# AI 3401 TRACTORS AND ENGINE SYSTEMS

# **UNIT III NOTES**



### Brake system:

# **Working Principle:**

Brake works on the principle of friction. When a moving element is brought into contact with a stationary element, the motion of the moving element is affected. This is due to frictional force which acts in opposite direction of the motion and converts kinetic energy into heat energy.

## **Classification of brake:**

Brakes can be classified as: 1. Mechanical brake i. Internal expanding shoe type ii. External contracting shoe type iii. Disc type 2. Hydraulic brake

#### TYPES:

- Based upon brake application:
- ➤ Service or primary brakes
- ➤ Parking or secondary brakes
- Based upon actuation:
- Mechanical brakes
- > Hydraulic brakes
- ➤ Air brakes
- ≻ Servo brakes
- ➤ Electrical brakes
- Based on construction:
- ≻ Drum brake
- ➤ Disc brake

# **Mechanical brakes:**

Mechanical braking system is also called as manualstretch braking, because the braking force is given by means of pedal which is transmitted by means of wire and ropes or mechanical linkages.

A cam is attached along with the brake shoes so that it can be actuated by mechanical linkage. By revolution it brings contact between the shoes and the drum, thereby reducing the speed or to bring the vehicle to rest.



This braking system is obsolete now as service brakes, but still used in some vehicles as secondary brakes.

• The main disadvantage of mechanical linkage is that braking effects on all wheels are not equal which bring instability of moving vehicle. Therefore, a compensation is employed to reduce the uneven braking effect.

## Internal expanding shoe type:



Two brake shoe made of frictional material fitted on the inside of the brake drum are held away from the drum by means of springs. One end of each shoe is fulcrum whereas the other end is free to move by the action of a cam which in turn applied force on the shoes. The movement of the cam is caused by the brake pedal through the linkage. The drum is mounted on the rear axle whereas the shoe assembly is stationary and mounted on the back plate. **External contracting shoe type:** 



This type of brake system is normally available on crawler tractors. The drum mounted on the drive axle is directly surrounded by the pedal is depressed, the band tightens the drum. Disc brake: Two actuating discs have holes drilled in each disc in which steel balls are placed. When the brake pedal is depressed, the links help to move the two discs in opposite directions. This brings the steel balls to shallow part of the holes drilled in the disc. As a result, the two discs are expanded and braking discs are presses in between the discs and the stationary housing. The braking discs are directly mounted on the differential shaft which ultimately transfer the travelling effect to the differential shaft.

Hydraulic brake:



Hydraulic brake system is based on the principle of Pascal's law. The brake fluid which is usually a mixture of glycerine and alcohol is filled in the master cylinder. When the pedal is depressed, the piston of the master cylinder is forced into the cylinder and the entire system turns to a pressure system. Immediately, the piston of the wheel cylinder slides outward which moves the brake shoe to stop the rotating drum. When the pedal is released, the return spring of the master cylinder moves the piston back to its original position, causing a sudden pressure drop in the line. The retracting springs of the brake shoe bring them back to their original position. Thus the piston of the wheel cylinder returns back.

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Most of the cars today use hydraulically operated foot brakes on all the four wheels with an additional hand brake mechanically operated on the rear wheels.

• An outline of the hydraulic braking system is shown in Fig

The main component in this is the master cylinder, which contains reservoir for the brake fluid.

• Mater cylinder is operated by the brake pedal and is further connected to the wheel cylinders in each wheel through steel pipe lines, unions and flexible hoses.

• The system is so designed that even when the brakes are in the released position, a small pressure of about 50 kPa is maintained in the pipe lines to ensure that the cups of the wheel cylinder are kept expanded.

• This prevents the air from entering the wheel cylinders when the brakes are released. Besides, this pressure also serves the following purposes:

➤ It keeps the free travel of the pedal minimum by opposing the brake shoe retraction springs.

➤ During bleeding, it does not allow the fluid pumped into the line to return, thus quickly purging air from the system.

#### **ANTI-LOCK BRAKING SYSTEM:**

• With conventional brake systems one of the road wheels will always tend to lock sooner than the other, due to the continuously varying road grip conditions for all the road wheels.

• An antilock brake system senses individual wheel slippage and automatically controls the brake line pressure rise and fall which counteracts any wheel skid tendency.

• Modern antilock brake systems not only cause the vehicle to stop without deviating from its straight-line path, these also provide directional stability since there is no skidding of the wheels.

• Skidding is avoided by releasing the braking pressure just before the wheels lock up, and then reapplying the same. This releasing and reapplying the brakes in succession is what an

antilock system does and this process is called pressure modulation. These systems can modulate the pressure to the brakes about 15 times per second.

• ABS calculate the required slip rate of the wheels accurately based on the vehicle speed and the speed of the wheels and then controls the brake fluid pressure to achieve the target slip rate. Although ABS prevent complete locking of the wheels, in practice it allows some wheel slip in order to attain the best possible braking.

• A modern ABS consists of an electronic control unit (ECU), one sensor on each wheel, an electrically driven hydraulic pump and a pressure accumulator.

