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SURFACE VEHICLE RECOMMENDED PRACTICE

An American National Standard

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(R) Recommended Practice for Bar-coded Vehicle Emission Configuration Label

***Foreword*—**This Document has also changed to comply with the new SAE Technical Standards Board format.

1. ***Scope*—**This SAE Recommended Practice describes the basic content requirements, bar-code specifications, and functional test specifications of a vehicle emission configuration (VEC) label. On the vehicle, the VEC label is to be mounted under the hood in a readily accessible location for use of a bar-code scanning device.

1.1 **Purpose—**This document specifies a permanent vehicle emission configuration label that can be automatically identified through a bar-coded format.

2. ***References***

2.1 **Applicable Publications—**The following publications form a part of this specification to the extent specified herein.

2.1.1 AIAG PUBLICATIONS—Available from Automotive Industry Action Group, 26200 Lahser Road, Suite 200, Southfield, MI 48034.

AIAG B-1—Bar Code Symbology
AIAG B-7—Vehicle Emission Configuration

3. ***Definitions***

3.1 **Vehicle Emission Configuration (VEC)—**The VEC identifies selected emission controls on a vehicle as well as partially identifying the engine family designation.

3.2 **Engine Displacement—**The engine displacement signifies the engine size as expressed in liters. Two characters on the VEC label indicate the engine displacement; the decimal point is deleted.

3.3 **Emission Control System (ECS) Combination Code—**A coded letter or single-digit number in the VEC that designates the combination of selected major emission controls that are installed on the vehicle by the vehicle manufacturer. The frequency of engine ignition is included in this code combination.

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3.4 Label (Reference AIAG B-7—Appendix A)—The surface containing the VEC information in bar-coded and human-readable formats.

3.5 Bar-Code Reader (Reference AIAG B-7—Appendix A)—A device for machine reading of bar codes, which typically consists of a noncontact scanner, a decoder, and a data communications device.

3.6 Permanent Label—A permanent label shall be intended to provide a scannable life that approximates the life of the vehicle as simulated by the test specifications in Section 7.

3.7 Verification—A procedure to compare dimensional and optical characteristics of a bar code to specified tolerances using mechanical or manual processes.

3.8 Measurement or Analysis—The process to arrive at actual dimensions, which are used for comparison to specifications.

4. Label Specifications

4.1 Vehicle Emission Configuration Label Content—The VEC bar code shall consist of eight characters preceded by the data identifier "3T." The eight characters are defined in the following paragraphs. The bar code also contains a start and stop character. The label will also contain a title, VEC, unless the bar code is part of the Vehicle Emission Control Information Label.

4.1.1 ENGINE DISPLACEMENT—The VEC label shall first contain two characters for engine displacement specified in liters.

For engine displacements less than 10 L, the displacement shall be expressed to the nearest one-tenth of a liter, and then multiplied by 10 on the VEC label. For displacements 10 L and over (rare), the displacement shall be expressed to the nearest liter. (This procedure allows the elimination of the decimal point from the VEC label.) See Table 1.

TABLE 1—VEC LABEL CONTENT CHARACTERS 1 AND 2: ENGINE DISPLACEMENT

Label Character No.	Designation
1,2	Engine displacement in liters (Example: 11 would be 1.1 L, or 11 L in rare cases)

4.1.2 VEHICLE CLASS—The VEC label's third character shall contain information to describe the vehicle class.

TABLE 2—VEC LABEL CONTENT CHARACTER 3: VEHICLE CLASS

TABLE 2A—1998 AND LATER MY FEDERAL AND CALIFORNIA LIGHT-DUTY

Code	Fuel	Description GVWR (lbs)	Description ALVW (lbs)	Description LVW (lbs)	Tier 1
V	Any		LDV or CARB PC		LDV
1	Any	0-6000	Any	0–3750	LDT1
2	Any	0-6000	Any	3751–5750	LDT2
3	Any	>6000	3751-5750	0–3750	LDT3(1)
4	Any	>6000	≥5751	0-3750	LDT4(1)
5	Any	>6000	3751-5750	≥3751	LDT5(1)
6	Any	>6000	≥5751	≥3751	LDT6(1)

1. Federal Only

TABLE 2B—1998 AND LATER MY CALIFORNIA MEDIUM-DUTY

Code	Designation	GVWR	ALVW
G	MDV-1	>6000	0–3750
H	MDV-2	>6000	3751–5750
J	MDV-3	>6000	5751–8500
K	MDV-4	>6000	8501–10000
L	MDV-5	>6000	10001–14000
W	MDV OPT	8501-14000	Incomplete Vehicle

TABLE 2C—1998 AND LATER MY HEAVY-DUTY OR CFV HEAVY-DUTY

Code	Useful Life	Standard	Description
A	LHDE	Light-Duty	Option for <10 000 GVWR
B	LHDE	<14K GVWR(1)	Typically GVWR <19.5K, HP 70-170
C	LHDE	>14K GVWR(2)	Typically GVWR <19.5K, HP 70-170
D	MHDE	>14K GVWR	Typically GVWR 19.5K-33K, HP 170-250
E	HHDE	>14K GVWR	Typically GVWR >33K, HP >250
F	HHDE	URBAN BUS	HHDE Bus

1. Also use this code for families containing both <14K and >14K GVWR, if all vehicles are intended to comply with <14K standards.
2. Use this code for families containing both <14K and >14K GVWR.

TABLE 2D—1998 AND LATER MY 50 STATE TRUCK (6000—14 000 GVWR)
FEDERAL HEAVY LIGHT-DUTY TRUCK AND CALIFORNIA MEDIUM-DUTY TRUCK

Code	EPA LDT Vehicle Class[1] (6000–8500 GVWR)	California MDT Vehicle Class[2] (6000–14 000 GVWR)
M	3	H
N	4	J
P	5	H
R	6	J

1. Codes from Table 2A: 1998 and Later MY Federal and California Light-Duty
2. Codes from Table 2B: 1998 and Later MY California Medium-Duty

TABLE 2E—1998 AND LATER MY 50 STATE TRUCK (6000—14 000 GVWR)
FEDERAL HEAVY-DUTY TRUCK AND CALIFORNIA MEDIUM-DUTY TRUCK

Code	EPA HDT Vehicle Class[1] (>8500 GVWR)	California MDT Vehicle Class[2] (6000–14 000 GVWR)
S	A	K
T	B	W

1. Codes from Table 2C: 1998 and Later MY Heavy-Duty or CFV Heavy-Duty
2. Codes from Table 2B: 1998 and Later MY California Medium-Duty

NOTE—Characters 7, 8, 9, 0, U, X, Y, and Z are reserved.

EXAMPLES OF FEDERAL, CALIFORNIA, AND 50-STATE VEHICLE CLASS

Example 1: A federal-only engine family is certified in the LDT5 vehicle class. Character 3 of the VEC bar code for this engine family should be 5.

Example 2: A California-only engine family is certified in the MDV-2 vehicle class. Character 3 of the VEC bar code for this engine family should be H.

Example 3: A 50-state engine family is certified in the federal LDT5 vehicle class and the California MDV-2 vehicle class. Character 3 of the VECI bar code for this family should be P.

4.1.3 WILD CARD—The fourth character of the VEC label shall be a wild card. An alphanumeric character may be used (A, B, C...X, Y, Z or 0, 1, 2, 3...7,8,9), but the wild card must ensure that every vehicle engine family will have an original VEC bar code.

4.1.4 COMBUSTION CYCLE AND FUEL—The VEC label shall contain the combustion cycle fuel information.

TABLE 3—VEC LABEL CONTENT
CHARACTER 5: COMBUSTION CYCLE AND FUEL

Otto Cycle (SI) Piston	Otto Cycle (SI) Rotary	Diesel Cycle (CI)	Two Stroke Cycle	Turbine	Fuel
G	R		2	T	Gasoline
		D	4	Q	Diesel
M		A			Methanol
E		B			Ethanol
			3	S	Methanol/Ethanol
F					Flexible methanol-gasoline
		W			Flexible methanol-diesel
N		J			Other Flexible (i.e., Dual fuel (gasoline and CNG) or Bi-fueled (diesel and CNG))
C		K	5	U	LNG/CNG
L		P	6	V	LPG
	X				Other fuels
			7	W	Flexible

Y - Hybrid electric
Z - Electric

4.1.5 CALIFORNIA AND FEDERAL STANDARD—The sixth VEC label shall contain the California Emission Standard (Table 4) and the seventh character shall contain the Federal Emissions Standard (Table 5).

TABLE 4—VEC LABEL CONTENT
CHARACTER 6: CALIFORNIA EMISSION STANDARD
LETTER CODE FOR CALIFORNIA EMISSION STANDARDS

Code	Standard	In-Use
A	Tier 0	Full
B	Tier 1	Full
C	Tier 1	Alternative
D	TLEV	Full
E	TLEV	Alternative
F	LEV	Full
G	LEV	Alternative
H	ULEV	Full
J	ULEV	Alternative
K	SULEV	Full
L	SULEV	Alternative
M	ILEV Only	Full
N	ILEV + LEV	Full
P	ILEV + ULEV	Full
R	ILEV + SULEV	Full
S	ILEV + ZEV	Full
U	AB 965	(see Char 7)
Z	ZEV	Full
X	Not CARB Certified	N/A

TABLE 5—VEC LABEL CONTENT
CHARACTER 7: FEDERAL EMISSION STANDARD
LETTER CODES FOR FEDERAL EMISSION STANDARDS

Code	Standard	In-Use
A	Tier 0	Full
B	Tier 1	Full
C	Tier 1	Alternative
D	TLEV	Full
E	TLEV	Alternative
F	LEV	Full
G	LEV	Alternative
H	ULEV	Full
J	ULEV	Alternative
K	SULEV	Full
L	SULEV	Alternative
M	ILEV Only	Full
N	ILEV + LEV	Full
P	ILEV + ULEV	Full
R	ILEV + SULEV	Full
S	ILEV + ZEV	Full
Z	ZEV	Full
X	Not U.S. EPA Certified	N/A

EXAMPLES OF FEDERAL, CALIFORNIA, AND 50-STATE STANDARDS

Example 1: A federal-only engine family is certified to the Tier 1 standard and is subject to the full in-use standard. Characters 6 and 7 of the VEC bar code for this engine family should be XB.

Example 2: A California-only engine family is certified to the LEV standard and is subject to the alternate in-use standard. Characters 6 and 7 of the VEC bar code for this engine family should be GX.

Example 3: A 50-state engine family contains three engine codes A, B, and C. The following table shows the federal and California certification and in-use standards for each engine code and the corresponding VEC bar-code characters:

TABLE 6—EXAMPLES OF 1998 AND LATER MY 50-STATE SIXTH AND SEVENTH CHARACTERS

Engine Code	California Standard Certification	California Standard In-Use	Federal Standard Certification	Federal Standard In-Use	Character 6	Character 7
A	TLEV	FULL	TIER 1	FULL	D	B
B	N/A	N/A	TIER 1	FULL	X	B
C	TLEV	FULL	N/A	N/A	D	X

4.1.6 ECS COMPONENT COMBINATION—The eighth character on the VEC label is the code for the ECS combination and the engine ignition frequency. The emission controls to be coded in this position are for use in vehicle inspection programs. The engine ignition frequency is specified because some engine designs have twice the ignition frequency of other designs. The correct ignition frequency must be identified to measure engine speed properly during the vehicle inspection. Initially, the ECS combination codes will be standardized as shown in Table 7. Label codes A through R will describe the ECS component combinations for vehicles with an ignition frequency of one event per two engine revolutions. Label codes S through 9 will describe the ECS component combinations for vehicles with an ignition frequency of one event per engine revolution. Column 3 of Table 7 is intended to specify compliance with the on-board diagnostic (OBD) requirements; a "Yes" would specify compliance with either Federal OBD or California OBD II. All combinations of up to four ECS components can be coded in this label position for vehicles with either of the two ignition frequencies. The reserved column is intended to be specified by government regulation.

4.2 Human-Readable Character Suppression (Reference AIAG B-7 — Appendix A)—The human-readable characters for start, stop, and the data identifier shall be suppressed from printing.

4.3 Human-Readable Character Height (Reference AIAG B-7 — Appendix A)—The minimum height of the human-readable characters is 2.38 mm (0.094 in).

4.4 Horizontal or Vertical Printing (Reference AIAG B-7 — Appendix A)—The symbols may be printed horizontally or vertically. When the bar codes are printed horizontally, the human-readable data should be printed directly above or below and centered. When bar codes are printed vertically, the human-readable data should be printed vertically and centered to the left or right of the bar code.

4.5 Title—This label shall contain the title of "VEC" unless the bar code is part of the Vehicle Emission Control Information Label.

5. General Symbology Specifications

5.1 Code 39 Symbology—The VEC bar code shall conform to "Bar Code Symbology for 3 of 9 Bar Codes" published by the Automotive Industry Action Group (AIAG B-1), which is effective as of this date. This specification is shown in Appendix B. All aspects of the bar-code symbology codes shall follow this specification except as described in the following sections.

5.2 Code Density and Dimensions (Reference AIAG B-7 — Appendix A)—The average width of the narrow element shall be within the range of 0.19 mm (0.0075 in) and 0.317 mm (0.0125 in).

The ratio shall be 3:1 with an allowable range of 2.8 to 3.2.

The minimum bar height shall be 9.5 mm (0.375 in) or 15% of bar-code length.

TABLE 7—VEC LABEL CONTENT CHARACTER 8: ECS COMPONENT COMBINATION

Label Code	Col. #1 Air Injection	Col. #2 EGR	Col. #3 Federal OBD/OBD II	Col. #4 (Reserved)
Ignition Frequency: One Event per Two Engine Revolutions				
A	NO	NO	NO	
B	YES	NO	NO	
C	NO	YES	NO	
D	YES	YES	NO	
E	NO	NO	YES	
F	YES	NO	YES	
G	NO	YES	YES	
H	YES	YES	YES	
I				
J				
K				
L				
M				
N				
O				
P				
Q				
R				
Ignition Frequency: One Event per Engine Revolution				
S	NO	NO	NO	
T	YES	NO	NO	
U	NO	YES	NO	
V	YES	YES	NO	
W	NO	NO	YES	
X	YES	NO	YES	
Y	NO	YES	YES	
Z	YES	YES	YES	
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				

6. Scanning Devices (Reference AIAG B-7—Appendix A)—To avoid damage to the label or vehicle surfaces, only noncontact bar code scanners shall be used to scan the bar codes. Scanning devices shall use a light source at B633 nanometer range or in the visible red light spectral band range.

7. Functional Test Specifications

7.1 Scope—This section defines the minimum laboratory performance testing requirements for new, original equipment, underhood labels that are to be mounted in a protected location. (A protected location on the vehicle is where the label is not exposed to ambient elements outside of the vehicle.) These testing requirements are not for field compliance testing purposes.

7.2 VEC Label—The label must have a pressure-sensitive adhesive on the back with a built-in self-destructive feature. Labels must be easily removed from the release liner with minimal effort with no damage to the label.

7.3 Panel Preparation for Laboratory Performance Testing—The preparation of panels or substrate will conform to each vehicle manufacturer's specifications in accordance with the approved vehicle manufacturer's test procedures.

7.4 Label Test Specification Procedure—Test specifications detailed in this document will conform to each vehicle manufacturer's approved test/laboratory/material specifications.

7.5 Label Appearance—Labels to be tested, shall be free of streaks, blisters, wrinkles, ragged edges, and any other surface imperfections which will make them unsuitable for the intended usage. The design and color are specified on the engineering drawing.

7.6 Label Release Specifications—The adhesive side of the labels shall have a protective release backing with sufficient strength to protect the adhesive film during shipment, storage, and handling. The release backing shall not tear or delaminate while being removed from the label; also, it shall separate evenly and clearly from the adhesive and shall not cause the label to void. It shall be free of any contaminants or any other surface treatment that would be detrimental to the adhesive qualities of the label.

7.7 Label Identification/Qualification Requirements—Labels qualified to this specification shall be assigned a vehicle manufacturer's part number, after which time no change can be made to the material without approval of the purchaser.

7.8 Label Storage—Labels shall not be adversely affected by storage up to 30 days at room temperature up to 40 °C (104 °F).

7.9 Environmental Test Specifications

7.9.1 LABEL LEGIBILITY—Test shall be completed within 48 h after removal from the conditioning environment.

After each of the exposures, the label must not show evidence of delamination, loss of printing, loss of adhesion or any other effect that would render it to be illegible.

7.9.2 EVIDENCE OF TAMPERPROOF FEATURE—Test shall be completed within 48 h after removal from the conditioning environment.

The tamperproof feature shall be evaluated by removal of the label from the test panel after each test. The label will be removed by pulling the label from the test panel at a 90 degree angle to plane. Removal of the label from the test panel must cause permanent and obvious damage to the label, rendering it inappropriate to be transferred.

7.9.3 HUMIDITY TEST—Humidity cabinet for 96 h at 100% relative humidity and 37.7 °C (100 °F).

7.9.4 THERMAL CYCLE TEST—Maintain the panel for 1 h at –40 °C (–40 °F) then expose to heat for 1 h at 121 °C ± 3 °C (250 °F ± 37.4 °F). Repeat for four cycles.

7.9.5 IMMERSION OIL—Immerse panel for 2 h in oil at 25 °C (77 °F). (ASTM #3 oil.)

7.9.6 IMMERSION IN ENGINE COOLANT—Pour 1000 mL of boiling engine coolant solution on a panel 85 degrees to normal plane.

8. Bar-Code Verification Procedures

8.1 Scope—These procedures describe the equipment, calibration, and verification process for bar-coded labels. They are used to make a laboratory comparison of dimensional optical characteristics of a bar code to specified tolerance using mechanical or manual processes.

These verification procedures are considered to be for laboratory auditing, not for auditing for in-field compliance. They are not intended to replace any other multiple-scan audits suggested by other sources. These procedures are to be performed randomly on independent labels, not as a concurrent test.

Verification equipment can be used from, but not limited to, the sources listed as follows or from any other equipment manufacturer that satisfies the verification procedures specified herein:

a. Micro Plotter Engineering Ltd.
b. Photographic Science Corp.
c. RJS Inc.
d. Symbol Technologies

8.2 Calibration

8.2.1 The verification equipment is to be calibrated as described by the manufacturer of the verification equipment. Operation of the verification equipment is to be performed as described in the manufacturer's operating manual.

8.2.2 The verification equipment manufacturer's test label is to be verified once to proper calibration. If it fails to meet the manufacturer's tolerances to indicate the equipment is correctly calibrated, calibration should be repeated and the test label verified again.

8.3 Verification—The verification procedure is to be completed within 48 h after completion of the environmental testing for label performance and function. The label is to be wiped with a soft absorbent cloth (5 strokes) prior to the verification procedure. The procedure is to be performed on the label after each environmental test.

8.3.1 The label to be audited is to be mounted on the surface material for which it was intended and which facilitates the verification procedure.

8.3.2 BAR AND SPACE ANALYSIS/MEASUREMENT—The first measurement is to be taken approximately on the centerline of the bar code perpendicular to the bars. The measurements are to be taken in accordance with the equipment manufacturer's operating manual. The methodology is not intended to replace any other multiple-scan audits suggested by other sources. Symbology specifications are in accordance with AIAG B-1 with exceptions as noted.

8.3.2.1 The minimum nominal narrow element dimension is to measure 0.119 mm (0.0075 in), and the maximum nominal narrow element size is to measure 0.317 mm (0.0125 in). Tolerances are as specified in AIAG B-1.

8.3.2.2 If the bar code remains out of tolerance, a second analysis is to be taken just below or to the left of the first analysis.

8.3.2.3 If the bar code still remains out of tolerance, a third analysis is to be taken just above or to the right of the first analysis.

8.3.2.4 If the bar code still remains out of tolerance, the label is not acceptable and the audit is complete.

8.3.2.5 The enclosed flow chart describes the physical audit procedure (see Figure 1).

8.3.3 ENCODATION—The human-readable interpretation is to be compared to the encoded bar code to assure it is correct based on the applicable standard.

NOTE—The start/stop characters and the data identifiers are not to be included in the human-readable interpretation.

8.3.4 If the bar-coded label meets or exceeds the specified tolerance and guidelines, the label is considered acceptable.