

# CHAPTER 1



## SHOP SAFETY

### OBJECTIVES

After studying Chapter 1, the reader will be able to:

1. Identify situations where hearing protection should be worn.
2. Discuss how to safely handle tools and shop equipment.

3. Describe how to properly use a fire extinguisher.
4. Discuss shop safety procedures.

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### KEY TERMS

ANSI (p. 2)  
Bump Cap (p. 2)  
Decibel (dB) (p. 3)  
Eye Wash Station (p. 7)  
Fire Blankets (p. 7)

Microbes (p. 5)  
“PASS” (p. 6)  
Personal Protective Equipment (PPE) (p. 2)  
Spontaneous Combustion (p. 4)

## PERSONAL PROTECTIVE EQUIPMENT

Safety is not just a buzzword on a poster in the work area. Safe work habits can reduce accidents and injuries, ease the workload, and keep employees pain free.

### Safety Glasses

The most important **personal protective equipment (PPE)** a technician should wear all the time are safety glasses, which meet standard **ANSI Z87.1**. See Figure 1-1.

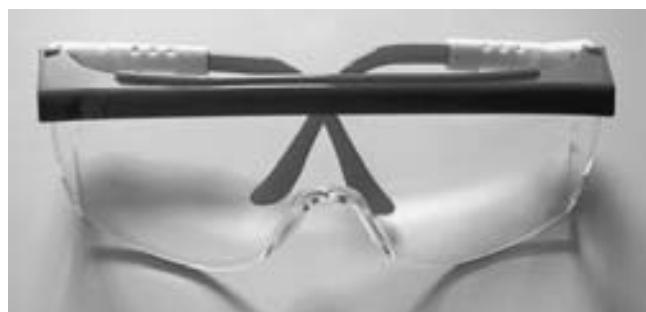
### Steel-Toed Shoes

Steel-toed safety shoes are also a good investment. See Figure 1-2. If safety shoes are not available, then leather-topped shoes offer more protection than canvas or cloth.

### Gloves

Wear gloves to protect your hands from rough or sharp surfaces. Thin rubber gloves are recommended when working around automotive liquids such as engine oil, antifreeze, transmission fluid, or any other liquids that may be hazardous. Several types of gloves and their characteristics include:

- **Latex surgical gloves.** These gloves are relatively inexpensive, but tend to stretch, swell, and weaken when exposed to gas, oil, or solvents.
- **Vinyl gloves.** These gloves are also inexpensive and are not affected by gas, oil, or solvents.
- **Polyurethane gloves.** These gloves are more expensive, yet very strong. Even though these gloves are also not affected by gas, oil, or solvents, they do tend to be slippery.
- **Nitrile gloves.** These gloves are exactly like latex gloves, but are not affected by gas, oil, or solvents, yet they tend to be expensive.



**FIGURE 1-1** Safety glasses should be worn at all times when working on or around any vehicle or servicing any component.



**FIGURE 1-2** Steel-toed shoes are a worthwhile investment to help prevent foot injury due to falling objects. Even these well-worn shoes can protect the feet of this service technician.

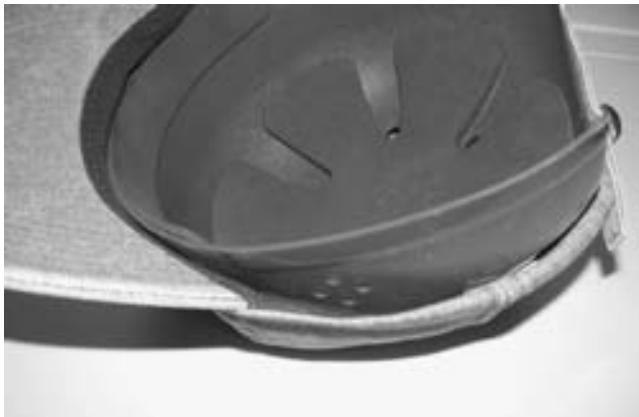


**FIGURE 1-3** Protective gloves such as these vinyl gloves are available in several sizes. Select the size that allows the gloves to fit snugly. Vinyl gloves last a long time and often can be worn all day to help protect your hands from dirt and possible hazardous materials.

- **Mechanic's gloves.** These gloves are usually made of synthetic leather and spandex and provide thermo protection, as well as protection from dirt and grime. See Figure 1-3.

### Bump Cap

Service technicians working under a vehicle should wear a **bump cap** to protect the head against under-vehicle objects and the pads of the lift. See Figure 1-4.



**FIGURE 1-4** One version of a bump cap is this padded plastic insert that is worn inside a regular cloth cap.



**FIGURE 1-5** Remove all jewelry before performing service work on any vehicle.

## Hands, Jewelry, and Clothing

Remove jewelry that may get caught on something or act as a conductor to an exposed electrical circuit. See Figure 1-5.

Take care of your hands. Keep your hands clean by washing with soap and hot water that is at least 110°F (43°C). Avoid loose or dangling clothing. Also, ear protection should be worn if the sound around you requires that you raise your voice (sound level higher than 90 **decibels [dB]**).

**NOTE:** A typical lawnmower produces noise at a level of about 110 dB. This means that everyone who uses a lawnmower or other lawn or garden equipment should wear ear protection.

## TECH TIP

### PROFESSIONAL BEHAVIOR IN THE SHOP IS A MUST

To be respected as a professional service technician and for safety, always behave in a professional manner. These behaviors include, but are not limited, to the following:

- Show respect to other technicians and employees. For example, the shop owner or service manager may not always be right, but they are always the boss.
- Avoid horseplay or practical jokes.
- Act as if a customer is observing your behavior at all times because this is often the case.

## SAFETY TIPS FOR TECHNICIANS

- When lifting any object, get a secure grip with solid footing. Keep the load close to your body to minimize the strain. Lift with your legs and arms, not your back.
- Do not twist your body when carrying a load. Instead, pivot your feet to help prevent strain on the spine.
- Ask for help when moving or lifting heavy objects.
- Push a heavy object rather than pull it. (This is opposite to the way you should work with tools—never push a wrench! If you do and a bolt or nut loosens, your entire weight is used to propel your hand(s) forward. This usually results in cuts, bruises, or other painful injury.)
- Always connect an exhaust hose to the tailpipe of any running vehicle to help prevent the buildup of carbon monoxide inside a closed garage space. See Figure 1-6.
- When standing, keep objects, parts, and tools with which you are working between chest height and waist height. If seated, work at tasks that are at elbow height.
- Always be sure the hood is securely held open. See Figure 1-7.

## CLEANING METHODS AND PROCESSES

There are four basic types of cleaning methods and processes used in vehicle service, including:



**FIGURE 1-6** Always connect an exhaust hose to the tailpipe of the engine of a vehicle to be run inside a building.

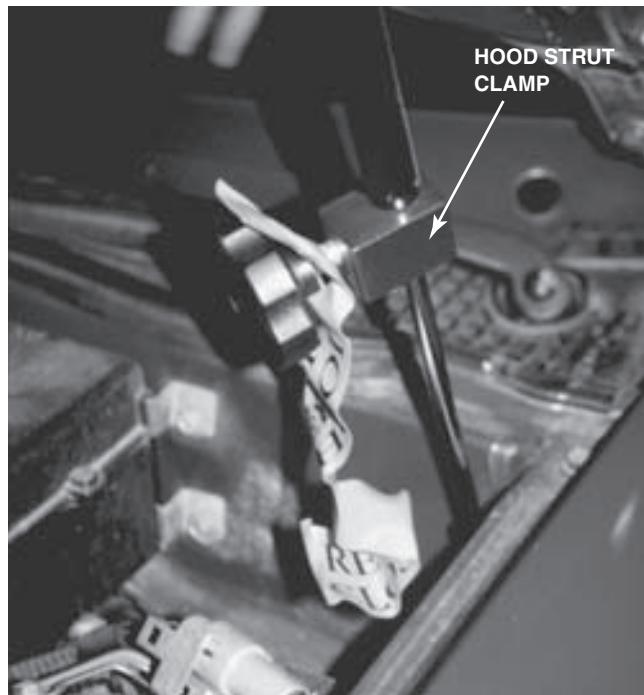


(a)

**FIGURE 1-7a** A crude but effective method is to use locking pliers on the chrome-plated shaft of a hood strut. Locking pliers should only be used on defective struts because the jaws of the pliers can damage the strut shaft.

## Power Washing

Power washing uses an electric or gasoline powered compressor to increase the pressure of water and force it out of a nozzle. The pressure of the water itself is usually enough to remove dirt, grease, and grime from vehicle components. Sometimes



(b)

**FIGURE 1-7b** A commercially available hood clamp. This tool uses a bright orange tag to help remind the technician to remove the clamp before attempting to close the hood. The hood could be bent if force is used to close the hood with the clamp in place.


**SAFETY  
TIP**

**SHOP CLOTH DISPOSAL**

Always dispose of oily shop cloths in an enclosed container to prevent a fire. See Figure 1-8. 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**.

a chemical cleaner, such as a detergent, is added to the water to help with cleaning.

**Safe Use of Power Washers.** Because water is being sprayed at high pressure, a face shield should be worn when using a power washer to protect not only the eyes but to also protect the face in the event of the spray being splashed back toward the technician. Also use a pressure washer in an area



**FIGURE 1-8** All oily shop cloths should be stored in a metal container equipped with a lid to help prevent spontaneous combustion.



**TECH  
TIP**

**POUND WITH  
SOMETHING  
SOFTER**

If you must pound on something, be sure to use a tool that is softer than what you are about to pound on to avoid damage. Examples are given in the following table.

The Material Being Pounded	What to Pound With
Steel or cast iron	Brass or aluminum hammer or punch
Aluminum	Plastic or rawhide mallet or plastic-covered dead-blow hammer
Plastic	Rawhide mallet or plastic dead-blow hammer

where the runoff from the cleaning will not contaminate local groundwater or cause harm to plants or animals.

### Chemical/Microbe Cleaning

Chemical cleaning involves one of several cleaning solutions, including detergent, solvents, or small, living microorganisms

called **microbes** that eat oil and grease. The microbes live in water and eat the hydrocarbons that are the basis of grease and oil.

**Safe Use of Chemical Cleaning.** A face shield should be worn when cleaning parts using a chemical cleaner. Avoid spilling the cleaner on the floor to help prevent slipping accidents. Clean and replace the chemical cleaner regularly.

### Abrasive Cleaning

Abrasive cleaning is usually used to clean disassembled parts, such as engine blocks. The abrasives used include steel shot, ground walnut shells, or in the case of cleaning paint from a vehicle body, baking soda can be used.

**Safe Use of Abrasive Cleaners.** Always wear a protective face shield and protective clothing, including gloves, long sleeves, and long pants.

### Thermal Ovens

Thermal cleaning uses heat to bake off grease and dirt with special high-temperature ovens. This method of cleaning does require the use of expensive equipment but does not use any hazardous chemicals and is environmentally safe.

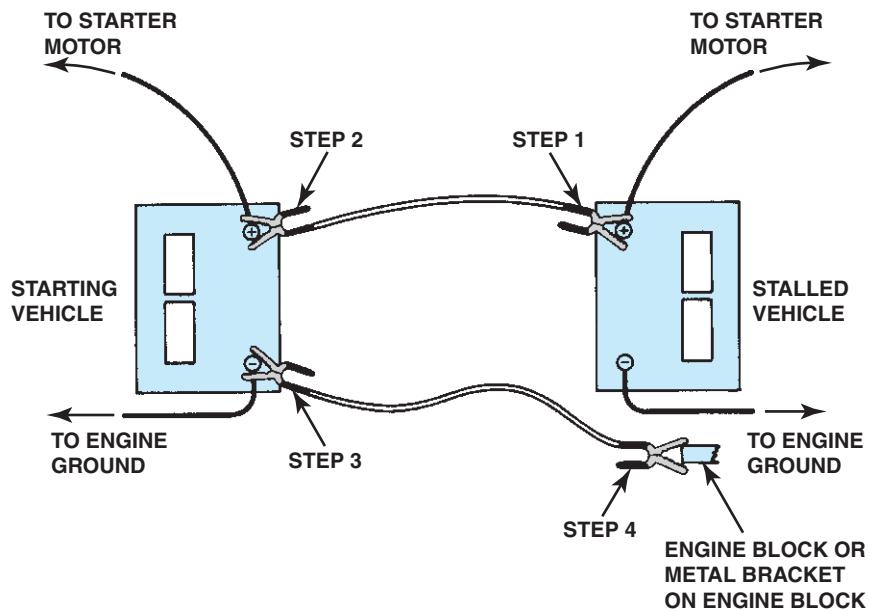
**Safe Use of Thermal Ovens.** Because thermal ovens operate at high temperatures, often exceeding 600°F (315°C), the oven should be turned off and allowed to cool overnight before removing the parts from the oven to avoid being exposed to the high temperature.

## ELECTRICAL CORD SAFETY

Use correctly grounded three-prong sockets and extension cords to operate power tools. Some tools use only two-prong plugs. Make sure these are double insulated and repair or replace any electrical cords that are cut or damaged to prevent the possibility of an electrical shock. When not in use, keep electrical cords off the floor to prevent tripping over them. Tape the cords down if they are placed in high foot traffic areas.

## JUMP-STARTING AND BATTERY SAFETY

To jump-start another vehicle with a dead battery, connect good-quality copper jumper cables as indicated in Figure 1-9 or use a jump box. The last connection made should always be on the engine block or an engine bracket as far from the battery as possible. It is normal for a spark to be created when the jumper cables finally complete the jumping circuit, and



**FIGURE 1-9** Jumper cable usage guide.

### SAFETY TIP

#### COMPRESSED AIR SAFETY

Improper use of an air nozzle can cause blindness or deafness. Compressed air must be reduced to less than 30 PSI (206 kPa). See Figure 1-10. If an air nozzle is used to dry and clean parts, make sure the air stream is directed away from anyone else in the immediate area. Coil and store air hoses when they are not in use.



**FIGURE 1-10** The air pressure going to the nozzle should be reduced to 30 PSI or less.

this spark could cause an explosion of the gases around the battery. Many newer vehicles have special ground connections built away from the battery just for the purpose of jump-starting. Check the owner's manual or service information for the exact location.

Batteries contain acid and should be handled with care to avoid tipping them greater than a 45-degree angle. Always remove jewelry when working around a battery to avoid the possibility of electrical shock or burns, which can occur when the metal comes in contact with a 12-volt circuit and ground, such as the body of the vehicle.

## FIRE EXTINGUISHERS

There are four classes of fire extinguishers. Each class should be used on specific fires only:

- *Class A* is designed for use on general combustibles, such as cloth, paper, and wood.
- *Class B* is designed for use on flammable liquids and greases, including gasoline, oil, thinners, and solvents.
- *Class C* is used only on electrical fires.
- *Class D* is effective only on combustible metals such as powdered aluminum, sodium, or magnesium.

The class rating is clearly marked on the side of every fire extinguisher. Many extinguishers are good for multiple types of fires. See Figure 1-11.

When using a fire extinguisher, remember the word “**PASS.**”

P = Pull the safety pin.

A = Aim the nozzle of the extinguisher at the base of the fire.



**FIGURE 1-11** A typical fire extinguisher designed to be used on class A, B, or C fires.



**FIGURE 1-12** A CO<sub>2</sub> fire extinguisher being used on a fire set in an open steel drum during a demonstration at a fire department training center.

S = Squeeze the lever to actuate the extinguisher.  
S = Sweep the nozzle from side-to-side.

See Figure 1-12.

## Types of Fire Extinguishers

Types of fire extinguishers include the following:

- **Water.** A water fire extinguisher, usually in a pressurized container, is good to use on Class A fires by reducing the temperature to the point where a fire cannot be sustained.
- **Carbon dioxide (CO<sub>2</sub>).** A carbon dioxide fire extinguisher is good for almost any type of fire, especially Class B

or Class C materials. A CO<sub>2</sub> fire extinguisher works by removing the oxygen from the fire and the cold CO<sub>2</sub> also helps reduce the temperature of the fire.

- **Dry chemical (yellow).** A dry chemical fire extinguisher is good for Class A, B, or C fires by coating the flammable materials, which eliminates the oxygen from the fire. A dry chemical fire extinguisher tends to be very corrosive and will cause damage to electronic devices.

## FIRE BLANKETS

**Fire blankets** are required to be available in the shop areas. If a person is on fire, a fire blanket should be removed from its storage bag and thrown over and around the victim to smother the fire. See Figure 1-13 showing a typical fire blanket.

## FIRST AID AND EYE WASH STATIONS

All shop areas must be equipped with a first-aid kit and an eye wash station centrally located and kept stocked with emergency supplies.

### First-Aid Kit

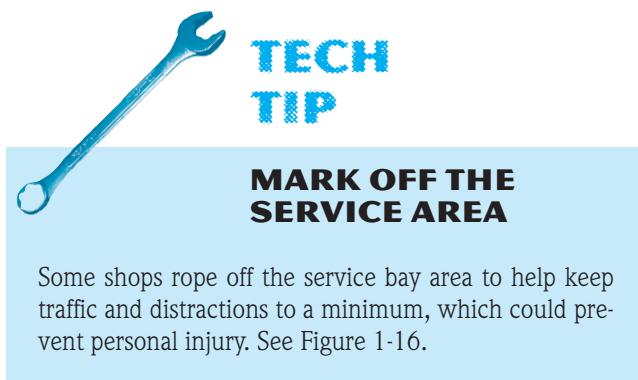
A first-aid kit should include:

- Bandages (variety)
- Gauze pads
- Roll gauze
- Iodine swab sticks
- Antibiotic ointment
- Hydrocortisone cream
- Burn gel packets
- Eye wash solution
- Scissors
- Tweezers
- Gloves
- First-aid guide

See Figure 1-14. Every shop should have a person trained in first aid. If there is an accident, call for help immediately.

### Eye Wash Station

An **eye wash station** should be centrally located and used whenever any liquid or chemical gets into the eyes. If such an emergency does occur, keep eyes in a constant stream of water and call for professional assistance. See Figure 1-15.



**FIGURE 1-13** A treated wool blanket is kept in this easy-to-open wall-mounted holder and should be placed in a centralized location in the shop.



**FIGURE 1-14** A first-aid box should be centrally located in the shop and kept stocked with the recommended supplies.



**FIGURE 1-15** A typical eye wash station. Often a thorough flushing of the eyes with water is the best treatment in the event of eye contamination.



**FIGURE 1-16** This area has been blocked off to help keep visitors from the dangerous work area.

## SUMMARY

1. All service technicians should wear safety glasses that meet standard ANSI Z87.1.
2. Ear protection should be worn anytime the noise level is at 90 decibels (dB) or higher.
3. Safety should be exercised when working with electrical cords or when jump-starting another vehicle.

4. If a fire extinguisher is needed, remember: pull the safety pin, aim the nozzle, squeeze the lever, and sweep the nozzle from side-to-side.

## REVIEW QUESTIONS

1. List four items that are personal protective equipment (PPE).
2. What are the types of fire extinguishers and their usage?
3. What items are included in a typical first-aid box?

## CHAPTER QUIZ

1. What do you call the service technician's protective head cover?
  - a. Cap
  - b. Hat
  - c. Bump cap
  - d. Helmet
2. All safety glasses should meet the standards set by \_\_\_\_.
  - a. ANSI
  - b. SAE
  - c. ASE
  - d. DOT
3. When washing hands, the water should be at what temperature?
  - a. 98°F (37°C)
  - b. 110°F (43°C)
  - c. 125°F (52°C)
  - d. 135°F (57°C)
4. Hearing protection should be worn anytime the noise level exceeds \_\_\_\_.
  - a. 60 dB
  - b. 70 dB
  - c. 80 dB
  - d. 90 dB
5. Two technicians are discussing the safe use of a wrench. Technician A says that a wrench should be pulled toward you. Technician B says that a wrench should be pushed away from you. Which technician is correct?
  - a. Technician A only
  - b. Technician B only
  - c. Both Technicians A and B
  - d. Neither Technician A nor B
6. Exhaust hoses should be used because one of the exhaust gases is deadly in high concentration. This gas is \_\_\_\_.
  - a. Carbon monoxide (CO)
  - b. Carbon dioxide (CO<sub>2</sub>)
  - c. Hydrocarbons (HC)
  - d. Oxides of nitrogen (NO<sub>x</sub>)
7. The process of combustion occurring without an open flame is called \_\_\_\_.
  - a. Direct ignition
  - b. Non-open flame combustion
  - c. Spontaneous combustion
  - d. Cold fusion
8. When using a fire extinguisher, what word can be used to remember what to do?
  - a. PASS
  - b. FIRE
  - c. RED
  - d. LEVER

- 9.** Which type of fire extinguisher is usable for most types of fires?
- a. CO<sub>2</sub>
  - b. Dry chemical
  - c. Water
  - d. CO
- 10.** Which item is usually *not* included in a first-aid kit?
- a. Eye wash solution
  - b. Antibiotic cream
  - c. Fire blanket
  - d. Bandages