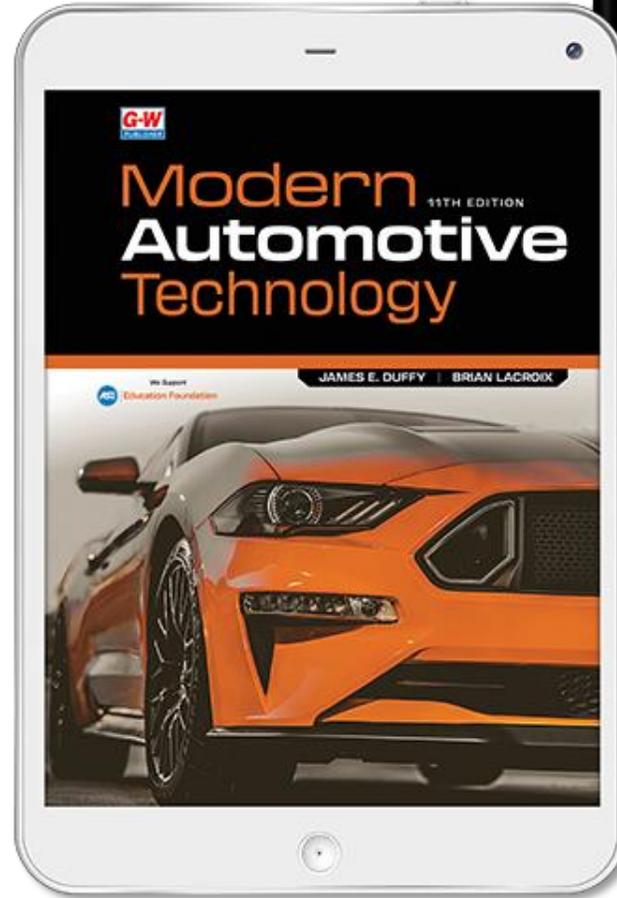


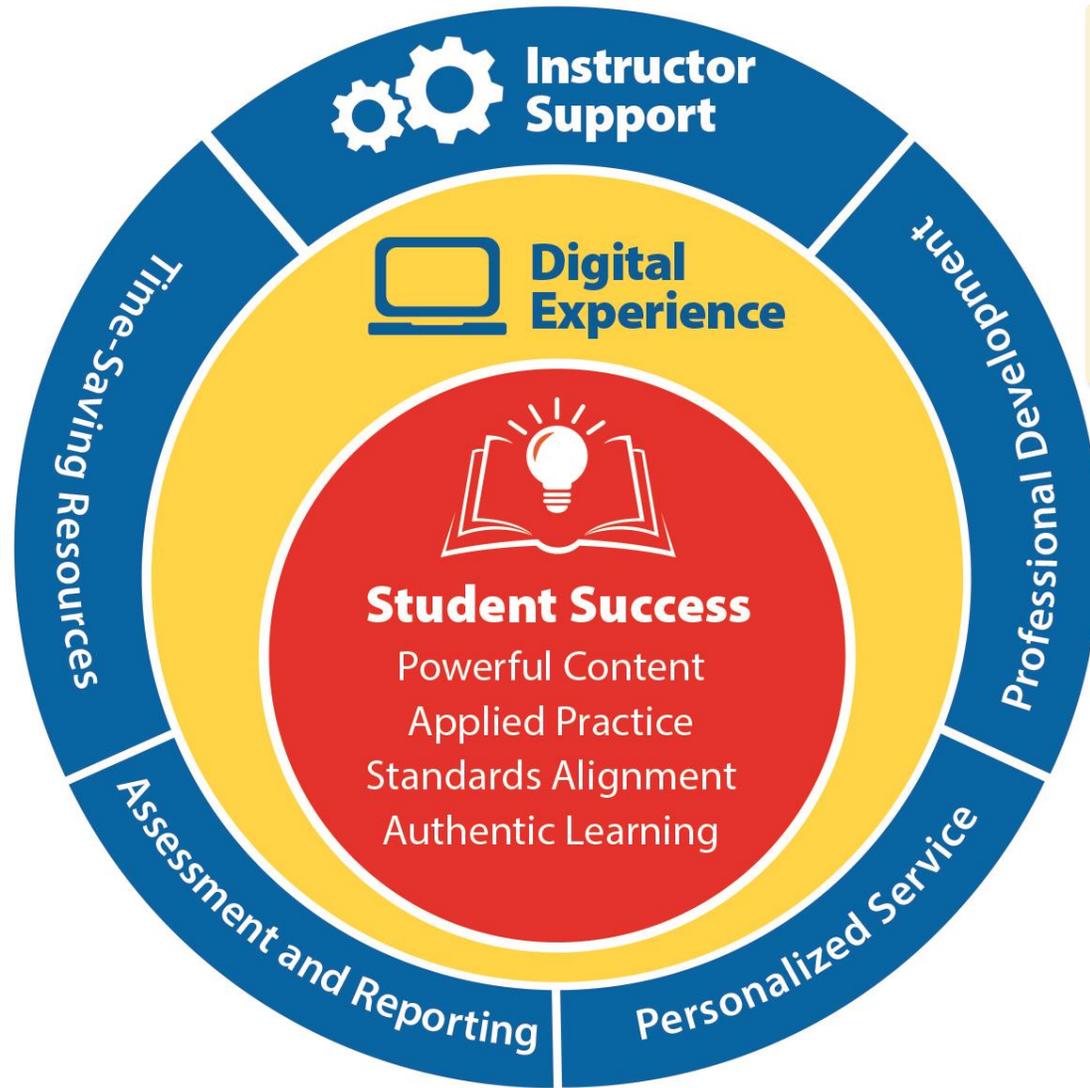
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Modern Automotive Technology



Together, We Build the Future



Student Success Is At the Heart of What We Do



*Shown are examples across various titles

- ✓ Prepare for class
- ✓ Reinforce new concepts
- ✓ Assess learning

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Modern Automotive Technology: Lesson Plan

Instructor:
Course:

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Unit:

Chapter 2: Auto Shop Safety

Learning Outcomes

- 2.1 Describe the layout of a typical auto shop.
 - Auto Shop Layout
- 2.2 Summarize safety best practices in an auto shop.
 - Shop Safety
- 2.3 Describe how physical injuries can be prevented in an auto shop.
 - Preventing Physical Injury
- 2.4 Outline proper fire prevention and safety training in an auto shop, including fire extinguisher identification and usage guidelines.
 - Fire Prevention
- 2.5 Identify best practices to prevent electrical accidents in an auto shop.
 - Preventing Electrical Accidents
- 2.6 List general safety rules to follow when working in an auto shop.
 - General Shop Safety Rules

Materials, Equipment, and Supplies
Needed for this lesson:

Safety Notes

Be certain learners are aware of safety procedures in this chapter:

- Do not attempt to use a heavy vehicle for a demonstration. A heavy vehicle can slide.
- Always carry an undeployed air bag. This can prevent injury during handling or storage.
- Gasoline is by far the most flammable liquid. It has the potential for causing harm in flames.
- Fire extinguishers are designed to be used after a fire alarm before attempting to extinguish the fire. Immediately evacuate the area.

Demonstration

- Show students the proper use of tools by technicians. Demonstrate during job tasks to ensure proper procedures for high-voltage systems.
- Show students the various types of electrical systems.



Presentations for PowerPoint

**Modern
Automotive
Technology**

**Lesson Plans, PowerPoint Presentations,
and Answer Keys**

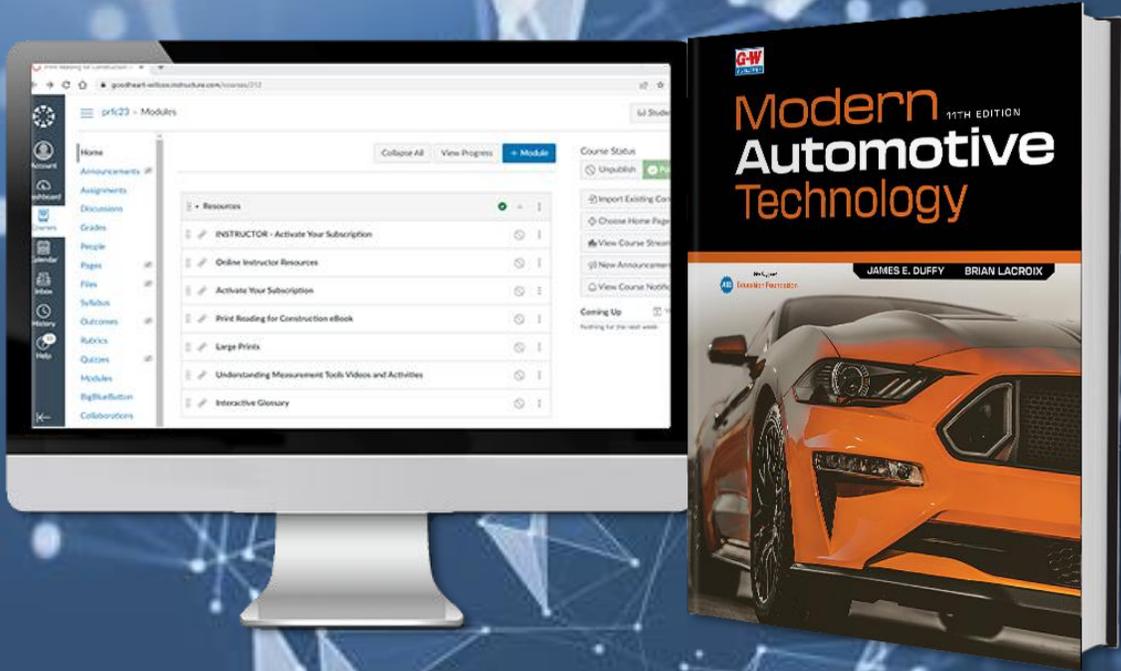


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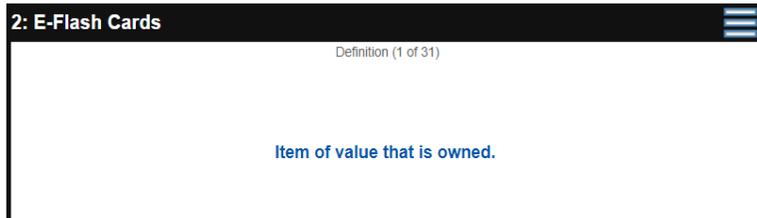
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2: Vocabulary Game

Select a point value. Choose the term that matches the definition. Score: 800

<input checked="" type="radio"/> 100	100	100	100
200	200	200	200
300	<input checked="" type="radio"/> 300	300	300
400	400	400	<input checked="" type="radio"/> 400

Definition: Act of giving money, goods, or services to meet the needs of others and support causes that are important to an individual.

- pay yourself first
- variable expense
- recordkeeping
- philanthropy

Check Answer

Interactive Activities

Modern Automotive Technology Workbook: Chapter 1

Workbook and Shop Manual

Name: _____
Date: _____
Class: _____

Chapter 1: The Automobile

Chapter Review

Objective: After studying this chapter, you will be able to identify and describe basic vehicle construction, vehicle types, and the primary parts of major automotive systems.

- What is a group of related parts and assemblies that work together to perform a specific task? (1.1)
 - A. Spark plug.
 - B. System.
 - C. Component.
 - D. Assembly.

Answer: _____
- A set of fitted parts designed to
 - A. system
 - B. block
 - C. assembly
 - D. component

Answer: _____
- The most basic type of removal
 - A. component
 - B. system
 - C. assembly
 - D. exhaust

Answer: _____

Project 1: Job 1—Perform Safety and Environmental Inspections

After completing this job, you will be able to locate the shop's fire extinguishers, fire exits, and eyewash stations. You will be able to locate and properly use safety glasses and other shop safety equipment. You will also learn the general safety rules of an auto shop. You will learn the methods of preventing environmental damage through environmentally friendly work procedures.

Procedures

Warning
Before performing this job, review all pertinent safety information in the text and discuss safety procedures with your instructor.

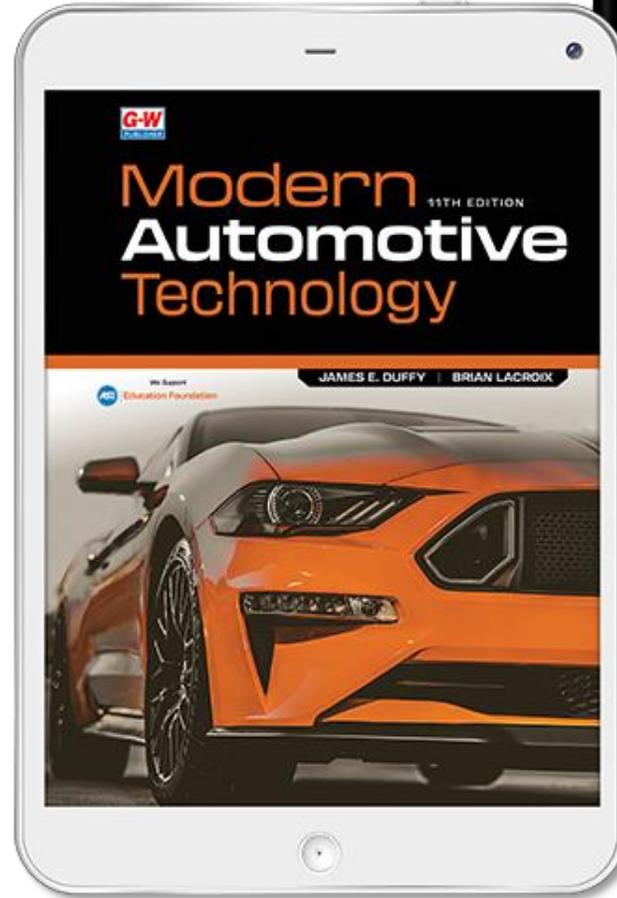
Personal Protective Equipment

- Eye protection (safety glasses or goggles) should be worn during any operation that could injure your eyes. See **Figure 1-1**. This includes, for example, hammering, drilling, grinding, sandblasting, using compressed air, carrying a battery, or working around a spinning engine fan.



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Modern Automotive Technology

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Student Textbook

CONCERN, CAUSE, CORRECTION

Keep the following customer concern in mind as you study this chapter. Try to determine how best to pinpoint the cause of this concern and, if necessary, the repairs that must be performed to correct the concern. The steps for determining the cause and the applicable correction will be given later in this chapter.

Name: Y. Oliveira	Phone: 555-5733	RO #: 1044
Address: 741 Verano Parkway	City, State, Zip: Climatesville, IN 47111	
Year, Make, Model: 2023 Acura TLX	VIN: 19UUB5F55PA005065	Mileage: 7910
Description		
Customer Concern: Mrs. Oliveira brings her 2023 Acura TLX to the shop. She states that her air conditioning system is not blowing as cold as usual.		



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Figure 60-9. A leak detector will make an audible signal if refrigerant gases are present.

SECTION 11

Advanced Driver Assistance Systems and Service

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What's New to the Edition



ASE-TYPE QUESTIONS

1. Noise is coming from a vehicle's rear drive axle assembly. Technician A says that a barometer can distinguish the faulty axle assembly part based on the noise's sound wave. Technician B says that touching the drive axle assembly to feel the noise's vibrations is the most efficient way to diagnose the noise concern when shop testing the vehicle on a lift. Who is correct? (35.1)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.
2. A whining noise is coming from a high-mileage vehicle's differential when driving straight. Technician A inspects the ring and pinion gears for problems. Technician B replaces the axle seals, believing that it is the cause of the whining noise. Who is correct? (35.1)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.
3. A customer complains of a lubricant leak near the rear drive axle assembly. Technician A first checks to see if the leaking fluid is brake fluid. Technician B first checks the condition of the differential pinion gear seal and the housing's drive axle seals. Who is correct? (35.1)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.
4. The bearings in a drive axle assembly need replacing. Before performing this task, Technician A checks the condition of all drive axle assembly parts. Before performing this task, Technician B wants to determine the cause of the original bearing failure. Who is correct? (35.1)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.
5. Noise is coming from a vehicle's differential case during vehicle cornering. Technician A looks for damaged spider gears in the differential. Technician B inspects the condition of the axle mounting flanges. Who is correct? (35.1)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.
6. The lubricant in a limited-slip differential needs changing. Technician A tells the vehicle owner that all differential lubricant is the same and interchangeable. Technician B tells the vehicle owner that for optimal performance, all differentials, especially limited-slip differentials, should be filled with the differential lubricant specified by the vehicle manufacturer. Who is correct? (35.2)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.
7. A solid rear drive axle must be removed from its axle housing. Technician A says that a retainer plate may be used to hold this particular axle in its housing. Technician B says that a C-clip may be used to hold this particular axle in its housing. Who is correct? (35.3)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.
8. A vehicle's retainer plate-type drive axle needs to be replaced. Technician A says that the first step of this repair procedure is to remove the inspection cover and extract the differential spider gears. Technician B says that the last step of this repair procedure is to install a new C-clip in the groove at the inner end of the axle shaft where it enters the differential case. Who is correct? (35.3)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.





Cylinder Head and Valve Train Components

TECHNICAL TERMS

bare cylinder head	spring free length
cam lobe	spring installer height
camshaft bearing	spring open length
camshaft duration	spring pressure
camshaft lift	valve face angle
camshaft thrust plate	valve float
exhaust port	valve guide
hydraulic valve lifter	valve overlap
intake port	valve retainer
interference angle	valve seal
keeper	valve seat
manifold runner	valve seat angle
mechanical lifter	valve spring assembly
poppet valve	valve spring seat
press-fit valve guide	valve spring shim
press-fit valve seat	valve stem
roller lifter	valve timing

LEARNING OUTCOMES

After studying this chapter, you will be able to:

- 14.1** Describe the design and construction of an engine cylinder head, including valve guides, valve seats, and combustion chamber shape.
- 14.2** Identify valve train components, including the engine valves, valve seals, valve spring assemblies, camshaft, push rods, rocker arms, and lifters, and describe the operation of each.
- 14.3** Describe the construction and design of intake manifolds.
- 14.4** Describe the construction and design of exhaust manifolds.

INTRODUCTION

An engine top end includes the cylinder head assembly, valve train, camshaft, valve cover, and intake and exhaust manifolds. Understanding the construction of an engine top end improves your ability to troubleshoot and repair an engine. This chapter examines the engine top end and each of its major parts, **Figure 14-1**.

14.1 Cylinder Head

A *bare cylinder head* is a complex metal casting with all its parts removed. These parts include the valves, keepers, retainers, springs, seals, and rocker arms. A bare cylinder head is commonly made of aluminum or cast iron. Older automotive engines used cast iron cylinder blocks.

Intake and exhaust ports are cast into the cylinder head. The *intake ports* route air (direct injection) or air and fuel (port injection) into the combustion chambers. The *exhaust port* routes burned gases out of the engine.

If a cylinder head becomes badly damaged, the technician

Chapter-Opening Materials



WARNING

Hollow sodium-filled valves are used in a few high-performance engines. They are very light and allow high engine rpm for prolonged periods. However, they can explode if placed in a fire and, therefore, must be disposed of properly.

TECH TIP

As automotive engineers design more compact, lighter, and more powerful engines, many of the auxiliary units that were traditionally mounted on the front of the engine and driven off the front of the crankshaft are now mounted elsewhere. They are driven off the rear or even the center of the crankshaft in these new designs.

This chapter lays out the construction and operation of engine front end assemblies. Study it carefully. It will help you understand later chapters on service and repair. Refer to **Figure 16-1**.

TECH TIP

Oil pumps, water pumps, and other front end-related parts are detailed in other textbook chapters. Refer to the index for more information on these components.

CAUTION

Never remove the spring from inside a radiator hose. The hose can collapse and cause engine overheating if the spring is removed.

Heater hoses are small-diameter hoses that carry coolant to the heater core under the vehicle's dashboard. *Hose clamps* or specialized quick-connect fittings hold the radiator hoses and heater hoses on their fittings. See **Figure 18-6**. Spring-type hose clamps are commonly used. A technician expands the spring-type clamp with pliers before installing it over a hose and fitting. When the technician releases the pliers, the clamp automatically tightens on the hose. A *worm-drive hose clamp* uses a worm gear that engages slots in the clamp strap to allow tightening around the hose.

CAUTION

Avoid using worm-drive hose clamps on plastic fittings in the cooling system. They do not clamp the hose evenly and can crack plastic hose fittings.

Special Features

 **GREEN TECHNOLOGY**

Subaru's Environmental Commitment

Automotive manufacturer Subaru (the Subaru Group) has joined other auto manufacturers in their efforts to reduce their carbon footprint and build a sustainable industry.

Subaru recovers and recycles bumpers, steel, shredder dust (vehicle residue from shredder), airbags, and chlorofluorocarbon (CFC) substitutes from used vehicles. Subaru constructs vehicles from the design stage with recycling in mind. They use materials that can easily be recycled, build structures that can easily be dismantled, and label materials for easy identification.

Subaru continues to work toward achieving "zero-emission factory status." They have implemented energy-efficient production processes and lowered water consumption by their global manufacturing plants. In addition, they seek suppliers who are also resolved to reduce their own carbon

footprints. Subaru requests that business partners formulate an environmental management system to ensure the sustainability of their material acquisition and processing.



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SERVICE PROCEDURE

Removing a Water Pump

To remove a water pump on any engine:

1. Refer to the vehicle's service information for specialized instructions and warnings.
2. Make sure the engine has cooled down, the cooling system is not under pressure, and that the battery is disconnected.
3. Carefully remove the pressure cap.
4. Place a drain pan under the radiator or drain area.
5. Open the drain valve or petcock on the bottom of the radiator. Allow the cooling system to drain completely. Close the drain valve or petcock.
6. Following the service information procedure, unbolt and remove all brackets, pulleys, belts, and other components preventing pump removal. Often, the air conditioning compressor, power steering pump, or alternator must be moved to allow removal of the water pump.
7. Remove any hose(s) that might be connected to the water pump.
8. Remove the bolts holding the water pump to the engine. Keep all the bolts organized to aid reassembly. Never use excessive force when trying to remove an old water pump. It is easy to overlook hidden bolts that secure the pump.
9. Make sure all bolts are out and lightly tap the rear or side of the pump housing with a rubber mallet to free the pump from the engine.
10. Remove all the old gasket, O-ring, or sealer material from the engine. The engine-to-pump mating surfaces must be perfectly clean to prevent coolant leakage when the new pump is installed. Be careful not to gouge or scratch the sealing surfaces, especially on aluminum parts. Always refer to the service information for specific instructions.



WORKPLACE SKILLS

Professionalism

Professionalism is a comprehensive trait that includes everything from following orders to taking pride in good workmanship. A professional takes the time to do everything the proper way. If a technician presents themselves with professionalism, customers have more confidence that their vehicles will be properly fixed. Always think, dress, and act like a professional. Consider the following situations:

1. A technician arrives at the service shop where they work three days a week. Their long hair is loose, they are not wearing the proper uniform work shirt, and they are wearing a bracelet and several metal rings. Explain why the employee's appearance is unprofessional and unsafe.
2. An employee gets a large tattoo on their forearm that many people might find offensive. Their supervisor

requests that they wear long-sleeve shirts when working at the reception desk. Is the supervisor's request reasonable? Explain your answer.



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Special Features

SUMMARY

- Engine oil is a refined petroleum lubricant that is filtered and pumped throughout the engine to provide a barrier between metal surfaces, reducing friction while cooling and cleaning components. Engine oils are categorized into three main groups: conventional, synthetic, and synthetic blend. Within these three groups, oil producers offer high-mileage formulas for automotive engines with 75,000 miles (120,700 km) or more of service. (8.1)
- Technicians will encounter engine oil ratings and standards from the Society of Automotive Engineers (SAE), American Petroleum Institute (API), International Lubricant Standardization and Approval Committee (ILSAC), European Automobile Manufacturers Association (ACEA), and specific vehicle manufacturers. (8.2)
- Oils are rated by viscosity, or the fluid's resistance to flow. Multigravity oils, which are required in all automotive engines, have the properties of two different-weight oils. They exhibit the characteristics of a thin oil when cold and a thicker oil when warm. Examples include 5W-20 and 10W-30. (8.2)
- When performing engine oil and filter service, refer to the vehicle's service information for the manufacturer's oil recommendation and required standards. Before using an engine oil, examine the label on the bottle to check that it meets the required standards for optimal engine performance. (8.2)
- Transmission and driveline fluids assist a vehicle's drive train assemblies in transferring power to the wheels. Driveline fluids vary greatly depending on the manufacturer. When servicing these components, identify the manufacturer's recommended fluid or a suitable alternative. (8.3)
- Most brake fluids used in modern vehicles are glycol ether-based and are categorized as DOT 3, 4, 5, or 5.1. Each DOT rating has a progressively higher boiling point, which ensures the hydraulic brake system works effectively during heavy brake usage. (8.3)
- Coolants carry heat from engine components to the radiator to maintain an efficient engine operating temperature. They must act as lubricants for the engine's water pump and have sufficient corrosion protection to prevent damage or contamination to the cooling system. (8.4)
- Antifreeze must be mixed with an equal part of demineralized or distilled water to create a coolant capable of balancing the need to cool components

- and provide heat and freeze protection, at the proper pH to prevent corrosion. (8.4)
- Common shop lubricants include dielectric grease, white lithium grease, heavy-duty grease, penetrating oil, and silicone lubricant spray. Common shop chemicals include brake cleaner, throttle body cleaner, battery terminal cleaner, battery terminal protector, and anti-seize compound. Wear the appropriate PPE for the chemical in use. (8.5)
 - Many shop chemicals used by technicians are aerosol sprays. Take precautions when using these products, as the spray can's contents might not be flammable, but the aerosol propellant usually is. (8.5)

REVIEW QUESTIONS

Answer the following questions using the information provided in this chapter.

Know and Understand

1. What is *not* a benefit of synthetic engine oils compared to conventional engine oils? (8.1)
 - A. Synthetic oils minimize internal engine sludge and deposits and improve fuel economy.
 - B. Synthetic oil contains greater quantities of the same additives found in conventional engine oils.
 - C. Synthetic oils are less expensive and a more economical option for vehicle manufacturers and owners than conventional engine oils.
 - D. Synthetic oils can endure higher operating temperatures than conventional engine oils.
2. What is the main advantage of using high-mileage-formulated engine oils in automotive engines with 75,000 miles (120,700 km) or more of service? (8.1)
 - A. They contain specific complementary additive packages to prevent sludge and fight against part wear.
 - B. They are categorized as ultra-low viscosity oils that reduce internal engine part clearances.
 - C. They decrease vehicle tailpipe emissions due to their ability to increase the engine's operating temperature.
 - D. They are only produced as synthetic blend oils so that they are transferable between all automotive engines.

3. The Society of Automotive Engineers (SAE) _____ numbering system is used in the automotive industry to rate the thickness or resistance to flow of an engine oil. (8.2)
 - A. buoyancy
 - B. compressibility
 - C. cavitation
 - D. viscosity
4. What oil-certifying organization sets European standards and ratings for engine oil? (8.2)
 - A. ILSAC.
 - B. ACEA.
 - C. API.
 - D. SAE.
5. *True or False?* Brake fluid is considered hygroscopic and will absorb moisture. (8.3)
6. Which of the following oils is an example of a differential oil weight? (8.3)
 - A. 5W-20.
 - B. 75W-140.
 - C. SAE 30.
 - D. 0W-20.
7. Antifreeze must be mixed with _____ to create coolant that is installed in a vehicle's cooling system. (8.4)
 - A. gear oil
 - B. mineral spirits
 - C. hydraulic fluid
 - D. demineralized or distilled water
8. All of the following fluids are types of automotive coolant used in modern vehicles, *except*: (8.4)
 - A. hybrid organic acid technology (HOAT) coolant.
 - B. organic acid technology (OAT) coolant.
 - C. performance additive technology (PAT) coolant.
 - D. inorganic additive technology (IAT) coolant.
9. A zerk fitting is used to inject _____ during automotive service. (8.5)
 - A. engine oil
 - B. anti-seize compound
 - C. heavy-duty grease
 - D. gear oil
10. How is anti-seize compound used in automotive service? (8.5)
 - A. Insulating and promoting conductivity in electrical connections.
 - B. Lubricating window tracks and door latches.
 - C. Creating a corrosion barrier between two components that will need to be serviced frequently.
 - D. Lubricating suspension system parts.

Apply and Analyze

1. What is the role of the API in automotive engine oils? What information can a technician determine by looking at the API donut and starburst on a bottle of engine oil? (8.2)
2. Describe how brake fluid that has absorbed an excessive amount of moisture could create a dangerous situation in the hydraulic brake system. (8.3)
3. How is dielectric grease used during automotive service? Why is it used? (8.5)
4. How would a technician install heavy-duty grease in a universal joint that is equipped for lubrication? (8.5)
5. Why is chlorinated brake cleaner banned in some states? Why do many manufacturers *not* recommend using throttle body cleaner on their engines? (8.5)

Critical Thinking

1. Why do vehicle manufacturers develop their own proprietary formulas for engine oil and other system fluids that are required for use in their vehicles? (8.2)
2. A vehicle owner says they noticed a small coolant leak and added one gallon of tap water from their well to the cooling system. As the technician inspecting the vehicle to diagnose the cooling system concern, what would you recommend for service? (8.4)
3. When installing heavy-duty grease in a component with a grease gun, a technician notices water prior to a milky-colored grease coming out of the part. What should the technician do? (8.5)
4. Explain why anti-seize compound should *not* be applied to a cylinder head bolt during reassembly of an engine. (8.5)



ASE-TYPE QUESTIONS

1. Conventional and synthetic engine oils are being discussed. Technician A says that ultra-low viscosity engine oils are only available as synthetic blend oils. Technician B says that conventional engine oils have longer service intervals than synthetic oils. Who is correct? (8.1, 8.2)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.
2. Technician A says that most engine oils are made by processing and refining crude oil. Technician B says that API/ILSAC standards are established and updated regularly to maintain specifications with the changing design and technology of modern internal combustion engines. Who is correct? (8.1, 8.2)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.
3. Technician A says that ACEA standards for engine oil are typically more rigorous than API/ILSAC standards. Technician B says that turbocharger-equipped gasoline engines often require a higher temperature viscosity grade than conventional engines. Who is correct? (8.2)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.
4. Which of the following is an example of a vehicle manufacturer-created fluid standard or specification? (8.2)
 - A. API SN.
 - B. dexos.
 - C. 75W-140.
 - D. ILSAC GF-6A.
5. Technician A says that vehicle manufacturers specify that a universal type of transmission fluid
6. Technician A says that DOT 3 brake fluid is classified as synthetic, while DOT 4, DOT 5, and DOT 5.1 brake fluids are the conventional type. Technician B says that all-wheel-drive vehicles equipped with a power transfer unit often require the OEM fluid in the PTU for optimal performance. Who is correct? (8.3)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.
7. Coolant additives contain _____. (8.4)
 - A. anti-foamers
 - B. corrosion and wear inhibitors
 - C. bittering agents
 - D. All are correct.
8. Technician A says that IAT coolant is formulated with a blend of organic acids and conventional additives. Technician B says that mixing coolant types can cause cooling system issues, as the coolants can negatively react and cause gelling or a loss of performance. Who is correct? (8.4)
 - A. A only.
 - B. B only.
 - C. Both A and B.
 - D. Neither A nor B.
9. Where is the best place to spray penetrating oil on a rusted bolt installed on a vehicle? (8.5)
 - A. Bolt head.
 - B. Washer installed on the bolt.
 - C. Base of the bolt.
 - D. Any area the bolt threads are exposed.
10. What shop lubricant or chemical is best for cleaning oil residue off the side of an engine after completing an engine oil and filter change? (8.5)
 - A. White lithium grease.
 - B. Brake cleaner.
 - C. Penetrating oil.
 - D. Anti-seize compound.



Name:
Class:
Date:

Section 1: Introduction to Automotive Technology and Foundational Workplace Skills

Section Review

1. A set of fitted parts designed to complete a function is referred to as a(n) _____. (Ch 1)
- A. assembly
 - B. block
 - C. system
 - D. component

Answer:

For questions 2–4, match the following terms to the identifying phrases.

- A. Frame
 - B. Body
 - C. Chassis
2. Collection of vehicle assemblies that contains the tires, wheels, engine, transmission, and drive axle assembly. (Ch 1)

Answer:

3. Strong metal structure that provides a mounting place for the other parts. (Ch 1)

Answer:

4. Skin that forms the outside of the vehicle. (Ch 1)

Answer:

5. Which of the following is a type of accident that can happen in an automotive shop? (Ch 2)

- A. Asphyxiation.
- B. Explosion.
- C. Electric shock.
- D. All of these are correct.

Answer:

Page 1

6. Automotive shops most often have multipurpose _____ fire extinguishers installed in multiple locations around the shop that are capable of extinguishing Class A, B, and C fires. (Ch 2)

- A. soda-acid
- B. dry chemical
- C. pressurized water
- D. carbon dioxide

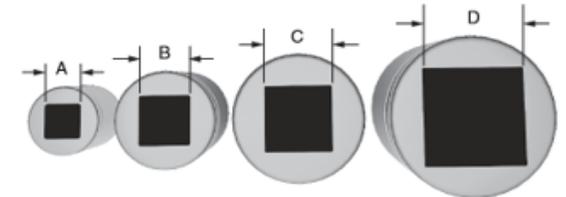
Answer:

7. What type of wrench is least likely to slip and strip a hex bolt head? (Ch 3)

- A. 16-point
- B. 12-point
- C. 6-point
- D. 4-point

Answer:

8. Match the correct drive size to the socket. (Ch 3)



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- 3/4"
- 1/4"
- 3/8"
- 1/2"

Answer A:

Answer B:

Answer C:



Name:

Date:

Class:

PROJECT 3: Performing Oil Changes and Checking an Engine for Leaks

Introduction

Periodic oil and filter changes can greatly prolong the life of an engine. Oil changes are relatively simple, but must be done correctly. It is also vital that any coolant leaks be found and promptly fixed. In Job 6, you will drain and replace oil and change the oil filter. In Job 7, you will observe the engine for oil, coolant leaks.

Project 3 Jobs

- Job 6—Change Oil and Filter
- Job 7—Inspect an Engine for Leaks

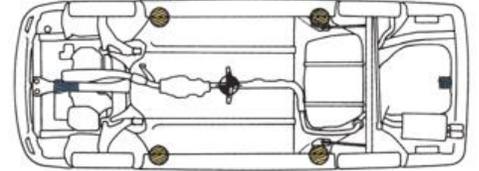
Tools and Materials

The following list contains the tools and materials that may be needed to complete jobs in this project. The items used will depend on the make and model of vehicle serviced.

- Vehicle in need of service.
- Applicable service information.
- Oil filter wrench.
- Oil drain pan.
- Oil filter.
- Correct type and grade of oil.
- Leak detection equipment.
- Shop towels.
- Hand tools as needed.
- Safety glasses and other protective equipment as needed.

Safety Notice

Before performing this job, review all pertinent safety information in the text. Review safety information with your instructor.



■ Floor jack locations
● Frame contact hoist, twin post hoist or scissor jack (emergency) locations
⊕ Approximate center of gravity

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Figure 6-1. When raising a vehicle, make sure the lift pads are positioned at recommended lift points.

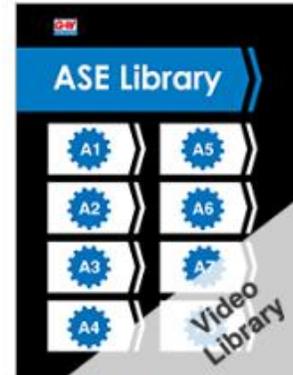
4. Place the oil drain pan under the engine oil pan. Figure 6-2 shows a typical oil drain pan.



Page 2



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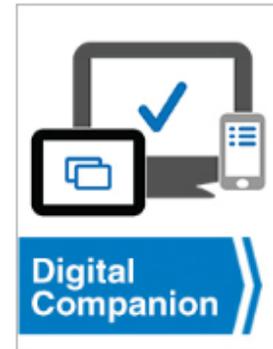
ASE Series Video Library



Multimeter Simulations



Modern Automotive Technology 11e, Shop Manual

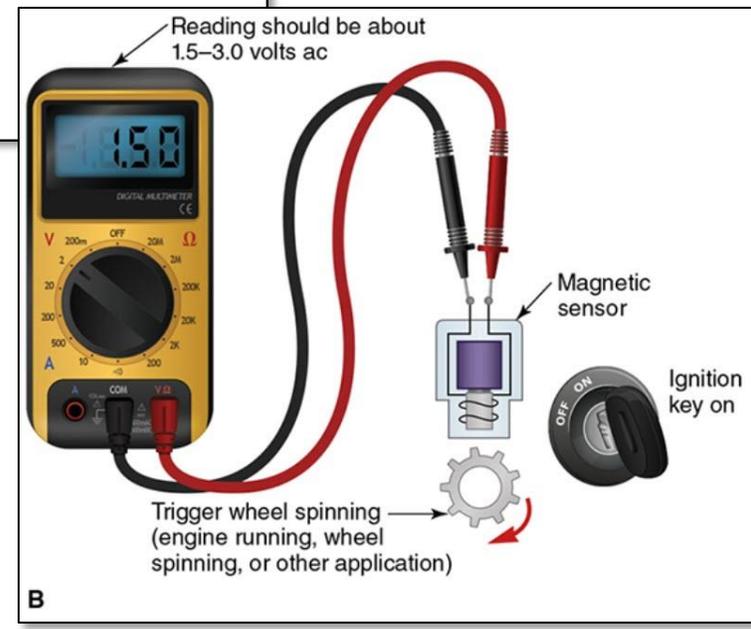
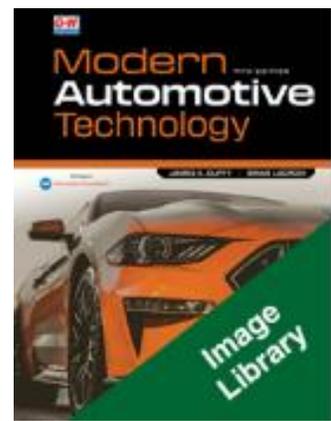
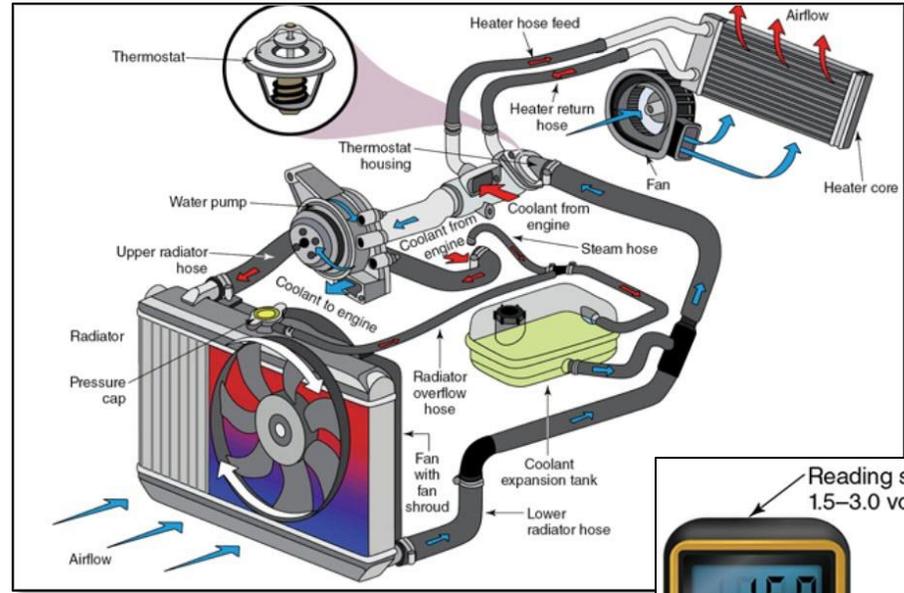


Modern Automotive Technology 11e, Digital Companion



Automotive Virtual Toolbox

Digital Assets

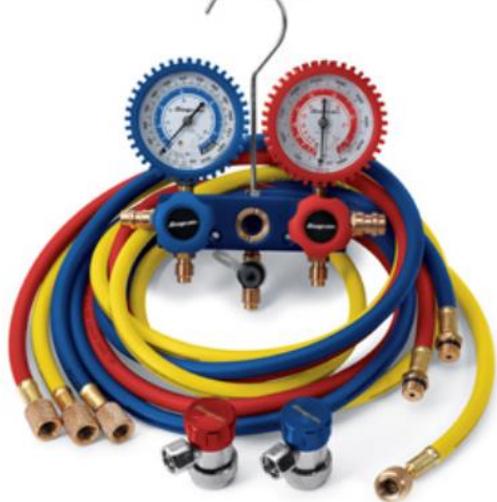


Images and Illustrations



Auto Heating and Air Conditioning E-Flash Cards

Term (3 of 5)



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Measuring Resistance in a Series Circuit: Problem 1

Battery

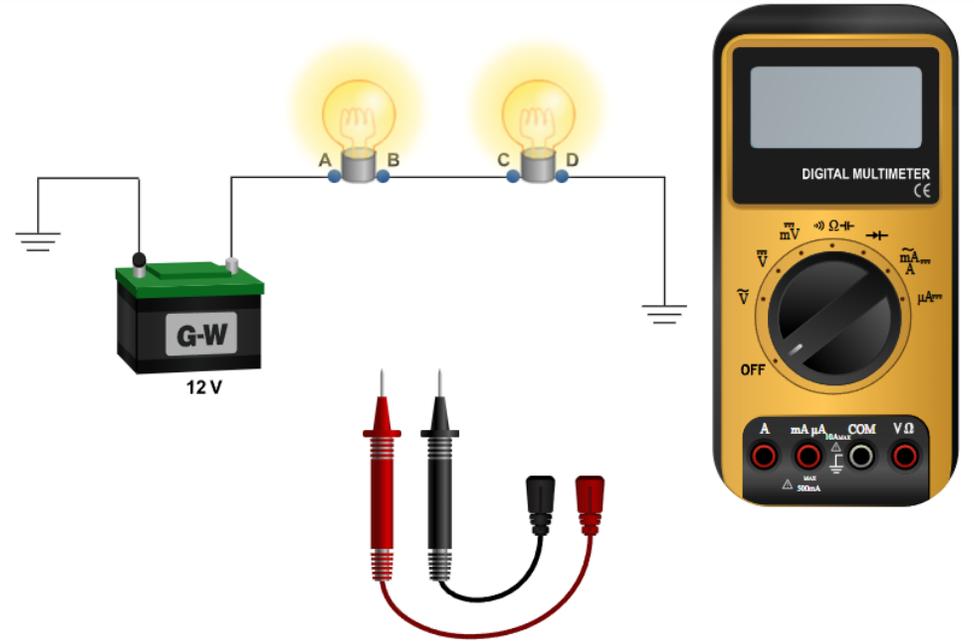
- Connected
- Disconnected

Multimeter Red Lead

- A
- mA μ A
- V Ω
- Disconnected

Multimeter Black Lead

- COM
- Disconnected



Multimeter Setting

OFF

Multimeter Red Probe

Disconnected

Multimeter Black Probe

Disconnected

Using Electrical Test Equipment

The video player shows a close-up of a car's engine bay. A white plastic reservoir with a yellow cap is prominent. An overlay titled "ASE Library" is positioned in the top-left corner of the video frame. It features a grid of seven blue gear icons labeled A1 through A7, with A7 partially obscured by a "Video Library" label. The video player controls at the bottom include a play/pause button, a 10-second rewind button, a 10-second fast forward button, a progress bar showing 00:00 / 02:37, and a speaker icon for volume control. The "G-W" logo is visible in the bottom right corner of the video frame.

[Hide transcript](#)

This interactive activity interface is titled "Instructions" and includes a "Reset" button in the top right corner. Below the title, there are two rows of buttons for selecting fluid types: "Oil refill dipstick", "Power steering fluid", "Windshield washer fluid", "Clutch fluid", "Engine oil" in the first row; and "Engine coolant", "Brake fluid" in the second row. The main area features a top-down view of a car's engine compartment with several callout lines pointing to various components. To the right of the engine view is a vertical column of seven empty rectangular input boxes for user responses. In the bottom right corner, there is a "Digital Companion" button with a checkmark icon, a "SUBMIT" button, and a small "iStock.com" watermark.

Video Library and Interactive Activities



INTERACTIVE VIDEOS



Engine



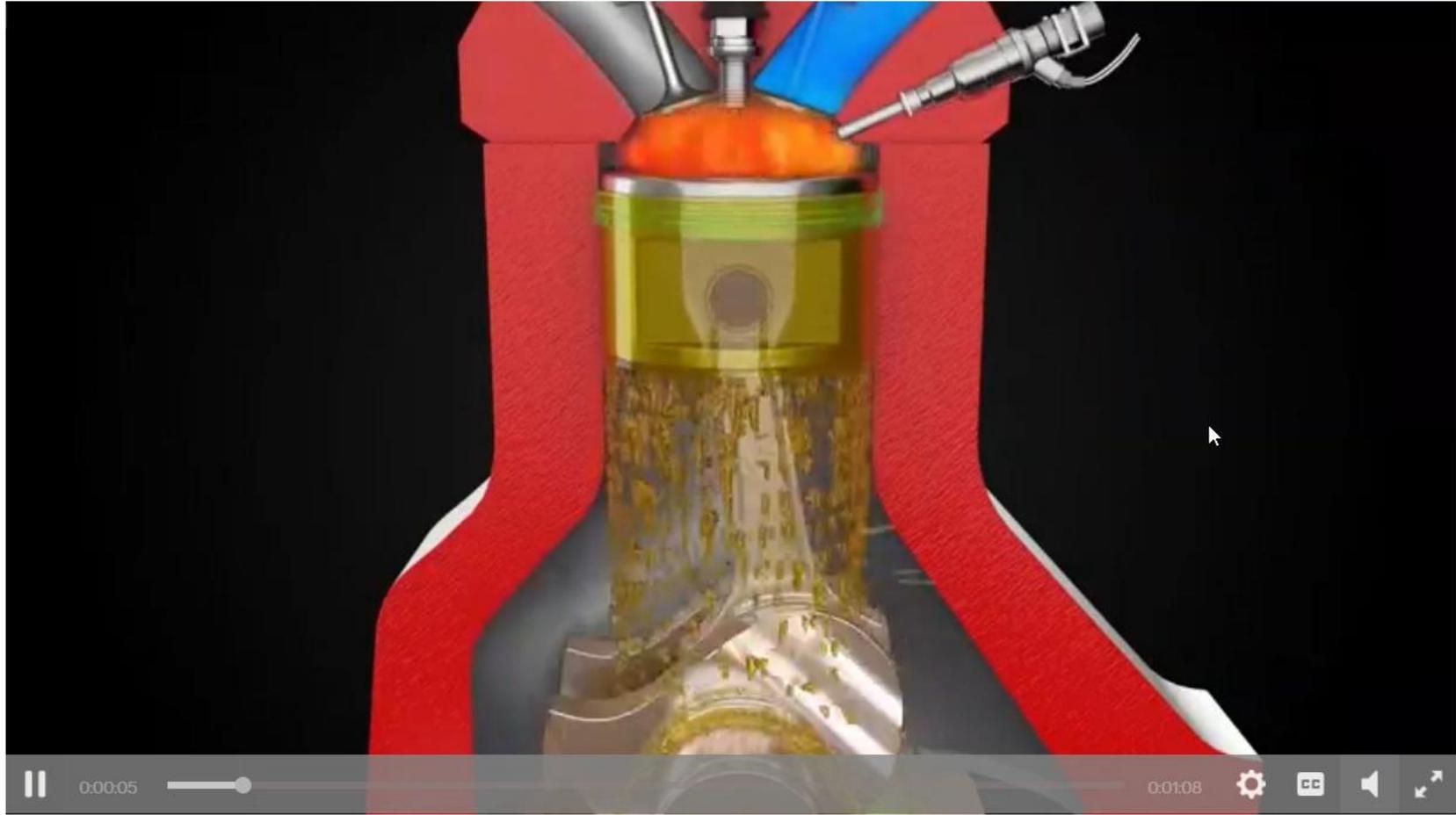
Engine Oil System



Timing Belt



Timing Chain



NARRATED VIDEOS



Engine Oil S... 01:54



Timing Belt 01:17



Timing Chain



Engine

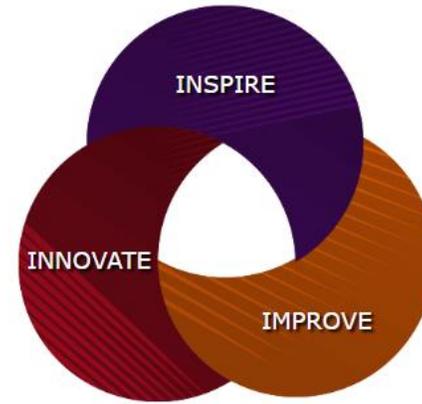
Basic Description

Internal combustion engines consist of pistons, a crankshaft, and valves.

MotoVisuals from Advance Auto Parts



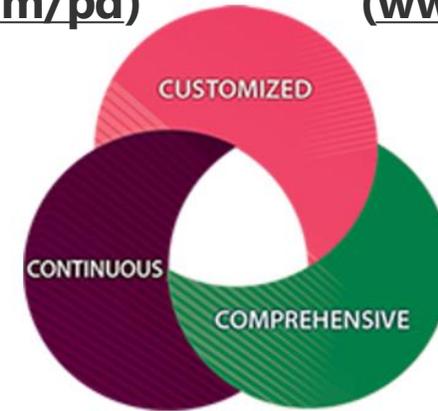
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Take Automotive 

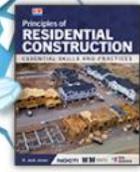
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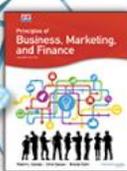
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Subject: Architecture and Construction

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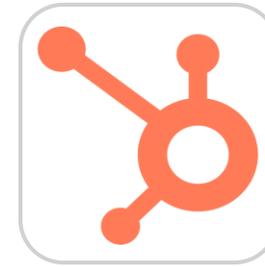


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