

**T.C.  
MİLLÎ EĞİTİM BAKANLIĞI**

**RAYLI SİSTEMLER TEKNOLOJİSİ**

**TEKNİK YABANCI DİL(İNGİLİZCE) 1**

**Ankara, 2014**

- 
- Bu modül, mesleki ve teknik eğitim okul/kurumlarında uygulanan Çerçeve Öğretim Programlarında yer alan yeterlikleri kazandırmaya yönelik olarak öğrencilere rehberlik etmek amacıyla hazırlanmış bireysel öğrenme materyalidir.
  - Millî Eğitim Bakanlığınca ücretsiz olarak verilmiştir.
  - **PARA İLE SATILMAZ.**

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# EXPLANATIONS

<b>ALAN</b>	<b>Raylı Sistemler Teknolojisi</b>
<b>DAL/MESLEK</b>	Raylı Sistemler Teknolojisi Alanı Tüm Dallar
<b>MODÜLÜN ADI</b>	Teknik Yabancı Dil (İngilizce) 1
<b>MODÜLÜN TANIMI</b>	Raylı sistem Teknolojisinde kullanılan araç-gereç ve uyarı işaretleri, çeken araçların ana donanımları ile ilgili temel tanım ve kavramlar, çekilen araç teknolojisi, alt yapı ile üst yapı ilgili terim ve malzemeleri için kullanılan teknik İngilizceyi okuma, anlama, yazma ve konuşma becerisinin kazandırıldığı öğrenme materyalidir.
<b>SÜRE</b>	40/32
<b>ÖN KOŞUL</b>	10. ve 11. sınıf İngilizce derslerini başarmış olmak (Temel seviyede İngilizce yeterliğine sahip olmak)
<b>YETERLİK</b>	Makine bakım onarım ve demiryolu inşaat ile ilgili Teknik İngilizceyi kullanmak.
<b>MODÜLÜN AMACI</b>	<b>Genel Amaç:</b> Gerekli ortam sağlandığında raylı sistemler bakım onarım ve demiryolu inşaatı ile ilgili Teknik İngilizceyi, okuma, anlama, yazma ve konuşma düzeyinde öğrenebileceksiniz. <b>Amaçlar</b> <ol style="list-style-type: none"><li>1. Raylı sistem teknolojisinde kullanılan araç-gereç ve uyarı işaretleri ile ilgili Teknik İngilizce'yi kullanabileceksiniz.</li><li>2. Çeken araçların ana donanımları temel tanım ve terimleri ile ilgilinin Teknik İngilizceyi kullanabileceksiniz.</li><li>3. Çeken araç teknolojisi ile ilgili Teknik İngilizceyi kullanabileceksiniz.</li><li>4. Alt yapı terim ve malzemeleri ile ilgili Teknik İngilizceyi kullanabileceksiniz.</li><li>5. Üst yapı terim ve malzemeleri ile ilgili Teknik İngilizceyi kullanabileceksiniz.</li></ol>
<b>EĞİTİM ÖĞRETİM ORTAMLARI VE DONANIMLARI</b>	<b>Ortamlar:</b> Sınıf, dil laboratuvarı, raylı sistem mekanik atölyeleri, kütüphane, projeksiyon vb. <b>Donanımlar:</b> TV, VCD, Video, Internet,
<b>ÖLÇME VE DEĞERLENDİRME</b>	Modülün içinde yer alan öğrenme faaliyetlerinden sonra, verilen ölçme araçları ile kendi kendinizi değerlendireceksiniz. Modül sonunda öğretmeniniz tarafından teorik ve pratik performansınızı ölçme teknikleri uygulayarak modül uygulamaları ile kazandığınız bilgi ve becerileri ölçerek değerlendirileceksiniz.

# INTRODUCTION

**Dear student;**

Nowadays, knowing of foreign language is a fact that cannot be ignored. And everyone knows this fact. It has become an important part of people's daily lives. If people know a foreign language, they can find a job easily. In addition, It is possible to achieve better wages.

We live in the time period described as the information age. The information age has accelerated the development of technology. In addition, information life and of time the validity is short increasingly. Therefore, the information obtained must be kept up to date. At this point, you need to know a foreign language in order to be a step ahead.

Today, English has been adopted by the whole world and was accepted as a world language. All issued information are translated into English and are published.

The railway system sector is developing very fast. The highest using of technological developments has become an industry branch. Therefore, people working in this area need to know Technical English usage.

This module is about railway systems technology which includes English equivalents and usage patterns of the basic definition and terms. With this module you will be able to follow the developments in the field of railwat systems and will have the knowledge of technical English.



# LEARNING ACTIVITY -1

## AIM

At the end of this activity you will be able to express the basic concepts about the tools and warning signs that are used in the field of railway systems and translate the basic texts related to this area.

## RESEARCH

- Visiting a foundation running in the field of railway systems search the tools and the warning signs and find the english equivalents of the terms.
- Prepare a feedback report and present it in the class to your instructor and your friends.

## 1. EQUIPMENTS AND WARNING SIGNS USED IN RAILWAY SYSTEM VEHICLES

### 1.1. The Security Signs Used in Hand-Tools

- We use various hand tools in our ordinary life and in our job. Hand tools vary from a simple screwdriver to lathe table.
- Hand tools can be operated by means of arm power or any kind of energy source.
- We use hand tools to fix, to mix, to cut, to arrange , to hang, to staple, to make a hole, to heat, to turn, to drive, to shape or to sign different materials.
- Hand tools can be sharp , sharp pointed , square-shaped. They also can be tong-mouthed, extremely hot or extremely cold..



**Figure 1.1: Hand Tools**



**Figure 1.2: Hand tools can be dangerous**

Hand tools can be dangerous for both their users or anyone who is near that hand tool. Hand tools may cause injuries for those people.

Not to cause any job-accident, we should obey some rules while we are working.

The main causes of those accidents are as follows;

- To use inappropriate tool
- To use tools against the procedures
- Insufficient maintenance
- And inappropriate storing

➤ **Hand-Tool Controls**

1. Are the hand-tools appropriate for the work you are doing?
2. Are the hand-tools used appropriately?
3. Do the hand-tools carry/have appropriate security conditions?
4. Are the hand-tools stored in a secure place?

In the picture above; a worker is fixing a screw of a machine. As seen; he is fixing the screw with a pocket-knife. This worker has the possibility to get injured any time.



**Figure 1.3: The usage of a screwdriver**

In the picture above; worker is tightening the screw with a screwdriver while he is holding the wood with his left hand. When he starts to tightening the screw, if the screwdriver slips and hits his left hand, it may cause a serious injury.



**Figure 1.4: Cable stripping**

In the picture above; worker is cutting the protective cloth/cover on a rod. He is holding the rod with his hand tightly, so that rod won't move. Is there a possibility for him to get injured, why?

The knife is sharp , so it can slip out of his hand and cut any part of him.

- He is not using the knife in a correct manner.
- Knife is not the right tool for this work.



**Figure 1.5: The loosen key**

In the picture above; worker is pushing down the spanner by his hand to loosen the screw nut. That's not a safe situation, because if the screw nut loosens suddenly, he may lose his balance and he may injure his hand.

When choosing a hand-tool, we should, first of all, check whether the tool is appropriate for the work or not. Then we should ensure that we know the right use of the hand-tool.

In the picture below; we can observe that some hand-tools don't have the necessary security conditions. In the pictures below, we can check over the security rules mentioned above.



In order to avoid the possible injuries of hand-tools, we should check four criterian mentioned above and we sould say “yes” to all questions.



As we see in the pictures above; the following things cause many of the injuries and incidents;

- Fall of hand-tools from high places
- Carrying sharp or sharp pointed things in your pocket,
- Leaving the hand-tools in tool bag unneatly.



When you finish the work or you need to leave the tool, you should put it in a safe place.

Imagine that the person in the picture above is stretching to take a pencil. As estimated; there is a possibility for him to injure his hand with the pocket knife on the pencils, because the pocket knife has been left open.

## 1.2 Security Signs and Warnings Used in Electrical Devices

Electricity is one of the most important energy sources. We use electricity to lighten dark, to heat and cool houses and offices. We are bound to electricity to do many things such as; running various machines and running the engines.

Electricity; despite all its good sides; can be dangerous and also it can cause human deaths.

### ➤ Some Security Rules to be Aware of While Working with Electrical Devices

- Do not use worn-out cords or hand-tools with worn-out cords.
- Do not leave the devices such as fixing key, on the tool before you start to run it.
- Do not make jokes to the people who are working with hand-tool and do not touch them.
- Check the tools before using them. Do not attempt to mend them.
- Do not force the hand-tools. Be more careful if there are cables or pipes etc. where you work.
- Do not use electrical hand-tools in wet or damp places. Be more alert while you are working near flammable materials.
- Do not try to fix the hand-tools when it is plugged. Do not attempt to change its components.

Below you will find the security signboards about the security signs and cautions in the use of electrical devices.



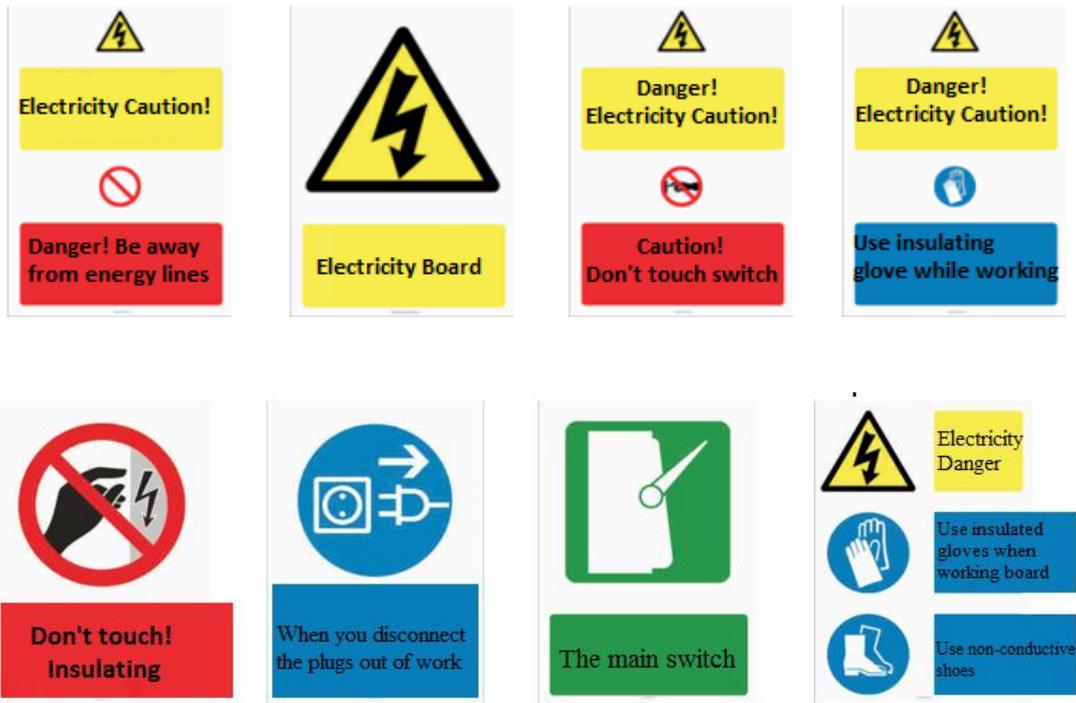


Figure 1.6: Security Signboards

Disconnect the plugs when out of work

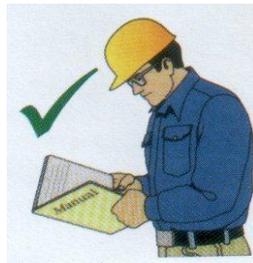


Figure 1.7: Not isolated electricity cables on the wall may cause accidents.

### 1.3. Security Signs and Warnings in the Use of Pnomatic and Hydraulic Devices

#### ➤ Things to be Learnt About the Pnomatic and Hydraulis Systems

- Before using a pnomatic or hydraulic equipment, read the instructions carefully and be sure that you understand the instructions clearly.



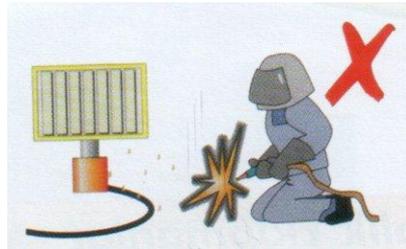
**Figure 1.8: Read the instructions**

- You shouldn't exceed the maximum capacity of the devices.
- In every lifting process, it is necessary that roller's top should be placed on secure place. Top supportive plate should be used when necessary.
- Check whether all the equipments in the system have the well-adjusted pressure and capacity degree or not. System's capacity is limited with the capacity of equipment with lowest capacity.
- You should try the system before you use it under the load. So that you will get good impression about the system and controls.
- Never carry or drag a pnomatic or hydraulic equipment by holding from its hose. This may cause a damage or possible break-down at the hose.
- Keep pnomatic or hydraulic equipment clean, dry and purified from any other dangerous materials.



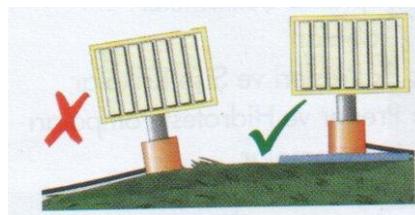
**Figure 1.9: Keep cables clean, dry and purified from other dangerous materials**

- Prevent pneumatic or hydraulic hoses to be twisted or to be broken. Do not let vehicles pass over the hoses or do not drop heavy materials on it. If you are not sure about the hoses, check them with pressure test.



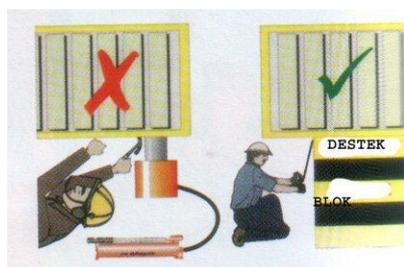
**Figure 1.10: Check with pressure test**

- Keep your pneumatic or hydraulic equipments away from open fire or heat over 65 C.
- Always lift the load by centralising. Check that the equipment is certainly under the load. Check whether the lifting process done parallel or not. In order to lessen the side loading effect, use when necessary, movable head.



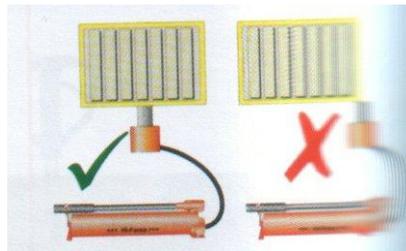
**Figure 1.11: Check whether the lifting process done parallel or not**

Never place your body under the load or applied power. You should take the load on dowl before you approach or go under it.



**Figure 1.12: Never place your body under a load or energy loaded sources**

- Never plug or unplug pneumatic or hydraulic connections when it is under pressure.
- Do not fix equipment pressure over the factory settings. Use manometer to observe system's pressure. Do not use the equipment till it is mended or the problem is discovered.
- Always check oil leakage.
- Check that the pistol is closed before you remove the hoses. So you will be sure that oil has returned to pump tank.



**Figure 1.13: Check that the pistol is closed before you remove the hoses**

- Do not lower the load on open pistol. Always lift the pistol up to the level of load.
- Bring your pneumatic or hydraulic equipment to authorized service for maintenance and mending. Be sure that they are using the original pieces.

## 1.4. Security Signs and Warnings in the Use of Pressured Covers and Devices

The parts or hardware that contributes to resistance of pressured container are made of unalloyed steel or unalloyed aluminium or aluminium that never hardens as it gets older. The maximum running pressure of container cannot be over 30 bar. The minimum running heat cannot be under  $-50^{\circ}\text{C}$ . The maximum running heat cannot be over  $300^{\circ}\text{C}$  for steel containers, it also cannot be over  $100^{\circ}\text{C}$  for aluminium or aluminium alloyed containers.



**Figure 1.14: Do not put side by side with the welding tube of pressurized tubes**

If there is no warning sign near the pressured tubes and if these pressured tubes are near any kind of heat source, these situations may cause accidents

In below, you will find the security signboard about the security signs and cautions in the use of pressured containers and devices.



**Figure 1.15: Security Signs and Cautions**

## 1.5. Security Signs and Warnings about Chemical Cleaners Such as Acidic Basic Used in the Systems.

- Colors as warning signs;

**Red:** Fire prevention signs, banning signs, places where flammable and flaring substances are stored, extinguishers and extinguishing equipments or bans about dangerous substances/materials.

**Orange:** Danger signs are used as warning signs against danger.

**Yellow:** Warning sign (against possible danger)

**Green :** Job security and health informing sign (it is used for general security and health)

**Blue:** Caution and banning sign (maintenance, mending, breakdown etc.)

**Purple:** Radiation risk/danger

**White:** Direction sign, security and health sign ( Fire prevention sign, ban sign, caution sign)

**Black:** It is used in preparing direction sign (Danger sign, warning sign)

- Classifying dangerous substances

- Explosives
- Gases
- Liquid substances
- Solid substances
- Oxidizing
- Irritant

➤ Chemical risk warning signs

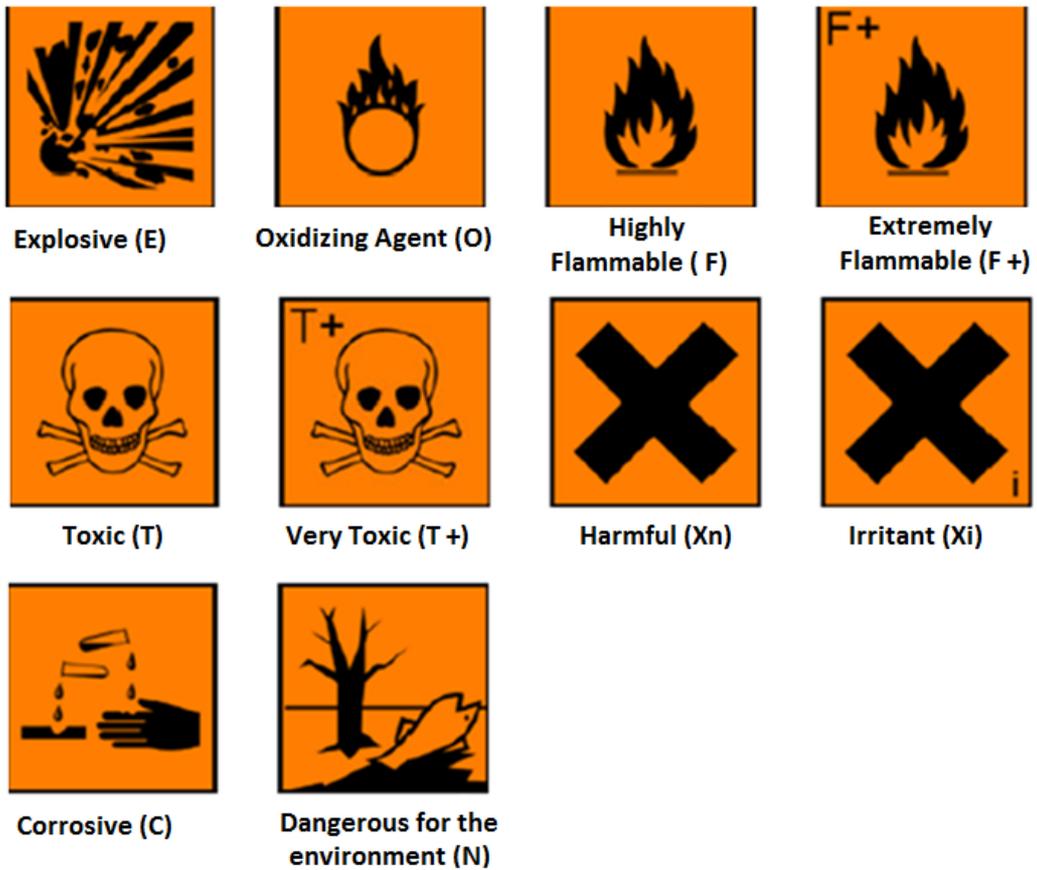


Figure 1.16: Warning signs

## APPLICATION ACTIVITY

Steps of process	Suggestions
<p>Translate the text below into Turkish.</p>	<ul style="list-style-type: none"> <li>➤ Read the whole text.</li> <li>➤ While reading try to predict the terms that you do not know.</li> <li>➤ Find the english equivalents of the terms from technical dictionaries.that you can't predict.</li> <li>➤ You can find detailed information about the terms from the text</li> </ul>

In our ordinary life we use different kinds of hand-tools or electrical hand tools to fix, to twist, to mend, to repair things. We are not aware of that we may get injured while using those tools. In order to avoid accidents and damages of those tools we should keep some practicalrules in mind. First of all, we should keep hand-tool always in a safe place where nobody will get injured. It is better to keep sharp tools in tool bags. We should read the instructions before using a new tool especially when we don know how to use it. We should be sure of the right use of it. Apart from hand-tools, we should also be alert about the electrical hand-tools. We shouldn't attempt to fix or mend the device when it is plugged. We shouldn't make jokes who are working with devices. We shouldn't use devices with worn-out cords. We shouldn't try to mend the devices by our own. We should take it to the service when it is out of order or broken. If we keep those simple rules in mind, we will reduce the risk of facing any work accidents.

### CHECKLIST

If you have behaviors listed below, evaluate yourself putting (X) in "Yes" box for your earned skills within the scope of this activity otherwise put (X) in "No" box.

<b>EVALUATION CRITERIA</b>		<b>YES</b>	<b>NO</b>
<b>1</b>	Have you executed technical English applications on warning signs that are used in hand tools?		
<b>2</b>	Have you executed technical English applications on warning signs that are used in electrical motors?		
<b>3</b>	Have you executed technical English applications on warning signs that are used in Pneumatic / hydraulic device?		
<b>4</b>	Have you executed technical English applications on warning signs that are used in pressure vessels and equipment?		
<b>5</b>	Have you executed technical English applications on warning signs that are used in acidic and alkaline chemical cleaners?		

## **EVALUATION**

Evaluation at the end of "No" answers in the form of a further Review. You do not see yourself in the learning activity should be repeated enough. All your answers are "Yes" in the "Measurement and Evaluation," please go to.

## MEASURING AND EVALUATION

### Choose the correct option

1. What is the name of the tool which can be operated by arm power or any kind of energy source?
  - A) Electrical devices
  - B) Hand tools
  - C) Pnomatic devices
  - D) Hydraulic devices
  
2. Which one in the below is not the cause of accident while working with hand-tools?
  - A) Making appropriate storing
  - B) Using inappropriate devices
  - C) Usin devices against the instructions
  - D) Not doing sufficient maintenance
  
3. Which one in the below is not among security rules to be obeyed while working with electrical hand-tools?
  - A) Do not make jokes or touch to the people working with hand-tools.
  - B) Do not use the hand-tools with worn out cords.
  - C) Do not use the electrical devices in damp or wet places
  - D) Fix the hand-tool when it is plugged.
  
4. Which one in the below is not among the security rules to be obeyed while working with hydraulic and pnomatic devices?
  - A) Prevent hydraulic and pnomatic hose to be twisted or broken.
  - B) Check the leakage in the system.
  - C) Do the maintenance of hydraulic and pnomatic devices by yourself
  - D) Keep the hydraulic and pnomatic devices away from open fire.
  
5. What does the yellow means as warning sign?
  - A) Warning sign for the possible dangers
  - B) Attention and banning sign
  - C) Direction sign
  - D) Fire prevention and banning sign

---

## **EVALUATION**

Please compare the answers with the answer key. If you have wrong answers, you need to review the Learning Activity. If you give right answers to all questions, pass to the next learning activity

# LEARNING ACTIVITY -2

## AIM

- At the end of this activity you will be able to express the main definitions and terms about the main hardware of pulling vehicles technology that are used in the field of railway systems and translate the basic texts related to this area.

## RESEARCH

- Visit a foundation running in the field of railway systems technology, search the main definitions and terms about the main hardware of pulling vehicles that are used in the field of railway systems and find the english equivalents of the terms.
- Prepare a feedback report and present it in the class to your instructor and your friends.

## 2. MAIN DEFINITIONS AND TERMS ABOUT THE MAIN HARDWARE OF PULLING VEHICLES

### 2.1 Main Definitions and Terms of Locomotive Engines

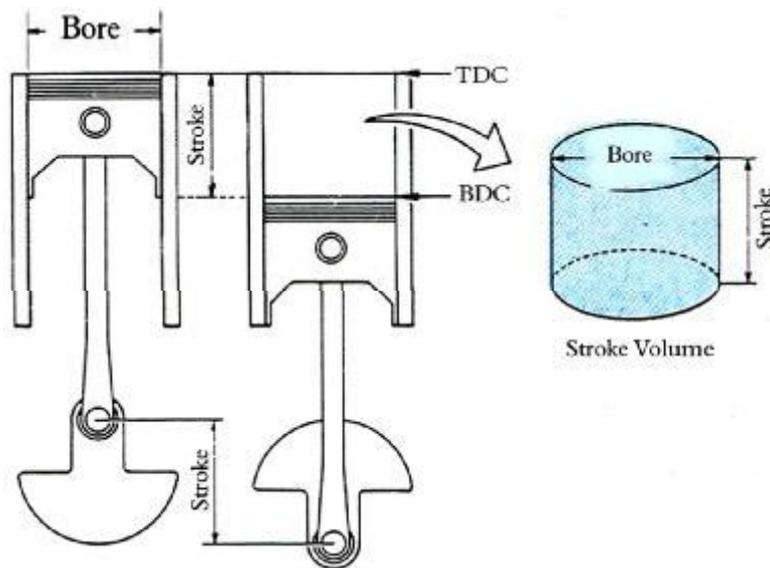
#### ➤ Stroke and Stroke Volume (SV) (Swept Volume)

Stroke is the distance in the space where the piston moves in the cylinder, that is, the distance between top dead center and bottom dead center.

Stroke is a movement that the piston makes (moves) between dead centers in the cylinder. As theoretical, a stroke is formed for crankshaft to turn of 180°.

Bore is the diameter of the cylinder.

Stroke volume is the volume between T.D.C. and B.D.C. Total stroke volume products stroke volume and cylinder numbers of an engine



**Figure 2.1: Stroke and Stroke Volume**

➤ **Cycle**

The movement that piston makes between two dead points in cylinder is called time. It is the movement between two dead points of piston and 180 degree turning movement of crank pivot. It continues as 180 degree theoretically for a time.

- **Four Cycle Diesel Engine**

- **Induction Stroke**

The inlet valve opens and the piston moves downward, a depression is created in the cylinder. Atmospheric pressure outside the cylinder forces air through the open inlet port into the cylinder, as in Figure 2.2. Once the piston has reached the end of the induction stroke the inlet valve is closed.

**Note:** Only air is drawn into the engine as there is no carburetor and the air intake is not throttled or obstructed in any way.

- **Compression Stroke**

The piston moves upwards, both inlet and exhaust valve remain closed, and the air trapped in the cylinder is compressed to approximately one-sixteenth of its original volume, as indicated in Figure 2.2. The actual compression ratio used varies from engine to engine

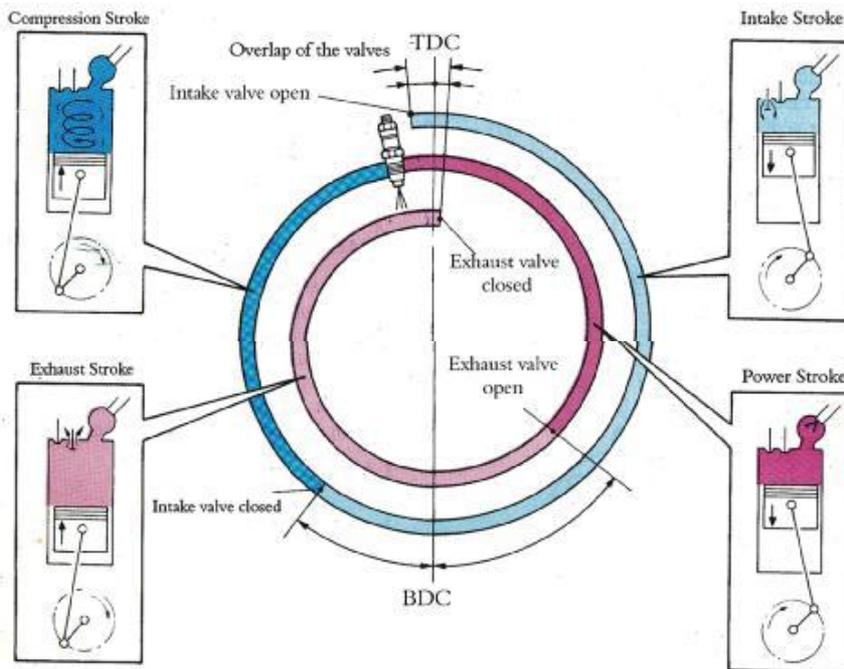
from approximately 12:1 to 23:1 or in some applications even higher. As a result of the high pressure the air temperature within the cylinder will be about 800°C (1500°F). A measured quantity of atomized fuel is injected into the cylinder just before the piston reaches the top of its stroke.

- **Power Stroke**

The injected fuel has a self-ignition temperature in the region of 400°C (752°F), therefore, being introduced into a temperature of 800°C, it ignites and begins to burn. The expansion of the burning gases forces the piston down on its power stroke, as shown in Figure 2.2

- **Exhaust Stroke**

As the piston nears the end of its downward stroke, the exhaust valve opens. The spent exhaust gases are forced out of the cylinder as the piston moves upward on its exhaust stroke as illustrated in Figure 2.2. When the piston reaches the top of its travel the exhaust valve is closed and the inlet valve opens and another cycle of operations begins.



**Figure 2.2 : Running principle of the four-cylinder diesel engine**

➤ **Combustion Chamber Volume (CCV) (Clearance Volume)**

Combustion chamber volume is the volume between the crown of the piston and cylinder head while the piston is at T.D.C.

➤ **Cylinder Volume**

Cylinder volume is the total of stroke volume and combustion chamber volume. Total cylinder volume is the product of cylinder volume and cylinder numbers of an engine.

• **Compression Ratio**

$$\text{Compression Ratio} = \frac{\text{Combustion Chamber Volume} + \text{Stroke Volume}}{\text{Stroke Volume}}$$

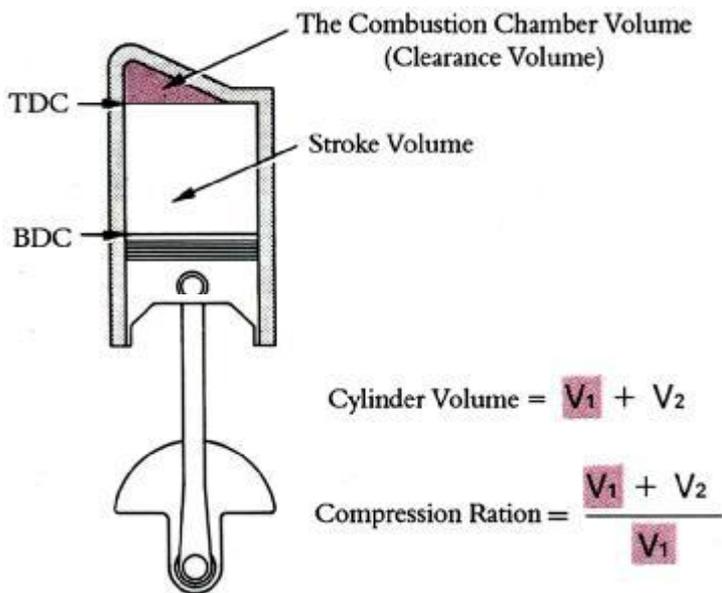
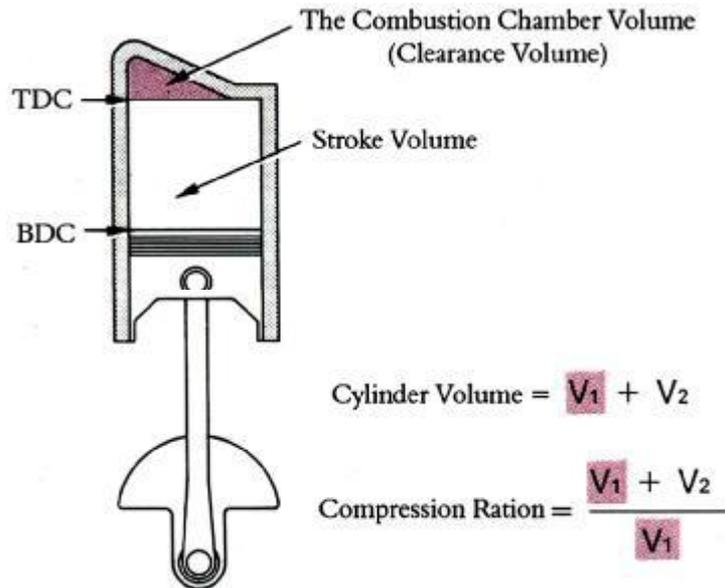


Figure 2.3: The Combustion Chamber Volume and Compression Ratio



➤ **Dead Centre:**In the cylinder of the piston, dead center is the point where piston stops long time because it changes the direction of its motion.

- **Top Dead Centre (T.D.C.):**In the cylinder, the crown of the piston reaches at the top. In the case of an engine the term “top dead center (t.d.c.)” refers to the position of the piston at the top of its stroke.
- **Bottom Dead Centre (B.D.C.):**In the cylinder, the crown of the piston reaches the bottom. The term “bottom dead centre (b.d.c)” refers to where the piston is at its lowest position.

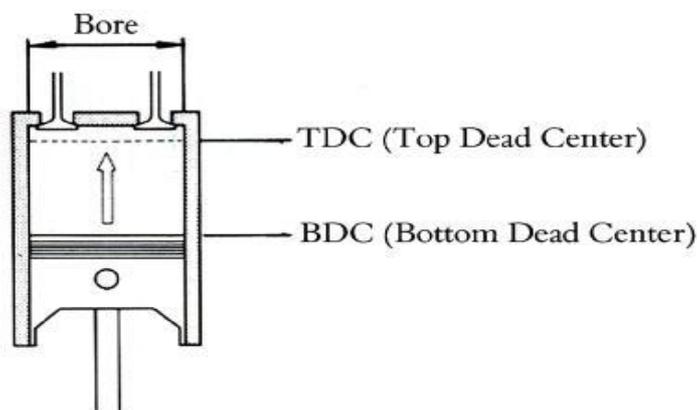
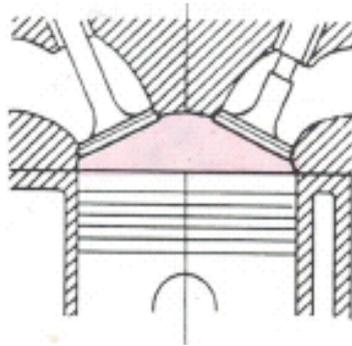


Figure 2.4: Stroke and Stroke Volume

➤ **The End of the Compression Stroke**

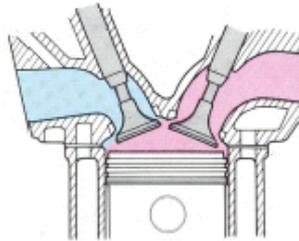
The end of the compression is the position that two valves are covered (closed) and that the piston is at T.D.C. during the end of the compression stroke and the start (beginning) of power stroke



**Figure2.5: Sente**

➤ **Overlap of the Valves**

Overlap of the valves is the position that two valves are uncovered and that the piston is at T.D.C. during the end of the intake stroke and the start of exhaust stroke.



**Figure 2.6: Supap Bindirmesi**

➤ **Vacuum**

Non-existence or lackness of air or pressure in an environment is called as vacuum. We can create fractional-vacuum in every area.

➤ **Pressure**

Pressure has been defined as power for per unit square. It is calculated with this formula  $P=F/A$ .

In this equation;

P: Pressure

F: Vertical power on surface yüzeye dik kuvvet

A: surface area

The unit is  $\text{N/m}^2$ =pascal in the unit system

## 2.2. Classification of Locomotive Engines

### ➤ According to Fuel

- Gasoline engine
- Diesel Engine
- LPG Engine
- Hydrogen

### ➤ According to the Valve System of Engine

- L Type
- I Type
- T Type
- F Type

### ➤ According to Cylinder Numbers

According to cylinder numbers, vehicle engines are classified single-cylinder engines and multi-cylinder engines. Multi-cylinder engines are usually produced two, three, four, six, eight, twelve and sixteen cylinders. In most of the vehicles usually used engines have four, six and eight cylinders.

### ➤ According to Cylinder Design (According to Arrangements of Engine Cylinder)

Vehicle engines are usually classified according to the number and actual arrangement of the cylinders in the engine block. In most of the cars and light commercial vehicles commonly used cylinder arrangements are the in-line and V-formation type although other designs may be employed.

- **In-line Engines**

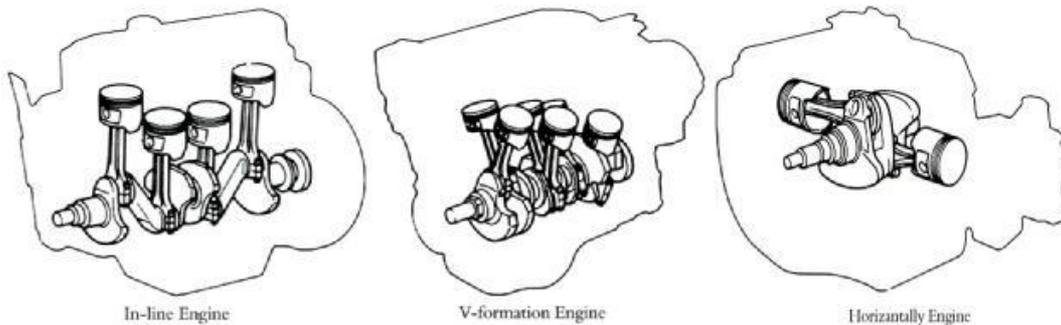
The most popular arrangement to use in the small and medium sizes of vehicles is probably the four-cylinder in-line engine. In-line engines may also have two, six, or even eight cylinders mounted in straight line, one after the other. Usually the cylinders are formed in a vertical bank above the crankshaft as indicated in Fig 2.4. On some engines, the cylinders are inclined from the vertical so overall engine height can be reduced and space conserved in the engine compartment. The cylinders are usually numbered from front to rear although there are some manufacturers who number their engines from the rear to the front.

- **V-Formation Engines**

In “V” engines the cylinders are mounted above the crankshaft to form the letter “V” when viewed from either end (Fig.2.4). The cylinders are usually cast integrally with the crankcase in two rows or banks which are set at either a right angle *or* an acute angle to each other. Although engines with sixteen cylinders have been produced in the past, most V-engines are now produced in four, six, eight and occasionally twelve cylinder arrangements. The V-type engine has the advantage of being much shorter than the in-line arrangement. It does not occupy as much space when installed in the vehicle. If the overall length of the engine can be reduced, the crankshaft can be made more rigid with less tendency toward internal or torsional vibration. In most arrangements the cylinders are numbered starting from the front of the left-hand bank, and then continuing from the front of the right-hand bank.

- **Horizontally Opposed Engines**

The engine has two banks of cylinders mounted directly opposite to each other on the crankcase as indicated Fig 2.6. These are sometimes referred to as “flat” engines and are usually produced in two, four, and six cylinder arrangements. The pistons move inwardly and outwardly together providing excellent balance and regular firing intervals. Horizontally opposed engines are admirably suited to air cooling and have proved to be very successful in operation. The most notable design was the four-cylinder, horizontally opposed, air-cooled Volkswagen engine. The cylinders are numbered in the same manner as in the case of a V engine.



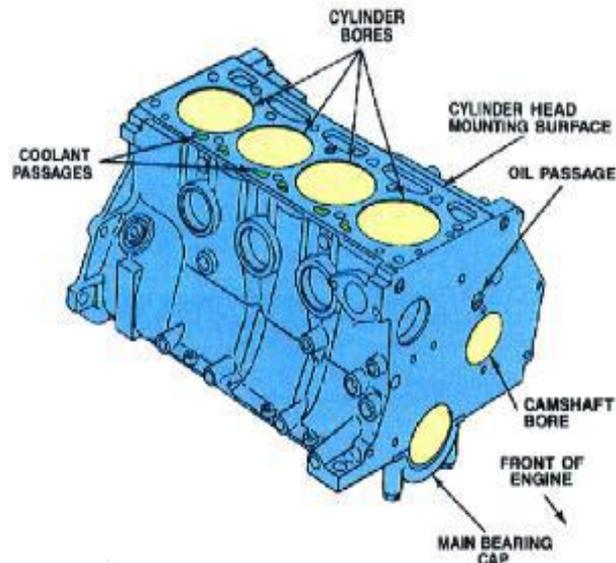
**Figure 2.7: According to Arrangements of Engine Cylinder**

- **Stationary Parts of the Engine**

- **Cylinder (Engine) Block**

The cylinder block is the main shell of the engine. Most blocks are made of cast iron but a few are aluminum which is lighter and conducts heat better. Because aluminum is too soft to withstand the constant rubbing of the piston, most aluminum engines have cast-iron sleeves (called liners) inserted in the cylinders. The block can have many cracks if water

freezes and expands in these passages. Sometimes this expansion will dislodge the core plugs-discs that seal holes required during the casting process and for this reason the core plugs are sometimes referred to as freeze-out plugs. However the core plugs are not reliable safety valves and it is important to maintain at least a 50 percent concentration of antifreeze in the engine's cooling system.



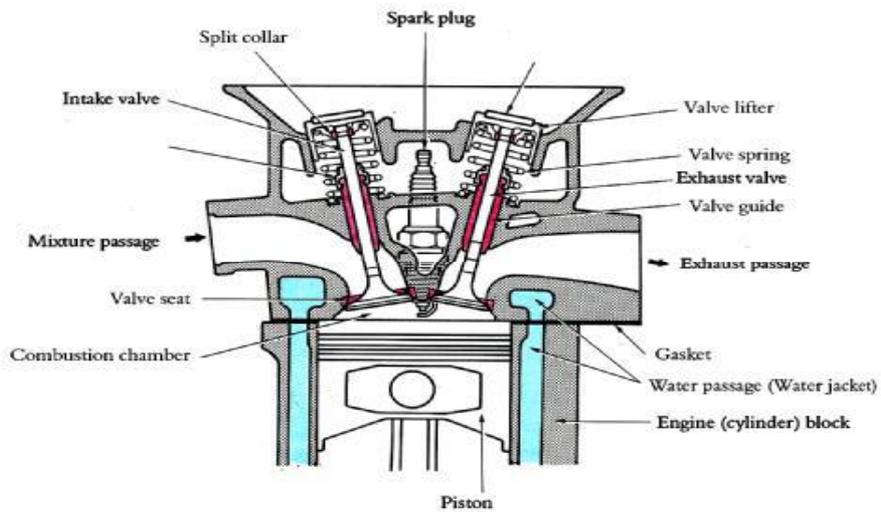
**Figure 2.8: In-line four-cylinder engine**

- **Cylinder Head (Cover)**

The cylinder head corresponds to the head of an engine consisting of water jackets for cooling combustion chambers and their surroundings intake and exhaust valve holes gas passages past those valves intake and exhaust manifolds spark plug holes and lubricating oil passages.

The cylinder head is usually cast from iron or from aluminum alloy. Most modern engines use an aluminum alloy head which combines the advantages of lightness and high heat conductivity.

Head gasket provides a seal between the cylinder block and head to prevent the escape of gases and fluids. It is pierced by many holes, the large ones for the cylinders and the smaller ones for the pushrods, studs, and oil and water passages. The gasket is often made of a compressible material such as asbestos with a copper or steel cover.

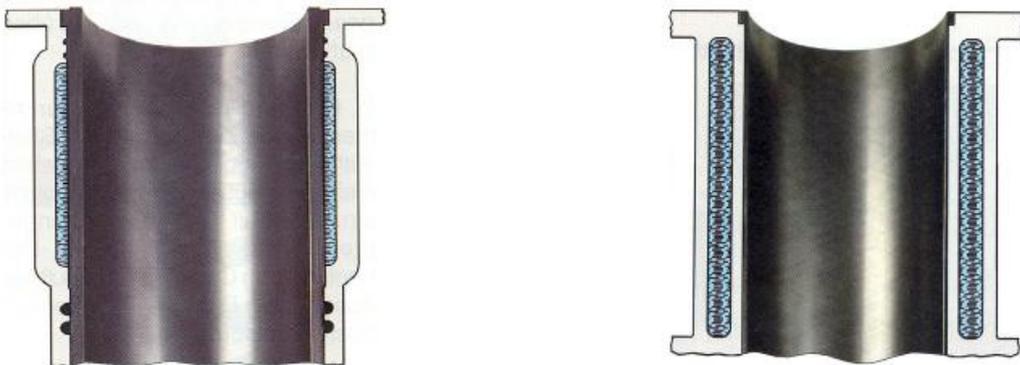


**Figure 2.9: Description of each part of cylinder head (cover)**

- **Liners**
  - **Wet Liner**

The engine block contains holes in which the liners are inserted. The liners are “wet” when their external surface is in direct contact with cooling water.

On the top part of the block, water tightness is obtained through direct metal to metal bearing. At the bottom through tight joints inserted in grooves cut in the lower part of the liner or of the block, or by means of a bearing and brass joint.



**Figure 2.10: Wet liners**

- **Dry Liners**

This is a thin sleeve made of cast iron or of steel which is forced into a hole bored in the block. Thus a liner is not in direct contact with the cooling liquid.



**Figure 2.11: Dry liners**

- **Manifolds**
- **Intake Manifold**

Formal name is “inlet manifold” but it is more generally called “intake manifold”. It is used with a multi-cylinder engine for distributing the air-fuel mixture fed from the carburetor to all the cylinders. Its primary role is to uniformly deliver the mixture to all cylinders but it should also play another very difficult role that is to uniformly distribute the gasoline which flows along the wall of the manifold in liquid state, as well as the atomized gasoline.

Furthermore the intake manifold also assists the atomization of gasoline because this does not occur only in the carburetor.

- **Exhaust Manifold**

An exhaust manifold plays the role of gathering exhaust gases from multiple cylinders into single or dual flow. It is designed for the functions of avoiding interference to the exhaust gas from other cylinders and of allowing exhaust at high efficiency to contribute to the increase of power output by reducing the volume of gases remaining in the cylinders at the same time. The material of an exhaust manifold for a mass-produced engine is generally cast iron.

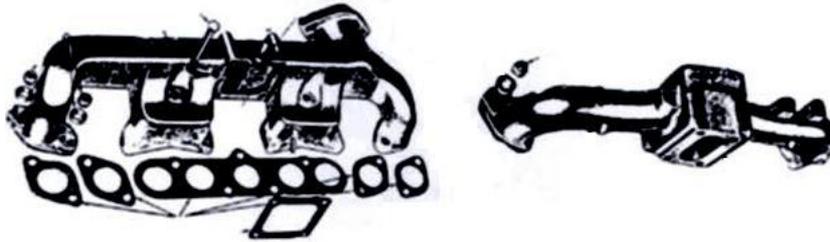


Figure 2.12: Manifolds

- **Oil Pan**

The oil pan acts as a reservoir for oil, and it also serves as a dust shield for the bottom of the engine. It is attached to the bottom of the block with cap screws.

The pan is generally made of thin steel stamped to shape.

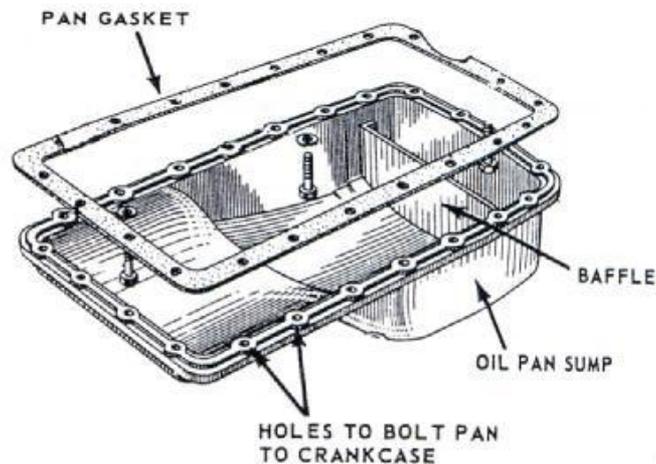


Figure 2.13: Oil pan

- **The Moving Parts of the Engine**

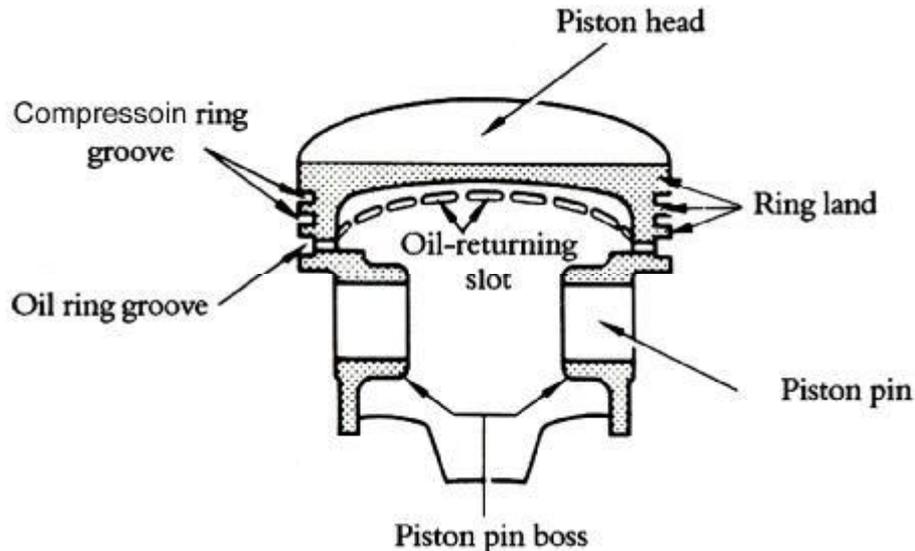
- **Piston**

As the piston is pushed down by the combustion pressure of high-temperature burned gases, the crankshaft is rotated through the connecting rod. Thus, the piston must meet the following requirements.

1. The piston must be strong enough to withstand high temperatures.
2. To prevent seizure during reciprocating motion the piston must have a practical

shape with an adequate cylinder clearance. It must also be able to keep the cylinder wall lubricated.

3. Small amount of frictional resistance.
4. Both the piston and the piston rings must possess good wear-resisting properties.
5. Lightness.

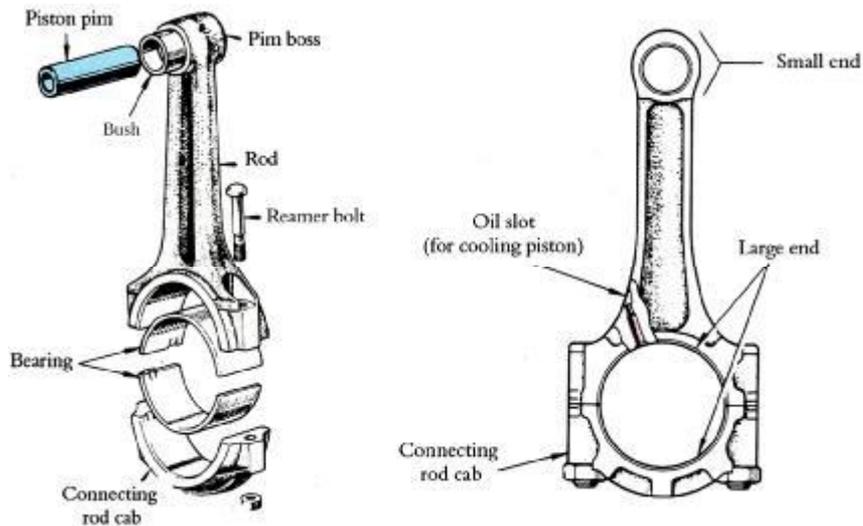


**Figure 2.14: Description of each part of piston**

Pistons are usually made of aluminum. Often aluminum pistons are tin-plated to allow a good breaking-in job when the engine is started. Aluminum pistons can be forged but are more commonly cast. The aluminum piston is light and for most purposes, this gives it an advantage over the cast iron type. A piston must change its direction of travel at the end of every stroke. At speeds sometimes in excess of four thousand revolutions per minute (rpm), it is obvious that the lighter the piston is the more efficient it will be. Cast iron is a good material for pistons used in a slow speed engine. It has excellent wear characteristics and will perform admirably in an engine suited to its needs. Pistons which are designed to operate in silicon aluminum cylinders are iron-plated aluminum.

- **Connecting Rod**

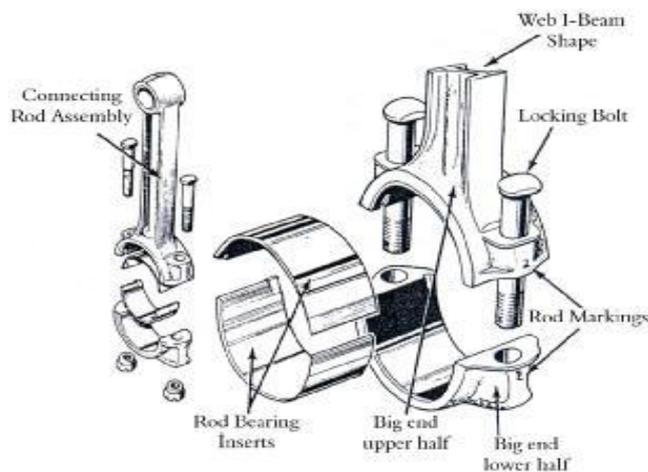
The connecting rod connects a piston to a crankpin on the crankshaft. It converts the reciprocating motion of the piston to the continuous rotary motion of the crankshaft.



**Figure 2.15. Description of each part of connecting rod**

As the name implies, connecting rods are used to connect, pistons to the crankshaft.

The upper end of a rod oscillates (swings back and forth), while the lower or big end is bearing rotates (Figure 1.16).



**Figure 2.16: Typical connecting rod construction**

As there is very little bearing movement in the upper end, the bearing area can be reasonably small. The lower (big) end rotates very fast, and the crankshaft journal turns

inside the connecting rod. This rotational speed tends to produce heat and wear. To make the rod wear well, a larger bearing area is required.

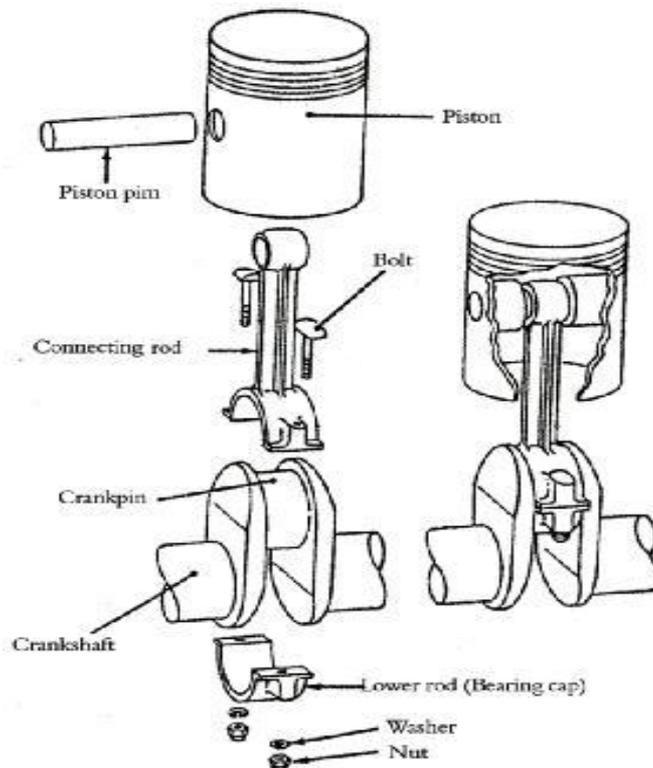
The upper end of the rod has a hole through it for the piston pin. The lower end must be installed on the crankshaft journal.

The upper and lower halves of the rod are bolted together. The upper and lower halves should be numbered and when installed, the numbers should be on the same side. This prevents turning the cap around when installing the rod.

Connecting rods are generally made of alloy steel. They are drop-forged to shape, then machine. The customary shape utilizes I-beam construction (Figure 2.16).

- **Piston Pin**

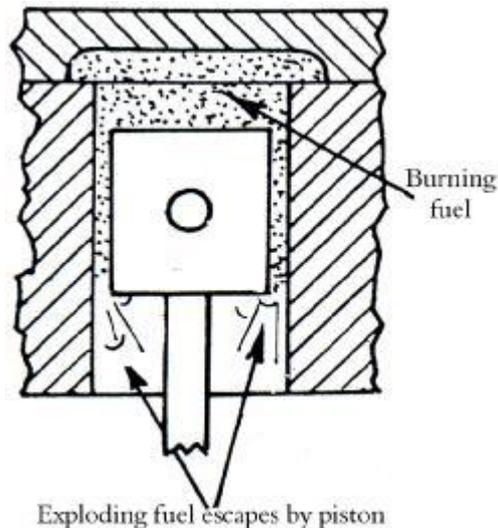
The piston is attached to the small end of the connecting rod by means of a piston pin. The pin passes through the small end of the connecting rod and the bosses in the piston, thus transmitting the thrust power of the piston to the connecting rod.



**Figure 2.17: Connecting piston and connecting rod**

- **Piston Rings**

There is a clearance of 0.03 to 0.06 mm (0.012 to 0.004 in) between the piston and the cylinder. If the skirt has a 0.03 to 0.06 mm clearance and the head 0.08 to 0.10 mm, it is obvious that the piston can not seal the cylinder effectively (Figure 2.18).



**Figure 2.18: Piston cannot seal by itself because clearance with cylinder wall must be maintained**

Piston rings provide the necessary seal of this clearance so that the compressed fuel charge and/or high-pressure burned gases will not escape from the combustion chamber into the crankcase. In addition, they serve to adjust the film of oil on the cylinder wall. The two upper rings are called compression rings which prevent the escape of burned gases and function as a heat passage for cooling the piston. The lowest ring is called an oil-control ring which scrapes off excess oil remaining on the cylinder wall.

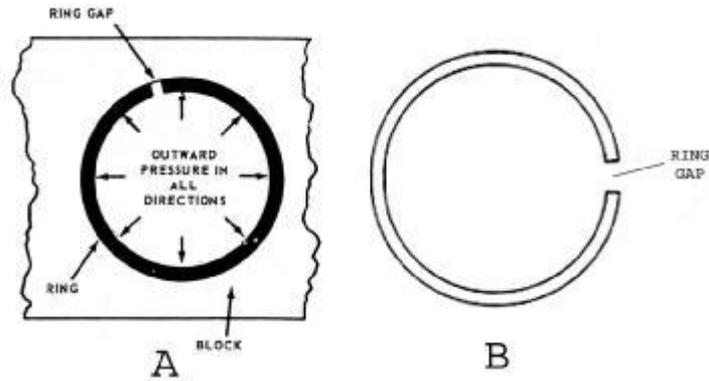
The solution to the leakage problem is the use of piston rings. A properly constructed and fitted ring will rub against the cylinder wall with good contact all around the cylinder.

The ring will ride in grooves that are cut into the piston head. The sides of the ring will fit the edges of the grooves quite closely. This side clearance can be around 0.05 mm.

- **Ring Gap**

The ring is built so it must be squeezed together to place it in the cylinder. This will cause the ring to exert an outward pressure, thus keeping it tightly against the cylinder wall (Figure 2.19-A).

The ring is not solid all the way around but is cut through in one spot. This cut spot forms what is called the ring gap (Figure 2.19-B).



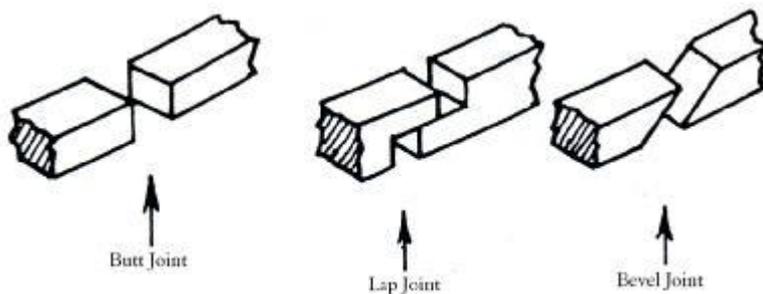
**Figure 2.19: Top view of cylinder shows sealing action of piston ring**

When the ring is in the cylinder, the cut ends must not touch. When the ring heats up, it will lengthen. Since it cannot expand outwardly, it will close the gap. If there is not enough gap clearance, the ends will soon touch and as the ring continues to lengthen, it will break up into several places. This can ruin a good engine.

A general rule for ring gap clearance is to allow 0.07 to 0.10 per mm of cylinder diameter.

Many different types of joints have been used in an endeavor to stop leakage through the ring gap. This leakage is commonly referred to as blow by. It has been found that the common butt joint is about as effective as any and is much simpler to adjust (Figure 2.17) illustrates a few of the types of joints that have been used.

The ring is placed in the groove by expanding it out until it will slip over the piston head and slide down and into the ring groove.



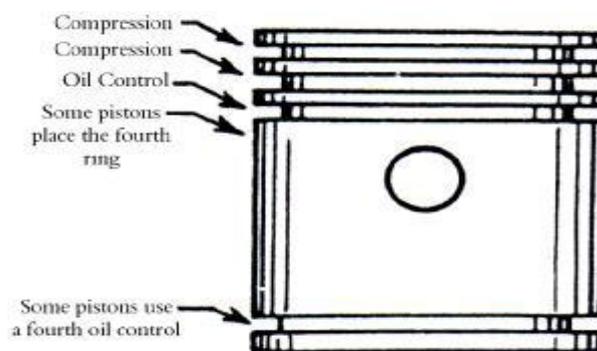
**Figure 2.20: Types of piston ring gap joints**

- **Types of Rings**

There are two distinct types of rings. One is called a compression ring and the other an oil control ring.

Most engines use three rings on each piston; two compression rings and one oil control ring. Others use two compression rings and two oil rings. Some diesel engines use five or more rings.

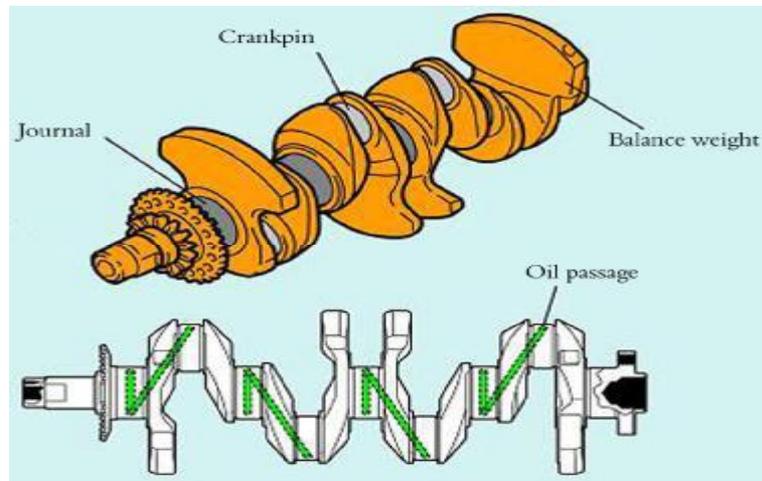
All rings may be above the piston pin; or a second oil control ring may be set into a groove near the bottom of the skirt. The compression rings are always used in the top grooves and the oil control rings in the lower grooves (Figure 2.21)



**Figure 2.21: Location of compression oil control**

- **Crankshaft**

As combustion pressure is applied to the piston, it moves up and down inside the cylinder. This up-and-down motion or reciprocating motion is changed to rotary motion by means of the crankshaft and connecting rods. In other words, the downward power thrusts when act on the pistons are converted to engine torque by the crankshaft.



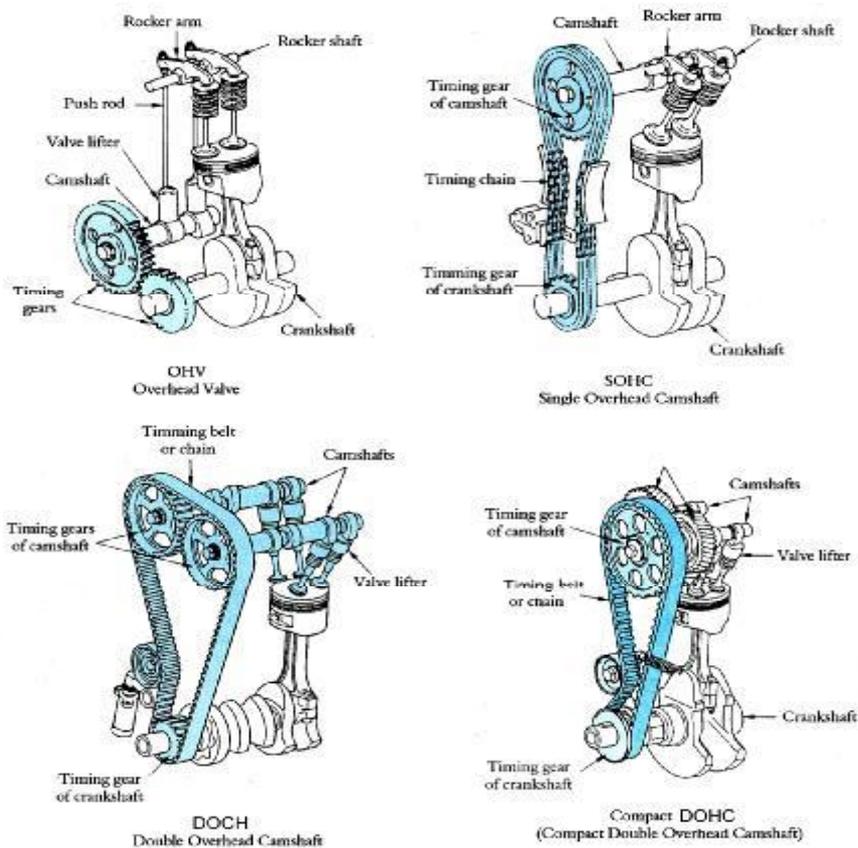
**Figure 2.22: Parts of crankshaft**

- **The Valve Mechanism**

During the operation of a 4-cycle engine, the intake valve draws in air-fuel mixture with the piston on its suction stroke and the exhaust valve expels the burned gases with the piston on its exhaust stroke. In short, these valves serve as the lids for each intake and exhaust port and they must perform the following functions:

1. When close, valves must provide a tight seal in order to prevent any leakage of the mixture or burned gases.
2. When open, they should allow the mixture or burned gases to pass through with a minimum of flow resistance or otherwise the engine performance will decrease considerably.
3. They must be able to withstand high temperatures since they are attached to the combustion chamber and therefore are exposed to the extremely hot burning gases when the mixture burns. The exhaust valve must especially be able to withstand exhaust gases reaching  $800^{\circ}\text{C}$  ( $1.472^{\circ}\text{F}$ ) or higher passing through it.

- **The Types of Valve Mechanism**



**Figure 2.23: The type of valve mechanism**

- **Parts of valve mechanism**

**The valves** in some engines rub against hardened inserts called the valve guide and valve seal. Most combustion heat is passed from the valve to the water passages via the seat when the valve's closed. A worn valve guide will allow oil to be sucked into the combustion chamber. A damaged seal may lower the cylinder's compression (Figure 2.24).

**Rocker arms** on many cars are made of pressed steel. These GM arms pivot on ball studs instead shafts.

**Valve Operation:** As the cam rotates, it lifts the lappet and pushrod, pivots the rocker arm, and opens the valve (Figure 2.25-A). Further cam rotation allows the tappet and ushrod to fall and the spring to close the valve (Figure 2.25-B). This design with the camshaft in the cylinder block is called an overhead-valve pushrod engine.

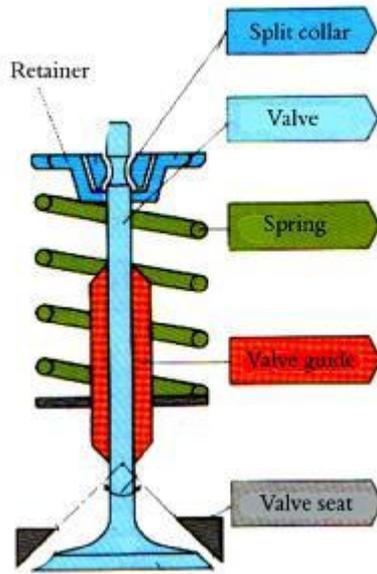


Figure 2.24: Parts of valve system

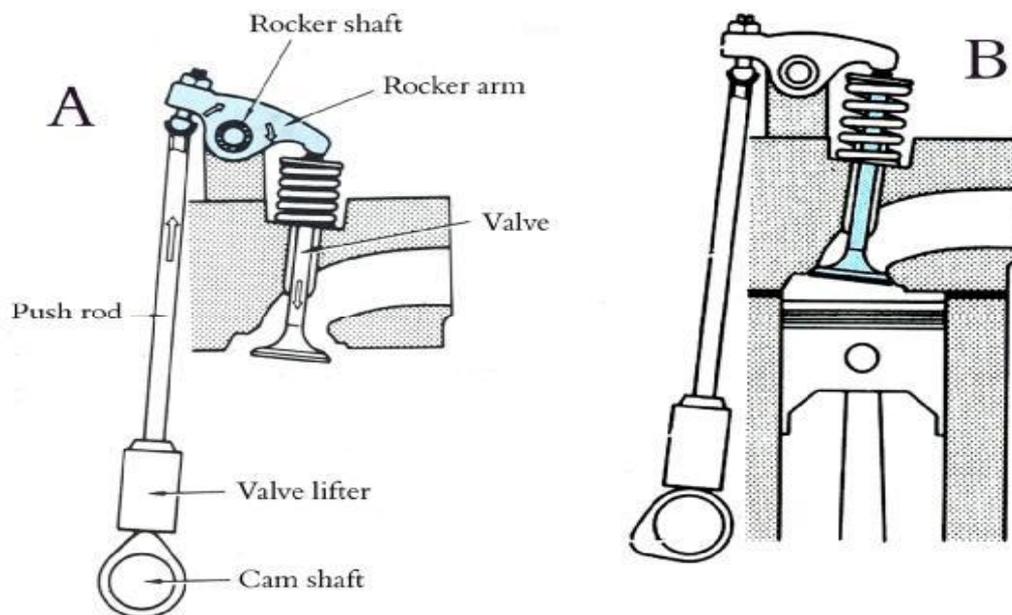


Figure 2.25: Valve operation

**Hydraulic Lifters** vary their height to maintain zero valve clearance at all times. When the lifter is down (left), pressurized oil flows past a check valve and fills the lifter. As the cam raises the lifter (right), oil is trapped below the check valve and the lifter rises like a solid unit. When the lifter drops, oil leaks out so that the valve can close completely.

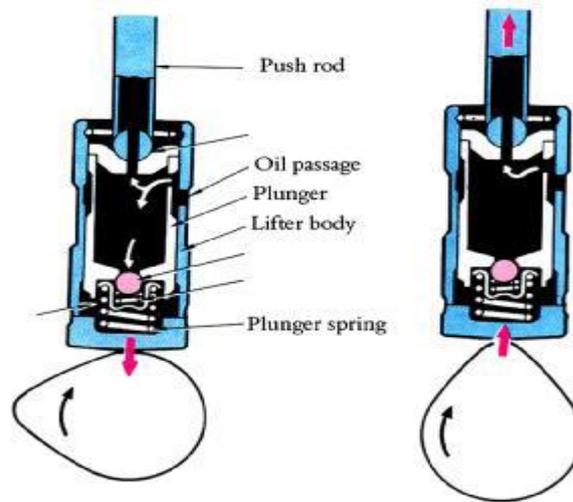


Figure 2.26: Hydraulic lifters

- **Camshaft**

The camshaft is driven by the crankshaft at  $\frac{1}{2}$  the speed of the crankshaft for opening and closing the intake and exhaust valves. It consists of the following parts:

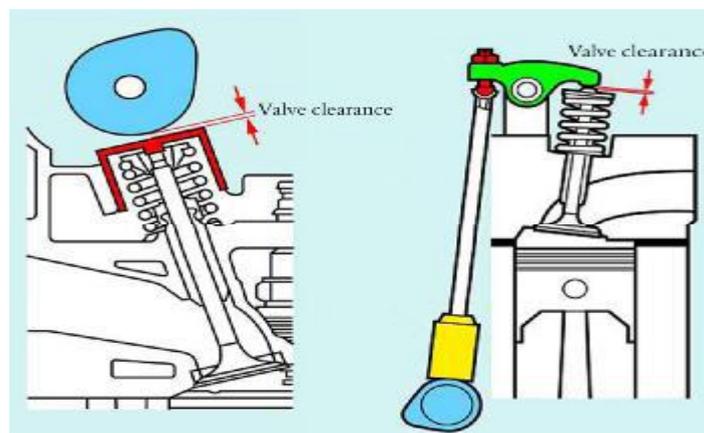
1. Oil pump drive gear: Drives the oil pump
2. Distributor drive gear: Drives the distributor
3. Fuel pump drive cam: Drives the fuel pump
4. Journal: Supports the camshaft
5. Cams: Open and close the intake and exhaust valves

- **Valve Clearance Adjustment**

The valve clearance must be set when the cam follower is on the back of the cam. This ensures that the valve is fully closed. This position may be determined by rotating the crankshaft through one full revolution from the fully open position of the valve. There are various methods of operating overhead valves and the method of adjustment of the valve clearance depends upon the arrangement employed. If the conventional pushrod and rocker arm assembly are used, adjustment is usually by setscrew and locknut. Measurement of the valve clearance is generally made with a feeler gauge of the recommended size inserted between the top of the valve stem and the rocker arm as illustrated in Figure 2.27. If the

feeler gauge will not go between the valve stem and the rocker arm, the locknut should be released and the setscrew slackened. Alternatively, if excessive clearance exists, the setscrew should be tightened. The clearance is correct when it is just possible to enter the feeler gauge blade of the correct thickness between the valve stem and the rocker arm.

Some manufacturers give specifications for adjusting the valve clearance when the engine is operating at normal temperature and at a slow idle speed. The feeler gauge is inserted between the valve stem and the rocker while the engine is in operation. Adjustments are then carried out in a similar manner to those described in the above. This is probably the most accurate method of adjusting valve clearances although there are practical problems which can make the procedure somewhat difficult.



**Figure 2.27: Valve clearance**

- **Flywheel**

The flywheel absorbs energy from the engine during the power stroke, and then returns it to the engine during the other three strokes of the cycle. Therefore the larger the flywheel, the more effectively it will operate to reduce changes in revolving speed or torque variation. However, if the flywheel is too large, a substantial turning force will be required to start the engine; also, the engine will provide reduced acceleration performance; and finally, there will be an increase in vehicle weight. For these reasons, it is preferable to keep the flywheel as light as possible.

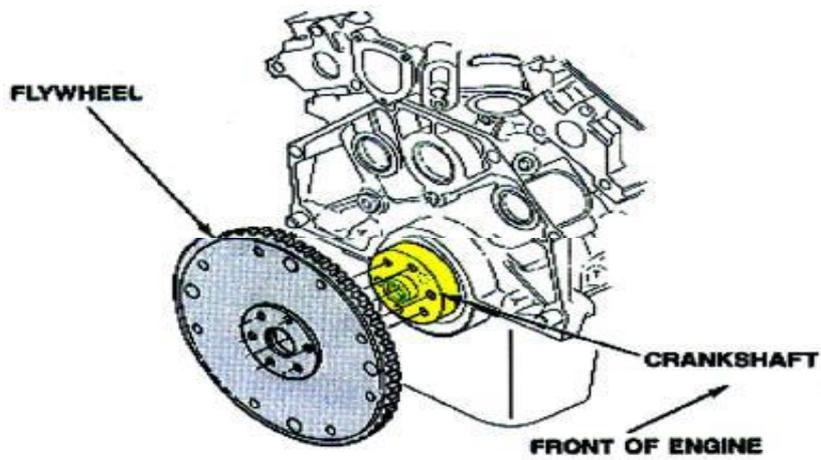
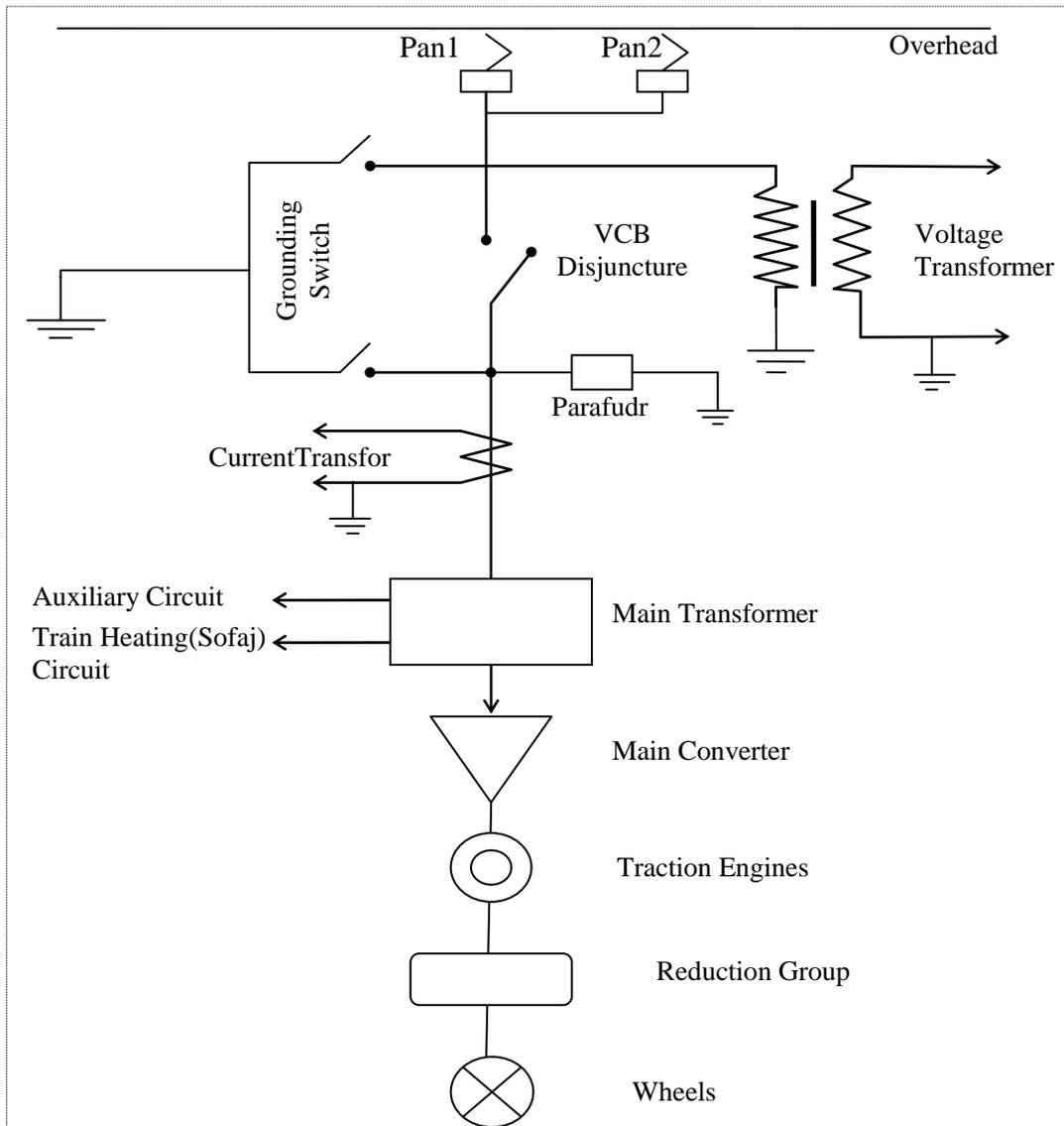


Figure 2.28: Flywheel assemble

## 2.3. Technology about the Main Hardware of Electrical Locomotives

### 2.3.1. Electricity and Electronics Systems in Locomotive

#### 2.3.1.1. Electrical Circuit in Locomotive



**Figure 2.29: E 43000 Type Locomotive High Voltage and Traction Circuit**

- **Pantograph**

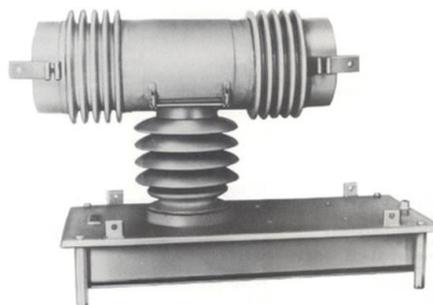
The duty of pantograph is to take alternative current electricity energy by means of coils from overhead and to send that alternative current electricity energy to main transformer through disjuncture. The normal contact pressure of pantograph is 7 kg.



**Figure 2.30: Pantograph**

- **Disjuncture**

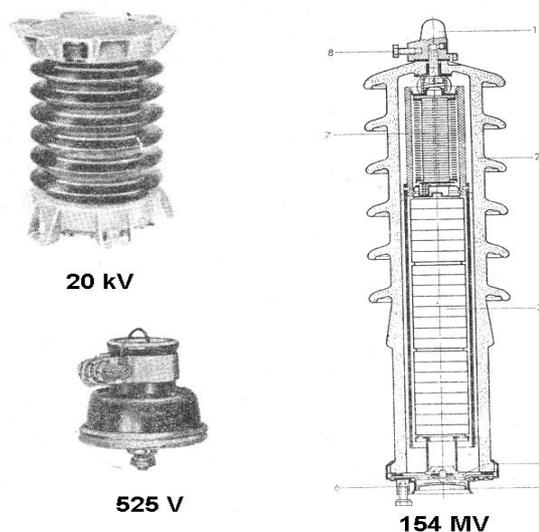
It is high voltage circuit switch which is combined with air and electricity systems. Disjuncture conveys 19-30 kV alternative current it takes from pantograph to main transformer (Disjuncture cuts the energy out of those values above). It both protects all electricity circuits of vehicle and by means of grounding section, it also provides total grounding of vehicle. All safety circuits of locomotive are connected to disjuncture in a serial way. Disjuncture fuse is above low voltage cabinet.



**Figure 2.31: Disjuncture**

- **Parafudr (Surge Protector)**

Surge protector protects locomotive and staff from abnormal voltage spikes which comes from overhead or it protects them in the case of thunder strikes . Surge protector unloads high voltage to the ground and protects staff and locomotive..



**Figure 2.32: Surge protector**

- **Transformer**

The machines that changes tense and current without changing frequency and power of alternative current are called transformers.

- **Converter**

The devices which convert electricity loads applied to its input such as current, voltage, frequency and phase into another types in its output are called “ converter”. Sometimes they are also called as inventors, there are two types of converters called as; dynamic and static.

- **Transaction Engine**

It transfers the rolling movement that occurs with stimulation of electricity energy by help of gear set to the wheels and it provides the movement of vehicle.

### 2.3.1.2. Charging Systems

Auxiliary alternator that gets movement from diesel motor is an alternative current machine. It revolves nearly three times more compared to diesel motor cycle. Alternative current which is produced, is converted into direct current in an auxiliary rectifier. Voltage regulator is used to keep the alternator's output voltage at 74 nominal volt. This alternator is now a machine that uses magnetic field .The energy produced by alternator are used as follows;

1. Battery charge
2. Lightening circuits Aydınlatma devreleri
3. Low Voltage remote-control and control circuits.
4. Warning alternator notice

### 2.3.1.3. Starting Systems

The starter is a conventional electric motor designed to turn the engine unit fires. Most car engines have to be rotated at 50 to 150 rpm before they will start. This requires considerable electric power, particularly in winter, when the engine is cold and the oil is thick.

To manage this high current, a switch called a solenoid is frequently used to turn on the starter. The solenoid and/or starter may be triggered by a relay.

The starter turns the engine's crank-shaft through a pair of gears. One, the pinion, is mounted on the starter shaft. It engages with the other, the flywheel, which rotates the crankshaft. The gear ratio between pinion and flywheel is generally about 10:1 that is, the torque of the starter is multiplied 10 times.

When the engine fires the starter pinion must disengage from the flywheel. Otherwise, the engine will run the starter motor at a high speed and damage it.

The starter works in the same way as any electric motor-it depends on the force that magnets exert on each other. The south pole of a magnet is attracted to the northern pole of another, and vice versa. Inside, a starter is a set of fixed electro-magnets called the field magnets, or field windings. Between them is the armature-another set of electromagnets that change polarity as they turn, becoming south whenever north on a field magnet is approached, and vice versa.

The change of polarity is achieved by a rotating commutator that makes contact with a pair of carbon brushes.

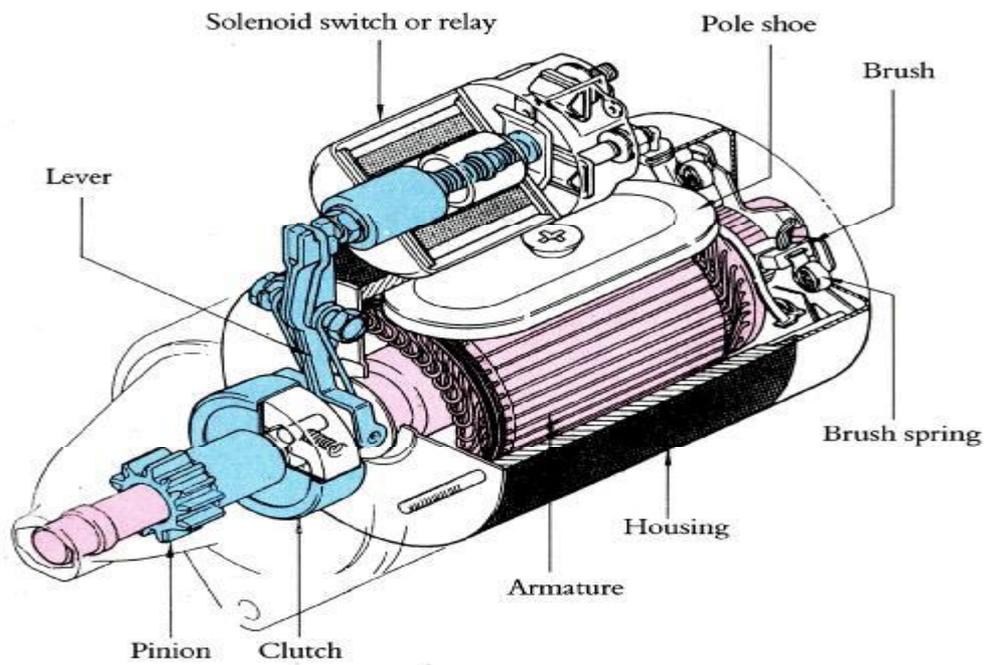


Figure 2.33: Starting Systems

## APPLICATION ACTIVITY

Steps of process	Suggestions
<p>Translate the text below into Turkish.</p>	<ul style="list-style-type: none"> <li>➤ Read the whole text.</li> <li>➤ While reading try to predict the terms that you do not know.</li> <li>➤ Find the english equivalents of the terms from technical dictionaries.that you can't predict.</li> <li>➤ You can find detailed information about the terms from the text</li> </ul>

When the piston reaches the bottom of its stroke, the intake valve closes and the crankshaft forces the piston back up through the cylinder. This compresses the air-fuel mixture in the combustion chamber.

As the piston nears the top of the compression stroke, the air-fuel mixture is ignited by a spark from the spark plug. This explodes the mixture, and the pressure of the rapidly expanding gas drives the piston down through the cylinder. Both valves are closed during this firing stroke.

After reaching the bottom of the firing stroke, the exhaust valve opens, and the spinning crankshaft forces the piston up through the cylinder once again. This time all the burned gases are driven, or exhausted, from the cylinder and combustion chamber.

When the piston reaches the top of the exhaust stroke, the exhaust valve closes and the intake opens. The piston is drawn down on another intake stroke.

## CHECKLIST

EVALUATION CRITERIA		YES	NO
1	Have you executed technical English applications in the main equipment for the towing of vehicles?		
2	Have you executed technical English applications in the towing vehicle engines, the basic definitions and terms?		
3	Did you use technical English terms about the towing of vehicles electric-electronic home equipment?		
4	Have you executed application of technical English applications in the towing vehicle engines, the basic definitions and terms?		
5	Have you executed application of technical English starter system used in railway vehicles?		

## EVALUATION

Evaluation at the end of "No" answers in the form of a further Review. You do not see yourself in the learning activity should be repeated enough. All your answers are "Yes" in the "Measurement and Evaluation," please go to.

## MEASURING AND EVALUTION

**Read the sentences and answer the questions. Then, compare your answers with the answer key at the end of the module.**

1. Which one reaches the crown of the piston at the top of the cylinder?
  - A) Top Dead Center (T.D.C.)
  - B) Bottom Dead Center (B.D.C.)
  - C) Stroke
  - D) Combustion Chamber
2. Which one is not a stationary part of the engine?
  - A) Cylinder block
  - B) Cylinder head
  - C) Oil pan
  - D) Connecting rod
3. Which one acts as a reservoir for oil and at the same time serves as a collector dust at the bottom of the engine?
  - A) Cylinder head
  - B) Oil pan
  - C) Manifolds
  - D) Oil pump
4. Which engine does not contain block?
  - A) Liners
  - B) Water passage
  - C) Cooling water
  - D) Mixture passage
5. Which one is the position that two valves are opened and that the piston is at T.D.C.during the end of the intake stroke and start of exhaust stroke?
  - A) Overlap of the valves
  - B) The end of the compression stroke
  - C) Power stroke
  - D) Compression stroke

### EVALUATION

Please compare the answers with the answer key. If you have wrong answers, you need to review the Learning Activity. If you give right answers to all questions, pass to the next learning activity.

# LEARNING ACTIVITY -3

## AIM

At the end of this activity you will be able to express the main definitions and terms about pulled vehicle technology that are used in the field of railway systems and translate the basic texts related to this area.

## RESEARCH

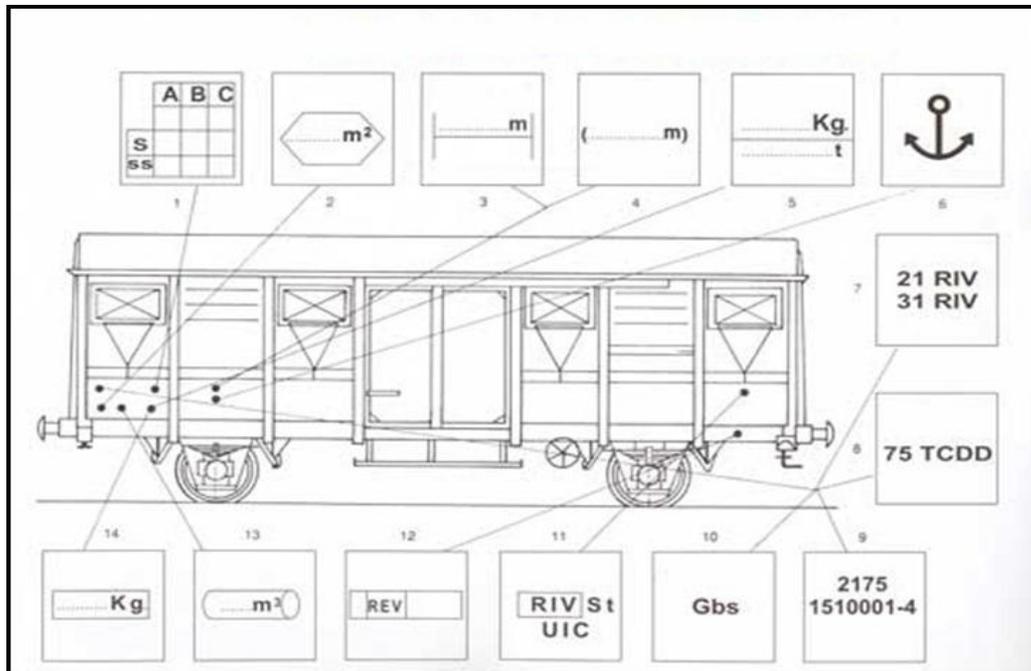
- Visit a foundation running in the field of railway systems technology, search the main definitions and terms about pulled vehicle technology that are used in the field of railway systems and find the english equivalents of the terms.
- Prepare a feedback report and present it in the class to your instructor and your friends.

## 3. MAIN DEFINITIONS AND TERMS OF PULLED VEHICLE TECHNOLOGY

### 3.1. Main Definitions and Terms Used in Wagon Under Frame

The vehicles which carry passengers and load are called as “wagon” in railways. Wagon is a vehicle which cannot move by itself but a pulling vehicle make it move.

While the wagons are being manufactured, the agreements such as UIC ( International Railway Union), RIC ( An Agreement about the Exchange and use of Passenger Wagons in International Traffic), RIV (An Agreement about the Exchange and Use of Goods Wagons in International Traffic) are taken into consideration during construction process. The passenger and goods wagons are manufactured according to international standards so that they can be used in railways all around the world.



### The Places of Scripts and Signs on Goods Wagons

Figure:3.1: Scripts and Signs on Goods agons

The meanings of signs on wagon in figure 3.1 are shorlty as follows;

1. In this signboard, A,B, and C letters express the classified railway lines. The numbers under these letters(A,B,C) express the maximum load as ton that can be carried in these lines. If there is no “s” and “ss” letters, the maximum speed for wagon is 90 km/h. The numbers in the same line with “s” letter show the maximum load which can be carried in A,B,C lines. In this case, the maximum speed for wagon is 100 km/h. The numbers which are at the same line with “ss” letters show the maximum load that can be carried in A,B,C lines. In that case; the maximum speed for wagon is 120 km/h.
2. The number which is in hexagon-like sign express the base area measure of wagon.
3. It shows the loading length of wagon.
4. It shows the lenth among buffers in wagon.
5. The weight(as kg) shown above rectangle-like signis tare of wagon, and the number below shows the power of hand brake as ton
6. It means that wagon can be carried by ferry.
7. International Administrating Number of Wagon (the first two numbers of wagon)
8. The code number of the administration that owns or registers the wagon officially.
9. The number of wagon
10. The letters used in this part vary according to construction style and these letters express the wagon type.
11. These signs and nicknames show that wagon can be operated in international traffic.

12. It shows the last revision date of wagon.
13. It shows the capacity of tank wagon as bulk.
14. It shows tare of wagon.

- **The Places of Scripts and Signs on Passenger Wagons**

The meanings of signs on wagons on figure 3.2 are shortly as follows;

1. It is not compulsory to be written down.
2. This script can be placed at the same line between first and second windows. If the level of first window is higher than other windows and if there is no enough place between first window and entrance door, this board can be placed on direction board.
3. In order to make it to been seen any time, the place of the script which will be put next to hand brake can be changed slightly.
4. This place is suggested.
5. Sizes; minimum height 160 mm; minimum length 250 mm.
6. In the case of lending, keep one free place for second script.
7. It means “ reserved”
8. It is acceptable to put this script any other place on the side of wagon.
9. It is permitted to put this script, which is normally on the side of wagon, on the left side of RIC frame. Scripts and signs should be written both sides of wagon with same row, fard from left to right.

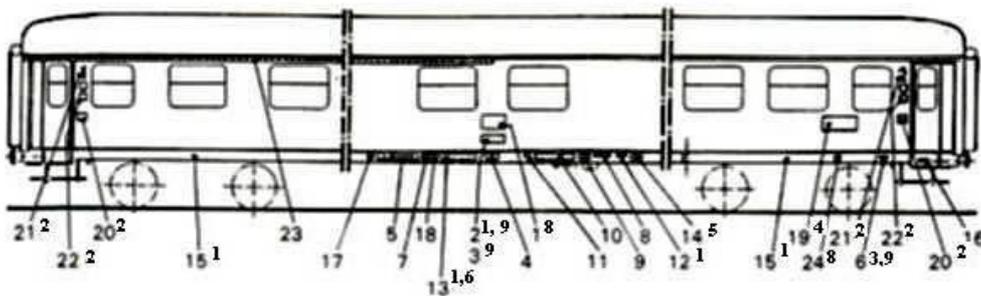


Figure:3.2. The Scripts and Signs on Passenger Wagons

Sign	Descriptions of Scripts and Signs	Fitting Color
1	Nickname of owner of network or owner of material	Yellow-White
2	Explanation of Type (not compulsory to write )	Yellow-White
3	Number of vehicle	Yellow-White
4	Tare, total weight, total number of seats, load limit for freight cars and post wagons	Yellow-White
5	RIC sign and energy feeding qualifications	Yellow-White
6	Pictogramme and script that shows brake weight which has been gotten with hand-brake	Dark color on light ground

<b>Sign</b>	<b>Descriptions of Scripts and Signs</b>	<b>Fitting Color</b>
7	Speaker system, electro-pneumatic shutting system and sign for vehicles that are equipped with remote control illumination	Yellow-White
8	The last revision date	Yellow-White
9	Length without buffer, distance between torque shafts and gap between axles on spark plug	Yellow-White
10	Scripts and signs for brake	Yellow-White-Red
11	Sign for vehicles which are equipped with R brake	Yellow-White
12	The place for national script about brake (not compulsory to write)	Yellow-White-Red
13	Parking place of vehicle (not compulsory to write)	Contrast Colors
14	Place for sticker	A different color from color of wagon
15	Marking resistance point for lifting	Yellow-White
16	Manufactured year (the manufacturer of vehicle should be defined on board)	-
17	MC Sign (only members of network OSJD)	Yellow-White
18	Sign for pressure leakproof vehicles or pressure leakproof vehicles that are equipped with leakproof WCs.	Yellow-White
19	Out destination board	Dark color on white ground
20	Out number board	Red on white ground
21	Showing class for passenger materials	Contrast color
22	Pictogrammes and information which can be written on information band for passengers	Contrast color
23	First class showing band	Sarı tayfında
24	Marking unloading hoses of leakproof WCs	Contrast colors
25	Signs for Wagon with owners	Yellow-White

### 3.2. Main Descriptions and Terms Used in Wagon Hardware

- **Chassis**

Chassis is the main framework of wagon. It is made of hard iron beam and it carries the load on itself. Wagon trunk and moving parts are attached to chassis with connecting components.



**Figure 2.3 : Chasis**

- **Wheel Set**

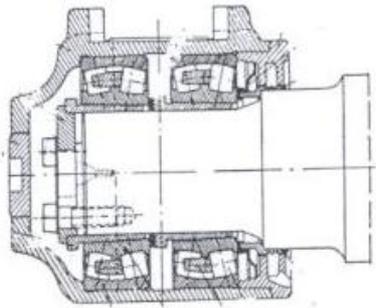
Wheel set carries wagon load and it conveys the weight of wagon and load to rails. It is a component which directs wagon to the desired direction by rolling on rail. There are two types of wheel sets; monobloc and grooved rim.



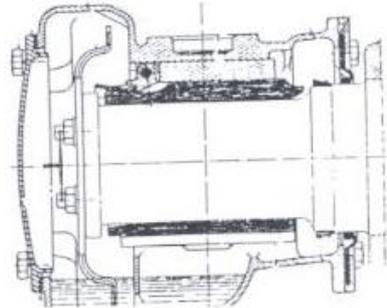
**Figure 2.4: Chasis**

- **Axle Box**

Axle boxes act as depot for axle oil which is necessary to lubricate axle beds. They carry the wagon load and direct the load to the axles.



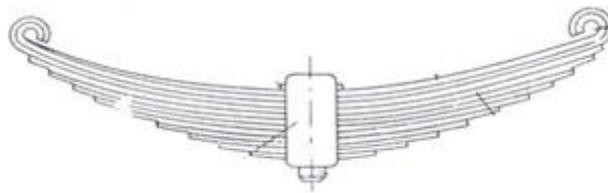
**Roller bearing axle-box**



**Plain bearing axle-box**

- **Safety Catch**

It deflates or decreases the vibrations to the minimum level, which comes vertically from rail or parallel to the rails. It is used in as follows; axle, bogie, traction and buffer equipments

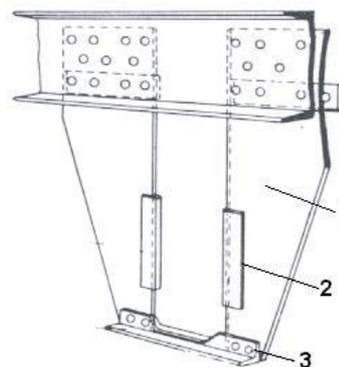


**Figure 3.5: Leaf spring**

- **Plakdögart (Axle Guide)**

It enables the connection between chassis and wheel set. Plakdögards are connected to chassis by joint or rivet.

- 1- Plakdögart (Axle guide)
- 2- Skate
- 3- Braga



**Figure 3.6: Plakdögart**

- **Skate**

It has been connected to plakdögar either by rivet or screw. They are interior side of buategres, and prevents corrosion. They are made of soft materials ( bell metal, bronze, fiber, soft iron, polyamide)

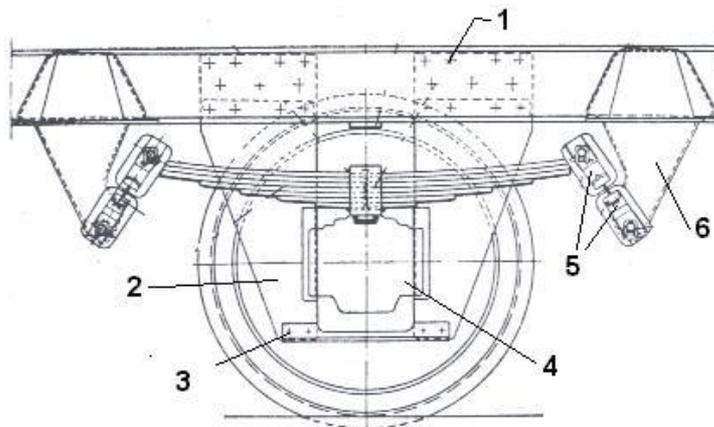
- **Braga**

It connects two plakdögar under axle box. It prevents widening of plakdögar in sudden departs and stops and in entering curves. If there is no braga, plakdögar chasis breaks at connection point and derails. Bolts and nuts should be complete.

- **Suspension Bracket**

Suspension brackets are connected to chasis by rivet or joint, it connects moving parts to chasis.

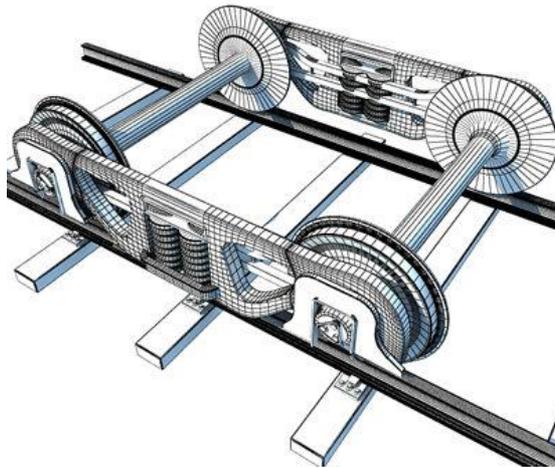
- 1- Frame
- 2- Plakdögar (axle guide)
- 3- Braga
- 4- Axle Box
- 5- Spring Shackles
- 6- Suspension Brackets



**Figure 3.7: Suspension System**

- **Bogie**

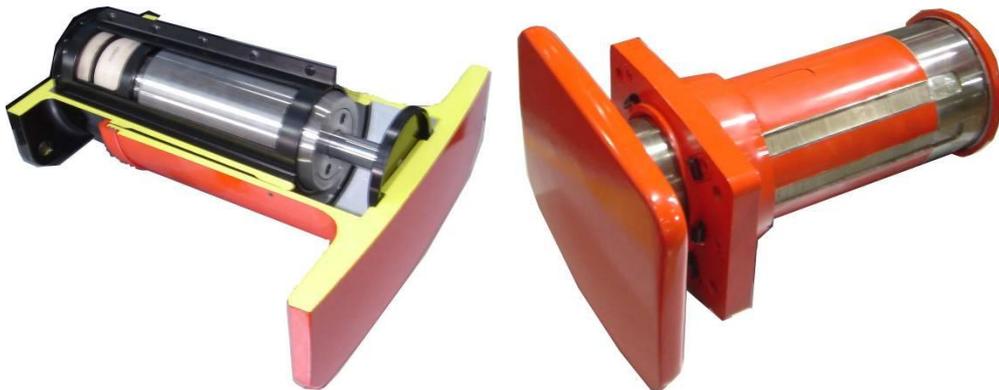
Bogie is a small chasis which increases numbers of axles in wagons and at the same time it extends wagon length. It is a component which enables wheel sets to roll in bogie as a group around axis.



**Figure 3.8: Passengers and Good wogon bogies**

- **Buffers**

Buffers are components which deflate the power that come out of rail, and they direct the power as less as possible.



**Figure 3.9: Kinds of buffers**

- **Traction Installation**

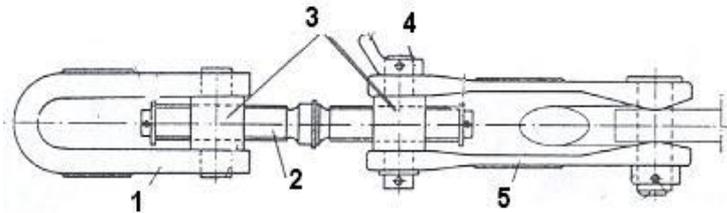
It is composed of draw hook, draw pod, and draw spring. Draw spring is connected to other wagons with harness. Draw spring prevents breaks at sudden lifts, and guarantees smooth depart. Draw packages are installed interior side of buffer sleepers and draw hook pivot is attached in draw package. Diffirent kinds of draw springs are used.



**Figure 3.10: Traction kit**

- **Harness**

They are the wagon parts that enable the connection of draw cars. There are three types; automatic, semi-automatic and screwed.



**Figure 3.11: Screwed harness set**

- **Baseboards (Brush holders)**

Baseboards prevent the entrance of big items such as stone, tree, soil or metal parts between rail and wheel, which cowcatcher cannot prevent. Baseboards that are composed of steel rope or wires are located in front of wheels.

- **Cowcatcher**

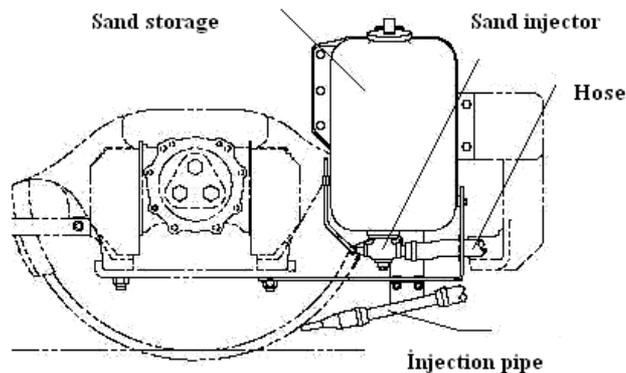
Cowcatchers are located in front of and back of locomotive. It prevents the entrance of things and snow under the locomotive which exists on its way. The minimum height of cowcatcher from rail is 65-70 mm.



**Figure 3.12: Cowcatcher**

- **Sanding System**

The brake or traction power applied to the wheels in locomotives should not exceed the friction force between wheel and rail. If it exceeds, there occurs aquaplaning in braking process, and there occurs wheel slip in traction process. If the surface of rail is wet or slippery, the friction force decreases. In order to prevent that, sand is vaporized between wheel and rail to increase the friction force.



**Photo 3.13: Locomotive sand system**

## APPLICATION ACTIVITY

Steps of Process	Suggestions
<p>Translate the text below into Turkish.</p>	<ul style="list-style-type: none"> <li>➤ Read the whole text.</li> <li>➤ While reading try to predict the terms that you do not know.</li> <li>➤ Find the english equivalents of the terms from technical dictionaries that you can't predict.</li> <li>➤ You can find detailed information about the terms from the text.</li> </ul>

In standard gauge cars, seating is usually between three and five seats across the width of the car, with an aisle in between (resulting in 2+1, 2+2 or 3+2 seats) or at the side. Tables may be present between seats facing one another. Alternatively, seats facing the same direction may have access to a fold-down ledge on the back of the seat in front.

- If the aisle is located between seats, seat rows may face the same direction, or be grouped, with twin rows facing each other. Sometimes, for example on a commuter train, seats may face the aisle.
- If the aisle is at the side, the car is usually divided in small compartments. These usually contain 6 seats, although sometimes in second class they contain 8, and sometimes in first class they contain 4.
- In vehicles intended for commuter services seats are sometimes placed with their backs to the carriage side. This gives a wide accessway and standing room which accommodates standing passengers at peak times and improves loading and unloading speeds.

Passenger cars can take the electricity supply for heating and lighting equipment from two main sources - either directly from a head end power generator on the locomotive via bus cables; or by an axle powered generator which continuously charges batteries whenever the train is in motion.

Modern cars usually have either air-conditioning or windows that can be opened (sometimes, for safety, not so far that one can hang out), or sometimes both. Various types of onboard train toilet facilities may also be provided.

## CHECKLIST

If you have behaviors listed below, evaluate yourself putting (X) in “Yes” box for your earned skills within the scope of this activity otherwise put (X) in “No” box.

EVALUATION CRITERIA		YES	NO
1	Have you used technical English in the main equipment for towing trailers?		
2	Have you used basic definitions and English used in the captured vehicles?		

## EVALUATION

Please review your "No" answers in the form at the end of the evaluation. If you do not find yourself enough, repeat learning activity. If you give all your answers "Yes" to all questions, pass to the "Measuring and Evaluation".

## MEASURING AND EVALUATION

**Read the sentences and answer the questions. Then, compare your answers with the answer key at the end of the module.**

1. What is the name of the component which carries the wagon load and conveys the weight of load to rail and moves the wagon to the desired direction by rolling on rail ?
  - A) Wheel unit
  - B) Bogie
  - C) Safety catch
  - D) Buffer
  
2. What is the name of the component which increases the numbers of pivots in wagons and extends the length of wagons?
  - A) Wheel Set
  - B) Susta
  - C) Bogie
  - D) Buffer
  
3. The vehicles that carry passengers and loads in railways are called ..... ?
  - A) Tram
  - B) Pulling vehicle
  - C) Train
  - D) Wagon
  
4. Which one in below is the agreement about the Exchange and use good wagons in international traffic?
  - A) RST
  - B) RIC
  - C) RIV
  - D) UIC
  
5. Which one in below is the agreement about the Exchange and use of passenger cars in international traffic?
  - A) RST
  - B) RIC
  - C) RIV
  - D) UIC

---

## **EVALUATION**

Please compare the answers with the answer key. If you have wrong answers, you need to review the Learning Activity. If you give right answers to all questions, pass to the next learning activity

# LEARNING ACTIVITY -4

## AIM

At the end of this activity you will be able to express the terms and materials about infrastructure technology that are used in the field of railway systems and translate the basic texts related to this area.

## RESEARCH

- Visit a foundation running in the field of railway systems technology, search the terms and materials about infrastructure that are used in the field of railway systems and find the english equivalents of the terms.
- Prepare a feedback report and present it in the class to your instructor and your friends.

## 4. TERMS AND MATERAILS ABOUT INFRASTRUCTURE

### 4.1. Main Description and Terms of Materails Used on Road

#### ➤ Connection Materails

- **Joint**

Joint points and points where rails are mounted to one another are called “joint. Joints are the weakest and the most easily disrupted points of road. In those points, to prevent rail cracks and to reduce maintenance expenses, rail welding is applied.

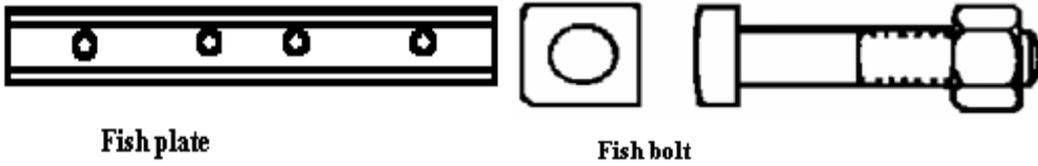
There are three kinds of materails that connect a rail to another.

- **Fish Plate**

The iron bars used to connect two rails from the tops are called fish plate.

- **Fish Bolt**

It has three parts; head, body and nut. Bolt nuts are attached to the innerside , so that they are easily seen during road checks.



**Fish plate**

**Fish bolt**

**Figure 4.1: Screwed harness set**

- **Washer**

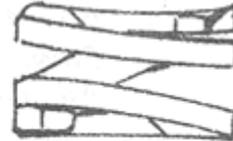
It is used in both rail-to-rail connection and rail-to-sleeper connection. There are three types of washers; single washer, double washer, triple washer. They are placed between fish plate and fish bolt. They provide tightness and tenseness of connection. In below, you will see three types of washers.



**Single Washer**



**Double Washer**



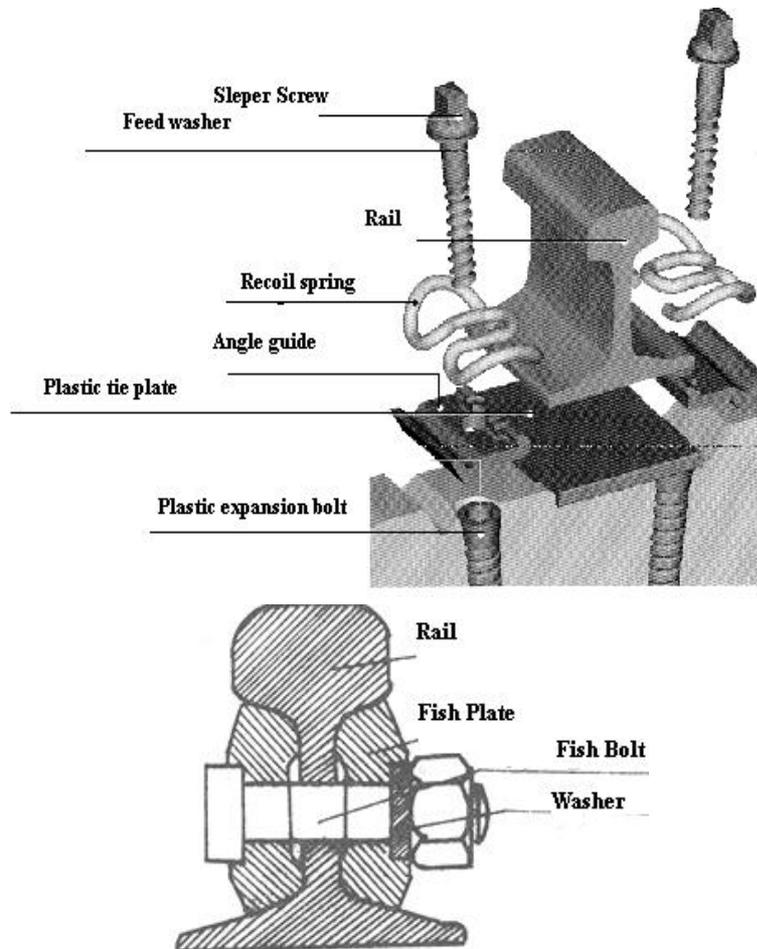
**Triple Washer**

**Figure 4.2: Types of washers**



**Figure 4.3:**

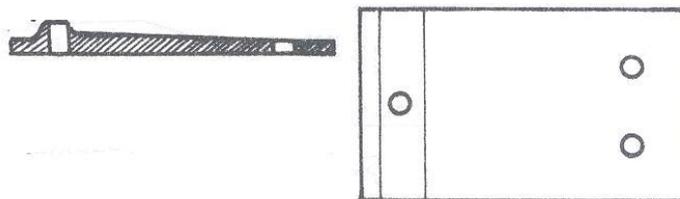
➤ **Road Materails that Connects Rail to Sleeper**



**Figure 4.4: Road Materails that Connects Rail to Sleeper**

- **Tie Plate**

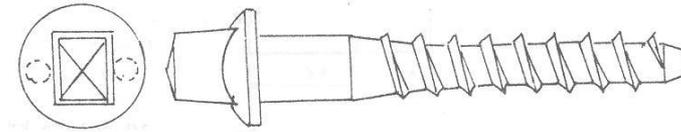
It is placed between base of rail and sleeper. It conveys load that comes from rail to sleeper in a wider surface. It keeps rail gauge. And prevents overturn of rails. In some roads, it provides 1/20 cant to the road.



**Figure 4.5: Tie Plate**

- **Sleper Screw**

In wooden and concrete sleeper roads, it is used to connect base of rail to sleeper or to connect rail by means of tie plate to sleeper.



**Figure 4.6: Slepser Screw**

## 4.2. Main Descriptions and Terms Used in Road Structure

- **Detour**

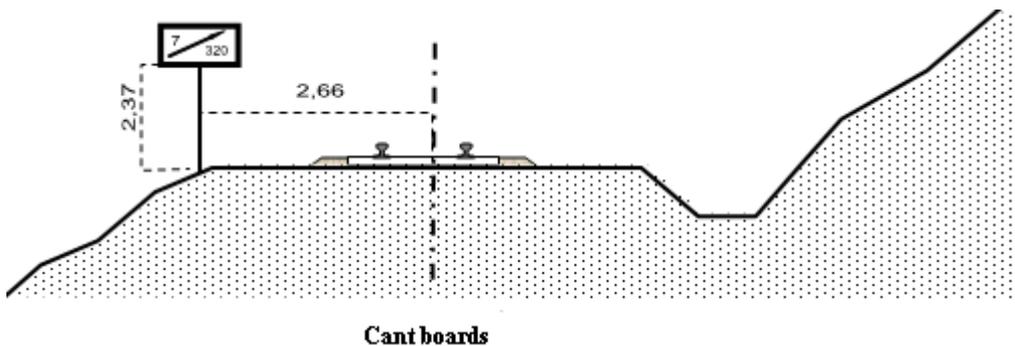
The second road which is build temporarily to run the train when there is an accident or happening on main road.

- **Bevel**

To provide the pass of railway, some fulling and cutting processes are applied. At the end of this process, some surfaces with cant are comes out on the side of infrastructure. That surfaces with cants are called bevel.

- **Cant**

Cant is the ratio of rise difference of two points with different heights to horizontal distance between those two points, Cant in railways is expressed as %0 (thousand).For instance; % 5 (0,005), %18 (0,018) etc.



**Figure 4.7: Cant**

- **Alignment**

The straight parts of railway is called alignment.

- **Curve**

The curved points of road which connects straight road in different directions are called “curve”.

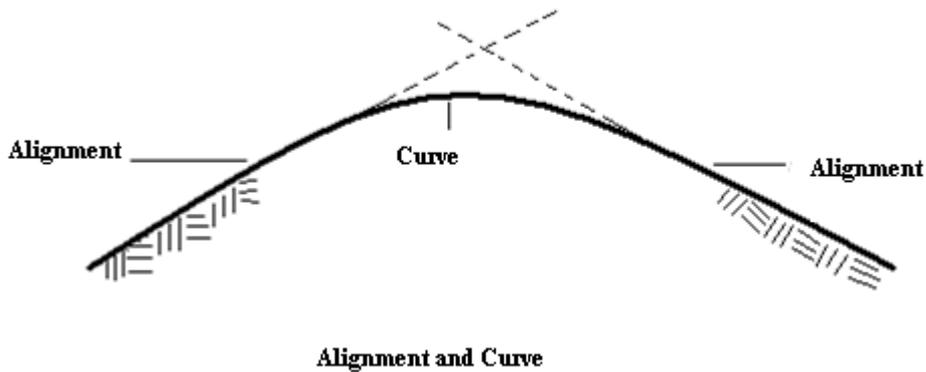


Figure 4.8: Curve

- **Versine**

The right distance from any point of chord which cuts the arc of circle to arc of circle is called “versine”. The right distance which connects central points of chord and central points of arc of circle is called “complete versine”.

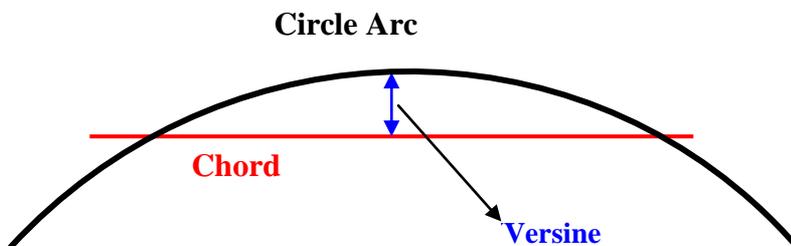
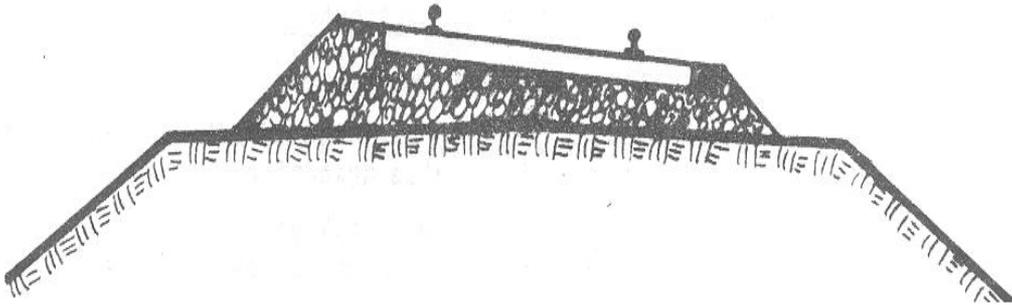


Figure 4.9: Versine

- **Superelevation**

In horizontal curves, train is under the effect of centrifugal force and in order to decrease the effect of scattering towards the out of curves, outer rail set is increased compared to inner rail set. That surplus of height is called “Superelevation”.



**Figure: 4.10: Superelevation given road cross section**

## APPLICATION ACTIVITY

Steps of Process	Suggestions
<p>Translate the text below into Turkish</p>	<ul style="list-style-type: none"> <li>➤ Read the whole text.</li> <li>➤ While reading try to predict the terms that you do not know.</li> <li>➤ Find the english equivalents of the terms from tecnical dictionaries that you can't predict.</li> <li>➤ You can find detailed information about the terms from the text.</li> </ul>

Rail transport is a means of conveyance of passengers and goods, by way of wheeled vehicles running on rails. In contrast to road transport, where vehicles merely run on a prepared surface, rail vehicles are also directionally guided by the tracks on which they run. Track usually consists of steel rails installed on sleepers/ties and ballast, on which the rolling stock, usually fitted with metal wheels, moves.

Rolling stock in railway transport systems generally has lower frictional resistance when compared with highway vehicles and the passenger and freight cars (carriages and wagons) can be coupled into longer trains. The operation is carried out by a railway company, providing transport between train stations or freight customer facilities. Power is provided by locomotives which either draw electrical power from a railway electrification system or produce their own power, usually by diesel engines. Most tracks are accompanied by a signalling system. Railways are a safe land transport system when compared to other forms of transport. Railway transport is capable of high levels of passenger and cargo utilization and energy efficiency, but is often less flexible and more capital-intensive than highway transport is, when lower traffic levels are considered.

In the 1880s, electrified trains were introduced, and also the first tramways and rapid transit systems came into being. Starting during the 1940s, the non-electrified railways in most countries had their steam locomotives replaced by diesel-electric locomotives, with the process being almost complete by 2000. During the 1960s, electrified high-speed railway systems were introduced in Japan and a few other countries. Other forms of guided ground transport outside the traditional railway definitions, such as monorail or maglev, have been tried but have seen limited use.

**CHECKLIST**

If you have behaviors listed below, evaluate yourself putting (X) in “Yes” box for your earned skills within the scope of this activity otherwise put (X) in “No” box.

<b>EVALUATION CRITERIA</b>		<b>YES</b>	<b>NO</b>
<b>1</b>	Did you use technical english related to road materials?		
<b>2</b>	Did you use technical english related to road construction?		

**EVALUATION**

Please review your "No" answers in the form at the end of the evaluation. If you do not find yourself enough, repeat learning activity. If you give all your answers "Yes" to all questions, pass to the "Measuring and Evaluation

## MEASURING AND EVALTION

### Choose the correct option

1. What is the name is the right distance from any point of chord which cuts the arc of circle to arc of circle?
  - A) Versine
  - B) Chord
  - C) Superelevation
  - D) Cant
2. What is the name of the surface with cant that comes out near infrastructure at the end of cutting and filling process to enable the passes of railways?
  - A) Cant
  - B) Superelevation
  - C) Curve
  - D) Bevel
3. What is the name of curved points of road which connects straight road in different directions?
  - A) Superelevation
  - B) Cant
  - C) Curve
  - D) Versine
4. Which one below is not among the connection elements that connects rail to sleeper?
  - A) Sleeper Screw
  - B) Joint
  - C) Plastic dowel
  - D) Feeding washer
5. What is the name of joint points which connects rails?
  - A) Joint
  - B) Sleepr Screw
  - C) Washer
  - D) Plastic dowel

### MATCH THE WORDS WITH THE DEFINITIONS

**A.**

- 6. Curve
- 7. Alignment
- 8. Detour
- 9. Tie plate
- 10. Washer
- 11. Fish Plate
  
- 12. Joint

**B**

- a- It is the point where rails are mounted to one another.
- b- It is used to connect rail-to-rail and rail-to-sleeper.
- c- They are iron bars used to connect two rails from the top.
- d- It conveys load coming from rail to sleeper in a wider surface
- e- It is the straight part of railway.
- f- The second road used temporarily when there is accident on the way
- g- It is the the curved point of road which connects straight road in different directions

**True or False**

- 13. In rail, to reduce the effect of scattering inner rail set is increased \_\_\_\_
- 14. The right distance from any point of chord which cuts the arc of circle to arc of circle is called "versine" \_\_\_\_
- 15. The surfaces with cants that come out after filling and cutting processes are called bevel. \_\_\_\_
- 16. Fish bolt is used to connect base of rail to sleeper or to connect rail by means of tie plate to sleeper. \_\_\_\_
- 17. Washer is placed between base of rail and sleeper. \_\_\_\_

**EVALUATION**

Please compare the answers with the answer key. If you have wrong answers, you need to review the Learning Activity. If you give right answers to all questions, pass to the next learning activity.

# LEARNING ACTIVITY -5

## AIM

At the end of this activity you will be able to express the main terms and materials of superstructure those are used in the field of railway systems and translate the basic texts related to this area.

## RESEARCH

- Visit a foundation running in the field of railway systems, search the main terms and materials of superstructure that are used in the field of railway systems and find the English equivalents of the terms.
- +Prepare a feedback report and present it in the class to your instructor and your friends.

## 5. MAIN TERMS AND MATERIALS OF SUPERSTRUCTURE

### 5.1. Definitions and Terms of Superstructure

In railways; rail, sleeper, balast and all connection materials, that are placed on infrastructure, that provides the movement of train and conveys the weight of train to platform are called “superstructure”.

#### 5.1.1. Rail

Rail is a superstructure material and is made of casted-steel. Rail provides a rolling surface which shows the least resistance to the wheels of railway vehicles. It also conveys the power coming from axle to sleepers.



Figure 5.1: Superstructure materials

### 5.1.2 Sleepers

A superstructure material which disseminates load coming from rail to a wider surface, protects the gauge and keeps on axis against side effects is called “sleeper”.

- a) Wooden (timber) Sleeper
- b) Iron Sleeper
- c) Concrete Sleeper
- d) Plastic Sleeper

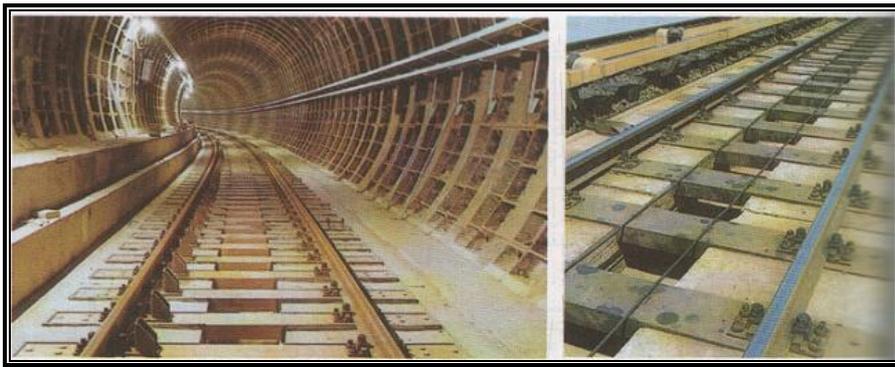


Figure 5.2: Sleepers

### 5.1.3. Ballast

Ballasts are hard and strong stones which are sharp-cornered, sharp-edged and cubic shaped and are broken 30-60 mm sizes. They are placed neatly on platforms, they fill the gaps of sleeper and they act as beds for sleeper.

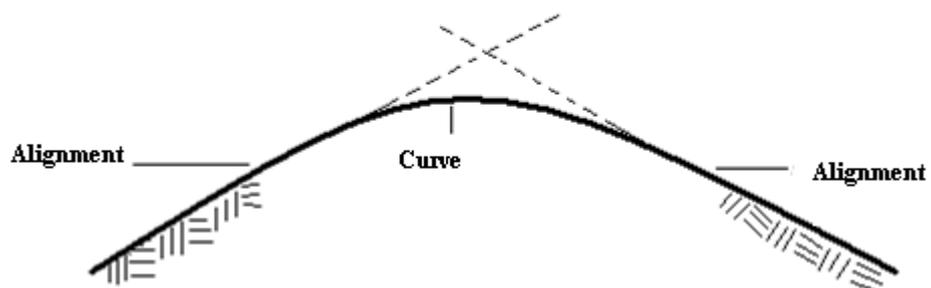


Figure 5.3: Alignment and Curve

#### 5.1.4. Definitions and Terms of Infrastructure

##### ➤ Platform

Platform is a leveled stabilized surface piece that ballast is placed on in cutting and filling.

##### ➤ Cutting

In an area where railway passes, if rise of land (black line) is higher than rise of way (red line), higher parts are eliminated. Those parts which are eliminated and passed by arrangement of graded and ungraded bevels are called “cuttings”

##### ➤ Filling

In an area where railway passes, in parts where rise of field (Black line) is lower than rise of way (red line), by filling hollows, black rise is increased to the level of red rise. This manufacturing is called “filling”.

##### ➤ Tunnels

In the area where railway passes, if field rise (black line) is much higher than way rise (red line) and if cutting costs too much price, the area is drilled. At the end of the drilling process, there occurs a passage with two-sides open. These passages are called “tunnels”.

##### ➤ Bridges

The artistic buildings which are built to pass obstacles such as rivers, highway, railway or any other, which are not under embankment and has 8 meters or bigger gap are called “bridges”.



Figure 5.4: Bridges

➤ **Viaduct**

They are multiple-gaped bridges that are built on high valleys.

➤ **Crossover**

The works which provide the crosses to the other side of road when railway and highway meet is called “crossover”

➤ **Underpass**

Crossovers which are built to enable passes of pedestrians and highway vehicles under railway are called “underpass”.



**Figure 5.5: Underpass**

➤ **Flyover**

Crossover which are built to enable passes of pedestrians and highway vehicles over railway is called “flyover”.



**Figure 5.6: Flyover**

➤ **Level Crossing**

The parts where highway and railways meet each other at the same level are called “level crossing”



**Figure 5.7: Protected Level Crossing**

## APPLICATION ACTIVITY

Steps of process	Suggestions
<p>Translate the text below into Turkish.</p>	<ul style="list-style-type: none"> <li>➤ Read the whole text.</li> <li>➤ While reading try to predict the terms that you do not know.</li> <li>➤ Find the english equivalents of the terms from technical dictionaries that you can't predict.</li> <li>➤ You can find detailed information about the terms from the text</li> </ul>

When the piston reaches the bottom of its stroke, the intake valve closes and the crankshaft forces the piston back up through the cylinder. This compresses the air-fuel mixture in the combustion chamber.

As the piston nears the top of the compression stroke, the air-fuel mixture is ignited by a spark from the spark plug. This explodes the mixture, and the pressure of the rapidly expanding gas drives the piston down through the cylinder. Both valves are closed during this firing stroke.

After reaching the bottom of the firing stroke, the exhaust valve opens, and the spinning crankshaft forces the piston up through the cylinder once again. This time all the burned gases are driven, or exhausted, from the cylinder and combustion chamber.

When the piston reaches the top of the exhaust stroke, the exhaust valve closes and the intake opens. The piston is drawn down on another intake stroke.

## CHECKLIST

If you have behaviors listed below, evaluate yourself putting (X) in "Yes" box for your earned skills within the scope of this activity otherwise put (X) in "No" box.

Evaluation Criteria	Yes	No
Did you use technical english related to the upper structure and basic definitions and terms?		
Did you use technical english related to the tunnel, bridge, walkway etc. structures?		

## EVALUATION

Please review your "No" answers in the form at the end of the evaluation. If you do not find yourself enough, repeat learning activity. If you give all your answers "Yes" to all questions, pass to the "Measuring and Evaluation".

## MEASURING AND EVALUTION

### Choose the correct option

1. What is the name of part where highway and railway meet and cross at the same level?

- A) Level Crossing
- B) Bridge
- C) Tunnel
- D) Viaduct

2. What is name of work which enables passes of transportation vehicles to other side of road when railway and highway meet?

- A) Platform
- B) Tunnel
- C) Bridge
- D) Crossover

3. Strong and hard stones which are placed neatly on platform, fills the gap of sleeper and act as bed for sleeper, which are sharp-cornered, sharp-sided, cubic shaped and are broken at 30-60 mm sizes are called ..... ?

- A) Filling
- B) Sleeper
- C) Ballast
- D) Rail

4. What is the name of the work which is built to enable passes of pedestrians and highway vehicles over the railway?

- A) Underpass
- B) Flyover
- C) Crosswalk
- D) Level Crossing

5. What is the name of the bridge with multi-gaped built on high valleys? vadiler

- A) Viaduct
- B) Tunnel
- C) Underpass
- D) Flyover

### EVALUATION

Please compare the answers with the answer key. If you have wrong answers, you need to review the Learning Activity. If you give right answers to all questions, pass to the next learning activity.

# MODULE EVALUATION

Write “ True or False” according to the knowledge

1. Orange: Danger signs are used as warning signs against danger. \_\_\_\_\_
2. Connecting Rod is the motionless part of engine . \_\_\_\_\_
3. Axle boxes act carry the wagon load and direct the load to the axles. \_\_\_\_\_
4. Fish Plate, the iron bars used to connect two rails from the tops are called Tie Plate \_\_\_\_\_
5. Sleepers are superstructure materials which disseminates load coming from rail to a wider surface. \_\_\_\_\_

**Level Crossing, flyover, underpass, crossover, bridge, tunnel, platform, sleeper, ballast, rail**

**Fill in the blanks with the suitable word.**

6. \_\_\_\_\_ provides a rolling surface which shows the least resistance to the wheels of railway vehicles.
7. \_\_\_\_\_ is a superstructure material that protects gauge.
8. \_\_\_\_\_ are the parts where highway and railways meet each other at the same level.
9. \_\_\_\_\_ is a crossover which is built to enable passes of pedestrians and highway vehicles over railway.
10. \_\_\_\_\_ fills the gaps of sleeper and they act as beds for sleeper.

# ANSWER KEY

## LEARNING ACTIVITY - 1

<b>SORULAR</b>	<b>CEVAPLAR</b>
1	B
2	A
3	D
4	C
5	A

## LEARNING ACTIVITY - 2

<b>SORULAR</b>	<b>CEVAPLAR</b>
1	A
2	D
3	B
4	D
5	C

## LEARNING ACTIVITY - 3

<b>SORULAR</b>	<b>CEVAPLAR</b>
1	C
2	C
3	D
4	C
5	B

## LEARNING ACTIVITY - 4

<b>SORULAR</b>	<b>CEVAPLAR</b>
1	A
2	D
3	C
4	B
5	A
6	G

7	E
8	F
9	D
10	B
11	C
12	A
13	F
14	T
15	T
16	T
17	F

### LEARNING ACTIVITY - 5

<b>SORULAR</b>	<b>CEVAPLAR</b>
1	A
2	D
3	C
4	B
5	A

### MODULE EVALUATION

<b>SORULAR</b>	<b>CEVAPLAR</b>
1	T
2	F
3	T
4	F
5	T
6	Rail
7	Sleepers
8	Level Crossing
9	Crossovers
10	Ballast

**Assess yourself and compare your answers with the answer keys**

## SOURCES

**KAYA Orhan, Motor Ayarları ve Bakımı**  
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**CAN Y., Vagon Bilgisi KALINBACAK Ğ., Çeken Araç Bilgisi,**