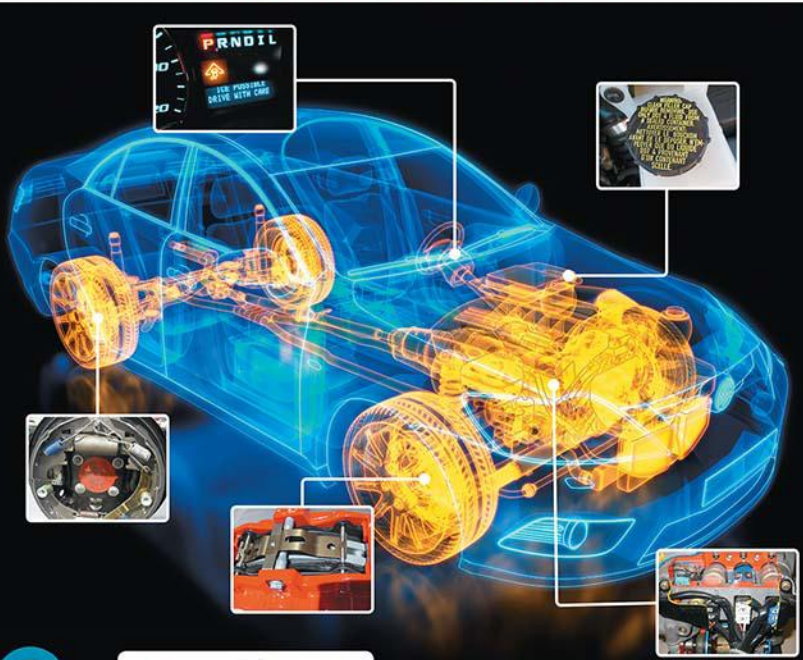
Automotive Chassis Systems

JAMES D. HALDERMAN



EIGHTH EDITION

AUTOMOTIVE CHASSIS SYSTEMS

EIGHTH EDITION

James D. Halderman

Pearson

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BRIEF CONTENTS

CONTENTS

PREFACE

NEW TO THIS EDITION. Based on the suggestions and recommendations from automotive instructors and reviewers, the following changes have been made to the eighth edition:

- The number of chapters has been increased from 35 to 37 to help meet the latest ASE tasks. The new chapters include:

  Chapter 1—Service Information, Work Orders, and Vehicle Identification
  Chapter 37—Vibration and Nosie Diagnosis and Correction

- Over 40 new full-color photos and line drawings to make the subject come alive.
- Updated throughout and correlated to the latest ASE tasks.
- New Case Studies included in this edition covering the "three Cs" (Complaint, Cause, and Correction).
- New OSHA hazardous chemical labeling requirements added to Chapter 2.
- The chapter on brake principles (Chapter 5) has been expanded to include the details on brake friction materials, which are now in one location, instead of being repeated in the drum and disc brake chapters.
- Qualifying brake lathe information added to Chapter 16.
- Additional content on snap-in and clamp-on TPMS sensors, plus updated relearn procedures, in Chapter 23.

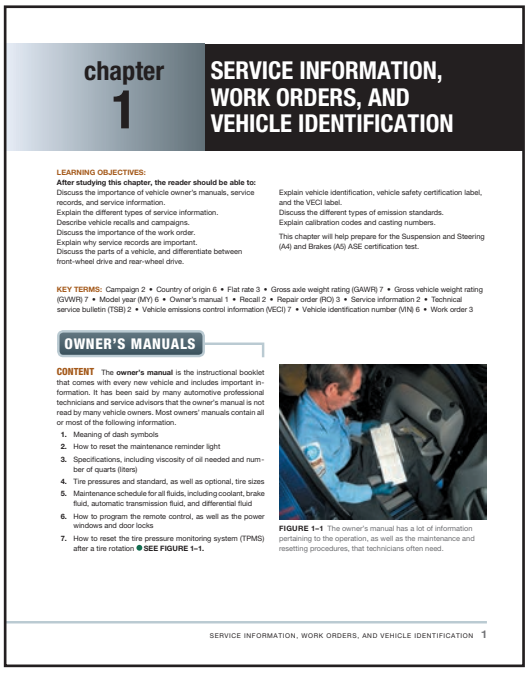
ASE CORRELATED This comprehensive textbook is divided into sections that correspond to the two areas of certifications (A4 and A5) as specified by the National Institute for Automotive Service Excellence (ASE). The areas of the ASE material certification test are listed in the objectives at the beginning of each chapter, and all laboratory worksheets are correlated to the ASE Task Sheets.

A COMPLETE INSTRUCTOR AND STUDENT SUPPLEMENT PACKAGE Please see page viii for a detailed list of supplements.

A FOCUS ON DIAGNOSIS AND PROBLEM SOLVING
The primary focus of this textbook is to satisfy the need for problem diagnosis. Time and again, the author has heard that technicians need more training in diagnostic procedures and skill development. To meet this need and to help illustrate how real problems are solved, diagnostic stories are included throughout. Each new topic covers the parts involved, as well as their purpose, function, and operation, and how to test and diagnose each system.

The following pages highlight the unique core features that set this book apart from other automotive textbooks.

IN-TEXT FEATURES



chapter 1

SERVICE INFORMATION, WORK ORDERS, AND VEHICLE IDENTIFICATION

LEARNING OBJECTIVES:

After studying this chapter, the reader should be able to:

Discuss the importance of vehicle owner's manuals, service records, and service information.
Explain the different types of service information.
Describe vehicle recalls and campaigns.
Discuss the importance of the work order.
Explain why service records are important.
Discuss the parts of a vehicle, and differentiate between front-wheel drive and rear-wheel drive.
Explain vehicle identification, vehicle safety certification label, and the VECI label.
Discuss the different types of emission standards.
Explain calibration codes and casting numbers.

This chapter will help prepare for the Suspension and Steering (A4) and Brakes (A5) ASE certification test.

KEY TERMS: Campaign 2 • Country of origin 6 • Flat rate 3 • Gross axle weight rating (GAWR) 7 • Gross vehicle weight rating (GVWR) 7 • Model year (MY) 6 • Owner's manual 1 • Recall 2 • Repair order (RO) 3 • Service information 2 • Technical service bulletin (TSB) 2 • Vehicle emissions control information (VECI) 7 • Vehicle identification number (VIN) 6 • Work order 3

OWNER'S MANUALS

CONTENT The **owner's manual** is the instructional booklet that comes with every new vehicle and includes important information. It has been said by many automotive professional technicians and service advisors that the owner's manual is not read by many vehicle owners. Most owners' manuals contain all or most of the following information.

1. Meaning of dash symbols
2. How to reset the maintenance reminder light
3. Specifications, including viscosity of oil needed and number of quarts (liters)
4. Tire pressures and standard, as well as optional, tire sizes
5. Maintenance schedule for all fluids, including coolant, brake fluid, automatic transmission fluid, and differential fluid
6. How to program the remote control, as well as the power windows and door locks
7. How to reset the tire pressure monitoring system (TPMS) after a tire rotation ● SEE FIGURE 1–1.

FIGURE 1–1 The owner's manual has a lot of information pertaining to the operation, as well as the maintenance and resetting procedures, that technicians often need.

SERVICE INFORMATION, WORK ORDERS, AND VEHICLE IDENTIFICATION 1

LEARNING OBJECTIVES AND KEY TERMS appear at the beginning of each chapter to help students and instructors focus on the most important material in each chapter. The chapter objectives are based on specific ASE tasks.

TECH TIP

Right to Tighten

Whenever removing any automotive component, it is wise to screw the bolts back into the holes a couple of threads by hand. This ensures that the right bolt is used in its original location.

TECH TIP feature real-world advice and "tricks of the trade" from ASE-certified master technicians.

SAFETY TIP

Shop Cloth Disposal

Always dispose of oily shop cloths in an enclosed container to prevent a fire. ● **SEE FIGURE 1–69.** Whenever oily cloths are thrown together on the floor or workbench, a chemical reaction can occur, which can ignite the cloth, even without an open flame. This process of ignition without an open flame is called **spontaneous combustion**.

SAFETY TIPS alert students to possible hazards on the job and how to avoid them.

CASE STUDY

Real World Fixes

Present students with actual automotive service scenarios and show how these common (and sometimes uncommon) problems were diagnosed and repaired. Each case study includes the "Three Cs" (Complaint, Cause and Correction)

CASE STUDY present students with actual automotive scenarios and show how these common (and sometimes uncommon) problems were diagnosed and repaired.

FREQUENTLY ASKED QUESTION

What Is an "SST?"

Vehicle manufacturers often specify a **special service tool (SST)** to properly disassemble and assemble components, such as transmissions and other components. These tools are also called special tools and are available from the vehicle manufacturer or their tool supplier, such as Kent-Moore and Miller tools.

FREQUENTLY ASKED QUESTIONS are based on the author's own experience and provide answers to many of the most common questions asked by students and beginning service technicians.

NOTE: Most of these "locking nuts" are grouped together and are commonly referred to as *prevailing torque nuts.* This means that the nut holds its tightness or torque and does not loosen with movement or vibration.

NOTES provide students with additional technical information to give them a greater understanding of a specific task or procedure.

CAUTION: Never use hardware store (nongraded) bolts, studs, or nuts on any vehicle steering, suspension, or brake component. Always use the exact size and grade of hardware that is specified and used by the vehicle manufacturer.

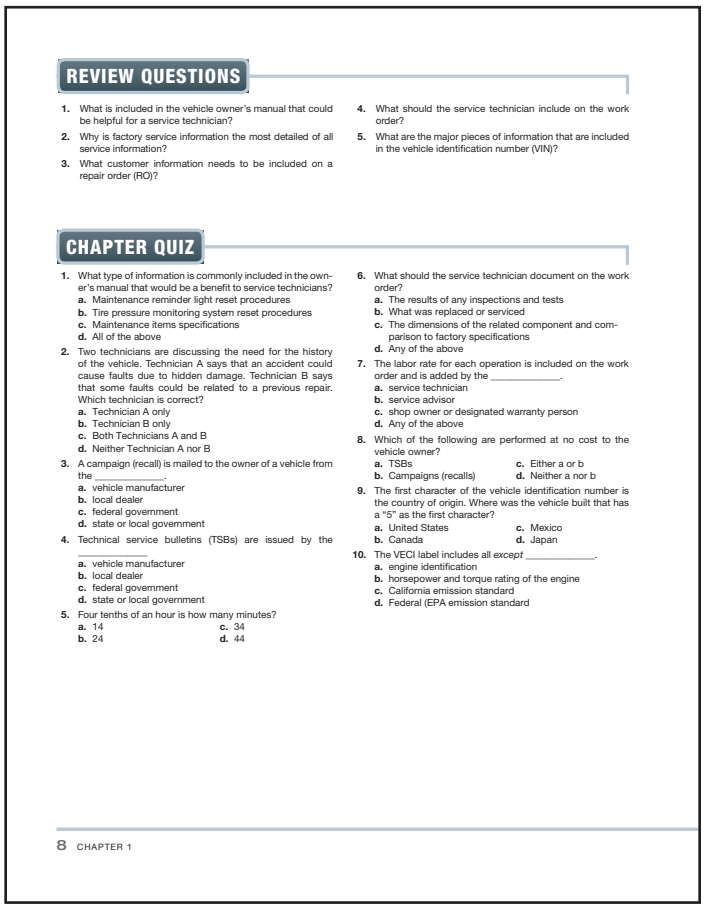
CAUTIONS alert students about potential damage to the vehicle that can occur during a specific task or service procedure.

WARNING

Do not use incandescent trouble lights around gasoline or other flammable liquids. The liquids can cause the bulb to break and the hot filament can ignite the flammable liquid, which can cause personal injury, or even death.

WARNINGS alert students to potential dangers to themselves during a specific task or service procedure.

STEP-BY-STEP photo sequences show in detail the steps involved in performing a specific task or service procedure.



REVIEW QUESTIONS

1. What is included in the vehicle owner's manual that could be helpful for a service technician?
2. Why is factory service information the most detailed of all service information?
3. What customer information needs to be included on a repair order (RO)?
4. What should the service technician include on the work order?
5. What are the major pieces of information that are included in the vehicle identification number (VIN)?

CHAPTER QUIZ

1. What type of information is commonly included in the owner's manual that would be a benefit to service technicians?
   a. Maintenance reminder light reset procedures
   b. Tire pressure monitoring system reset procedures
   c. Maintenance items specifications
   d. All of the above
2. Two technicians are discussing the need for the history of the vehicle. Technician A says that an accident could cause faults due to hidden damage. Technician B says that some faults could be related to a previous repair. Which technician is correct?
   a. Technician A only
   b. Technician B only
   c. Both Technicians A and B
   d. Neither Technician A nor B
3. A campaign (recall) is mailed to the owner of a vehicle from the _____.
   a. vehicle manufacturer
   b. local dealer
   c. federal government
   d. state or local government
4. Technical service bulletins (TSBs) are issued by the _____.
   a. vehicle manufacturer
   b. local dealer
   c. federal government
   d. state or local government
5. Four tenths of an hour is how many minutes?
   a. 14
   b. 24
   c. 34
   d. 44
6. What should the service technician document on the work order?
   a. The results of any inspections and tests
   b. What was replaced or serviced
   c. The dimensions of the related component and comparison to factory specifications
   d. Any of the above
7. The labor rate for each operation is included on the work order and is added by the _____.
   a. service technician
   b. service advisor
   c. shop owner or designated warranty person
   d. Any of the above
8. Which of the following are performed at no cost to the vehicle owner?
   a. TSBs
   b. Campaigns (recalls)
   c. Either a or b
   d. Neither a nor b
9. 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
10. The VECI label includes all *except* _____.
    a. engine identification
    b. horsepower and torque rating of the engine
    c. California emission standard
    d. Federal (EPA emission standard

8 CHAPTER 1

THE REVIEW QUESTIONS AND CHAPTER QUIZ at the end of each chapter help students review the material presented in the chapter and test themselves to see how much they've learned.

SUPPLEMENTS

RESOURCES IN PRINT AND ONLINE

Automotive Technology

NAME OF SUPPLEMENT	PRINT	ONLINE	AUDIENCE	DESCRIPTION
Instructor Resource Manual 0135758602		✔	Instructors	NEW! The Ultimate teaching aid: Chapter summaries, key terms, chapter learning objectives, and lecture resources.
TestGen 0135758696		✔	Instructors	Test generation software and test bank for the text.
PowerPoint Presentation 0135758955		✔	Instructors	Slides include a lecture outline of the text to help instructors with in class instruction.
Image Bank 0135758556		✔	Instructors	All of the images from the textbook to create customized slides.
ASE Task Sheets—for instructors 0135758777		✔	Instructors	Downloadable ASE task sheets for easy customization.
ASE Task Sheets—for Students 0135764343	✔		Students	Student's can purchase a study activity manual that correlates ASE Automobile Standards to chapters and page numbers in the text.
VitalSource eBook 0135257492		✔	Students	An alternative to purchasing the print textbook, students can save up to 50% off the suggested list price of the print text. Visit **www.vitalsource.com**

All online resources can be downloaded from the Instructor's Resource Center: **www.pearsonhighered.com** *Search for your specific title there and select the Resources.*

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—James D. Halderman

ABOUT THE AUTHOR

JIM HALDERMAN brings a world of experience, knowledge, and talent to his work. His automotive service experience includes working as a flat-rate technician, a business owner, and a professor of Automotive Technology.

He has a Bachelor of Science Degree from Ohio Northern University and a Master's Degree from Miami University in Oxford, Ohio. Jim also holds a U.S. Patent for an electronic transmission control device. He is an ASE-certified Master Automotive Technician (A1-A9), plus G1, L1, and L3.

Jim is the author of 18 Automotive textbooks; all published by Pearson Education. Jim has presented numerous technical seminars to national audiences, including the California Automotive Teachers (CAT) and the Illinois College Automotive Instructor Association (ICAIA). He is also a member and presenter at the North American Council of Automotive Teachers (NACAT). Jim was also named Regional Teacher of the Year by General Motors Corporation and a member of the advisory board for Technological Studies department at Ohio Northern University. Jim and his wife, Michelle, live in Dayton, Ohio. You can reach Jim at:

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chapter 1

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5. Maintenance schedule for all fluids, including coolant, brake fluid, automatic transmission fluid, and differential fluid
6. How to program the remote control, as well as the power windows and door locks
7. How to reset the tire pressure monitoring system (TPMS) after a tire rotation. ● **SEE FIGURE 1–1.**

FIGURE 1–1 The owner's manual has a lot of information pertaining to the operation, as well as the maintenance and resetting procedures, that technicians often need.

SERVICE INFORMATION

PURPOSE OF SERVICE INFORMATION **Service information** is needed to correctly service or repair vehicles because it contains all of the specifications, as well as the specified procedures to follow when servicing or repairing a vehicle.

FACTORY SERVICE INFORMATION Until the 1990s, most service information was found in paper manuals called *service manuals* or *shop manuals*. More recently, the manufacturer provides this information in a digital format. The most comprehensive and accurate service information is the service information from the vehicle manufacturer. This information is available for most, if not all, vehicles and can be purchased from their website. For the exact location for purchasing factory service information, visit National Automotive Service Task Force (NASTF) website for the websites for all vehicle manufacturers' service information and cost: www.NASTF.org.

AFTERMARKET SERVICE INFORMATION While factory service manuals cover just one year and one or more models of the same vehicle, most aftermarket service manuals cover multiple years and/or models in one manual. Originally, aftermarket service information was available in only paper manuals. Paper service manuals had the following disadvantages:

1. Required a lot of storage space
2. The pages would become dirty from handling
3. Difficult to use at the vehicle or to make copies from the thick manuals

Paper service manuals were replaced with electronic service information that came on CDs and then DVDs, before becoming available on the Internet. Most electronic service information has technical service bulletins (TSBs), wiring diagrams, and a main menu that includes the major components of the vehicle as a starting point. ALLDATA and Mitchell On-Demand are examples of commonly used subscription services that include service information for many vehicles. ● **SEE FIGURE 1–2.**

TECH TIP

Print It Out

It is often a benefit to have the written instructions or schematics (wiring diagrams) at the vehicle while diagnosing or performing a repair. The advantage of electronic service information is that the material can be printed out and taken to the vehicle for easy access. This also allows the service technician to write or draw on the printed copy, which can be a big help when performing tests, such as electrical system measurements. The schematic can be color-coded to show where there should be voltage and where a ground should be detected. These notes can then be used to document the test results on the work order.

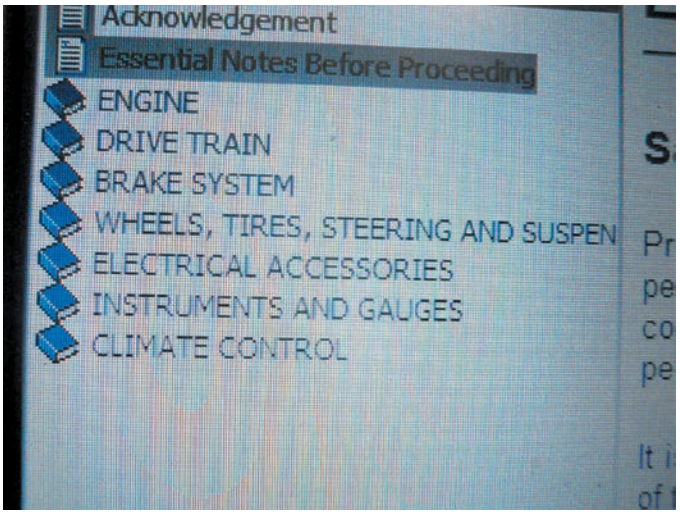

FIGURE 1–2 A main menu showing the major systems of the vehicle. Clicking on one of these major topics opens up another menu showing more detailed information.

TECHNICAL SERVICE BULLETINS

A **technical service bulletin (TSB)** is issued by the vehicle manufacturer to notify service technicians of a potential problem or other critical information. The TSB may include diagnostic procedures and the necessary corrective action. TSBs are not an authorization for repair or a guarantee to correct a concern. TSBs are designed for dealership technicians, but are republished by aftermarket companies and made available along with other service information to shops and vehicle repair facilities.

RECALLS AND CAMPAIGNS

A **campaign** is typically issued when a manufacturer wants to improve a product's performance or increase the customer's satisfaction. If the campaign involves a safety or emissions concern, it is considered a recall. A **recall** can occur when either the manufacturer or the National Highway Traffic Safety Administration (NHTSA) determines there is a concern. A recall or campaign is issued by a vehicle manufacturer and a notice is sent to all owners of record. While these faults may be repaired by independent shops, it is generally handled by a local dealer and treated as a warranty repair. Items that have created recalls in the past have included potential fuel system leakage problems, exhaust leakage, or electrical malfunctions that could cause a possible fire or the engine to stall. Unlike TSBs, whose cost is only covered when the vehicle is within the warranty period, a recall or campaign is always done at no cost to the vehicle owner regardless of the age or mileage on the vehicle. To check if a vehicle is subject to a recall, visit www.nhtsa.gov/recalls.

The site is free and requires that the vehicle identification number (VIN) be entered to get access to the data base.

WORK ORDER

SERVICE ADVISOR DOCUMENTATION The **work order**, also called a **repair order (RO)**, is a legal document that is signed by the vehicle owner or his/her representative. Historically, the RO has been a paper document. However, more recently, many repair facilities have switched to using an electronic RO. The service advisor or the person designated to complete the work order has to include the following information:

- Make, model, and year and other identifying information, such as color and vehicle identification number (VIN)
- Name and address of the owner with contact information, such as the cell phone number and email address
- Date of service and the name of the person who wrote the service invoice
- The miles shown on the odometer
- Estimate amount and list of requested work

All professional service facilities and shops use a form that is designed for their purposes and include all of the required information, as specified by the local area and state. The work order is a legal document because it is basically a contract between the owner of the vehicle and the shop. If the invoice is not paid, a lien can be placed on the vehicle and it will not be released to the owner until the bill is paid. If the bill is not paid, the ownership of the vehicle can be transferred to the shop. Because this document is so important, all work performed on the vehicle should be clearly stated, including any measured values along with the specified values from service information. Also listed on the service invoice (work or repair order) are the parts used and their costs.

SERVICE TECHNICIAN DOCUMENTATION The role of the service technician is to not only perform the services and repairs as requested by the vehicle owner, but also to document the work order so that an accurate record of what was performed and the parts used on the work order. The service technician is usually identified by a technician number and the number is included under each operation that was performed by the shop. For example, there may be more than one technician assigned to one vehicle and the number of the technician who performed each operation is documented. This is commonly used where the oil change is performed by the lube technician, while the electrical diagnosis and repair was performed by another service technician. The technician should document the work order by stating not only what was done, but what service tools were used such as:

1. Verified the customer concern of a rough running engine and the "check engine light" was on by visual inspection.
2. Looked for stored diagnostic trouble codes using a factory scan tool and noted that a P0300 (random misfire detected) was set.
3. Performed a visual inspection of the secondary ignition system components.
4. Found evidence of a coil boot that arced to the cylinder head on cylinders 2 and 3. Recommended the replacement of the coils and boots for cylinders 2 and 3. The technician also stated on the work order that the coils and the boots on the other cylinder may need to be replaced too, because they are all operating under the same operating conditions. ● **SEE FIGURE 1–3.**

PARTS DOCUMENTATION Parts are those items used to repair a vehicle or to restore it to useful service. The part number(s) and the costs are usually documented on the work order by the parts department personnel in larger shops, or the shop owner or service manager in smaller shops. The service technician orders and installs parts. The service technician should provide all of the necessary information as may be required, including the VIN so that the correct part can be ordered or pulled from stock.

LABOR TIME DOCUMENTATION The labor time, called **flat rate**, is found in labor guides, and lists vehicle service procedures and the time it should take an average technician to complete the task. This flat-rate time is the basis for estimates and the pay for the technicians. The flat rate is not determined by the technician in most cases, but is determined by the designated warranty person or the shop owner in small shops. All times are expressed in tenths of an hour with each tenth representing six minutes. ● **SEE CHART 1–1**.

Some TSBs include the time needed to accomplish the task. ● **SEE FIGURE 1–4.**

SERVICE RECORDS

PURPOSE The purpose of service records is to provide a history of the service work that has been performed on the vehicle in the past. Whenever service work is performed, a record of what was done is usually kept on file or stored electronically on a network or online server for a number of years. The wise service technician will check the vehicle service history if working on a vehicle with an unusual problem. Often, a previous repair may indicate the reason for the current problem or it could be related to the same circuit or components.

- **Example #1**—A collision could have caused hidden damage that can affect the operation of the vehicle. Knowing that a collision had been recently repaired may be helpful to the technician. An accident could cause faults due to hidden damage and some faults could be related to a previous repair.
- **Example #2**—If the current issue is an error code for an engine misfire and the history of the service work on the vehicle does not show an oil change for several years, this might help the technician to find the root cause.

Customer's Description of Problem/Repair:

This accurately describes the problem or symptom I am experiencing with my motor vehicle. Customer's Initials _____

HOME TOWN CHEVROLET
100 N. MAIN ST.

8993

NAME: MR CUSTOMER
DATE RECEIVED: 1/25/19
ADDRESS: 444 W. 3rd St.
COMPLETION DATE:
CITY: STATE: ZIP:
MILEAGE IN: 50,340
VIN: 1G2NW51AAFS6201
ENGINE NO.: 1.8 L
MAKE: CHEVY
MILEAGE OUT:
TYPE OR MODEL: Cruze
YEAR: 2015
LICENSE NUMBER: BQU449
PHONE WHEN READY: YES ☐ NO ☐
TERMS:
ORDER ACCEPTED BY:
PHONE:

COST	QUAN.	PART NUMBER / DESCRIPTION	PRICE
	1	Battery Interstate 60 Month Battery	74 00
	1	Oil filter	11 25
	1	Air filter	36 59
	1	Seal Ring	25
	1	Ant Mast	67 97
			190 06
		SUBLET REPAIRS	

	TECH ID # / INIT.	LABOR CHARGE
CHANGE OIL ☐		
CHANGE OIL FILTER CART. ☐		
CHANGE TRANS. OIL ☐		
CHANGE DIFF. OIL ☐		
LUBRICATE ☐		
PACK FRONT WHEEL BRGS. ☐		
X TIRES ☐		
ADJUST BRAKES ☐		
WASH ☐		
SAFETY INSPECTION ☐		

OPER. NO.	INSTRUCTIONS:		LABOR CHARGE
1.0	50 K Service		450 00
.6	Check Battery Replace		22 50
.5	Ant Mast		22 50
.5	Check left front Headlight		22 50

ESTIMATE
(UNDER OHIO LAW) YOU HAVE THE RIGHT TO AN ESTIMATE IF THE EXPECTED COST OF RE-PAIRS OR SEVENTY-FIVE DOLLARS.INITIAL YOUR CHOICE.
WRITTEN ESTIMATE ____ ORAL ESTIMATE ____ I DO NOT REQUEST AN ESTIMATE ____

WARRANTY STATEMENT AND DISCLAIMER: THE DEALER HEREBY DISCLAIMS ALL WARRANTIES EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT ANY LIABILITY IN CONNECTION WITH THE SALE OF SAID PARTS OR THIS REPAIR. THIS DISCLAIMER IN NO WAY AFFECTS THE PROVISIONS OF ANY MANUFACTURER OR OTHER SUPPLIER WARRANTIES. IF DEALER PROVIDES A WRITTEN WARRANTY, ANY IMPLIED WARRANTIES ARE EXPRESSLY LIMITED TO THE TERM OF THE WRITTEN WARRANTY.

ORIGINAL ESTIMATE
$ _____
AUTHORIZED ADDITIONS
$ _____

CUSTOMERS ACCEPTANCE
_____ INITIAL HERE
DATE _____
TIME _____
BY _____

In the event that you, the customer, authorize commencement but do not authorize completion of a repair or service, a charge will be imposed for disassembly, reassembly or partially completed work. Such charge will be directly related to the actual amount of labor or parts involved in the inspection, repair or service.

ALL PARTS ARE NEW UNLESS SPECIFIED OTHERWISE.

This Facility charges _____ % of the Total _____ Charges, up to a Maximum of $ _____ , for Shop Materials.

WE WILL OFFER TO RETURN TO YOU ALL REPLACED PARTS, AS REQUIRED BY LAW, UNLESS THEY ARE TO BE REBUILT, SOLD, OR RETURNED TO THE MANUFACTURER.

I hereby authorize the repair work herein set forth to be done by you, together with the furnishing by you of the necessary parts and other material for such repair, and agree: that you are not responsible for any delays caused by unavailability or delayed availability of parts or material for any reason; that you neither assume nor authorize any other person to assume for you any liability in connection with such repair; that you shall not be responsible for loss of or damage to the above vehicle, or articles left therein, in case of fire, theft or other cause beyond your control; that an express mechanic's lien is hereby acknowledged on the above vehicle to secure the amount of repairs thereto; that your employees may operate the above vehicle on streets, highways or elsewhere for the purpose of testing and/or inspecting such vehicle.
I HEREBY ACKNOWLEDGE RECEIPT OF A COPY HEREOF.
X _____

		SALE
TOTAL LABOR		517 50
TOTAL PARTS		190 06
GAS, OIL & GREASE		18 75
SUBLET REPAIRS		
TAX	6.5%	47 21
TOTAL		773 52

TO ORDER: www.reysource.com; 1-800-344-0996; fax 1-800-531-9055 Reynolds and Reynolds FORM OHIO-134 (1/05)

FIGURE 1–3 A typical work order showing the customer concern and what was done to correct the issue. Electronic work orders include all of the same required information. This included a stored diagnostic trouble code and what was found to be wrong and what was done to complete the repair.

TENTHS OF AN HOUR	NUMBER OF MINUTES
0.1	6 minutes
0.2	12 minutes
0.3	18 minutes
0.4	24 minutes
0.5	30 minutes
0.6	36 minutes
0.7	42 minutes
0.8	48 minutes
0.9	54 minutes
1.0	60 minutes

CHART 1–1

The time that is published for repair and service operations are expressed in tenths of an hour.

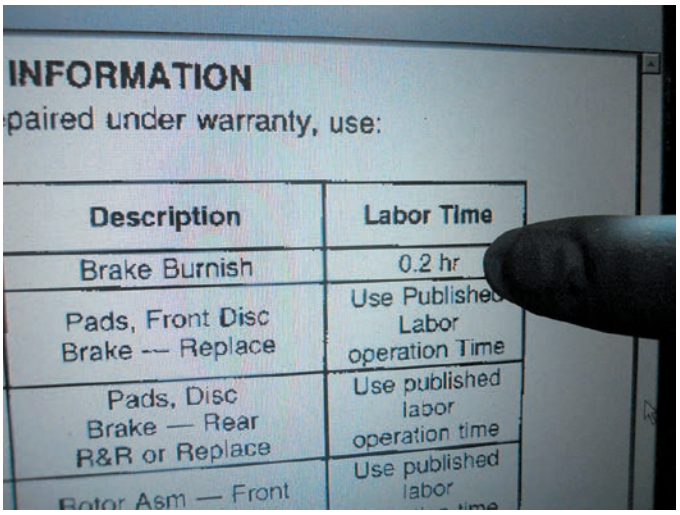

FIGURE 1–4 Some technical service bulletins also include the designated flat-rate time when specifying a repair procedure.

ADDITIONAL INFORMATION

FROM THE CUSTOMER The service advisor or shop owner records the following information from the customer and about the vehicle:

1. Record the vehicle identification number (VIN) of the vehicle on the work order
2. Record the make, model, year, and mileage on the work order
3. Record what the customer's complaint (concern) is so that the service technician can verify the complaint and make the proper repair
4. Review the customer's vehicle history file and identify additional required service

CHECK THE VEHICLE BEFORE WORK IS STARTED As part of the work order writing process, the service advisor should look over the vehicle and make a written note of any vehicle damage that may already exist. If any damage is noted, it should be mentioned to the customer and noted on the work order. Often the customer is not aware of any damage, especially on the passenger side, and thus would blame the shop for the damage after the service work was performed.

SPECIAL SERVICE TOOLS (SSTs) Automotive dealerships have tool rooms that are supposed to have all the SSTs that are recommended by the factory. These tool rooms are for the use of the dealership technicians so that they have access to the tools needed to work on the vehicle being serviced. The tools are often sorted by content area and are identified by a tool number. SSTs are made primarily by a small group of manufacturers. They make the following SSTs:

- Miller Special Tools (Chrysler)
- Rotunda Tools (Ford, Mazda, Jaguar, Land Rover)
- Kent-Moore Tools (Detroit Diesel, General Motors, Hyundai, Lexus, Mitsubishi, Nissan, Saab, Subaru, Volvo, Kia, Toyota, Isuzu). ● **SEE FIGURE 1–5.**

Other Manufacturers of SSTs include:

- Sir Tools
- Assenmacher
- Baum Tools

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.

FIGURE 1–5 The special tool number is printed or stamped on the tool for easy identification. The Kent-Moore part number J-44217 indicates a tool used to hold a timing chain.

FRONT AND REAR The proper term for the back portion of any vehicle is rear (e.g., 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 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., Traverse

Year: e.g., 2018

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 1–6.**

Since 1981, all vehicle manufacturers have used a VIN that is 17 characters long. ● **SEE FIGURE 1–7.** Although every vehicle manufacturer assigns various letters or numbers within these 17 characters, there are some constants, including:

- The first number or letter designates the **country of origin.** ● **SEE CHART 1–2.**
- The model of the vehicle is commonly the fourth and/or fifth character.
- The eighth character is often the engine code. (Some engines cannot be determined by the VIN.)
- The tenth character represents the model year (MY) on all vehicles. ● **SEE CHART 1–3.**

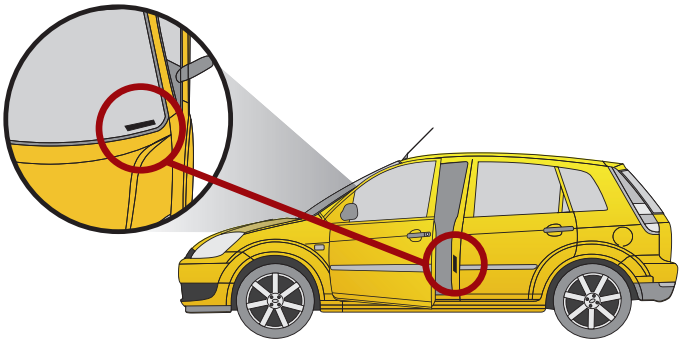

FIGURE 1–6 The vehicle identification number (VIN) is visible through the base of the windshield and on a decal inside the driver's door.

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

CHART 1–2

The first number or letter designates the country of origin.

A = 1980/2010	L = 1990/2020	Y = 2000/2030
B = 1981/2011	M = 1991/2021	1 = 2001/2031
C = 1982/2012	N = 1992/2022	2 = 2002/2032
D = 1983/2013	P = 1993/2023	3 = 2003/2033
E = 1984/2014	R = 1994/2024	4 = 2004/2034
F = 1985/2015	S = 1995/2025	5 = 2005/2035
G = 1986/2016	T = 1996/2026	6 = 2006/2036
H = 1987/2017	V = 1997/2027	7 = 2007/2037
J = 1988/2018	W = 1998/2028	8 = 2008/2038
K = 1989/2019	X = 1999/2029	9 = 2009/2039

CHART 1–3

VIN year chart. (The pattern repeats every 30 years.)

TECH TIP

Use a VIN Decoder

Perform a search for "VIN decoder" and many will be found, including the free one posted on the National Highway Traffic Safety Administration website (www.nhtsa.gov). A VIN decoder is useful to find what equipment and accessories the vehicle has.

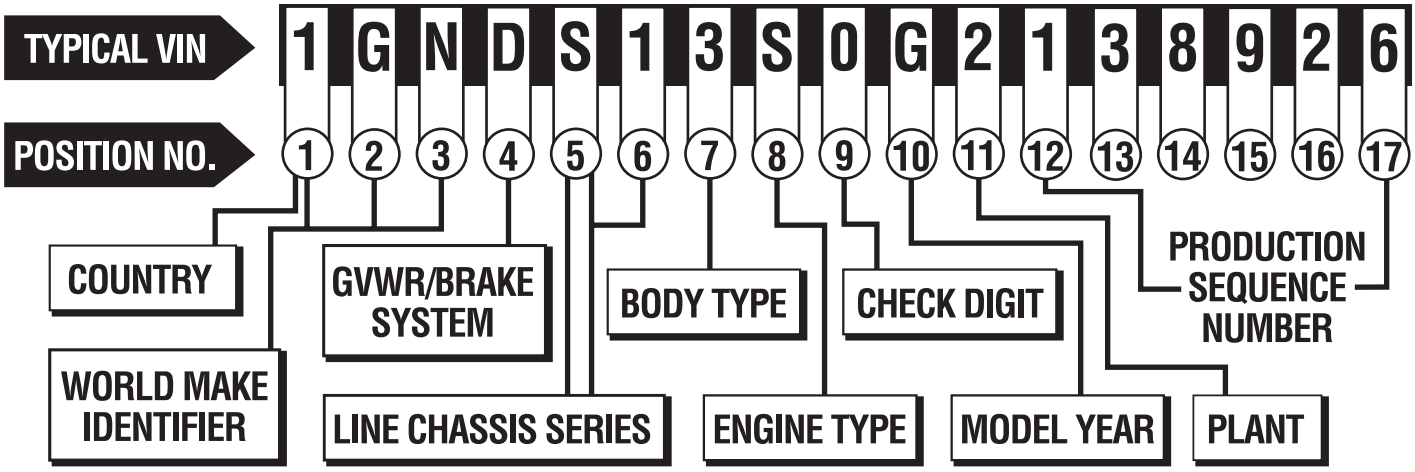

FIGURE 1-7 A typical VIN showing the information that is represented.