**ỦY BAN NHÂN DÂN THÀNH PHỐ HỒ CHÍ MINH**

**TRƯỜNG CAO ĐẲNG KINH TẾ KỸ THUẬT**

**THÀNH PHỐ HỒ CHÍ MINH**

ISO 9001 - 2008

# GIÁO TRÌNH

# MÔN HỌC: TIẾNG ANH CHUYÊN NGÀNH Ô TÔ

**NGÀNH/NGHỀ: BẢO TRÌ VÀ SỬA CHỮA Ô TÔ**

**TRÌNH ĐỘ: TRUNG CẤP**

*(Ban hành kèm theo Quyết định số: /QĐ-CĐKTKT ngày tháng năm 20 của Hiệu trưởng Trường Cao đẳng Kinh tế - Kỹ thuật Thành phố Hồ Chí Minh)*

**Thành phố Hồ Chí Minh, năm 2018**

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**THÔNG TIN CHỦ NHIỆM ĐỀ TÀI**

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| TRƯỞNG KHOA | TỔ TRƯỞNG BỘ MÔN | CHỦ NHIỆM ĐỀ TÀI |
|---|---|---|

**HIỆU TRƯỞNG**

**DUYỆT**

**Thành phố Hồ Chí Minh, năm 2018**

## TUYÊN BỐ BẢN QUYỀN

# LỜI GIỚI THIỆU

Để thực hiện biên soạn giáo trình đào tạo nghề BẢO TRÌ VÀ SỬA CHỮA Ô TÔ ở trình độ Trung Cấp Nghề, giáo trình Tiếng Anh chuyên ngành Ô tô là một trong những giáo trình môn học đào tạo chuyên ngành được biên soạn theo nội dung chương trình khung được Bộ Lao động Thương binh Xã hội và Tổng cục Dạy Nghề phê duyệt. Nội dung biên soạn ngắn gọn, dễ hiểu, tích hợp kiến thức và kỹ năng chặt chẽ với nhau, logíc.

Khi biên soạn, người biên soạn đã cố gắng cập nhật những kiến thức mới có liên quan đến nội dung chương trình đào tạo và phù hợp với mục tiêu đào tạo, nội dung lý thuyết và thực hành được biên soạn gắn với nhu cầu thực tế trong sản xuất đồng thời có tính thực tiễn cao. Nội dung giáo trình được biên soạn với dung lượng thời gian đào tạo 45 giờ gồm có:

UNIT 1: INTERNAL COMBUSTION ENGINE

UNIT 2: ELECTRICAL SYSTEMS

UNIT 3: FUEL SYSTEM

UNIT 4: COOLING SYSTEM

UNIT 5: LUBRICATION SYSTEM

UNIT 6: BRAKE SYSTEM

UNIT 7: POWERTRAIN SYSTEM

UNIT 8: STEERING SYSTEM

Trong quá trình sử dụng giáo trình, tuỳ theo yêu cầu cũng như khoa học và công nghệ phát triển có thể điều chỉnh thời gian và bổ sung những kiên thức mới cho phù hợp. Trong giáo trình, người biên soạn có đề ra nội dung thực tập của từng bài để người học cũng cố và áp dụng kiến thức phù hợp với kỹ năng.

Tuy nhiên, tùy theo điều kiện cơ sở vật chất và trang thiết bị, giáo viên có thể sử dụng cho phù hợp. Mặc dù đã cố gắng tổ chức biên soạn để đáp ứng được mục tiêu đào tạo nhưng không tránh được những khiếm khuyết. Rất mong nhận được đóng góp ý kiến của các thầy, cô giáo, bạn đọc để người biên soạn sẽ hiệu chỉnh hoàn thiện hơn.

.

*TP.HCM, ngày…. tháng… năm 20..*

Người biên soạn

**Phạm Thị Thanh Trúc**

# MỤC LỤC

# GIÁO TRÌNH MÔN HỌC

**Tên môn học: TIẾNG ANH CHUYÊN NGÀNH Ô TÔ**

**Mã môn học: 2107012**

**Vị trí, tính chất, ý nghĩa và vai trò của môn học/mô đun:**

- Vị trí: Học phần TACN ô tô được giảng dạy ở HK3 của chương trình đào tạo ngành bảo trì sửa chữa ô tô bậc trung cấp

- Tính chất: Là môn học chuyên môn bắt buộc của chuyên ngành ô tô.

- Ý nghĩa và vai trò của môn học/mô đun:

**Mục tiêu của môn học/mô đun:**

- Về kiến thức:

  + Đọc và trình bày được nội dung của tài liệu chuyên ngành cơ bản trong lĩnh vực ô tô.
  + Trình bày được tên gọi bằng tiếng anh của các chi tiết tre6nc ác hệ thống ô tô
  + Miêu tả được các chi tiết trên ô tô bằng tiếng Anh.

- Về kỹ năng:

  + Truy cập internet tìm kiếm tài liệu chuyên ngành bắng tiếng Anh.
  + Tìm kiếm được tên tiếng Anh của các phụ tùng trên ô tô

- Về năng lực tự chủ và trách nhiệm:

  + Phân tích được tầm quan trọng của học phần tiếng Anh chuyên ngành trong chương trình đào tạo chuyên ngànhvà trong thực tế việc làm sau khi tốt nghiệp
  + Thái độ học tập nghiêm túc, tham gia thảo luận và làm việc nhóm

# UNIT 1: INTERNAL COMBUSTION ENGINE

**Objectives:**

After studying this unit, you should be able to recognize the structure and operation principle of internal combustion engine.

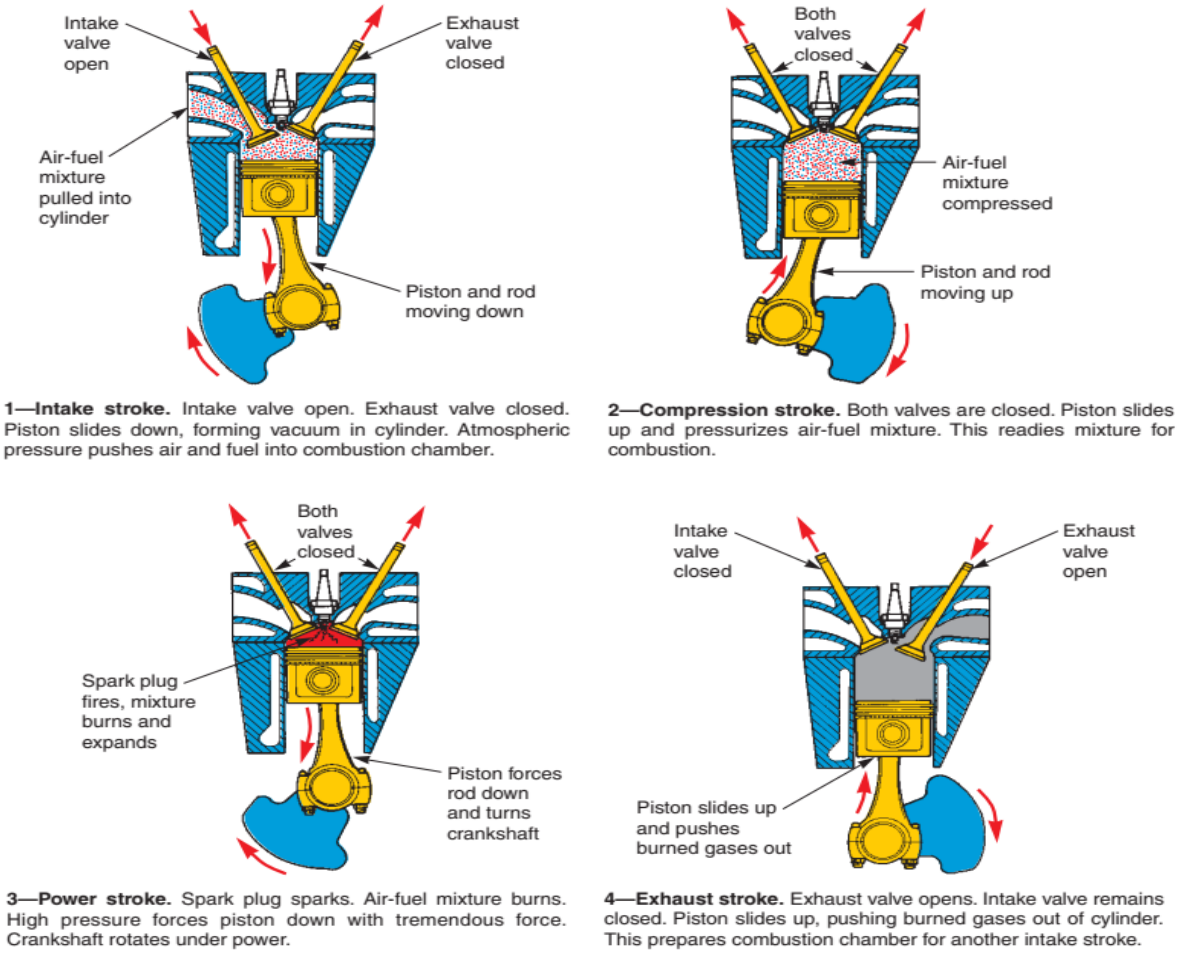
**Introduction:**

Unit 1 supplies students with knowledge of the structure and operation principle of gasoline four strokes engine, gasoline two strokes engine, diesel four strokes engine, and diesel two strokes engine.

**Main content:**

## 1.1 Gasoline four strokes engine

### 1.1.1 Structure




**1—Intake stroke.** Intake valve open. Exhaust valve closed. Piston slides down, forming vacuum in cylinder. Atmospheric pressure pushes air and fuel into combustion chamber.

**2—Compression stroke.** Both valves are closed. Piston slides up and pressurizes air-fuel mixture. This readies mixture for combustion.

**3—Power stroke.** Spark plug sparks. Air-fuel mixture burns. High pressure forces piston down with tremendous force. Crankshaft rotates under power.

**4—Exhaust stroke.** Exhaust valve opens. Intake valve remains closed. Piston slides up, pushing burned gases out of cylinder. This prepares combustion chamber for another intake stroke.

**Figure 1.1- Gasoline four strokes engine**

### 1.1.2 Operation principle

Automobile engines normally use a four-stroke cycle. Four separate piston strokes (up or down movements) are needed to produce one cycle (complete series of events). The piston must slide down, up, down, and up again to complete one cycle.

As the four strokes are described below, study the simple drawings in Figure 1-1.

1. The intake stroke draws the air-fuel mixture into the engine's combustion chamber. The piston slides down while the intake valve is open and the exhaust valve is closed. This produces a vacuum (low-pressure area) in the cylinder. Atmospheric pressure (outside air pressure) can then force air and fuel into the combustion chamber.
2. The compression stroke prepares the air-fuel mixture for combustion. With both valves closed, the piston slides upward and compresses (squeezes) the trapped air-fuel mixture.
3. The power stroke produces the energy to operate the engine. With both valves still closed, the spark plug arcs (sparks) and ignites the compressed air-fuel mixture. The burning fuel expands and develops pressure in the combustion chamber and on the top of the piston. This pushes the piston down with enough force to keep the crankshaft spinning until the next power stroke.
4. The exhaust stroke removes the burned gases from the combustion chamber. During this stroke, the piston slides up while the exhaust valve is open and the intake valve is closed. The burned fuel mixture is pushed out of the engine and into the exhaust system.

During engine operation, these four strokes are repeated over and over. With the help of the heavy flywheel, this action produces smooth, rotating power output at the engine crankshaft.

Obviously, other devices are needed to lubricate the engine parts, operate the spark plug, cool the engine, and provide the correct fuel mixture. These devices will be discussed shortly.

## 1.2 Gasoline two strokes engine

### 1.2.1 Structure

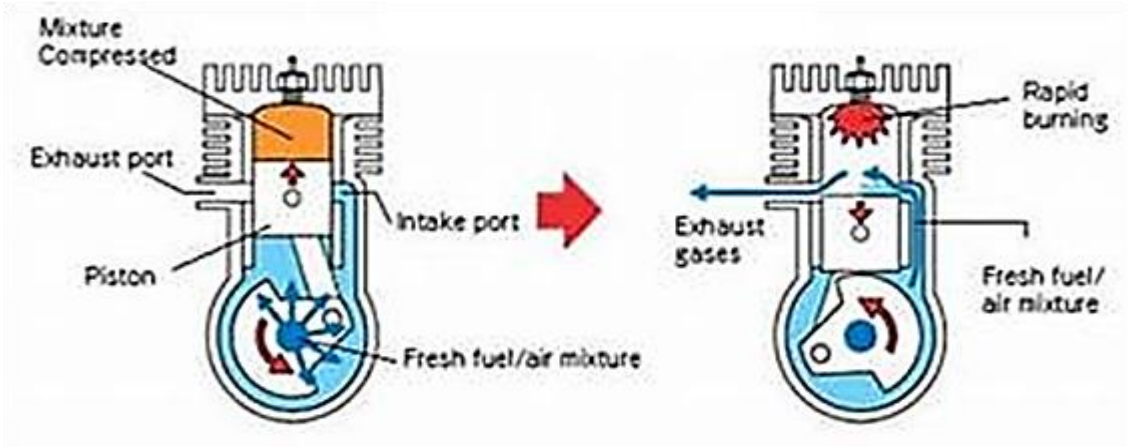



**Figure 1.2- Gasoline four strokes engine**

### 1.2.2 Operation principles

A two stroke engine is a type of internal combustion engine which completes a power cycle with two strokes of the piston during only one crankshaft revolution.

In four stroke engines, there is one working stroke in two revolutions of the crankshaft or in a cycle of four strokes of the piston. The desire of one working stroke in every revolution of the crankshaft has led to the development of two stroke engine.

In 1838, Barnett, an Englishman, described the mechanism for supplying a charge to the cylinder by means of separate pumps. In 1878, Dugald Clerk also made a lot of contribution in this direction and described a two stroke cycle known as Clerk Cycle.

The two-stroke engine employs for small powers required in autocycles, scooters, motorcycles. In two-stroke engines, there is no suction and exhaust strokes. There are only two remaining strokes the compression stroke and power stroke. These are usually called the upward stroke and downward stroke. Also, instead of valves, there are inlet and exhaust ports in two-stroke engines.

Fresh charge enters the cylinder at the end of the working stroke through the inlet port. And then burnt exhaust gases are forced out through the exhaust port by a fresh charge.

*1. Upward Stroke*

During upward stroke, the piston moves upward from the bottom dead centre to top dead centre. By compressing the charge air petrol mixture in the combustion chamber of the cylinder. Due to upward movement of the piston, a partial vacuum is created in the crankcase.

And a new charge is drawn into the crankcase through the uncovered inlet port. The exhaust port and transfer port are covered when the piston is at the top dead centre position. The compressed charge is ignited in the combustion chamber by a spark given by the spark plug.

*2. Downward Stroke*

As soon as the charge is ignited the hot gases compress the piston which moves downward, rotating the crankshaft thus doing the useful work. During this stroke, the inlet port is covered by the piston and the new charge is compressed in the crankcase. Further downward movement of the piston uncovers first the exhaust port and then the transfer port. and hence the exhaust starts through the exhaust port.

As soon as transfer port is open, the charge through it is forced into the cylinder. The charge strikes the deflector on the piston crown, rises to the top of the cylinder and pushes out most of the exhaust gases. The piston is now at the bottom dead centre position.

The cylinder is completely filled with a fresh charge, although it is somewhat with the exhaust gases. The cycle of events is then repeated, the piston making two strokes for each revolution of the crankshaft.

## 1.3 Diesel four strokes engine

### 1.3.1 Structure

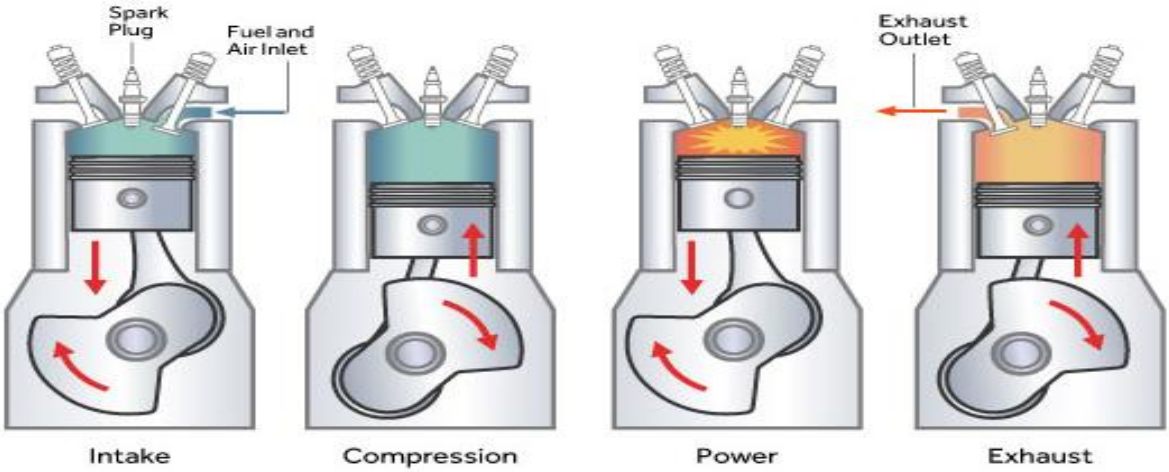



**Figure 1.3- Diesel four strokes engine**

### 1.3.2 Operation principles

Basically, there are two types of diesel engine types - the Four Stroke and Two Stroke. The 'Diesel Cycle' uses higher Compression-Ratio. It was named after German engineer Rudolph Diesel, who invented and developed first Four-Stroke diesel engine. The four strokes of the diesel cycle are similar to that of a petrol engine. However, the 'Diesel Cycle' considerably defers by the way the fuel system supplies the diesel the engine and ignites it.

A conventional internal combustion diesel engine works on 'Diesel Cycle'. In the simple diesel engines, an injector injects diesel into the combustion chamber above the piston directly. The 'Compression-Ignition engine' is also another name for the Diesel engine. This is mainly because it burns the diesel with hot and compressed air. The temperature of the air inside the combustion chamber rises to above 400°c to 800°c. This, in turn, ignites the diesel injected into the combustion chamber. Thus, the 'Diesel Cycle' does not use an external mechanism such as a spark-plug to ignite the air-fuel mixture.

The Four-Stroke diesel engine works on the following cycle:

1. Suction Stroke – With pistons moving downwards and the opening of the inlet valve creates the suction of clean air into the cylinders.
2. Compression – With the closing of Inlet valve the area above the piston gets closed. The piston moves up resulting in compression of the air in a confined space under higher compression-ratio.

   Combustion Process – At this stage, the injector sprays the diesel into the combustion chamber. The rise in temperature of the air caused by its compression; results in instantaneous burning of diesel with an explosion. This causes heat to release which generates expanding forces known as power.
3. Power Stroke – Furthermore, these forces again push the pistons downwards resulting in their reciprocating motion.

4. Exhaust Stroke – On their way up, the pistons push the exhaust gases above them through the exhaust valve which opens during the exhaust stroke.

This cycle repeats itself until the engine turns off, resulting in the continuance of engine's running.

A diesel engine is mainly classified into two types - Indirect-Injection (IDI) & Direct-injection (DI). The Direct-Injection diesel cycle was an earlier generation technology. It later evolved into its successor & more advanced CRDi. Earlier generation utility vehicles, trucks, buses & generators still widely use the simple DI engines. Furthermore, sophisticated & refined CRDi engines became very popular in the Sedans, MPVs, SUVs and Luxury cars in the recent past.

## 1.4 Diesel two strokes engine

### 1.4.1 Structure

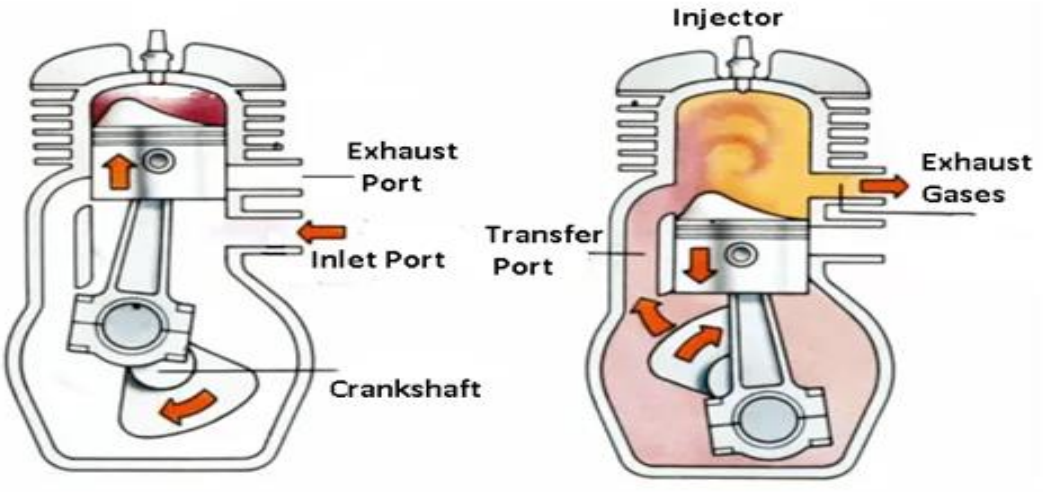



**Figure 1.4- Diesel two strokes engine**

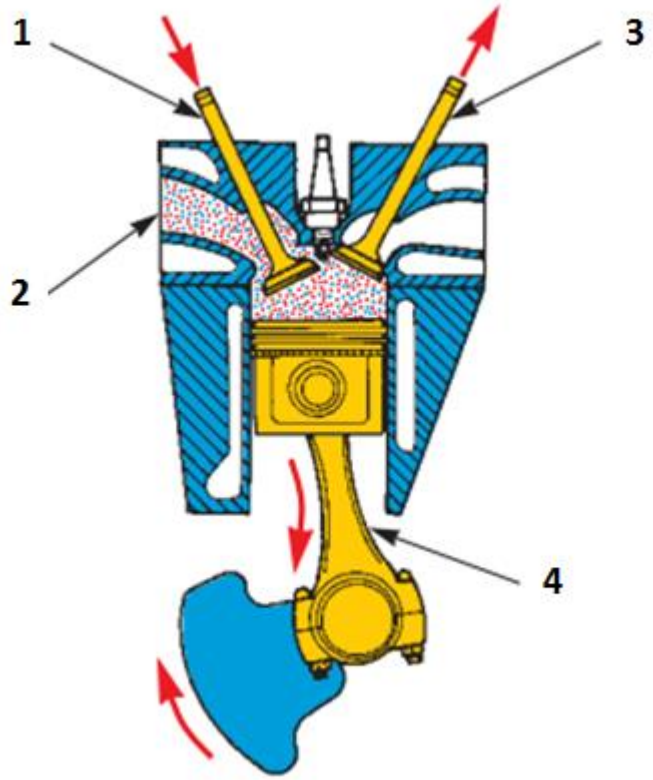
### 1.4.2 Operation principles

In this two stroke engine, only air is compressed inside the cylinder. and the fuel (diesel) is injected by an injector fitted in the head of the cylinder. There is no spark plug in this engine. The remaining operations of the two stroke compression ignition engine are exactly the same. as those of the spark ignition engine.

## 1.5 Exercise

1. Name parts of gasoline four strokes engine, gasoline two strokes engine, diesel four strokes engine, and diesel two strokes engine.

2. What is the stroke below? Can you identify the following parts? Write the correct letter and words next to each number.




A. Exhaust valve closed

B. Air-fuel mixture pulled into cylinder

C. Piston and rod moving down

# UNIT 2: ELECTRICAL SYSTEMS

UNIT 2: ELECTRICAL SYSTEMS

**Objectives:**

After studying this unit, you should be able to recognize the structure and function of electrical systems.

**Introduction:**

Unit 2 supplies students with knowledge of the structure and function of Starting system, Charging system, Ignition system, Lighting system, and Horn system.

**Main content:**

## 2.1 Starting system

### 2.1.1 Structure and function

The starting system has a powerful electric starting motor that rotates the engine crankshaft until the engine 'fires' and runs on its own power. The major parts of the starting system are shown in Figure 2.1.

### 2.1.2 Wiring Diagram

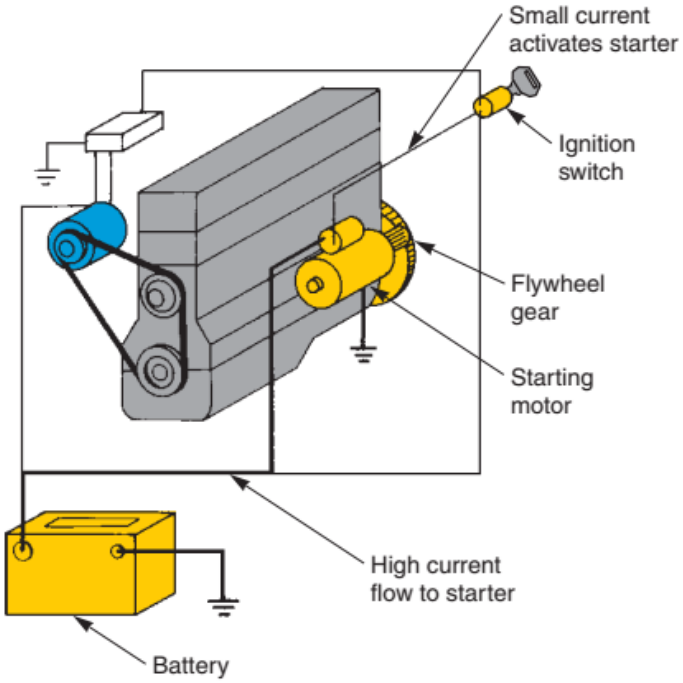



**Figure 2.1- Starting system**

### 2.1.3 Operation principle of staring system

A battery provides the electricity for the starting system. When the key is turned to the start position, current flows through the starting system circuit. The starting motor is energized, and the starting motor pinion gear engages a gear on the engine flywheel. This spins the crankshaft. As soon as the engine starts, the driver must shut off the starting system by releasing the ignition key.

## 2.2 Charging system

### 2.2.1 Structure and function

The charging system is needed to replace electrical energy drawn from the battery during starting system operation. To re-energize the battery, the charging system forces electric current back into the battery. The fundamental parts of the charging system are shown in Figure 2.2.

### 2.2.2 Wiring Diagram

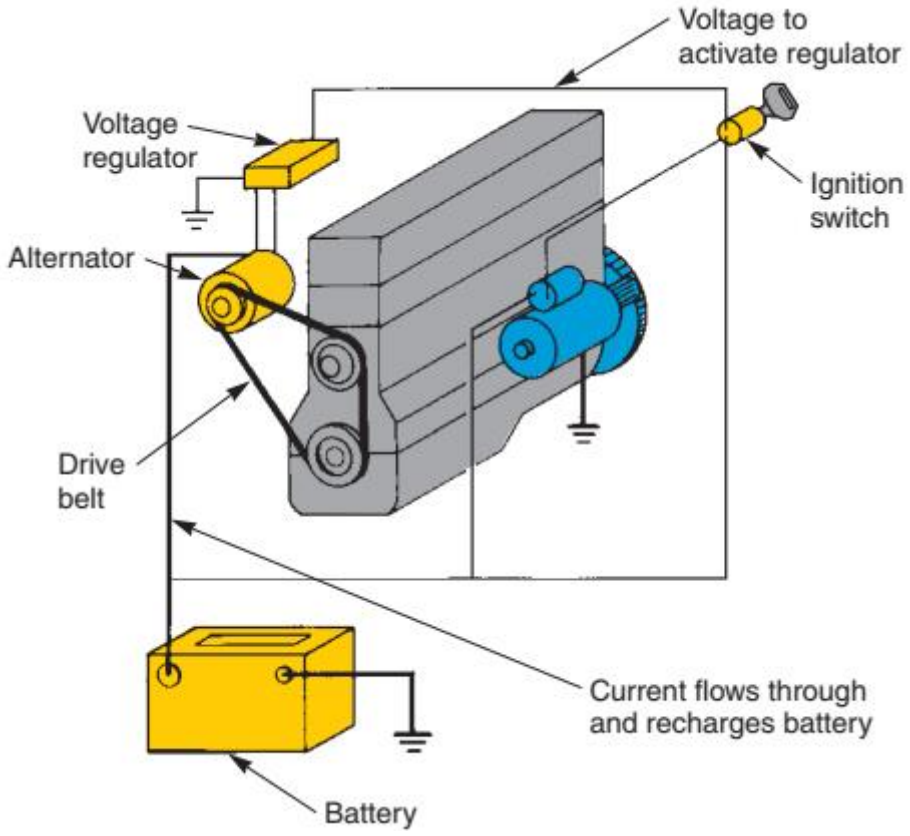



**Figure 2.2- Charging system**

### 2.2.3 Operation principle of charging system

When the engine is running, a drive belt spins the alternator pulley. The alternator (generator) can then produce electricity to recharge the battery and operate other electrical needs of the vehicle. A voltage regulator, usually built into the alternator, controls the voltage and current output of the alternator.

## 2.3 Ignition system

### 2.3.1 Structure and function

An ignition system is needed on gasoline engines to ignite the air-fuel mixture. It produces an extremely high voltage surge, which operates the spark plugs. A very hot electric arc jumps across the tip of each spark plug at the correct time. This causes the air-fuel mixture to burn, expand, and produce power. Study Figure 2.3.

### 2.3.2 Wiring Diagram

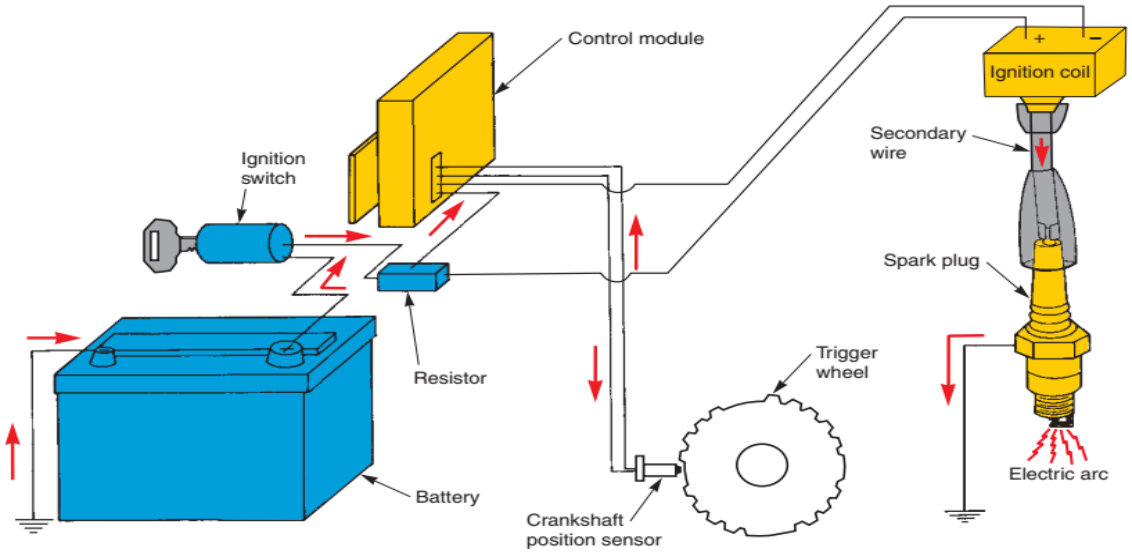



**Figure 2.3- Ignition system**

### 2.3.3 Operation principle of staring system

With the ignition switch on and the engine running, the system uses sensors to monitor engine speed and other operating variables. Sensor signals are fed to the control module. The control module then modifies and amplifies (increases) these signals into on-off current pulses that trigger the ignition coil. When triggered, the ignition coil produces a high voltage output to 'fire' the spark plugs. When the ignition key is turned off, the coil stops functioning and the spark-ignition engine stops running.

## 2.4 Lighting system

### 2.4.1 Structure and function

The lighting system consists of the components that operate a vehicle's interior and exterior lights (fuses, wires, switches, relays, etc.).

### 2.4.2 Wiring Diagram

The exact circuit and part configurations will vary from one model to another.

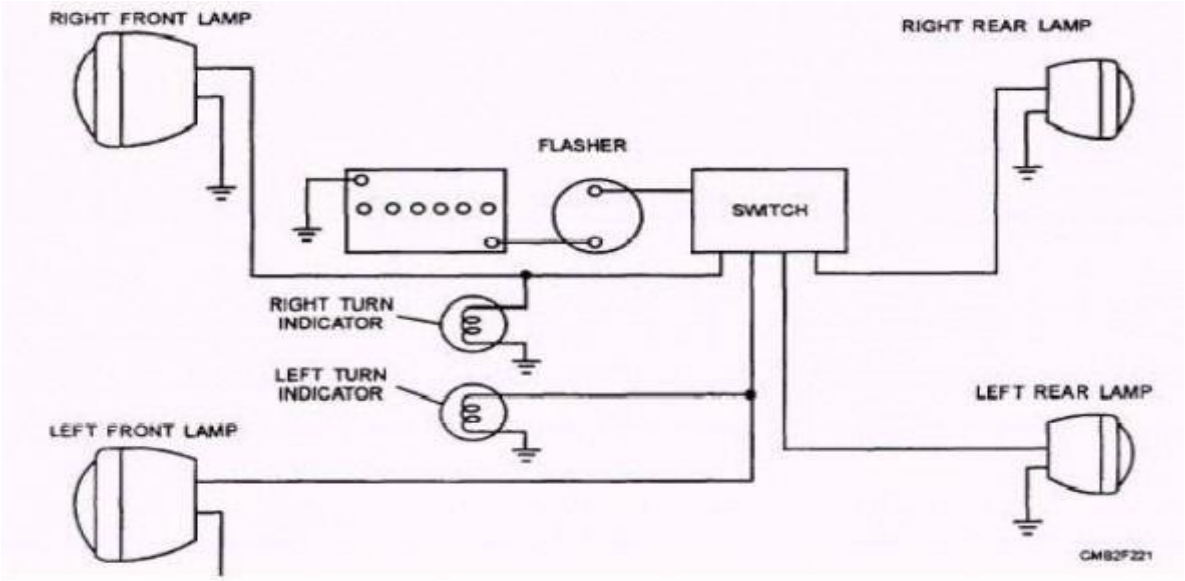



**Figure 2.4- Lightning system**

### 2.4.3 Operation principle of Lightning system

The exterior lights typically include the headlights, turn signals, brake lights, parking lights, backup lights, and side marker lights. The interior lights include the dome light, trunk light, instrument panel lights, and other courtesy lights.

## 2.5 Horn system

### 2.5.1 Structure and function

Car horns are usually electric, driven by a flat circular steel diaphragm that has an electromagnet acting on it in one direction and a spring pulling in the opposite direction. The diaphragm is attached to contact points that repeatedly interrupt the current to that electromagnet causing the diaphragm to spring back the other way, which completes the circuit again.

### 2.5.2 Wiring Diagram

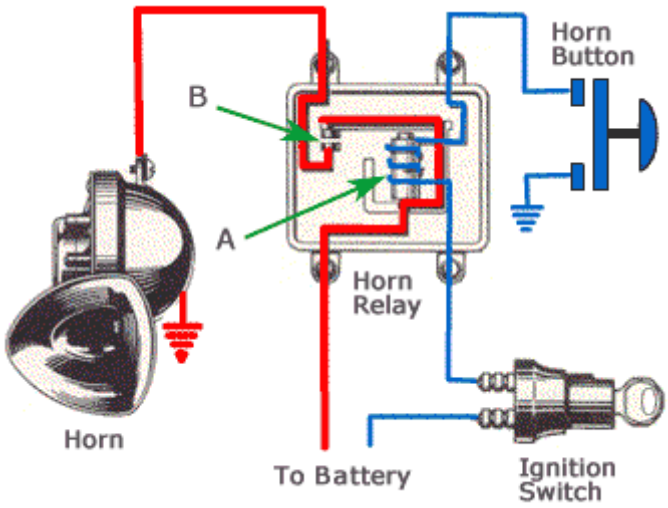



**Figure 2.5- Horn system**

### 2.5.3 Operation principle of horn system

Cars are usually fitted with a high-frequency (HF) or wind tone horn as standard equipment, normally located behind the front grille. A vibrating diaphragm makes the sound in both types.

The diaphragm is moved by an electromagnet and contact breaker, like that of an electric bell.

In an HF horn, a resonator plate is fixed to the diaphragm to amplify the sound.

In a wind tone, the diaphragm makes air vibrate in a trumpet, giving a lower pitched and more musical sound. The length of the trumpet fixes the pitch.

In some cars there is a pair of wind-tones, tuned to give two notes. They are marked for low notes and 'H' for high.

A third type of horn, the air horn, uses a compressor, and is fitted only as an accessory. It has a loud and distinctive note and is sold with fitting instructions.

Note that an audible warning device is a legal requirement for all vehicles, and strident horns sounding fluctuating notes are allowed on emergency-service vehicles and police cars only.

## 2.6 Exercise

1. The car’s electrical system consists of the:

(A) ignition, starting, lubrication, and lighting systems.

(B) ignition, charging, lighting, and hydraulic systems.

(C) lighting, charging, starting, and ignition systems.

(D) None of the above.

2. Name main parts of Starting system, Charging system, Ignition system, Lighting system, and Horn system.

# UNIT 2: ELECTRICAL SYSTEMS

# UNIT 3: FUEL SYSTEM

**Objectives:**

After studying this unit, you should be able to recognize the structure and function of fuel system.

**Introduction:**

Unit 3 supplies students with knowledge of the structure and function of Gasoline fuel

System and Diesel fuel system.

**Main content:**

**What is Fuel system?**

Fuel system provides a combustible air-fuel mixture to power the engine.

The fuel system must provide the correct mixture of air and fuel for efficient combustion (burning). This system must add the right amount of fuel to the air entering the cylinders. This ensures that a very volatile (burnable) mixture enters the combustion chambers.

The fuel system must also alter the air-fuel ratio (percentage of air and fuel) with changes in operating conditions (engine temperature, speed, load, and other variables).

There are three basic types of automotive fuel systems: gasoline injection systems, diesel injection systems, and carburetor systems.

## 3.1 Gasoline fuel system

### 3.1.1 Structure and function

Modern gasoline injection systems use a control module, sensors, and electrically operated fuel injectors (fuel valves) to meter fuel into the engine. This is the most common type of fuel system on gasoline, or spark ignition, engines. See Figure 3.1.

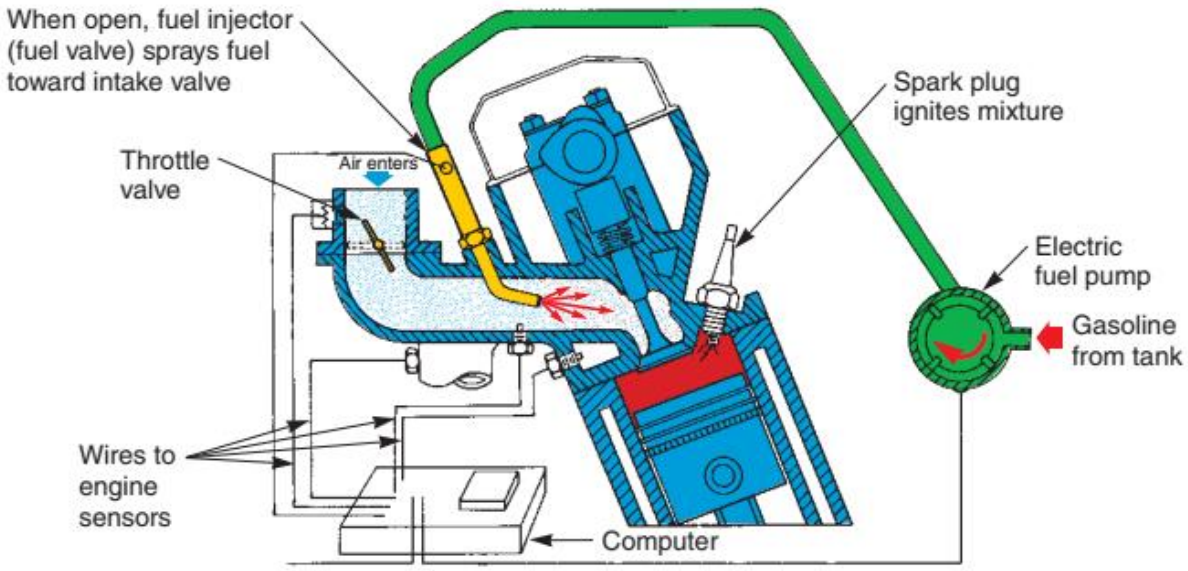



**Figure 3.1- Gasoline fuel system**

### 3.1.2 Operation principle of gasoline fuel system

An electric fuel pump forces fuel from the fuel tank to the engine. The control module, reacting to electrical data it receives from the sensors, opens the injectors for the correct amount of time. Fuel sprays from the open injectors, mixing with the air entering the combustion chambers.

A throttle valve controls airflow, engine speed, and engine power. When the throttle valve is open for more engine power output, the computer holds the injectors open longer, allowing more fuel to spray out. When the throttle valve is closed, the computer opens the injectors for only a short period of time, reducing power output.

The throttle valve (air valve) is connected to the accelerator pedal. When the pedal is pressed, the throttle valve opens to increase engine power output.

## 3.2 Diesel fuel system

### 3.2.1 Structure and function

A diesel fuel system is primarily a mechanical system that forces diesel fuel (not gasoline) directly into the combustion chambers. Unlike the gasoline engine, the diesel engine does not use spark plugs to ignite the air-fuel mixture. Instead, it uses the extremely high pressure produced during the compression stroke to heat the air in the combustion chamber. The air is squeezed until it is hot enough to ignite the fuel. Refer to Figure 3.2.

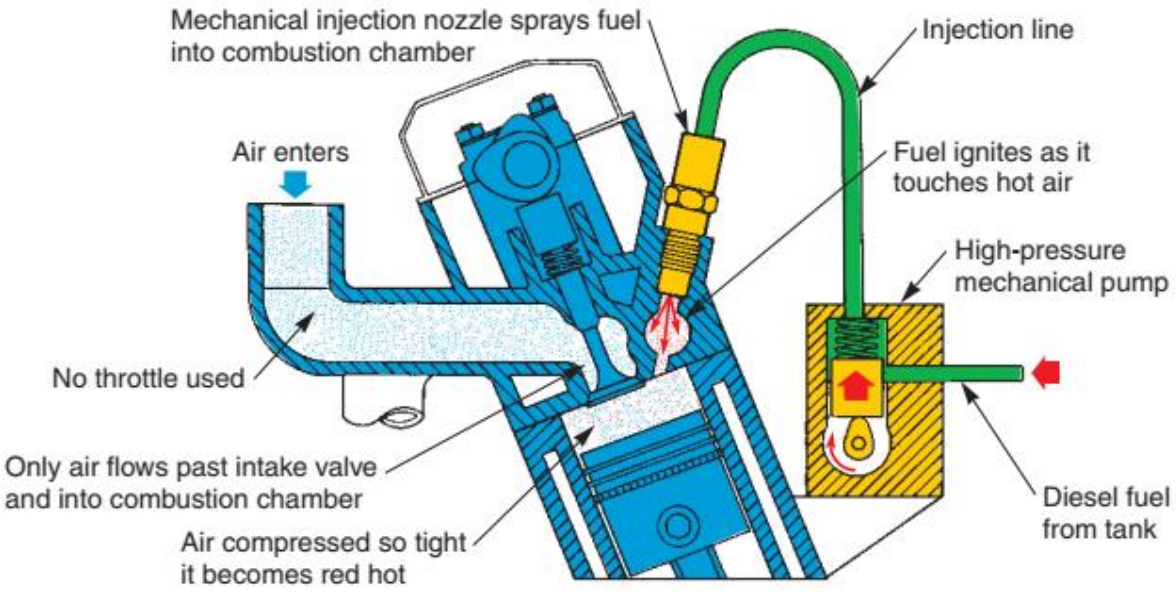



**Figure 3.2- Diesel fuel system**

### 3.2.2 Operation principle of diesel fuel system

When the mechanical pump sprays the diesel fuel into a combustion chamber, the hot air in the chamber causes the fuel to begin to burn. The burning fuel expands and forces the piston down on the power stroke. Electronic devices are commonly used to monitor and help control the operation of today's diesel injection systems.

## 3.3 Exercise

1. Each of the following is a basic type of automotive fuel system except:

   (A) carburetor.

   (B) auto injection.

   (C) diesel injection.

   (D) gasoline injection.

2. Describe the two common types of fuel systems.

# UNIT 4: COOLING SYSTEM

**Objectives:**

After studying this unit, you should be able to recognize the structure and function of cooling system.

**Introduction:**

Unit 4 supplies students with knowledge of the structure and function of Cooling system.

**Main content:**

## 4.1 Structure and function

The cooling system maintains a constant engine operating temperature. It removes excess combustion heat to prevent engine damage and also speeds engine warm-up. Look at Figure 4.1.

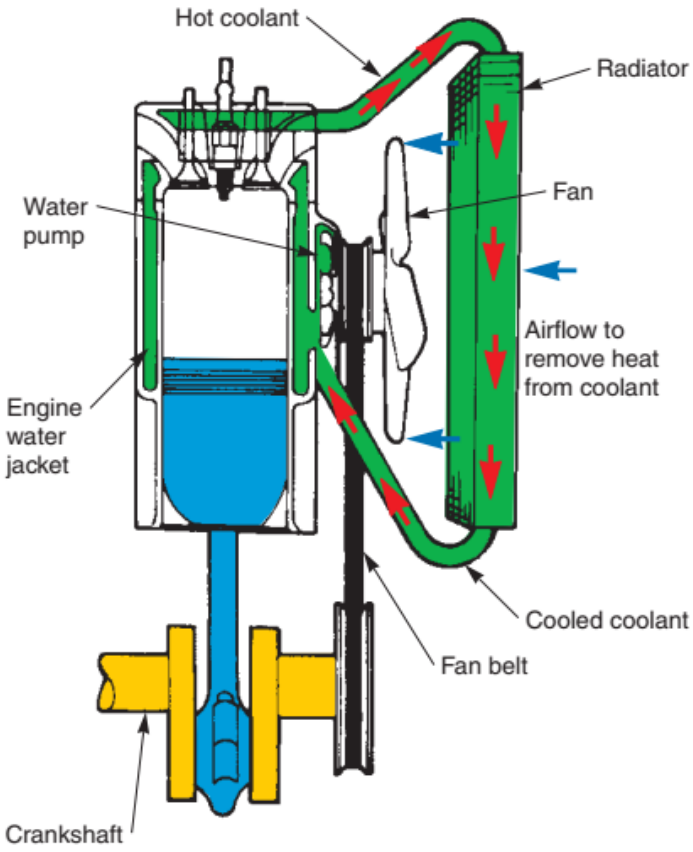



**Figure 4.1- Cooling system**

## 4.2 Operation principle of cooling system

The water pump forces coolant (water and antifreeze solution) through the inside of the engine, hoses, and radiator. The coolant collects heat from the hot engine parts and carries it back to the radiator.

The radiator allows the coolant heat to transfer into the outside air. An engine fan draws cool air through the radiator. The thermostat controls coolant flow and engine temperature. It is usually located where the top radiator hose connects to the engine.

### 4.3 What is coolant?

Coolant or antifreeze is one of the most important fluids in a car.

Basically, coolant or antifreeze, which mixes with water in an engine's cooling system is designed to both lower the freezing point and raise the boiling point of the system. This means, by adding coolant/antifreeze to your car's cooling system you're able to increase the temperature a vehicle can run at before the cooling system will boil.

Coolant or antifreeze is an alcohol-based additive that's usually green in colour (although it can also be red, blue, and orange) and made up of Ethylene Glycol.

### 4.4 Exercise

1. What system reduces the amount of toxic substances released by the vehicle?

2. Describe the operation principle of cooling system.

# UNIT 5: LUBRICATION SYSTEM

## I. Structure and function:

Just as the inside of the engine needs lubrication (via oil) other parts of the vehicle need lubrication as well. A lube job involves applying lubricants (various kinds of grease and oil) to some of the moving parts under the vehicle and to some of the rubber parts to keep them supple.

The transmission fluid, power steering fluid and brake fluid are lubricants, too. The parts of the vehicle that need periodic lubrication can include the steering linkage, transmission shift linkage, clutch linkage, parking brake cables, differential and driveshaft universal joint fittings.

Because of these are hard to find and hard to reach, most require a special kind of lubricant. Because you can get into trouble if you don’t deal with them properly, once or twice a year, you take your vehicle to the dealership or to a good independent repair facility. Have them lubricate everything that needs it – including the distributor, if the vehicle has one. The rest of the time, just lubricate the things that are pointed out in this unit and you’ll be way ahead of the game.

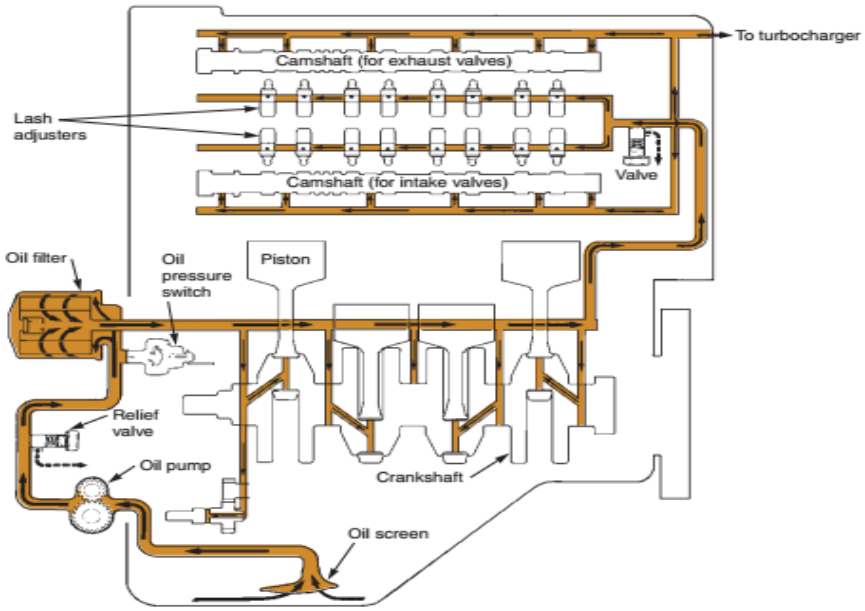



*Figure 5.1. The lubrication system uses oil to reduce friction and wear the pump forces oil to high-friction points*

What do you lubricate when you do a lube job? What tools do you need? How do you do it? All these questions are answered in this unit.

If you know one thing about car maintenance, you know that you have to change the oil regularly. What you probably don't know is where the oil goes, what the oil is actually oiling, or why it has to be changed all the dang time.

UNIT 5: LUBRICATION SYSTEM

The number one function of oil in the engine is exactly what you'd expect: It keeps things moving. Just imagine the eardrum-piercing sounds of metal pistons screeching up and down inside a dry cylinder. Shudder.

Unlike the ads for various drugs on television, there are several pleasant side effects of keeping the engine lubricated with oil. There's less friction, which means the engine has to make less of an effort to keep chugging along. That in turn means it can skate along on less fuel and run at a lower temperature. And all of this means less wear and tear on the moving engine parts. Keeping clean oil in the system means your engine is happy, which means your wallet is happy. Everybody wins!

Don't be fooled by the word "lubrication," however. Sometimes, when you pull into the bay at your local quick lube shop, they suggest you need a "lube job." That's not an oil change. That's oiling up a squeaky chassis and suspension system, neither of which share oil with the engine lubrication system. "Squeaky Chassis" would make an excellent band name, by the way.

**II. Principle operation:**

**Oil pan:** This is where Oliver hangs out when the engine isn't doing anything; the oil lounge, if you will. In most cars, this pan holds about 4 to 6 quarts of oil.

**Pickup tube:** When the engine is switched on, it needs oil immediately. Oliver and his oil buddies get sucked up by the pickup tube and lined up for action.

**Oil pump:** The pump does the sucking so that Oliver can slide up that tube against gravity and then pressurizes the oil. Oliver and his little oil friends get jammed in together even closer. Let's hope Oliver remembered to put on deodorant today.

**Pressure relief valve:** If Oliver and his friends get too close they start to plan a riot, this relief valve gives them a bit of much-needed breathing space. It's the lubrication system's way of saying, "Settle down, kids."

**Oil filter:** While Oliver and his friends are allowed to pass into the engine, the filter stops any dirt and debris the oil may have picked up on its last pass through the system.

**Spurt holes and galleries:** Oliver giggles every time he says "spurt holes." He's really immature. These are the little holes drilled in the crankshaft or other parts of the system that allow the oil to coat the bearings and cylinders that need to stay lubricated.

**Sump:** After doing his job to keep the moving parts of the engine moving, an exhausted Oliver slides all the way down into the oil pan again, also known as the sump, to hang out until he's sucked back up the pickup tube -- and he's back on the job.

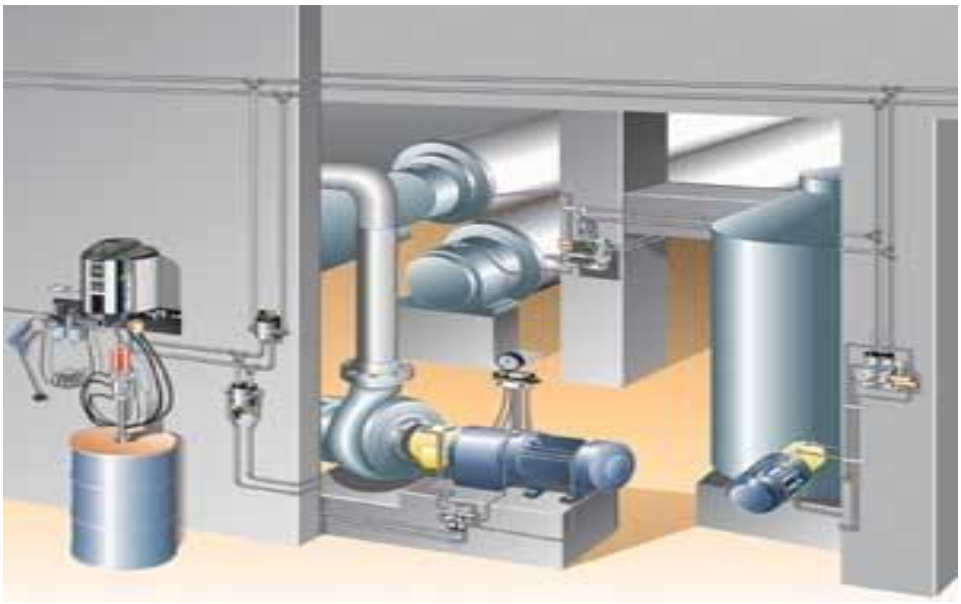


***Figure 5.2. Main Components of an Automatic Grease Lubrication System***

There are basically two types of oil systems in vehicles, both of which sound like types of walruses or something: wet sump and dry sump.

Most cars use a **wet sump** system. (The more you say it, the weirder it sounds. Wet sump. Wet sump.) That means the oil pan is at the bottom of the engine, and the oil is stored there. Remember Oliver the oil molecule's lounge? It's kind of like he has a table next to the dance floor at the club. And in this strange metaphor, the dancers are pistons and bearings.

The advantage of a wet sump system is its simplicity. The oil is close to where it will be used, there aren't too many parts to engineer or repair, and it's relatively cheap to build into a car.

Some cars, especially high-performance cars, use a **dry sump** system. That means the sump isn't underneath the engine -- in fact, it can be located anywhere within the engine compartment. After Oliver does his job in the engine, he doesn't just drip into the lounge. He goes to the VIP room away from the dance floor.

A dry sump system gets you a couple of bonuses: First, it means the engine can sit a little lower, which gives the car a lower center of gravity and improves stability at speed. Second, it keeps extra oil from soaking the crankshaft, which can lower horsepower. And, since the sump can be located anywhere, it can also be any size and shape.

Two-stroke engines, by the way, use a completely different type of technology. Scooters, lawn mowers and other two-stroke machines have the oil mixed right in with the gasoline. When the gasoline evaporates in the combustion process, the oil is left behind to do its slick business.

Sometimes you have to do this yourself, measuring the correct amounts before filling the tank. But sometimes, as in most motor scooters, there's an injection system that takes oil from the reservoir and mixes it with the gasoline for you in just the right proportions.

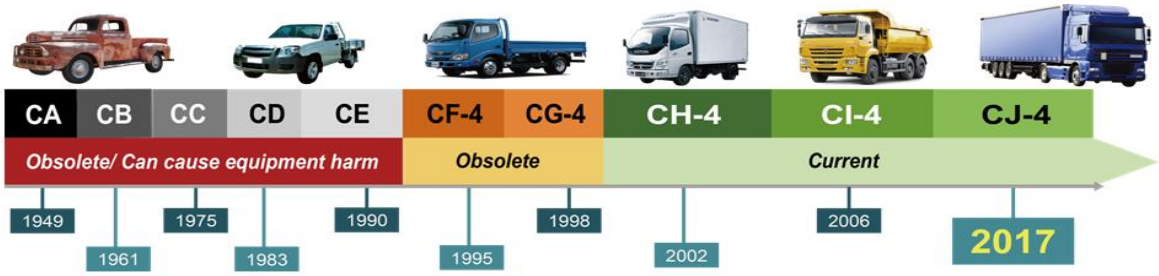
## III. Engine oil

Engine oil is the “life blood” of your car. It’s a vital component of the engine system, lubricating moving parts and ensuring your car has a long and happy life. If you’re unsure how to change your oil, choose a service to have it changed at a workshop alongside an oil filter fitting.

There are engine oils currently on the shelves at auto parts stores, gas station convenience stores, food stores, and other retail outlets that can cause harm to your car’s engine. Yes, you heard correctly – Cause harm to your car’s engine. These are obsolete engine oils formulated for use in cars built prior to the 1930s! Know how to read the labels on the front and back of the bottles of oil you buy or you may be using product that can cause unsatisfactory performance or harm to your engine.

The service rating of passenger car and commercial automotive motor oils is classified by the American Petroleum Institute (API). The service rating is shown in the API “Service Symbol Donut” on the product label. As shown in the illustration below, engine oils with an API SA Service Classification were formulated for use in cars built prior to 1930, and are now obsolete. Yet, there are still not hard to find in retail outlets.

**API service classification for diesel engine**




API FA-4 and the FA-4 Donut identify certain XW-30 oils specifically formulated for use in select high-speed four-stroke cycle diesel engines designed to meet 2017 model year on-highway greenhouse gas (GHG) emission standards. API FA-4 oils are not interchangeable or backward compatible with API CK-4, CJ-4, CI-4 PLUS, CI-4, and CH-4 oils. Refer to engine manufacturer recommendations to determine if API FA-4 oils are suitable for use.

The service rating of passenger car and commercial automotive motor oils is classified by the American Petroleum Institute (API).

**American Petroleum Institute Diesel Engine Oil Service Classifications**

| Category | Status | Service |
|---|---|---|

| | | |
|---|---|---|
| CJ-4 | Current | For high-speed four-stroke cycle diesel engines designed to meet 2010 model year on-highway and Tier 4 non road exhaust emission standards as well as for previous model year diesel engines. These oils are formulated for use in all applications with diesel fuels ranging in sulfur content up to 500 ppm (0.05% by weight). However, the use of these oils with greater than 15 ppm (0.0015% by weight) sulfur fuel may impact exhaust after treatment system durability and/or drain interval. CJ-4 oils are especially effective at sustaining emission control system durability where particulate filters and other advanced after treatment systems are used. Optimum protection is provided for control of catalyst poisoning, particulate filter blocking, engine wear, piston deposits, low- and high-temperature stability, soot handling properties, oxidative thickening, foaming, and viscosity loss due to shear. API CJ-4 oils exceed the performance criteria of API CI-4 with CI-4 PLUS, CI-4, CH-4, CG-4 and CF-4 and can effectively lubricate engines calling for those API Service Categories. When using CJ-4 oil with higher than 15 ppm sulfur fuel, consult the engine manufacturer for service interval. |
| CI-4 | Current | Introduced in 2002. For high-speed, four-stroke engines designed to meet 2004 exhaust emission standards implemented in 2002. CI-4 oils are formulated to sustain engine durability where exhaust gas recirculation (EGR) is used and are intended for use with diesel fuels ranging in sulfur content up to 0.5% weight. Can be used in place of CD, CE, CF-4, CG-4, and CH-4 oils. Some CI-4 oils may also qualify for the CI-4 PLUS designation. |
| CH-4 | Current | Introduced in 1998. For high-speed, four-stroke engines designed to meet 1998 exhaust emission standards. CH-4 oils are specifically compounded for use with diesel fuels ranging in sulfur content up to 0.5% weight. Can be used in place of CD, CE, CF-4, and CG-4 oils. |
| CG-4 | Obsolete | Introduced in 1995. For severe duty, high-speed, four-stroke engines using fuel with less than 0.5% weight sulfur. CG-4 oils are required for engines meeting 1994 emission standards. Can be used in place of CD, CE, and CF-4 oils. |

| | | |
|---|---|---|
| CF-4 | Obsolete | Introduced in 1990. For high-speed, four-stroke, naturally aspirated and turbocharged engines. Can be used in place of CD and CE oils. |
| CF-2 | Obsolete | **OBSOLETE: Introduced in 1994. For severe duty, two-stroke-cycle engines. Can be used in place of CD-II oils.** |
| CF | Obsolete | OBSOLETE: Introduced in 1994. For off-road, indirect-injected and other diesel engines including those using fuel with over 0.5% weight sulfur. Can be used in place of CD oils. |
| CE | Obsolete | **CAUTION**: Not suitable for use in most diesel-powered automotive engines built after 1994. |
| CD-II | Obsolete | **CAUTION**: Not suitable for use in most diesel-powered automotive engines built after 1994. |
| CD | Obsolete | **CAUTION**: Not suitable for use in most diesel-powered automotive engines built after 1994. |
| CC | Obsolete | **CAUTION**: Not suitable for use in most diesel-powered engines built after 1990. |
| CB | Obsolete | **CAUTION**: Not suitable for use in most diesel-powered engines built after 1961. |

**UNIT 6: BRAKE SYSTEM**

**UNIT 6: BRAKE SYSTEM**

## I. Structure and function

Before relegating to the "Guess I'll finish later." pile and go on to learn macramé or fly-tying, take the time to educate yourself about an automotive system that most people take for granted, even though it may be the only system in the car that can kill you if you don't keep it in good repair. As you've properly guessed, it's the brakes.

One reason that today's vehicles are the safest in history is that they're equipped with hydraulic brake systems designed to operate a very simple principle with a minimum of parts and maintenance. Since 1968, all vehicles are also equipped with dual brake systems to ensure that if one set of brakes fails, the other set will still be able to stop your car, and with a dashboard light to warn you if the front or rear brakes fail.

The figure 6.1 shows a basic brake system with a power booster disc brakes of the front wheels and the drum brakes of the rear wheels. Your vehicle may not have power brakes or may have disc or drum brakes all around, but the principle is the same in any case.

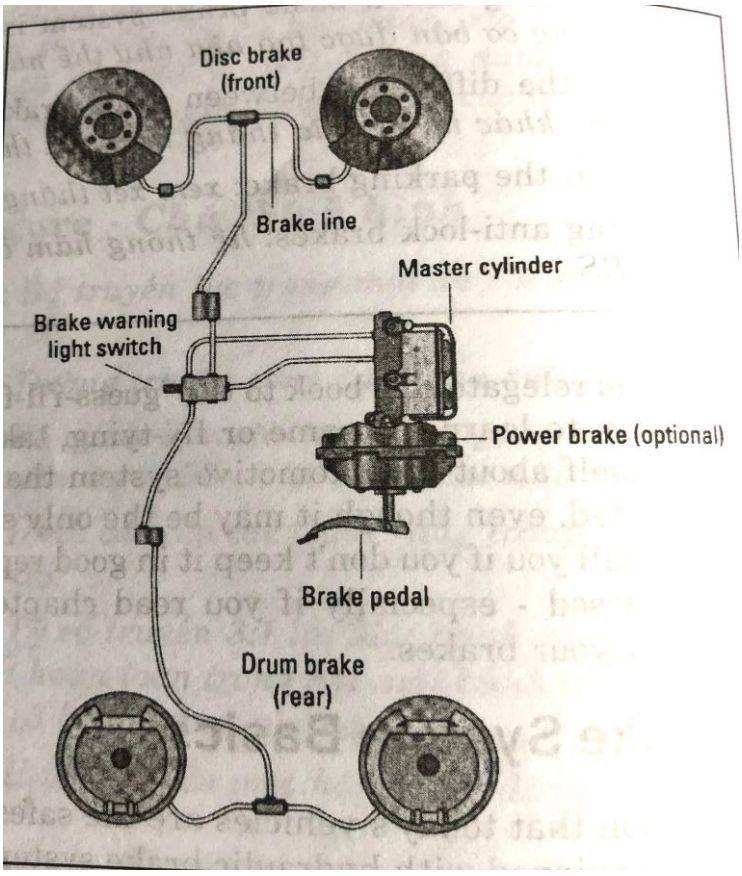



*Figure 6.1. The brake system*

In most automobiles, there are three basic types of brakes including; service brakes, emergency brakes, and parking brakes. These brakes are all intended to keep everyone inside the vehicle and traveling on our roadways safe.

## UNIT 6: BRAKE SYSTEM

*A. Hydraulic braking system are classified on 2 basis*

1. On the basis of frictional contact mechanism. On this basis, hydraulic brakes are of 2 types

(i) Drum brake or internal expanding hydraulic brakes.

(ii) Disc brakes or external contracting hydraulic brakes.

2. On the basis of brake force distribution. On this basis, hydraulic brakes are of 2 types

(i) Single acting hydraulic brakes

(ii) Dual acting hydraulic brakes

*B. Antilock Braking System (ABS)* is a type of active safety system of a vehicle. It is also known as the anti-skid braking system. This system comes into action when the driver suddenly applies the brakes during an emergency. Employing the antilock braking system on cars and bikes is now mandatory in most parts of the world.

Whenever the driver suddenly applies the brakes to a high-speed vehicle, there is always a chance of the 'wheel-lock'. The wheel-lock means that the respective wheel stops suddenly instead of coming to a halt slowly. Due to the wheel-lock, the driver loses control over the vehicle and the vehicle skids off the road. Thus, a fatal accident takes place. In order to avoid such situations, the manufacturers employ the ABS system.

### II. Principle operation

### A. A brake system basic

1. The brake pedal: is attached to a shaft that leads to the brake master cylinder. When you step on the brake pedal, small pistons in the master cylinder force brake fluid out of the master cylinder and into the brake lines. If the brakes are working properly, the pedal should stop a couple of inches from the floor. It should push down easily, stop firmly at its lowest point without feeling spongy and stay put instead of sinking down slowly when you put normal pressure on it.

2. The power brake booster: Today most vehicles have power brakes. If the car has power brakes, a brake booster is located between the brake pedal and the master cylinder to increase the force applied to the pistons in the master cylinder so that the car can stop with less effort on your part.

3. The brake master cylinder is under the hood, up near the firewall on the driver's side. You should see either a metal box or a plasric bottle. It's filled with brake fluid and is connected to the brake pedal, with brake linesleading from it to the four wheels of the car. When you step on the brake pedal, fluid goes out of the master cylinder into the brake lines. When you release the pedal, the fluid flows back into the master cylinder.

4. Brake lines run from the master cylinder, along the car frame, to each wheel. The lines are made of steel, except fot the portions that lie right near the front wheels and the rear axle. These

portions of brake lines are made of rubber that is flexible enough to contend with the greater amount of movement that takes place in these areas when you steer the car.

**B. Drum brakes**

1. Brake drums are hollow steel cylinders located in back of each wheel. Because the lug bolts that go through them are the same as the ones that go through the wheels of your car, they turn when the wheels turn. If you keep brakes in good condition and replace the brake linings before they become too worn, the brake drums should last for the life of the vehicle. If drums become worn, they can be "reground" or "turned" to a smooth surface – unless they are worn more than 0.60 of an inch. In that case, the drums must be replaced.

2. Wheel cylinders are small but powerful mechanisms located inside each brake drum on the brake backing plate.

3. Brake shoes

4. Brake linings

5. Adjusting devices

**C. Disc brakes**

Disc brakes are composed of a flat steel disc – sandwiched between a pair of calipers. These calipers contain one or more pistons that force thebrake fluid in the brake lines into the disc. Between the disc, sometimes called a rotor, and the pistons are brake pads, which operate in the same way that brake shoes do.they grab the disc with their rough friction linings and force the disc to stop turning, which in turn forces the wheel to stop turning and the car to stop moving. The effect is the same as on a bicycle when the brakes grab the wheel directly to stop it from turning.

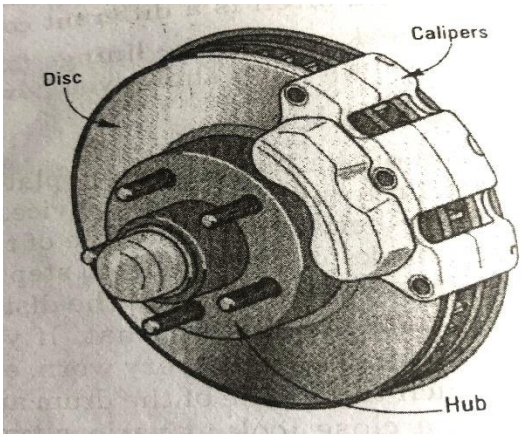



Figure 6.2. A typical disc brake

**D. The parking brake**

The parking brake or emergency brake is usually attatched to a car's rear wheels. On vehicles with drum brakes, the parking brake is ussually attached with cables to the rear brakes. These are called intergral parking brakes. You can easily adjust the cables, which run underneath the car, by turning a screw that control the tension on the cable.

Some vehicles with drum brakes, different devices do the same job. Some parking brakes are linked to the tramission and rather than activating the rear brakes, they stop the driveshaft from turning the rear wheels. On these brakes, the band and lining are attached to a drum on the trammision. When you pull the lever, the band squeezes the lining against the drum, and the driveshaft stops turning. When a tranmission-type parking brake doesn't seem to be performing properly, have a professional check.

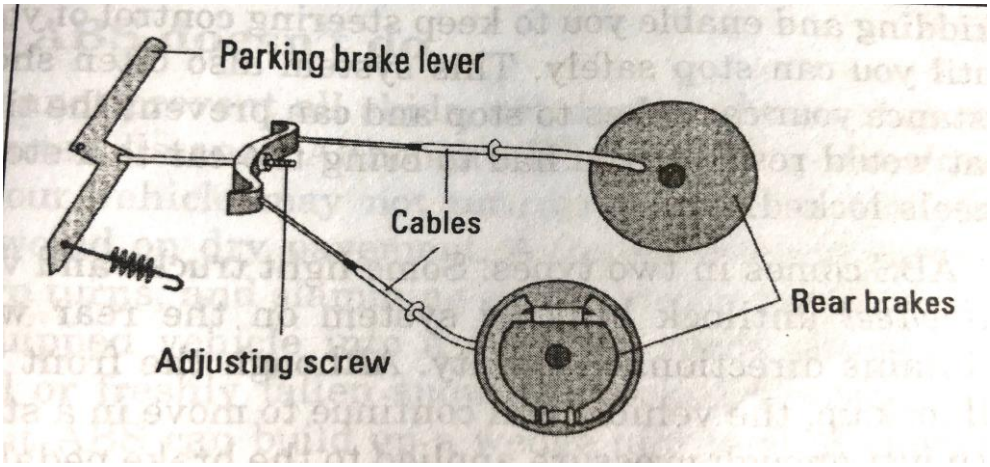



Figure 6.3. A tramission-type parking brake system

**E. The anti-lock braking system (ABS)**

The ABS has the following components:

1. Wheel speed sensors
2. ABS control module
3. Brake control unit
4. Valves
5. Pump

Wheel speed sensors continuously monitor the speed of each wheel. As long as all the wheels have comparable speed, the system does not interfere with their operation. However, if the speed sensors find that the speed of any of the wheels is reducing drastically, then it means that the particular wheel is going to lock.

However, the locked wheel hampers vehicle stability. Thus, the vehicle stops responding to the steering input given by the driver. At this moment, the vehicle also starts to skid; thereby causing a fatal accident. To avoid such a mishap, the ABS comes into action.

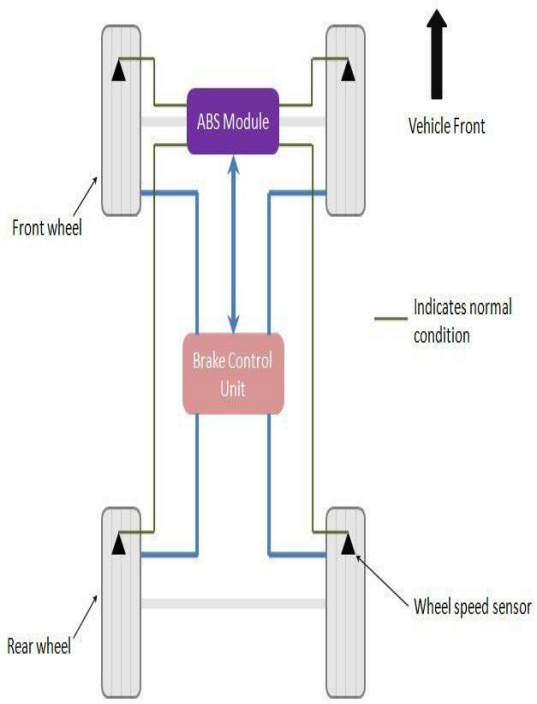
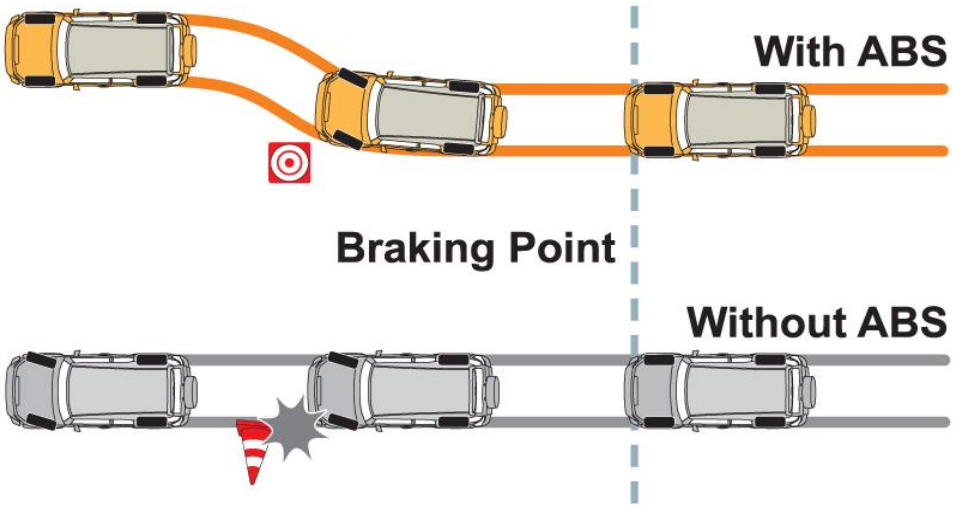



*Figure 6.4. Components of ABS and its normal operation*

- **Advantages**

1. A BS maintains the vehicle steerability and stability during panic braking.
2. It reduces the braking distance by up to 10% or more, especially on wet surfaces.



- **Disadvantages**

Perhaps the only disadvantage of the Antilock Braking System is its higher cost. In recent times, purchasing the Antilock Braking System installed bike or car costed significantly to the customer. However, this higher cost is completely offset by the improved safety this system provides. Also, the auto industry is working on developing a low-cost version of the antilock braking system.

## III. Brake fluid

The brake system produces friction to slow or stop the vehicle. When the driver presses the brake pedal, fluid pressure actuates a brake mechanism at each wheel. These mechanisms force friction material (brake pads or shoes) against metal discs or drums to slow wheel rotation.

Brake fluid, also known as hydraulic fluid, is responsible for moving the various components of your vehicles braking system. The fluid operates under high temperatures and high pressure and, without it, your car or truck would not be able to stop when you push the brake pedal inside your vehicle. Brake fluid is a non-compressible substance that lies within the brake lines, delivering the force created by your push on the brake pedal to each of the brake rotors on the four corners of your vehicle. This applies pressure to the wheels and ultimately slows or stops your movement. Here is a step-by-step and somewhat simplified look at how brake fluid works within a hydraulic brake system:

- The driver depresses the brake pedal.
- The pedal compresses a piston inside the brake caliper.
- This compression increases the pressure inside the brake lines and sends the brake fluid into motion.
- The pressure of the brake fluid then causes the brake rotors to squeeze down on brake pads, which then make contact with the wheels, slowing and eventually stopping wheel rotation and also the vehicle itself.

The types of brake fluid

While brake fluid function is relatively easy to understand, there is a wide variety of types to choose from, which may be confusing when it is time to replace the brake, or hydraulic fluid. The two chief types of brake fluid are glycol-based, which can be further divided by grade, and silicon-based fluids. Glycol-based brake fluids are typically used in vehicles with anti-lock brake systems (ABS) while silicone-based ones work only in cars and trucks without ABS technology. If a vehicle without anti-lock brakes has ever had a glycol-based brake fluid, you cannot switch to a silicone-based one because small amounts of glycol will remain behind and chemically compromise the integrity of the silicone. Glycol-based fluids are classified by a Department of Transportation (DOT) number up to 5.1, which indicates the boiling point of the fluid. Higher DOT numbers indicate better quality of hydraulic fluid that can withstand

higher temperatures. To know what type of brake fluid is best for your vehicle, consult your owners' manual or give one of our mechanics a call.

How often to change brake fluid

Over time, brake fluid can absorb moisture from the air, which will cause the fluid to degrade and not work properly. This is why it is important to periodically drain the oil fluid out and replace it with new fluid to ensure proper brake fluid function. Most mechanics suggest changing the fluid for brakes every one to two years, although every vehicle has different maintenance needs. Since the purpose of brake fluid is so integral to safety, check your owners' manual for the recommended brake fluid changing schedule. If it is still unclear how often you should change out fluids or you suspect there is something amiss with your braking system, don't put off calling a mobile mechanic from Your Mechanic for help.

# UNIT 7: POWERTRAIN SYSTEM

**Objectives:**

After studying this unit, you should be able to recognize the structure and function of Powertrain system.

**Introduction:**

Unit 7 supplies students with knowledge of the structure and function of Powertrain system such as: clutch, transmission, propeller shaft and differential.

**Main content:**

## 7.1. Clutch

### 7.1.1 Structure and function

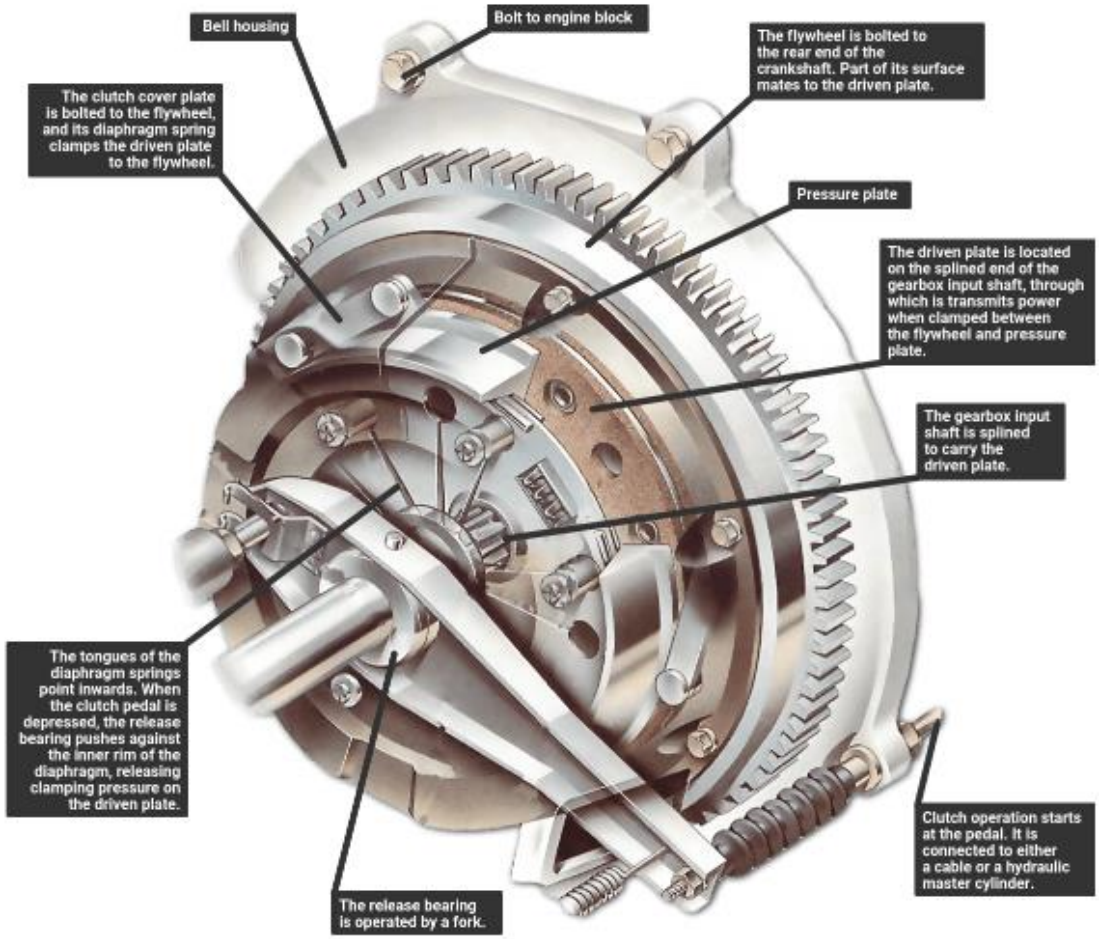



**Figure 7.1- Clutch system**

### 7.1.2 Operation principle of clutch

The clutch allows the driver to engage or disengage the engine and manual transmission or transaxle. When the clutch pedal is in the released position, the clutch locks the engine flywheel and the transmission input shaft together. This causes engine power to rotate the transmission gears and other parts of the drive train to propel the vehicle. When the driver presses the clutch pedal, the clutch disengages power flow and the engine no longer turns the transmission input shaft and gears.

## 7.2 Tranmission

### 7.2.1 Structure and function

The transmission uses various gear combinations, or ratios, to multiply engine speed and torque to accommodate driving conditions. Low gear ratios allow the vehicle to accelerate quickly. High gear ratios permit lower engine speed, providing good gas mileage.

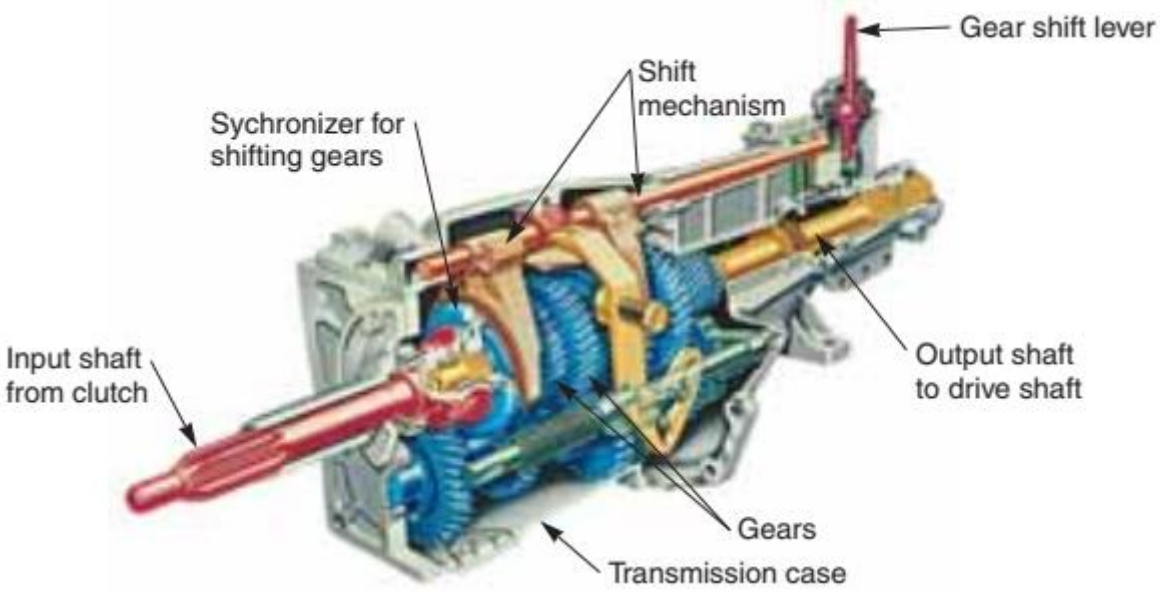
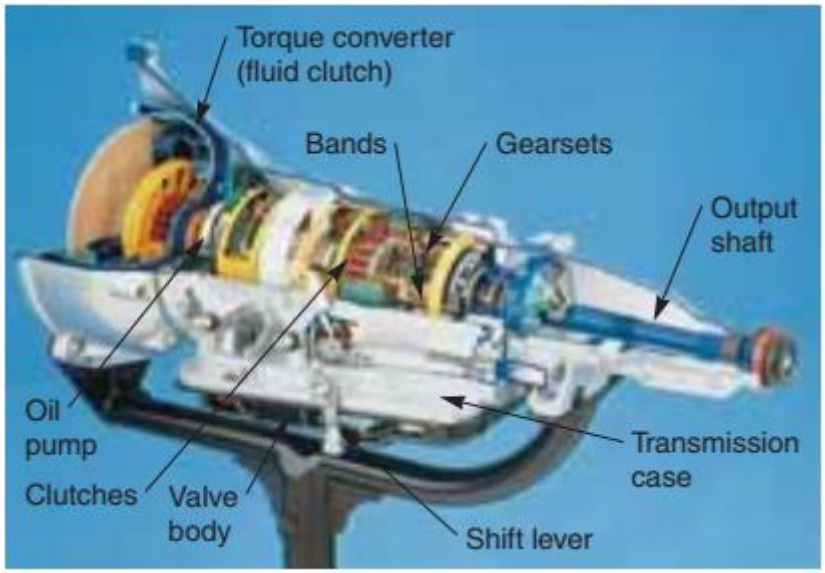



**Figure 7.2.1- Transmission**

### 7.2.2 Operation principle of brake system

A manual transmission lets the driver change gear ratios to better accommodate driving conditions, Figure 7.2.1. An automatic transmission, on the other hand, does not have to be shifted by the driver. It uses an internal hydraulic system and, in most cases, electronic controls to shift gears. The input shaft of an automatic transmission is connected to the engine crankshaft through a torque converter (fluid coupling) instead of a clutch. The elementary parts of an automatic transmission are pictured in Figure 7.2.2.




**7.2.2- Operation principle of brake system**

### 7.2.3 What is tranmission oil?

Transmission oil or transmission fluid is used to lubricate the components of a car's transmission for optimum performance. In vehicles with automatic transmissions, this fluid also acts as a coolant. There are several types of auto transmission fluids, and the type used in individual cars and trucks depends on the type of transmission inside. Automatic transmissions use regular automatic transmission fluid, as the name suggests. Manual transmission fluid can vary, however, using either plain motor oil, a transmission oil known as heavyweight hypoid gear oil, or automatic transmission fluid. The type of transmission fluid to use in vehicles with standard transmissions can usually be found in the maintenance section of the owner's manual.

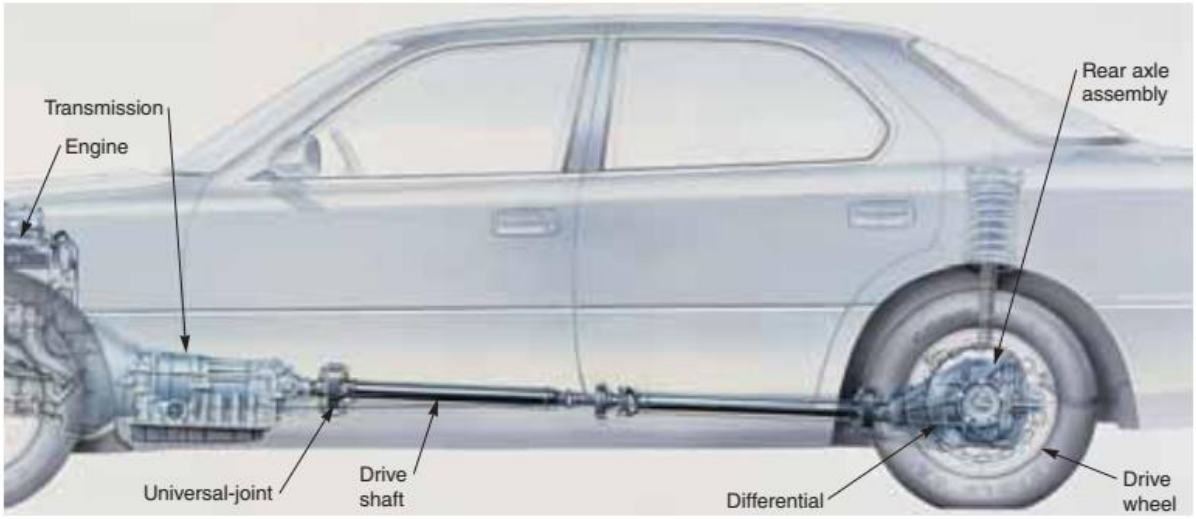
While the primary function of auto transmission fluid is to lubricate the various parts of the transmission, it can serve other functions as well:

- Clean and protect metal surfaces from wear
- Condition gaskets
- Enhance cooling function and reduce high operating temperatures
- Increase rotational speed and temperature range

## 7.3 Propeller shaft

### Structure and function

The drive shaft, or propeller shaft, transfers power from the transmission to the rear axle assembly. Look at Figure 7.3.




## 7.4. Differential

### 7.4.1 Structure and function

The rear axle assembly contains a differential and two axles.

The differential is a set of gears and shafts that transmits power from the drive shaft to the axles. The axles are steel shafts that connect the differential and drive wheels, Figure 7.3.

### 7.4.2 Operation principle of differential

The transaxle consists of a transmission and a differential in a single housing. Although a few rear-wheeldrive vehicles are equipped with transaxles, they are most commonly used with front-wheel-drive vehicles, Figure 7.4.1. Both manual and automatic transaxles are available. The internal parts of a modern transaxle assembly are illustrated in Figure 7.4.2.

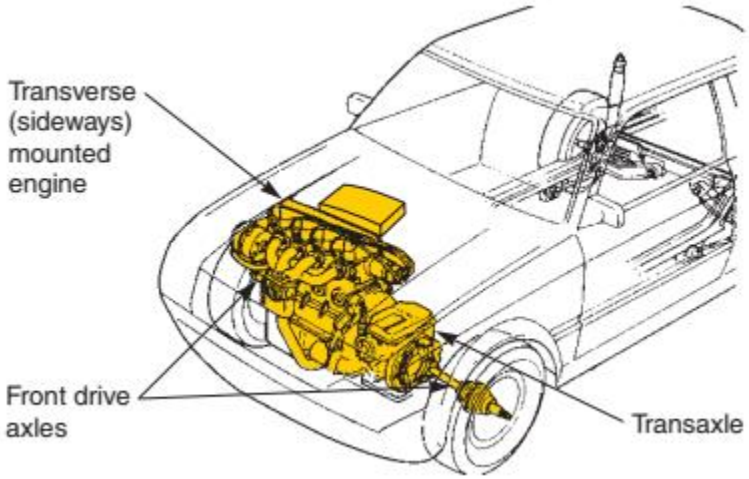



**Figure 7.4.1- Front-wheel-drive vehicles do not have a drive shaft or a rear drive axle assembly. The complete drive train is in the front of the vehicle. (Ford)**

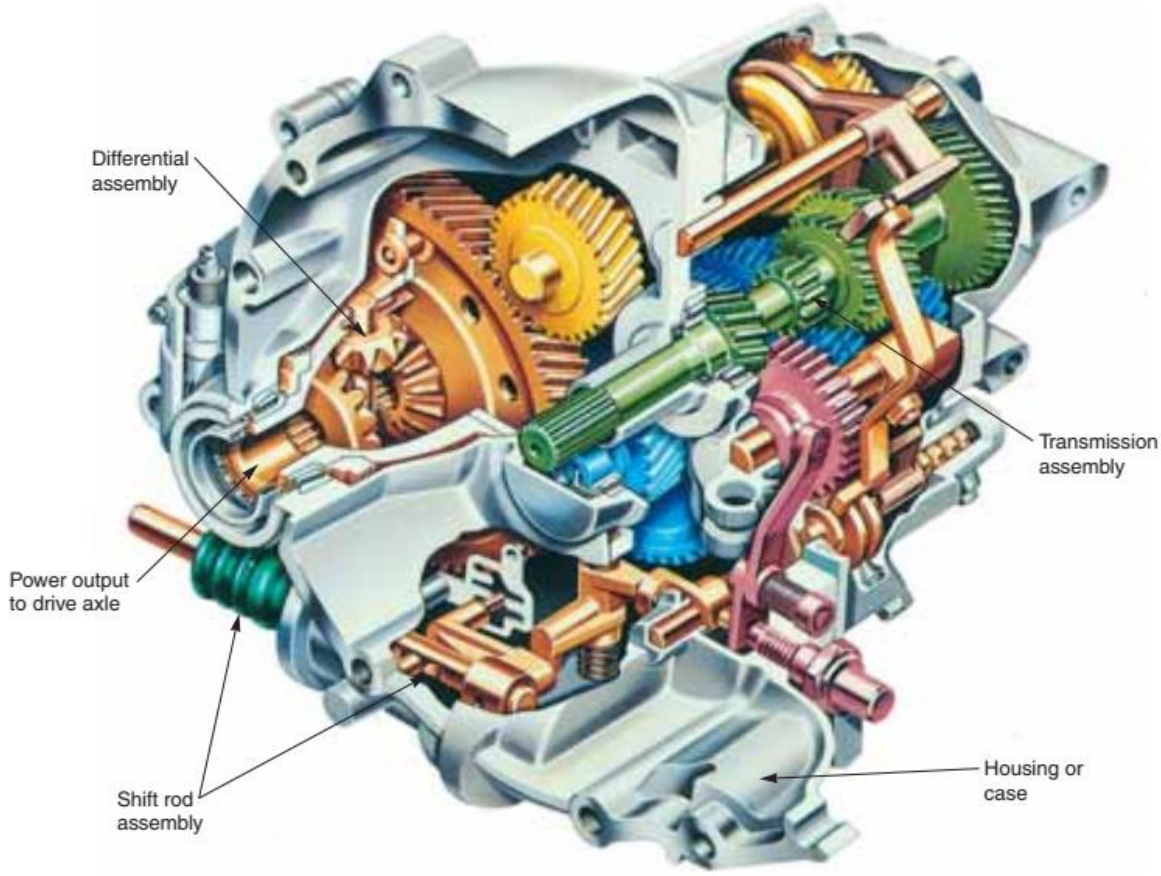



**Figure 7.4.2- A transaxle contains a transmission and a differential in one housing. (Ford)**

The front drive axles connect the transaxle differential to the hubs and wheels of the vehicle. These axles are equipped with constant-velocity joints, which allow the front wheels to be turned to the left or right and to move up and down.

### 7.4.3 What is differential oil?

Differential oil, sometimes referred to as gear oil, is found in the axle housing. It's thicker than engine oil and is designed to perform under high pressure (gears mashing together, hydraulic nature of clutch packs) rather than high temperatures like engine oil.

As you cruise down the road, the gear oil splashes about lubricating gears, bearings and clutch packs. The differential oil lubricates the ring and pinion gears that transfer power from the driveshaft to the wheel axles. If your car is fitted with a limited-slip differential, it also keeps all the moving parts in that assembly healthy. The purpose of the differential fluid is to cool and lubricate your differential. Without the oil your differential would overheat due to the metal-to-metal contact and burn itself out.

## 7.5 Exercise

UNIT 7: POWERTRAIN SYSTEM

1. What is the difference between a manual transmission and an automatic transmission?

2. A one-piece drive shaft rotates the drive wheels on most front-wheel drive cars. True or False?

3. A rear axle assembly contains two _____ and a(n) _____.

4. Explain the term “transaxle.”

## UNIT 8: STEERING SYSTEM

**Objectives:**

After studying this unit, you should be able to recognize the structure and function of cooling system.

**Introduction:**

Unit 8 supplies students with knowledge of the structure and function of Steering system.

**Main content:**

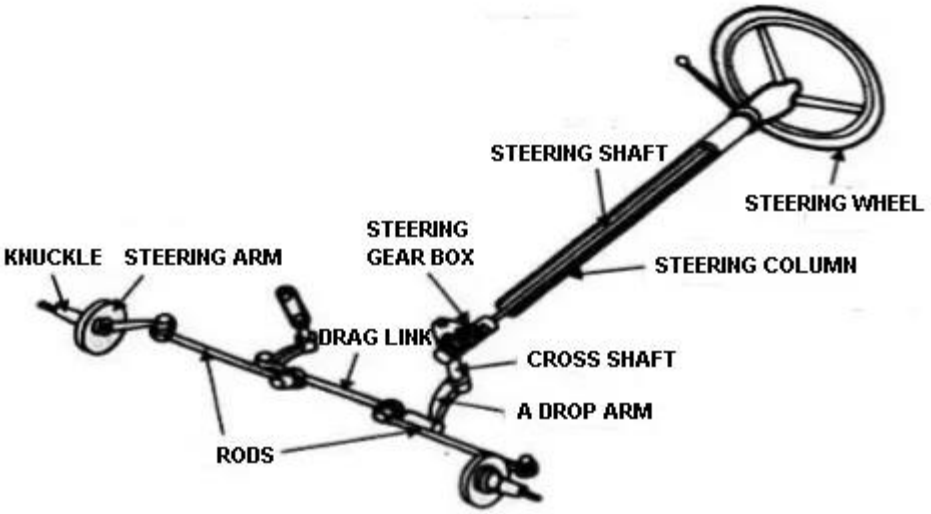
### 8.1 Structure and function

The car steering system or just steering system is the most important part in automobile vehicle steering control, respond so well to the driver while driving. Steering control makes you feel safe while driving.

Car steering system in the automobile, it is the process of running the vehicle in the desired direction by turning, usually the front wheels. For effective control of the vehicle throughout its speed range with safety, proper steering is necessary.

The system allows a driver to use only light forces to steer a heavy car.

Steering is also possible by the turning of the rear wheels, which is used generally in low-speed slow floor vehicles, for lifting and transporting the heavy parts to a short distance for example forklift.



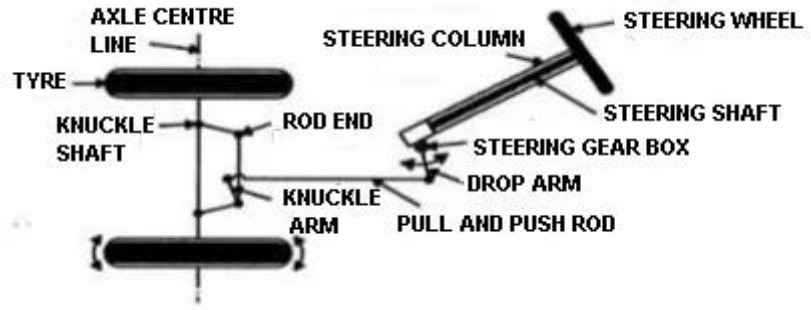



**Figure 8.1- steering system**

### 8.2 Operation principle of steering system

Steering system will convert the rotary motion of the steering wheel into the angular turn of the front wheels.

- Steering wheel rotates the steering column.
- The steering gearbox is fitted to the end of this column. Therefore, when the wheel is rotated, the cross shaft in the gearbox oscillates.
- The cross shaft is connected to the drop arm. This arm is linked by means of a drag link to the steering arms.
- Steering arms on both wheels are connected by the tie rods to the drag link.
- When the steering wheel is operated the knuckle moves to and fro, moving the steering knuckle are connected to each other.
- One end of the drag link is connected to the tie rod. The other end is connected to the end of the drop arm.

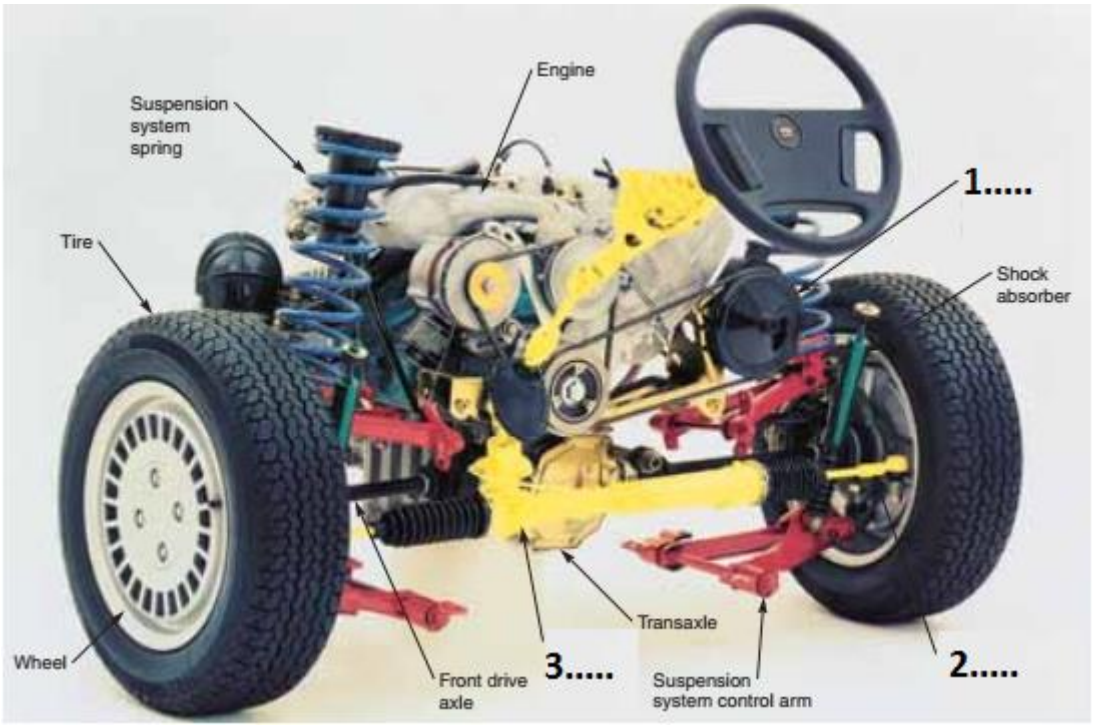
### 8.3 What is steering system fluid?

Steering system fluid is a hydraulic fluid used in the steering system of a vehicle. The fluid runs through the power steering pump and hoses, providing an assist to the steering system and making the vehicle easier to control. In addition to providing power to the system, the fluid works as a lubricant and a sealant to prevent corrosion and leaks in the system.

Although some fluids are water based, most are made from mineral oil because it provides better lubrication and can withstand the high temperatures and heat that the engine in a running vehicle creates. Other oils, such as rapeseed, canola, and silicone oils, are sometimes used for hydraulic fluids.

### 8.4 Exercise

Complete the diagram with correct names of the missing parts.


Engine
Suspension system spring
1.....
Tire
Shock absorber
Transaxle
Wheel
Front drive axle
3.....
Suspension system control arm
2.....

## TÀI LIỆU THAM KHẢO

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