APPENDIX A Technical Specifications

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INTRODUCTION

The Colorado AIR Program is in the process of modifying its current automotive inspection and maintenance program to comply with the Clean Air Amendments of 1990. Colorado's current program is based upon BAR 84 inspection technology utilizing a decentralized program format encompassing nine Front Range counties. In order to achieve compliance with the Clean Air Amendments of 1990, Colorado will change to a program format that will have a contractor based operation conducting the IM 240 emissions test and a population of independent inspectors conducting inspections utilizing a new Colorado 94 emissions analyzer. The contractor is based in the “enhanced” program area, basically the Denver metropolitan area and will inspect 1982 and newer vehicles. Independent inspection facilities will inspect vehicles of all years within the “basic” program area as well as being able to inspect 1981 and older vehicles within the “enhanced” area.

The demands for more accurate analytical information as well as a more automated inspection process with real-time data transfer has superseded the capabilities of BAR 84 technology. Current BAR 90 analytical technology is acceptable, but other system enhancements are necessary to meet Colorado's inspection needs. These enhancements and other technical details are described in the remainder of this document.

1.0 GENERAL

1.1 Design Goals

The specifications that have been developed are designed utilizing a personal computer system. The analyzer system must be capable of performing uniform and consistent emission tests for Colorado's Automotive Inspection and Readjustment (AIR) Program. Features of the analyzer include: vehicle emissions measurements of hydrocarbon (HC), carbon monoxide (CO), carbon dioxide (CO2)and oxygen(O2); engine RPM measurements, exhaust dilution determinations, pressure test system for EVAP; data entry; data retrieval tables; a dedicated printer (for vehicle inspection certificates) and an additional printer for diagnostics and general purpose printouts; data recording on double sided high density 1.44 megabyte (Mb) 3.5” floppy diskette and a 120Mb (or greater) hard drive; modem for “on-line real time” data transmission; CRT information display to the inspector; bar code (2D) reader and printing capabilities; and fully menu driven, interactive simple microprocessor controlled operation.

Additional, automatic features required include: gas calibrations, zero and span checks, pressure calibrations, gas auditing procedure; leak checks, HC hang-up checks, audit menus (i.e., data read system), test sequencing, and low-flow checks. The analyzer shall be designed and constructed to provide reliable and accurate service in the automotive environment. The software used in the analyzer shall consist of a process control system as well as data look-up files. Security shall be provided to prevent unauthorized modifications to the software or test data and recording unauthorized entry (tampering) and locking out of the inspection process when detected.

The emissions analyzer software shall be designed for maximum operational simplicity.

It shall also be capable of providing emission-reading characteristics, independent of the inspection function, which can be used for vehicle diagnostic.

1.2 Useful Life

The useful life of the analyzer shall be a minimum of five years.

1.3 Nameplate Data

A nameplate including the following information shall be permanently affixed to the housing of the analyzer:

Name and Address of Manufacturer

Model Description

Serial Number

Date of Assembly

The manufacturer shall affix a stick-on type label to the analyzer that contains a toll-free telephone number for customer service. This number can also be included in a service software message.

1.4 Manuals

Each analyzer shall be delivered with the following manuals:

A. Reference Operating Instructions

B. Operation Instruction Manual

C. Maintenance Instruction Manual (limited)

D. Initial Start-up Instructions

Colorado 94 Analyzer manufacturers may consolidate manuals. The manuals shall be constructed of durable materials and shall not deteriorate as a result of normal use over a five-year period. The analyzer housing shall provide convenient storage for each manual in a manner that will:

E. Allow easy use.

F. Prevent accidental loss or destruction.

1.5 Certification Documentation

The analyzer software shall be fully documented. Two copies of the documentation listed below shall be submitted to the Colorado Department of Public Health and Environment as part of the certification application.

A. Complete program listings. Program listings may be on diskette. They are not required to be submitted with the application for certification.

B. Functional specifications.

C. Functional flowcharts of the software.

D. Example inputs and outputs from all processes.

E. Detailed interface information on system components including the identification of protocol and output specifications.

F. All DOS file layouts with file names, file types, file security, field names, field types, field sizes, and field editing criteria.

Documentation provided by the vendor to meet this requirement will be treated as proprietary information by the Colorado Department of Public Health and Environment.

Prior to certification of any Colorado 94 emissions analyzer for sale in Colorado, the manufacturer of such analyzer shall provide the Division with software source codes and all other technical information (including, but not limited to all working codes, schematics and drawings) necessary to operate, maintain, calibrate and repair such analyzer in the event that the manufacturer or its agent ceases providing adequate maintenance, calibration and repair services in Colorado. The manufacturer shall keep such information current, and will provide the Division with copies of any and all changes. So long as such maintenance, calibration and repair, services are available from the manufacturer or its agent, the Division shall protect such information as confidential commercial data if it is clearly marked as such. In the event that the manufacturer becomes insolvent or stops providing adequate maintenance, repair or calibration services in Colorado all such information shall be the property of the Division and may be released to a third party as necessary to repair, calibrate and maintain the analyzers.

1.6 Warranty Coverage/Mandatory Service Contract

A written warranty coverage agreement, signed by an authorized representative of the equipment manufacturer and the vehicle inspection station owner, which provides a complete description of coverage for all systems and components and all manufacturer provided services listed in Section 1.8, must accompany the sale or lease of each Colorado 94 emissions analyzer.

An extended service contract must be available upon the expiration of the manufacturers original warranty period. Original manufacturer's warranty shall be a minimum of one year from the date of purchase. The “service contract” shall be offered in one-year increments and is a mandatory condition of inspection station operation. The “service contract” agreement shall include the inspection station owner's name, inspection station address, telephone number, inspection station identification number, analyzer serial number and detailed terms of the agreement. The agreement must extend for at least one year with the expiration date entered to software file and monitored by the system clock. Approaching expiration messages must be displayed at daily system start-up beginning thirty days prior to expiration and massaging “30 days until expiration, 29 days etc.” Failure to renew the “service contract agreement” will cause the analyzer to automatically “lock-out” from any official inspection process. Renewals shall be offered at the inspection station owner's request and governed by “good business” practices between the parties involved. Service contract agreements must be available by the manufacturer for the mandated life of the Colorado AIR Program. Cost disclosures and detailed descriptions of coverage's must be available in printed form and distributed to all Colorado 94 users. Cost disclosure shall also be made for “consumable” inventory items 1.8B. This information would most appropriately be presented with the original manufactures warranty.

1.7 Tampering Resistance

Controlled access design shall be the responsibility of the manufacturer and is subject to approval by the Colorado Department of Public Health and Environment. Analyzer service personnel, inspectors or others shall be prohibited, to the Colorado Department of Public Health and Environment satisfaction, from creating or changing any test results, programs or data files contained in the analyzer. Manufacturers shall utilize special BIOS partitions, or other appropriate software and hardware provisions, deemed necessary to protect the I/M files and programs. The protection features shall prevent access to the secured floppy disk drive and those portions of the hard disk containing I/M programs and test data or files.

The emission analyzer and the sampling system shall be made tamper-resistant to the Colorado Department of Public Health and Environment satisfaction. At a minimum, the manufacturer shall develop tamper-resistant features to prevent unauthorized access though the cabinet. Microswitches, keyed locks, or software algorithms requiring the use of a password, which can be changed by the Colorado Department of Public Health and Environment would all be acceptable provided the physical or logical design effectively prevents unauthorized access.

Manufacturers may offer analyzers with additional floppy disk drives that can run optional software application programs.

If tampering occurs, a software lockout algorithm shall be activated which aborts any existing test sequence and prevents further inspections until an authorized AIR Program official clears the lockout.

The lockout system shall be designed so that an AIR Program official from the audit menu can activate it. Only AIR Program Auditors may remove lockouts put in place from the audit menu. Manufacturers shall develop a system by which their service technicians shall be prevented from clearing “tamper” lockouts.

Optional software packages shall not interfere with the normal operation of the I/M inspection and testing software, and shall not compromise the tamper-resistant features of the analyzer.

Manufacturer field service representatives will not have access to DOS, unless assurances acceptable to the Colorado Department of Public Health and Environment have been provided that insure, integrity of the system will not be jeopardized.

1.8 Manufacturer Provided Services

The manufacturer shall agree to provide the following services to the inspection station as part of the manufacturer's original warranty and thereafter as a portion of the service contract agreement. The cost of a service agreement is to be listed on a year-by-year basis. Future charges cannot exceed the amount published.

A. Delivery, installation, calibration, and verification of the proper operating condition of a Colorado 94 emissions analyzer.

B. Quarterly (90 days) examination, calibration, and routine maintenance of the analyzer and sampling systems. Full systems support and repair, including loaner units. Upon initial sale or loan, provide “extra” printer medium (1 ea.) sample filter(s)(2), sample hose (1) and sample probes (1). Maintain the “extra” consumable inventory upon examination and provide a software history file for the replacement of consumables accessible to AIR Program officials. Consumables and the cost(s) thereof must be disclosed in the service agreement.

C. Instruct all certified inspectors employed by the inspection station at the time of installation in the proper use, maintenance, and operation of the analyzer. The analyzer shall contain a feature that will allow an inspector to go through the complete inspection procedure without generating an official inspection record. This function will be used for evaluating inspector performance, by AIR Program officials, or by the manufacturer for demonstration purposes. The “training mode” shall not require the use of an inspector's access code or allow access to secured areas of hardware or software. The display shall show a message throughout the inspection that this is not an official inspection. Vehicle inspection reports shall indicate to the satisfaction of the Colorado Department of Public Health and Environment that they are for training only. No official Certificate of Compliance will be generated during the training exercise.

D. On-site service response by a qualified repair technician within two (2) business days, (48 hours) excluding Sundays and national holidays, of a request from the inspection station. The names, toll-free telephone numbers, and service facility addresses of all manufacturer representatives responsible for equipment service shall be provided to the inspection station. A service representative shall be available at all times during normal working hours. Sundays and national holidays are not included. All system repairs, component replacements, and/or analyzer adjustments, shall be accomplished on-site within 48 hours after a service request has been initiated. If the completion of this work is not possible within this time period, a Colorado 94 loaner unit shall be provided until the malfunctioning unit is properly repaired and returned to service. Service representatives shall have a software driven menu option that allows the transfer of inspection station, inspector information and other applicable data files from one analyzer to another without manual inputs and without transfer of previous test files.

E. Updates of the “Functional” software will be limited to once per year at no cost.

Updates of operational software i.e., file based information will be on an “as required” basis. All forms of software updating will utilize modem technology for the updating process. File updates are at no cost and every effort will be made to minimize them.

F. The analyzer software shall be designed so that AIR Program officials can insert a floppy disk, prepared by the manufacturer, into the Program system host, and update the existing software version, via modem. A system of manual updating by program officials utilizing the auditor's menu shall also be available. Look-up up tables and message screens shall be designed sufficiently separate from the main operations software so that it is not possible, to interfere in any way with the operations of the analyzer.

The Colorado Department of Public Health and Environment will require the manufacturer to render updates as necessary in the first year of the program to ensure the program meets all design criteria. Thereafter software updates will be limited to once per year at no cost. Since modem software updating will be utilized, there are no costs to the analyzer owner. A software version number, consisting of a four character alpha-numeric code made up of the last two digits of the year followed by a two character version number, shall be recorded in the analyzer and included on each vehicle test record. The analyzer manufacturer shall not modify any existing software version without obtaining written approval from the Colorado Department of Public Health and Environment.

The Colorado Department of Public Health and Environment may require the manufacturers to conduct on-site or laboratory testing of in-use analyzers in order to document continued compliance. When an analyzer is removed from the field, for repair or testing, manufacturers shall supply the inspection station from which it was removed with a temporary replacement unit meeting all program requirements. Manufacturers shall pay for all necessary shipping and transfer costs for the replacement of the analyzer selected for compliance testing. Manufacturers shall also pay for any required testing performed by their personnel or by an independent company.

The manufacturers shall provide training to AIR Program officials on all operational, maintenance, and quality control features of the analyzers, including full access to and use of inspection menus, audit menus and calibration menus, as well as optional programs offered to inspectors. Such training shall be conducted at the manufacturer's expense as a condition of certification and thereafter at reasonable intervals upon written request by the Colorado Department of Public Health and Environment

1.9 Certification Requirements

The manufacturer shall submit a formal certificate to the Colorado Department, of Public Health and Environment that states that any analyzer sold or leased by the manufacturer or its authorized representatives for use in the Colorado AIR Program will satisfy all design and performance criteria described in these specifications. The manufacturer shall also provide sufficient documentation to demonstrate conformance with these criteria including a complete description of all hardware components, the results of appropriate performance testing, and a point-by-point response to specific requirements. Previous certification by the California Bureau of Automotive Repair (BAR) is necessary for the analytical bench.

In addition, a full description of the company's service procedures and policies, as well as sample contracts, warranties, and extended service agreements, shall be provided as part of the certification application to ensure proper maintenance of all analyzers throughout their useful life. One fully functional analyzer shall be presented for evaluation and one additional fully functional analyzer for the certification process. If certified these units will remain in AIR Program possession for continued in-use evaluation for the life of the AIR Program. In the event that 1 % of overall unit sales exceed this two-unit base, in-use evaluation will require 1 % of overall unit sales for in use evaluation.

2.0 CONSTRUCTION DESIGN

2.1 Materials

All materials used in the fabrication of the analyzer and the appropriate housing assembly shall be new and of industrial quality and durability. Contact between non-ferrous and ferrous metals shall be avoided where possible. Suitable protective coatings shall be applied where galvanic action is likely. All mechanical fasteners shall have appropriate locking features. Use of self-tapping screws shall be limited. All parts subject to adjustment or removal and reinstallation shall not be permanently deformed by the adjustment or removal-reinstallation process and this process shall not cause deformations to adjoining parts. Only materials that are not susceptible to deterioration when in contact with automobile exhaust gases shall be used.

2.2 Construction

The analyzer shall be complete and all necessary parts and equipment required for satisfactory operation shall be furnished. A suitable means of storing the probes and sample hose shall be provided. A means of storing the “spares” inventory shall be included. All parts shall be manufactured and assembled to permit the replacement and/or adjustment of components and parts without requiring the modification of any parts or the basic equipment design. Where practical, components and/or subassemblies shall be modularized. The analyzer cabinet finish shall be baked enamel or another durable finish.

2.3 Mobility

The analyzer unit shall be designed for easy and safe movement over rough surfaces and/or graded surfaces (15° incline). The center of gravity and wheel design shall be such that the analyzer can negotiate a vertical grade separation of one-half inch (1/2”) without overturning when being moved in a prescribed manner. Industrial grade, swivel casters shall be used to permit 360° rotation of the unit. The caster wheels shall be equipped with oil resistant tires and foot operated brakes capable of preventing movement on a 15° incline.

2.4 Electrical Materials/Construction

Unless otherwise specified, all electrical components and wiring shall conform to standards established by the Underwriters Laboratories, Standard for Electrical and Electronic Measuring and Testing Equipment (U.L-1244).

The analyzer shall operate from an 115VAC, 60 hertz (Hz) supply. An input voltage variation of ±12 volts shall not change analyzer performance more than 1 % of full scale. The analyzer must operate on a 15 AMP breaker. The power cable shall be equipped with a standard three-prong connector at the inlet, and shall have a National Electrical Code rating of SO, SJO or better with an overall length not to exceed 25 feet. Each emissions analyzer shall incorporate safety devices to prevent conditions hazardous to personnel or detrimental to equipment. The system shall be grounded to prevent electrical shock, and adequate circuit overload protection shall be provided. The analyzer shall incorporate an internal surge protector.

2.5 Sampling System

The sampling system consists of two subsystems: (1) external sampling system; and (2) internal sampling system. The external system shall include a sample probe, sample hose twenty-five feet (25') in length, a water trap, and a filtration system. The internal subsystem shall include but not necessarily be limited to, a sample pump and bypass pump, or an equivalent system approved by the Colorado Department of Public Health and Environment.

The sample probe shall incorporate a positive means of retention to prevent it from slipping out of the tailpipe when in use. A thermally insulated, securely attached handgrip shall be provided on the probe in such a manner that easy probe insertion using one hand is ensured.

The probe shall also have a smooth surface near the probe tip before the flexible portion of the probe to be used for sealing of the span gas adaptor necessary for field or on-board leak checking (vacuum or gas) or response time checking equipment. For standardization, it is recommended that the sealing surface be one-half inch (1/2”) in outside diameter and one-half to one inch (1/2” to 1”) long. A probe tip cap shall be provided for the sample system leak check. A probe tip adapter or assembly shall be included for use with spark arrester type tail pipes.

The interconnecting hose shall be of such design and weight that the inspector can easily handle it. The hose shall be of non-kinking construction and fabricated of materials that will not be affected by or react with the exhaust gases. Molecular HC hang-up shall be minimized. The hose connection to the analyzer shall be reinforced at the point of maximum bending. The system shall be designed with a water trap in the bypass sample stream. The water trap shall be continually self-draining. The trap bowl shall be constructed of a durable transparent material. The water trap should be located as low as possible on the analyzer so that condensed water in the sample hose will drain into them. However, the trap must be placed in a position readily visible to the inspector. The sample for the analyzer shall be obtained from the top of the water trap. The sampling system shall be equipped with a suitable particulate filter upstream of the optical bench. There may be a secondary filter located in the sample hose, serviceable by the inspector. This filter must have sufficient capacity to filter the samples obtained during the routine testing of vehicles in the inspection station. Threaded connections must be used to attach the filter to the sample hose. A prompt shall be provided to the inspector indicating when the filter should be changed based on an indication of low flow (automatic lock-out) or other criteria approved by the Colorado Department of Public Health and Environment

The pumps shall contain corrosion resistant internal surfaces. The pumps shall have a minimum operational life of 2,000 hours without failure.

The sample pump system may be a single pump, multiple pumps, or a multiple stage pump or an equivalent system approved by the Colorado Department of Public Health and Environment. The sample pump shall have integral motor overload protection and be permanently lubricated. The bypass system shall be connected in the sample system so that any water condensed in the water trap is removed and dumped outside the system.

2.6 Storage Temperature

While in storage, the analyzer and all components thereof shall be undamaged from ambient air temperatures ranging from 0° F to 120° F.

2.7 Operating Temperature

The analyzer and all components shall operate within calibration limits in ambient air temperatures ranging from 41° F to 110° F.

2.8 Humidity Conditions

The analyzer shall be designed for use inside a building that is vented or open to outside ambient humidity. The analyzer, including all components of the analytical, sampling, and computer systems, shall operate within the required performance specifications at ambient conditions of up to 80% percent non-condensing relative humidity throughout the required temperature range, assuming the components are reasonably protected by the inspector from direct contact with water, or other condensing moisture. Failure of any component due to exposure to temperature and humidity extremes within this limits specified during actual use shall be corrected at the manufacturer's expense.

2.8.1 Temperature Control

Analyzer components that affect sensitivity and calibration shall have their internal temperatures controlled to maintain design temperature when exposed to prevailing ambient conditions. If internal operating temperatures are exceeded the analyzer will automatically lockout from any official inspection process.

2.9 Barometric Pressure Compensation

Barometric pressure compensation shall be provided. Compensation shall be made for elevations up to 6,000 feet (mean sea level). At any given altitude and temperature, errors due to barometric pressure changes of ±two inches (2") of mercury shall not exceed the accuracy limits specified in this specification. Manufacturers shall describe in writing how compensation will be accomplished. The method used shall be acceptable if approved by the Colorado Department of Public Health and Environment.

2.10 Operational Design

A. Analytical System

These analyzers shall utilize non-dispersive infrared systems for measuring hydrocarbons (HC), carbon monoxide (CO), and carbon dioxide (CO2). Oxygen (O2) shall also be measured and ambient air will be used for calibration purposes.

B. Readout Display/CRT Screen

The screen shall contain numerical HC (as hexane), CO, CO2 and O2 displays and a pass/fail indication at the completion of the inspection process. Pressure purge shall be a pass/fail indication, with pressure/time values recorded to file.

The numerical display shall be of a digital format. The resolution of the emissions display shall be as follows:

HC: XXXX ppm (as hexane)

CO: XX.XX%

CO2: XX.X%

O2: XX.X%

The **MINIMUM** display increments shall be 1 ppm HC, 0.01 % CO, 0.1% CO2, and 0.1% O2. The displays shall be capable of full-scale readings of 2000 ppm HC (as hexane), 9.99% CC, 16.0% CO2 and 25.0% O2.

CRT display is to be employed for an exhaust sample validity (sample dilution). This indication will signal excess dilution in the exhaust system based upon measurement of CO + CO2 emissions.

The analyzer shall be capable of selecting the pass/fail values (limits) based on vehicle model year, vehicle type, or other criteria. The system shall be designed in such a manner that the standards and vehicle groups may be readily revised by a modem software update.

Specific emissions limits and vehicle model year groupings are available in this Regulation Number 11, Part F: maximum allowable emissions limits for motor vehicle exhaust, evaporative and visible emissions for Light-Duty and Heavy-Duty vehicles.

2.11 Automatic Calibrations

The analyzer shall be designed to require an automatic two-point gas calibration for HC, CO, and CO2, and an automatic electrical zero and span check. (O2 shall be measured by ambient air.) The automatic gas calibration shall be conducted every 24 or 72 hours, activated by the internal clock. The option of 24 HOUR calibration will be software selectable, with the default @ 72 hours. Electrical zero and span check (automatic) shall be required prior to each test sequence. User-friendly prompts shall be provided to the inspector to indicate every step needed to properly perform the required gas calibration (including when it is necessary to turn the gas cylinder valve on and off).

If the system is not calibrated, or the system fails the calibration or the zero and span check, an error message or fault indication shall be displayed and the analyzer shall be locked out to prevent the performance of an emissions inspection. Lockout will remain until the system is property calibrated and passes a calibration check and zero and span check.

The calibration record will contain before and after calibration readings. The gas calibration shall ensure that accuracy specifications are satisfied and that linearity is correct at the required span points. The gas calibration and leak check procedures shall require no more than five (5) minutes to complete. The analyzer shall provide adequate prompts on the display to guide the inspector through the calibration procedure in a manner that minimizes the amount of calibration gas used.

The system shall have the capability of printing historical calibration data for specified date ranges by the AIR Program Auditor. (Audit menu, calibration history)

For HC, CO and CO2, analyzer manufacturers shall limit gas usage during the gas calibration procedure to two liters per point. The analyzer shall also be designed to keep the loss of calibration gas to an absolute minimum (less than 0.5 liters in 24 hours) if the calibration gas valve(s) is/are not shut off. Manufacturers shall provide an evaluation of this capability, consisting of at least four (4) analyzers, with their certification application materials and shall demonstrate this feature during certification.

The analyzer shall be equipped with a gas calibration port for the purpose of performing a probe to calibration port comparison for audit purposes. Gas auditing shall be accomplished by introducing standard gases into the analyzer either through the calibration port or through the probe. Span gases utilized for calibration shall be within two percent (2%) of the following points: Ambient air may be used to calibrate the O2 sensor.

(HC)	300	ppm propane
	1.0	% carbon monoxide (CO)
	6.0	% carbon monoxide (CO2)
	Bal.	Nitrogen (N2)
(HC)	1200	ppm propane
	4.0	% carbon monoxide (CO)
	12.0	% carbon monoxide (CO2)
	Bal.	Nitrogen (N2)

The standard gases used to calibrate, and audit the analyzers shall satisfy the criteria included in the Federal Clean Air Act, Section 207 (b) and described in Subpart W of Part 85 of Chapter I, Title 40 of the Code of Federal Regulations. In order to ensure that the quality of the standard gases used in the program meet these specifications, all standard gases purchased by the inspection facility for use in the analyzer must conform to the requirements established in 1990 by the California BAR for Test Analyzer System Calibration Gases. Calibration gases must be purchased from a vendor that is approved by the Division,. These requirements include the testing and certification of the concentration, accuracy, precision, and purity of the standard gases to within the referenced limits and the labeling of individual gas canisters describing these and other specified parameters.

Automatic EVAP Pressure Calibration

The pressure test system is to be calibrated every 24 or 72 hours and zero/span checked before each inspection. Pressure calibration checks should be performed simultaneously with the gas calibration procedure. Calibration and/or zero span checks must pass or the analyzer must lockout from further testing until the discrepancies are corrected. All calibrations will be stored to the Cal.Dat file. Pressure system calibrations shall be performed in a maximum time period of 5 minutes, calculated independently from the gas calibration and leak check. The optional 24-hour option shall be selectable and defaulted to 72 hours.

A. Automatic Leak Check

An automatic leak checking system shall be provided that will allow the vacuum side of the system to be checked for leakage. Appropriate valves lines, and switches shall be installed to permit this operation. Minimal activity by the inspector, such as setting the probe in a holder or capping the probe, is permitted, provided errors resulting from improper inspector action would be identified by the computer and would require corrective actions. Improper action would cause the system to fail a leak check, and automatically lockout. User-friendly prompts shall be provided to the inspector to indicate every step needed to properly perform the required leak check (including when it is necessary to turn the gas cylinder valve on and off).

A system leak check shall be accomplished every 4 or 24 hours and in conjunction with the gas calibration performed every 24/72 hours, activated by the internal clock. The 4-hour option shall be software selectable with the 24 hours as the default value. Four-hour leak checks are required only for those facilities performing more than 4000 inspections per year. The analyzer shall not allow an error of more than ±3% of reading using mid-range Colorado certified span gas to perform the leak check. Fittings and connectors used on the sample hose and probe shall be constructed to inhibit the bypass of the leak check. A maximum of two liters of calibration gas may be used to perform the leak check. If the system is not leak checked, or the system fails a leak check, an error message or fault indication shall be displayed, and the analyzer will be locked out to prevent the performance of an emission inspection, until the system is properly leak checked and passes.

B. Automatic HC Hang-Up Check

The analyzer shall be designed for using ambient air induced through the sample probe, prior to each test sequence. The analyzer shall have a CRT prompt/indicator. “Hang-up” activation shall cause the analyzer to automatically sample ambient air through the sample line and probe. The system shall continue to sample room air for a maximum of ***150*** seconds or until the HC response is below 20-ppm hexane.

If the HC hang-up does not drop below 20 ppm within ***150*** seconds, a message shall be displayed indicating possible dirty filters or sample line. If after ***150*** seconds HC levels are not below specified values, the test shall be discontinued until HC hang-up is corrected. When the level stabilizes below this value, an indication that testing may begin shall be displayed. The analyzer shall be locked out from operating until the HC level is met.

C. Vehicle Diagnostics

During analyzer warm-up, emissions diagnostics and other gas reading functions shall be prohibited. After successful warm-up and for the purpose of vehicle diagnosis or repairs, the analyzer shall have a menu selection that will allow the analyzer to continuously monitor the vehicle exhaust.

The automatic data collection system shall be prevented from operating anytime the analyzer is not being used in the official emissions inspection mode.

D. Dilution

The analyzer manufacturer shall document to the satisfaction of the Colorado Department of Public health and Environment that the flow rate on the analyzer shall not cause more than 10% dilution during sampling of the exhaust at normal idle (10% dilution defined as sample of 90% exhaust and 10% ambient air). Manufacturers shall utilize the procedures specified by the BAR for demonstrating this dilution criterion. The analyzer shall be equipped with a feature to identify vehicle exhaust system leaks and sample dilution. The preferred method for identifying leaks is monitoring the CO & CO2 levels in the exhaust. Other additional techniques that can demonstrate improved sensitivity to leaks may also be used.

DILUTION VALUES:

All light duty vehicles: 6%

All heavy-duty vehicles: 5%

If the CO + CO2 reading is less than the limit, the inspector shall be prompted to check the exhaust system for leaks and to make sure that the sample probe is all the way into the tailpipe. If the excessive dilution is detected after the initiation of the test sequence, the analyzer output shall display “SAMPLE DILUTION”. If dilution continues the inspector shall be required to “Abort Test”. The system shall store the “Abort Test” indication.

E. Engine Tachometer

A digital display tachometer shall be CRT displayed for the purpose of measuring engine speed. The tachometer operation shall be by two means; (1) radio frequencies "RF" type transmitter/receiver that requires no direct vehicle connection and can detect engine RPM on vehicles utilizing "DIS" systems. (2) a cable type connection capable of detecting engine RPM from all forms of current O.E.M. ignition technology. Tachometer performance shall be no less than; RPM with a 0.5 second response time and an accuracy of ±3.0% of actual RPM. During an official inspection process, the software will prompt the inspector to shut the engine off while connecting the RPM probe (only if a cable connection is being made). A software "HELP" screen will be available to assist the inspector in locating an RPM signal. This information may be supplied or reviewed by the Colorado Department of Public Health and Environment. Based on the vehicle identification information available to the inspector, the analyzer will prompt the inspector as to which vehicles require a specific type or method of connection of the tachometer pick-up. Analyzers shall be provided with all the software and hardware that is necessary to make them capable of reading engine RPM from all O.E.M. ignition technologies in use at the time of certification, Possible updates may be required to enable future ignition systems to be monitored for engine RPM.

F. Analytical Bench Accuracy

Each analyzer shall meet the following analytical accuracy requirement:

Channel	Range	Accuracy
HC ppm	0-400	±12ppm
	401-1000	±30ppm
	1001-2000	±80ppm
CO%	0-2.00	±0.15%
	2.01-5.00	2.040%
CO2%	04.0%	±0.6
	4.1-14.0	±0.5%
	14.1-16.0	±0.6%
O2%	0-10.0	±0.5%
	0-10	±1.3%

The analyzer display resolution electronics shall have sufficient resolution and accuracy to achieve the following:

HC	1 ppm	HC
CO	0.01%	CO
CO2	0.1%	CO2
O2	0.1%	O2

G. Drift

If zero and/or calibration drift cause the infrared signal levels to move beyond the adjustment range of the analyzer, the inspector shall be locked out from testing and instructed to call for service.

H. Warm-Up

The analyzer shall reach stabilized operation in an inspection station environment within 15 minutes at ° 41 degrees Fahrenheit from “power on”. The instrument shall be considered “warmed-up” when the zero and span readings for HC, CO, and CO2 have stabilized, within ± 3% of full range of low scale, for five minutes without adjustment.

Functional operation of the gas-sampling unit shall remain disabled through a system lockout until the instrument meets stability and warm-up requirements. If the analyzer does not achieve stability with 15 minutes, from “power-on” , it shall be locked out from I/M testing and a message shall be displayed instructing the inspector to call for service.

During the warm-up, the Main Menu shall be displayed unless an optional functional menu or menus are offered. The analyzer system shall lock out all bench related functions during warm-up. During warm-up, a message under the main menu shall be prominently displayed as follows: “Warm-up in progress - checking for stability”. During the initial entry into the “warm-up” period, and before any other menu can be selected, the software will automatically enter a “bulletin display” function and display any messages or bulletins forwarded from the AIR Program host system via modem transfer in the past 72 hours. This screen will reference the inspector.dat file and require each inspector to enter their access code as verification of receipt, before allowing that inspector to Proceed with an inspection. No inspector can enter into an official inspection without having “logged on” as having seen the Bulletin screen. When stability is achieved and the warm-up requirements are satisfied, access to gas bench functions shall be permitted.

I. System Response Time Requirements

The response time from the probe to the display shall not exceed eight (8) seconds to 90% of a step change in input, nor will it exceed 12 seconds to 95% of a step change in input. For the O2 sensor, the response time shall be no more than fifteen (15) seconds to 90% of full scale.

J. Optical Correction Factors

The hexane/propane equivalency factor (PEF) shall be limited to values between 0.49 and 0.52. If an optical bench is used that can demonstrate accuracy of propane/hexane identification within specification, using a range greater or lesser than indicated, it will be considered. Factor confirmation shall be made on each analyzer assembly by measuring both N-hexane and propane on assembly line quality checks. The PEF shall be permanently stored in non-volatile memory. The PEF shall be displayed on the monitor on request by inquiry through the menu system. The optical bench shall he marked with a permanent “stamped” type tag identifying its PEF.

The signal strength from the source to the detector for all channels shall be monitored such that when the signal degrades beyond the adjustment range of the analyzer, the analyzer shall be locked out from operation, i.e. fail calibration.

K. Interference Effects

The effect of extraneous gas interference on the HC, CO, and CO2 analyzers shall not exceed ±10 ppm HC, ± 0.05% CO, and ±0.20% for CO2.

The instrument design shall insure that readings do not vary as a result of electromagnetic radiation and induction devices normally found in the inspection environment (including high energy vehicle ignition systems, RF transmission radiation sources, and building electrical systems). In addition, the manufacturer shall ensure that the analyzer processor and memory components are sufficiently protected to prevent the loss of programs and test records.

2.12 Gas Calibration File

At the conclusion of each gas calibration the required data shall be placed in the CAL.DAT file.

2.13 Microcomputer Specifications

A. A standard microcomputer must be included in the analyzer and is to be used to control all analyzer functions. Each vendor is to develop DOS executable programs for each required function. These programs shall:

1. control each of the analyzer functions and time of function;

2. examine and obtain values from all of the analyzer sensors;

3. read and write information to diskette in standard DOS format; and

4. copy the analyzer, inspection station identification information from the hard disk onto each new floppy diskette when formatted.

The Colorado Department of Public Health and Environment reserves the right to add additional programs and functional performance requirements, up to the technical limits of the hardware, to improve the I/M program.

Sufficient flexibility shall be provided in the design of the microcomputer system to allow expansion of the analyzer to include, but not be limited to, the following additional capabilities:

1. connect and recover data from vehicle on-board diagnostic systems (OBD) meeting SAE specifications when they become available;

2. monitor vehicle recall data; identify, record and process data as required when an official EPA/SAE format is identified.

3. accommodate additional input channels in both analog and digital form. Two free slots, 16 bit capability.

The manufacturer may offer additional features that utilize the microcomputer as a stand-alone personal computer by providing optional software to perform various non-I/M functions. Such offerings must not interfere with the inspection requirements, or in any manner affect or allow the inspector to tamper with the inspection-related computer programming or data files.

The analyzer shall be equipped with an internal clock that operates independently from the power source and will provide accurate and automatic date and time information for the following functions:

a. each test performed;

b. automatic gas calibration and pressure test check (72 hours); (24 hour) optional

c. automatic leak check (4 or 24 hours and every 24/72 hours for automatic gas calibration), and leak check combination.

d. audit sequence:

All equipment and software submitted for Colorado certification must be the full and current configuration proposed for sale. Partial, dated, or incomplete models are not acceptable.

Acceptance of the microcomputer portion of the Colorado 94 Analyzer system will be dependent upon the satisfactory performance of the full-proposed configuration meeting all the requirements of this specification.

The proposed hardware configuration must be fully supported by all software and/or operating systems listed in the acceptance requirements or elsewhere in these specifications. Performance tests to prove compatibility will be conducted. The vendor will bear all shipping and equipment preparation charges for the certification testing.

2.14 Standard Hardware: Minimum Required Configuration

1. Operating System

DOS Version 6.2 or most current

2. Processor

The microprocessor must be fully compatible with the Intel 80486 microprocessor. Upgradable to Pentium technology.

3. RAM Memory

The system must contain at least 2 MB of user available RAM. (expandable to 16 MB)

4. Power Up Sequence

The system must include a power up sequence that provides a self-diagnostic routine to check the on-line presence of critical PC components (including, at a minimum, the processor, firmware ROM, hard disk controller, keyboard, clock, modem, printers, bar code reader I/O ports, setup RAM and memory).

5. Video

The CRT display must be at least 12” in diagonal measure and operate in a VGA mode.

The software shall automatically blank the screen or use a screen saver mode, if no keyboard entry is made for 10 minutes. The display shall return when the inspector strikes any key.

6. Floppy Disk

   Each unit must come with an IBM compatible floppy disk drive that will permit full usage of 2sHD 1.44 Mb 3.5" removable media. The drive must be located in a secured area accessible only to authorized AIR Program Service representatives. That secured drive must also include an approved method to limit logical access. Colorado Department of Public Health and Environment will test the system for drive security and it should not provide access to the secured floppy except through the approved security procedure. The secured floppy drive shall be designated the "A" drive.

7. Hard Disk

   Each unit must come with at least 120 megabytes of hard disk storage. The vendor may use up to 40 megabytes for their programs and data provided at least a full 80 megabytes of usable storage is available for Colorado Department o1 Public Health and Environment and user information. The hard disk is to be self-parking (where applicable), shock mounted, and able to operate reliably in the inspection environment. The hard disk must also include a Colorado Department of Public Health and Environment approved method of limiting access to data and programs. The hard disk containing programs and data files shall be designated the "C" drive.

8. I/O Ports

   The unit must include sufficient I/O ports of proper configuration to allow the connection of all required options and the capability to add additional I/O boards.

9. Keyboard

   The Colorado 94 Analyzer keyboard must be fully interfaced with the microcomputer and have all of the necessary normal, numeric, cursor, control, shift, alternate, and function keys needed to operate a standard IBM PC compatible microcomputer, preferably 101 keys should be provided.

10. Bar Code Scanner

    The bar code scanner shall be equivalent to the PDF 1000 "HV" (High Visibility) Scanner from Symbol Technologies. Performance specifications are included in Technical Specification Appendix A. The PDF 1000 "HV" is a scanner capable of reading both 1 -D and PDF-417(2-D) bar codes.

11. Hard Disk Expansion

    System must include a hard disk interface that will fully support a second internal disk drive of the same type as the original type drive or a functional equivalent approved by the Colorado Department of Public Health and Environment that does not compromise tamper-resistance.

12. Additional Storage

    3.5" 1.44 Mb Floppy Disk Drive IBM Optical disk drive, floptical, CD ROM reader etc., these options would be for manufacturer offered look up tables, service information or other options requiring additional storage capability.

13. Communications

Hayes compatible modem at 14,400B, M.N.P. Level 5. Error correction: Microcom networking protocol (M.N.P.) levels 1-4 and V.42 data compression: M.N.P. level 5 and V.32BIS/V.42BIS. Protocol will be provided within the operational software package. Modem communications will be necessary during the inspection process for V.I.N. verification, multiple "I" Test Control, vehicle recall etc., from the Network System Host Computer.

2.15 Required Printers

A. Diagnostic printer:

A 24 pin impact printer shall be supplied which is dedicated to the task of printing designated information on a VEHICLE DIAGNOSTIC FORM, or other repair type information. Continuous, fanfold, preprinted (ghost printed certificates) will be used. The printer shall print information on the certificate using 12 characters per inch and 80 characters per line.

B. Certificate Printer:

The certificate printer is to be a "thermal transfer" technology printer, capable of producing PDF 417, two dimensional bar code and Code 39, one-dimensional bar code. As of date, Standard Register produces a model of printer that meets or exceeds all requirements necessary to print upon the required certificate. This model is a PT650 Thermal/Thermal Transfer Printer. Specifications of the certificate printer shall be Standard Register FT650 or equivalent. With equivalency being defined as successful completion of printing, security, storing and dispensing of the required certificate. Final acceptance of alternative printers lies with written State approval.

Standard Register PT650 technical specifications are included in the Technical Specification Appendix B.

PHYSICAL SPECIFICATIONS OF CERTIFICATE:

Physical specifications of the certificate, to include print fields, physical design, materials and sizing are to be determined by the Department of Revenue.

C. Certificate Security:

The inspection certificate printer and certificate storage area shall be located in a secured area. Access to the area securing the printer and certificates shall be available only to the licensed inspector at the station. The certificate storage area shall have a redundant security system utilizing both a hardware lock and a software lock that meets Colorado Department of Public Health and Environment approval. Certificates will be prevented from being "pulled" through the printer. A form of printer locking must be utilized. The secured area containing certificates and the certificate printer, shall be designed so that the same key can be used to open any access doors that secure any optional storage media. If any of these doors are opened, a microswitch (or equivalent) shall be used which prevents the printing of certificates and records each event with time and date to an entry.dat file.

The purpose of the software lock is to restrict access to the printer with the following exceptions: loading and aligning certificates prior to printing, clearing paper misfeed or jam problems, etc., and to provide a record of the personnel performing those functions.

The area containing the certificates shall be located so that proper routing is maintained on the certificates as they are fed through the printer.

If tampering occurs, a software lockout algorithm shall be activated which aborts any existing test sequence and prevents further emission testing until an AIR Program official clears the lockout.

There shall be easy access to the vehicle diagnostic report printer so that the inspector can easily replace paper, clear paper jams and change ribbons.

2.16 Clock/Calendar

The analyzer unit shall have a real time clock/calendar which shall make available the current date and time. Date will be in month, day, year format and time will be in 24-hour format. The AIR Program system host computer shall update both time and date during each transfer of data via the system modem.

The date/time, along with the time the test started and when it ended, is to be included on the test record. The start time is when the inspector's access code is entered and the end time is when the analyzer data is written to the test file.

If the clock/calendar fails or becomes unstable (as referenced to the program host system during modem data transfer), the analyzer unit shall be locked out from I/M testing and a message shall be displayed indicating that service is required.

Resetting of the clock, independent of the host updating, shall require controlled access.

2.17 Lockout Notification

The analyzer shall alert the inspector of any lockout situation by prominently displaying a message on the CRT. Any lockout condition will be stored to file.

2.18 Vehicle Diagnosis

The analyzer shall be capable of menu selection that will allow the analyzer to be used as an ordinary garage type emissions analyzer for general automotive repair work and diagnostics.

2.19 Software Loading

The inspector shall not have to load the microcomputer's operating or applications software to operate the analyzer. On each POWER ON of the analyzer, the analyzer shall automatically do all microcomputer component self-diagnostics, memory checking, and loading of all necessary operating software without inspector intervention. Upon satisfactory computer component check out, the applications software is to present a menu of available analyzer operations. All offered features are to be menu-driven. For each feature, a context sensitive, on-line help facility is to be provided which can be accessed preferably with a single keystroke.

3.0 DISPLAY PROMPTS AND PROGRAMMING CRITERIA REQUIREMENTS

Operational software requirements will be available from the Division upon request.

ATTACHMENT I PDF 1000 Scanner

This document is contained in the Air Pollution Control Division's Emissions Technical Center Procedures Manual and is incorporated by reference.

ATTACHMENT II Thermal Transfer Printer

This document is contained in the Air Pollution Control Division's Emissions Technical Center Procedures Manual and is incorporated by reference.

ATTACHMENT III Colorado Automobile Dealers Transient Mode Test Analyzer System

This document is contained in the Air Pollution Control Division's Emissions Technical Center Procedures Manual and is incorporated by reference.

ATTACHMENT IV Specifications for Colorado 97 Analyzer

INTRODUCTION

Colorado's current enhanced I/M program contains a two-speed idle (TSI) emissions testing component, the Colorado 94 Test Analyzer System that is based upon BAR 90 technology. The TSI program utilizes a decentralized, independent inspection only format encompassing the nine Front Range counties. The DMA program is expanding to the North Front Range counties of Weld and Larimer in 2010. This inspection only population of independent inspectors will conduct inspections utilizing a new Colorado 97 emissions analyzer.

The demands for more accurate analytical information as well as a more automated inspection process with real-time data transfer has superseded the capabilities of BAR 90 (Colorado 94) technology. System enhancements are necessary to meet Colorado's inspection needs. These enhancements and other technical details are described in this document.

1.0 GENERAL

It is expected that the Colorado 97 software will be Colorado 94 software upgraded to BAR 97 and SAE J1978 and J1979 compliance.

1.1 Design Goals

The specifications that have been developed are designed utilizing a personal computer system. The analyzer system must be capable of performing uniform and consistent emission tests for Colorado's Automotive Inspection and Readjustment (AIR) Program. Features of the analyzer include: vehicle emissions measurements of hydrocarbon (HC), carbon monoxide (CO), carbon dioxide (CO2)and oxygen(O2); engine RPM measurements, exhaust dilution determinations, pressure test system for EVAP; OBD II monitor readiness and diagnostic trouble code retrieval; data entry; data retrieval tables; a dedicated printer (for vehicle inspection certificates; data recording on hard drive or removable media; modem for “on-line real time” data transmission; monitor information display to the inspector; bar code reader and printing capabilities; and fully menu driven, interactive simple microprocessor controlled operation.

Additional, automatic features required include: gas calibrations, zero and span checks, pressure calibrations, gas auditing procedure; leak checks, HC hang-up checks, audit menus (i.e., data read system), test sequencing, and low-flow checks. The analyzer shall be designed and constructed to provide reliable and accurate service in the automotive environment. The software used in the analyzer shall consist of a process control system as well as data look-up files. Security shall be provided to prevent unauthorized modifications to the software or test data and recording unauthorized entry (tampering) and locking out of the inspection process when detected.

The emissions analyzer software shall be designed for maximum operational simplicity.

It shall also be capable of providing emission-reading characteristics, independent of the inspection function, which can be used for vehicle diagnostic.

1.2 Useful Life

The useful life of the analyzer shall be a minimum of five years.

1.3 Nameplate Data

A nameplate including the following information shall be permanently affixed to the housing of the analyzer:

Name and Address of Manufacturer

Model Description

Serial Number

Date of Assembly

The manufacturer shall affix a stick-on type label to the analyzer that contains a toll-free telephone number for customer service. This number can also be included in a service software message.

1.4 Manuals

Each analyzer shall be delivered with the following manuals:

A. Reference Operating Instructions

B. Operation Instruction Manual

C. Maintenance Instruction Manual (limited)

D. Initial Start-up Instructions

Colorado 97 Analyzer manufacturers may consolidate manuals. The manuals shall be constructed of durable materials and shall not deteriorate as a result of normal use over a five-year period. The analyzer housing shall provide convenient storage for each manual in a manner that will:

E. Allow easy use.

F. Prevent accidental loss or destruction.

1.5 Certification Documentation

The analyzer software shall be fully documented. Two copies of the documentation listed below shall be submitted to Colorado Department of Public Health and Environment as part of the certification application.

A. Complete program listings. Program listings may be on disk. They are not required to be submitted with the application for certification.

B. Functional specifications.

C. Functional flowcharts of the software.

D. Example inputs and outputs from all processes.

E. Detailed interface information on system components including the identification of protocol and output specifications.

F. All file layouts with file names, file types, file security, field names, field types, field sizes, and field editing criteria.

Documentation provided by the vendor to meet this requirement will be treated as proprietary information by Colorado Department of Public Health and Environment.

Prior to certification of any Colorado 97 emissions analyzer for sale in Colorado, the manufacturer of such analyzer shall provide the Division with software source codes and all other technical information (including, but not limited to all working codes, schematics and drawings) necessary to operate, maintain, calibrate and repair such analyzer in the event that the manufacturer or its agent ceases providing adequate maintenance, calibration and repair services in Colorado. The manufacturer shall keep such information current, and will provide the Division with copies of any and all changes. So long as such maintenance, calibration and repair, services are available from the manufacturer or its agent, the Division shall protect such information as confidential commercial data if it is clearly marked as such. In the event that the manufacturer becomes insolvent or stops providing adequate maintenance, repair or calibration services in Colorado all such information shall be the property of the Division and may be released to a third party as necessary to repair, calibrate and maintain the analyzers.

1.6 Warranty Coverage/Service Contract

A written warranty coverage agreement, signed by an authorized representative of the equipment manufacturer and the vehicle inspection station owner, which provides a complete description of coverage for all systems and components and all manufacturer provided services listed in Section 1.8, must accompany the sale or lease of each Colorado 97 emissions analyzer.

An extended service contract shall be available upon the expiration of the manufacturers original warranty period. Original manufacturer's warranty shall be a minimum of one year from the date of purchase. The “service contract” shall be offered in one-year increments. The “service contract” agreement shall include the inspection station owner's name, inspection station address, telephone number, inspection station identification number, analyzer serial number and detailed terms of the agreement. The agreement must extend for at least one year and if purchased, the expiration date must be entered to software file and monitored by the system clock. Approaching expiration messages must be displayed at daily system start-up beginning thirty days prior to expiration and messaging “30 days until expiration, 29 days etc.” Renewals shall be offered at the inspection station owner's request and governed by “good business” practices between the parties involved. Service contract agreements must be available by the manufacturer for the mandated life of Colorado AIR Program. Cost disclosures and detailed descriptions of coverage's must be available in printed form and distributed to all Colorado 97 users. Cost disclosure shall also be made for “consumable” inventory items 1.8B. This information would most appropriately be presented with the original manufactures warranty.

1.7 Tampering Resistance

Controlled access design shall be the responsibility of the manufacturer and is subject to approval by Colorado Department of Public Health and Environment. Analyzer service personnel, inspectors or others shall be prohibited, to Colorado Department of Public Health and Environment satisfaction, from creating or changing any test results, programs or data files contained in the analyzer. Manufacturers shall utilize special BIOS partitions, or other appropriate software and hardware provisions, deemed necessary to protect the I/M files and programs. The protection features shall prevent access to the secured floppy disk drive and those portions of the hard disk containing I/M programs and test data or files.

The emission analyzer and the sampling system shall be made tamper-resistant to the Colorado Department of Public Health and Environment satisfaction. At a minimum, the manufacturer shall develop tamper-resistant features to prevent unauthorized access through the cabinet. Microswitches, keyed locks, or software algorithms requiring the use of a password which can be changed by the Colorado Department of Public Health and Environment would all be acceptable provided the physical or logical design effectively prevents unauthorized access.

Manufacturers may offer analyzers with additional disk drives that can run optional software application programs.

If tampering occurs, a software lockout algorithm shall be activated which aborts any existing test sequence and prevents further inspections until an authorized AIR Program official clears the lockout.

The lockout system shall be designed so that an AIR Program official from the audit menu can activate it. Only AIR Program Auditors may remove lockouts put in place from the audit menu. Manufacturers shall develop a system by which their service technicians shall be prevented from clearing “tamper” lockouts.

Optional software packages shall not interfere with the normal operation of the I/M inspection and testing software, and shall not compromise the tamper-resistant features of the analyzer.

Manufacturer field service representatives will not have access to DOS, unless assurances acceptable to Colorado Department of Public Health and Environment have been provided that insure, integrity of the system will not be jeopardized.

1.8 Manufacturer Provided Services

The manufacturer shall agree to provide the following services to the inspection station as part of the manufacturer's original warranty and thereafter as a portion of the service contract agreement. The cost of a service agreement is to be listed on a year-by-year basis. Future charges cannot exceed the amount published.

A. Delivery, installation, calibration, and verification of the proper operating condition of a Colorado 97 emissions analyzer.

B. Quarterly (90 days) examination, calibration, and routine maintenance of the analyzer and sampling systems. Full systems support and repair, including loaner units. Upon initial sale or loan, provide “extra” printer medium (1 ea.) sample filter(s) (2), sample hose (1) and sample probes (1). Maintain the “extra” consumable inventory upon examination and provide a software history file for the replacement of consumables accessible to AIR Program officials. Consumables and the cost(s) thereof must be disclosed in the service agreement.

C. Instruct all certified inspectors employed by the inspection station at the time of installation in the proper use, maintenance, and operation of the analyzer. The analyzer shall contain a feature that will allow an inspector to go through the complete inspection procedure without generating an official inspection record. This function will be used for evaluating inspector performance, by AIR Program officials, or by the manufacturer for demonstration purposes. The “training mode” shall not require the use of an inspector's access code or allow access to secured areas of hardware or software. The display shall show a message throughout the inspection that this is not an official inspection. Vehicle inspection reports shall indicate to the satisfaction of Colorado Department of Public Health and Environment that they are for training only. No official Certificate of Compliance will be generated during the training exercise.

D. On-site service response by a qualified repair technician within two (2) business days, (48 hours) excluding Sundays and national holidays, of a request from the inspection station. The names, toll-free telephone numbers, and service facility addresses of all manufacturer representatives responsible for equipment service shall be provided to the inspection station. A service representative shall be available at all times during normal working hours. Sundays and national holidays are not included. All system repairs, component replacements, and/or analyzer adjustments, shall be accomplished on-site within 48 hours after a service request has been initiated. If the completion of this work is not possible within this time period, a Colorado 97 loaner unit shall be provided until the malfunctioning unit is properly repaired and returned to service. Service representatives shall have a software driven menu option that allows the transfer of inspection station, inspector information and other applicable data files from one analyzer to another without manual inputs and without transfer of previous test files.

E. Updates of the “Functional” software will be limited to once per year at no cost.

Updates of operational software, i.e., file based information will be on an “as required” basis. All forms of software updating will utilize modem technology for the updating process. File updates are at no cost and every effort will be made to minimize them.

F. The analyzer software shall be designed so that AIR Program officials can insert a disk, prepared by the manufacturer, into the Program system host, and update the existing software version, via modem. A system of manual updating by program officials utilizing the auditor's menu shall also be available. Look-up up tables and message screens shall be designed sufficiently separate from the main operations software so that it is not possible, to interfere in any way with the operations of the analyzer.

Colorado Department of Public Health and Environment will require the manufacturer to render updates as necessary in the first year of the program to ensure the program meets all design criteria. Thereafter software updates will be limited to once per year at no cost. Since modem software updating will be utilized, there are no costs to the analyzer owner. A software version number, consisting of a four character alpha-numeric code made up of the last two digits of the year followed by a two character version number, shall be recorded in the analyzer and included on each vehicle test record. The analyzer manufacturer shall not modify any existing software version without obtaining written approval from Colorado Department of Public Health and Environment.

Colorado Department of Public Health and Environment may require the manufacturers to conduct on-site or laboratory testing of in-use analyzers in order to document continued compliance. When an analyzer is removed from the field, for repair or testing, manufacturers shall supply the inspection station from which it was removed with a temporary replacement unit meeting all program requirements. Manufacturers shall pay for all necessary shipping and transfer costs for the replacement of the analyzer selected for compliance testing. Manufacturers shall also pay for any required testing performed by their personnel or by an independent company.

The manufacturers shall provide training to AIR Program officials on all operational, maintenance, and quality control features of the analyzers, including full access to and use of inspection menus, audit menus and calibration menus, as well as optional programs offered to inspectors. Such training shall be conducted at the manufacturer's expense as a condition of certification and thereafter at reasonable intervals upon written request by Colorado Department of Public Health and Environment

1.9 Certification Requirements

The manufacturer shall submit a formal certificate to Colorado Department, of Public Health and Environment that states that any analyzer sold or leased by the manufacturer or its authorized representatives for use in Colorado AIR Program will satisfy all design and performance criteria described in these specifications. The manufacturer shall also provide sufficient documentation to demonstrate conformance with these criteria including a complete description of all hardware components, the results of appropriate performance testing, and a point-by-point response to specific requirements. Previous certification by the California Bureau of Automotive Repair (BAR) is necessary for the analytical bench.

In addition, a full description of the company's service procedures and policies, as well as sample contracts, warranties, and extended service agreements, shall be provided as part of the certification application to ensure proper maintenance of all analyzers throughout their useful life. One fully functional analyzer shall be presented for evaluation and one additional fully functional analyzer for the certification process. If certified these units will remain in AIR Program possession for continued in-use evaluation for the life of the AIR Program. In the event that 1 % of overall unit sales exceed this two-unit base, in-use evaluation will require 1 % of overall unit sales for in use evaluation.

2.0 HARDWARE SPECIFICATIONS

2.1 General

Colorado 97 hardware shall be compliant with the BAR 97 Section 2 specification, the August 2008 revision available at: http://www.bar.ca.gov/pdf/Industry/GasBlenderSpecifications.pdf

And/or current SAE on-board diagnostic “J” standards including but not limited to J1978 and J1979 available from SAE.

NOTE: The Colorado 97 is not an ASM system. ASM hardware, i.e. the dynamometer and NOx sensor, are not needed. By extension, ASM software is also unnecessary.

2.2 Span Gases

The Colorado 97 shall use two tri-blend span gas blends meeting the current California BAR97 calibration span gas low (blend 31) and high (blend 34) specifications, bearing an official “Colorado Approved Calibration Gas” label as shown in Attachment VI of this Appendix A, and supplied by a vendor approved by the Division.

2.3 Audit Gases

Audit gases shall meet California BAR97 audit gas specifications for low range and mid range #2 audit gases without NO, as approved by the Division.

3.0 SOFTWARE COMPONENTS

3.1 Communication and Data Field Specification

Operational software requirements at a minimum must support the existing Colorado 94 Communication Protocol and Data Field Specification. For inquiries referencing the Communication and Data Field Specification, please contact the Colorado Air Pollution Control Division

3.2 Society of Automotive Engineers (SAE) “J” Standards

The Colorado 97 shall be compliant with current SAE on-board diagnostic “J” standards including but not limited to J1978 and J1979.

3.3 OBD II

The Colorado 97 must be capable of accessing OBD II readiness monitors and diagnostic trouble codes. The operational software requirements will be available from the Division upon request.

3.4 Forms

The Colorado 97 shall be capable of completing the current, print on demand Vehicle Inspection Report (VIR) form. Examples of the VIR are following this Section 3.0.

3.5 Upgrades

Software shall be updated/upgraded per Section 1.8 of this Attachment IV.

Vehicle Inspection Report – Passing Form

DR 2071A (01/31/12)

VEHICLE INSPECTION REPORT

A2510FEL9H

STATE OF COLORADO

RESULTS

Overall Result	Emissions	Equipment Inspection	On Board Diagnostics	Smoke	Total Amount Paid
PASS	PASS	PASS	PASS	PASS	0.00

VEHICLE INFORMATION						OFFICIAL USE ONLY	
DATE:	26-OCT-2011 11:29:41	YEAR:	2007	STATION:	5025E	TEST:	2
VIN:		MAKE:	CHR	LANE:	01	TVFY:	B8B6
PLATE:		MODEL:	PT CRUISER	ODOMETER:	22000	VVFY:	E7BA

EMISSIONS TEST INFORMATION	READINGS	LIMITS	RESULTS
HC GPM	0.0099	4.0000	PASS
CO GPM	0.0011	20.0000	PASS
CO2 GPM	204.1342		
NOx GPM	0.0002	9.0000	PASS

EQUIPMENT INSPECTION	
Catalytic Converter Presence:	PASS
Air Injection System Presence:	PASS
Oxygen Sensor Presence:	PASS
Gas Cap Presence:	PASS
Gas Cap Integrity:	

ON BOARD DIAGNOSTICS

Check Engine Light: PASS
Check Engine Light Command Status: Off
Diagnostic Trouble Codes:
P0100, Mass or Volume Air Flow Circuit Malfunction
P0200, Injector Circuit Malfunction
P0201, Injector Circuit Malfunction - Cylinder 1
P0300, Random/Multiple Cylinder Misfire Detected
P0302, Cylinder 2 Misfire Detected

CONSUMER INFORMATION

Congratulations, your vehicle has passed the emissions inspection. If you are renewing your registration by mail, follow the instructions regarding the renewal process located on the back side of your renewal notice. If you are renewing your registration in person, the Certificate of Emissions Control, located below, must accompany all supporting documents at the time of registration. After 24 hours, you may renew your registration online at www.colorado.gov/renewplates. If the Certificate of Emission Control is lost, a new inspection is required at the owner's/operator's expense. For questions, comments and complaints contact Air Care Colorado at 303-456-7090 or the Department of Revenue at 303-205-5603 and if located outside the Denver Metro Area, call 888-200-8827. Retain this document in the vehicle as proof of emission compliance.

PLEASE REMOVE THE "CERTIFICATE OF EMISSIONS CONTROL", LOCATED BELOW, AND INCLUDE IT WITH YOUR RENEWAL CARD AND REGISTRATION PAYMENT. DO NOT STAPLE THIS DOCUMENT OR PAYMENT TO YOUR RENEWAL CARD.

CUT HERE

State of Colorado

A2510FEL9H

VOID

DATE	26-OCT-2011	VIN			
YEAR	2007	MAKE		PT CRUISER	
PLATE		FACILITY	5025E	INSPECTOR	55555

Vehicle Inspection Report – Failing Form

DR 2071B (01/18/12)

VEHICLE INSPECTION REPORT

B1610DLP9J

STATE OF COLORADO

RESULTS

Overall Result	Emissions	Equipment Inspection	On Board Diagnostics	Smoke	Total Amount Paid
FAIL	FAIL	FAIL	ADVISE	FAIL	0.00

VEHICLE INFORMATION						OFFICIAL USE ONLY	
DATE:	20-SEP-2012 10:32:06	YEAR:	2001	STATION:	5016E	TEST:	1
VIN:		MAKE:	FORD	LANE:	01	TVFY:	F161
PLATE:	TEST1	MODEL:	FOCUS	ODOMETER:	12345	VVFY:	

EMISSIONS TEST INFORMATION				EQUIPMENT INSPECTION	
	READINGS	LIMITS	RESULTS	Catalytic Converter Presence:	FAIL
HC GPM	3.8625	1.2000	FAIL	Air Injection System Presence:	FAIL
CO GPM	27.1893	15.0000	FAIL	Oxygen Sensor Presence:	FAIL
CO2 GPM	433.8854			Gas Cap Presence:	PASS
NOx GPM	2.9067	1.5000	FAIL	Gas Cap Integrity:	FAIL

ON BOARD DIAGNOSTICS

Check Engine Light: FAIL
Check Engine Light Command Status: On
Diagnostic Trouble Codes:

0115, Engine Coolant Temperature Circuit Malfunction
0130, O2 Sensor Circuit Malfunction (Bank 1 Sensor 1)
0172, System too Rich (Bank 1)

CONSUMER INFORMATION

Your vehicle has failed to comply with required State regulations for emissions inspection. All items listed as failure must be addressed prior to your next inspection. For questions, comments and complaints contact Air Care Colorado at 303-456-7090 or the Department of Revenue at 303-205-5603 and if located outside the Denver Metro Area, call 888-200-8827. You are entitled to one free reinspection within 10 calendar days, the reinspection can be performed at any one of Air Care Colorado's centers. The information recorded on this report is extremely valuable to a repair technician when having your vehicle repaired. If your vehicle fails the reinspection, you may be entitled to a waiver. Waiver eligibility information, to include hardship waivers, is available at the inspection station or by calling the Department of Revenue at 303-205-5603.

HIGH HC READINGS	HIGH CO READINGS	HIGH NOx READINGS
HIGH HC READINGS ARE A RESULT OF UNBURNED OR PARTIALLY BURNED FUEL.	HIGH CO READINGS OCCUR WHEN THE AIR/FUEL MIXTURE IS TOO RICH.	HIGH NOx READINGS ARE THE RESULT OF HIGH COMBUSTION TEMPERATURES AND/OR PRESSURES.

CUT HERE

VEHICLE REPAIR FORM

This form must be completed by the person performing the repairs AND accompany the vehicle at the time of reinspection.

Mark here if some or all repairs were warranty or recall related: ☐	Parts Costs:	$
Repaired by Vehicle Owner: ☐ Repaired by Repair Facility: ☐	Labor costs:	$
Repair Date:	Miscellaneous Costs:	$
Name of Repair Facility:	Diagnostic Costs:	$
Name of Person Filling Out Form:	Total Repair Costs:	$
Technician Number:		
Facility Number:		
Signature:		
VIN:		

ATTACHMENT V Specifications for Colorado On-Board Diagnostic (OBD) Stand-Alone Analyzer

INTRODUCTION

This document contains specifications for manufacturers to design a Colorado (CO) Onboard Diagnostic (OBD) Test Analyzer System (CO-OBD-TAS) for use in the Colorado Automobile Inspection and Readjustment (AIR) program. The CO-OBD-TAS certified for use shall be capable of conducting OBD emissions inspections, malfunction indicator lamp/check engine light (MIL) visual inspections, gas cap visual and pressure tests and a visual opacity check.

Changes to Regulation 11 allow for OBD Inspections as of January 1st 2015. Light-duty vehicles in their eighth through eleventh (8th-11th) model years will receive a mandatory (i.e., pass/fail determination) OBD inspection.

The OBD, MIL, gas cap and opacity inspections shall be conducted in accordance with the procedures set forth in AQCC Regulation No. 11, 40 C.F.R. Part 51, and EPA guidance document 420-R-01-015, *Performing Onboard Diagnostic System Checks as Part of a Vehicles Inspection and Maintenance Program*.

Design Goals

The CO-OBD-TAS must be designed and constructed to provide reliable and accurate service in the automotive service environment and have a useful life of at least five years. The software used in the CO-OBD-TAS must consist of a process control system capable of using reference data. The software also must be designed for maximum operational simplicity and be capable of providing testing information that can be used for vehicle diagnostics. In addition, the CO-OBD-TAS must include security measures that will prevent unauthorized modifications to the software or inspection data, record unauthorized entry, also known as tampering, and prevent subsequent inspections when tampering is detected.

The CO-OBD-TAS specifications contain the minimum requirements for CO-OBD-TAS used to perform emissions inspections in the AIR Program. Manufacturers may include additional items with approval from the Colorado Department of Public Health and Environment (CDPHE).

It is expected that the CO-OBD-TAS software will be SAE 1978 and J1979 compliant. The OBD inspection will include a visual and functional (bulb) check of the Malfunction Indicator Light (MIL) and an electronic examination of the vehicle's OBD computer. As outlined in the EPA guidance document, there are seven steps in this OBD inspection:

- Initiate the inspection by collecting and entering the vehicle identification information;
- Perform a visual inspection of the MIL and perform a key-on, engine-off inspection;
- Locate the vehicle's data link connector (DLC) and connect the OBD test equipment;
- Start and run the vehicle;
- With the OBD test equipment connected, determine the following:
    - The status of the vehicle's non-continuous readiness monitors;
    - The status of the MIL (commanded on or off);
    - The Diagnostic Trouble Codes (DTCs);

- Electronically record the results of the OBD inspection; and
- Turn off the vehicle and disconnect the scan tool.

Pass/Fail Requirement

The CO-OBD-TAS shall fail vehicles for the following reasons:

- Gas Cap visual fails; or
- Gas Cap integrity does not meet the standards; or
- Visual opacity greater than 5%; or
- The MIL does not illuminate at all during the Bulb check (Fail); or
- The MIL stays illuminated when the vehicle is running (Fail); or
- MIL status is commanded on; regardless of whether or not the MIL is actually illuminated (Fail).

The CO-OBD-TAS shall pass vehicles for the following reasons:

- Gas Cap visual inspection passes;
- Gas Cap integrity is within standards;
- Visual opacity less than 5%;
- The readiness requirements in Section 4 are met;
- The MIL visual bulb check passes;
- The MIL is not commanded on; and
- No Fraud is detected, as per Section 7.

Readiness Monitors

As part of the OBD inspection, the status of the vehicle's non-continuous readiness monitors is to be queried. The OBD TAS Manufacturer will implement EPA's listing of "Manufacturers Known to Have OBD Readiness Issues" and apply corrections to the readiness monitor requirements for those vehicles.

If the readiness evaluation indicates that a vehicle has more than one unset (not ready) readiness monitor, and the malfunction indicator light (MIL) is commanded off, then the inspection shall be automatically aborted with the reason printed out on the vehicle Inspection Report (VIR).

If a vehicle is unable to receive an OBD inspection (i.e. unable to communicate, DLC or readiness monitor issues), then the inspection will be aborted and the reason printed out the vehicle Inspection Report (VIR).

Keyless Ignitions

If a vehicle has a keyless ignition, then the OBD TAS software shall bypass the MIL bulb check. The software shall determine keyless ignition systems electronically, by way of an OBD test information look-up table. The software shall provide for an override (changes the default, from the table, for the keyless ignition data field) in case the keyless ignition vehicle is not listed in the table.

OBD Retest Requirements

The same readiness monitor requirements in Section 4 shall apply to OBD re-tests.

OBD Fraud Prevention

The contractor will build an OBD inspection fraud detection module as approved by the CDPHE in the CO-OBD-TAS software.

OBD Equipment Requirements

The CO-OBD-TAS must include hardware and software necessary to access the on-board computer systems on all model-year 1996 and newer vehicles. The equipment design and operation of the CO-OBD-TAS must meet the federal requirements contained in Title 40 of the Code of Federal Regulations (CFR), Chapters 85.2207-2231 and the recommended practices regarding OBD inspections contained in the J1962, J1978 and J1979 published by the Society of Automotive Engineers (SAE). The CO-OBD-TAS must be able to connect to the vehicle's OBD connector and access, at a minimum, the following OBD data:

- The engine revolutions per minute (RPM);
- The readiness monitor status;
- The malfunction indicator light (MIL) status;
- The OBD communications protocol;
- The electronic VIN; and
- The diagnostic trouble codes (DTCs).

At a minimum, the CO-OBD-TAS must also be capable of communicating with all OBD vehicles that use the following communications protocols:

- International Organization for Standardization (ISO) 9141;
- Variable pulse width (VPW) as defined in the SAE's J1850;
- Pulse width modulation (PWM) as defined in the SAE's J1850;
- Keyword protocol 2000 (KWP); and
- Controller area network (CAN) as defined in the ISO 15765-4.3:2001.

The OBD interrogation process must be fully integrated into the CO-OBD-TAS, automated, and require no inspector intervention to collect and record the OBD data retrieved via the OBD connector link. No separate interface may be used.

The CO-OBD-TAS shall meet the design and performance specifications in the Air Quality Control Commission's (AQCC) Regulation Number 11.

Gas Cap Tester

The gas cap tester must be able to supply air pressure significant enough to produce and measure a leak rate of 60 cubic centimeters per min (cc/min) of air at 30 inches of water pressure. The tester must be tamper resistant; control the air supply pressure and prevent over pressurization; provide a visual or digital signal that the required air supply pressure is within the acceptable range and a flow comparison test is ready to be conducted; be supplied with a reference passing gas cap, or equivalent, with a nominal 52-56 cc/min leak rate; and be supplied with a reference failing gas cap, or equivalent, with a nominal 64-68 cc/min leak rate.

The tester may use: a squared edged circular orifice to generate the required leak rate; and ambient air or any convenient low pressure source.

The gas cap tester connector must be a minimum length of 20 feet so that it can reach gas caps that are attached to vehicles.

The CO-OBD-TAS must prevent all inspections if the gas cap tester calibration has not passed in the last 24 hours.

Gas Cap adapters must be available for at least 95 percent of the gas caps used for the most recent 12 model-year light-duty vehicles and trucks. Varying internal volumes of the gas caps and adapter assemblies must not affect the accuracy of the inspection results. Adapters must be made available the first day of each year upon the introduction of new model-year vehicles.

Opacity

The CO-OBD-TAS software shall require an entry for a visual opacity inspection.

Recording of Test Results/Documentation

The CO-OBD-TAS shall automatically record the date, start time, station, and inspector ID for each test. Required data for each element of the inspection shall be collected and entered into the CO-CO-OBD-TAS. A data specification is available from CDPHE upon request. Due to possible systems changes or new requirements, the required data list may be changed.

The CO-OBD-TAS shall print the test results in the form of a state-approved Vehicle Inspection Report (VIR, Form DR2071). The CO-OBD-TAS shall print these forms from plain security paper or some other paper as approved by CDPHE. The VIR shall contain at a minimum the OBD test results. VIRs for vehicles with a passing OBD test shall include a Certificate of Emissions Compliance (CEC) printed on the VIR.

Computers and Peripheral Requirements

The CO-OBD-TAS functions must be controlled by a personal computer (PC), or functional equivalent, and include the hardware and software needed to perform the functions required by this specification.

The CDPHE reserves the right to add additional programs and performance requirements, up to the technical limits of the hardware, to improve the AIR program.

The manufacturer may offer a CO-OBD-TAS with additional disk drives that can run optional software hardware application programs, however, the computer must not be bootable from any additional drive, nor must any program run from one of these drives have access to the computer's operating system. Additional drives must be located in a limited access secured area within the CO-OBD-TAS cabinet. The peripheral equipment, such as bar code readers, OBD scanners, and keyboards may use wireless communication to interact with the CO-OBD-TAS.

VID Communications Overview

A required component of the AIR program is the electronic transmission of inspection data. The

Centralized Emissions Testing Contractor for the Colorado AIR program has an electronic network that enables the CO-OBD-TAS to automatically connect to a centralized vehicle identification database (VID). The CO-OBD-TAS must demonstrate the ability to receive, install, use, and transmit data to and receive data from the VID using the communications protocol. The communications protocol will be provided by the CDPHE.

Each inspection station must obtain and maintain VID communication services. The CO-OBD-TAS must use the communications protocol to access the features of the VID communications services in order to conduct vehicle inspections.

Printer

A laser printer or a CDPHE approved equivalent printer must be supplied with each CO-OBD-TAS purchased, leased, or upgraded. The CO-OBD-TAS's printer must be interchangeable with a locally purchased off-the-shelf laser printer.

Power and Telephone Cord

The modem must be, at a minimum, designed to connect to the CO-OBD-TAS with a modular telephone connector that has a standard wiring configuration. The connector must be located on the back of the CO-OBD-TAS cabinet. Alternatives to this requirement may be proposed to the CDPHE for evaluation.

The telephone and power cords must be at least 25 feet long and enclosed in a protective cable meeting the Underwriter's Laboratory approval. Alternative methods to protect the telephone and power cords may be submitted to the CDPHE for approval. The manufacturer shall design the cabinet so that convenient storage is provided for the excess telephone and power cords.

Power Requirements

The CO-OBD-TAS must operate on an alternating current (AC) and must not be powered by a portable AC generating unit. Input power must be 115 volts of alternating current (VAC) with 60 hertz. The instruments must meet the specified requirements over an input voltage variation of at least +/- 12 volts.

Construction

The CO-OBD-TAS must be designed and constructed to provide reliable and accurate service in the automotive service environment. The CO-OBD-TAS must be supplied with a cabinet that is equipped with a storage area large enough to secure all accessories and operating manuals.

Materials

The materials used in construction of the CO-OBD-TAS must be resistant to corrosive substances found in the automotive service environment and be designed to last for at least five years. The exterior and interior finish of the entire cabinet and console must be sufficiently durable to withstand the chemicals and environmental conditions normally encountered in the automotive service environment for the period of the warranty.

Mobility

The CO-OBD-TAS may be permanently mounted or mobile with the use of wheels. Wheels must be at least five inches in diameter and have a locking mechanism capable of preventing movement on a 15 degree incline.

The CO-OBD-TAS must be designed to move over rough surfaces, through three-inch deep holes, and on 15 degree inclines without tipping over. The CO-OBD-TAS must not tip over when placed at the center of an inclined plane and rotated 360 degrees stopping in the position where it is most likely to tip over. The incline plane must make an angle of 10 degrees with the horizontal floor. In addition, the CO-OBD-TAS must not become unstable or tip over when rolled straight off the edge of a two-inch high platform or when one wheel is rolled over a drain, two inches below the surface, or inside an 18-inch diameter depression.

Electrical Design

Fuses or circuit breakers must be used to protect individual electrical circuits in the CO-OBD-TAS. The main circuit breaker and fuses must be readily accessible from the exterior of the cabinet. CO-OBD-TAS operation must be unaffected by electrical line noise and voltage surges. The CO-OBD-TAS must be protected from voltage surges to prevent damage to the internal components from a simultaneous start up of a 220 volt compressor, an arc welder, hydraulic controls, and other equipment commonly found in the typical automotive service environment.

Bar Code Scanner

The bar code scanner must be able to read a one-dimensional (1-D) and a two-dimensional (2-D) bar code through a windshield and use visible laser diode technology or an equivalent approved by the CDPHE. The bar code scanner must not be able to read Universal Product Code (UPC) 1-D bar codes. The bar code scanner must be able to withstand multiple drops to concrete covering a distance of at least 4 feet and be environmentally sealed to withstand the normal operating conditions of an automotive service environment.

Additional Specifications

The useful life of the CO-OBD-TAS shall be a minimum of five years.

A nameplate including the following information shall be permanently affixed to the housing of the CO-OBD-TAS: Name and Address of Manufacturer, Model Description, Serial Number, and Date of Assembly.

Each CO-OBD-TAS shall be delivered with the following manuals: Reference Operating Instructions,

Operation Instruction Manual, Maintenance Instruction Manual (limited), and Initial Start-up Instructions

CO-OBD-TAS manufacturers may consolidate manuals. The manuals shall be constructed of durable materials and shall not deteriorate as a result of normal use over a five-year period. The CO-OBD-TAS housing shall provide convenient storage for each manual in a manner that will allow easy use and prevent accidental loss or destruction.

The CO-OBD-TAS software shall be fully documented. Two copies of the documentation listed below shall be submitted to CDPHE as part of the Certification application.

Functional Specifications

CO-OBD-TAS manufacturers shall provide for use during the Acceptance Testing Process:

- Functional flowcharts of the software;
- Example inputs and outputs from all processes;
- Detailed interface information on system components including the identification of protocol and output specifications; and
- All file layouts with file names, file types, file security, field names, field types, field sizes, and field editing criteria.

Documentation provided by the vendor to meet this requirement will be treated as proprietary information by Colorado Department of Public Health and Environment.

Prior to certification of any CO-OBD-TAS for sale in Colorado, the manufacturer shall provide the CDPHE technical information (including, but not limited to all working codes, schematics and drawings) necessary to operate, maintain and repair such CO-OBD-TAS in the invent that the manufacturer ceases providing adequate maintenance, and repair services in Colorado.

The CO-OBD-TAS manufacturer shall keep such information current, and will provide CDPHE with copies of any and all changes. So long as such maintenance and repair services are available from the manufacturer or its agent, the CDPHE shall protect such information as confidential commercial data if it is clearly marked as such. In the event that the manufacturer becomes insolvent or stops providing adequate maintenance or repair services in Colorado all such information shall be the property of the CDPHE and may be released to a third party as necessary to repair and maintain the CO-OBD-TAS.

Warranty Coverage

A written warranty coverage agreement, signed by an authorized representative of the equipment manufacturer and the vehicle inspection station owner, which provides a complete description of coverage for all systems and components and all manufacturer provided services must accompany the sale or lease of each CO-OBD-TAS. Original manufacturer's warranty shall be a minimum of one year from the date of purchase. An extended service contract shall be available upon the expiration of the manufacturers original warranty period.

Tampering Resistance

Controlled access design shall be the responsibility of the manufacturer and is subject to approval by CDPHE. CO-OBD-TAS service personnel, inspectors or others shall be prohibited, to satisfaction of CDPHE, from creating or changing any test results, programs or data files contained in the CO-OBD-TAS. The CO-OBD-TAS shall be made tamper-resistant to the satisfaction of CDPHE and DOR.

If tampering occurs, a software lockout algorithm shall be activated which aborts any existing test sequence and prevents further inspections until an authorized AIR Program official clears the lockout.

Auditing Requirements

Title 42, Article 4, Part 3, C.R.S. establishes the I/M Program-based authority of the Colorado Department of Revenue (DOR). As such, DOR is responsible for emissions inspector and station licensing as prescribed by C.R.S., AQCC Regulation 11, and DOR Regulation 1. In order to maintain the integrity of the I/M Program, DOR conducts various quality assurance audits of the CO-CO-OBD-TAS units. The specification for this audit will be provided by CDPHE and DOR.

Manufacturer Provided Services

The CO-OBD-TAS manufacturer shall agree to provide the following services to the inspection station as part of the manufacturer's original warranty:

The delivery, installation, calibration, and verification of the proper operating condition of a CO-OBD-TAS.

Instruction of all certified inspectors employed by the inspection station, at the time of installation, in the proper use, maintenance, and operation of the CO-OBD-TAS.

On-site service response by a qualified repair technician within two (2) business days, (48 hours) excluding Sundays and national holidays, of a request from the inspection station.

CDPHE will require the manufacturer to render updates as necessary in the first year of the program to ensure the program meets all design criteria. Thereafter software updates will be limited to once per year at no cost. Since modem software updating will be utilized, there are no costs to the CO-OBD-TAS owner. A software version number, consisting of a four character alpha-numeric code made up of the last two digits of the year followed by a two character version number, shall be recorded in the CO-OBD-TAS and included on each vehicle test record. The CO-OBD-TAS manufacturer shall not modify any existing software version without obtaining written approval from CDPHE.

CO-OBD-TAS manufacturers shall provide training to AIR Program officials on all operational, maintenance, and quality control features of the CO-OBD-TAS units, including full access to and use of inspection menus and audit menus. Such training shall be conducted at the manufacturer's expense as a condition of certification.

Certification Requirements

The CO-OBD-TAS manufacturer shall submit a formal certificate to CDPHE that states that any CO-OBD TAS sold or leased by the manufacturer or its authorized representatives for use in Colorado AIR Program will satisfy all design and performance criteria described in these specifications. The manufacturer shall also provide sufficient documentation to demonstrate conformance with these criteria including a complete description of all hardware components, the results of appropriate performance testing, and a point-by-point response to specific requirements.

In addition, a full description of the company's service procedures and policies, as well as sample contracts, warranties, and extended service agreements, shall be provided as part of the certification application to ensure proper maintenance of all CO-OBD-TAS throughout their useful life. One fully functional CO-CO-OBD-TAS shall be presented for evaluation and certification process.

The Acceptance Testing Procedure (ATP) for CO-OBD-TAS will include a verification that the unit meets all requirements in this specification and federal requirements contained in 40 CFR §§85.2207 - 85.2231 and the recommended practices contained in the J1962, J1978, and J1979 published by the SAE. The ATP procedures and acceptance criteria are contained in the EPA's guidance document, *"Performing Onboard Diagnostic System Checks as Part of a Vehicle Inspection and Maintenance Program" (EPA, 2001)* or EPA's applicable update to this document.

ATTACHMENT VI "Colorado Approved" Calibration Span Gas Label Samples