

**The Pennsylvania State University  
Workforce Education and Development**

**Lesson Plan Template**

Name of Instructor: Brian Stevens
Program Title: Automobile/Automotive Mechanics Technology/Technician
Course Title: Automotive Mechanics
Unit Title: Cleaners and Lubricants
Lesson Title: General rules for using Cleaners and Lubricants
Lesson Performance Objective: Given information to follow manufacture's recommendation for proper use and storage of Cleaners, Lubricants, and Specialty Chemicals.
Time (length of lesson): 45-60 min.
Equipment and Materials needed: Information package and question sheet.
Technical Standard(s): 104, 105, 201, 204
Academic Standard(s): CIP 47.0604 Follow precisely the multi-step process.
Introduction: Students will read and answer questions on safe use and storage of automotive cleaners and lubricants used in an automotive shop.

Body: General rules for using Cleaners, Solvents, Specialty Cleaning Agents, and light/heavy Oils. Read information and answer questions.

Summary: Given information of safe use of shop materials used daily in an automotive shop to keep a safe, healthy work place.

Student Assessment:

Formative Assessment(s)

Summative Assessment:

Universal Design for Learning (UDL)

Multiple Means of Engagement:

Multiple Means of Representation:

Multiple Means of Expression:

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## UNIT 3: CLEANERS AND LUBRICANTS

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The following topics are addressed in this unit:

### Cleaners, Lubricants, and Specialty Chemicals

- General Rules
- Solvents
- Oils
- Greases
- Specialty Additives
- Specialty Chemicals

## CHAPTER 1: CLEANERS, LUBRICANTS, AND SPECIALTY CHEMICALS

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### GENERAL RULES

#### GENERAL RULES FOR USING CHEMICALS

There are many different types of chemicals used in the automotive service industry. This section will look specifically at some of the more common types of solvents, soaps, and cleaning solutions. First, let's look at some basic rules that apply to working with any type of chemical.



- Follow the manufacturer's recommendations.
- Carefully read the product label for correct uses and hazards.
- Work to prevent spills, damage to vehicles, or unsafe situations/conditions.
- Properly store chemicals and used rags.
- Use chemicals only for the intended purposes.

**CAUTION:** Consult the instructor before using any unfamiliar product.



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## SOLVENTS

### TYPES AND USES OF SOLVENTS AND CLEANERS

#### Parts-Washing Solvent (petroleum-based)

Petroleum-based **parts-washing solvent** dissolves oil, grease, and varnish from engine components and other parts of the vehicle. It is usually dispensed in a parts-washing tank that filters and recycles the solvent.



This solvent contains **volatile organic compounds (VOCs)** that give off toxic vapors and must be managed as a hazardous waste. Parts-washing solvent is not as flammable as some other solvents, but it can burn and does present a fire hazard. Keep electrical devices, sparks, and any hot material away from the parts-washing tank. The solvent tank should be equipped with a safety link, which will melt should the solvent ignite. When the safety link melts, the lid on the washer tank will close and smother the fire.

Parts-washing solvent presents a hazard to the eyes and skin, especially when the solvent is fresh, and breathing solvent vapors is also a health risk. Wear personal protective equipment (PPE) when working with any solvent. These PPEs may include proper gloves and a respirator. Eye protection is always required in a shop environment.

**CAUTION:** Some technicians may have a severe allergic reaction to the parts-washing solvent.

Petroleum-based parts-washing solvent can melt some shoe rubber and should never be splashed or poured on the shop floor. If a solvent spill is not immediately wiped up from the floor, it can cause others to slip and fall. Never put items such as electric motors in a solvent tank as they can sustain insulation damage. To extend the usable life of solvents, and to avoid clogging the tank, remove most of the grease, gasket material, and dirt from parts before washing. Never pour any other liquids into any solvent tank.

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## **Parts-Washing Solvent (water-based)**

Water-based (also called aqueous-based) **Parts-Washing Solvent** is used for the same purposes as the petroleum-based solvents, but it is typically nonflammable and contains less than 5% VOCs. Besides water, the ingredients in aqueous-based solvents generally include a detergent, corrosive substance, or alkaline agent and a rust inhibitor. Rather than dissolving grease and solids with chemicals, aqueous solvents use heat, pressure, agitation, and detergents to clean automotive parts. These water-based solvents remove oil and lubricants from the cleaned parts. They must be dried and lubricated once the cleaning process is complete to prevent rusting of metal parts.

Aqueous-based solutions use special equipment that heats the solvent and sprays it with great force; essentially like a pressure washer. Spray cabinets, which are completely enclosed, are best for cleaning heavily soiled parts or a large number of parts. Sink-top units can be used for more lightly soiled parts or for fewer parts.

The life of a solvent can be prolonged by using filters, maintaining the solvent's concentration, and skimming grease from the solution. As it is used, aqueous solvent may also become hazardous waste. Waste disposal professionals can analyze the solution to determine how to dispose of it properly.

## **Other Cleaners - Choke and Throttle Body, Brake, and Gasket Remover**

All of the following cleaners are extremely flammable and present a dangerous fire hazard, either because the substance burns, or because of the propellant in its aerosol can. Never spray these cleaners on hot engine parts or around sparks or fire. Also, do not spray these cleaners near the face since they can damage painted surfaces. In addition, the cleaners can not only damage eyes and irritate skin, but breathing its vapors is also hazardous. As a result, users of these products should always wear PPE and spray the cleaners away from the body so that vapors are not inhaled and the cleaners do not contact the skin. Safety warnings on the cans should always be observed, and lastly, do not store, or expose, any of these substances to heat, under any circumstances, since heat can cause their containers to explode.

### **Choke and Throttle Body Cleaner**

Choke and Throttle Body Cleaner is an aerosol product that is more aggressive than parts-washing solvent in cleaning oil, grease, and varnish from carburetor components or other small precision-machined parts. It is a petroleum-based product.

### **Brake Cleaner**

Brake Cleaner is an aerosol product that is extremely effective in removing grease and oil from brake drums, rotors, and engine flywheels.

### **Gasket Remover**

Gasket Remover is an aerosol product that loosens gasket material that may be tightly stuck to engine components with sealers or glue.

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## Specialty Cleaning Agents

There are many specialty cleaning agents which are used in an automotive environment. As with all chemicals, always follow the manufacturer's recommendations and only use the cleaners for their intended purpose.

Some examples of specialty cleaners include the following:

- Spot remover
- Bug and tar remover
- Upholstery cleaner
- Carpet cleaner
- Vinyl cleaner and conditioner
- Battery cleaner
- Wire wheel cleaner
- White sidewall cleaner

**CAUTION:** Gasoline is intended for use as a fuel, not as a cleaner for automotive parts. DO NOT use gasoline as a solvent. Gasoline fumes can cause similar health problems as cleaning solvents and contribute to hydrocarbon emissions. The fumes are also extremely flammable and, if ignited, can cause severe burns or death. Gasoline additives can also leave harmful deposits on important engine components.

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## OILS

### General Rules for Using Oils

Oil is a petroleum-based, or synthetic, product that lubricates parts or acts as a hydraulic fluid. When using oils, follow the precautions below.

**CAUTION:** Wear personal protective equipment (PPE) when working with oils.



All types of oils can represent a significant fire hazard. Spontaneous combustion, fire initiated without flame, can and does occur with rags soaked in any type of oil. Oil must be stored in a designated area away from heat, flame, or sparks. Oily rags must be stored in a metal safety container with an airtight lid built for this purpose. Oil can ignite at any temperature above 0° when mixed with pure oxygen. Oil must never be applied to oxyacetylene welding equipment. Immediately use or discard bottles and cans that are leaking oil.

If oil is dripped or spilled on a shop floor, clean it immediately and, if necessary, scrub the remaining slickness with soap and water.

Avoid prolonged contact with oils. Short-term contact can cause irritation, chapping, or drying of the skin. Long-term contact can cause a variety of skin diseases that includes cancer.



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### Light or Penetrating Oils

Light or penetrating oils are aerosol products that include rust-penetrating oil, silicone lubricant, liquid graphite, and belt dressing. Light oils are used to lubricate precision parts because the lubricant gets into tight clearances and does not attract as much dust and dirt as heavier oils. Because they can dissolve some rust, rust-penetrating oils are used to aid in the removal of rusty bolts and fasteners. Liquid graphite dries to a slick, black coating that does not attract any dust or dirt. This makes it desirable for components with tiny moving parts, such as locks.

**CAUTION:** Aerosol cans are pressurized. The can must not be punctured or crushed, even when empty. The can should not be stored near heat or sparks. Never spray these products towards the body.



### Standard and Heavy Oils

Standard and heavy oils are motor oil, automatic transmission fluid, power steering fluid, and gear lube.

**Motor/engine oils** are used in vehicle engines and classified by viscosity or weight (e.g., 10W-30) and a two-letter grade (e.g., SJ and SL). Refer to the manufacturer's recommendation for the correct viscosity and service classification for the vehicle being serviced. Refer to the vehicle service information for the proper interval for changing the motor oil.

Engine oils are typically categorized into several types based on needs of an engine as determined by the Society of Automotive Engineers (SAE): Regular/conventional, semi-synthetic, synthetic and high mileage. Regular oils come from within the earth. Semi-synthetic is a blend of man-made chemicals and regular oil. Full synthetic is chemically created with no oil from within the earth. High mileage is a combination of oils and additives to assist in lubricating engines with wear, and reducing leaks and usage associated with high mileage engines.

The SAE and manufacturers determine what type, grade, and weight of oil should be used in each build. The American Petroleum Institute (API) and International Lubricant Standards Advisory Committee (ILSAC) then perform testing procedures to ensure that the lubricants meet or exceed SAE/Original Equipment Manufacturers (OEM) requirements.

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Engine oils have labeling to tell the user what is in the container, what grade it is, and what level it conforms to such as SN/SP, etc. Most engines use a multi-weight oil such as 5W30. It is a base weight oil of 5W when cold and gives the lubricating quality of a 30W at normal operating temperature. And, if you didn't know, the "W" in the weight means winter. Always refer to manufacturer's requirements for selecting a quality engine oil.

**Automatic transmission fluid (ATF)** is available in three main types: Type F, Dexron III, and Mercon V. ATF is used in all automatic transmissions and some manual-shift, front-wheel-drive transaxles. Some vehicle manufacturers recommend using only their products that include specific additives. **Refer to the manufacturer's recommendation when selecting and using ATF.**

**Power steering fluid** is similar to ATF. Refer to the manufacturer's recommendation when selecting and using power steering fluid.

**Gear lube** is thicker than motor oil (80-90 weight) or ATF and provides superior lubrication between the large and highly stressed gears of manual gear boxes and differentials.

### Hydraulic Fluids

Hydraulic fluids include hydraulic jack oil and brake fluids.

**Hydraulic Jack Oil** is used in shop equipment that has hydraulic cylinders, such as jacks, engine hoists, lift racks, and forklifts.

**CAUTION:** Do not add hydraulic jack oil to shop equipment without the permission and supervision of the instructor.

**Brake Fluid** is used in both hydraulic brake systems and manual transmission hydraulic clutch systems. Brake fluids are rated at DOT-3 (Department of Transportation Specification #3) or DOT-4, although there are a few applications that use silicone-based DOT 5.0 or 5.1. Using the incorrect brake fluid can result in brake fade, the deterioration of rubber seals, or complete brake failure.

Most hydraulic fluids, especially brake fluid, attack and dissolve paint. Cover fenders when adding brake fluid. Thoroughly wash hands immediately after contact with brake fluid.

**Note:** If you suspect that brake fluid has contacted a painted surface, immediately wash that surface with soap and water.

Hydraulic fluids, especially brake fluid, must be capped tightly to prevent dirt and moisture from contaminating the fluid. Small amounts of moisture can turn to steam when brake fluid becomes hot, during brake application, which will reduce the effectiveness of the brakes. Hydraulic fluids must be stored in a designated area away from heat, flame, or sparks.

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## GREASES

### General Rules for Working With Greases

Grease, rather than oil, is used when a lubricant must remain on parts for a long period of time and endure high pressure. When working with greases, follow the precautions below.

**CAUTION:** Always wear PPE when working with greases.

- Greasy rags are susceptible to spontaneous combustion, and therefore, must be stored in a metal safety container with an airtight lid.
- Grease products must be stored in a designated area away from heat, flame, or sparks.
- Wipe up all grease spills and clean the area immediately with soap and water.
- Avoid prolonged contact with greases. Short-term contact can cause skin irritation, chapping, or drying of the skin while long-term contact can cause a variety of skin diseases, including cancer.

### Types and Uses of Greases

**Multipurpose grease** is suitable for lubricating such items as steering linkage components and wheel bearings. Multipurpose grease can also be used as an assembly lube when installing bearings in a manual-shift transmission. Read the information on the lubrication label before using multipurpose grease to be sure that it is recommended for the planned application.

**Wheel bearing grease** is suitable for steering linkage components and wheel bearings. If you are packing wheel bearings on a disc brake system, or other high heat application, use an extreme-pressure (EP) wheel bearing grease that is compatible with disc brakes.

**Cam lubricant** is sometimes included with a new camshaft and can help with breaking in the camshaft.

**White lithium grease** is a general-purpose lubricant, available in either a tube or aerosol can, that can be used to lube hood hinges, door hinges, cables, linkages, and for shop equipment maintenance.

Some light-colored greases, such as white lithium grease, are not compatible with ATF and should not be used as an assembly lube, or as a prelube, for internal transmission parts.

**Stick lubricants** are used on door strikers since they do not stain clothing.

**Dielectric grease** is used to seal electrical connections to keep out dirt, corrosion, and moisture, while still maintaining electrical connectivity.

**Brake system silicone compound** is a greaselike lubricant used to lube sliders, rubber parts, or plastic parts on brake systems.

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## SPECIALTY ADDITIVES

### TYPES AND USES OF SPECIALTY ADDITIVES

**Specialty additives** include oil treatment, gas treatment, transmission conditioner, and starting ether. Refer to the container label for hazard warnings and handling procedures.

**CAUTION:** Always wear PPE when working with specialty additives.

**Oil treatments** are used to raise motor oil viscosity or to free sticking valves or lifters. Raising the motor oil viscosity can extend engine life by increasing oil pressure.

**Note:** Adding too much oil treatment can result in poor lubricating properties or oil that exceeds the proper viscosity, especially in cold weather.

**Gas treatment**, is used to help reduce moisture in gasoline and eliminate buildup of carbon, gum, and varnish in fuel lines. Gas treatment usually contains alcohol. Excessive amounts of methanol can destroy rubber carburetor or fuel system components and damage the lining of the fuel tank.

**Transmission conditioner** is added to automatic transmission fluid to prolong the life of the fluid and improve the shifting performance of worn transmissions.

**Starting fluid** is sometimes used to start an engine in extreme cold. The directions for using starting ether must be followed carefully.

**CAUTION:** Starting ether is extremely flammable and can create an explosion if the engine backfires.

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## SPECIALTY CHEMICALS

### TYPES AND USES OF SPECIALTY CHEMICALS

There are numerous **specialty chemicals** used in the automotive service industry. Common specialty chemicals include sealers, locking and anti-seize compounds, and adhesives.

**CAUTION:** Always wear PPE when working with specialty chemicals.

#### Sealers

The two broad types of automotive sealers are hardening and non-hardening. **Hardening sealers** form a hard seal between components and are used to seal permanent assemblies and fill gaps in irregular surfaces. **Non-hardening sealers** remain pliable and are used in applications that are exposed to vibration, expansion, and contraction.

**Room temperature vulcanizing sealer (RTV)**, typically available in a tube, is a special rubber that sets up at room temperature and forms a seal between components. RTV is aerobic, which means it cures when exposed to air, and is typically used in place of a rubber or fiber gasket. RTV comes in different colors for different applications. Make sure you select the right product for the area you are working on.

**Note:** Some RTVs cannot be used on engines in vehicles equipped with oxygen sensors as they can damage those components.

**Gasket sealers**, applied with a brush or from a tube, help to ensure a good seal between gaskets and irregular surfaces. These sealers are anaerobic, which means they will cure only in the absence of air.

**Thread Sealant** is used to seal threads and bolts that are exposed to liquids, usually lubricating oil or coolant.

#### Locking and Anti-Seize Compounds

**Locking compounds** prevent fasteners from loosening by acting as a sort of lock washer. Locking compounds have various strengths that range from "wrench removal" to "permanently bonded." The color of the product produces different locking protection. Choose the type needed for the application. Note that certain locking compounds, when used, require the use of heat to remove.

**Anti-seize compounds** prevent threaded fasteners from becoming permanently bonded to another component and are used when the fastener is made of a different type of metal from the component to which it is attached. One use is when installing steel spark plugs in aluminum cylinder heads.

#### Adhesives

Two common adhesives are Weatherstrip adhesive, (also used as gasket adhesive) and rearview mirror adhesive.

**Weatherstrip** is used to glue gaskets to metal and weather strips to a vehicle's doors and trunk

**Rearview mirror adhesive** is used to glue inside rearview mirrors to the windshield.



## Cleaners and Lubricants

Name \_\_\_\_\_

1. There are many types of \_\_\_\_\_ used in the automotive service industry.
2. \_\_\_\_\_-based parts-washing solvent dissolves oil, grease, and varnish from engine components and other parts of the vehicle.
3. Parts-washing solvent presents a hazard to the \_\_\_\_\_ and \_\_\_\_\_.
4. \_\_\_\_\_ and \_\_\_\_\_ cleaner is an aerosol product that is more aggressive than parts-washing solvent in cleaning oil, grease, and varnish from carburetor components or other small precision-machined parts.
5. \_\_\_\_\_ is an aerosol product that is extremely effective in removing grease and oil from brake drums, rotors, and engine flywheels.
6. \_\_\_\_\_ is intended for use as a fuel, not as a cleaner for automotive parts.
7. \_\_\_\_\_ oils are used in vehicle engines and classified by viscosity or weight.
8. \_\_\_\_\_ is thicker than motor oil and provides superior lubrication between the large and highly stressed gears of manual gear boxes and differentials.
9. \_\_\_\_\_ fluids include hydraulic jack oil and brake fluids.
10. \_\_\_\_\_, rather than oil, is used when a lubricant must remain on parts for along period of time and endure high pressure.

