



FOURTH EDITION

AUTOMOTIVE ELECTRICITY AND ELECTRONICS

JAMES D. HALDERMAN

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James D. Halderman

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PREFACE

PROFESSIONAL TECHNICIAN SERIES Part of Pearson Automotive's Professional Technician Series, the fourth edition of *Automotive Electricity and Electronics* represents the future of automotive textbooks. The series is a full-color, media-integrated solution for today's students and instructors. The series includes textbooks that cover all 8 areas of ASE certification, plus additional titles covering common courses.

The series is also peer reviewed for technical accuracy.

UPDATES TO THE FOURTH EDITION

- Over 40 new full-color photos and line drawings to make the subject come alive.
- Additional explanations about electrical circuits to make learning this important topic easier to understand. (Chapter 4)
- New content covering GMLAN low-speed bus. (Chapter 16)
- Added content on BCM-controlled turn signals (Chapter 23).
- Unlike other textbooks, this book is written so that the theory, construction, diagnosis, and service of a particular component or system is presented in one location. There is no need to search through the entire book for other references to the same topic.

NATEF CORRELATED NATEF-certified programs need to demonstrate that they use course material that covers NATEF tasks. All *Professional Technician* textbooks have been correlated to the appropriate NATEF task lists. These correlations can be found in two locations:

- As an appendix to each book.
- At the beginning of each chapter in the *Instructor's Manual*.

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 vi 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, "Real World Fix" 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, TOOLS, AND SAFETY

LEARNING OBJECTIVES

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

1. Locate and interpret vehicle and part identification numbers and labels.
2. Locate vehicle service information from a variety of sources.
3. Identify the strength and grades of various threaded fasteners.
4. Identify the various kinds of hand tools and their uses.
5. Identify the various kinds of automotive tools and their uses.
6. Describe personal protective equipment and safety precautions to be used when working on automobiles.

This chapter will help you understand the ASE content knowledge for vehicle identification and the proper use of tools and shop equipment.

KEY TERMS

Adjustable wrench 9	Nuts 8
Bench grinders 25	Open-end wrench 9
Bolts 5	PPE 25
Breaker bar 11	Pinch weld seam 29
Bump cap 25	Pitch 5
Calibration codes 3	Pliers 15
Campaign 4	Punches 18
Casting number 3	Ratchet 11
Cheater bar 13	Recall 4
Chisels 18	Screwdrivers 13
Drive sizes 11	Snips 18
Extensions 11	Socket 10
Eye wash station 34	Socket adapter 13
Files 17	Spontaneous combustion 27
Fire blanket 33	SST 22
Fire extinguisher classes 33	Stud 5
GAWR 3	Tensile strength 6
Grade 6	Trouble light 22
GVWR 3	TSB 4
Hacksaw 19	UNC 5
Hammer 14	UNF 5
Hybrid electric vehicles (HEVs) 35	Universal joint 11
Light-emitting diode (LED) 23	VECI 3
Metric bolts 6	VIN 2
	Washers 8
	Wrenches 9

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.



REAL WORLD FIX

The Electric Mirror Fault Story

Often, a customer will notice just one fault even though other lights or systems may not be working correctly. For example, a customer noticed that the electric mirrors stopped working. The service technician checked all electrical components in the vehicle and discovered that the interior lights were also not working.

The interior lights were not mentioned by the customer as being a problem most likely because the driver only used the vehicle in daylight hours.

REAL WORLD FIXES present students with actual automotive scenarios and shows 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 to potential dangers to themselves during 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), Phillips, and Torx.
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, multi-groove, 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. List three precautions that must be taken whenever hoisting (lifting) a vehicle.
2. Describe how to determine the grade of a fastener, including how the markings differ between fractional and metric bolts.
3. List four items that are personal protective equipment (PPE).
4. List the types of fire extinguishers and their usage.
5. Why are wrenches offset 15 degrees?
6. What are the other names for a line wrench?
7. What are the standard automotive drive sizes for sockets?
8. Which type of screwdriver requires the use of a hammer or mallet?
9. What is inside a dead-blow hammer?
10. What type of cutter is available in left and right cutters?

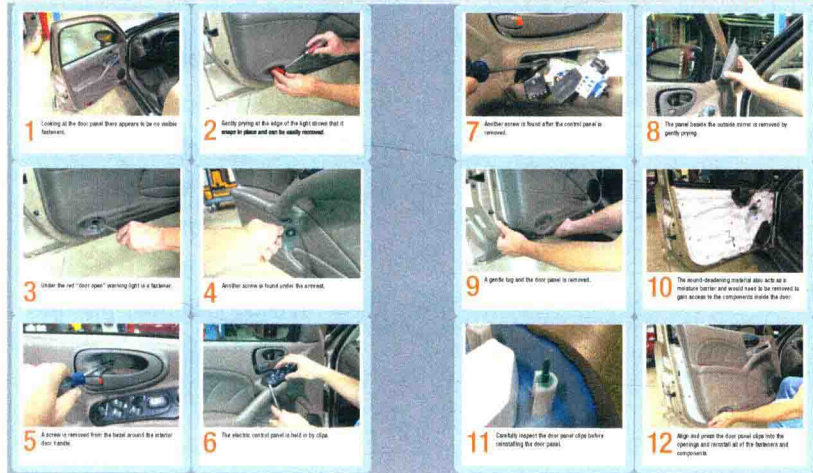
CHAPTER QUIZ

1. The correct location for the pads when hoisting or jacking the vehicle can often be found in the _____.
a. Service manual c. Owner's manual
b. Shop manual d. All of the above
2. For the best working position, the work should be _____.
a. At neck or head level
b. Overhead by about 1 foot
c. At knee or ankle level
d. At chest or elbow level
3. A high-strength bolt is identified by _____.
a. A UNC symbol c. Strength letter codes
b. Lines on the head d. The coarse threads
4. A fastener that uses threads on both ends is called a _____.
a. Cap screw c. Machine screw
b. Stud d. Crest fastener
5. When working with hand tools, always _____.
a. Push the wrench—don't pull it toward you
b. Pull a wrench—don't push it away from you
6. The proper term for Charnal Locks is _____.
a. Vise-Grip b. Crescent wrench
c. Locking pliers d. Multi-groove adjustable pliers
7. The proper term for Vise-Grip is _____.
a. Locking pliers c. Side cutters
b. Slip-joint pliers d. Multi-groove adjustable pliers
8. Two technicians are discussing torque wrenches. Technician A says that a torque wrench is capable of tightening a fastener with more torque than a conventional breaker bar or ratchet. Technician B says that a torque wrench should be calibrated regularly for the most accurate results. Which technician is correct?
a. Technician A only
b. Technician B only
c. Both Technicians A and B
d. Neither Technician A nor B
9. What type of screwdriver should be used if there is very limited space above the head of the fastener?
a. Offset screwdriver c. Impact screwdriver
b. Standard screwdriver d. Robertson screwdriver
10. What type of hammer is plastic coated, has a metal casing inside, and is filled with small lead balls?
a. Dead-blow hammer
b. Soft-blow hammer
c. Sledge hammer
d. Plastic hammer

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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.

DOOR PANEL REMOVAL



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

SUPPLEMENTS

RESOURCES IN PRINT AND ONLINE

Automotive Electricity and Electronics

NAME OF SUPPLEMENT	PRINT	ONLINE	AUDIENCE	DESCRIPTION
Instructor Resource Manual 0133143686		✓	Instructors	NEW! The Ultimate teaching aid: Chapter summaries, key terms, chapter learning objectives, lecture resources, discuss/demonstrate classroom activities, MyAutomotiveLab correlation, and answers to the in text review and quiz questions.
TestGen 0133053091		✓	Instructors	Test generation software and test bank for the text.
PowerPoint Presentation 0133053113		✓	Instructors	Slides include chapter learning objectives, lecture outline of the test, and graphics from the book.
Image Bank 0133053121		✓	Instructors	All of the images and graphs from the textbook to create customized lecture slides.
Instructors Resource CD-ROM 0133143694	✓			Take your instructor resources with you! This convenient CD houses the text PowerPoint presentation, Image Bank, instructors manual, and TestGen.
NATEF Correlated Task Sheets – for instructors		✓	Instructors	Downloadable NATEF task sheets for easy customization and development of unique task sheets.
NATEF Task Sheets – For Students 013305313X	✓		Students	Study activity manual that correlates NATEF Automobile Standards to chapters and pages numbers in the text. Available to students at a discounted price when packaged with the text.
CourseSmart eText 0133053105		✓	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.coursesmart.com

All online resources can be downloaded from the Instructor's Resource Center: www.pearsonhighered.com/irc

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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 at a leading U.S. community college for more than 20 years.

He has a Bachelor of Science Degree from Ohio Northern University and a Masters Degree in Education 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 and Advanced Engine Performance (L1) ASE certified.

Jim is the author of many automotive textbooks all published by Prentice Hall.

He has presented numerous technical seminars to national audiences including the California Automotive Teachers (CAT) and the Illinois College Automotive Instructor Association (ICAlA). 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 an outstanding alumnus of Ohio Northern University.

Jim and his wife, Michelle, live in Dayton, Ohio. They have two children. You can reach Jim at

jim@jameshalderman.com

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