

CHAPTER 9



VEHICLE IDENTIFICATION AND EMISSION RATINGS

OBJECTIVES

After studying Chapter 9, the reader will be able to:

1. Identify a vehicle.
2. Interpret vehicle identification numbers and placard information.

3. Interpret vehicle emissions and emission control information.
4. Read and interpret casting numbers.
5. Locate calibration codes.

KEY TERMS

Bin Number (p. 111)
Calendar Year (CY) (p. 108)
Calibration Codes (p. 111)
California Air Resources Board (CARB) (p. 109)
Casting Numbers (p. 111)
Country of Origin (p. 108)
Environmental Protection Agency (EPA) (p. 109)

Gross Axle Weight Rating (GAWR) (p. 109)
Gross Vehicle Weight Rating (GVWR) (p. 109)
Model Year (MY) (p. 108)
Tier 1 (p. 109)
Tier 2 (p. 109)
Vehicle Emissions Control Information (VECI) (p. 109)
Vehicle Identification Number (VIN) (p. 108)

PARTS OF A VEHICLE

The names of the parts of a vehicle are based on the location and purpose of the component.

Left Side of the Vehicle— Right Side of the Vehicle

Both of these terms refer to the left and right as if the driver is sitting behind the steering wheel. Therefore, the left side (including components under the hood) is on the driver's side.

Front and Rear

The proper term for the back portion of any vehicle is rear (for example, left rear tire).

FRONT-WHEEL DRIVE VERSUS REAR-WHEEL DRIVE

Front-wheel drive (FWD) means that the front wheels are being driven by the engine, as well as turned by the steering wheel. Rear-wheel drive (RWD) means that the rear wheels are driven by the engine. If the engine is in the front, it can be either front- or rear-wheel drive. In many cases, a front engine vehicle can also drive all four wheels called four-wheel drive (4WD) or all-wheel drive (AWD). If the engine is located at the rear of the vehicle, it can be rear-wheel drive or four-wheel (4WD) drive.

VEHICLE IDENTIFICATION

All service work requires that the vehicle, including the engine and accessories, be properly identified. The most common identification is the make, model, and year of the vehicle.

Make: e.g., Chevrolet

Model: e.g., Trailblazer

Year: e.g., 2007

The year of the vehicle is often difficult to determine exactly. A model may be introduced as the next year's model as soon as January of the previous year. Typically, a new **model year** (abbreviated **MY**) starts in September or October of the year prior to the actual new year, but not always. This is why the **vehicle identification number**, usually abbreviated **VIN**, is so important. See Figure 9-1.

Since 1981 all vehicle manufacturers have used a VIN that is 17 characters long. Although every vehicle manufacturer assigns various letters or numbers within these 17 characters, there are some constants, including:



FIGURE 9-1 Typical vehicle identification number (VIN) as viewed through the windshield.

- The first number or letter designates the **country of origin**.
- The model of the vehicle is commonly the fourth and/or fifth character.

1 = United States	6 = Australia	L = China	V = France
2 = Canada	8 = Argentina	R = Taiwan	W = Germany
3 = Mexico	9 = Brazil	S = England	X = Russia
4 = United States	J = Japan	T = Czechoslovakia	Y = Sweden
5 = United States	K = Korea	U = Romania	Z = Italy

- The eighth character is often the engine code. (Some engines cannot be determined by the VIN number.)
- The tenth character represents the **calendar year** (abbreviated **CY**) on all vehicles. See the following chart.

VIN Year Chart (*The pattern repeats every 30 years*)

A = 1980/2010 J = 1988/2018 T = 1996/2026 4 = 2004/2034

B = 1981/2011 K = 1989/2019 V = 1997/2027 5 = 2005/2035

C = 1982/2012 L = 1990/2020 W = 1998/2028 6 = 2006/2036

D = 1983/2013 M = 1991/2021 X = 1999/2029 7 = 2007/2037

E = 1984/2014 N = 1992/2022 Y = 2000/2030 8 = 2008/2038

F = 1985/2015 P = 1993/2023 1 = 2001/2031 9 = 2009/2039

G = 1986/2016 R = 1994/2024 2 = 2002/2032

H = 1987/2017 S = 1995/2025 3 = 2003/2033

VEHICLE SAFETY CERTIFICATION LABEL

A vehicle safety certification label is attached to the left side pillar post on the rearward-facing section of the left front door. This label indicates the month and year of manufacture as well as the **gross vehicle weight rating (GVWR)**, the **gross axle weight rating (GAWR)**, and the vehicle identification number (VIN).

VECI LABEL

The **vehicle emissions control information (VECI)** label under the hood of the vehicle shows informative settings and emission hose routing information. See Figure 9-2.

The VECI label (sticker) can be located on the bottom side of the hood, the radiator fan shroud, the radiator core support, or the strut towers. The VECI label usually includes the following information:

- Engine identification
- Emissions standard that the vehicle meets
- Vacuum hose routing diagram
- Base ignition timing (if adjustable)
- Spark plug type and gap
- Valve lash
- Emission calibration code

EMISSION STANDARDS IN THE UNITED STATES

In the United States, emissions standards are managed by the **Environmental Protection Agency (EPA)** as well as some



FIGURE 9-2 A VECI label on a 2004 Pontiac GTO.

U.S. state governments. Some of the strictest standards in the world are formulated in California by the **California Air Resources Board (CARB)**.

Tier 1 and Tier 2

Federal emission standards are set by the Clean Air Act Amendments (CAAA) of 1990 grouped by *tier*. All vehicles sold in the United States must meet **Tier 1** standards that went into effect in 1994 and are the least stringent. Additional **Tier 2** standards have been optional since 2001, and are currently being phased in to be fully adopted by 2009. The current Tier 1 standards are different between automobiles and light trucks (SUVs, pickup trucks, and minivans), but Tier 2 standards are the same for both types.

There are several ratings that can be given to vehicles, and a certain percentage of a manufacturer's vehicles must meet different levels in order for the company to sell its products in affected regions. Beyond Tier 1, and in order by stringency, are the following levels:

- **TLEV—Transitional Low-Emission Vehicle.** More stringent for HC than Tier 1.
- **LEV—(also known as LEV I)—Low-Emission Vehicle.** An intermediate California standard about twice as stringent as Tier 1 for HC and NO_x.
- **ULEV (also known as ULEV I)—Ultra-Low-Emission Vehicle.** A stronger California standard emphasizing very low HC emissions.
- **ULEV II—Ultra-Low-Emission Vehicle.** A cleaner-than-average vehicle certified under the Phase II LEV standard. Hydrocarbon and carbon monoxide emissions levels are nearly 50% lower than those of a LEV II-certified vehicle. See Figure 9-3.



FIGURE 9-3 The underhood decal showing that this Lexus RX-330 meets both national (Tier 2;BIN 5) and California LEV-II (ULEV) regulation standards.

- **SULEV—Super-Ultra-Low-Emission Vehicle.** A California standard even tighter than ULEV, including much lower HC and NO_x emissions; roughly equivalent to Tier 2 Bin 2 vehicles.
- **ZEV—Zero-Emission Vehicle.** A California standard prohibiting any tailpipe emissions. The ZEV category is largely restricted to electric vehicles and hydrogen-fueled vehicles. In these cases, any emissions that are created are produced at another site, such as a power plant or hydrogen reforming center, unless such sites run on renewable energy.

NOTE: A battery-powered electric vehicle charged from the power grid will still be up to 10 times cleaner than even the cleanest gasoline vehicles over their respective lifetimes.

The current California ZEV regulation allows manufacturers a choice of two options for meeting the ZEV requirements:

1. Vehicle manufacturers can meet the ZEV obligations by meeting standards that are similar to the ZEV rule as it existed in 2001. This means using a formula allowing a vehicle mix of 2% pure ZEVs, 2% AT-PZEVs (vehicles earning advanced technology partial ZEV credits), and 6% PZEVs (extremely clean conventional vehicles). The ZEV obligation is based on the number of passenger cars and small trucks a manufacturer sells in California.
2. Manufacturers may also choose a new alternative ZEV compliance strategy of meeting part of the ZEV requirement by producing the sales-weighted market share of

approximately 250 fuel-cell vehicles by 2008. The remainder of the ZEV requirements could be achieved by producing 4% AT-PZEVs and 6% PZEVs. The required number of fuel-cell vehicles will increase to 2,500 from 2009 to 2011, 25,000 from 2012 through 2020, and 50,000 from 2015 through 2017. Manufacturers can substitute battery electric vehicles for up to 50% of the fuel-cell vehicle requirements.

- **PZEV—Partial-Zero-Emission Vehicle**—Compliant with the SULEV standard; additionally has near-zero evaporative emissions and a 15-year/150,000-mile warranty on its emission control equipment.

Tier 2 standards are even more stringent. Tier 2 variations are appended with “II,” such as LEV II or SULEV II. Other categories have also been created:

- **ILEV—Inherently Low-Emission Vehicle**
- **AT-PZEV—Advanced Technology Partial-Zero-Emission Vehicle.** If a vehicle meets the PZEV standards and is using high-technology features, such as an electric motor or high-pressure gaseous fuel tanks for compressed natural gas, it qualifies as an AT-PZEV. Hybrid electric vehicles such as the Toyota Prius can qualify, as can internal combustion engine vehicles that run on natural gas (CNG), such as the Honda Civic GX. These vehicles are classified as “partial” ZEV because they receive partial credit for the number of ZEV vehicles that automakers would otherwise be required to sell in California.
- **NLEV—National Low-Emission Vehicle.** All vehicles nationwide must meet this standard, which started in 2001. See Tables 9-1 and 9-2.

TABLE 9-1 LEV Standard Categories

		NMOG Grams (Mile)	CO Grams (Mile)	NO_x Grams (Mile)
LEV I (Cars)	TLEV	0.125 (0.156)	3.4 (4.2)	0.4 (0.6)
	LEV	0.075 (0.090)	3.4 (4.2)	0.2 (0.3)
	ULEV	0.040 (0.055)	1.7 (2.1)	0.2 (0.3)
LEV II (Cars and Trucks < 8,500 lbs)	LEV	0.075 (0.090)	3.4 (4.2)	0.05 (0.07)
	ULEV	0.040 (0.055)	1.7 (2.1)	0.05 (0.07)
	SULEV	-(0.010)	-(1.0)	-(0.02)

Note: Numbers in parentheses are 100,000-mile standards for LEV I, and 120,000-mile standards for LEV II. NMOG means non-methane organic gases, which includes alcohol. CO means carbon monoxide. NO_x means oxides of nitrogen. Data compiled from California Environmental Protection Agency—Air Resource Board (CARB) documents.

TABLE 9-2 California LEV II 120,000-Mile Tailpipe Emissions Limits

Certification Level	NMOG (g/mi)	CO (g/mi)	NO _x (g/mi)
LEV-II	0.090	4.2	0.07
ULEV-II	0.055	2.1	0.07
SULEV-II	0.010	1.0	0.02

Note: Numbers in parentheses are 100,000-mile standards for LEV I, and 120,000-mile standards for LEV II. NMOG means non-methane organic gases, which includes alcohol. CO means carbon monoxide. NO_x means oxides of nitrogen. The specification is in grams per mile (g/mi). Data compiled from California Environmental Protection Agency—Air Resources Board (CARB) documents.

Federal EPA Bin Number

The higher the tier number, the newer the regulation; the lower the **bin number**, the cleaner the vehicle. The 2004 Toyota Prius is a very clean Bin 3, while the Hummer H2 is a dirty Bin 11. Examples include:

- Tier 1: The former federal standard; carried over to model year 2004 for those vehicles not yet subject to the phase-in.
- Tier 2, Bin 1: The cleanest federal Tier 2 standard; a zero-emission vehicle (ZEV).
- Tier 2, Bins 2–4: Cleaner than the average standard.
- Tier 2, Bin 5: “Average” of new Tier 2 standards, roughly equivalent to a LEV II vehicle.
- Tier 2, Bins 6–9: Not as clean as the average requirement for a Tier 2 vehicle.
- Tier 2, Bin 10: Least-clean Tier 2 bin applicable to passenger vehicles. See Tables 9-3 and 9-4.

CALIBRATION CODES

Calibration codes are usually located on power train control modules (PCMs) or other controllers. Some calibration codes are only accessible with a scan tool. Whenever diagnosing an engine operating fault, it is often necessary to know the calibration code to be sure that the vehicle is the subject of a technical service bulletin or other service procedure. See Figure 9-4.

TABLE 9-3 EPA Tier 2—120,000-Mile Tailpipe Emission Limits

Certification Level	NMOG (g/mi)	CO (g/mi)	NO _x (g/mi)
Bin 1	0.0	0.0	0.0
Bin 2	0.010	2.1	0.02
Bin 3	0.055	2.1	0.03
Bin 4	0.070	2.1	0.04
Bin 5	0.090	4.2	0.07
Bin 6	0.090	4.2	0.10
Bin 7	0.090	4.2	0.15
Bin 8a	0.125	4.2	0.20
Bin 8b	0.156	4.2	0.20
Bin 9a	0.090	4.2	0.30
Bin 9b	0.130	4.2	0.30
Bin 9c	0.180	4.2	0.30
Bin 10a	0.156	4.2	0.60
Bin 10b	0.230	6.4	0.60
Bin 10c	0.230	6.4	0.60
Bin 11	0.230	7.3	0.90

Note: The bin number is determined by the type and weight of the vehicle. The highest bin allowed for vehicles built after January 1, 2007, is Bin 8. Data compiled from the Environmental Protection Agency (EPA).

CASTING NUMBERS

Whenever an engine part such as a block is cast, a number is put into the mold to identify the casting. See Figure 9-5. These **casting numbers** can be used to check dimensions such as the cubic inch displacement and other information. Sometimes changes are made to the mold, yet the casting number is not changed. Most often the casting number is the best piece of identifying information that the service technician can use for identifying an engine.

TABLE 9-4 Air Pollution Score

U.S. EPA Vehicle Information Program (The Higher the Score, the Lower the Emissions)	
Selected Emissions Standards	Score
Bin 1 and ZEV	10
PZEV	9.5
Bin 2	9
Bin 3	8
Bin 4	7
Bin 5 and LEV II cars	6
Bin 6	5
Bin 7	4
Bin 8	3
Bin 9a and LEV I cars	2
Bin 9b	2
Bin 10a	1
Bin 10b and Tier 1 cars	1
Bin 11	0

Courtesy of the Environmental Protection Agency (EPA).



FIGURE 9-4 A typical computer calibration sticker on the case of the controller. The information on the sticker is often needed when ordering parts or a replacement controller.



FIGURE 9-5 Engine block identification number cast into the block is used for identification.

SUMMARY

1. The front, rear, left, and right side of a vehicle are as viewed from the driver's seat.
2. The vehicle identification number (VIN) is very important as it includes when the vehicle was built, as well as the engine code and many other details about the vehicle.
3. The VECI label under the hood often needs to be checked by the technician to properly service the vehicle.
4. Other vehicle information that the technician may need for a service or repair include calibration codes, casting numbers, and emissions rating.

REVIEW QUESTIONS

1. From what position are the terms left and right determined?
2. What are the major pieces of information that are included in the vehicle identification number (VIN)?
3. What information is included on the VECI label under the hood?
4. What does Tier 2 Bin 5 mean?

CHAPTER QUIZ

1. The passenger side is called the _____.
 a. Right side
 b. Left side
 c. Either right or left side, depending on how the vehicle is viewed
 d. Both a and b
2. A vehicle with the engine in the front can be _____.
 a. Front-wheel drive
 b. Rear-wheel drive
 c. Four-wheel drive
 d. Any of the above
3. The vehicle identification number (VIN) is how many characters long?
 a. 10
 b. 12
 c. 17
 d. 21
4. The tenth character represents the year of the vehicle. If the tenth character is a "Y," what year is the vehicle?
 a. 1998
 b. 2000
 c. 2002
 d. 2004
5. The first character of the vehicle identification number is the country of origin. Where was the vehicle built that has a "5" as the first character?
 a. United States
 b. Canada
 c. Mexico
 d. Japan
6. The VECI label includes all *except* _____.
 a. Engine identification
 b. Horsepower and torque rating of the engine
 c. Spark plug type and gap
 d. Valve lash
7. The vehicle safety certification label includes all *except* _____.
 a. VIN
 b. GVWR
 c. Tire pressure recommendation
 d. GAWR
8. What are the characters that are embedded in most engine blocks and are used for identification?
 a. VIN
 b. Calibration codes
 c. Bin number
 d. Casting number
9. If the first number of the VIN is an "S," where was the vehicle made?
 a. United States
 b. Mexico
 c. Canada
 d. England
10. Technician A says that the lower the Bin number is, the cleaner. Technician B says that SULEV has cleaner standards than ULEV. Which technician is correct?
 a. Technician A only
 b. Technician B only
 c. Both Technicians A and B
 d. Neither Technician A nor B