



# LECTURE-17

# INTRODUCTION TO HYDRAULICS

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# Learning Objectives

After the completion of this module, the student will be able to:

- Identify the common uses of hydraulic systems.
  - Determine that liquids are incompressible.
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# Module 1: Introduction to Hydraulics

All machines require some type of power source and a way of transmitting this power to the point of operation.

The three methods of transmitting power are:

- Mechanical
  - Electrical
  - Fluid
- In this course we are going to deal with the third type of power transmission which is the **Fluid Power**

# Module 1: Introduction to Hydraulics

- **Fluid power** is the method of using pressurized fluid to transmit energy.
- **Liquid** or **Gas** is referred to as a **fluid**.  
Accordingly, there are two branches of fluid power; **Pneumatics**, and **Hydraulics**.
- **Hydraulic systems** use **liquid** to transfer force from one point to another.
- **Pneumatic systems** use **air** to transfer force from one point to another. Air is

# Module 1: Introduction to Hydraulics

- **Air is Compressible:**

*(This describes whether it is possible to force an object into a smaller space than it normally occupies. For example, a sponge is compressible because it can be squeezed into a smaller size).*

- **liquid is Incompressible:**

*(The opposite to compressible. When a "squeezing" force is applied to an object, it does not change to a smaller size. Liquid, for example hydraulic fluid, possesses this physical property).*

# Module 1: Introduction to Hydraulics

- Hydraulic systems are commonly used where mechanisms require **large forces and precise control**.
- Examples include **vehicle power steering and brakes, hydraulic jacks** and **heavy earth moving machines**.

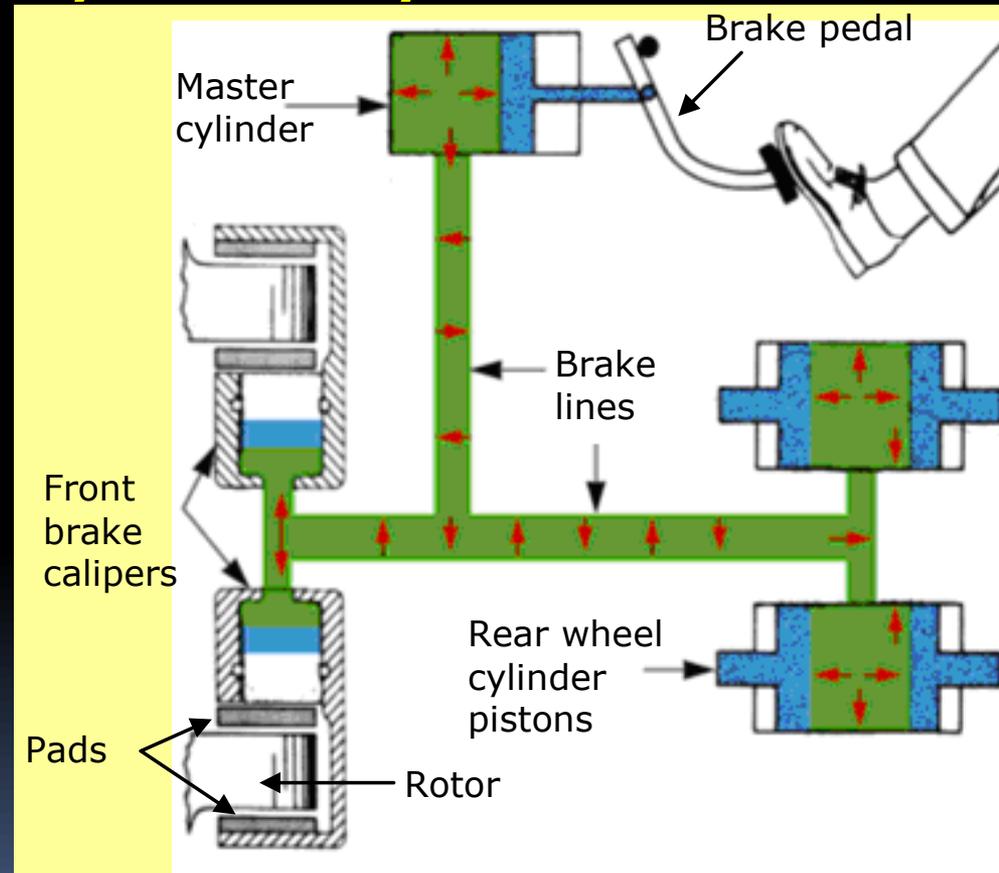
## 2. Uses of hydraulics

- Hydraulics plays an important role in many industries; there are a lot of **hydraulic applications** in manufacturing, transportation, and construction sectors.
- Hydraulics systems are used where large, precise forces are required.

## 2.1 Common examples of hydraulic systems include:

### 2.1.1 Vehicle brake hydraulic systems

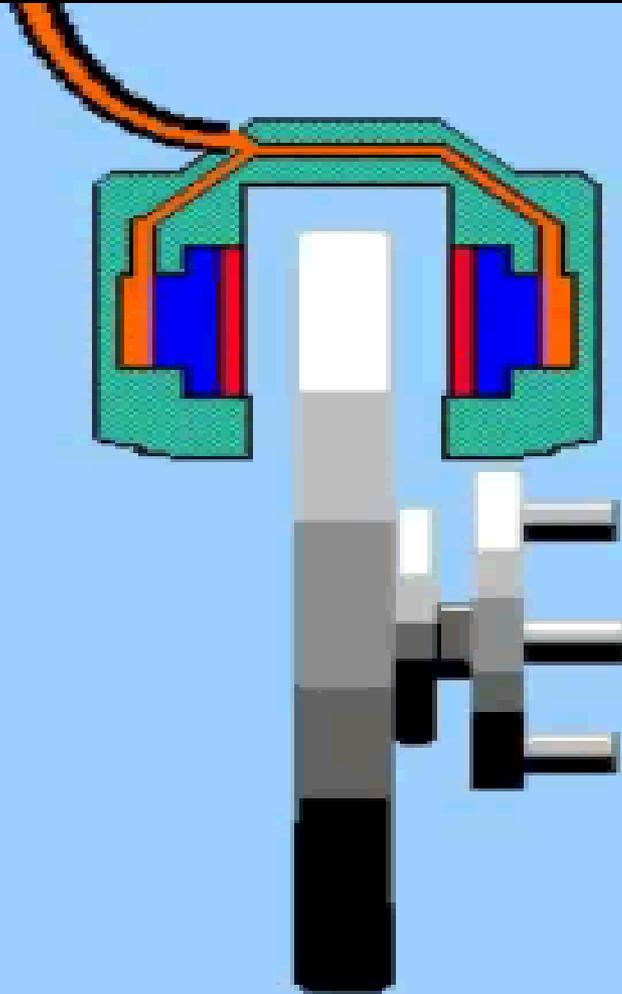
The function of a vehicle braking system is to stop or slow down a moving vehicle. When the brake pedal is pressed as illustrated in Fig. 1.1, the hydraulic pressure is transmitted to the piston in the brake caliper of the brakes. The pressure forces the brake pads against the brake rotor, which is rotating with the wheel. The friction between the brake pad and the rotor causes the wheel to slow down and then stop.



Tip: Watch the hydraulic brake system video.

Fig.1.1: A schematic diagram of the vehicle's hydraulic brake system.

## 2.1 Common examples of hydraulic systems include:



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### 2.1.2 Vehicle power steering

- The vehicle power steering system uses hydraulic oil, the **hydraulic pump** supplies the oil through the **control valves** to the power cylinder as shown in Fig. 1.2. **The major advantage of using this system is to turn the vehicle's wheels with less effort.**

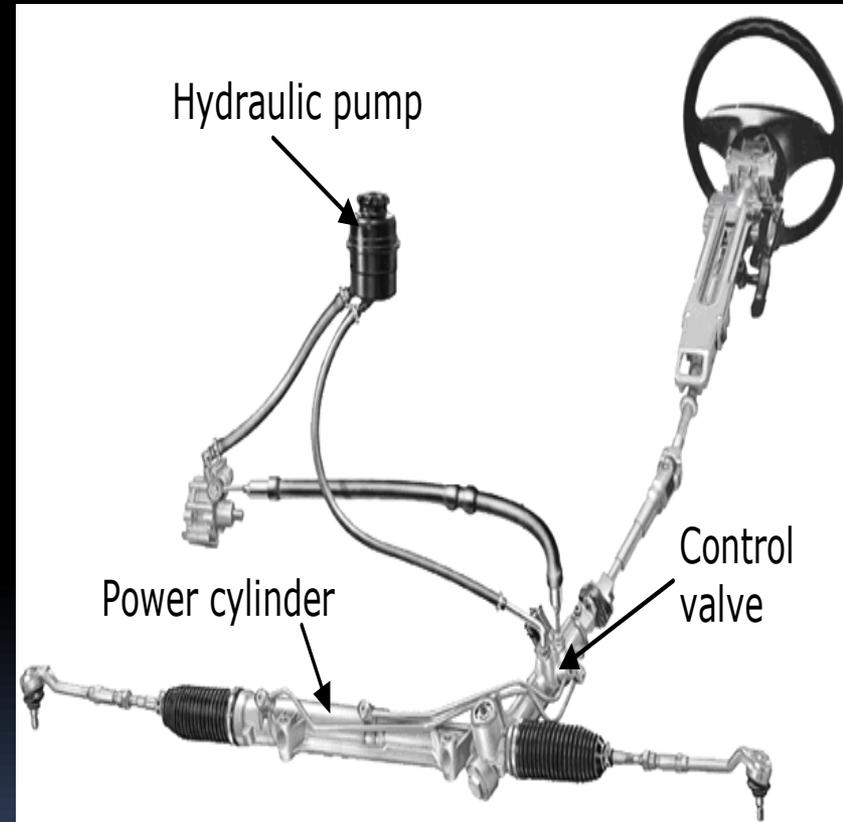


Fig.1.2:Vehicle hydraulic power steering system

## 2.1 Common examples of hydraulic systems include:

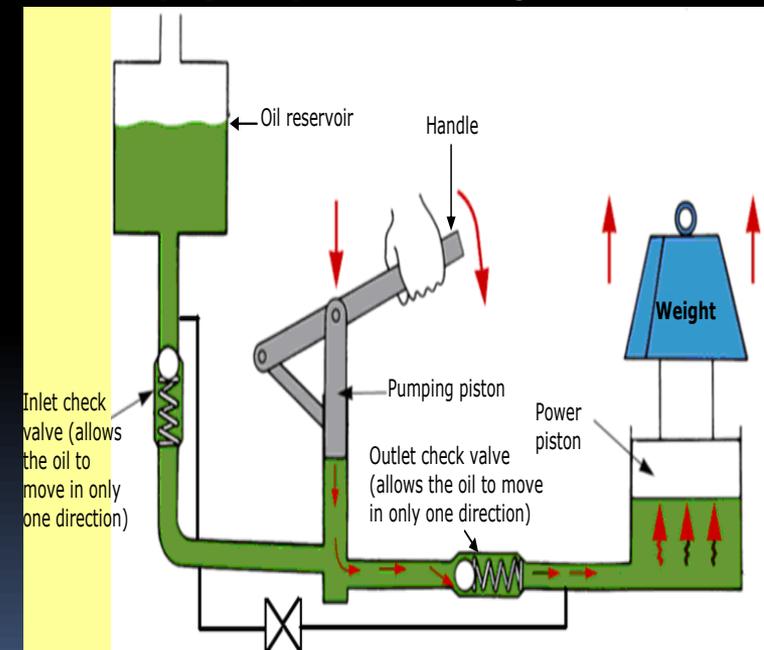
### 2.1.3 Hydraulic jack

- In a hydraulic jack, a small piston (pumping piston) transmits pressure through the oil to a large piston (power piston) through a check valve, resulting in the weight being lifted as shown in Fig.1.3.

- **Tip: Watch the hydraulic jack video.**



(a) Hydraulic jack



(b) Hydraulic jack schematic diagram

# Tip: Watch the hydraulic jack video.

[Hydraulics](#) < [Course](#) < [Principles of hydraulic systems](#) < How it works

## How it works

Let's take a closer look at how a simple hydraulic system works, using a hydraulic jack as an example.

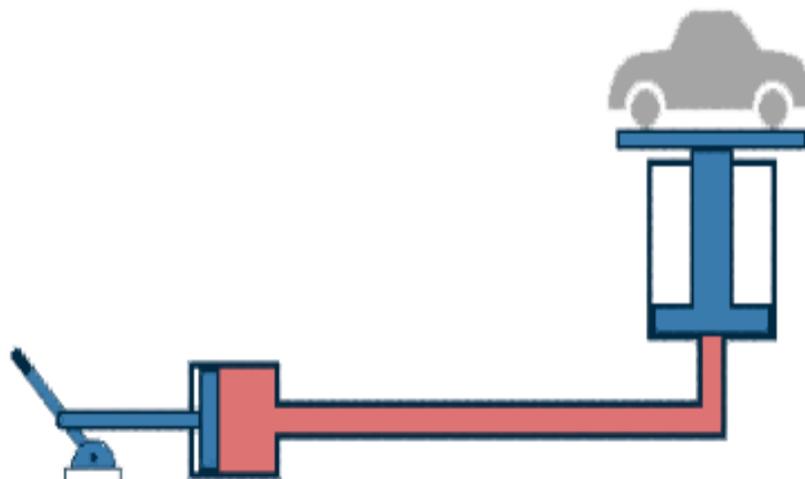
A hydraulic pump can be driven manually with a lever.

The hydraulic pump sucks in hydraulic fluid from the tank and transports it via lines to the hydraulic cylinder.

Check valves prevent the hydraulic fluid from flowing back.

When the lines are filled with hydraulic fluid, pressure builds up against the load of the cylinder.

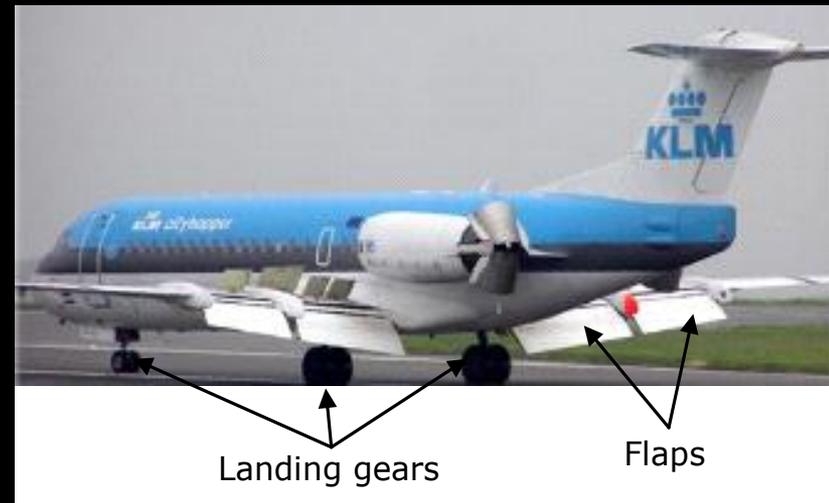
When pressure is high enough the load on the cylinder is overcome and the cylinder piston rod begins to advance, lifting the car.



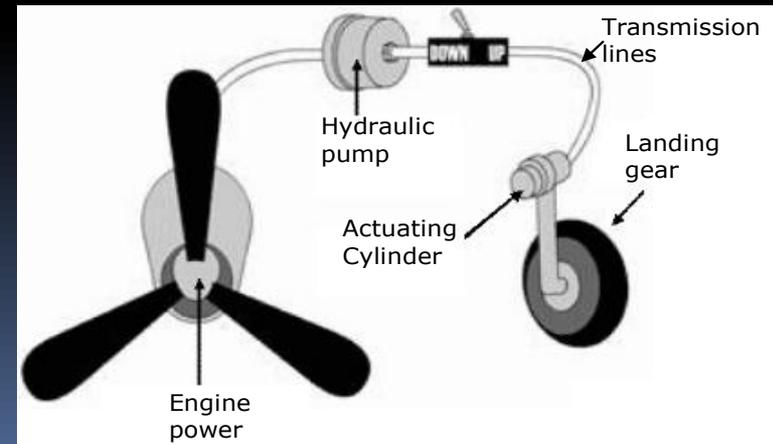
## 2.1 Common examples of hydraulic systems include:

### 2.1.4 Aircraft hydraulic systems

- All modern aircraft contain hydraulic systems to operate mechanisms, such as:
- Flaps (Fig. 1.4a)
- Landing gear (Fig. 1.4a)
- The hydraulic pump that is coupled to the engine provides hydraulic power as illustrated by Fig. 1.4b.
- Power is also distributed to systems through the aircraft by transmission lines.
- Hydraulic power is converted to mechanical power by means of an actuating cylinder or hydraulic motor.



(a) Landing gears and flaps



(b) Landing gear schematic diagram