

# **www.MINEPORTAL.in**

(All Mining Solutions)

**DOWNLOAD MINEPORTAL APP FROM GOOGLE PLAY STORE**

- **ONLINE TEST SERIES FOR**
  - **DGMS COAL/METAL FIRST & SECOND CLASS**
  - **GATE MINING**
  - **COAL INDIA EXAMS**
  - **OTHER PSUs MINING EXAMS**
- **FREE STUDY MATERIAL-MINEPORTAL NOTES & USER NOTES**
- **MINING VIDEO LECTURES**
- **DISCUSSION FORUM**
- **WHATSAPP CHAT SUPPORT FOR MINING EXAMS & QUERY RELATED TO MINING**

**CALL/WHATSAPP- 8804777500**

**VISITING SITE-** [www.MINEPORTAL.in](http://www.MINEPORTAL.in)

**Facebook-** [www.fb.com/mineportal.in](http://www.fb.com/mineportal.in)

**EMAIL-** [INFO@MINEPORTAL.IN](mailto:INFO@MINEPORTAL.IN)

**TYPEES OF CLUTCH**

# **IIT(BHU) VARANASI**

**STUDENT'S NOTES**

COURTESY:-MAYANK

**[www.MINEPORTAL.in](http://www.MINEPORTAL.in)**

A **clutch** is a mechanical device which provides for the transmission of power (and therefore usually motion) from one component (the driving member) to another (the driven member). The opposite component of the clutch is the brake.

Clutches are used whenever the ability to limit the transmission of power or motion needs to be controlled either in amount or over time (e.g., electric screwdrivers limit how much torque is transmitted through use of a clutch; clutches control whether automobiles transmit engine power to the wheels).

In the simplest application clutches are employed in devices which have two rotating shafts. In these devices one shaft is typically attached to a motor or other power unit (the driving member) while the other shaft (the driven member) provides output power for work to be done. In a drill for instance, one shaft is driven by a motor and the other drives a drill chuck. The clutch connects the two shafts so that they may be locked together and spin at the same speed (engaged), locked together but spinning at different speeds (slipping), or unlocked and spinning at different speeds (disengaged).

## **Friction Clutches**

Friction clutches are by far the most well-known type of clutches.

### **Materials**

Various materials have been used for the disc friction facings, including asbestos in the past. Modern clutches typically use a compound organic resin with copper wire facing or a ceramic material. A typical coefficient of friction used on a friction disc surface is 0.35 $\mu$  for organic and 0.25 $\mu$  for ceramic. Ceramic materials are typically used in heavy applications such as trucks carrying large loads or racing, though the harder ceramic materials increase flywheel and pressure plate wear.

### **Push/Pull**

Friction disk clutches generally are classified as "Push Type" or "Pull Type" depending on the location of the pressure plate fulcrum points. In a pull type clutch, the action of pressing the pedal pulls the release bearing, pulling on the diaphragm spring and disengaging the vehicle drive. The opposite is true with a push type, the release bearing is pushed into the clutch disengaging the vehicle drive. In this instance, the release bearing can be known as a thrust bearing (as per the image above).

### **Pads**

Clutch pads are attached to the frictional pads, part of the clutch. They are most commonly made of rubber but have been known to be made of asbestos. Clutch pads usually last about 100,000 miles (160,000 km) depending on how vigorously the car is driven.

### **Dampers**

In addition to the damped disc centres which reduce driveline vibration, pre-dampers may be used to reduce gear rattle at idle by changing the natural frequency of the disc. These weaker springs are compressed solely by the radial vibrations from an idling engine. They are fully compressed and no longer in use once drive is taken up by the main damper springs.

## Load

Mercedes truck examples: A clamp load of 33KN (33,000N) is normal for a single plate 430. The 400 Twin application offers a clamp load of a mere 23KN (23,000N). Burst speeds are typically around 5,000rpm with the weakest point being the facing rivet.

## Manufacturing

Modern clutch development focuses its attention on the simplification of the overall assembly and/or manufacturing method. For example drive straps are now commonly employed to transfer torque as well as lift the pressure plate upon disengagement of vehicle drive. With regards to the manufacture of diaphragm springs, heat treatment is crucial. Laser welding is becoming more common as a method of attaching the drive plate to the disc ring with the laser typically being between 2-3KW and a feed rate 1m/minute.

## Multiple plate clutch

This type of clutch has several driving members interleaved or "stacked" with several driven members. It is used in race cars including F1, IndyCar, World Rally and even most club racing, motorcycles, automatic transmissions and in some diesel locomotives with mechanical transmissions. It is also used in some electronically controlled all-wheel drive systems.

## Wet vs. dry

A "wet clutch" is immersed in a cooling lubricating fluid which also keeps the surfaces clean and gives smoother performance and longer life. Wet clutches, however, tend to lose some energy to the liquid. Since the surfaces of a wet clutch can be slippery (as with a motorcycle clutch bathed in engine oil), stacking multiple clutch disks can compensate for the lower coefficient of friction and so eliminate slippage under power when fully engaged.

The Hele-Shaw clutch was a wet clutch that relied entirely on viscous effects, rather than on friction.

A "dry clutch", as the name implies, is not bathed in fluid and should be, literally, dry.

## Centrifugal

A centrifugal clutch is used in some vehicles (e.g. Mopeds) and also in other applications where the speed of the engine defines the state of the clutch, for example, in a chainsaw. This

clutch system employs centrifugal force to automatically engage the clutch when the engine rpm rises above a threshold and to automatically disengage the clutch when the engine rpm falls low enough. The system involves a clutch shoe or shoes attached to the driven shaft, rotating inside a clutch bell attached to the output shaft. The shoe(s) are held inwards by springs until centrifugal force overcomes the spring tension and the shoe(s) make contact with the bell, driving the output. In the case of a chainsaw this allows the chain to remain stationary whilst the engine is idling; once the throttle is pressed and the engine speed rises, the centrifugal clutch engages and the cutting chain moves. See Saxomat and Variomatic.

### **Cone clutch**

Distinguished by conical friction surfaces. The cone's taper means that a given amount of movement of the actuator makes the surfaces approach (or recede) much more slowly than in a disc clutch. As well, a given amount of actuating force created more pressure on the mating surfaces.

### **Torque limiter**

Also known as a slip clutch or safety clutch, this device allows a rotating shaft to slip when higher than normal resistance is encountered on a machine. An example of a safety clutch is the one mounted on the driving shaft of a large grass mower. The clutch will yield if the blades hit a rock, stump, or other immobile object. Motor-driven mechanical calculators had these between the drive motor and gear train, to limit damage when the mechanism jammed, as motors used in such calculators had high stall torque and were capable of causing damage to the mechanism if torque wasn't limited.

- Carefully-designed types disengage, but continue to transmit torque, in such tools as controlled-torque screwdrivers.
- Many safety clutches are not friction clutches, but belong to the "interference clutch" family, of which the dog clutch (see below) is the best-known

**Belt clutch:** Used on agricultural equipment and some piston-engine-driven helicopters. Engine power is transmitted via a set of vee-belts that are slack when the engine is idling, but by means of a tensioner pulley can be tightened to increase friction between the belts and the sheaves.

**Dog clutch:** Utilized in automobile manual transmissions mentioned above. Positive engagement, non-slip. Typically used where slipping is not acceptable. Partial engagement under any significant load tends to be destructive

**Electromagnetic clutch:** Typically a clutch that is engaged by an electromagnet that is an integral part of the clutch assembly. However, magnetic particle clutches have magnetically influenced particles contained in a chamber between driving and driven members which upon

application of direct current causes the particles to clump together and adhere to the operating surfaces. Engagement and slippage are notably smooth.

Overrunning clutch or freewheel: If some external force makes the driven member rotate faster than the driver, the clutch effectively disengages. Examples include:

- Borg-Warner overdrive transmissions in cars
- Typical bicycles have these so that the rider can stop pedaling and coast
- An oscillating member where this clutch can then convert the oscillations into intermittent linear or rotational motion of the complimentary member; others use ratchets with the pawl mounted on a moving member
- The winding knob of a camera employs a (silent) wrap-spring type as a clutch in winding and as a brake in preventing it from being turned backwards.
- The rotor drive train in helicopters uses a freewheeling clutch to disengage the rotors from the engine in the event of engine failure, allowing the craft to safely descend by autorotation.

Wrap-spring clutches: These have a helical spring wound with square-cross-section wire. In simple form the spring is fastened at one end to the driven member; its other end is unattached. The spring fits closely around a cylindrical driving member. If the driving member rotates in the direction that would unwind the spring the spring expands minutely and slips although with some drag. Rotating the driving member the other way makes the spring wrap itself tightly around the driving surface and the clutch locks up.

A **dog clutch** is a type of clutch that couples two rotating shafts or other rotating components not by friction but by interference. The two parts of the clutch are designed such that one will push the other, causing both to rotate at the same speed and will never slip.

Dog clutches are used where slip is undesirable and/or the clutch is not used to control torque. Without slippage, dog clutches are not affected by wear in the same way that friction clutches are.

Dog clutches are used inside manual automotive transmissions to lock different gears to the rotating input and output shafts. A synchromesh arrangement ensures smooth engagement by matching the shaft speeds before the dog clutch is allowed to engage.

A good example of a simple dog clutch can be found in a Sturmey-Archer bicycle hub gear, where a sliding cross-shaped clutch is used to lock the driver assembly to different parts of the planetary geartrain.