

**BUREAU OF AUTOMOTIVE REPAIR**

**SPECIFICATIONS AND CERTIFICATION  
PROCEDURES  
FOR  
CALIBRATION AND AUDIT GASES  
Used in the California Emissions I/M Program**

**June 1997**  
*(Revision B - July 2004)*



**SPECIFICATIONS AND CERTIFICATION PROCEDURES  
FOR  
CALIBRATION AND AUDIT GASES  
Used in the California Emissions I/M Program  
June 1997**

**SECTION 1**

**INTRODUCTION**

**1.1 SCOPE**

This document specifies

- 1- the requirements for the calibration and audit gases used in the State of California's Emissions Inspection/Maintenance Programs;
- 2- the requirements for the containers for these gases;
- 3- the requirements and procedures for certifying and labeling the gases and containers;
- 4- the requirements and procedures for becoming a certified gas blender.

This document supersedes all prior BAR gas blender specifications: it covers all gas blend and gas blender requirements, from BAR-74 through BAR-97.

**1.2 DEFINITIONS**

**ANALYTICAL (CERTIFIED) ACCURACY:** The relative percent deviation of the stated concentration of the components of a gas blend from the "true" value as determined by comparison with the appropriate California BAR Master Standard or SRMs/CRMs/NTRMs.

$$\% \text{ Deviation} = \frac{(\text{Stated Conc'n} - \text{"True" Conc'n})}{\text{"True" Conc'n}} \times 100$$

**ASM:** Acceleration Simulation Mode—steady-state loaded-mode emissions tests that measure a vehicle's emissions while driving at a constant speed and a constant load on a dynamometer.

**ASME:** American Society of Mechanical Engineers

**AUDIT GAS BLENDS:** Reference gas standards having direct analytical traceability to NIST SRMs/CRMs/NTRMs or BAR Master Standards, used by the bureau's field personnel and/or those of the State of California's contractors authorized to perform field audits.

**AUTHORIZED GAS DISTRIBUTOR:** A company authorized by a Certified Gas Blender to distribute (in approved cylinders) the blender's certified gas blends.

**BLEND TOLERANCE:** Maximum allowable value of

$$\frac{(\text{actual concentration} - \text{desired concentration}) \times 100}{\text{desired concentration}}$$

of the components of a gas blend, where the desired concentration is the concentration specified in §2.2 of this document.

**CALIBRATION GAS:** A blend of pure (see PURITY OF GAS COMPONENTS, below) propane (HC), carbon monoxide (CO) and carbon dioxide (CO<sub>2</sub>), with nitrogen (N<sub>2</sub>) as the balance or carrier gas, which is used to calibrate or adjust automotive exhaust emissions analyzers. Nitric oxide (NO), with nitrogen (N<sub>2</sub>) as the balance or carrier gas, is specified as either an additional component or as a separate blend. Zero air is considered a calibration gas.

**CALIFORNIA BAR MASTER STANDARD:** A primary standard gas blend established by the bureau, directly traceable to and named by NIST.

**CERTIFIED GAS BLENDER:** A blender of precision gases approved by the Bureau of Automotive Repair capable of providing consistently high quality gas blends meeting or exceeding the requirements of this standard. Note: If a gas blender has more than one facility for blending gases, each facility receives its own BAR certification, not the company as a whole. The facility that blends the gases must also fill the cylinders. Regardless of whose name a gas blend is sold under, the name of the facility that blended the gas must appear on the BAR label.

**CGA:** Compressed Gas Association

**CRM:** Certified Reference Material

**DCA/BAR OR BUREAU:** California Department of Consumer Affairs, Bureau of Automotive Repair, 10240 Systems Parkway, Sacramento, CA 95827

**DISPOSABLE CYLINDERS:** Single-use, low-pressure cylinders. See §2.5.2 for specifications.

**DOT:** Department of Transportation (federal)

**HIGH-PRESSURE CYLINDERS:** Refillable, reusable cylinders. See §2.5.3 for specifications.

**NIST:** National Institute of Standards and Technology (formerly the National Bureau of Standards)

**NIST-TRACEABLE:** A gas or gas blend which has been named using scientifically appropriate protocol involving standards obtained from NIST.

**NTRM:** NIST-Traceable Reference Material. (Gases which meet the requirements of NIST Special Publication 260-126.)

**PURITY OF GAS COMPONENTS:** For the purposes of this I/M program, the minimum purity levels of the individual components of the gas blends are defined as:

Propane: 99.5%	O <sub>2</sub> < 50 ppm
Carbon monoxide: 99.8%	THC < 50 ppm; O <sub>2</sub> < 10 ppm; Fe(CO) <sub>5</sub> + Ni(CO) <sub>4</sub> < 4 ppm
Carbon dioxide: 99.8%	THC < 50 ppm; O <sub>2</sub> < 5 ppm
Nitric oxide: 99.0%	
Nitrogen: 99.9997%	Total O <sub>2</sub> < 1 ppm (All blends containing NO)

**NOTE:** Some non-I/M industries require that C<sup>13</sup> be stripped from their gases. IT IS ESSENTIAL that gas blends meeting this specification use components in the blending process from which the C<sup>13</sup> has NOT been stripped.<sup>1</sup>

**REFILLABLE CYLINDERS:** In this document, used synonymously with high-pressure cylinders. See §2.5.3 for specifications.

**SAE:** Society of Automotive Engineers

**SRM:** Standard Reference Material (from NIST)

---

<sup>1</sup> This is because the design of the NDIR analyzers used in I/M programs measure CO<sub>2</sub> at the C<sup>13</sup> wavelength, since the IR absorption at the C<sup>12</sup> wavelength is too great.

## SECTION 2

### TECHNICAL REQUIREMENTS

#### 2.1 GENERAL

This section describes the gas blends required by the California I/M program, the specifications for these blends, and the cylinders to be used.

#### 2.2 APPLICABLE GAS BLENDS

This standard applies to the following gas blends. Coverage of this standard may be expanded to other gas blends at a future date.

##### 2.2.1 BAR-90ET & Earlier Calibration Span Gases

###### (1) *Low-Range BAR-90ET*

300 ppm	propane (HC)
1.00%	carbon monoxide (CO)
6.0%	carbon dioxide (CO <sub>2</sub> )
Balance:	Nitrogen (N <sub>2</sub> )

###### (2) *Mid-Range BAR-90ET*

1200 ppm	propane (HC)
4.00%	carbon monoxide (CO)
12.0%	carbon dioxide (CO <sub>2</sub> )
Balance:	Nitrogen (N <sub>2</sub> )

###### (3) *Low-Range BAR 84*

600 ppm	propane (HC)
1.60%	carbon monoxide (CO)
11.0%	carbon dioxide (CO <sub>2</sub> )
Balance:	Nitrogen (N <sub>2</sub> )

###### (4) *BAR-74/80*

3000 ppm	propane (HC)
8.00%	carbon monoxide (CO)
Balance:	Nitrogen

###### (5) *BAR-74/80 with CO<sub>2</sub>*

3000 ppm	propane (HC)
8.00%	carbon monoxide (CO)
11.0 %	carbon dioxide (CO <sub>2</sub> )
Balance:	Nitrogen

## 2.2.2 BAR-90ET and Earlier Audit Gas Blends

(1) *Low-Range BAR-90ET*

300 ppm	propane (HC)
1.00%	carbon monoxide (CO)
6.0%	carbon dioxide (CO <sub>2</sub> )
Balance:	Nitrogen (N <sub>2</sub> )

(2) *Mid-Range #1 BAR-90ET*

1200 ppm	propane (HC)
4.00%	carbon monoxide (CO)
12.0%	carbon dioxide (CO <sub>2</sub> )
Balance:	Nitrogen (N <sub>2</sub> )

(3) *Mid-Range #2 BAR-90ET*

2000 ppm	propane (HC)
6.00%	carbon monoxide (CO)
8.0%	carbon dioxide (CO <sub>2</sub> )
Balance:	Nitrogen (N <sub>2</sub> )

(4) *High-Range BAR-90ET*

3200 ppm	propane (HC)
8.00%	carbon monoxide (CO)
14.0%	carbon dioxide (CO <sub>2</sub> )
Balance:	Nitrogen (N <sub>2</sub> )

(5) *Mid-Range BAR-84*

1800 ppm	propane (HC)
4.70%	carbon monoxide (CO)
7.0%	carbon dioxide (CO <sub>2</sub> )
Balance:	Nitrogen (N <sub>2</sub> )

## 2.2.3 BAR-97 Calibration Gases

(1) *Low-Range BAR-97*

200 ppm	propane (HC)
0.50%	carbon monoxide (CO)
6.0%	carbon dioxide (CO <sub>2</sub> )
Balance:	Oxygen-free Nitrogen (N <sub>2</sub> )

(2) *Low-Range BAR-97 with NO*

200 ppm	propane (HC)
0.50%	carbon monoxide (CO)
6.0%	carbon dioxide (CO <sub>2</sub> )
300 ppm	nitric oxide (NO) (<3 ppm NO <sub>2</sub> )
Balance:	Oxygen-free Nitrogen (N <sub>2</sub> )

- (3) *BAR-97 Low-Range NO*

300 ppm	nitric oxide (NO) (<3 ppm NO <sub>2</sub> )
Balance:	Oxygen-free Nitrogen (N <sub>2</sub> )
- (4) *High-Range BAR-97*

3200 ppm	propane (HC)
8.00%	carbon monoxide (CO)
12.0%	carbon dioxide (CO <sub>2</sub> )
Balance:	Oxygen-free Nitrogen (N <sub>2</sub> )
- (5) *High-Range BAR-97 with NO*

3200 ppm	propane (HC)
8.00%	carbon monoxide (CO)
12.0%	carbon dioxide (CO <sub>2</sub> )
3000 ppm	nitric oxide (NO) (<30 ppm NO <sub>2</sub> )
Balance:	Oxygen-free Nitrogen (N <sub>2</sub> )
- (6) *BAR-97 High-Range NO*

3000 ppm	nitric oxide (NO) (<30 ppm NO <sub>2</sub> )
Balance:	Oxygen-free Nitrogen (N <sub>2</sub> )
- (7) *Zero Air*

<1 ppm	Total Hydrocarbons (THC) as Carbon
<1 ppm	carbon monoxide (CO)
<400 ppm	carbon dioxide (CO <sub>2</sub> )
<1 ppm	nitric oxide (NO)
20.9%	oxygen (O <sub>2</sub> )

#### 2.2.4 BAR-97 Audit Gases

- (1) *Low-Range BAR-97 with NO*

200 ppm	propane (HC)
0.50%	carbon monoxide (CO)
6.0%	carbon dioxide (CO <sub>2</sub> )
300 ppm	nitric oxide (NO) (<3 ppm NO <sub>2</sub> )
Balance:	Oxygen-free Nitrogen (N <sub>2</sub> )
- (2) *BAR-97 Mid-Range #1 with NO*

960 ppm	propane (HC)
2.40%	carbon monoxide (CO)
3.6%	carbon dioxide (CO <sub>2</sub> )
900 ppm	nitric oxide (NO) (<10 ppm NO <sub>2</sub> )
Balance:	Oxygen-free Nitrogen (N <sub>2</sub> )

- (3) *BAR-97 Mid-Range #2 with NO*
- |          |  |
|----------|--|
| 1920 ppm | propane (HC)                                 |
| 4.80%    | carbon monoxide (CO)                         |
| 7.2%     | carbon dioxide (CO <sub>2</sub> )            |
| 1800 ppm | nitric oxide (NO) (<20 ppm NO <sub>2</sub> ) |
| Balance: | Oxygen-free Nitrogen (N <sub>2</sub> )       |
- (4) *High-Range BAR-97 with NO*
- |          |  |
|----------|--|
| 3200 ppm | propane (HC)                                 |
| 8.00%    | carbon monoxide (CO)                         |
| 12.0%    | carbon dioxide (CO <sub>2</sub> )            |
| 3000 ppm | nitric oxide (NO) (<30 ppm NO <sub>2</sub> ) |
| Balance: | Oxygen-free Nitrogen (N <sub>2</sub> )       |
- (5) *Zero Air*
- |          |  |
|----------|--|
| <1 ppm   | Total Hydrocarbons (THC) as Carbon     |
| <1 ppm   | carbon monoxide (CO)                   |
| <1 ppm   | carbon dioxide (CO <sub>2</sub> )      |
| <1 ppm   | nitric oxide (NO)                      |
| 20.9%    | oxygen (O <sub>2</sub> )               |
| Balance: | Oxygen-free Nitrogen (N <sub>2</sub> ) |

## 2.2.5 Other BAR-97 Audit Gas Blends

- (1) *Low-Range BAR-97*
- |          |  |
|----------|--|
| 200 ppm  | propane (HC)                           |
| 0.50%    | carbon monoxide (CO)                   |
| 6.0%     | carbon dioxide (CO <sub>2</sub> )      |
| Balance: | Oxygen-free Nitrogen (N <sub>2</sub> ) |
- (2) *BAR-97 Low-Range NO*
- |          |   |
|----------|---|
| 300 ppm  | nitric oxide (NO) (<3 ppm NO <sub>2</sub> ) |
| Balance: | Oxygen-free Nitrogen (N <sub>2</sub> )      |
- (3) *BAR-97 Mid-Range #1*
- |          |  |
|----------|--|
| 960 ppm  | propane (HC)                           |
| 2.40%    | carbon monoxide (CO)                   |
| 3.6%     | carbon dioxide (CO <sub>2</sub> )      |
| Balance: | Oxygen-free Nitrogen (N <sub>2</sub> ) |
- (4) *BAR-97 Mid-Range #1 NO*
- |          |  |
|----------|--|
| 900 ppm  | nitric oxide (NO) (<10 ppm NO <sub>2</sub> ) |
| Balance: | Oxygen-free Nitrogen (N <sub>2</sub> )       |



- (5) *BAR-97 Mid-Range #2*

1920 ppm	propane (HC)
4.80%	carbon monoxide (CO)
7.2%	carbon dioxide (CO <sub>2</sub> )
Balance:	Oxygen-free Nitrogen (N <sub>2</sub> )
- (6) *BAR-97 Mid-Range #2 NO*

1800 ppm	nitric oxide (NO) (<20 ppm NO <sub>2</sub> )
Balance:	Oxygen-free Nitrogen (N <sub>2</sub> )
- (7) *High-Range BAR-97*

3200 ppm	propane (HC)
8.00%	carbon monoxide (CO)
12.0%	carbon dioxide (CO <sub>2</sub> )
Balance:	Oxygen-free Nitrogen (N <sub>2</sub> )
- (8) *BAR-97 High-Range NO*

3000 ppm	nitric oxide (NO) (<30 ppm NO <sub>2</sub> )
Balance:	Oxygen-free Nitrogen (N <sub>2</sub> )

#### 2.2.6 Nitric Oxide (NO)

The NO may be provided in a cylinder separate from the HC, CO, and CO<sub>2</sub>. If the blender should choose to add NO to the mixture of HC, CO, CO<sub>2</sub>, & N<sub>2</sub>, a minimum of one year's stability data for the blend must be provided to the bureau for its evaluation before the blend will be certified.

#### 2.3 GAS BLEND TOLERANCE AND ACCURACY

Section 1.2 contains the definitions of blend tolerance and analytical accuracy. The following paragraphs define the allowable limits.

**BAR-74, -80, -84, -90ET Blend Tolerance:** Zero blend tolerance.

**BAR-97 Blend Tolerance:**  $\pm 2\%$  blend tolerance for both audit and calibration (span) gases.

**BAR-74, -80 -84, -90ET Analytical Accuracy:** Naming error shall not exceed  $\pm 2\%$  of nominal value for calibration span gases;  $\pm 1\%$  of nominal value for audit gas blends.

**BAR-97 Analytical Accuracy:** Naming error shall not exceed  $\pm 1\%$  of label value for calibration span gases;  $\pm 1\%$  of label value for audit gas blends.

#### 2.4 REFERENCE STANDARDS

Upon initial certification and as required thereafter, the gas blender shall prepare at least one cylinder of each blend listed in §2.2. that it plans to sell in California's I/M program. The gas blender shall submit them to a bureau-approved laboratory for naming against

the California BAR Master Standard gases or against NIST SRMs/CRMs/NTRMs if a BAR Master Standard is not available for the particular blend. These named cylinders shall be used by the blender's facility as its reference standards for analyzing the production calibration span gases.

In addition, the gas blender shall own and maintain at its certified facility a full complement of NIST SRMs, CRMs and NTRMs for performing other analytical work pertinent to its operations.

## **2.5 CYLINDERS**

### **2.5.1 Cylinder Type and Usage**

The information in this paragraph is for the blender's information only; no action is required on the part of the blender.

Cylinders containing the zero and calibration gas blends for use on the emissions analyzers by the end user must be bureau-approved, of the nonrefillable, disposable, low pressure design.

High-pressure refillable cylinders may be used by Test-Only facility contractors, representatives of the bureau or certain of the bureau's other contractors, as well as at the service facilities of the individual emissions analyzer manufacturers or their distributors. Other uses of high-pressure cylinders must receive prior approval of the bureau.

Zero air is an exception to this limitation. It may be provided in either disposable or high-pressure refillable cylinders (as well as via BAR-approved zero air generators).

### **2.5.2 Disposable Cylinders**

- a. Disposable cylinders shall be made in accordance with DOT Specification 39 (CFR 49, 178.65, Specification 39) for nonrefillable, disposable cylinders (260 psig service pressure, 325 psig test pressure, 650 psig minimum burst pressure).
- b. Nominal size shall not exceed 750 cubic inches  $\pm 5\%$  (approximately 9 inches inside diameter by 16 inches high overall, providing an equivalent water capacity of 27 pounds). As a minimum, cylinders shall contain 3.75 cubic feet of gas blend at 260 psig cylinder pressure.
- c. Cylinders shall be designed with an integral stand so that, if stored in an upright position, the cylinder will not fall over during routine handling. Dimpled bases are not acceptable as integral stands.
- d. The cylinder shutoff valve outlet shall be CGA 165, 1/4-in. SAE flare, 45°, male. All shutoff valves shall be of the non-refillable type.

- e. Each cylinder shall be equipped with a safety relief device in accordance with DOT regulations [CFR 49, 173.34(d)]. The safety relief device used must comply with the requirements of CGA Pamphlet S-1.1, 7th Ed. (1989).
- f. Each cylinder shall be equipped with a safety shield that adequately protects the shutoff valve.
- g. No metal, plastic, elastomer, weld flux, antiseize compound, valve lubricant, paint, or other material shall be used in cylinder fabrication or assembly, or in cylinder charging equipment, which is incompatible with the gas blend or could cause contamination or degradation to it.
- h. All cylinders shall be thoroughly cleaned, dried and passivated in such a manner that the contained blend can meet the stability requirements of this document (see §2.6).
- i. All cylinders must comply with the applicable portions of the Federal and California DOT, OSHA, and California Division of Industrial Safety requirements, and must be approved by the bureau in this regard.
- j. Blenders must comply with the applicable portions of the Federal DOT specifications for shipping cylinders.

### 2.5.3 High-Pressure Refillable Cylinders

- a. Refillable cylinders must be aluminum, made in accordance with DOT Specifications 3AL2015 or 3AL2216, whichever is applicable (ref: CFR 49, 178.46, Specification 3AL). ZERO AIR ONLY: May also be supplied in steel cylinders made in accordance with DOT Specifications 3AA2015, 3AA2265, and 3AA2400, and shall use CGA-590 fittings.
- b. Blenders wishing to supply gases in refillable cylinders must also be BAR-certified to supply gases in disposable cylinders. This requirement does not apply to blenders wishing to supply only zero air in refillable cylinders, and do not plan to supply any other gases or blends.
- c. No metal, plastic, elastomer, weld flux, antiseize compound, valve lubricant, paint, or other material shall be used in cylinder fabrication or assembly, or in cylinder charging equipment, which is incompatible with the gas blend or could cause contamination or degradation to it.
- d. All cylinders shall be thoroughly cleaned, dried and passivated in such a manner that the contained blend can meet the stability requirements of this document (see §2.6).

- e. All cylinders must comply with the applicable portions of the Federal and California DOT, OSHA, and California Division of Industrial Safety requirements, and must be approved by the bureau in this regard.
- f. Blenders must comply with the applicable portions of the Federal DOT specifications for shipping cylinders.
- g. Upon request, certified blenders shall provide the bureau with a list of their customers using high-pressure cylinders.

#### 2.5.4 **Labeling**

Caution signs shall be affixed to all cylinders and shall comply with the applicable DOT and OSHA regulations.

Certified blenders shall print labels in accordance with the requirements detailed in Appendix C of this document. These adhesive-backed BAR labels shall be affixed to the top of the cylinder, approximately halfway between the valve and the cylinder side. The color of the labels shall be white and will contain the following information:

- \* Gas Blend Code Number (see §2.5.5 Bar Code Definition Table)
- \* The BAR Label Number<sup>1</sup>
- \* The actual concentrations of the individual gases in the blend<sup>2</sup>
- \* The analytical accuracy
- \* The date filled
- \* The lot number
- \* The expiration date (see §2.6)
- \* The name and address of the certified blending facility.

Upon certification of a facility, the bureau will provide a camera-ready copy of the label artwork for producing the appropriate labels. Camera-ready copy will be provided for each gas blend for which the facility is certified.

The information on the label shall be machine-printed. Hand printing is not permitted.

Each label shall have its individual BAR Label Number imprinted on it (see Appendix C). No BAR Label Number may be used more than once, nor may any be sold or transferred to another facility or gas blender. The BAR Label Numbers are assigned to individual facilities only by the Bureau's Engineering & Research Branch. Blocks of numbers may be obtained free of charge by calling (916) 255-1384.

---

<sup>1</sup> This is synonymous with the "BAR #", found on the upper right of the label (see Appendix C).

<sup>2</sup> Printing of actual concentrations of individual gases is required for BAR-97 calibration and audit gas blends. For zero air, the nominal concentration of O<sub>2</sub> is required. The maximum allowable impurity levels, preceded by a less-than (<) sign, may be preprinted.

Each blender facility shall implement QA procedures to ensure that (1) No BAR Label Number is used more than once, (2) all BAR Label Numbers assigned by the facility are within the block of numbers issued to them by the Bureau, and (3) a warning is generated when the supply of numbers is getting low, so that the facility may request a new block from the Bureau. The label-generating software may be used to automatically perform these functions with a periodic audit by facility QA personnel.

#### **2.5.5 Bar Code Label**

Each BAR-97 gas cylinder, whether calibration gas or audit gas, shall have a bar code label affixed to it, consisting of three bar code strips. Each gas blend shall have a different identifying character for the first strip line. All second lines will have a common identifier, as will all third lines. The following identifying characters are described below.

Gas Blend	Bar Code Leading Identifier		
	Line 1	Line 2	Line 3
High Range Cylinder	\$ (dollar sign)	+ (plus)	- (hyphen)
Mid Range #1 Cylinder	A	+ (plus)	- (hyphen)
Mid Range #2 Cylinder	B	+ (plus)	- (hyphen)
Low Range Cylinder	C	+ (plus)	- (hyphen)
Zero Air Cylinder	. (period)	+ (plus)	- (hyphen)

The label shall contain the following information:

#### GAS CYLINDER BAR CODE DEFINITIONS

BAR CODE STRIP #	FIELD	DESCRIPTION	DEFINITION
1	BAR Label Number	2 Alpha characters followed by 8 numeric characters: AAnnnnnnnn	The two alpha characters uniquely define each gas blender facility. The eight numeric characters are assigned sequentially in blocks on a first-come first-served basis. (See §2.5.4.)
	Gas Blend Code	2 numeric characters:  nn	The gas blend code is based on the list of blends in Section 2 of the <i>Specifications and Accreditation Procedures for Calibration and Audit Gases Used in the California Emissions I/M Program, June 1997, Rev B</i> . For example, a High-Range BAR-97 Calibration Gas (2% Blend Tolerance, 1% Certified Accuracy) containing a nominal blend of 3200 ppm C <sub>3</sub> H <sub>8</sub> , 8.00% CO and 12.0% CO <sub>2</sub> is coded as 34 (Item 4 of '2.2.3 of the specification). (For Zero Air) BAR-97 Zero air blends have the following gas blend codes: “37” for calibration; “45” for audit.

BAR CODE STRIP #	FIELD	DESCRIPTION	DEFINITION
1 (Cont'd)	Actual concentration of hydrocarbon in blend*.  (For Zero Air) HC Impurity Level	6 numeric characters:  nnnnnn	The left-most character shall be a 1 for propane or a 2 for hexane. BAR reserves the right to add identifiers for other hydrocarbons at a later date. The remaining five characters shall represent the actual concentration* of the hydrocarbon in ppm, and shall be right-justified. <i>Example: 3209 ppm propane would be represented as 103209.</i>  (For Zero Air) The remaining five characters shall represent the maximum allowable impurity level for THC which is <1 ppm, and shall be right-justified. This shall be shown as "200001."
2	Actual concentration of CO in blend*.  (For Zero Air) CO Impurity Level	4 numeric characters:  nnnn	The four characters shall represent the actual concentration of the CO in percent (with two decimal places assumed), and shall be right-justified. <i>Example: 8.16% CO would be represented as 0816.</i>  (For Zero Air) The four numeric characters shall represent the maximum allowable impurity level for CO which is <1 ppm and shall be right-justified. Since the BAR label requires a % value, this shall be shown as "0000."

---

\*As determined by post-blending analysis (see '2.7)

	Actual concentration of CO <sub>2</sub> in blend*.  (For Zero Air) CO <sub>2</sub> Impurity Level	3 numeric characters:  nnn	The three characters shall represent the actual concentration of the CO <sub>2</sub> in percent (with one decimal place assumed), and shall be right justified. <i>Example: 14.10% CO<sub>2</sub> would be represented as 141.</i>  (For Zero Air) The three numeric characters shall represent the maximum allowable impurity level for CO <sub>2</sub> which is <400 ppm for calibration and <1 ppm for audit, and shall be right-justified. However, since the BAR label requires a % value, this shall be shown as “ <b>000</b> .”
BAR CODE STRIP #	FIELD	DESCRIPTION	DEFINITION
2 (Cont'd)	Actual concentration of NO in blend*.  (For Zero Air) NO Impurity Level	4 numeric characters:  nnnn	The four characters shall represent the actual concentration of the nitric oxide in ppm, and shall be right justified. <i>Example: 989 ppm NO would be represented as 0989.</i>  (For Zero Air) The four numeric characters shall represent the maximum allowable impurity level for NO which is <1 ppm, and shall be right-justified. This shall be shown as “ <b>0001</b> .”
	Actual concentration of O <sub>2</sub> in blend*.	3 numeric characters:  nnn	The three characters shall represent the actual concentration of the O <sub>2</sub> in percent (with one decimal place assumed), and shall be right justified. <i>Example: 21.0% O<sub>2</sub> would be represented as 210.</i>  (For Zero Air) The three numeric characters shall represent the <b>nominal</b> concentration of the O <sub>2</sub> in percent (with one decimal place assumed), and shall be right justified. This shall be shown as “ <b>209</b> .”

\*As determined by post blending analysis (see '2.7).



3	Expiration Date	8 numeric characters: nnnnnnnn	The characters represent the date in month/day/year format. The year is expressed as four digits. <i>Example: May 8, 2004 would be represented as 05082004.</i>
	Blender's Lot Number	9 alphanumeric characters: nnnnnnnnn	The first 8 numeric characters represent the fill date in month/day/year format. The year is expressed as four digits. The last numeric character at the end of the string represents the sequential lot blended that day. <i>Example: The fifth lot filled on May 8, 2004 would be represented as 050820045.</i>

These fields shall be fixed in length, left justified, and zero-filled (if necessary).

a) ***Bar-Coded Label Characteristics and Placement***

i) ***Durability***

The bar-coded label material shall be such that its bar code can be successfully scanned on the date of the cylinder's expiration, having spent its useful life in an automotive environment.

ii) ***Permanent Attachment***

The bar-coded label shall be affixed to its cylinder so that it is permanently attached, and cannot be removed without destroying the bar code.

iii) ***Location On Cylinder***

Disposable Cylinders: The label shall be placed on the top (domed portion) of the cylinder, in an unobscured area. (This location is necessary because, in the majority of analyzer configurations, only the top of the cylinder is visible and accessible when installed.)

Refillable (High-Pressure) Cylinders: The label shall be placed on the side of the cylinder, within two inches of the top of the cylindrical portion. The bar code shall be parallel to the cylinder's axis, and directly in line with the outlet of the cylinder's shutoff valve. The bar code label shall be protected from damage in a manner acceptable to the Bureau.

iv) ***Alternative Configurations***

Alternative configurations shall be submitted to BAR for its consideration.

**b) General Bar Code Symbology Specifications**

**i) Code 39 Symbology**

The bar code shall conform to “BAR Code Symbology for 3 of 9 Bar Codes” published by the Automotive Industry Action Group (AIAG B-1). All aspects of the bar-code symbology codes shall follow this specification except as described in the following sections.

**ii) Code Density and Dimensions (Reference Appendix A of AIAG B-7)**

The average width of the narrow element is within the range of 0.19 mm (0.0075 inches) and 0.317 mm (0.0125 inches). The ratio is three to one with an allowable range of 2.8 to 3.2. The minimum bar height is 9.5 mm (0.375 inches) or 15 percent of the bar code length.

**c) Scanning Devices (FOR GAS BLENDER’S INFORMATION ONLY)**

A typical bar code scanner that will be used to read the bar code label is Symbol Technologies Model Number LS-3020HV-HxxxA.

**2.6 EXPIRATION DATES**

For all cylinders, disposable or refillable, the expiration date for propane (C<sub>3</sub>H<sub>8</sub>), carbon monoxide (CO) and carbon dioxide (CO<sub>2</sub>) in nitrogen (N<sub>2</sub>) shall be 36 months from the fill date.

The expiration date for nitric oxide (NO) in N<sub>2</sub>, or any blend containing NO, shall be 24 months from the fill date.

The expiration date for zero air shall be sixty (60) months from the fill date.

Until the expiration date is reached, the gases contained in the cylinders shall meet all the requirements of this document.

**2.7 QUALITY ASSURANCE**

Gas blenders shall have a fully documented and implemented quality assurance program as a prerequisite to certification.

Blenders shall test each lot of gas in accordance with accepted industry practice for precision gases. At a minimum, blenders shall analyze five (5) cylinders or 3% of each lot, whichever is more. In addition, each lot of gas containing NO shall be held for at least one week and, at the end of the week, a similar (randomly-selected) sample from the same lot shall be re-analyzed to check that the blend has not degraded due to insufficient passivation, inadvertent introduction of impurities, etc.

For each lot, the test results and the number of cylinders in the lot shall be made available to the bureau upon request. Documentation shall be maintained for a minimum of three (3) years.

The bureau may order or perform spot retesting of gas blends at random.

Equipment maintenance shall be performed regularly, in accordance with the equipment manufacturer's recommendations. Maintenance may be performed more frequently than recommended, but not less frequently. Each major equipment item shall have a separate maintenance form. These forms and a description of the manufacturer-recommended maintenance shall be kept on the equipment in a readily accessible location within a protective cover. The forms shall include the dates of maintenance as well as the names and signatures of the persons performing the maintenance. These forms shall be made available to the bureau upon request.

## **2.8 RESULTS OF NONCONFORMANCE**

When violations of the requirements of this standard are discovered, blenders will lose their certification regardless of the magnitude of the violation. Blenders wishing to continue to supply gas will be required to apply for recertification.

The bureau may, at its discretion, exempt the blender from certain portions of the application requirements, but will, at a minimum, conduct a thorough review of blending equipment and procedures. Special emphasis will be placed on quality assurance and equipment maintenance procedures and documentation. An onsite inspection may be made by a bureau representative.

## SECTION 3

### CERTIFICATION PROCEDURES

#### 3.1 GENERAL

- a. No gas blender may supply calibration or audit gases for use in California's emissions inspection programs unless the blender has been certified by the bureau.
- b. Certification is facility-specific: Companies are not certified—facilities are. Information furnished in the certification package shall apply only to the individual facility requesting certification.
- c. Certification of one blending facility owned by a company does not imply or impart certification to other facilities owned by that company.
- d. Sale of a facility shall void the certification. The facility shall notify the bureau in writing sixty (60) days prior to the change of ownership. The new owner must submit an application for certification and must receive written bureau approval before selling any gases for use in the program. The new owner shall assume responsibility for any gases produced by the previous owner.
- e. Gas blender facility certification must be renewed annually.

#### 3.2 SUBMITTAL PACKAGE

The submittal package shall contain the information required in the following paragraphs. The information in the package shall be as complete as possible; however, if certain information is not available, this shall be indicated along with the reasons why, for the bureau's consideration.

THE BUREAU WILL TREAT AS CONFIDENTIAL ALL INFORMATION  
CONTAINED IN THE SUBMITTAL PACKAGE MARKED AS "PROPRIETARY."

The completed package shall be submitted to the State of California, Bureau of Automotive Repair, 10240 Systems Parkway, Sacramento, California 95827.

##### a. Application Cover Sheet

A sample cover sheet is shown in Appendix B. The cover sheet must be signed by the president or the chief financial officer of the gas blending company.

##### b. Facility Description

The Facility Description shall include the following information:

- Facility address

- Number of employees
  - Square footage of office, laboratory and production areas
  - Plant features and modifications aimed specifically toward blending gases
- c. Instrumentation  
Describe the production and laboratory instrumentation by type of instrument, brand, model number and established calibration/maintenance schedules and procedures.
- d. Instrument Maintenance Personnel  
List the number of instrument maintenance personnel employed and their qualifications.
- e. Reference Gases  
Indicate the concentrations and ages of the NIST SRMs/CRMs/NTRMs used to prepare facility reference standards. In addition, indicate the cylinder numbers, SRM/CRM/NTRM numbers, concentrations, and expiration dates for each of these cylinders.
- After receipt of the named reference cylinders (see §2.4), and upon all certifications after initial certification, the blender shall supply the bureau with the cylinder numbers, gas concentrations, expiration dates, and cylinder pressure readings for each of these cylinders.
- f. Production Capabilities  
Describe the production capabilities of the facility in terms of products currently produced, monthly volume, and past experience in producing specialty gases.
- g. Prices  
List the estimated selling price(s) of the blends to the users. Cost estimates shall be based on a quantity production type of operation. Wholesale and retail cost estimates are user prices rather than manufacturing costs.
- h. Business Status Report  
Include the following information as part of the submittal package:
- Indication that the applicant is a bona fide gas blender of precision gas blends. If the facility has a catalog of gas blends, the latest issue of the catalog shall be included with the application.
  - Evidence that the applicant is either a California corporation or a registered out-of-state corporation.
  - An organization chart for the facility, including names, titles and telephone numbers for key personnel. If the facility is a division, subsidiary, or profit center of an organization, the organization chart shall

include the name, title, address and telephone number of the person in the organization to whom the facility reports.

- Annual sales volume during the previous fiscal year, for the facility only, for gas blends only.

**NOTE:** A projected annual sales volume of at least \$250,000 for gas blends only is required for facility certification.

i. Marketing Plan

Submit a marketing plan for California which includes the following information as a minimum:

- A description of the distribution methods to be used
- A list of distributors used by the applicant, including current addresses and telephone numbers

**NOTE:** The bureau requires that the facility maintain an up-to-date distributor list, and that any changes to it be provided on a quarterly basis.

- The bureau requires that product delivery shall be made to local distributors within 60 days of certification. Include a description of the provisions that will be made by the facility to meet this requirement.

j. Methods for Recalling Nonconforming Gases

Provide a written procedure for initiating a recall and replacing cylinders of nonconforming gas blends. The procedure shall include provision for an emergency telephone number in California by means of which the blender can be contacted to initiate an immediate recall of gases if they are found to be in violation of bureau standards. This phone must be manned between the hours of 8:00 AM and 5:00 PM Monday through Friday as a minimum.

To facilitate a recall, the certified blender and/or his distributors shall track the location of all cans through the end user by means of the BAR label number. Include a detailed description of the tracking procedure in the submittal package.

At a minimum, the blender shall replace the bad cylinder with a good, certified, full cylinder. A toll-free information phone number shall be established when the bureau identifies a nonconforming product. This phone shall be used to provide the procedure for obtaining good, certified cylinders. This phone shall be manned between 8:00 AM and 5:00 PM on weekdays from the time of notification by the bureau until the bureau is satisfied that all complaints have been handled.

At the blender's discretion, additional mechanisms may be established to mitigate the negative impacts of the recall. A description of these mechanisms shall be included in the application.

k. Tracking of High-Pressure Cylinders

Provide a description of the procedure to be used for tracking high-pressure cylinders. (See '2.5.3.f.)

l. Quality Assurance Procedures

The application shall include the following minimum information about the applicant's quality assurance program.

- A detailed description of the program, including sampling techniques, test methodology and rationale, and the documentation scheme used.
- A maintenance and calibration schedule for each major item of laboratory equipment used in the quality assurance program.
- A description of the lot control system used for statewide traceability of gas cylinders.

m. Compliance with Safety Regulations

The submittal package must include a statement signed by the chief officer of the facility certifying that the blender is in compliance with all applicable DOT, OSHA and California OSHA standards.

n. Liability Bonding

Provide a copy of product liability insurance to demonstrate that adequate protection (\$300,000 minimum) exists for catastrophic failure situations (e.g., cylinder or valve rupture, noxious gas leakage). Evidence of distributor bonding coverage throughout the state shall be provided to the bureau annually.

o. Sample Disposable Cylinder

An empty disposable cylinder with a non-refillable valve in the original open position must be submitted to the bureau for approval. The cylinder must also come with the appropriate gas cylinder label and bar code label to demonstrate compliance with the labeling requirement of the specification.

### 3.3 **PRODUCT SAMPLE**

For each Gas Blend Type\* to be sold in California, submit one production sample from each of two different lots, in approved cylinders, to a laboratory designated by the bureau for comparison with the bureau-established, NIST-traceable standards.

---

\* The following are gas blend types: BAR-74/80 calibration gas, BAR-84 calibration gas, BAR-84 audit gas, BAR-90ET calibration gas, BAR-90ET audit gas, BAR-97 calibration gas, BAR-97 audit gas (including zero air). **NOTE: A BAR-90ET certification will automatically confer certification to the facility for BAR-74/80 and BAR-84 blend types. Certification of BAR-97 calibration gases automatically provides certification for BAR-97 audit gases.**

If more than one blend is specified in a gas type, the blender shall submit samples of the blend with the lowest concentrations of the components. However, both high and low range BAR-97 calibration gases must be submitted for certification. In addition, if a choice exists between a blend with NO and one without NO, the blend with NO shall be submitted. For example, for the BAR-97 calibration gases, the blends submitted shall be Low-Range BAR-97 with NO, comprising 200 ppm propane, 0.5% CO, 6.0% CO<sub>2</sub>, 300 ppm nitric oxide, balance N<sub>2</sub>, and High Range BAR-97 with NO comprising 3200 ppm propane, 8.00% CO, 12.0% CO<sub>2</sub>, 3000 ppm nitric oxide, balance N<sub>2</sub>.

Calibration gas samples shall be submitted in disposable cylinders; audit gas blends shall be submitted in refillable (high-pressure) cylinders.

The comparison shall establish that the submitted blends are within  $\pm 2\%$  of the label value for BAR-90ET and earlier calibration gases and  $\pm 1\%$  of the label value for BAR-90ET audit gases, and  $\pm 1\%$  of the label value for BAR-97 calibration gases and  $\pm 1\%$  of the label value for BAR-97 audit gases. Copies of the laboratory reports shall be submitted to the bureau by the audit lab as part of the submittal package.

If a blender fails to meet these accuracy requirements for any mixture after two attempts, he must wait six months before resubmitting samples of that mixture for approval.



## **APPENDIX A**

### **SUBMITTAL PACKAGE CHECK LIST**

- \_\_\_ SECTION 3.2.a: APPLICATION COVER SHEET WITH SIGNATURE OF PRESIDENT OR CHIEF FINANCIAL OFFICER.
- \_\_\_ SECTION 3.2.b: FACILITY DESCRIPTION
- \_\_\_ SECTION 3.2.c: INSTRUMENTATION DESCRIPTION
- \_\_\_ SECTION 3.2.d: LIST OF INSTRUMENT MAINTENANCE PERSONNEL
- \_\_\_ SECTION 3.2.e: LIST OF REFERENCE GASES
- \_\_\_ SECTION 3.2.f: DESCRIPTION OF PRODUCTION CAPABILITIES
- \_\_\_ SECTION 3.2.g: ESTIMATED SELLING PRICES
- \_\_\_ SECTION 3.2.h: BUSINESS STATUS REPORT
  - \_\_\_ INDICATION OF BONA FIDE BLENDER STATUS
  - \_\_\_ CALIFORNIA CORPORATION STATUS
  - \_\_\_ ORGANIZATION CHART
  - \_\_\_ ANNUAL SALES VOLUME
- \_\_\_ SECTION 3.2.i: MARKETING PLAN
- \_\_\_ SECTION 3.2.j: METHODS FOR RECALLING NONCONFORMING GASES
- \_\_\_ SECTION 3.2.k: TRACKING OF HIGH-PRESSURE CYLINDERS
- \_\_\_ SECTION 3.2.l: QUALITY ASSURANCE PROCEDURES
- \_\_\_ SECTION 3.2.m: COMPLIANCE WITH SAFETY REGULATIONS
- \_\_\_ SECTION 3.2.n: LIABILITY BONDING
- \_\_\_ SECTION 3.2.o: SAMPLE DISPOSABLE CYLINDER
- \_\_\_ SECTION 3.3: PRODUCT SAMPLE LABORATORY TEST REPORT

**APPENDIX B**

**SAMPLE COVER SHEET**

**APPLICATION FOR CERTIFICATION AS AN  
APPROVED GAS BLENDER FOR THE STATE OF CALIFORNIA  
AUTO EMISSIONS CONTROL PROGRAM**

Date of Application \_\_\_\_\_

\_\_\_\_\_ hereby applies for certification of its facility whose name (company, corporation or subsidiary) and address is shown below as an approved gas blender for the State of California Emissions I/M Program.

Authorized Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Facility Name:

\_\_\_\_\_

Facility Address:

\_\_\_\_\_

\_\_\_\_\_

Telephone Number: ( ) \_\_\_\_\_

Name and Title of Facility \_\_\_\_\_  
Contact Person: \_\_\_\_\_

\_\_\_\_\_

Location of major distribution centers in California:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Estimated number of days after notification of certification that production gas blends in cylinders will be available to the program: \_\_\_\_\_

## **APPENDIX C**

**Official BAR Label**

**for**

**BAR Disposable Calibration Gas Cylinders**

**Reference: Section 2.5.4**