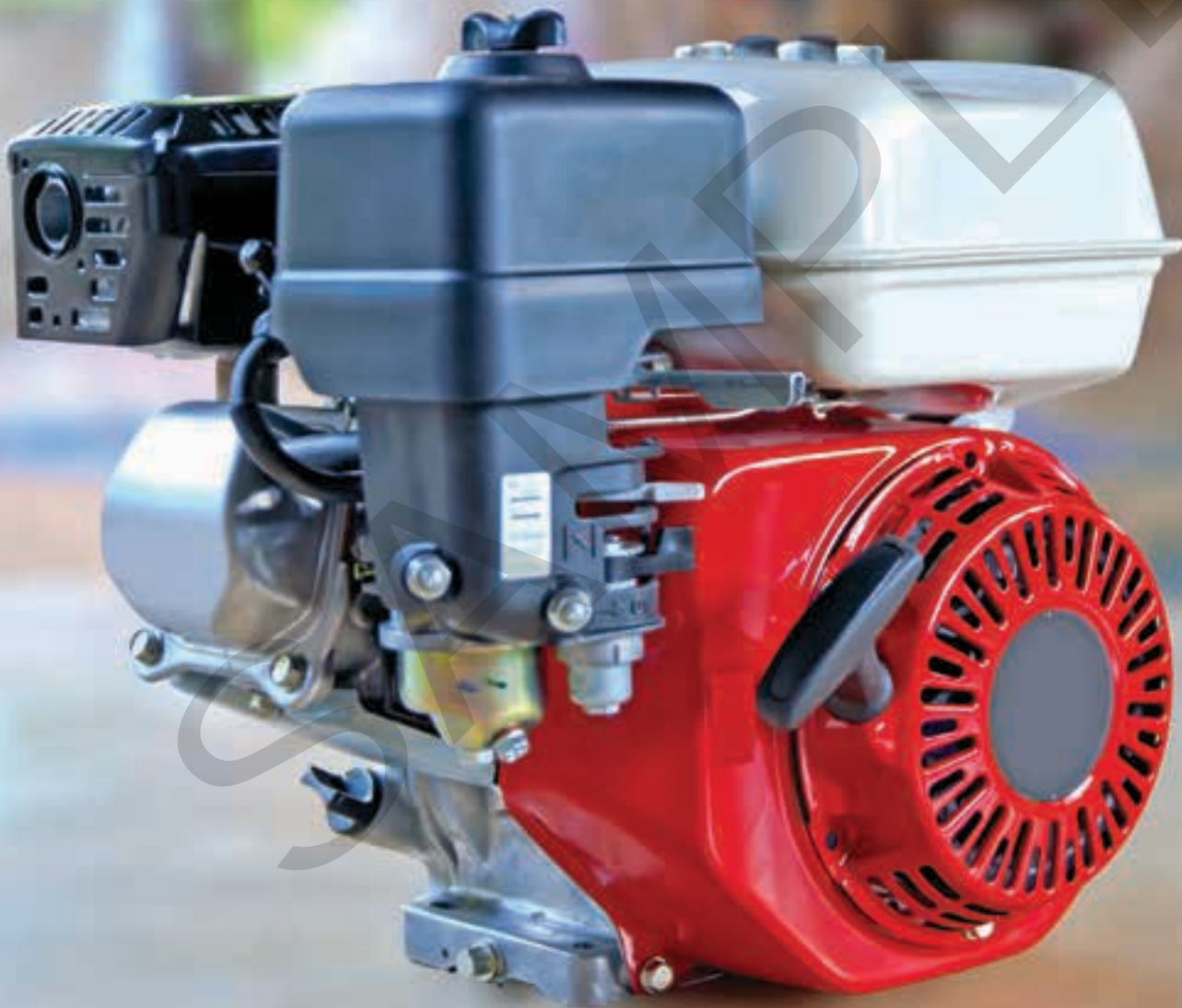


# Small Gas Engines

12TH EDITION

Fundamentals • Service • Troubleshooting • Repair • Applications



**Alfred C. Roth • Blake J. Fisher • W. Scott Gauthier**

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# Preface

*Small Gas Engines* is an easy-to-understand, up-to-date textbook detailing the operation, diagnosis, service, and repair of small gasoline engines. It has been designed to help prepare aspiring technicians for exciting and productive careers in the small engine and outdoor power equipment service industry. It also provides the information needed to prepare for Equipment & Engine Training Council (EETC) certification tests.

The information provided in the book is applicable to a wide range of small engines, including overhead valve, overhead cam, and L-head designs from different manufacturers. Variations in basic engine design and the techniques needed to diagnose and service diverse engine types are clearly explained.

Because small engine technology continues to evolve, the new edition of *Small Gas Engines* has been carefully reviewed and revised to include recent technologies, like electronic fuel injection. At the same time, we realize that small engines tend to stay in service for an extended period. We carefully evaluated older technologies in the book, and eliminated those that have slipped into complete obsolescence while keeping those that a technician is likely to encounter occasionally on the job.

The 2023 edition of *Small Gas Engines* contains information to help you pass the EETC certification tests. It also contains information on the employment and workplace skills needed to succeed as a small engine technician.

*Small Gas Engines* has been painstakingly designed to provide a student-focused approach to learning. Short sentences, concise definitions, and hundreds of color illustrations will help you learn quickly and easily. Information is presented using a building-block approach that starts with simple principles and general rules, and progresses gradually to more complex subjects.

As society transitions from printed textbooks to digital learning tools, we know it is important to provide the content you need in the format you need. The *Small Gas Engines* textbook and the accompanying workbook are available in both print and digital formats, and are supported with professionally developed, user-friendly online resources. These resources include electronic study tools and interactive activities designed to prepare you for success in your studies and career.

We congratulate you on your study of small engine technology and encourage you to take advantage of all the resources available as part of the *Small Gas Engines* learning solution.

## About the Authors

Alfred Roth taught for more than 30 years at the college level and was a member of the Equipment & Engine Training Council (EETC) Certification Test Committee. He was also an inventor and holds six patents.

Blake Fisher is a technical editor and writer with over 20 years of experience. His areas of expertise include small engines, automotive technology, and welding.

W. Scott Gauthier has more than 30 years of experience as a technical editor and writer. In addition to this textbook, he is a coauthor of the Goodheart-Willcox *Automotive Encyclopedia* and has written several educational supplements.

# Reviewers

The authors and publisher wish to thank the following industry and teaching professionals for their valuable input into the development of *Small Gas Engines*.

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# New to This Edition

The 12th edition of *Small Gas Engines* received content updates to help ensure its relevancy. Illustrations have been enhanced by adding color gradients, increasing their educational value. End-of-chapter review questions have been revised to include multiple levels of Bloom's Taxonomy. Additional changes include:

- Added information on dry sump systems and hybrid four-stroke engines to Chapter 11.
- Updated oil classification information in Chapter 11.
- End of chapter assessments now include a section of auto-gradable Know and Understand questions.
- Added Critical Thinking questions in each chapter.

SAMPLE

## Precision Exams by YouScience Certification

Goodheart-Willcox is pleased to partner with YouScience to correlate *Small Gas Engines* with their Small Engine Repair certification standards. Students who pass the exam and performance portion of the exam can earn a Career Skills certification. Precision Exams by YouScience and Career Skills Exams were created in partnership with industry and subject matter experts to align real-world job skills with marketplace demands. Students can showcase their skills and knowledge with industry-recognized certifications—and build outstanding resumes to stand out from the crowd!

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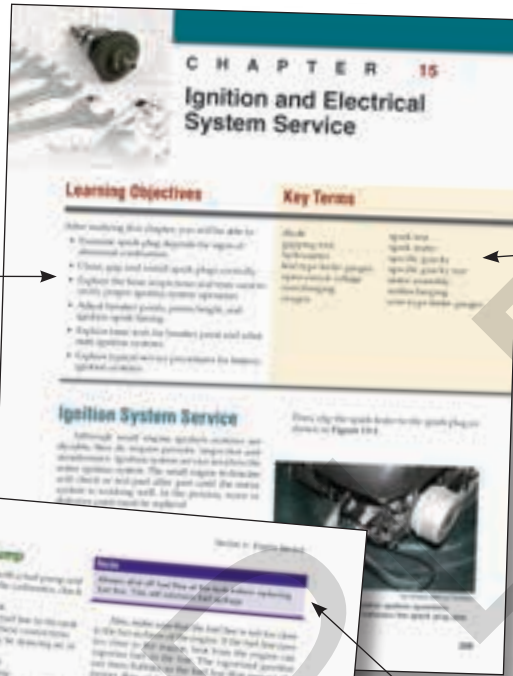
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# Guided Tour

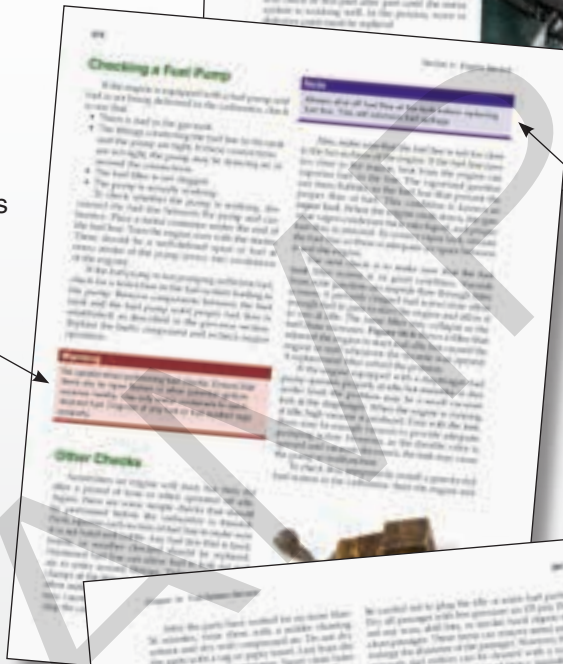
The instructional design includes student-focused learning tools to help students succeed. This visual guide highlights the features designed for the textbook.

**Learning Objectives** clearly identify the knowledge and skills to be obtained when the chapter is completed.



**Key Terms** list the key terms to be learned in the chapter.

**Warnings** identify hazards that may result in personal injury if the proper procedures and safety measures are not followed. If a warning is not understood, always consult a supervisor or instructor.



**Notes** offer guidance for service procedures or present more detailed information about small gas engine systems or applications.

**Cautions** identify hazards that may result in temporary or permanent damage of equipment or tools if the proper procedures and safety measures are not followed. If a caution is not understood, always consult a supervisor or instructor.



**Green Tech** features highlight key practices related to sustainability, energy efficiency, and environmental issues.



**Illustrations** have been designed to clearly and simply communicate the specific topic. Many illustrations have been updated for this edition. Photographic images have been reviewed and updated as needed to ensure their continued appropriateness and relevancy.



**Summary** feature provides an additional review tool for you and reinforces key learning objectives.



**Suggested Activities** extend your learning and help you apply knowledge.

**Review Questions** allow you to demonstrate knowledge, identification, and comprehension of chapter material.

**Know and Understand** questions enable you to demonstrate knowledge, identification, and comprehension of chapter material.

**Analyze and Apply** questions extend learning and develop your abilities to use learned material in new situations and to break down material into its component parts.

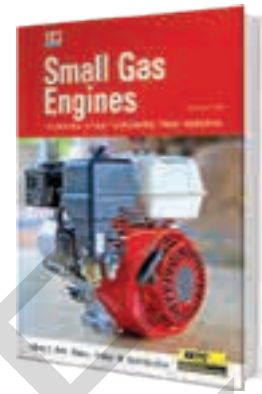
**Critical Thinking** questions develop higher-order thinking and problem-solving, and personal and workplace skills.

# TOOLS FOR STUDENT AND INSTRUCTOR SUCCESS

## Student Tools

### Student Text

*Small Gas Engines* covers all areas of engine theory and service. The book includes extensive information on L-head, overhead valve, and overhead cam engine designs. The theory sections of the book give the reader a sound understanding of the science involved in four-stroke and two-stroke internal combustion cycles in easy-to-understand language. They also provide the reader with clear explanations of the role of basic engine components, and the benefits and operation of various engine designs. The troubleshooting and engine service information in the book is generalized rather than manufacturer-specific so that it can be applied to a wide range of engine designs from different manufacturers. The book contains all of the service procedures needed to completely rebuild a small, single-cylinder gas engine.



### Lab Workbook

The lab workbook that accompanies *Small Gas Engines* is designed to help students recall, review, and apply concepts introduced in the book. Questions that correspond to each textbook chapter reinforce key concepts. Hands-on jobs in the lab workbook allow students to practice what they learn from the textbook and in the classroom.

### Online Learning Suite

The Online Learning Suite provides the foundation of instruction and learning for digital and blended classrooms. An easy-to-manage shared classroom subscription makes it a hassle-free solution for both students and instructors. An online student text and lab workbook, along with rich supplemental content, brings digital learning to the classroom. All instructional materials are found on a convenient online bookshelf and accessible at home, at school, or on the go.



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## Online Instructor Resources (OIR)

Online Instructor Resources provide all the support needed to make preparation and classroom instruction easier than ever. Available in one accessible location, the OIR includes Instructor Resources, Instructor's Presentations for PowerPoint®, and Assessment Software with Question Banks. The OIR is available as a subscription and can be accessed at school, at home, or on the go.

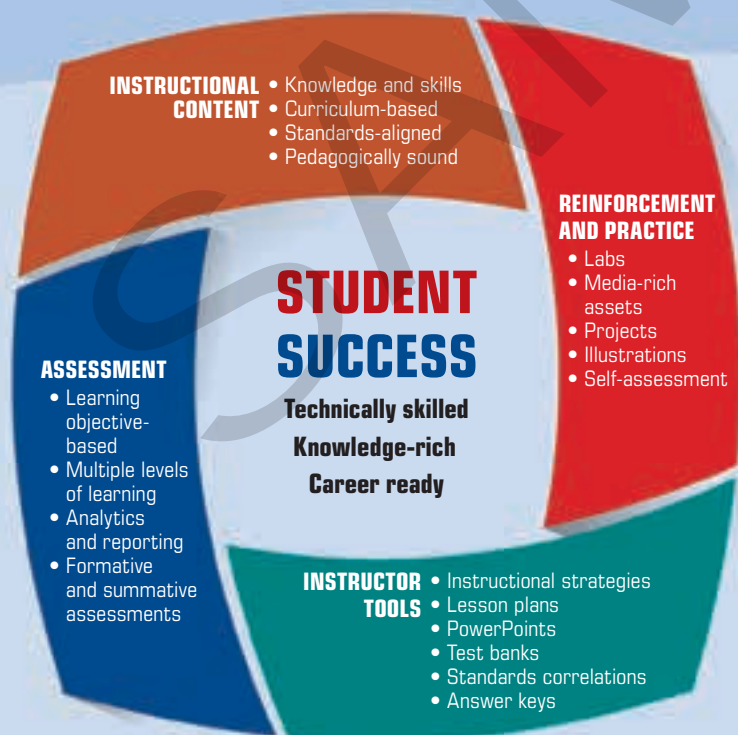
**Instructor Resources** One resource provides instructors with time-saving preparation tools such as answer keys, editable lesson plans, and other teaching aids.

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# Brief Contents

## Section 1—Shop Equipment, Supplies, and Safety

1	Safety in the Small Gas Engine Shop . . . . .	3
2	Tools and Measuring Instruments . . . . .	15
3	Fasteners, Sealants, and Gaskets . . . . .	47
4	Fundamentals of Electricity, Magnetism, and Electronics. . . . .	69

## Section 2—Basics of Engine Operation

5	Principles of Engine Operation, Two- and Four-Stroke Engines . . . . .	93
6	Engine Components. . . . .	107
7	Measuring Engine Performance. . . . .	131

## Section 3—Engine Systems

8	Fuel Supply, Air Induction, and Emissions . . . . .	151
9	Carburetion and Fuel Injection . . . . .	171
10	Ignition Systems . . . . .	201
11	Lubrication Systems. . . . .	219
12	Cooling Systems. . . . .	235

## Section 4—Engine Service

13	Preventive Maintenance and Troubleshooting . . . . .	247
14	Fuel System Service. . . . .	271
15	Ignition and Electrical System Service . . . . .	295
16	Engine Disassembly and Inspection. . . . .	317
17	Cylinder, Crankshaft, and Piston Service . . . . .	335
18	Camshaft and Valve Train Service . . . . .	349
19	Engine Reassembly and Break-In . . . . .	367

## Section 5—Applications

20	Lawn and Brush Equipment . . . . .	383
21	Lawn and Garden Tractors . . . . .	413
22	Snow Throwers. . . . .	449
23	Personal Watercraft . . . . .	469
24	Career Opportunities and Certification. . . . .	491

# Contents

## SECTION 1

### Shop Equipment, Supplies, and Safety

#### CHAPTER 1

#### Safety in the Small Gas Engine Shop. . . . . 3

#### Shop Safety. . . . . 3

Proper Housekeeping . . . . .	3
Hazardous Materials . . . . .	4
Personal Protective Gear . . . . .	5
Proper Ventilation . . . . .	6
Hand Tool Safety . . . . .	6
Power Tool Safety . . . . .	7
Compressed Air Safety . . . . .	7
Lift Properly . . . . .	7
Electrical Safety . . . . .	7
Engine Operating Safety . . . . .	8

#### Be Prepared for Emergencies . . . . . 8

#### Hazardous Wastes . . . . . 9

Disposing of Shop Wastes . . . . .	9
------------------------------------	---

#### OSHA . . . . . 11

Safety Data Sheets . . . . .	11
------------------------------	----

#### CHAPTER 2

#### Tools and Measuring Instruments . . . . . 15

#### Introduction. . . . . 15

#### Hand Tools. . . . . 15

Wrenches . . . . .	16
Pliers . . . . .	18
Screwdrivers . . . . .	19
Hammers . . . . .	19
Punches . . . . .	20
Seal Drivers . . . . .	21
Cutting and Forming Tools . . . . .	21
Probe and Pickup Tools . . . . .	24

#### Vises . . . . . 24

#### Engine Tools . . . . . 25

Gear and Flywheel Pullers . . . . .	25
Flywheel Holders . . . . .	25
Ridge Reamers . . . . .	25
Ring Spreaders . . . . .	26
Ring Compressors . . . . .	26
Glaze Breakers and Cylinder Hones . . . . .	27
Valve Spring Compressors . . . . .	27
Lapping Sticks . . . . .	28
Engine Test Instruments . . . . .	28

#### Power Tools . . . . . 29

Drills and Drill Presses . . . . .	29
Bench Grinders . . . . .	29

#### Cleaning Tools and Equipment . . . . . 30

#### Measuring Instruments . . . . . 30

Micrometers . . . . .	30
Micrometer Depth Gauges . . . . .	34
Vernier Calipers . . . . .	34
Digital Slide Caliper . . . . .	37
Dial Caliper . . . . .	38
Telescoping Gauges . . . . .	38
Small Hole Gauge . . . . .	39
Thickness Gauges . . . . .	40
Combination Square . . . . .	41
Dial Indicator . . . . .	41
Screw Pitch Gauge . . . . .	42

#### CHAPTER 3

#### Fasteners, Sealants, and Gaskets. . . . . 47

#### Threaded Fasteners . . . . . 47

Bolts . . . . .	48
Nuts . . . . .	49
Bolt and Nut Terminology . . . . .	50
Thread Designations . . . . .	52
Screws . . . . .	53
Tightening and Loosening Threaded Fasteners . . . . .	54
Removing Stubborn Fasteners . . . . .	55
Removing Broken Fasteners . . . . .	56
Chasing Threads . . . . .	56

<b>Internal Thread Repair</b> .....	<b>57</b>
Tapping New Threads .....	57
Threading with a Die .....	58
<b>Washers</b> .....	<b>58</b>
<b>Pins</b> .....	<b>59</b>
Cotter Pins .....	59
Clevis Pins .....	59
Dowel Pins .....	59
Straight Pins .....	59
Grooved Pins .....	59
Taper Pins .....	59
Rolled Pins .....	60
<b>Retaining Rings</b> .....	<b>60</b>
<b>Keys</b> .....	<b>60</b>
<b>Adhesives and Sealants</b> .....	<b>61</b>
Thread Locking Compound .....	61
Sealants .....	62
Antiseize Compounds .....	62
<b>Gaskets</b> .....	<b>62</b>
<b>CHAPTER 4</b>	
<b>Fundamentals of Electricity, Magnetism, and Electronics</b> ..	<b>69</b>
<b>Introduction</b> .....	<b>69</b>
Atoms and Electricity .....	70
Direct Current and Alternating Current ..	71
Electrical Units of Measurement .....	71
Ohm's Law .....	71
<b>Types of Electrical Circuits</b> .....	<b>72</b>
Series Circuit .....	72
Parallel Circuit .....	73
Series-Parallel Circuit .....	73
<b>Magnetism</b> .....	<b>74</b>
Magnetic Fields .....	74
Theory of Permanent Magnets .....	74
Magnetic Attraction and Repulsion .....	75
Magnetism and Electricity .....	76
<b>Electrical Components</b> .....	<b>76</b>
<b>Electrical Wire and Connectors</b> .....	<b>77</b>
Switches .....	78
Solenoids .....	78
Relays .....	78

Transformers .....	79
Circuit Protection Devices .....	81
<b>Electronics</b> .....	<b>82</b>
Semiconductor Diodes .....	82
Transistors .....	83
Silicon Controlled Rectifiers .....	84
<b>Electrical Test Equipment</b> .....	<b>85</b>
Jumper Wires .....	85
Test Lights .....	85
Meters .....	86

## SECTION 2

# Basics of Engine Operation

## CHAPTER 5

### Principles of Engine Operation, Two- and Four-Stroke Engines ..... 93

#### Principles of Engine Operation ..... 93

    Gasoline Must Be Atomized ..... 93

    Combustion Force Must Be Contained .. 93

#### Constructing an Elementary Engine ..... 96

#### Simple Engine in Operation ..... 96

#### Two- and Four-Stroke Engines ..... 97

#### Four-Stroke Engine ..... 97

    Intake Stroke .....
 97 |

Compression Stroke .....
 98 |

Power Stroke .....
 98 |

Exhaust Stroke .....
 99 |

Valve Timing .....
 99 |

Lubrication .....
 100 |

#### Two-Stroke Engine ..... 100

Principles of Two-Stroke Operation ... 101

Scavenge Loss .....
 102 |

Stratified Scavenge Engine .....
 102 |

#### Four-Stroke Engine vs. Two-Stroke Engine ..... 103

xiv

**CHAPTER 6**

**Engine Components . . . . . 107**

**Engine Components. . . . . 107**

**Engine Block. . . . . 107**

**Crankshaft. . . . . 108**

Crankshaft Main Bearings . . . . . 109

Crankcase Seals . . . . . 109

**Pistons. . . . . 110**

Piston Construction . . . . . 110

Piston Thrust Surfaces. . . . . 112

Piston Head Size . . . . . 112

Piston Head Shape . . . . . 112

**Piston Rings . . . . . 113**

Piston Ring Types . . . . . 113

Piston Ring Construction . . . . . 115

Ring Tension . . . . . 115

Ring Movement . . . . . 116

**Piston Pins . . . . . 117**

**Connecting Rods and Bearings . . . 117**

Friction-Type Rod Bearings . . . . . 118

Antifriction Bearings. . . . . 119

**Intake and Exhaust Ports. . . . . 120**

Two-Stroke Engine Ports . . . . . 120

Four-Stroke Engine Ports and Poppet

Valves . . . . . 120

**Camshafts and Gears. . . . . 120**

**Valve Lifter or Tappet . . . . . 121**

**Valve Train Configurations. . . . . 123**

**Starter Assembly . . . . . 123**

Automatic Compression Release. . . . . 123

**Flywheel . . . . . 126**

**CHAPTER 7**

**Measuring Engine Performance. . . . . 131**

**Basic Terminology . . . . . 131**

Engine Bore and Stroke. . . . . 131

**Science of Engine Performance . . . 132**

Energy . . . . . 132

Force . . . . . 132

Pressure. . . . . 133

Work. . . . . 134

Power . . . . . 135

Torque . . . . . 136

**Measurements of Engine**

**Performance . . . . . 138**

Engine Displacement. . . . . 138

Compression Ratio. . . . . 139

Engine Horsepower . . . . . 139

Engine Torque . . . . . 143

Torque and Horsepower. . . . . 144

Volumetric Efficiency . . . . . 144

Practical Efficiency . . . . . 145

Mechanical Efficiency. . . . . 146

Thermal Efficiency . . . . . 146

---

**SECTION 3**

**Engine Systems**

**CHAPTER 8**

**Fuel Supply, Air Induction, and Emissions. . . . . 151**

**Engine Fuels . . . . . 151**

Gasoline. . . . . 151

Liquefied Petroleum Gas and

Natural Gas . . . . . 153

Kerosene and Diesel Fuels . . . . . 153

**Fuel Systems. . . . . 154**

Fuel Tanks . . . . . 154

Fuel Lines and Fittings. . . . . 155

Fuel Filters . . . . . 155

Fuel Pumps . . . . . 156

Vapor Return Fuel Systems . . . . . 158

**Air Induction Systems . . . . . 158**

Air Cleaners and Air Filters . . . . . 158

**Crankcase Breathers . . . . . 162**

**Mufflers . . . . . 163**

**Emissions . . . . . 164**

Emission Control Regulations . . . . . 165

**CHAPTER 9**

**Carburetion and Fuel Injection . . . . . 171**

**Principles of Carburetion . . . . . 171**

Air-Fuel Mixture . . . . . 172

Carburetor Pressure Differences . . . . . 172

**Types of Carburetors . . . . . 174**

Float-Type Carburetors . . . . . 175

Diaphragm-Type Carburetors . . . . . 180

Vacuum Carburetors . . . . . 183

**Primers . . . . . 184**

**Anti-Afterfire Solenoids . . . . . 184**

**Manual Throttle Controls . . . . . 185**

**Governor Throttle Controls . . . . . 186**

What an Engine Governor Does . . . . . 186

Types of Governors . . . . . 187

Governor Features . . . . . 190

**Introduction to Electronic Fuel Injection (EFI) . . . . . 191**

Open-Loop and Closed-Loop EFI Systems . . . . . 192

Advantages of EFI . . . . . 192

**EFI System Components . . . . . 193**

Fuel Pump and Fuel Pressure Regulator . . . . . 194

Fuel Injector . . . . . 194

Throttle Body . . . . . 194

Engine Control Unit (ECU) . . . . . 195

Sensors . . . . . 195

Idle Air Control Valve . . . . . 196

**CHAPTER 10**

**Ignition Systems . . . . . 201**

**Basic Ignition System Operation . . 201**

**Ignition System Components . . . . . 202**

Ignition Coil . . . . . 203

Spark Plugs . . . . . 203

Spark Plug Wire . . . . . 204

Switching Devices . . . . . 204

**Magneto Ignition Systems . . . . . 206**

Operation of Capacitive Discharge Ignition (CDI) System . . . . . 207

Operation of Transistor-Controlled Ignition (TCI) System . . . . . 208

Operation of the Mechanical Breaker Point Ignition (MBI) System . . . . . 211

Magneto Ignition Systems for Two-Cylinder Engines . . . . . 213

**Battery Ignition Systems . . . . . 213**

Ignition Coil . . . . . 214

Lead-Acid Battery . . . . . 215

The Discharging/Charging Cycle . . . . . 216

**CHAPTER 11**

**Lubrication Systems . . . . . 219**

**Principles of Lubrication . . . . . 219**

Friction . . . . . 219

**Qualities of Lubricating Oil . . . . . 220**

Permits Easy Starting . . . . . 220

Lubricates and Prevents Wear . . . . . 220

Protects Against Rust and Corrosion . . . . . 221

Keeps Engine Parts Clean . . . . . 221

Cools Engine Parts . . . . . 222

Seals Combustion Pressures . . . . . 222

Prevents Foaming . . . . . 222

Aids Fuel Economy . . . . . 222

**Oil Specifications . . . . . 222**

SAE Viscosity Grade . . . . . 222

API Engine Oil Service Classification . . . . . 223

**Selecting the Proper Engine Oil . . . 224**

**Engine Lubrication Systems . . . . . 225**

Two-Cycle Engine Lubrication . . . . . 225

Four-Cycle Engine Lubrication . . . . . 226

Oil Filter Systems . . . . . 230

Low-Oil Warning and Shutdown Systems (LOS) . . . . . 231



**CHAPTER 12**

**Cooling Systems . . . . . 235**

Principles of Engine Cooling . . . . . 235

Air Cooling . . . . . 236

Liquid Cooling . . . . . 237

Pressurized Cooling Systems . . . . . 237

Outboard Engine Cooling Systems . . . 239

---

**SECTION 4**

**Engine Service**

**CHAPTER 13**

**Preventive Maintenance  
and Troubleshooting . . . . . 247**

Preventive Maintenance . . . . . 247

Engine Cleaning . . . . . 247

Checking Oil Level and Condition . . . . 248

Changing Oil . . . . . 249

Lubricating Cables and Linkage . . . . . 250

Spark Plug Service . . . . . 251

Air Cleaner Service . . . . . 252

Crankcase Breather Service . . . . . 254

Muffler Service . . . . . 254

Battery Service . . . . . 255

Pressurized Liquid Cooling System  
Service . . . . . 256

Maintaining Outboard Cooling  
Systems . . . . . 257

Storing an Engine . . . . . 257

**Systematic Troubleshooting . . . . . 258**

Check the Easiest Things First . . . . . 259

Verify the Fundamental Operating  
Requirements . . . . . 259

Checking RPM . . . . . 259

Testing Compression . . . . . 260

Testing Differential Pressure . . . . . 261

**Service Information . . . . . 262**

Engine Identification . . . . . 265

**CHAPTER 14**

**Fuel System Service . . . . . 271**

Troubleshooting the Fuel System . . 271

Hard Starts . . . . . 271

Checking Air-Fuel Mixture . . . . . 272

Checking Gravity-Fed Fuel Supply . . . . 273

Checking a Fuel Pump . . . . . 274

Other Checks . . . . . 274

**Carburetor Adjustments . . . . . 275**

High Speed and Idle Mixture  
Adjustment . . . . . 275

Anti-Afterfire Solenoid Check . . . . . 276

**Carburetor Overhaul . . . . . 276**

Carburetor Removal . . . . . 277

Carburetor Disassembly . . . . . 278

Diaphragm Carburetor Disassembly . . 280

Cleaning the Carburetor . . . . . 280

Inspecting Float Carburetor Parts . . . . 282

Assembling Float-Type Carburetors . . . 282

Inspecting Diaphragm Carburetor  
Parts . . . . . 285

Assembling a Diaphragm Carburetor . . 285

**Engine Governor Service . . . . . 286**

Resetting a Centrifugal Governor  
System . . . . . 287

Governor Adjustment . . . . . 287

**Fuel Injection Diagnosis . . . . . 288**

**CHAPTER 15**

**Ignition and Electrical  
System Service . . . . . 295**

**Ignition System Service . . . . . 295**

Performing a Spark Test . . . . . 295

Spark Plugs . . . . . 296

Magneto System Service . . . . . 299

Servicing Battery Ignition Systems . . . 300

**Electrical System Service . . . . . 301**

Batteries . . . . . 301

Wiring . . . . . 306

Ammeters . . . . . 306

Switches and Solenoids . . . . .	306
Checking the Charging and Starting System Circuits . . . . .	306

**CHAPTER 16**

**Engine Disassembly and Inspection . . . . . 317**

**Introduction . . . . . 317**

**Engine Inspection . . . . . 318**

Engine Removal . . . . .	319
--------------------------	-----

**Engine Disassembly . . . . . 320**

Removal of Exterior Engine Components . . . . .	320
Organizing the Job . . . . .	322
Disassembling the Engine's Mechanical Systems . . . . .	323
Removing the Valve Assemblies on an L-Head Engine . . . . .	331
Removing the Valve Assemblies on an Overhead Valve Engine . . . . .	332

**CHAPTER 17**

**Cylinder, Crankshaft, and Piston Service . . . . . 335**

**Cylinder Reconditioning . . . . . 335**

Cylinder Inspection . . . . .	335
Cylinder Measurement . . . . .	336
Reboring the Cylinder . . . . .	337
Honing the Cylinder . . . . .	338

**Crankshaft and Main Bearing Service . . . . . 339**

Inspecting the Crankshaft . . . . .	340
Inspecting the Main Bearings . . . . .	341

**Piston Assembly Service . . . . . 342**

Checking Piston Clearance . . . . .	343
Ring Side Clearance . . . . .	344
Removing Piston Pins . . . . .	344
Measuring Piston Pins and Bosses . . . . .	345
Inspecting Connecting Rods . . . . .	345

**CHAPTER 18**

**Camshaft and Valve Train Service . . . . . 349**

**Introduction . . . . . 349**

**Camshaft Service . . . . . 349**

**Valve Service . . . . . 351**

Inspecting Valves and Seats . . . . .	351
Inspecting Valve Springs . . . . .	351
Valve Guides . . . . .	351
Refacing Valves . . . . .	354
Valve Lifter Service . . . . .	355
Valve Seat Service . . . . .	355
Lapping Valves . . . . .	360
Adjusting Valve Lifter-to-Stem Clearance . . . . .	362
Servicing Overhead Valves, Seats, and Guides . . . . .	363

**CHAPTER 19**

**Engine Reassembly and Break-In . . . . . 367**

**Introduction . . . . . 367**

**Reinstalling Internal Engine Components . . . . . 367**

Installing Valves (L-Head Engine) . . . . .	368
Installing the Crankshaft, Camshaft, and Governor Gear . . . . .	368
Installing the Piston and Rod Assembly . . . . .	369
Installing Overhead Valves . . . . .	374
Installing the Cylinder Head . . . . .	375
Installing the Crankcase Breather and Valve Cover . . . . .	376
Adjusting Crankshaft Endplay and Installing the Crankcase Cover . . . . .	377

**Reinstalling External Engine Components . . . . . 377**

**Engine Break-In . . . . . 378**

## SECTION 5

# Applications

### CHAPTER 20

## Lawn and Brush

### Equipment ..... 383

### Working Safely ..... 383

### Lawn Mowers ..... 385

Rotary and Reel Mowers .....	385
Push-Type and Self-Propelled Mowers .....	385
Optional Features.....	386
Engine Starting .....	387
Minor Checks.....	390
General Maintenance.....	390

### Chain Saws ..... 392

Chain Saw Designs .....	392
Safety Features .....	392
Rules for Safe Operation .....	394
Chain Saw Maintenance .....	395

### String Trimmers and Brushcutters .. 398

Design Features.....	398
Operator Safety .....	400
Starting and Safe Operation .....	401
String Trimmer and Brushcutter Maintenance .....	403

### Edger/Trimmers ..... 406

Edger/Trimmer Features .....	407
Safety Features and Adjustments .....	407
Rules for Safe Operation .....	408
Edger/Trimmer Maintenance .....	409
Edger/Trimmer Storage .....	410

### CHAPTER 21

## Lawn and Garden Tractors .. 413

### Tractor Safety ..... 413

Protect Children .....	414
Protective Clothing .....	414
Operating a Tractor Safely .....	414
Transporting a Tractor .....	415

### Tractor Uses ..... 415

Mowing and Mulching .....	415
Leaf Collecting .....	417
Plowing, Throwing, and Blowing Snow ..	417
Preparing Soil for Planting .....	419
Hauling a Trailer .....	419
Rotary Broom Sweeping .....	419

### Engine Components..... 420

### Chassis and Steering..... 420

### Transmissions ..... 422

Variable-Speed Transmission.....	424
Hydrostatic Transmissions .....	425

### Electrical Safety Systems ..... 430

Safety Interlocks.....	430
Electric Start Systems .....	433
Testing Procedure for Operator Presence System (Safety Seat).....	436

### Circuits for Study ..... 437

### General Maintenance ..... 437

Engine Lubrication.....	437
Optional Oil Accessories .....	444
Air Filter .....	444
Mufflers .....	444
Engine Cleaning.....	444
Radiator Cleaning .....	444
Battery Maintenance .....	445
Sharpening and Balancing Mower Blades .....	445
Fueling and Refueling .....	446
Storing a Tractor.....	446
Removing a Tractor from Storage.....	446

### CHAPTER 22

## Snow Throwers ..... 449

### Operating Safely..... 449

### Machine Types and Features..... 450

Small Snow Throwers .....	450
Midsize Snow Throwers .....	451
Heavy-Duty Snow Throwers.....	452
Engine Controls .....	453
Operator Presence Controls.....	453

Electric Start Systems . . . . .	454
Drive Systems . . . . .	455
Skid Shoes . . . . .	458
<b>Snow Thrower Operation . . . . .</b>	<b>460</b>
Engine Starting . . . . .	460
Snow Throwing . . . . .	461
<b>General Maintenance . . . . .</b>	<b>461</b>
Preventing Freeze-Up . . . . .	461
Servicing Augers . . . . .	461
Lubrication . . . . .	461
<b>Off-Season Storage . . . . .</b>	<b>463</b>
Starting after Storage . . . . .	463

**CHAPTER 23**

**Personal Watercraft . . . . . 469**

**Introduction . . . . . 469**

Identification Numbers and Placards . . . . .	470
--	-----

**Types of PWC . . . . . 470**

**PWC Main Components and  
Parts . . . . . 471**

**PWC Engines . . . . . 474**

PWC Engine Cooling Systems . . . . .	474
Jet Pump Propulsion System . . . . .	475
New Engine Break-In . . . . .	477

**General Maintenance . . . . . 478**

Fuel Filter . . . . .	478
Fuel Filter Screens . . . . .	478
Fuel Vent Check Valve . . . . .	478
Sediment Bowl . . . . .	478
Carburetors . . . . .	479
Cooling System Service . . . . .	480
Jet Pump Water Inlet Screen . . . . .	482
External Lubrication Points . . . . .	483

**Transporting PWC . . . . . 483**

Towing PWC to Shore . . . . .	484
-------------------------------	-----

**PWC Storage . . . . . 485**

**CHAPTER 24**

**Career Opportunities and  
Certification . . . . . 491**

**Career Opportunities in the Small**

**Gas Engine Field . . . . . 491**

Engine Service Technician . . . . .	491
Service Manager . . . . .	492
Sales Manager . . . . .	492
General Manager . . . . .	492
Manufacturer's Technician . . . . .	492
Service Representative . . . . .	493
Engineer . . . . .	493
Executive . . . . .	493
Entrepreneur . . . . .	493
Teacher . . . . .	494

**Considering Career Options . . . . . 494**

Examining Career Interests . . . . .	494
Determining Aptitudes and Abilities . . . . .	494
Considering Earning Levels . . . . .	494
Investigating Education and Training . . . . .	495
Learning about Job Duties and Responsibilities . . . . .	495
Considering Your Personal Traits . . . . .	495
Thinking about Lifestyle . . . . .	495
Researching Employment Outlook . . . . .	496

**Sources of Career Information . . . . . 496**

Internet Sites . . . . .	496
Networking . . . . .	496

**Applying for a Position . . . . . 496**

Your Résumé . . . . .	496
Letter of Application . . . . .	498
Job Application Forms . . . . .	498
The Job Interview . . . . .	499
Evaluating Job Offers . . . . .	500

**Succeeding in the Workplace . . . . . 500**

Maintain a Professional Appearance . . . . .	500
Work Habits . . . . .	500
Time Management . . . . .	501

Professional Behavior . . . . .	501	What Is on a Certification Test? . . . . .	504
Decision Making and Problem Solving . .	501	Who Can Take the Test? . . . . .	504
Communication Skills. . . . .	501	<b>Appendix A. . . . .</b>	<b>507</b>
Customer Relations Skills . . . . .	501	<b>Appendix B. . . . .</b>	<b>519</b>
Ethical Workplace Behavior . . . . .	502	<b>Glossary . . . . .</b>	<b>522</b>
Interpersonal Skills. . . . .	502	<b>Index . . . . .</b>	<b>546</b>
Belonging to Organizations . . . . .	503		
Lifelong Learning . . . . .	503		
<b>Certification. . . . .</b>	<b>503</b>		
Why Get Certified? . . . . .	503		

SAMPLE