



BUREAU OF AUTOMOTIVE REPAIR

SECTION 1



BAR-97 EMISSION INSPECTION SYSTEM SPECIFICATIONS

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DESIGN GUIDELINES AND PERFORMANCE CRITERIA FOR THE AUTOMATED BAR-97 ACCELERATION SIMULATION MODE (ASM) EMISSION INSPECTION SYSTEM (EIS) FOR USE IN GARAGES LICENSED TO TEST AND / OR REPAIR VEHICLES SUBJECT TO CALIFORNIA'S ENHANCED INSPECTION AND MAINTENANCE (I/M) PROGRAM.



The Bureau of Automotive Repair (BAR) is part of the State of California, Department of Consumer Affairs and is responsible for administering the vehicle inspection and maintenance (I/M) program known as Smog Check. The bureau is also responsible for developing inspection procedures and test equipment specifications, and certifying equipment and calibration gases. BAR-74[®], BAR-80[®], BAR-84[®], BAR-90[®], BAR-90ET[®], BAR-97[®], BAR-97[®], and ASM[®] are copyrighted trademarks of the bureau used to identify specifications and equipment.

BAR-97 ACCELERATION SIMULATION MODE (ASM) SPECIFICATION

ORGANIZATION OF SPECIFICATION

This document provides the specifications for the BAR-97 equipment and procedures to be used for performing inspections required by Sections 4000.1, 4000.2 and 4000.3 of the California Vehicle Code in accordance with the provisions contained in Division 26, Part 5, Chapter 5 (§44000 et. seq.) of the Health and Safety Code.

- Section 1 This section is an introduction, providing background about emission testing equipment, summarizing the BAR-90ET and the enhancements added to the BAR-97. System security and integrity are also included in this section.
- Section 2 This section gives the specifications, including performance standards, for all test-related hardware such as the computer, the analyzer, the dynamometer, the fuel cap tester, the low pressure fuel evaporative tester, the analyzer cabinet, and the bar code scanner.
- Section 3 This section describes in detail the software specification, including data storage; the form, manner and frequency of electronic transmission including transmission of test, calibration and vehicle records, sequences and procedures for performing required tests.
- Section 4 This section outlines the warranty requirements, certification terms, EIS in-use performance measures, and gas audit procedures.
- Section 5 This section defines the certification procedures.
- Section 6 This section describes aftermarket parts approval, warranty, and in-use performance requirements.

The Appendices contain items referred to in the Specification such as the emissions standards table, and the test record format as well as highly technical and strictly confidential items.

SECTION 1. INTRODUCTION**1.1 BACKGROUND INFORMATION**

The Bureau of Automotive Repair (BAR) has been developing specifications and certifying analyzers since the early 70s. Each generation of analyzers has been more reliable, accurate and complex. The first analyzer specifications were published in 1974. Subsequent specifications were published in 1980, 1984, 1990, and in 1996. Analyzers meeting the appropriate specifications were granted a BAR-74[©], BAR-80[©], BAR-84[©], BAR-90[©] or BAR-90ET[©], BAR-97[©] certificate.

The BAR-74 and BAR-80 analyzers were required to measure only hydrocarbons (HC) and carbon monoxide (CO). The BAR-80 was substantially more accurate than the BAR-74 because of improvements in the design of the infrared optical bench, rudimentary self-diagnostics and an on-board calibration gas cylinder. However, it was not until the BAR-84 specifications were developed that the analyzers became computerized. BAR-84 analyzers also had to be gas-calibrated once every seven days or be prevented from further testing. Computerization also allowed the analyzer to make the pass/fail decision automatically and allowed the BAR to require a number of other features to detect analyzer tampering, alleviate some pattern-failure problems, and give special instructions to the customer regarding warranty coverage.

The BAR-90 was the first Inspection and Maintenance (I/M) emissions analyzer designed around a personal computer system. This gave the BAR the ability to greatly refine the test procedure. Special testing and preconditioning procedures were programmed to minimize pattern failures, thereby improving the correlation of the Smog Check test procedure with the federal certification test procedure. The BAR-90 Test Analyzer System (TAS) has been used to perform uniform and consistent tests for California's biennial motor vehicle I/M Program since January 1, 1990, and, as of March 6, 2002, is still used in rural change of ownership areas.

Features of the BAR-90 TAS included: (a) vehicular emission measurements of HC, CO, CO₂ and O₂; (b) engine RPM measurements; (c) exhaust dilution determinations; (d) the capability to add a bar code scanner for more convenient and accurate data entry; (e) a dedicated printer for vehicle inspection reports and other general purpose printouts; (f) data recording on standard 1.44Mb 3.5" floppy diskettes and on a 40-megabyte hard disk; (g) information display to the TAS operator; (h) bidirectional communications via dial-up telephone line and modem; and (i) fully menu driven, interactive, simple microprocessor-controlled operation. The TAS was designed and constructed to provide reliable and accurate service in the automotive repair and service center environment and to maximize man/machine interface simplicity.

The BAR-90 developed and certified by California has been used *de facto* for performing no-load, two-speed emissions tests not only throughout the United States, but in other nations (e.g., Canada, Germany, Mexico, Sweden, Taiwan) as well.

On March 30, 1994, urgency legislation defined California's enhanced Smog Check II program. The new program is designed to clean the air and to meet the requirements of the federal Clean Air Act while meeting the special needs of the state. Key elements of the program were outlined in the revised State Implementation Plan (SIP) submitted to the U.S. Environmental Protection Agency (USEPA) on June 30, 1995. The key elements include:

- a) Acceleration Simulation Mode (ASM) loaded-mode testing using a dynamometer at licensed Smog Check Stations in the enhanced program areas¹
- b) Continued use of the BAR-90 no-load, two-speed idle test in basic areas where biennial testing is required, in change of ownership areas where testing is only required for vehicle sales or purchases, and when statewide testing heavy duty vehicles.
- c) More stringent certification standards, prerequisites and examinations for Smog Check Technicians.
- d) Targeting of high-emitting vehicles for inspection at state-contracted test-only facilities.
- e) Identification of gross polluting vehicles using results of initial emissions tests, remote sensing devices (RSDs) and a high emitter profile which is based on such factors as vehicle age make, engine size, type of emissions control system, the vehicle's individual Smog Check history, and previous RSD readings.
- f) Automatic electronic transmission of vehicle identification information for vehicles being tested, inspection data and inspection certification status from the Smog Check Stations to a central host computer system and to the Department of Motor Vehicles (DMV).

¹ **Enhanced Areas:** These areas do not meet federal or state air quality standards for ozone and are California's smoggiest urbanized areas. Biennial Smog Checks are required here. Thirty six percent (36%) of the vehicles in these areas must have their biennial Smog Checks performed at Test-Only stations.

Partially Enhanced Areas: These areas were opted into the enhanced program by the local air pollution control district/air quality management district. Although similar to the Enhanced areas, no vehicles in a Partially Enhanced area are directed to have their biennial Smog Checks performed at Test-Only stations.

Basic areas: Vehicles in these less-smoggy or less populated areas must have biennial testing at licensed test-and-repair stations.

Change of Ownership areas: These more rural areas of the state require emissions testing only when a vehicle changes ownership or is registered for the first time in California.

- g) Revised repair cost minimum and revised criteria for issuing emissions cost waivers; added an optional, one-time only, economic hardship extension.

As a result of the 1994 amendments, software modifications were made to the BAR-90 analyzer in 1996 to incorporate mandatory program changes. A name change to BAR-90ET was also made to differentiate the old from the new. The BAR-90ET incorporates the ability to identify the vehicle being tested and verify that the vehicle is at the proper test facility, electronically transmit inspection, repair and certification data, the use of the bar code scanner, and the revised emissions and gross polluter standards. Effective July 1, 1996, the BAR-90ET is the only TAS authorized to perform required Smog Check inspections in the basic and change-of-ownership only areas and, in the enhanced areas, is authorized to perform inspections on vehicles with greater than 8,500 pounds GVWR.

The 1994 amendments also required significant modifications to the BAR-90ET for use in the enhanced program areas. Again, a name change to BAR-97 was made to differentiate the BAR-90ET from the BAR-97. Thus, *in addition to the requirements for BAR-90ET*, the BAR-97 incorporates as mandatory components an NO channel and a dynamometer capable of performing the ASM steady-state test and/or transient tests, as well as a fuel cap test and other lane features.

Recent additions resulted in a name change to BAR-97 Revised. The additions include previous requirements outlined in Addendum 1 through Addendum 8 plus several new requirements.

1.2 COMMON TERMS

The following words may have been used interchangeably within this document:

analyzer	software
BAR-97	EIS
EIS	unit
instrument	

1.3 ELECTRONIC TRANSMISSION

1.3.1 Electronic Transmission (ET) Overview

A required component of the enhanced program is the electronic transmission of data -- information about the vehicle under test and the test results. Electronic Transmission (ET) is the name that BAR has given to the electronic network that enables the EIS to automatically connect to the BAR's centralized Vehicle Information Database (VID) via the modem and dial-up connection. The majority of the software protocols are confidential; however, the protocols that are not confidential are provided in greater detail in §3 of this Specification.

a) **Mandatory ET Service:**

In order to comply with the ET mandate, each Smog Check station shall obtain and maintain ET services through BAR's designated ET contractor. Effective July 1, 1996, the following criteria shall be met before an EIS is used for I/M test certification: (1) the EIS shall be connected to, and shall be fully functional with the ET service and (2) the EIS shall possess, and be operational with the current software or hardware update.

b) **ET Service Description:**

At the beginning of the test, following the technician's entry of the vehicle license plate number and VIN into the EIS using a bar code scanner, the ET software (via the modem and dial-up connection) initiates an automated call (initial call) to the VID. Vehicle-specific information (previous failed test results, waiver or extension data, emissions recall information, technical service bulletins, gross polluter status, test-only requirement) and test requirements are electronically returned from the VID. Information that the technician previously filled in manually will be automatically entered into the EIS and the technician will be responsible for verifying that the information is correct. If the vehicle information does not result in a matched VID record, a second call may be necessary.

At the conclusion of the Smog Check inspection, test results, repair results (when required), and smog check certificate number for passed tests, are transmitted electronically to the VID (end-of-test call). For valid passing tests, the VID immediately transmits the certificate number to DMV. The Vehicle Inspection Report (VIR) serves as the customer's record.

Using the ET system, the BAR is also able to send electronic messages to technicians and Smog Check Station owners.

- c) **Optional ACH Debit Transaction Authorization:**
The ET software update also enables Smog Check stations to automatically order a block of fifty Smog Check Certificates. However, this requires completion of the Automated Clearing House (ACH) Debit Transaction form and is an optional service provided by the BAR's ET contractor. Once the VID has authorized the order, the certificate numbers will be electronically transmitted to the EIS and the EIS will print out a receipt for certificate numbers received.
- d) **Optional Diagnostic and Repair Information:**
The ET service provides immediate electronic access to diagnostic and repair information for a fee. However, these services are not a substitute for the required set of current manuals or authorized CD-ROM system, which must be maintained on the shop's premises.
- e) **Charges for ET Services:**
Smog Check stations must maintain ET service in accordance with the terms specified by the BAR's ET contractor.

1.3.2 Form, Manner and Frequency of Data Transmittals for ET

- a) Form: For each inspection, the data transmittal shall consist of the vehicle's test record, calibration record and, when required, repair record (and other records) as described in Confidential Appendix C-2.
- b) Manner: The manner of the data transmittal shall be using the EIS modem via a dial-up connection. The EIS must be maintained to ensure proper operation and shall be connected to a fully operational and dial-up connection during all times of operation.
- c) Frequency: The data shall be transmitted for inspection and repair (when required) and shall include at least two transmissions per inspection, one for the initial call and another for the end-of-test call. If the initial contact results in no match being found, an additional transmission may be required.

1.4 TAMPER RESISTANCE

Controlled access design shall be the responsibility of the manufacturer. All security measures shall be submitted for approval by the BAR. Analyzer operators, State field representatives and manufacturer's representatives shall be prevented, to the BAR's satisfaction, from creating or changing any test results, BAR programs or BAR data files contained in the EIS as called for in this specification. Manufacturers shall utilize special computer BIOS, partitions (or equivalent approved by the BAR), as well as other appropriate software and hardware provisions deemed necessary by the BAR to protect the I/M files and programs. File and program protection may consist of mechanical systems in combination with electronic/software systems. The protection features shall

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prevent access to the secured disk drives and portions of the hard disk containing I/M programs and test data. The "control" key, or its functional equivalent giving access to the operating system (OS), shall not be activated except through the use of a special password and a dual entry method on the STATE MENU. The password shall be chosen by the BAR's Engineering Section at the time of certification testing. Access to the OS shall not be available to the manufacturer's service technicians. Other security or protection alternatives, such as more sophisticated BIOS limitations and LPT port key, may be proposed by the manufacturer for approval by the BAR.

In addition, the emission analyzer and the sampling system shall be made tamper-resistant to the BAR's satisfaction. At a minimum, the manufacturer shall develop tamper-resistant features to prevent unauthorized access through the cabinet. Microswitches, keyed locks, software-controlled locks, and software algorithms requiring the use of an access code shall all be utilized where appropriate. Access codes for STATE/QA functions shall be changed daily based on an algorithm provided by the BAR. Service access codes shall be changed daily based on a unique algorithm provided by the manufacturer. Both algorithms must be changed as part of any software update. Manufacturers may utilize a combination lock on the doors securing the disk drives as long as the locks are built-in, good quality and the combination can be easily changed by authorized personnel when a security problem is identified. The following examples illustrate ineffective and unacceptable security measures: A mercury switch would not be effective if the analyzer can be tipped over to one side to trigger the switch. A keyed lock would not be effective if it is placed in a position that allows the analyzer cabinet to be flexed slightly to bypass the lock. If there is a dynamometer control cabinet separate from the secured area of the analyzer cabinet, it shall be secured in a manner approved by the BAR.

The Smog Check technician shall have access to the required compact disc (CD) drive. However, access security to the BIOS, I/M related programs and data must be secured from this drive when accessed by a technician. The manufacturer shall provide security for the CD drive to prevent unauthorized read/writes (to memory, ROM, hard drive, etc.). This security shall guard against unauthorized executables that are executed from the CD. The manufacturer shall submit their method for providing this security to BAR for approval.

A software-controlled solenoid lock shall be used on the secured drive door of all EIS units submitted for certification. This solenoid lock may be used instead of, or in addition to, any key or combination lock that may be provided. The solenoid lock shall be controlled by the EIS software, unlatching the doors in response to authorized requests from the STATE MENU, always maintaining the appropriate levels of security. All BAR-97 EIS units shall have sensors, such as microswitches, to detect the open/closed state of the doors, as well as other secured areas of the EIS. The EIS shall monitor these sensors and shall define an inappropriate state as a tamper.

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Manufacturers may offer analyzers with additional disk drives that can run optional software application programs. However, the optional disk drives shall be secured from the BIOS, operating system and all other I/M related programs and test data (or equivalent acceptable to the BAR).

If tampering occurs, a software lockout algorithm shall be activated which aborts any existing test sequence and prevents further I/M testing until the lockout is cleared by a BAR field representative (or other representatives authorized by BAR such as QAs). In addition, manufacturers must describe, to the BAR's satisfaction, what security measures will be taken to prevent the unauthorized use of access codes, keys and combinations to the secured areas of the analyzer under each of the following circumstances:

- a. Tampering has occurred.
- b. A manufacturer's service technician quits or is fired.
- c. A combination, key or critical access code is obtained by an unauthorized person(s) such as a Smog Check technician.

Neither BAR field representatives (or other representatives authorized by the BAR such as contractor quality assurance personnel (QAs)) nor manufacturer's service representatives may have access to the analyzer's OS or be able to modify files on the hard disk. At no point shall technicians have access to either the OS or the BIOS.

The use of microswitches to detect unauthorized entry is acceptable. However, unauthorized access to the secured areas of the analyzer shall be detected even when the power is off. The analyzer shall record the type and location of each tamper (excluding the underhood tamper flag). The tamper attempts shall be recorded in a tamper file which includes the date of the tamper-caused lockout, the type and location of the lockout, the date the lockout was cleared and who it was cleared by (State or manufacturer's service representative). The specific tamper type and location shall only be accessible through the STATE MENU - LOCKOUT EIS function.

The lockout system shall be designed so that it can be activated by a BAR field representative from the STATE MENU. Only BAR field representatives (or other representatives authorized by BAR) may remove lockouts put in place from the STATE MENU. Manufacturers shall develop a system by which their service technicians shall be prevented, by some method approved by the BAR, from clearing BAR installed lockouts.

In particular, the following policies shall apply to the manufacturers' field representatives:

- a) They shall not be capable of
 - 1). clearing a State/QA-installed lockout, or
 - 2). clearing a lockout due to a requirement for a three-day gas calibration/leak check.
- b) They shall not add, delete or modify the station or technician license number.
- c) They shall not be capable of altering the calibration gas values.
- d) They shall not clear a lockout when there is evidence of physical tampering. Furthermore, they shall report this, or any other type of lockout, to a BAR field office by the end of the next working day following the lockout.
- e) They shall not have access to the OS under any circumstances.

The access codes used by the manufacturer's service representatives shall be changed automatically by the EIS on a daily basis. The algorithm must not be available to manufacturer's field service personnel. The daily service access codes may only be given to authorized field service representatives and may not be provided more than one week in advance.

The tamper resistance features shall be designed so that software programs, especially those which deal with repair and diagnostics of vehicles, can be added at a later date.

Optional software packages, supplied by the manufacturer, shall not interfere with the normal operation of the I/M inspection and testing software, shall not compromise the tamper-resistance of the analyzer (such as giving the technician access to the OS) and shall be approved by the BAR before they are delivered or installed in any BAR-97 analyzers.

Access to and from all required and mandatory-option programs shall be "seamless." These programs shall be accessed from the Main Menu or a submenu, and, when exited, shall return directly to the menu or submenu from which they were accessed, without requiring the EIS to reboot.