

THEORY OF OPERATION

Clutch Operation

The clutch is a mechanical device used to disconnect and reconnect driving (engine) and driven (transmission) members of a driveline. The clutch has three basic purposes:

1. When engaged, the clutch allows the engine and driveline to rotate together as one solid member.
2. When disengaged, the clutch disconnects the engine from the driveline allowing it to remain running while the vehicle is stopped.
3. The clutch can be used to interrupt and reconnect the flow of engine power to allow the changing of transmission gears, or to engage or disengage a power takeoff unit.

A foot pedal allows the driver to control the engagement and disengagement of the clutch (Fig. 2-1). When the clutch pedal is depressed, the release bearing is pulled rearward, toward the transmission. It pulls the diaphragm spring along with it, disengaging the clamp load on the driven disc. During clutch engagement, the release bearing moves toward the engine allowing the diaphragm spring to clamp the clutch disc between the pressure plate and engine flywheel and transmit engine power to the transmission. The advantages of the Valeo clutch in general operation is that it provides a much softer pedal feel allowing the driver improved control of clutch engagement.

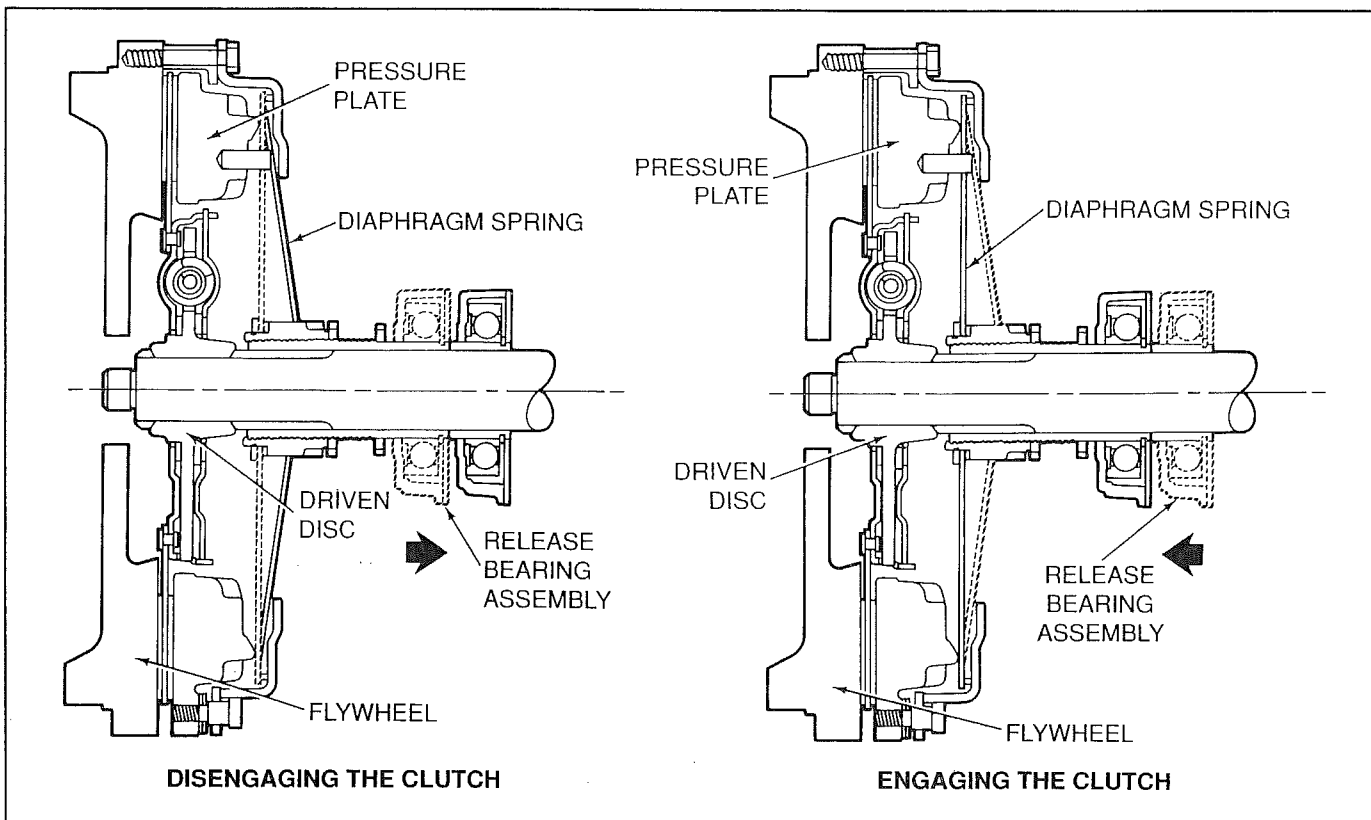


Figure 2-1. Clutch Engaged and Disengaged

THEORY OF OPERATION

Clutch Brake Operation

Non-synchronized transmissions may use a clutch brake (Fig. 2-2). The brake is a steel disc with two tangs, encased in a cover that has a facing material bonded to both sides.

The purpose of the clutch brake is to slow down or stop the transmission input shaft from rotating when the clutch pedal is depressed.

Pushing the clutch pedal to the floorboard beyond the normal clutch disengage position brings the clutch release bearing in contact with the clutch brake and the transmission front cover. Because the tangs on the brake hub are engaged in the transmission input shaft splines, the transmission is slowed down or stopped. The driver can then quickly shift into gear without clashing or damaging the gears.

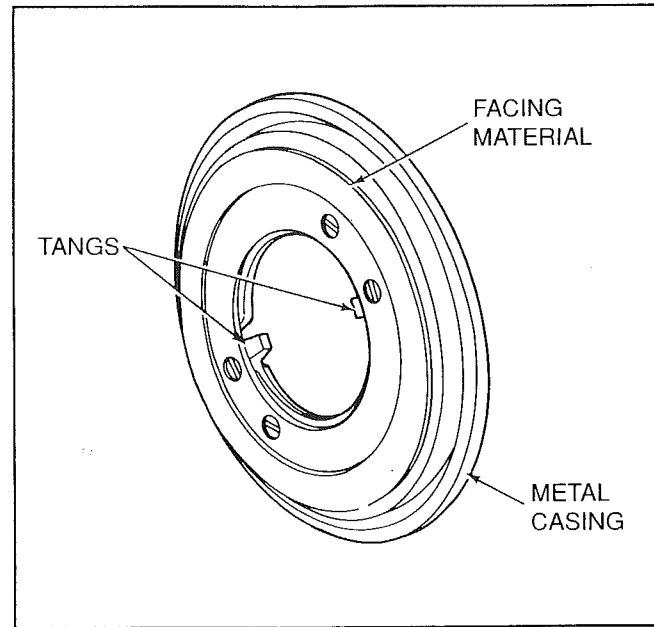


Figure 2-2. Typical Clutch Brake

FACTORS AFFECTING CLUTCH LIFE

Valeo single-disc diaphragm spring clutches are designed to provide years of trouble-free service. However, if today's powerful trucks are not serviced and driven correctly, greatly reduced clutch life may result.

Clutch wear life depends on how often and how long the clutch is slipped. There are three factors that technicians should be aware of that affect clutch life:

1. **Frequency of clutch engagements** - Vehicle application influences the frequency of clutch engagements. Stop and go driving will shorten clutch wear life.
2. **Long clutch engagements** - Extended slippage on vehicle start ups can be caused by:
 - Driver operation
 - Slips clutch excessively
 - Starts in too high a gear

- Insufficient vehicle startability
 - Insufficient gear reduction in transmission and axle to allow short and quick clutch engagement.
- 3. **Clutch Slippage** - Abnormal clutch slippage can severely reduce clutch life:
 - Driver influence
 - Poor driving techniques, such as using the clutch instead of brakes, to hold the truck on a hill.
 - Improper maintenance
 - Improper free play adjustment (no free play) can result in reduced clamp loads because it creates a condition similar to riding the clutch pedal.

Preventing Clutch Slippage

Clutch wear life is proportional to the amount of slippage it is subjected to. Therefore, to maximize life, abnormal or excessive slippage must be avoided. If the clutch begins to slip, back off the throttle or change to a lower gear to stop the slippage. If slipping continues for more than a few seconds under high load conditions, the clutch will become hot and will "fade" in the same way that hot brakes will fade.

Should excessive clutch slippage and/or overheating occur, pull the truck off the road and allow the clutch to cool completely. Clutches heat up faster and take longer to cool than brakes because they are in an enclosed space with minimal airflow. During the cooling off period, the clutch should be checked to determine the cause of slippage. (See Troubleshooting Section for causes.) At the very least, clutch pedal free play should be checked and adjusted if required.

If the clutch continues to slip after cooling, downshift one or two gears until the slippage stops. Then, drive to the nearest service location to have the clutch adjusted or repaired as needed.

The following are driver tips on how to improve clutch performance and extend the useful life of the entire driveline.

DO:

- Gently engage the clutch while the engine is at idle and start increasing the throttle only after the clutch is fully engaged.
- Start the truck in a gear low enough to allow a smooth and quick clutch engagement.
- Minimize clutch-engagement slip time to avoid excessive generation of heat.
- Use the clutch when performing normal upshifts and downshifts.

- Make every effort to match the engine speed to the transmission input shaft speed during upshifts and downshifts to avoid inducing drivetrain shock loads.
- Readjust the release bearing position whenever the clutch pedal free play drops below specification (see Section 11 for more information) (applies only to trucks that have non self-adjusting clutch release linkage).
- Complete a short and simple break-in procedure (see Clutch Installation in this manual) whenever a new clutch has been installed to properly "bed in" the new clutch facings.

DON'T:

- Start the truck with high engine rpm and long clutch slip times or the clutch will overheat.
- Start the truck with very short (abrupt) clutch slip times that shock the driveline.
- Upshift or downshift before reaching the correct engine rpm because this will shock-load the driveline.
- Rest your foot on the clutch pedal. This will start to disengage the clutch and could cause slippage.
- Coast down hill with the clutch disengaged and the transmission in gear. Safe vehicle control will be lost and maximum clutch disc rpm operating limits could be exceeded.
- Engage the clutch brake while the truck is moving. This can easily destroy the clutch brake.
- Use the clutch brake to stop the truck or hold it on a hill. It is too fragile for this purpose.
- Slip the clutch to hold the truck in place on a hill. This will quickly overheat the clutch.

MAXIMIZING CLUTCH LIFE**DON'T: (Continued)**

- Allow irregular clutch action to go unreported. Submit a driver's report after each trip and keep the maintenance director informed of a possible problem.
- Excessively slip the clutch when a vehicle is stuck. Rocking the vehicle by quickly changing gears (reverse to first) or excessive clutch slippage can cause extreme damage to the driveline.
- Allow the engine to lug. A lugging engine creates damaging torsional vibrations that can destroy the driveline of a vehicle. Keep the engine in its recommended operating range.
- Overload the vehicle. The vehicle's driveline, suspension and brakes were designed for a specific capacity. When this capacity is exceeded, the life expectancy of these components will decrease.
- Allow an untrained driver to operate a vehicle.