Center Plate

Center Plate

Normal Wear

See Figure 40.

Normal wear is a smooth and even wear on both sides of the plate. Minor damage such as heat marks can be removed with an emery cloth.

Too Much Wear

See Figure 41.

Driver Notices: Clutch slips.

Observations: The center plate must be replaced when the thickness of the plate is less than the following:

14 Inch Clutches With Ceramic Discs: 0.728 inch (18.5 mm).
14 Inch Clutches With Organic Discs: 0.610 inch (15.5 mm).
15-1/2 Inch Clutches: 0.681 inch (17.3 mm).

Causes: Center plate is not replaced at the correct interval.

Correction: Replace clutch assembly. Inspect clutch at regular intervals. This condition is not covered under warranty.

Wear Pattern is Not Even.

See Figure 42.

Driver Notices: Clutch drags.

Observations: Wear pattern is only in one area on both sides of center plate.

Causes: Warped or bent discs or center plate. Clutch not correctly installed.

Correction: Grind plate or replace clutch assembly. Make sure clutch is correctly installed. This condition is not covered under warranty.

Figure 40

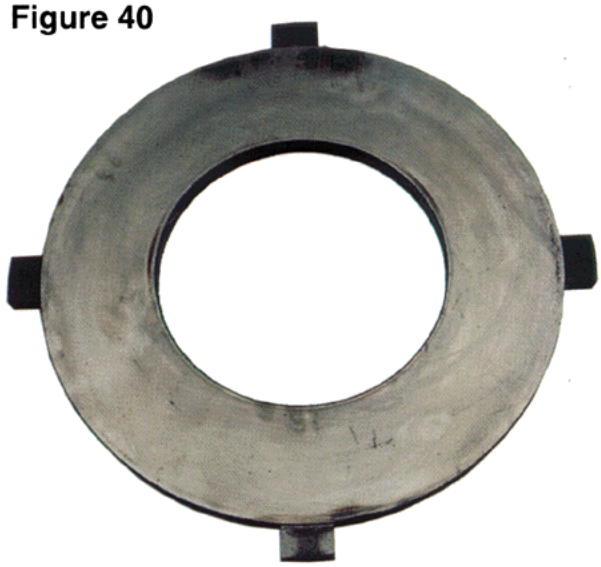


Figure 41

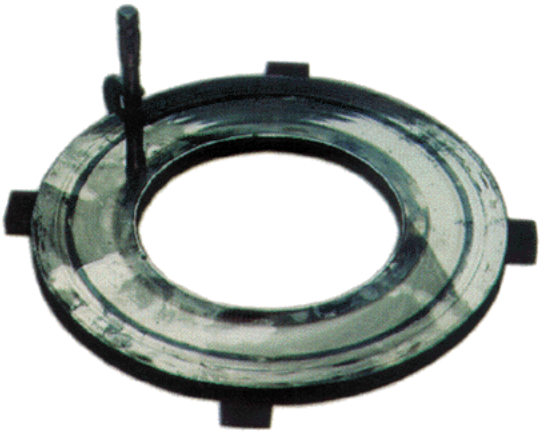
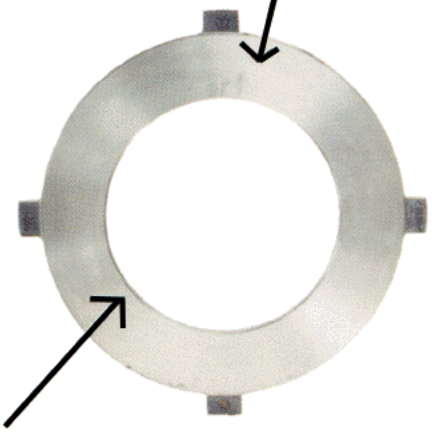


Figure 42



Clutch Cover / Intermediate Plate

Failure - Aluminum Spacer Ring on the Intermediate Plate is Broken (Eaton Fuller Solo ™ and Stamped Angle Spring 1402 only)

Possible Causes

As shown in Figure 34 (see arrow), the aluminum spacer ring broke when it was bolted up backwards onto the flywheel.

Note: The cover assembly mounting hole pads (see arrow in Figure 35) have made an indentation (see arrow in Figure 36) onto the spacer ring mounting hole pads (flywheel side). This evidence will confirm that the spacer ring/intermediate plate assembly was indeed installed backwards. The words "Flywheel side" (refer to Figure 37) will face the flywheel when properly installed. Mishandling of this assembly during installation and/or removal can also cause the spacer ring to break. Some results of installing the intermediate plate backwards are as follows:

- A clutch that will not release properly.
- The release bearing position may be closer than normal to the transmission bearing retainer cap immediately upon clutch installation.
- A "cracking" noise as you tighten the (8) mounting bolts that secure the cover to the flywheel.

Fig 34 (SAS)

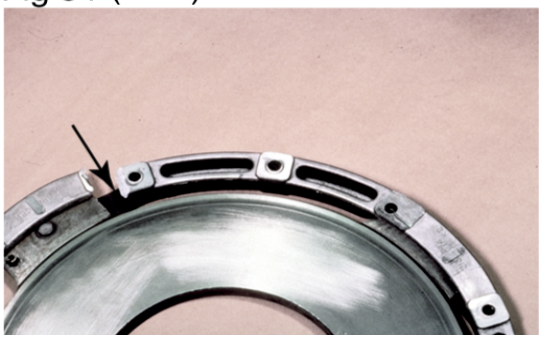


Fig 35 (SAS)

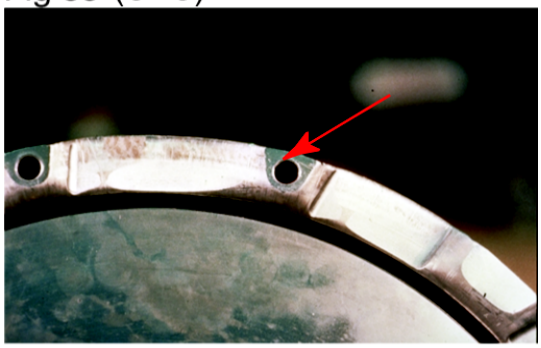


Fig 36

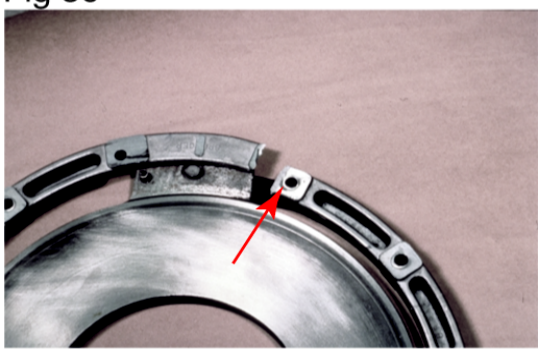
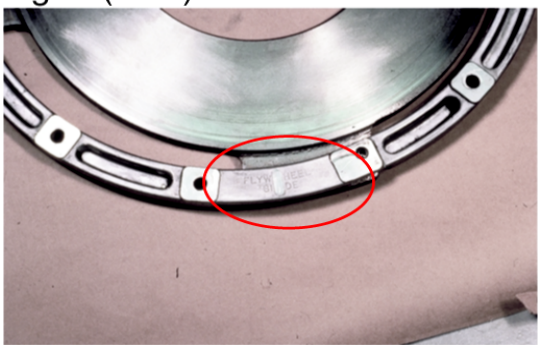


Fig 37 (SAS)



Section 3

Clutch Cover / Intermediate Plate

A broken conversion ring (CR) or intermediate plate lug in a stamped angle spring clutch results from the mechanic installing the conversion ring in backwards. Weight has been removed from the backside of the conversion ring similarly to the machined intermediate plate guide slots on the pressure plate side for balance. When drawing in the mounting bolts to proper torque, either the intermediate plate lug or the conversion ring will break if the ring is in backwards. The correct “Flywheel Side” is marked on the ring.

Photo by **D&W Clutch & Brake**

Damaged Tabs (15-1/2 Inch Clutch)

See Figure 48.

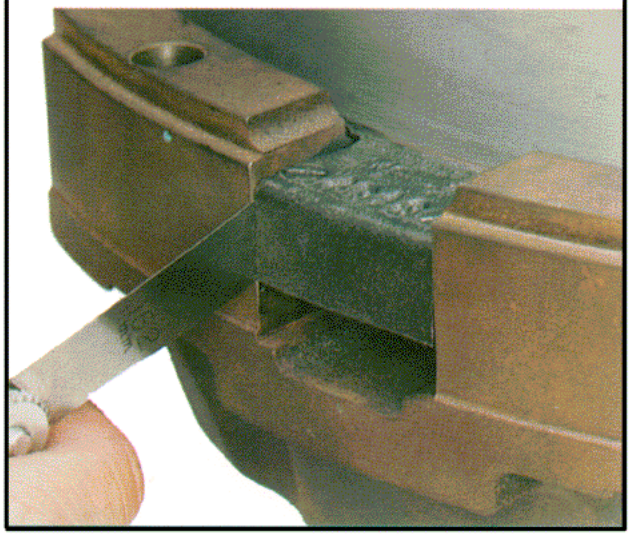
Driver Notices: Clutch is noisy. Clutch may be difficult to engage and disengage.

Observations: Tabs are worn or damaged. The clearance between the tab and the slot in the clutch housing is less than 0.006 inch (0.152 mm).

Causes: Drivetrain vibration.

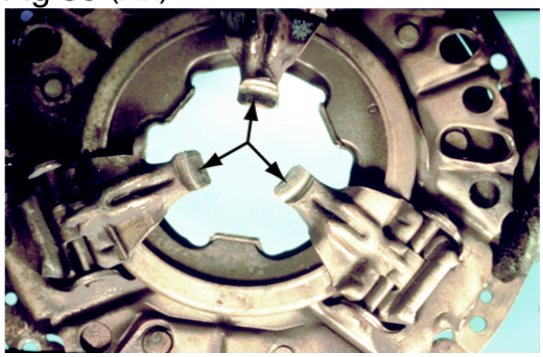
Correction: Replace the center plate. Correct the cause of drivetrain vibration. This condition is not covered under warranty.

Figure 48



Clutch Cover / Intermediate Plate

Fig 38 (AR)



Failure - Lever Wear

Possible Causes

As indicated by arrows in Figure 38, excessively worn levers are most likely the result of lack of maintenance. More specifically, lever wear can be the result of one or more of the following conditions:

- A dry, seized, or broken throw out bearing. Typical causes of a damaged bearing are:
  - a. Operating the truck without free-play
  - b. Constant riding of the clutch pedal

Both items 1 and 2 can cause the thinning and loss of bearing lubricant. They can also cause rapid lever wear due to constant contact with the bearing.

- A throw out bearing which fits too tightly on the front bearing cap stem. As a result, the return spring(s) (attached to the linkage or throw-out bearing) may not be capable of retracting the throw-out bearing away from the clutch levers. This will cause contact between these parts.
- Worn and/or binding linkages are causing the throw-out bearing to make "constant contact" with the clutch's three (3) release levers (Figure 38).
- Using a throw out bearing of inferior quality.

Fig 39

Failure - Adjusting Linkage to Compensate for Clutch Wear

Possible Causes

Figure 39 shows the back of the pressure plate. This clutch has been properly adjusted (internally, using the adjusting ring) because each of the 6 levers has more than one witness mark (or lever fulcrum point).

Fig 40

Figure 40 depicts a clutch that has not been adjusted properly. As shown, there is only one witness mark per lever indicating that the clutch was improperly adjusted using the linkage.

WARNING: Continually adjusting for clutch wear via the linkage can lead to the failures shown in Figures 4, 5, 25, and 57-58.

Section 3

Pressure Plate

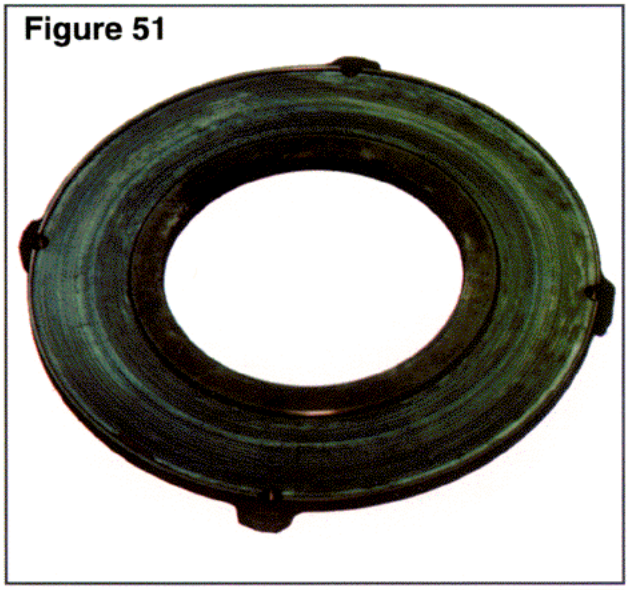
Pressure Plate

Normal Wear

See Figure 51.

Normal wear is smooth and even.

Figure 51



Wear Pattern is Not Even.

See Figure 52.

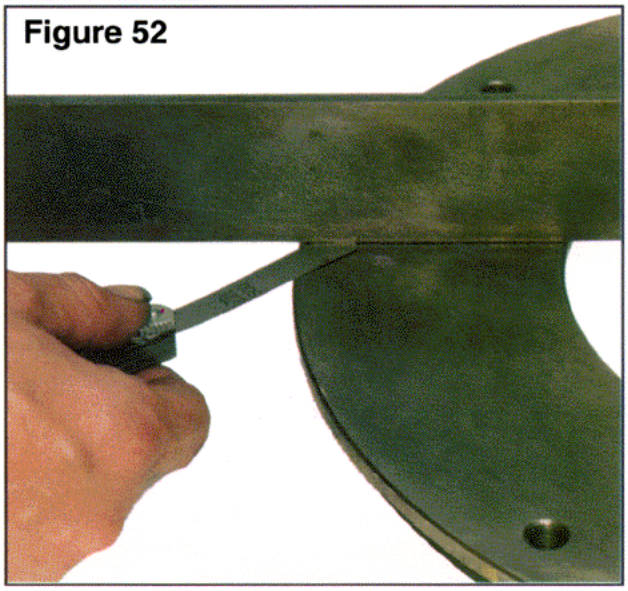
Driver Notices: Clutch slips.

Observations: Wear pattern is only in one area with some heat damage.

Causes: Warped or bent pressure plate. Clutch not correctly installed. The plate is warped if the taper is more than 0.005 inch (0.127 mm).

Correction: Replace clutch assembly. Install clutch correctly. This condition is not covered under warranty.

Figure 52



Broken or Cracked

See Figure 53.

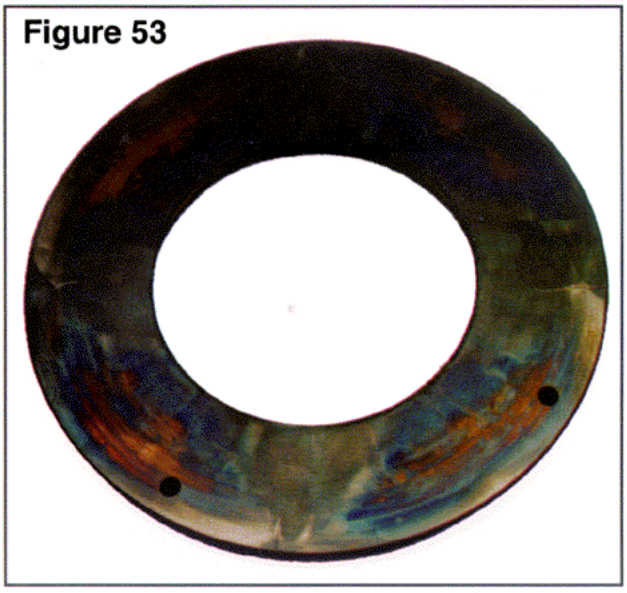
Driver Notices: Clutch slips and is difficult to engage or disengage. Clutch is noisy.

Observations: Pressure plate is cracked on the surface or is broken. Plate is severely burnt.

Causes: Excessive heat build-up, slipping or the clutch is out-of-adjustment or not adjusted correctly.

Correction: Replace clutch assembly. Make sure clutch is adjusted correctly. This condition is not covered under warranty.

Figure 53



Clutch Disc Assembly

Clutch Disc Assembly Failures

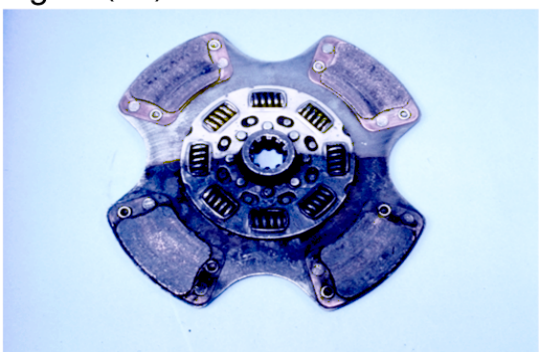
Failure - Oil Soaked Ceramic Disc

Possible Causes
After removal from the truck, the top half of this ceramic disc (Figure 41) was cleaned in order to reveal the contrast with the bottom half which is still oil soaked (Figure 30 shows the clutch cover that was run with this disc). Possible contributors to this condition are a leaking transmission and/or a leaking rear main engine seal.

Furthermore, oil on the disc buttons can cause the clutch to release poorly due to increased drag, and/or chatter/slip during engagement.

Note: Eaton does not recommend the reinstallation of any discs that are oil soaked because the button facings cannot be satisfactorily cleaned.

Fig 41 (AR)

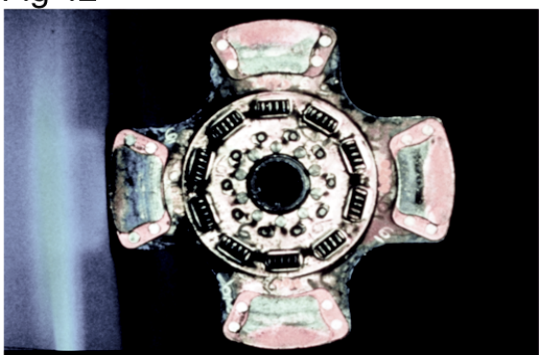


Failure - None

Normal Wear Patterns
When troubleshooting Eaton Fuller Clutches, do not be concerned with the wear pattern (darkened areas) of the disc buttons (see Figure 42). More specifically, it is normal for the darkened areas to vary in color, size, and their relative position upon each button.

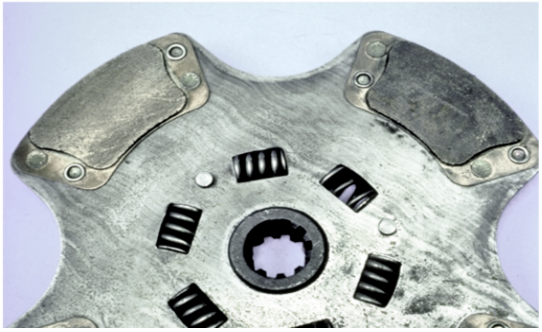
The exception to the above wear pattern is described in detail in Figure 46. The title of this description is: “Failure - Abnormal wear pattern at middle of disc button”.

Fig 42



Clutch Disc Assembly

Fig 43

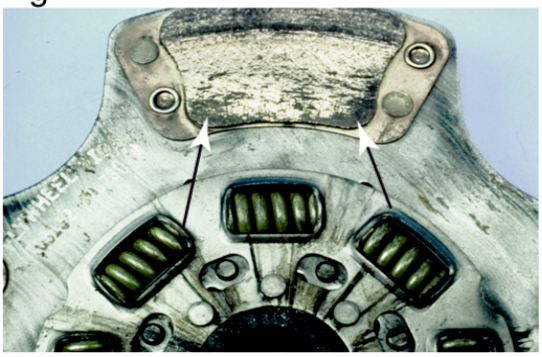


Failure - Grease on Buttons of Ceramic Disc

Possible Causes

Figure 43 shows a disc with grease on its buttons, flywheel side. When this disc was removed from the truck, all four buttons had a heavy layer of grease on them. The left button has been cleaned to show the contrast with the grease-covered button on the right. Failing to remove the grease (rust preventative) from the flywheel (new or resurfaced) can cause this problem.

Fig 44



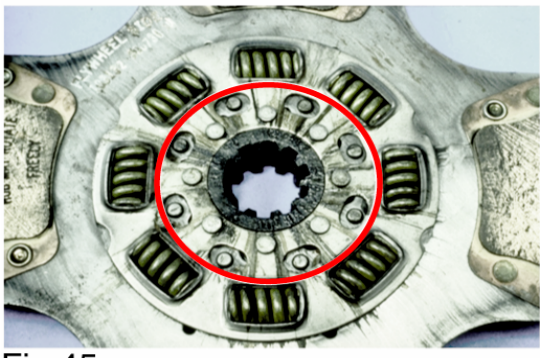


Fig 45

Greasing the splined areas of either the input shaft or disc hub(s) is not recommended because the grease can be spun onto the facing material of the driven disc(s) (refer to both arrows in Figure 44) . The circled area in Figure 45 reveals the numerous paths which the grease took as it moved toward the buttons (facing material) of this ceramic driven disc. The photographs in Figures 44-45 are of the same driven disc.

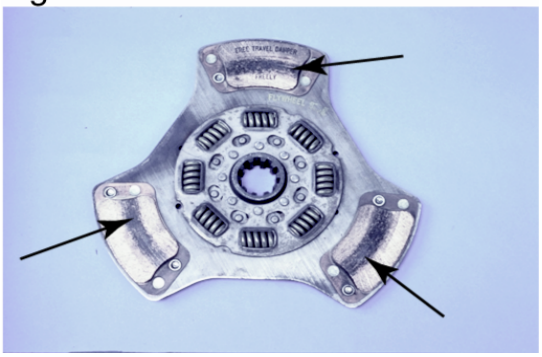
Note: Eaton does not recommend the reinstallation of driven discs which have become contaminated with grease or oil.

A contaminated driven disc can cause one or more of the following problems:

- Poor release
- Clutch chatters during engagement
- Slipping clutch

Also, grease on the splined areas of the input shaft/disc hub(s) will attract dirt, worn facing material, etc. which can impede the free movement of the disc hub on the input shaft, potentially causing a “poor release” complaint.

Fig 46



Failure - Abnormal Wear Pattern at Middle of Disc Button

Possible Causes

As shown by the dark areas of the three buttons in Figure 46, this disc was making major contact at the middle of each button on the flywheel side. The buttons on the opposite side had normal wear patterns. This abnormal wear pattern is found on service clutches (not original equipment), and is usually caused by a flywheel that is worn unevenly. This condition may result from improper resurfacing of the flywheel.

Before resurfacing any flywheel, consult your OEM service manual for proper procedures.

Clutch Disc Assembly

Failure - Warped Driven Disc

Possible Causes
Shown in Figure 47 is a brand new driven disc which was warped during transmission installation (as indicated by the dummy input shaft which is not perpendicular to the disc's hub). More specifically, the transmission was allowed to hang unsupported in the driven disc hub. A driven disc which has become bent due to improper installation techniques should not be reused because of the potential for a "poor release" complaint.

Fig 47

Failure - Front Disc and Flywheel Interference

Possible Causes
This failure can be attributed to one or more of the following specific conditions:

- The rivets of the disc (Figure 48) have been contacting the flywheel's mounting bolts. Some potential causes of this particular interference are as follows:
  a. Loose flywheel mounting bolt(s) due to inadequate torquing.
  b. Forgetting to tighten one or more or the mounting bolts when reinstalling the flywheel.
  c. Installing an extra washer under the flywheel mounting bolt.
  d. A flywheel which has been resurfaced too many times.
- The damper springs (see arrows, Figure 49 and 50) have been contacting the flywheel mounting bolts because the front driven disc was installed backwards. The driven disc (in Figure 49) had been wearing for a period of time before the interference occurred (as indicated by the full wear pattern on the ceramic buttons) while the one in Figure 50 was run for a very short period.

Fig 48

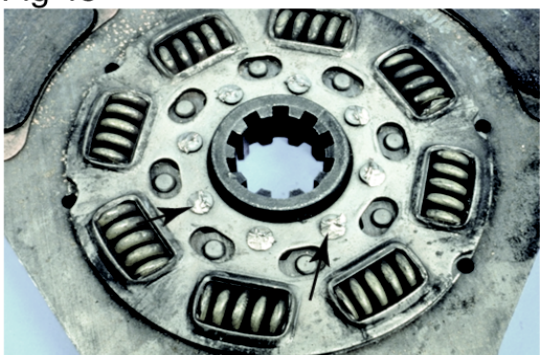


Fig 49 (EPP 14")

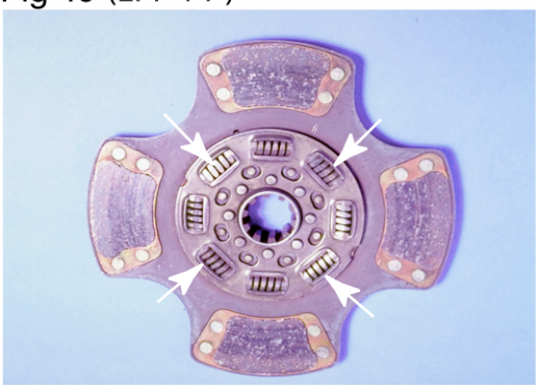
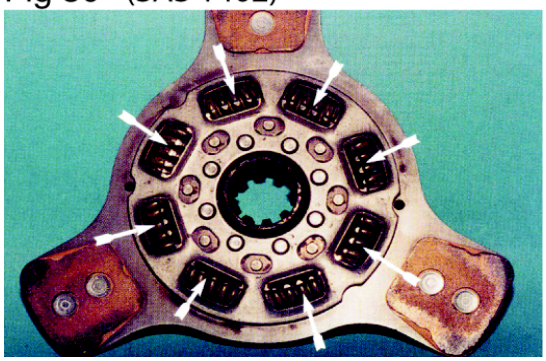


Fig 50 (SAS 1402)



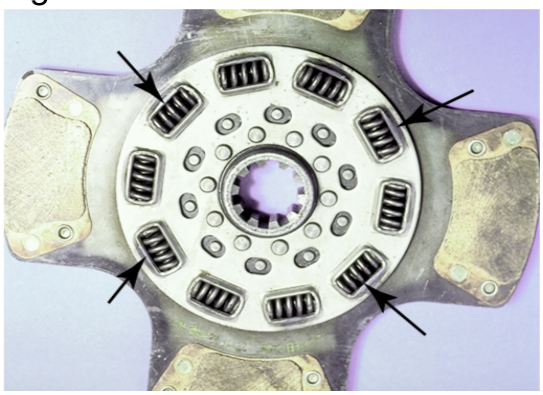
Section 3

Clutch Disc Assembly

Fig 51

- A disintegrating pilot bearing which is interfering with both the hub and rivets of the driven disc (Figure 51).

Fig 52



- Installation of the wrong clutch. Figure 52 (see arrows) shows the points of interference that resulted when a 10-spring driven disc was installed where an 8-spring was previously being run. In other words, the recessed area of the flywheel (mounting bolt cavity) was too small for the 10-spring driven disc. Before you mount the new clutch, consult the Eaton Installation Instructions (packaged with each Eaton Fuller Clutch) concerning “potential damper interference”. A driver complaint, resulting from the above failure, can be:

  a. The clutch does not release

  b. The clutch is noisy during operation

Clutch Disc Assembly

Failure - Burnt Discs

Possible Causes

The failures shown in Figures 53-56 and 58 are the result of excessive heat due to prolonged slippage. Figures 53, 54, and 58 show discs that became so hot (due to slippage) that the ceramic material began to flow and eventually separate from the disc. Figures 55 and 56 show how the organic material separates from the disc due to bonding agent failure as a result of extreme heat. Burnt discs may result from:

- Lack of free pedal
- Constantly riding the clutch pedal
- Utilizing a slipping clutch as a brake on an incline
- Partial unloading of a clutch due to a binding linkage system, interference, etc.
- Installation and use of improper clutch (wrong application)
- Worn driven disc facings

Fig 53 Ceramic Disc

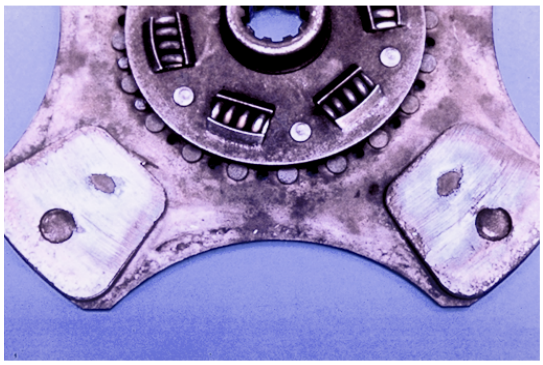


Fig 54 Ceramic Disc (SAS/severe)

Fig 55 Organic Disc

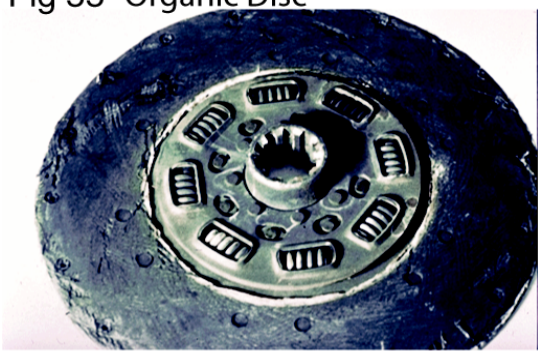
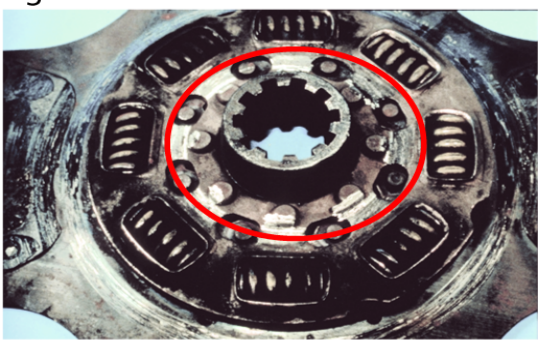


Fig 56 Organic Disc (Severe)

Section 3

Clutch Disc Assembly

Fig 57



Failure - Rear Disc Interfering with Retainer Assembly

Possible Causes

Figure 57 (see circle) shows the damage that will occur to the rear disc when it makes contact with the retainer assembly (refer to the arrow in Figure 25 concerning the subsequent damage to this part). This type of interference was so great that the clutch began to slip while engaged, thus creating enough heat to cause the ceramic buttons to self-destruct (Figure 58).

Fig 58

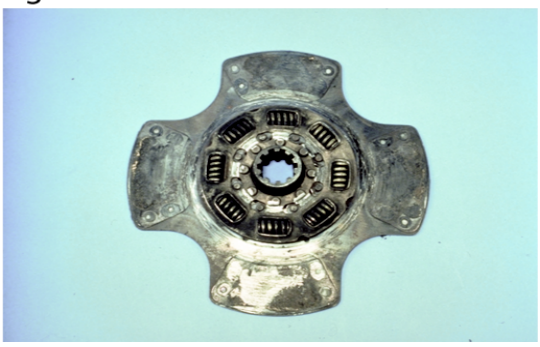


Fig 59

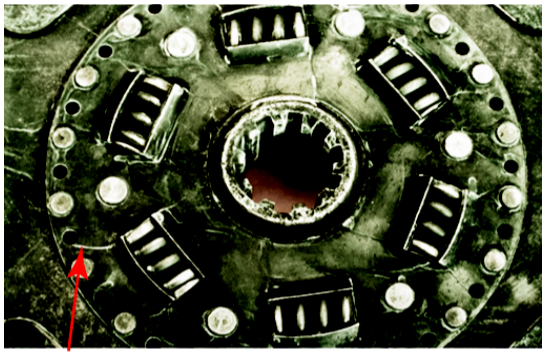
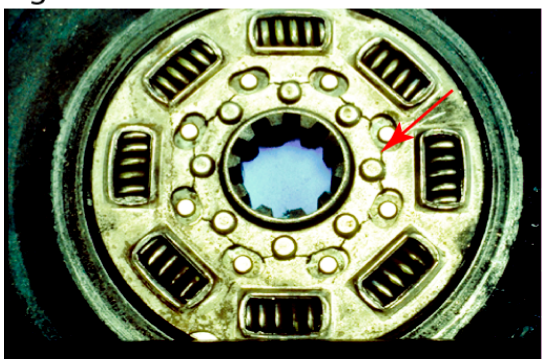


Fig 60



Failure - Cracked Damper Cover

Possible Causes

The cracks shown in Figures 59 and 60 (see arrows) can result from:

- Forcing the transmission input shaft into the disc hub during installation
- Allowing the transmission to hang unsupported in the driven disc(s) during installation
- Misalignment between the engine housing and the transmission bell housing

Clutch Disc Assembly

Failure - Hub of Rigid Driven Disc Worn Excessively or Fracturated

Possible Causes

Figure 61 shows a disc hub that has worn excessively (see arrow) and has also broken away from the disc. Note the narrow width of each spline compared with those on a new disc. Figure 62 reveals a hub in which the splines have been completely "pounded" out (see arrow.) The typical cause of worn splines is either torsional vibrations or misapplication of the clutch. A broken or cracked disc hub can be attributed to one or more of the following:

- A severe shock load, such as engaging the clutch while coasting down a hill.
- Misalignment between the transmission bell housing and engine housing due to loose transmission mounting bolts and/or worn mating faces of either housing.
- Misapplication—a rigid disc should not have been used, but rather a dampened disc assembly (D.D.A.).
- Torsional vibrations from the engine.
- Excessive flywheel runout.
- Allowing the transmission to hang unsupported in the driven disc during installation.

Fig 61

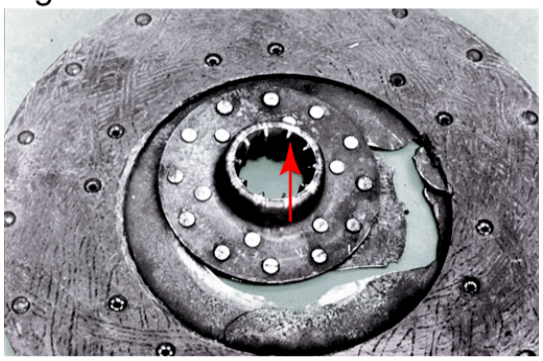
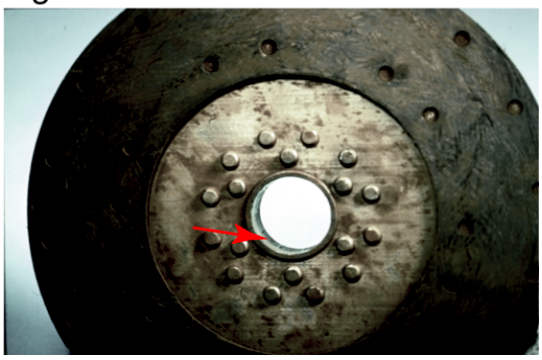


Fig 62



Failure - Non-Eaton Fuller Material

Possible Causes

Figure 63 is the disc of a non-Eaton rebuilt clutch. It is an old disc that was rebuilt, as indicated by the presence of dampener springs encased in rubber (see arrow). Consequently, the rubber covered springs can make the disc act as a rigid disc, thus increasing wear to the input shaft and the disc itself. As shown by an arrow in Figure 64, parts of this disc have broken. Also, the springs are wrapped in rubber to prevent any worn ones from falling out after the disc is put into service. Contrast this with the Eaton Fuller Reman Clutches in which only new discs are used.

Fig 63

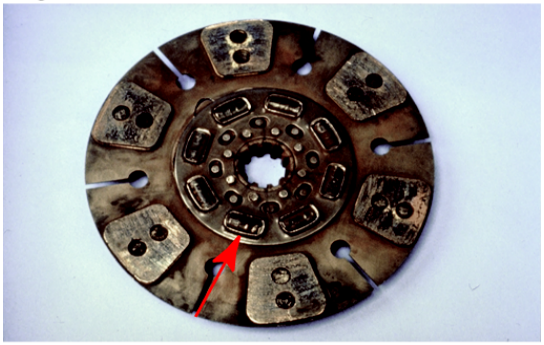
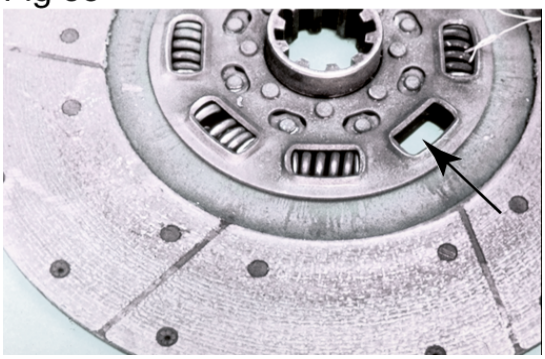


Fig 64

Clutch Disc Assembly

Fig 66



Failure - Broken and/or Missing Dampener Springs

Possible Causes

A broken dampener or missing spring (see arrow in Figure 66) may result from severe shock loads or excessive torsional vibration from the engine in excess of what the dampener springs can absorb. If the clutch disc is not original equipment, verify whether it matches the vehicle's application.

Photo by **D&W Clutch & Brake**

Photo by **D&W Clutch & Brake**

- Misapplication is the primary reason for the springs to break and come out of a disc spring cage. The spring cage window will become egg shaped over time and the dampening capability of the disc will decrease prior to failure.
- Driver abuse due to: starting in too high a gear; shock load from downshifting improperly to the wrong gear; letting the clutch out too quickly; or coasting and putting the clutch into gear while engine and rear RPM are not at the same rate will contribute to clutch disc damage and/or failure.
- Broken springs in a disc may also be the result of the disc spring cage rubbing against the heads of the flywheel mounting bolts. This may result from a flywheel that has been machined too deep, or a mechanic having used too thick a lock washer under the flywheel mounting bolt.

Clutch Disc Assembly

Failure - Burst Driven Disc, Friction Material Separates from Disc

Possible Causes
This type of failure is caused by very high RPM encountered when coasting in gear with the clutch released. In this situation, the rear wheels are driving the disc through the multiplication of the rear axle and transmission ratios. This can result in excess of 10,000 RPM which is beyond the burst strength of the facing material.

Example: Coasting a tractor down an unloading ramp can burst a driven disc. See Figures 67, 68, and 69.

Fig 67 (AS)

Fig 68 (AR)

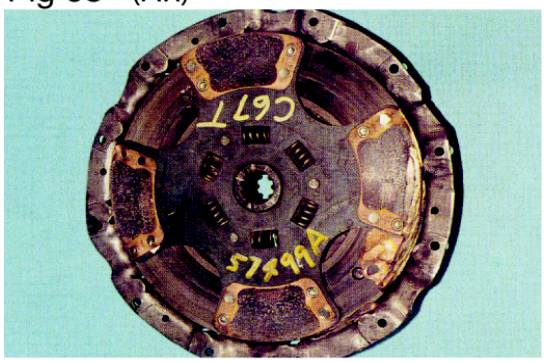


Fig 69 (close-up of Figure 68)

Failure - Worn Driven Disc Facings

Possible Causes
When the rivets (those which secure the facing material to the driven disc) begin to contact either the pressure plate, intermediate plate, or flywheel, then the entire clutch assembly is ready for replacement. Referring to the arrow in Figure 70, this rivet has been making contact with the pressure plate shown in Figure 17. Note the “shiny” appearance of the rivet and also the resulting “groove” on the pressure plate.

Fig 70

Pilot Bearing

Pilot Bearing Recommendations

The following pilot bearings are currently the minimum Eaton Fuller Clutch recommendations. The operating temperature that the pilot bearing encounters has increased in the last several years. This creates operating conditions that are no longer acceptable to the standard pilot bearings and grease. In addition, the life of the clutch has increased. The use of a high temperature grease and Viton seals are now mandatory to ensure adequate bearing life.

Failure of the pilot bearing usually results in a warranty claim for drag or clutch noise, also resulting in a claim against Eaton Fuller Clutch. Below is a list of the recommended Pilot Bearings. All of these bearings have Viton seals and a high temperature grease in addition to a C3 fit. It is acceptable to use synthetic high temperature grease and a C5 fit if desired.

Vendor	Seal Type	6205 Bearing	6306 Bearing
NTN	VITON	6205 LLUAV/C3	6306 LLUAV/C3
KOYO	VITON	6205 2RKF-S2/C3	6306 2RKF-S2/C3
NSK	VITON	6205 DDU7/C4 ENS	6306 DDU7/C4 ENS
SKF	VITON	6205 2RS2/C3	6306 2RS2/C3
FED-MOG	VITON	6205 VV/C3	6306 VV/C3