

AUTOMOTIVE ELECTRICITY AND ELECTRONICS



AUTOMOTIVE ELECTRICITY AND ELECTRONICS

SIXTH EDITION

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PREFACE

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

1. The number of chapters has been increased from 28 to 30 making it easier to select the exact content to study or teach.
2. The content in each chapter has been updated and expanded with over 40 new full color photos and line drawings to make the subject come alive.
3. The beginning chapters are more concisely organized making learning electrical systems easier. For example, the first chapter has been expanded and then divided into two shorter chapters:
 - **Chapter 1**—Service Information, Work Orders, and Vehicle Identification
 - **Chapter 2**—Tools and Safety
4. All of the electrical accessory circuits have been expanded so that it meets all of the latest ASE tasks and then divided into three chapters including:
 - **Chapter 26**—Security and Anti-Theft Systems
 - **Chapter 28**—Body Electrical Accessories
 - **Chapter 29**—Advanced Driver Assist Systems
5. New Case Studies included in this edition covering the “three Cs” (Complaint, Cause, and Correction).
6. New OSHA hazardous chemical labeling requirements added to Chapter 3 (Environmental and Hazardous Materials).
7. Static electricity and lightning information added to Chapter 4 (Electrical Fundamentals)
8. New content on three-legged and low-profile fuses, plus smart junction boxes, added to Chapter 11 (Automotive Wiring and Wire Repair).
9. Enhanced lead-acid batteries (ELA) information added to Chapter 18 (Batteries).

10. New content on float-type battery charges and memory saver tool that uses a 12-volt battery to connect to the power (terminal 16) and ground (terminals 4 and 5) of the DLC added to chapter 19 (Battery Testing and Service).
11. Stop-start and push-button start system added to Chapter 20 (Cranking Systems).
12. Cloudy headlight restoration information added to Chapter 24 (Lighting and Signaling Circuits).
13. Dash warning symbols (122 of them) added to Chapter 25 (Driver Information and Navigation Systems).
14. Airbag inflator sequences of inflation added to Chapter 27 (Airbags and Pretensioners).

ASE CORRELATED ASE-certified programs need to demonstrate that they use course material that covers ASE tasks. All *Professional Technician* textbooks have been correlated to the appropriate ASE task lists.

A COMPLETE INSTRUCTOR AND STUDENT SUPPLEMENTS PACKAGE All *Professional Technician* textbooks are accompanied by a full set of instructor and student supplements. Please see page xvi for a detailed list of supplements.

A FOCUS ON DIAGNOSIS AND PROBLEM SOLVING The Professional Technician Series has been developed to satisfy the need for a greater emphasis on problem diagnosis. Automotive instructors and service managers agree that students and beginning technicians need more training in diagnostic procedures and skill development. To meet this need and demonstrate how real-world problems are solved, the Case Study features are included throughout and highlight how real-life problems are diagnosed and repaired.

The following pages highlight the unique core features that set the Professional Technician Series 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.

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 schedules 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 and NATEF tasks.



TECH TIP

It Just Takes a Second

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 will be used in its original location when the component or part is put back on the vehicle.

TECH TIPS 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

Lightning Damage

A radio failed to work in a vehicle that was outside during a thunderstorm. The technician checked the fuses and verified that power was reaching the radio. Both the radio and the antenna were replaced to correct the problem. ● SEE FIGURE 28-26.

Summary:

- **Complaint**—Customer stated that the radio did not work.
- **Cause**—Visual inspection showed an antenna that had been stuck by lightning.
- **Correction**—Replacing the radio and the antenna restored proper operation.

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



FREQUENTLY ASKED QUESTION

How Many Types of Screw Heads Are Used in Automotive Applications?

There are many, including Torx, hex (also called Allen), plus many others used in custom vans and motor homes. ● SEE FIGURE 1–9.

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: Claw hammer has a claw used to remove nails; therefore, it is not for automotive service.

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

CAUTION: Do not use a screwdriver as a pry tool or chisel. Screwdrivers use hardened steel only at the tip and are not designed to be pounded on or used for prying because they could bend easily. Always use the proper tool for each application.

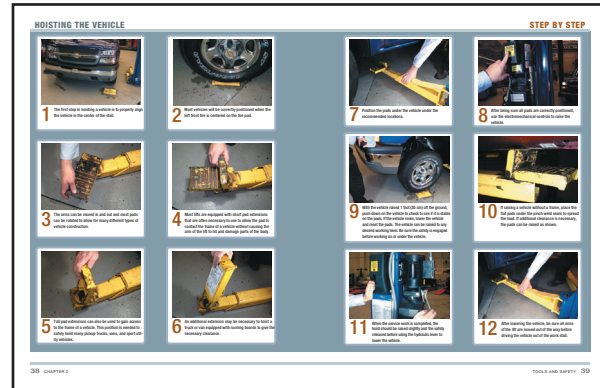
CAUTIONS alert students about potential damage to the vehicle that can occur during a specific task or service procedure.



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 about 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.

SUMMARY

1. Bolts, studs, and nuts are commonly used as fasteners in the chassis. The sizes for fractional and metric threads are different and are not interchangeable. The grade is the rating of the strength of a fastener.
2. Whenever a vehicle is raised above the ground, it must be supported at a substantial section of the body or frame.
3. Wrenches are available in open end, box end, and combination open and box end.
4. An adjustable wrench should only be used where the proper size is not available.
5. Line wrenches are also called flare-nut wrenches, fitting wrenches, or tube-nut wrenches and are used to remove fuel or refrigerant lines.
6. Sockets are rotated by a ratchet or breaker bar, also called a flex handle.
7. Torque wrenches measure the amount of torque applied to a fastener.
8. Screwdriver types include straight blade (flat tip) and Phillips.
9. Hammers and mallets come in a variety of sizes and weights.
10. Pliers are a useful tool and are available in many different types, including slip-joint, multigroove, linesman's, diagonal, needle-nose, and locking pliers.
11. Other common hand tools include snap-ring pliers, files, cutters, punches, chisels, and hacksaws.
12. Hybrid electric vehicles should be de-powered if any of the high-voltage components are going to be serviced.

REVIEW QUESTIONS

1. Why are wrenches offset 15 degrees?
2. What are the other names for a line wrench?
3. What are the standard automotive drive sizes for sockets?
4. Which type of screwdriver requires the use of a hammer or mallet?
5. What is inside a dead-blow hammer?

CHAPTER QUIZ

1. The correct location for the pads when hoisting or jacking the vehicle can often be found in the _____.
 - a. service manual
 - b. shop manual
 - c. owner's manual
 - d. all of the above
2. For the best working position, the work should be _____.
 - a. at neck or head level
 - b. at knee or ankle level
 - c. overhead by about 1 foot
 - d. at chest or elbow level
3. A high-strength bolt is identified by _____.
 - a. a UNC symbol
 - b. lines on the head
 - c. strength letter codes
 - d. the coarse threads
4. A fastener that uses threads on both ends is called a _____.
 - a. cap screw
 - b. stud
 - c. machine screw
 - d. crest fastener
5. Wrenches are made from _____.
 - a. cast from nickel steel
 - b. forged alloy steel
 - c. machined from billet steel
 - d. cast from chrome steel
6. The proper term for Channel Locks is _____.
 - a. Vise Grips
 - b. crescent wrench
 - c. locking pliers
 - d. multigroove adjustable pliers
7. The proper term for Vise Grips is _____.
 - a. locking pliers
 - b. slip-joint pliers
 - c. side cuts
 - d. multigroove adjustable pliers

THE SUMMARY, 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 Electricity and Electronics				
NAME OF SUPPLEMENT	PRINT	ONLINE	AUDIENCE	DESCRIPTION
Instructor Resource Manual 0135764394		✓	Instructors	NEW! The Ultimate teaching aid: Chapter summaries, key terms, chapter learning objectives, lecture resources, discuss/demonstrate classroom activities, and answers to the in-text review and quiz questions.
TestGen 0135764580		✓	Instructors	Test generation software and test bank for the text.
PowerPoint Presentation 0135764475		✓	Instructors	Slides include chapter learning objectives, lecture outline of the text, and graphics from the book.
Image Bank 0135764467		✓	Instructors	All of the images and graphs from the textbook to create customized lecture slides.
ASE Correlated Task Sheets—for Instructors 0135764602		✓	Instructors	Downloadable ASE task sheets for easy customization and development of unique task sheets.
ASE Correlated Task Sheets—for Students 0135764564	✓		Students	Study activity manual that correlates ASE Automobile Standards to chapters and pages numbers in the text. Available to students at a discounted price when packaged with the text.
VitalSource eText 0134074890		✓	Students	An alternative to purchasing the print textbook, students can subscribe to the same content online and 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/irc

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