushbutton.	EDEP will display "CHAN" in window #2.
	h. Press #1 and 6 pushbuttons.	EDEP will display #16 in window #3.
	i. Press "ENTER" pushbutton.	EDEP will display "GAS TEMPERATURE" in window #1.
	j. Press #1 pushbutton.	EDEP will display "DISP" in window #1.

STEP	PROCEDURE	INDICATION
E.M.S.		
4.	Check for proper gas ...(cont'd)	
	k. Press #2 pushbutton.	EDEP will display "2" in window #3.
	l. Press "ENTER" pushbutton.	EDEP will display "CHAN" in window #2.
	m. Press #5 pushbutton.	EDEP will display "5" in window #3.
	n. Press "ENTER" pushbutton.	EDEP will display GAS TEMPERATURE in window #1, and AMBIENT TEMPERATURE in window #2.
	Note: Gas temperature should be approximately 33°C and the ambient temperature should be approximately 26°C (after the EMS has stabilized). A change of more than 8°C should be reported to Operations Administrator.	
5.	Check for proper filter and gas pressure	
	a. Press #1 pushbutton.	EDEP will display "DISP" in window #1.
	b. Press #1 pushbutton.	EDEP will display "1" in window #3.
	c. Press "ENTER" pushbutton.	EDEP will display "CHAN" in window #2.
	d. Press #1 pushbutton.	EDEP will display "1" in window #3.
	e. Press "ENTER" pushbutton.	EDEP will display FILTER PRESSURE in window #1.
	f. Press #1 pushbutton.	EDEP will display "DISP" in window #1.
	g. Press #2 pushbutton.	EDEP will display "2" in window #3.
	h. Press "ENTER" pushbutton.	EDEP will display "CHAN" in window #2.
	i. Press #1 and 5 pushbuttons.	EDEP will display "15" in window #3.
	j. Press "ENTER" pushbutton.	EDEP will display FILTER PRESSURE in window #1, and GAS PRESSURE in window #2.
	Note: Filter pressure should be between 16 and 22 in. Hg. Gas pressure should be between 27 and 32 in. Hg. If not, report the out-of-tolerance condition to Operations Administrator.	

STEP	PROCEDURE	INDICATION
D.E.C		
1.	Vacuum all LA-35 & LA-36 printers	
	a. Turn printers off.	
	b. Vacuum keyboard thoroughly; be sure not to vacuum up any keys.	
	c. Turn printer on. All control keys should be up except "300" under "BAUD RATE".	The "STD. CHARA" LED should be "ON" for the LA-36 only. All other LEDs should be "OFF" on both type printers.
2.	Check and adjust VIR forms line-out on printer	
	a. The VIR should have one empty paper feed hole past the paper feed tractor on both sides.	
CLAYTON		
1.	Check louvers for proper operation	
	a. Load "Lane" tape.	
	b. Perform "WAKE UP" procedure.	"ENTER QUEUE NUMBER" LED will light on EDEP on completion of "WAKE UP".
	c. Press #9, 9, 6, 6 pushbuttons.	EDEP will display blank blank "9966"
	d. Press "ENTER" pushbutton.	EDEP will display "FUNC" blank blank
	e. Press #4 pushbutton.	EDEP will display "FUNC" blank " 4"
	f. Press "ENTER" pushbutton.	EDEP will display "DISC" blank blank
	g. Press #1 and 1 pushbuttons.	EDEP will display "DISC" blank " 11"
	h. Press "ENTER" pushbutton.	EDEP will display " 11" "s-r " blank

STEP	PROCEDURE	INDICATION
CLAYTON		
1.	Check louvers ... (cont'd)	
	i. Press #1 pushbutton.	EDEP will display " 11" "s-r " " 1"
	J. Press "ENTER" pushbutton.	EDEP will go blank in all windows. Louver "A" will open slowly, it should take about 3 seconds.
	k. Press #4 pushbutton.	EDEP will display "DISC" blank blank
	l. Press #1 and 1 pushbuttons.	EDEP will display "DISC" blank " 11"
	m. Press "ENTER" pushbutton.	EDEP will display " 11" "s-r " blank
	n. Press #2 pushbutton.	EDEP will display " 11" "s-r " " 2"
	o. Press "ENTER" pushbutton.	EDEP will go blank. Louver "A" will close slowly, about 2 seconds.
	p. Press #0 pushbutton.	"ENTER QUEUE NUMBER" LED will light on EDEP.
	q. Repeat steps c. - p. for louver "B". Press #1 and 2 pushbuttons in steps g. and l.	EDEP will display "12" in all steps where "11" was previously displayed.
	Note: Check each louver pit for evidence of oil leaks as this procedure is accomplished.	
MISCELLANEOUS		
1.	Vacuum all CRTs and check for proper operation	
	a. Make sure the station processor is initialized and lane operations started.	
	b. Thoroughly vacuum the CRT using the brush attachment. Include the screen and all of the cover as well as the keyboard.	
	c. Turn the brightness up.	CRT will display "QUEUE----" in the upper left corner.

STEP	PROCEDURE	INDICATION
MISC.		
1.	Vacuum all CRTs ... (cont'd)	
	d. Press #9, 9, 9 pushbutton.	CRT will display "QUEUE 9 9 9 _ "
	e. Press return to Newline pushbutton.	CRT will display registration format. The format should nearly cover the entire screen
	f. Press "ESC" and #8 pushbuttons.	CRT will momentarily display "CANCEL" in the upper right corner. The screen will then go blank except for "QUEUE _ _ _ _ " in the upper right corner.
2.	Check CO monitor operation	
	a. Check operate light.	Green Operate LED should be illuminated.
	b. Put "OPERATE/ZERO" switch in "ZERO" position.	Green Operate LED should go off.
	c. Put "OPERATE/ZERO" switch in "OPERATE" position.	Meter needle should jump slightly. Green operate LED should go on.
	d. Put "CALIBRATE/OPERATE" valve in "CALIBRATE position.	Place your finger over the bottom port of valve and feel for slight suction.
	e. Put "CALIBRATE/OPERATE" valve in "OPERATE" position.	
3.	Check probes and external hoses	
	a. Check probes for cracks and breaks.	
	b. Check flexible tips by grasping the base and applying a slight twisting pressure to tip.	The tip should not turn.
	c. Check non-flex tips by grasping the base below union coupler, then apply slight twisting pressure to tip.	The tip should not turn.
	d. Check EMS hoses, extension hoses, and dual hoses for loose fittings, cracks or soft spots.	

STEP	PROCEDURE	INDICATION
MISC.		
4.	Check facility air systems	
	a. Check station A/C.	Temperature should be at a reasonable comfortable setting.
	b. Check each exhaust fan by turning them on separately, then off.	Listen for the sound of the fan starting.
	c. Turn on all exhaust fans, one at a time.	Check all breakers after fans are on to make sure none are tripped.
5.	Drain any condensation from air compressor	
	a. Open compressor outside	Watch outside drain until the water stops draining.

EPA/HOUSTON DEMO PROGRAM

WEEKLY CHECK LIST

		Initial
E.M.S.		
1.	Vacuum air vapor condenser	_____
2.	Vacuum all easily accessible areas in EMS cabinet	_____
3.	Check EMS A/C	_____
4.	Perform sample system leak check	_____
5.	Perform leak check on calibration system and solenoid valve #5	_____
6.	Perform EMS health check	_____
7.	Check all solenoids using lane tape	_____
8.	Calibrate HC/CO and CO_2 analyzers	_____
9.	Perform RPM check	_____
D.E.C.		
1.	Vacuum inside printers	_____
MISCELLANEOUS		
	Check oil in air compressor	_____

C O M M E N T S: _____

_____

_____

Date performed: ___/___/___ By: _____

Approved: _____

STEP	PROCEDURE	INDICATION
E.M.S.		
1.	Vacuum air vapor condenser	
	a. Turn EMS off.	Red light in power button will extinguish. Fan in condenser will stop.
	Note: In all of the following steps extreme caution must be exercised to prevent bending the fan blades or the condenser fins with your hands or the vacuum cleaner accessories.	
	b. Turn off the EMS A/C unit.	A/C will stop.
	c. Open all EMS doors.	
	d. Using the vacuum's soft brush accessory, vacuum fins and fan blades and condenser.	Fan blades and condenser fins will be free of dust and dirt.
2.	Vacuum all easily accessible areas in EMS cabinet	All easily accessible areas will be free of dust and dirt.
	a. After completion, turn EMS back on and reload Lane tape.	
3.	Check EMS A/C	
	a. Check IDU processor mother board for white crystalized deposits.	
	b. Check for puddles or signs of dried up puddles.	
4.	Perform sample system leak check	
	Note: Ensure the latest revision of the "Lane" tape is loaded and the "ENTER QUEUE NUMBER" LED on the EDEP is illuminated before proceeding.	
	a. Remove sample system probe assembly from the quick-disconnect port on the sample hose and insert the probe hose plug.	

STEP	PROCEDURE	INDICATION
E.M.S.		
4.	Perform sample system ...(cont'd)	
	b. Press #9, 9, 6, 6 pushbuttons.	EDEP will display blank blank "9966"
	c. Press "ENTER" push-button.	EDEP will display "FUNC" blank blank
	d. Press #9 pushbutton.	EDEP will display "FUNC" blank " 9"
	e. Press "ENTER" push-button.	EDEP will display blank Gas pressure Filter pressure *Note:* Gas and Filter pressure should be within 27-32 in. Hg. and the pumps should be off.
	f. Press #2, 3, 8, and "SMOKE" pushbuttons.	EDEP will display blank Gas pressure Filter pressure *Note:* Gas pressure will remain at the previous reading and Filter pressure will decrease to approximately 4-6 in. Hg. If these readings are not within limits, correct the leak.
	g. Allow vacuum gauge on EMS Filter Panel to stabilize.	Vacuum gauge on filter panel will indicate 25 $\pm$ 1 in. Hg.
	h. Press "SMOKE" pushbutton.	EDEP will display blank Gas pressure Filter pressure Both pumps will shut off. *Note:* Gas pressure should remain steady while Filter pressure slowly increases as the vacuum gauge reading decreases.
	i. Monitor the vacuum gauge on the filter panel.	Vacuum gauge will indicate a maximum change of 3 in. Hg. in 15 seconds. *Note:* If the rate of change is greater than 3 in. Hg. in 15 seconds, correct the leak.

STEP	PROCEDURE	INDICATION
E.M.S.		
4.	Perform sample system ...(cont'd)	
	j. Remove probe plug from sample system quick-disconnect.	
	k. Press "SMOKE" pushbutton.	EDEP will display blank Gas pressure Filter pressure
	l. Press #0 pushbutton.	EDEP will go blank except the "ENTER QUEUE NUMBER" LED will light.
5.	Perform leak check on calibration system and solenoid valve #5	
	a. Turn BV 1, (N_2/Ambient Air) to the N_2 position.	
	b. Plug the portable vacuum gauge into the "ZERO GAS" port.	Portable vacuum gauge should read approximately 20 in. Hg.
	c. Press #9, 9, 6, 6 pushbuttons.	EDEP will display blank blank "9966"
	d. Press "ENTER" pushbutton.	EDEP will display "FUNC" blank blank
	e. Press #9 pushbutton.	EDEP will display "FUNC" blank " 9"
	f. Press "ENTER" pushbutton.	EDEP will display blank Gas pressure Filter pressure *Note:* The pump will stop; Gas pressure (about 27-32 in. Hg.) and Filter pressure (about 9.5 in. Hg.) will be displayed. Filter pressure should slowly increase while vacuum gauge slowly decreases. Vacuum or Filter pressure should not change more than 3 in. Hg. in 15 seconds.
	g. Remove the portable vacuum gauge from the "ZERO GAS" port, and remove the vacuum from the gauge by opening the plunger.	Portable vacuum gauge will indicate zero.

STEP	PROCEDURE	INDICATION
E.M.S.		
5.	Perform leak check ... (cont'd)	
	h. Plug the portable vacuum gauge in the "CAL GAS" port.	
	i. Turn BV 1 to Ambient Air position.	Filter pressure will go to about the same reading as gas pressure.
	j. Press "SMOKE" pushbutton.	
	k. Turn BV 1 to the N_2 position.	Portable vacuum gauge should stay at zero while filter pressure goes back to about 9.5 in. Hg.
	l. Press #0 pushbutton and turn BV 1 to ambient air position.	
6.	Perform E.M.S. Health Check	
	Using "EDEP", check all analog channels for proper readings (see Table #1).	
	a. Press #9, 9, 6, 6 pushbuttons.	EDEP will display blank blank "9966"
	b. Press "ENTER" pushbutton.	EDEP will display "FUNC" blank blank
	c. Press #1 pushbutton.	EDEP will display "FUNC" blank " 1"
	d. Press "ENTER" pushbutton.	EDEP will display "DISP" blank blank
	e. Press #1 pushbutton.	EDEP will display "DISP" blank " 1"
	f. Press "ENTER" pushbutton.	EDEP will display blank "CHAN" blank
	g. Press #1 pushbutton.	EDEP will display blank "CHAN" " 1"
	h. Press "ENTER" pushbutton.	EDEP will display Filter pressure blank blank

STEP	PROCEDURE	INDICATION
E.M.S.	Perform E.M.S. Health ...(cont'd)	
	i. Repeat step d. - h. for each channel. Substitute #1 for "ENTER" in step d. when repeating.	*Note:* See Table 1 for limits on all channels.
	j. Press #0 pushbutton after all channels are checked.	"ENTER QUEUE NUMBER" LED will light.

TABLE 1

HEALTH CHECK LIMITS

CHANNEL	A / D	NAME	LIMITS
12	0001	CAL VOLTAGE	OPEN
5	0002	AMBIENT TEMPERATURE	$16^{o}C$ - $32^{o}C$
16	0003	GAS TEMPERATURE	$0^{o}C$ - $45^{o}C$
15	0004	GAS PRESSURE	27 - 32 in. Hg.
1	0005	FILTER PRESSURE	16 - 22 in. Hg.
4	0006	HC REFERENCE VOLTAGE	7.5 - 9.0 V
10	0007	CO REFERENCE VOLTAGE	7.5 - 9.0 V
8	0008	CO_2 REFERENCE VOLTAGE	7.5 - 9.0 V
3	0009	HC SAMPLE VOLTAGE	6.8 - 9.5 V
2	000A	CO SAMPLE VOLTAGE	6.8 - 9.5 V
7	000b	CO_2 SAMPLE VOLTAGE	6.8 - 9.5 V
9	000C	NO_x CONCENTRATION	0 - 100 ppm
6	000d	AMBIENT CO	0 - 350 ppm

7.	Check all solenoids using Lane tape	
	a. Press #9, 9, 6, 6 pushbuttons	EDEP will display blank blank "9966"
	b. Press "ENTER" pushbutton.	EDEP will display "FUNC" blank blank

STEP	PROCEDURE	INDICATION
7.	Check all solenoids ... (cont'd)	
	c. Press #9 pushbutton.	EDEP will display "FUNC" blank " 9"
	d. Press "ENTER" pushbutton.	EDEP will display blank Gas pressure Filter pressure
	e. Press #1 thru #9 and "OVERRIDE" for #10, "CLEAR" for #11, and "ABORT" for #12 pushbuttons, twice each, ensuring that each solenoid energizes or de-energizes with each push of each button.	*Note:* Ensure that pumps are OFF, if not, press "SMOKE" to shut pumps off. For solenoids 1 & 6 and 3 & 7 and 9 & 13, which operate together you must put your hand on each solenoid to make sure you feel it operate.
	f. Press #0 pushbutton.	EDEP will go blank and the "ENTER QUEUE NUMBER" LED will be illuminated.

8. Calibrate HC/CO and CO_2 Analyzers Procedures

8.1 General Information

a. Span Gas Values

The approximate span gas values utilized are as follows:

HC - 3100 ppm Propane (balance is N_2)

CO - 8% (balance N_2)

CO_2 - 7% (balance N_2)

Note: These values are for reference only. The actual named concentration is used for calibration.

b. "NAMED" Calibration Gas Values

The values to be used during span calibration checks are the values that appear on gas naming facility labels attached to each HC and CO cylinder.

Note: Do not use any cylinders (HC and CO) if labels are missing or mutilated; notify Supervisor if this occurs.

c. Cylinder Bottle Pressure

IMPORTANT ! Span gas cylinders shall not be utilized if cylinder pressure is below 200 psi.

STEP	PROCEDURE	INDICATION
	d. Equipment Required	
	HC - Named Gas CO - Named gas CO_2 - 7% gas	N_2 - 99.99% gas Regulators and gas lines Lane tape
8.2	a. Obtain Span Calibration form.	
	b. Obtain and record gas bottle serial numbers and concentrations	
	c. Turn ON all gas cylinders connected with regulators.	All regulator gauges will indicate a minimum of 3 psi and a maximum of 5 psi.
	d. Obtain and record analyzer serial numbers and HC analyzer conversion factor. *Note:* The conversion factor may be obtained from the front panel of the HC/CO analyzer. If more than one label number is present, notify Supervisor. This factor will be recorded as a three-digit decimal number, less than one; e.g., (.XXX).	
	e. Calculate and record the HC analyzer Hexane reading. *Note:* This reading will be the measured HC displayed during Span check or calibration. Calculate the HC analyzer Hexane reading multiplying the named Propane cylinder (bottle) concentration times the HC analyzer conversion factor. *Example:* Cylinder "Names" concentration 3050 ppm Hexane & conversion factor .495: 3050 X .495 = 1509.75 Record rounded number 1510; use no decimal point and round to the nearest number.	
	f. Enter Queue number 9999 and press "ENTER" pushbutton. *Note:* Lane tape must be loaded and "ENTER QUEUE NUMBER" LED will be on.	EDEP will display "HC-C" blank Concentration

STEP	PROCEDURE	INDICATION
E.M.S. 8.2		
	g. Press "ENTER" pushbutton.	EDEP will display "HC-A" blank Ana. ser. no.
		Note: If displayed analyzer serial number differs from the number in step 4., notify Supervisor before proceeding to next step. All three flow meters will indicate 8 ± 1 SCFH.
	h. Position the AMBIENT/N_2 valve on the EMS to the N_2 position.	
	Note: If flow meters do not indicate 8 ± 1 SCFH, adjust needle valve labeled N_2 to obtain proper reading.	
	i. Press "ENTER" pushbutton.	EDEP will display "HC-O" "FLO " "ADJ "
	j. Wait approximately 60 seconds.	EDEP will display "HC-O" "FLO " "RDY?"
	Note: Verify that analyzer has been in flow mode for at least 30 seconds before proceeding to step k.	*Note:* "RDY?" display asks calibrator if gas flow is correct and is EMS ready for next step.
	k. Press "ENTER" pushbutton.	EDEP will display "HC-S" "FLO " "ADJ "
	Note: Turn appropriate manual valve to full ON position and verify that proper flow meter(s) indicates 8 ± 1 SCFH. If indication is not within limits, adjust needle valve directly below manual valve for proper indication.	
	l. Wait approximately 60 seconds.	EDEP will display "HC-S" "FLO " "RDY?"

STEP	PROCEDURE	INDICATION
E.M.S. 8.2	(cont'd)	
	m. Press "ENTER" pushbutton.	EDEP will display "HC-RESULTS CODE" "ANALYZER ZERO READING"
	Note: Record readings on Span Calibration form for analyzer under test. If adjustment of "ANALYZER SPAN READING" is required, record reading before and after adjustment.	*Note:* Result code denotes ANALYZER status as follows: "P" = Analyzer readings are within HTS required limits. "H" = Analyzer readings exceed HTS limits. "F" = Analyzer readings exceed State limits.
		Note: Analyzer zero reading must be "0000" If any other reading is displayed, notify Supervisor immediately before proceeding.
		Note: If Results Code is "H" or "F", refer to section 8.3 for adjustment procedures.
	n. Repeat steps a. thru m. for CO_2 Analyzers except do not enter "9999". Press "ENTER" key only. Step 7. will not be displayed during CO Analyzer check.	
	o. After CO_2 Analyzer has been checked, press "ENTER" key.	EDEP will momentarily display "DELY" blank blank
		Note: "DELY" denotes EMS transfer of calibration data to station processor. EDEP "ENTER QUEUE NUMBER" indicator will be illuminated.
	p. Close all manual valves on EMS.	
	q. Position AMBIENT/N_2 manual valve on the EMS to AMBIENT position.	
	r. Close all gas cylinder valves.	
	s. Record cylinder pressures on Calibration form.	

STEP	PROCEDURE	INDICATION
Analyzer Adjustment Procedures		
8.3	*Note:* The following procedures are to be performed only when the results obtained in section 8.2 step m. are either "H" or "F".	
	a. If result code is "H" and adjustment is to be performed, press "CLEAR" pushbutton. If result code is "F" and adjustment is to be performed, press "ENTER" key.	EDEP will display "HC-0" blank blank *Note:* After approximately 30 seconds the EDEP will automatically display the following: "HC-0" "RESULTS CODE" "VALUE OF ANALYZER ZERO READING" If value of Analyzer Zero Reading is other than "0000", check with Supervisor before proceeding to step b.
	b. Press "ENTER" key on EDEP.	EDEP will display "HC-S" blank blank After approximately 30 seconds, the EDEP will display the following: *Note:* "HC-S" "RESULTS CODE" "ANALYZER SPAN GAS READING" The analyzer is now in the ADJUST mode. Proceed to step c.
	c. Adjust the appropriate analyzer front panel potentiometer until the "Analyzer Span Gas Reading" displayed in step 6. is the same concentration value for calibration as the value recorded on the Span Calibration form.	EDEP will display "HC-S" "RESULTS CODE" "ANALYZER SPAN GAS READING" *Note:* As adjustment is made, "Analyzer Span Gas Reading" will approach the desired concentration value. If value before is within HTS limits, the Results code displayed will change to "P".
	d. Press "ENTER" key on EDEP.	EDEP will display "DELY" blank blank

STEP	PROCEDURE	INDICATION
E.M.S.		
	d. (cont'd)	*Note:* "DELY" display denotes EMS check of the Calibration adjustment. In this mode the EMS will automatically flow Zero and Span gases. The EMS will remain in this mode for approximately 60 seconds and then display the following: "HC-RESULTS CODE" "ANALYZER ZERO READING" "ANALYZER SPAN GAS READING" *Note:* Verify that the results code reading is "P". If not, repeat steps a. thru d. above until a "P" results code is obtained.
	Note: Steps a thru d are to to be performed for each analyzer under test that displays an "H" or "F" when performing step m., section 8.2.	
	e. Press "ENTER" key on EDEP.	EMS will proceed with Span Calibration.
9.	Perform RPM checks	
	Using EDEP and TCP, perform the following:	
	a. Place RMP (Relay Maintenance Panel) mode switch in the "BACKUP" position.	"READY" light will be illuminated on the TCP.
	b. Turn off DEC printer on the lane on which you are performing this test.	None (except STD. CHARA.). LED will extinguish on LA-36 printers.
	c. Press #9, 9, 9 pushbuttons.	EDEP will display blank blank " 999" TCP - "READY" light on.
	d. Press "ENTER" pushbutton.	EDEP will display " 999" "00__" " ___" TCP "READY & BACKUP" lights will be on.
	e. Press "CLEAR" pushbutton.	EDEP will display " 999" blank blank TCP - "READY & BACKUP" lights on.

STEP	PROCEDURE	INDICATION
E.M.S.		
9.	Perform RPM checks (cont'd)	
	f. Press #7, 7, 0, 0, 8, 0 pushbuttons.	EDEP will display " 999" " 77" "0080" TCP - "READY & BACKUP" lights on.
	g. Press "ENTER" pushbutton.	EDEP will go blank and "ENTER INSP. NO./CODE" LED will light. TCP - "READY & BACKUP" lights on.
	h. Press #5 pushbutton.	EDEP will display blank blank " 5" TCP - "READY & BACKUP" lights on.
	i. Press "ENTER" pushbutton.	EDEP "ENTER LOUVER" LED will light. TCP - "READY & BACKUP" lights on.
	j. Press "ENTER" pushbutton.	EDEP will go blank. TCP - "TESTING, SET SPEED, & BACKUP" lights will come on.
	k. Turn on the Portable Variable Tach Generator and hook up and set for 2500 rpm range.	EDEP "SYSTEM ERROR" LED will light. TCP - "SET SPEED" light will go off and "SAMPLE DILUTION" will come on.
	l. Press "OVERRIDE" pushbutton.	EDEP "ENTER INSP. NO./CODE" LED will light. TCP - "TESTING, SAMPLE DILUTION & BACKUP" lights will be on.
	m. Press #5 and "ENTER" pushbuttons.	EDEP will go blank. TCP - "SAMPLE DILUTION" light will go off and "SET SPEED" numbers and "ACTUAL SPEED" numbers will come on.
	n. Immediately switch the Tach Generator to 3000 rpm range.	TCP "SET SPEED" light will come on.
	o. Vary the Tach Gen settings back and forth while watching the TCP number readout. *Note:* Do not stay on 2500 rpm range long or TCP readout will go off.	TCP numbers should follow Tach Gen settings.
	p. Press "RESTART" pushbutton.	EDEP will display blank blank " 999" "ENTER QUEUE NUMBER" LED will be on. TCP - "READY & BACKUP" lights will be on.

STEP	PROCEDURE	INDICATION
E.M.S.		
10.	Perform RPM checks (cont'd)	
	q. Switch the Mode switch to the Auto position.	
	r. Press "CLEAR" pushbutton.	EDEP will go blank.
	s. Press #9, 9, 6, 6 pushbuttons.	EDEP will display blank blank "9966"
	t. Press "ENTER" pushbutton.	EDEP will display "FUNC" blank blank
	u. Press #8 pushbutton.	EDEP will display "FUNC" blank " 8"
	v. Press "ENTER" pushbutton.	EDEP will display blank blank RPM
		Note: EDEP will display what you have selected on the Portable Tach Generator.
	w. Vary the Tach Generator settings.	EDEP will display blank blank RPM
	x. Press #0 pushbutton and unhook the Tach. Generator.	EDEP will go blank with the "ENTER QUEUE NUMBER" LED on.
D.E.C.		
1.	Vacuum inside printers	
	a. Open hinged cover and lift it off the unit.	
	b. Remove hold-down screws from dust cover.	
	c. Lift the cover off by lifting the right side and tilting it off the left side.	
	Note: The cover cannot be lifted straight off because of the manual paper feed.	

STEP	PROCEDURE	INDICATION
D.E.C.		
1.	Vacuum inside printers (cont'd)	
	d. Turn unit off.	None, except "STD. CHARA." LED will extinguish on LA-36s.
	e. Vacuum entire upper area of printer.	All dirt and dust will be removed.
	f. Open rear door of printer.	
	g. Vacuum inside louver section of printer.	All dirt and dust will be removed.
	h. Close rear door.	
	i. Replace dust cover by reversal of removal procedure.	Cover should be seated on all four sides.
	j. Replace hold-down screws (start screws by hand, being careful not to strip them).	
	k. Replace lift cover by reversal of removal procedure.	
MISCELLANEOUS		
1.	Check oil in air compressor	
	a. Remove plug from compressor sump.	Oil should be up to the bottom of plug hole. The oil should be clean. Look at oil for dirt or metal shavings.
	b. Add oil if necessary.	
	c. Replace compressor sump plug.	
2.	Fill out and turn in Parts Request form (when applicable).	

EPA/HOUSTON DEMO PROGRAM

MONTHLY CHECK LIST

Initial

E.M.S.

1. Check and vacuum Air Conditioner . . . . . _____
2. Clean Ambient air filter . . . . . _____
3. Inspect entire EMS for:
   a. loose connections . . . . . _____
   b. cracked hoses . . . . . _____
   c. dirt or moisture . . . . . _____
4. Clean tape heads and pinch roller on EMS tape drive . . . . . _____
5. Check Hexane Propane conversion factor . . . . . _____

CLAYTON EQUIPMENT

1. Check exhaust louvers . . . . . _____
2. Check hoses, tubing, tank assembly and solenoids on exhaust louver . . . . . _____

MISCELLANEOUS

1. Inspect Air Compressor . . . . . _____
2. Clean the condition of all facility air moving equipment on the roof . . . . . _____
3. Clean external portion of CO Monitor . . . . . _____
4. Calibrate CO Monitor . . . . . _____
5. Calibrate Portable Analyzer . . . . . _____
6. Check external test equipment:
   a. scuff gauge . . . . . _____
   b. Digital analyzer (RPM section) . . . . . _____
   c. timing light . . . . . _____

C O M M E N T S: _____

_____

Date performed: ____/____/____ By: _____

Approved: _____

STEP	PROCEDURE	INDICATION
E.M.S.		
1.	Check and vacuum air conditioner	
	a. Turn off A/C at breaker panel.	Air conditioner will stop.
	b. Remove four cover hold-down screws.	
	c. Remove cover.	
	d. Vacuum entire unit including heat exchanger fins.	Entire unit should be free of dust and dirt.
	Note: Exercise caution not to damage fins with vacuum accessory tools. Also, be careful of your hands around fins; they are sharp and will cut your hands.	*Note:* Report any water puddles or signs of water having set or puddled to Maintenance headquarters.
2.	Clean Ambient air filter	
	a. Remove drain hose.	
	b. Twist sediment bowl counter-clockwise to remove.	
	c. Remove ceramic filter and retainer nut.	Filler and nut will drop out of the housing.
	d. Thoroughly wash filter in warm soapy water.	
	e. Blow the water out of the filter.	The filter should be clean and dry. Plug up one end and blow through it; there should not be too much resistance.
	f. Clean sediment bowl.	Bowl should be free of dust and dirt.
	g. Replace filter and retainer nut.	
	h. Replace sediment bowl.	
	i. Replace drain hose.	
3.	Inspect entire EMS for:	
	a. Loose connections on all tubing fittings and all electrical connections.	

STEP	PROCEDURE	INDICATION
E.M.S.		
3.	Inspect entire EMS for: (cont'd)	
	b. Cracked, kinked, or deteriorated hoses.	
	c. Excessive dirt or moisture.	
4.	Clean tape heads and pinch roller on EMS tape drive	
	a. Remove tape.	
	b. Using standard tape head cleaner and cotton swabs, clean the head and the entire pinch roller.	
	c. Inspect the roller for grooves.	
5.	Check Hexane/Propane conversion factor	
	a. Load CALCAL tape and put in a 30-second delay.	*See CALCAL Tape Procedure at the end of this Monthly Check List.*
	b. Set EDEP to display corrected concentration.	EDEP will display blank corrected con. blank
	c. Calibrate HC analyzer using Hexane, to exact readings on the bottle tag. Record readings.	EDEP will display blank "HEXANE" blank
	d. Read concentration again using station Propane; don't adjust. Record reading.	EDEQ will display blank "PROPANE" blank
	e. Calculate C.F. by dividing Hexane readings (step d.) by the Propane reading (step f.).	$CF = \frac{1800 \text{ ppm Hexane}}{3600 \text{ ppm Propane}} = .500$
	f. Computed conversion factor is ± .005 of conversion factor listed on analyzer. If not, change the CF number on the analyzer and in the station Processor.	

STEP	PROCEDURE	INDICATION
CLAYTON		
1.	Check exhaust louvers	
	a. Check for leaks at shaft end of cylinder assembly.	Leaks around shaft.
	b. Check cable and linkage.	Slack or frayed cable, loose pulleys, nuts, and bolts.
	c. Use SAE 30 W engine oil to lubricate louver hinges, sheave and pulley bearings cylinder shutter shaft pivot point. *Note:* Hinges of lower louver are reached through holes provided in frame by using tubing to place lubricant.	
	d. Check tank level. System uses automatic transmission fluid (Mobil ATF200 or equal). Make this check with louver B open so tanks are viable. (It may be necessary to remove floor slats and clean sight tubes to accomplish this task.) *Note:* If tanks require replenishment, be sure to use safety bolts.	Tanks are filled to plug level. Add fluid when level is below the "add" point (approximately one inch from connector 11 on left tank and two inches from connector 14 on right tank). *Note:* On some units the lines may be reversed, in which case the levels on the tanks will be opposite.
2.	Check hoses, tubing, tank assembly and solenoids on Exhaust Pit Louvers	
	a. With EMS on, switch louver switch to "Manual" on Relay Maintenance Panel (RMP).	
	b. Press louver control Code B on EDEP.	Louver B will open.
	c. Louver end plates each have holes in them. Place a one-half inch by four inch bolt in the hole with a nut on each side with the bolt extending over the pavement edge of the louver pit. This is to prevent louver lowering while you are working.	

STEP	PROCEDURE	INDICATION
CLAYTON		
2.	Check hoses, tubing,... (cont'd)	
	d. Remove floor slats.	
	e. Check and replace deteriorated hoses and tubing.	Hoses or tubing cracked or soft.
	f. Replace floor slats.	
	g. Remove safety bolts.	
	h. Switch control switch to A open.	
	i. Install safety bolts.	
	j. Remove floor slats.	
	k. Turn EMS power off.	
	l. Remove solenoid junction box cover.	
	m. Check solenoids for loose wires.	Wires or screws on terminals loose.
	n. Replace solenoid junction box cover.	
	o. Replace floor slats.	
	p. Turn EMS on and load Lane tape.	"ENTER QUEUE NUMBER" LED will be illuminated.
MISCELLANEOUS		
1.	Inspect Air Compressor	
	a. Clean intake air cleaner. Turn the filter plate until you can pull it out. Pull filter out and thoroughly vacuum it. Replace filter and retainer plate. Repeat this step for both compressors where applicable.	Outside of filter will be free of dirt.
	b. Check belt tension. Turn compressor off. Reach up from the bottom and pull on the belts, you should not be able to pull them more than 1 inch with a moderate pull.	

STEP	PROCEDURE	INDICATION
MISCELLANEOUS		
1.	Inspect Air Compressor (cont'd)	
	c. Check that all screws and nuts are tight.	
	d. Lubrication (yearly). Ball bearing motors that have grease fittings and plugs near the bearings are to be repacked with grease once a year. Use the best grade of ball bearing grease available.	
2.	Check the condition of all facility air moving equipment on the roof	
	Remove air conditioning filters and replace if necessary.	Air filter should be clean.
3.	Clean external portion of CO Monitor	
	a. Clean exterior of CO Monitor with a soft rag or paper towel and a liquid cleaning agent.	
4.	Calibrate CO Monitor	
	a. Position CO Monitor power on/off switch to the OFF position.	Green power ON indicator will not be illuminated.
	b. Remove front panel cover.	
	c. Turn OFF circuit breaker for CO Monitor under test.	Panel meter needle will indicate zero. *Note:* If needle does not indicate zero, adjust the potentiometer on panel meter housing for zero.
	d. Turn ON circuit breaker for CO monitor under test.	
	e. Position CO monitor power on/off switch to the ON position.	
	f. Rotate the selector valve 180° from the calibrate position.	Green power ON indicator will illuminate.

STEP	PROCEDURE	INDICATION
MISCELLANEOUS		
g.	Rotate the span potentiometer located on front panel to the center of its travel.	
h.	Rotate the zero potentiometer until the red alarm light illuminates.	Panel meter needle should indicate 300 ppm. *Note:* If above indication is not obtained adjust the alarm potentiometer on the front panel to obtain a reading of 300 ppm when the red light illuminates.
i.	Connect a DVM to test jacks located on right side of panel meter. Ensure that the red probe is connected to the red jack and that the black probe is connected to the black jack. Set DVM function control for DC volts and the range switch to 2. Turn ON the DVM.	DVM will indicate zero volts. *Note:* If DVM does not indicate zero volts adjust the zero potentiometer on CO Monitor front panel for zero volts indication on the DVM.
j.	Remove the DMV probes from the test jacks.	
k.	Rotate the selector valve 130° to the Calibrate position.	
l.	Fill the sample bag with 300 ppm CO gas.	
m.	Connect the sample gas bag to the CO Monitor Intake Port.	Panel meter will indicate 300 ppm.
	CAUTION Never connect the Pressurized Span Gas Cylinder directly to the CO Monitor Intake Port. Excessive pressure will damage the CO Monitor.	*Note:* If the meter does not indicate 300, adjust the Span potentiometer to obtain an indication of 300 ppm.
n.	Remove the sample gas bag from the CO Monitor Intake Port.	
o.	Position the Selector Valve to the OPERATE position.	
p.	Replace the front panel cover.	

STEP	PROCEDURE	INDICATION
5.	Calibrate Portable Analyzer Follow CEA600 operation/calibration procedures.	
6.	Check External Test Equipment a. scuff gauge b. Digital analyzer (RPM section) c. timing lights Follow recommended calibration/ operation checks on above equipment.	*Note*: Refer to Manufacturer's manual.

CALCAL TAPE PROCEDURE

OPERATION PROCEDURES

1. This section will describe the operation procedures for the use of CALCAL tape. There are two (2) sections in the procedure.

   - Flow Adjustment - which will allow setting and adjusting of all flow prior to the actual test.
   - Test - which will allow for the actual analyzer testing and recording of results.

   NOTE: All entries and displays in the following procedure are on the EMS E.D.E.P.

2. Procedures

   2.1 Flow Adjustment

   2.1.1 Load CALCAL tape into the EMS - when tape is loaded properly E.D.E.P. will display "CCAL"
   "PR--"
   "01.01"

   2.1.2 Press ENTER - E.D.E.P. blank

   If an external N2 cylinder is used, connect it to the external N2 quick disconnect on the EMS; rotate the ambient N/2 valve on the EMS to OFF position.

   2.1.3 Connect the appropriate gas cylinder (HC, CO, CO2) to the external "CAL" port quick disconnect on the EMS.

   2.1.4 Press ENTER - after 5-second delay, and E.D.E.P. blank, open N2 cylinder regulator and make sure that analyzer's flow meter indicates 8CFH and the cylinder regulated pressure does not exceed 4 psi (adjust flow with the cylinder pressure regulator or attach cylinder needle valve).

   2.1.5 Press #2 - E.D.E.P. will display "FLO"

   2.1.6 Depending upon the analyzer to be tested, press the following:

   HC Analyzer - press #4 - E.D.E.P. will display #4

   CO Analyzer - press #5 - E.D.E.P. will display #5

   CO_2 Analyzer - press #6 - E.D.E.P. will display #6

2.1.7 Press ENTER - E.D.E.P. blank

2.1.8 Open the gas cylinder connected at step 2.1.4 and adjust the regulator. Make sure the selected analyzer (step 2.1.6) flow is 8CFH and that the cylinder regulated pressure does not exceed 4 psi (adjust flow with cylinder flow pressure regulator or attached cylinder middle valve).

2.1.9 Press #2 E.D.E.P. will display "FLO"

2.1.10 Press #3 E.D.E.P. will display "3"

2.1.11 Disconnect external N2 cylinder. Rotate ambient/N2 valve on the EMS to AMBIENT and press ENTER - E.D.E.P. blank - this will put the analyzers on purge until the testing continues.

2.2 TEST

2.2.1 Press #1 - E.D.E.P. will display "GAS"

2.2.2 Depending upon the analyzer to be tested, press the following:

- HC Analyzer - press #1 - E.D.E.P. will display, "DISP"
- CO Analyzer - press #2 - E.D.E.P. will display "CO"
- CO2 Analyzer - press #3 - E.D.E.P. will display "CO2"

2.2.3 Press #3 E.D.E.P. will display, "DISP"

2.2.4 Press #2 E.D.E.P. will display "2"

2.2.5 Press ENTER - E.D.E.P. will display "DATA"

2.2.6 Press #5 - E.D.E.P. will display "5"

2.2.7 Press ENTER - E.D.E.P. will display previous reading - disregard

2.2.8 Press #5 - E.D.E.P. will display "DELY"

2.2.9 Press #50 - E.D.E.P. will display "50"

2.2.10 Press ENTER - E.D.E.P. will display analyzer previous reading - disregard

2.2.11 Press #2 - E.D.E.P. will display "FLO"

2.2.12 Press #3 - E.D.E.P. will display "3"

2.2.13 Connect N2 cylinder, rotate ambient/N2 valve to OFF position - press ENTER - E.D.E.P. will display decreasing delay time.

2.2.14 When delay reaches Ø window #2 on E.D.E.P. will display the zero value for the selected analyzer.

2.2.15 Press #5 - E.D.E.P. will display "DELY"

2.2.16 Press #20 - E.D.E.P. will display "20"

2.2.17 Press ENTER - E.D.E.P. will display previous reading - disregard

2.2.18 Press #2 - E.D.E.P. will display "FLO"

2.2.19 Depending upon the analyzer to be tested, press the following:

HC Analyzer - press #4 - E.D.E.P. will display #4

CO Analyzer - press #5 - E.D.E.P. will display #5

CO2 Analyzer - press #6 - E.D.E.P. will display #6

NOTE: Make sure that you have selected the same analyzer as was selected in steps 2.1.6 and 2.2.2

2.2.20 Press ENTER - E.D.E.P. will display decreasing delay time. When delay reaches Ø, window #2 will display the cylinder gas concentration.

2.2.21 When display stablizes, record reading.

2.2.22 Repeat steps 2.2.8 thru 2.2.21 for additional readings.

2.2.23 When all testing is complete,

- shut off gas cylinders
- disconnect gas cylinder
- reload CALCAL tape or lane tape into EMS

APPENDIX "C"

HOUSTON/EPA DEMONSTRATION PROGRAM

REPORTING GUIDELINES

PREPARED BY: Naftali Amir
NAFTALI AMIR

APPROVED BY: A. J. Arrigo
A. J. ARRIGO

RELEASE DATE: 2/25/80

REVISED: 5/12/80

1.0 SCOPE

This document will establish the methods and procedures for various reports to be generated by the Houston/EPA Demonstration Program Manager.

2.0 GENERAL INFORMATION

2.1 In general, all reports required to be submitted to EPA, as per Exhibit "B" "Reports of Work" of the Contract between EPA and Hamilton Test Systems, will be generated from Hamilton Test Systems motor vehicle inspection headquarters in Phoenix.

2.2 It is the responsibility of the Program Manager to provide the data needed for the above reports to MVI Headquarters.

2.3 In order to assist the Program Manager in the above task, various documents have been designed as follows:

- Daily Operation Log
- Weekly Status Report
- Monthly Report Work Sheet - Hourly Tests
- Monthly Report Work Sheet - Hourly Queues

2.4 The following table will cover the number of weeks to be included in each monthly report:

Month	# of Weeks	Week #
Mar	4	1-4
Apr	5	5-9
May	4	10-13
Jun	4	14-17
Jul	5	18-22
Aug	4	23-26

3.0 DAILY OPERATIONS LOG (Figure 1)

3.1 General

This form will be used for recording the Daily Operation Log data, per contract. Each form will be used for the daily data within an operation week.

3.2 Copies and Submittals

a. The Daily Operation Log is to be filled out in duplicate and filed (both copies) at the station.

b. The original is to be mailed to MVI Headquarters within 3 days following the operation week # for the particular reporting month (see table in paragraph 2.4).

3.3 Data Recording

a. A new form specifying operation week # is to be used for each week.

Note: Following entries are to be made on a daily basis:

b. Record the date, opening time, closing time, and total operating hours in section I "GENERAL."

c. Numerically, specify the personnel at work in section II "PERSONNEL."

d. Request all visitors to fill in their name, organization and purpose of visit in section III "VISITOR INFORMATION."

e. Use the "COMMENTS" section for a brief narrative (specify dates) on unusual happenings or conditions.

4.0 WEEKLY STATUS REPORT (Figure 2)

4.1 General

This form will be used for recording vehicle inspection status for the Weekly Status Report.

4.2 Copies and Submittals

a. The Weekly Status Report is to be filled out in duplicate.

b. At the end of the operation week, top copy is to be sent to:

Mr. David Brzezinski
Project Officer
Inspection and Maintenance Staff
Emission Control Technology Division
ENVIRONMENTAL PROTECTION AGENCY
2565 Plymouth Road
Ann Arbor, Michigan 48105

c. Follow procedure for submittal of the Daily Operation Log for the remaining copy of the Weekly Status Report.

4.3 Data of Recording

a. A new form specifying operation week # is to be used for each week.

b. Record the date for each day.

Note: The following steps are to be performed on a daily basis when all testing has been completed.

c. Substitute a blank computer paper for the VIR in the VIR printer.

d. Request display and print of the inspection status from the auxiliary computer (Alpha Micro).

e. Record on the Weekly Status Report the appropriate inspection categories.

4.4 Comments

a. Total tests are the sum of all tests performed during the day. Total tests = (HTS tests) + (Initial tests) + (Retests).

b. HTS tests are all tests with "customer" field entry of HTS.

c. Initial tests are all tests where "customer" field entries are not HTS and "retest" field entry = Ø.

d. Retests are all tests where "customer" field entries are not HTS, and "retest" field entries are other than Ø.

e. Due to a multiple failure possibility on a vehicle, the sum of various passed, failed, and rejected values will not equal the total test under the initial or retest categories.

5.0 MONTHLY REPORT WORK SHEET - HOURLY TEST (Figure 3)

5.1 General

This form will be used for recording hourly test data for the Monthly Progress Report. Each form will be used for the daily data within an operation week.

5.2 Copies and Submittals

Follow the procedures established for the Daily Operation Log.

5.3 Data Recording

(Refer to Figures 4 and 5 for a sample of completed work sheets for two consecutive weeks.)

a. Raw data for this report is to be generated automatically by the hour at the emission computer (DEC 11/34).

   Note: Steps b. through d. below should be performed immediately after the previous week's Work Sheet has been completed.

b. Record the operational week number, start date and end date for the coming week.

c. Copy line #10 (Cumulative Hourly Total Test) from previous week's Work Sheet onto line #9 (Total Hourly Test - Previous Week) for the coming week's Work Sheet.

d. Copy line #12 (Cumulative Days) from previous week's Work Sheet onto line #11 (Number of Days Previous Report) for the coming week's Work Sheet.

e. On the appropriate day (lines #1 through #5), record the valid hoursly inspections as they appear on the Hourly Status Report (Figure 6).

Notes: 1. Valid inspections are: (overall inspection - totals) - (overall inspection - aborted).

2. All tests performed after the official operating hours (due to overload) should be included together with the value for the last hour.

3. Remember - each hourly status, list all test performed from the beginning of the day. You must subtract current hour's status values from previous hours to find the actual inspection for a particular hour.

5.4 Calculation

The following are to be performed at the end of the week:

a. Sum all the values in each vertical column and record on line #6 (Total Hourly Test Present Week).

b. Record on line #7 (Total Days Present Week) the number of working days for each hour.

Note: 1. Due to the varied daily operating hours, line #7 "Total Day Present Week" for a normal operating week is as follows:

Hours of Day	Line #7	Days Included
09:00	5	Tue. - Sat.
10:00	5	Tue. - Sat.
11:00	5	Tue. - Sat.
12:00	5	Tue. - Sat.
13:00	5	Tue. - Sat.
14:00	5	Tue. - Sat.
15:00	4	Tue. - Fri.
16:00	4	Tue. - Fri.
17:00	4	Tue. - Fri.
18:00	1	Thu.
19:00	1	Thu.
20:00	1	Thu.

Note: 2. Line #7 is also to be adjusted if testing was not conducted as normal (see Example).

Example: If on Wednesday testing stopped at 16:00 due to equipment malfunction, then the value on line #7 for the 17:00 entry should be 3.

c. Divide each entry on line #6 by appropriate entry on line #7 and record the answer on line #8 (Average Hourly Test Current Week).

d. Add each entry on line #6 to previously recorded entries on line #9. Record answer on line #10 (Cumulative Hourly Total Test).

e. Add each entry on line #7 to previously recorded entries on line #11. Record answer on line #12 (Cumulative Days).

f. Divide each entry on line #10 by the appropriate entry on line #12 and record answer on line #13 (Average Cumulative Hourly Test).

5.5 Comment

The following is the explanation of the Work Sheet data shown on Figure 3.

a. The number in the box marked (i) is the "Number of Valid Inspections Performed in Each Week."

b. The number in the box marked (ii) is the "Cumulative Number of Valid Inspections as of Each Week."

c. Line #8 (iii) is the "Average Inspection Rate as a Function of the Hour of the Day."

d. Line #13 (iv) is the "for all the months since the start of the operational phase taken together the average inspection rate as a function of the hour of the day."

6.0 MONTHLY REPORT WORK SHEET - HOURLY QUEUE (Figure 7)

6.1 General

This form will be used for recording the hourly queue length data for the Monthly Progress Report. Each form will be used for the daily data within an operational week.

6.2 Copies and Submittals

Same as for Daily Operation Log.

6.3 Data Recording

Note: Steps a. through c. below should be performed immediately after the previous week's Work Sheet has been completed.

a. Record the operational week number, start date and end date for the coming week.

b. Copy line #10 (Cumulative Hourly Total Queue) from previous week's Work Sheet onto line #9 (Total Hourly Queue - Previous Week) for the coming week's Work Sheet.

c. Copy line #12 (Cumulative Days) from previous week's Work Sheet onto line #11 (number of Days Previous Report) for the coming week's Work Sheet.

d. On the appropriate day (lines #1 through #5), record the valid hourly queue length (number of vehicles in queue).

6.4 Calculation

The following are to be performed at the end of the week:

a. Sum all the values in each vertical column and record on line #6 (Total Hourly Queue Present Week).

b. Record on line #7 (Total Days Present Week) the number of working days for each hour.

Note: 1. Due to the varied daily operating hours, line #7 "Total Day Present Week" for a normal operating week is as follows:

Hours of Day	Line #7	Days Included
09:00	5	Tue. - Sat.
10:00	5	Tue. - Sat.
11:00	5	Tue. - Sat.
12:00	5	Tue. - Sat.
13:00	5	Tue. - Sat.
14:00	5	Tue. - Sat.
15:00	4	Tue. - Fri.
16:00	4	Tue. - Fri.
17:00	4	Tue. - Fri.
18:00	1	Thu.
19:00	1	Thu.
20:00	1	Thu.

Note: 2. Line #7 is also to be adjusted if testing was not conducted as normal (see Example).

Example: If on Wednesday testing stopped at 16:00 due to equipment malfunction, then the value on line #7 for the 17:00 entry should be 3.

c. Divide each entry on line #6 by appropriate entry on line #7 and record the answer on line #8 (Average Hourly Queue Current Week).

d. Add each entry on line #6 to previously recorded entries on line #9. Record answer on line #10 (Cumulative Hourly Total Queue).

e. Add each entry on line #7 to previously recorded entries on line #11. Record answer on line #12 (Cumulative Days).

f. Divide each entry on line #10 by the appropriate entry on line #12 and record answer on line #13 (Average Cumulative Hourly Queue).

6.5 Comments

The following is the explanation of the Work Sheet data shown on Figure 7.

a. Line #8 (iii) is the "average queue length as a function of the hour of the day."

b. Line #13 (iv) is the "for all the months since the start of the operational phase taken together the average queue length as a function of the hour of the day."

HOUSTON/EPA DEMONSTRATION PROGRAM

WEEKLY STATUS REPORT

WEEK #_____

	DAY:	TUE.	WED.	THU.	FRI.	SAT.	WEEKLY TOTALS
	DATE:	/ /	/ /	/ /	/ /	/ /	
	TOTAL TESTS:						
	H.T.S. TESTS:						
INITIAL TESTS CATEGORY	INITIAL TESTS (TOTAL):						
	PASSED:						
	FAILED EMISSIONS:						
	FAILED ECS:						
	FAILED PROPANE:						
	FAILED FUEL ECON:						
	REJECTS:						
RETESTS CATEGORY	RETEST (TOTAL)						
	PASSED:						
	FAILED EMISSIONS:						
	FAILED ECS:						
	FAILED PROPANE:						
	FAILED FUEL ECONOMY:						
	REJECTS:						

COMMENTS: (specify dates) _____

_____

_____

_____

NA/ds/2/80

Figure 1

HOUSTON/EPA DEMONSTRATION PROGRAM

DAILY OPERATION LOG

WEEK #_____

I GENERAL	TUE.	WED.	THU.	FRI.	SAT.
DAY:					
DATE:	/ /	/ /	/ /	/ /	/ /
OPENING TIME:	:	:	:	:	:
CLOSING TIME:	:	:	:	:	:
TOTAL OPERATING HRS:					
II PERSONNEL					
PROGRAM MANAGER					
ASST. MANAGER					
INSPECTORS					
III VISITORS INFORMATION					
NAME:					
ORGANIZATION:					
PURPOSE:					
NAME:					
ORGANIZATION:					
PURPOSE:					
NAME:					
ORGANIZATION:					
PURPOSE:					
NAME:					
ORGANIZATION:					
PURPOSE:					

COMMENTS: (SPECIFY DATES) _____

NA/ds/2/80

Figure 2

HOUSTON E.P.A. DEMONSTRATION PROGRAM

Figure 3

MONTHLY REPORT - WORK SHEET - HOURLY TESTS

WEEK #:_____ START DATE:__/__/__ END DATE: __/__/__

LINE #	LINE ITEMS / HOUR OF DAY	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	TOTALS
1	TUESDAY - HOURLY TEST													
2	WEDNESDAY - HOURLY TEST													
3	THURSDAY - HOURLY TEST													
4	FRIDAY - HOURLY TEST													
5	SATURDAY - HOURLY TEST													
6	TOTAL HOURLY TEST PRESENT WEEK (LINES 1-5)													(i)
7	TOTAL DAYS PRESENT WEEK													
8	AVERAGE HOURLY TEST CURRENT WEEK (LINES 6 ÷ 7)													(iii)
9	TOTAL HOURLY TEST PREVIOUS REPORT (LINE 10)													
10	CUMULATIVE HOURLY TOTAL TEST (LINES 6 + 9)													(ii)
11	NUMBER OF DAY PREVIOUS REPORT (LINE 12)													
12	CUMULATIVE DAYS (LINES 7 + 11)													
13	AVERAGE CUMULATIVE HOURLY TEST (10 ÷ 12)													(iv)

HOUSTON E.P.A. DEMONSTRATION PROGRAM

Figure 4

MONTHLY REPORT - WORK SHEET - HOURLY TESTS

WEEK #: 12

START DATE: 5/20/80 END DATE: 5/24/80

LINE #	LINE ITEMS / HOUR OF DAY	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	TOTALS
1	TUESDAY - HOURLY TEST	15	12	18	25	10	12	14	17	9				132
2	WEDNESDAY - HOURLY TEST	~~0~~	~~0~~	5	2	5	7	20	10	9				58
3	THURSDAY - HOURLY TEST	15	12	13	18	20	14	12	13	9	15	17	18	176
4	FRIDAY - HOURLY TEST	10	10	12	1	2	10	~~0~~	10	12				67
5	SATURDAY - HOURLY TEST	20	20	19	18	20	13							110
6	TOTAL HOURLY TEST PRESENT WEEK (LINES 1÷5)	60	54	67	64	57	56	46	50	39	15	17	18	(i) 543
7	TOTAL DAYS PRESENT WEEK	5	5	5	5	5	5	4	4	4	1	1	1	
8	AVERAGE HOURLY TEST CURRENT WEEK (LINES 6 ÷7)	12	10.8	13.4	12.8	11.4	11.2	11.5	12.5	9.75	15	17	18	(iii)
9	TOTAL HOURLY TEST PREVIOUS REPORT (LINE 10)	110	100	95	130	80	50	40	50	30	~~0~~	~~0~~	~~0~~	
10	CUMULATIVE HOURLY TOTAL TEST (LINES 6 + 9)	170	154	162	194	137	106	86	100	69	15	17	18	(ii) 1228
11	NUMBER OF DAY PREVIOUS REPORT (LINE 12)	54	54	54	54	54	54	54	54	54	~~0~~	~~0~~	~~0~~	
12	CUMULATIVE DAYS (LINES 7 + 11)	59	59	59	59	59	59	58	58	58	1	1	1	
13	AVERAGE CUMULATIVE HOURLY TEST (10 ÷ 12)	2.9	2.6	2.7	3.3	1.4	1.8	1.5	1.7	1.2	15	17	18	(iv)

HOUSTON E.P.A. DEMONSTRATION PROGRAM

Figure 5

MONTHLY REPORT - WORK SHEET - HOURLY TESTS

WEEK #: 13 START DATE: 5/27/80 END DATE: 5/31/80

LINE #	LINE ITEMS \ HOUR OF DAY	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	TOTALS
1	TUESDAY - HOURLY TEST	9	13	14	12	12	~~0~~	12	14	12				108
2	WEDNESDAY - HOURLY TEST		no	tests		—		holiday						~~0~~
3	THURSDAY - HOURLY TEST	~~0~~	2	15	17	19	30	14	12	19	10	9	8	155
4	FRIDAY - HOURLY TEST	12	4	5	4	5	~~0~~	2	~~0~~	~~0~~				32
5	SATURDAY - HOURLY TEST	20	20	20	20	20	20							120
6	TOTAL HOURLY TEST PRESENT WEEK (LINES 1÷5)	51	39	54	53	56	50	28	26	31	10	9	8	(i) 415
7	TOTAL DAYS PRESENT WEEK	4	4	4	4	4	4	3	3	3	1	1	1	
8	AVERAGE HOURLY TEST CURRENT WEEK (LINES 6 ÷ 7)	12.75	9.75	13.5	13.25	14	12.5	9.3	8.7	10.3	10	9	8	(iii)
9	TOTAL HOURLY TEST PREVIOUS REPORT (LINE 10)	170	154	162	194	137	106	86	100	69	15	17	18	
10	CUMULATIVE HOURLY TOTAL TEST (LINES 6 + 9)	221	193	216	247	193	156	114	126	100	25	26	26	(ii) 1643
11	NUMBER OF DAY PREVIOUS REPORT (LINE 12)	59	59	59	59	59	59	58	58	58	1	1	1	
12	CUMULATIVE DAYS (LINES 7 + 11)	63	63	63	63	63	63	61	61	61	2	2	2	
13	AVERAGE CUMULATIVE HOURLY TEST (10 ÷ 12)	3.5	3.1	3.4	3.9	3.1	2.5	1.9	2.1	1.6	12.5	13	13	(iv)

HOUSTON E.P.A. DEMONSTRATION PROGRAM

Figure 6

MONTHLY REPORT - WORK SHEET - HOURLY QUEUE

WEEK #:_____ START DATE: / / END DATE: / /

LINE #	LINE ITEMS / HOUR OF DAY	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	TOTALS
1	TUESDAY - HOURLY QUEUE													
2	WEDNESDAY - HOURLY QUEUE													
3	THURSDAY - HOURLY QUEUE													
4	FRIDAY - HOURLY QUEUE													
5	SATURDAY - HOURLY QUEUE													
6	TOTAL HOURLY QUEUE PRESENT WEEK (LINES 1-5)													(i)
7	TOTAL DAYS PRESENT WEEK													
8	AVERAGE HOURLY QUEUE CURRENT WEEK (LINES 6 ÷ 7)													(iii)
9	TOTAL HOURLY QUEUE PREVIOUS REPORT (LINE 10)													
10	CUMULATIVE HOURLY TOTAL QUEUE (LINES 6 + 9)													(ii)
11	NUMBER OF DAY PREVIOUS REPORT (LINE 12)													
12	CUMULATIVE DAYS (LINES 7 + 11)													
13	AVERAGE CUMULATIVE HOURLY QUEUE (10 ÷ 12)													(iv)

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-460/3-80-026		

4. TITLE AND SUBTITLE	5. REPORT DATE
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15. SUPPLEMENTARY NOTES

16. ABSTRACT In conjunction with an EPA project to assess methods, costs, projected effectiveness and acceptability of various motor vehicle exhaust emissions inspection and maintenance (I/M) alternatives, and to support the State of Texas in complying with its implementation plan, the Office of Mobile Source Air Pollution Control of the U.S. Environmental Protection Agency assisted the Texas Air Control Board in establishing a pilot motor vehicle emissions inspection and maintenance program in Houston, Texas. A portion of the program involved the operation of a centralized vehicle emissions inspection station which performed idle tests, underhood inspections of emission control systems and components, and physical/functional I/M tests to simulate the operation of the various alternative configurations for the legislatively mandated I/M program. The contract for the centralized concept was conducted by Hamilton Test Systems, Inc. of Phoenix, Arizona.

The purpose of the contract was to assist the Texas Air Control Board in evaluating the cost and technical details of operating a centralized vehicle emissions inspection station using an underhood inspection of emission control systems and components with either an idle mode tail pipe emission test or a "physical/functional" test procedure. A total of 4,647 vehicles was tested using one or both procedures during the span of the contract. Each vehicle was to be determined to have "passed" or "failed" using criteria established by the EPA. Specific instructions regarding test procedures, cutpoints, data handling and reporting were also provided by EPA. Hamilton Test Systems (HTS) was responsible only for the set up and operation of the inspection station. HTS was not responsible for soliciting vehicles for participation in the pilot I/M program, or for evaluation and analysis of test data.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
	In-Use Vehicles Inspection Maintenance Program Propane Gain Tire Pressure Computerized Emission Measurement	

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