Clutch Troubleshooting and Warranty Analysis Guide

Compiled by D&W Clutch & Brake
from the following original equipment sources:
   Eaton Corp.
   Dana Spicer
   Rockwell

This manual is to be used strictly for educational purposes promoting these OE specifications for preventive maintenance, understanding clutch performance, and warranty analysis.

D&W Clutch & Brake evaluates all warranty claims using the guidelines set by these OE manufacturers.

All pictures and literature in this guide are the property of the above named sources.
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Introduction

Factors that Effect Clutch Performance

The major cause of clutch failure can be summarized with two words: “EXCESSIVE HEAT”. Extreme operating temperatures (excessive heat) can cause the clutch to fail because the heat generated between the flywheel, driven discs, intermediate plate, and pressure plate are high enough to cause the metal to flow and the friction material to be destroyed.

Heat or wear is practically nonexistent when a clutch is fully engaged. But, during the moment of engagement (when the clutch is picking up the load), it generates considerable heat. An improperly adjusted or slipping clutch will generate sufficient heat to rapidly self-destruct.

Proper training of drivers and mechanics can go a long way toward extending clutch life. Anyone who drives the truck, whether on or off highway, should learn how to operate the vehicle properly. The most critical points to cover in driver training programs are: learning to start in the right gear, proper clutch engagement, recognizing clutch malfunctions, and recognizing the need for readjustment.

Maintenance personnel may want to attend driver training programs to see what driver misuse can do to clutch life. This training will place them in a better position to spot and analyze failures during their clutch maintenance programs.

The most important areas to cover in the training programs that can affect clutch performance are:

STARTING THE VEHICLE IN THE PROPER GEAR
An empty truck can be started satisfactorily in a higher transmission gear ratio than when partially or fully loaded. If auxiliary transmissions or multi-speed axles are used, they must be in the lower ratios for satisfactory starts. Drivers should be shown what ratios can be used for safe starts when the truck is empty or loaded. Do not let the driver find out for himself; he can burn up the clutch by this experimentation. If the truck is diesel powered, a good rule of thumb for the driver to follow is: empty or loaded, select the gear combination that lets you take up the slack and start moving out with an idling engine or, if necessary, just enough throttle to prevent stalling the engine. After the clutch is fully engaged, the engine should be accelerated for the upshift into the next higher gear.

GEAR SHIFTING TECHNIQUES
Many drivers upshift into the next gear—or even skip-shift into a higher gear—before the vehicle has reached the proper speed. This type of shifting is almost as damaging as starting off in a gear that is too high, since the engine speed and vehicle speeds are too far apart, requiring the clutch to absorb the speed difference as heat (excessive slippage).

EXCESSIVE VEHICLE OVERLOAD OR OVERLOADING THE CLUTCH
Clutches are designed and recommended for specific vehicle applications and loads. These limitations should not be exceeded. Excessive or extreme overloading can not only damage the clutch, but the entire vehicle power train as well. If the total gear reduction in the power train is not sufficient to handle excessive overloads, the clutch will suffer, since it is forced to pick up the load at a higher speed differential.

RIDING THE CLUTCH PEDAL
This practice is very destructive to the clutch since a partial clutch engagement permits slippage and excessive heat. Riding the clutch pedal will also put a constant thrust load on the release bearing, which can thin out the lubricant and also cause excessive wear on the pads. Release bearing failures can be attributed to this type of operation.

HOLDING THE VEHICLE ON AN INCLINE WITH A SLIPPING CLUTCH
This procedure uses the clutch to do the job normally expected of the wheel brakes. A slipping clutch accumulates heat faster than it can be dissipated, resulting in early failures.

COASTING WITH THE CLUTCH RELEASED AND TRANSMISSION IN GEAR
This procedure can cause high driven disc R.P.M. through multiplication of ratios from the final drive and transmission. It can result in “throwing” the facing off the clutch discs. Driven disc speeds of over 10,000 R.P.M. have been encountered in such simple procedures as coasting tractors down an unloading ramp. While an ample safety factor is provided for normal operation, the burst strength of the facing is limited.
ENGAGING CLUTCH WHILE COASTING
This procedure can result in tremendous shock loads and possible damage to the clutch, as well as the entire drivetrain.

REPORTING ERRATIC CLUTCH OPERATION PROMPTLY
Drivers should report erratic clutch operation as soon as possible, to give the maintenance personnel a chance to make the necessary inspection, internal clutch adjustment, linkage adjustments, lubrication, etc., thereby avoiding possible clutch failures and breakdowns while on the road. The importance of free-pedal travel (sometimes referred to as pedal lash) should be brought to the driver’s attention as well as the mechanic. This item should be included and commented on daily in the driver’s report, since clutch free-pedal is the maintenance personnel’s guide to the condition of the clutch and the release mechanism.

CLUTCH ADJUSTMENTS
Drivers and mechanics should be made aware of the fact that Eaton Fuller Angle-Spring and Easy-Pedal Clutches have provisions for an internal clutch adjustment. This permits the clutch “itself” to be readjusted while it is in the vehicle. Details of the clutch adjustment are covered in the Eaton Fuller Installation Instructions packaged with each clutch assembly.

When drivers and mechanics are properly trained, there are still certain problems that may occur. The following failure analysis and troubleshooting guide lists some common problems, their causes, and suggested corrective action. Note that some of these problems relate back to the previous discussion on poor driving and maintenance techniques.
WARNING!

DO NOT CLEAN ANY PART OF A CLUTCH SUBMITTED FOR WARRANTY EVALUATION!

The dirt or grease may be key evidence as to what may have caused the clutch to fail and become a warranty claim. Too little or too much grease may cause a clutch failure. Dirt on a clutch may illustrate unusual wear, or no wear, in places it should or should not be. These contaminants must be left intact to determine what to recommend as a solution to this truck’s problem(s) and avoid future warranty claims.

Any warranty claim submitted to D&W Clutch & Brake must include paperwork which includes all pertinent information about the unit claimed. D&W must be informed of the symptoms which lead to the failure, the part number of the clutch, installation date, removal date, mileage on the unit, year, make and model of the truck, the engine series and horsepower, the flywheel pilot bore size, and all necessary customer information.
Main Causes

Why Clutches Are Replaced

Here are some of the reasons that clutches are replaced.

- Normal wear.
- The clutch can not be adjusted.
- The clutch is out-of-adjustment.
- The clutch is not adjusted correctly.
- The clutch is not adjusted on a regular schedule.
- The driver does not use the clutch correctly.
- The clutch does not have the correct rated capacity for the application.
- The clutch is not lubricated correctly.
- The clutch is not installed correctly.

Clutch Can Not Be Adjusted

If the clutch can not be adjusted, check if the adjusting ring is able to move. See the procedure under “Adjusting Ring” in Section 3. Make sure an inspection cover is installed on the clutch housing. The inspection cover keeps dirt and contaminants from entering the clutch housing.

Clutch Is Out-Of-Adjustment

If the clutch is out-of-adjustment, damage will usually occur gradually unless the clutch is severely out-of-adjustment. “Slipping”, “dragging” or “will not disengage” are symptoms of an out-of-adjustment clutch. For more information, see the charts in this section.

The clutch is out-of-adjustment if the release bearing clearance is not correct and must be adjusted.

The clutch linkage is out-of-adjustment if:

- The release fork clearance is not correct and the linkage must be adjusted.
- The release bearing clearance is correct and the release fork clearance is not correct.

Release Bearing Clearance

The release bearing clearance is out-of-adjustment when the clearance is more than the specified clearance. (If the release bearing clearance is less than the specified clearance, the adjusting ring was turned the wrong way during adjustment.)

**NOTE:**
The specified release bearing clearance is 0.500 inch (12.7 mm) MINIMUM to 0.562 inch (14.2 mm) MAXIMUM with a TARGET clearance of 0.531 inch (13.5 mm) between the front of the release bearing and the clutch brake. If the clearance is 0.717 inch (18.0 mm) or more, the release bearing clearance MUST be adjusted. Figure 2.
Main Causes

As the linings on the discs wear, the release bearing clearance increases. The clutch will operate correctly until the release fork touches the wear pads on the release bearing.  **Figure 3.**

![Figure 3](image1)

When the release fork touches the wear pads on the release bearing, the driver will not have any free travel of the clutch pedal. The release bearing clearance must now be adjusted.

If the release bearing clearance is not adjusted when the fork touches the pads, the life of the clutch is greatly reduced.

The clutch must be adjusted internally before the release fork clearance is used up and before the pedal free travel is less than specifications.

**NOTE:**

For additional information on when the release bearing clearance is out-of-adjustment, see the “Release Bearing Clearance” chart in this section.

Release Fork Clearance

The linkage is correctly adjusted when the clearance between the tips of the release fork and the pads on the release bearing is 0.125 inch (3.17 mm) MINIMUM to 0.150 inch (3.81 mm) MAXIMUM with a **TARGET** clearance of 0.125 inch (3.17 mm). The clearance will be the very close to the same on both sides.  **Figure 4**

![Figure 4](image2)

If the clearance is not close to the same (very different) on each side of the fork, the bushings in the clutch housing or the cross shaft are worn or damaged. The clutch will not be adjusted correctly until the bushings and/or cross shaft are serviced.

If the clearance is more than 0.150 inch (3.81 mm), there will be too much clutch pedal free travel, and the release fork travels a greater distance before the clutch disengages. The clutch will be difficult to disengage, and may not disengage completely because the clutch pedal is at the end of travel and may not engage the clutch brake.  **Figure 5**.
Main Causes

Clutch Is Not Adjusted Correctly

When the clutch is not adjusted correctly, damage will occur gradually unless the clutch is severely out-of-adjustment. Slipping of the clutch during operation is one of the major signs of a clutch or linkage that is not adjusted correctly (for more information, see the charts in this section).

Typically, the clutch system is not adjusted until the driver complains that the free travel of the clutch pedal is more or less than the specified distance or that the clutch is slipping.

Many times, the linkage is adjusted to correct the free travel. The release bearing clearance is not checked or adjusted. The driver feels that the free travel is correct and that the clutch is operating.
correctly. But if the release bearing clearance is not adjusted, the life of the clutch is greatly reduced.

To determine if the release bearing clearance was adjusted:

⚠️ **WARNING**

*To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.*

1. If necessary, remove the clutch from the vehicle. See Maintenance Manual #25A, Clutches.

2. Remove the Allen-head capscrews that fasten the straps to the pressure plate.

3. Count the wear marks from the levers on the back of the pressure plate. Divide the number by "six" (6) to get the number of times the release bearing clearance was adjusted. **Figure 8.**

### Clutch Is Not Adjusted On A Regular Schedule

When the clutch is not adjusted on a regular schedule, damage will occur gradually. Slipping of the clutch during operation is one of the major signs of an out-of-adjustment clutch (for more information, see the charts in this section).

Check the clutch adjustment as part of a Preventive Maintenance (PM) Schedule to determine if the release bearing clearance or the clutch linkage must be adjusted.

Rockwell recommends determining a schedule based on any of the following:

- Adjust the clutch according to the way the driver operates the vehicle.
- Adjust the clutch when required by the preventive maintenance schedule of the vehicle. For typical on-highway applications, the clutch is usually adjusted every 40,000-70,000 miles (64,000-112,000 km).
- Adjust the clutch each time the engine oil is changed.

**NOTE:**

*A sample of a clutch adjustment log is shown in Figure 9.*
Main Causes

Driver Does Not Use Clutch Correctly

When the driver does not use the clutch correctly, damage will occur gradually except in cases of a severe shock load.

If the driver does not use the clutch correctly (starting in the wrong gear, keeping a foot on the clutch pedal, etc.), the service life of the clutch is reduced.

NOTE:
For additional information on damage from operating procedures, see the "Vehicle Operations" chart in this section.

To determine if the clutch and engine are correctly matched, see the following.

⚠️ WARNING
To prevent serious eye injury, always wear safe eye protection when doing maintenance or service.

1. Remove the inspection cover on the clutch housing.

2. See the identification tag on the clutch and find the specification number. Figure 10.

3. Look at the third and fourth digits of the specification number. The number indicates the clutch diameter in inches and will be "14" or "15". "14" indicates a 14 inch clutch is used. "15" indicates a 15-1/2 inch clutch is used. Figure 10.

4. Look at the last two digits on the specification number. The number is the pressure plate clamp load and will be "28", "32" or "36". Figure 10.

5. Determine if organic or ceramic discs are used.

6. Install the inspection cover.
Main Causes

7. Find the Engine Information Plate. See the vehicle operator's guide for the location of the plate. Look at the **Maximum Torque Rating** or the **Maximum Engine RPM** and record the information.

8. Find the GCW (Gross Combination Weight) of the vehicle.
Main Causes

Clutch Is Not Lubricated Correctly

When the clutch is not lubricated correctly, damage will occur gradually.

Many clutches are replaced because of lubrication problems that are usually indicated by a burnt condition in the area where lubricant is applied. Here are some of the common situations:

- **Clutch is not lubricated on a regular schedule.** Make sure the release bearing, the clutch linkage and the cross shaft bushings in the clutch housing are lubricated according to the schedule developed by the manufacturer of the vehicle or the fleet.

- **Too much lubricant is used.** If too much lubricant is used on the release bearing or cross shaft bushings in the clutch housing, a “chattering” noise can occur during operation and will
eventually grab or slip. Apply lubricant only until lubricant starts to come out of the grease fitting. **Figures 12 and 13.**

- **The wrong lubricant is used.** Rockwell recommends using a high temperature multi-purpose wheel bearing grease. If the wrong lubricant is used, the life of the clutch is reduced.

- **The lubricant is contaminated.** If the lubricant shows signs of contamination, make sure the inspection cover is installed to keep contaminants from entering the clutch housing. Also, check the operating environment of the vehicle that may require more frequent lubrication. Lubricant can also be contaminated by mixing different kinds of lubricants.

⚠️ **WARNING**

*If a grease fitting with an extension tube is used, the release bearing is lubricated with the engine running. Make sure the extension tube extends through the opening of the inspection cover so that hands and tools do not touch any moving parts. To prevent serious personal injury and damage, make sure the vehicle will not move and be careful around any moving parts.*

- **The wrong procedure is used.** If an extension tube is used on the grease fitting for the release bearing, lubricate the fitting with the **engine operating**. Make sure the passages in the extension tube are not blocked. If only a grease fitting is used, lubricate the fitting when the **engine is not operating**.

**Clutch Is Not Installed Correctly**

When the clutch is not installed correctly, damage will occur soon after the clutch is installed. Difficult engagement and disengagement of the clutch during operation is an indication that a clutch is not correctly installed (for more information, see the charts in this section).

The clutch and other related parts can be damaged by installation techniques that are not correct. Install the clutch according to the procedures described in Maintenance Manual Number 25A, "Clutches".

**NOTE:**

*For additional information on damage that occurs when the clutch is not correctly installed, see the “Installation Procedures” chart in this section.*
# Main Causes

## Release Bearing Clearance

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>DRIVER NOTICES</th>
<th>OBSERVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than specifications. ①</td>
<td>Pedal free travel is more than specifications. Early clutch brake engagement.</td>
<td>Early clutch brake replacement. Severe wear on release bearing cover that may remove rivets. Early clutch replacement because of too much wear on the facing of the disc, the pressure plate and the center plate.</td>
</tr>
<tr>
<td>More than specifications. Release fork doesn’t touch pads on release bearing.</td>
<td>Pedal free travel is less than specifications. Hard shifting into first and reverse gears.</td>
<td>The release bearing will not be damaged until the release fork touches the pads on the release bearing housing.</td>
</tr>
</tbody>
</table>

### NOTES:

① The specified release bearing clearances between the front of the release bearing and the clutch brake is **0.500 inch (12.7 mm) MINIMUM to 0.562 inch MAXIMUM with a TARGET clearance of 0.531 inch (13.5 mm). If the clearance is 0.717 inch (18.0 mm), the release bearing clearance must be adjusted.**

② The following will cause the release bearing clearance to be less than specifications:

1. The adjusting ring was turned more than the required amount when the release bearing clearance was last adjusted.

2. The clutch pedal was not pushed to the bottom of travel several times when the release bearing clearance was adjusted. The release bearing was not completely rearward in the correct position when the clearance was adjusted.
# Main Causes

## Release Fork Clearance

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>DRIVER NOTICES</th>
<th>OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than specifications.</td>
<td>Pedal free travel is more than specifications. Clutch is hard to operate. Grinding or clashing noise. Clutch drags.</td>
<td>Severe wear. Early clutch replacement because of too much wear on the facing of the disc, the pressure plate and the center plate.</td>
</tr>
<tr>
<td>Less than specifications. Release fork doesn't touch pads on release bearing.</td>
<td>Pedal free travel is less than specifications.</td>
<td>The release bearing will not be damaged until the release fork touches the pads on the release bearing housing.</td>
</tr>
<tr>
<td>Release fork clearance or linkage adjusted instead of release bearing clearance.</td>
<td>Clutch does not disengage and slips. Hard shifting into first and reverse gears due to no clutch brake contact</td>
<td>Early clutch assembly replacement. Round wear pattern on the pressure plate side of the rear clutch disc and also on the retainer and sleeve assembly.</td>
</tr>
</tbody>
</table>

**NOTES:**

1. The specified clearance between the tip of the release fork and the wear pads on the release bearing is 0.125 inch (3.17 mm) MINIMUM to 0.150 inch (3.81 mm) MAXIMUM with a TARGET clearance of 0.125 inch (3.17 mm). The clearance on each side of the release bearing must be nearly equal.

2. Often only the clutch linkage is adjusted when the clutch must be internally checked and adjusted (release bearing clearance and release fork clearance). If only the clutch linkage is adjusted and the clutch internal clearances are not checked and adjusted, the clutch will require early replacement and all warranties are voided.
# Main Causes

## Vehicle Operations

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>RESULTS</th>
<th>OBSERVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting and moving in a gear too high.</td>
<td>Not enough torque to move vehicle. Clutch slips and overheats.</td>
<td>Burnt or worn clutch assembly.</td>
</tr>
<tr>
<td>Shifting before minimum shift speed.</td>
<td>Shock load.</td>
<td>Broken hub in discs.</td>
</tr>
<tr>
<td>Keeping foot on the clutch pedal.</td>
<td>Clutch is always partially engaged or disengaged. Clutch slips and overheats. Lubricant in release bearing dries up and causes difficult clutch operation.</td>
<td>Burnt discs, center plate, pressure plate and flywheel. Look for excessive wear on tips of release fork and on the pads of the release bearing. Light burn marks on surface of release bearing assembly.</td>
</tr>
<tr>
<td>Pressing the clutch pedal too far when the vehicle is moving.</td>
<td>Too much force applied to clutch brake. Noise in first or reverse gears.</td>
<td>Broken, burnt or damaged clutch brake. Clutch brake requires early replacement.</td>
</tr>
<tr>
<td>“Popping” the clutch.</td>
<td>Shock load. Clutch also slips.</td>
<td>Weakens, cracks or breaks the clutch discs, the center plate and the transmission input shaft. Parts are also burnt.</td>
</tr>
<tr>
<td>Using the clutch as a brake.</td>
<td>Too much force against clutch. Clutch slips and overheats.</td>
<td>Early replacement of discs. Cracked, burnt or broken center plate.</td>
</tr>
<tr>
<td>Clutch is applied while coasting.</td>
<td>Shock load.</td>
<td>Broken hubs and/or discs. Broken or damaged transmission input shaft.</td>
</tr>
<tr>
<td>Coasting downhill with the transmission in gear and the clutch disengaged.</td>
<td>Rear axle drives the transmission and puts too many RPM's on the input shaft.</td>
<td>Springs, hubs or linings separate from disc.</td>
</tr>
</tbody>
</table>

**NOTES:**

1 See the following Warning.

⚠️ **WARNING**

Operate the vehicle according to the procedure of the manufacturer of the vehicle. Do not coast downhill with the transmission in gear and the clutch disengaged. If the vehicle coasts downhill with the transmission in gear and the clutch disengaged, the linings can separate from the discs and cause serious personal injury and damage.