Failure Diagnosis

The LuK guide to troubleshooting clutch system failures and malfunctions on agricultural vehicles
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LuK Tractor Clutches: No.1 in the field at all times!

The genuine LuK portfolio has the right parts for every possible use – OE quality and operational comfort included. LuK is the leading manufacturer of clutch technology, supplying all major tractor manufacturers worldwide. LuK damping systems provide a highly effective system to dampen vibrations. Rely on our cost effective products with prolonged operating life. Have the freedom to work your field 24/7.
We move the world – with quality.

Schaeffler Automotive Aftermarket is a specialist in components and services involving the complete drivetrain in passenger cars and commercial vehicles – from engines, to transmissions, to chassis. As a globally active company we move millions of people every day in cars, trucks, buses, and tractors. Our products are used in almost every new vehicle throughout the world – and for good reason: Schaeffler is the innovation-leader in original equipment manufacturing and aftermarket sales – and is a guarantee of the very highest quality.
1 The LuK guide to troubleshooting tractor clutch failures

This guide is for the use of anyone who sells, installs or reports on LuK agricultural clutches. It is intended to be a source of information that can help simplify the diagnosis of clutch failures and malfunctions. The content is confined to the most common cause of tractor clutch defects and is not designed to be a comprehensive list. Technical diagrams are generic examples of the type of product and for guidance only.

Major causes of problems

Flywheel
- The surface face of the flywheel may show signs of scoring, glazing, and/or gouges.
- This must be refaced to the tolerances laid down by the manufacturer.
- It is important that the same amount is refaced from the clutch mounting surface.
- Also take this opportunity to check the starter ring gear.

Spigot (pilot) bearing
- Binding or seized bearings will cause the clutch to not disengage.
- Collapsed bearings will cause noise and angular misalignment of the input shaft, and thus cause damage to the driven disc.

Oil seals
- Leaking oil seals are a major cause of clutch failure.

Driven disc
- Every driven disc should be checked for lateral run out (the maximum tolerance is 0.5 mm) prior to installation.

Release mechanism
- Release bearings should always be renewed whenever the clutch is replaced.
- The bearings should slide freely on their guide tube without tilting.
- Check the guide tube, for correct fitment. Guide tubes should be concentric to the transmission input shafts.
- All bearing carriers and release forks must be free of wear to their pivots.
- Excessive play in release shaft bushes reduces release bearing travel.
- Worn, bent, or broken release forks may prevent the clutch from disengaging.
- Lubricate all moving parts.

Clutch cable
- It is advisable to replace cables whenever clutches are replaced.
- Make certain that clutch cables are correctly routed when installing them.

Concentric Slave Cylinder (CSC)
- Always use the vehicle manufacturer’s specification and recommendation of clutch fluid.

Alignment
- Always use the correct aligning tools when installing the clutch and disc to avoid spline or disc damage.

Lubricants
- Grease that contains no suspended metallic particulates should be used for lubricating splines and release bearings/guide tubes.
- LuK can supply the correct high-melting-point grease for clutch replacements.
- Please order LuK Part No. 414 0014 10.
- Once grease has been applied to the splines on the gearbox input shaft, slide the driven disc hub onto the shaft and remove any excess grease.
2 What is clutch drag?

One function of the clutch is to interrupt the drive from the engine to the transmission, which allows the operator to select and engage each gear smoothly. If clutch drag occurs the operator will experience difficulty in selecting or changing gear without grating.

<table>
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<tr>
<th>Possible causes</th>
<th>Remedy</th>
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<tr>
<td>Excessive clutch pedal or hand clutch lever free</td>
<td>Refer to operator’s manual for correct settings</td>
</tr>
<tr>
<td>play</td>
<td></td>
</tr>
<tr>
<td>Air in hydraulic release system</td>
<td>Air in the system will reduce the thrust bearings release travel –</td>
</tr>
<tr>
<td>Master &amp; slave cylinder adjustment / fault</td>
<td>Bleed air from the system and ensure that the correct fluid is used</td>
</tr>
<tr>
<td>Concentric Slave Cylinder (CSC) fault</td>
<td>Check for external leaks, bleed air from the system and ensure that the correct fluid is used</td>
</tr>
<tr>
<td>Insufficient clutch pedal or hand lever release</td>
<td>Check the pedal and lever stop settings and for linkage fouling</td>
</tr>
<tr>
<td>travel</td>
<td></td>
</tr>
<tr>
<td>PTO second stage setting bolts</td>
<td>Bolts are factory set and depending on flywheel and disc condition they may require additional</td>
</tr>
<tr>
<td></td>
<td>adjustment during fitment to the tractor</td>
</tr>
<tr>
<td>Clutch cable stretched / collapsed</td>
<td>A faulty cable will reduce the movement of the release bearing – Replace the cable</td>
</tr>
<tr>
<td>Flywheel bearing seized / tight</td>
<td>Always replace the bearing</td>
</tr>
<tr>
<td>Clutch housing centre bearing seized / tight</td>
<td>Always replace the bearing</td>
</tr>
<tr>
<td>Incorrect disc centering on assembly</td>
<td>Use correct alignment tool when installing the clutch and disc to flywheel</td>
</tr>
<tr>
<td>Clutch release cross shaft and bushes worn</td>
<td>Excessive wear will not allow even or full clutch release travel – Replace worn parts</td>
</tr>
<tr>
<td>Clutch release fork worn or loose</td>
<td>Check release fork pivots for excessive or uneven wear</td>
</tr>
<tr>
<td>Clutch disc friction loose or damaged</td>
<td>Check that the friction riveting is secure and friction face is flat and even</td>
</tr>
<tr>
<td>Clutch disc friction contaminated</td>
<td>Contaminated discs must be replaced</td>
</tr>
<tr>
<td>Clutch disc distorted</td>
<td>Disc may be distorted during transport, during installation or by exposure to severe heat input</td>
</tr>
<tr>
<td></td>
<td>in service – Replace the disc</td>
</tr>
<tr>
<td>Pressure plate tangential straps damaged</td>
<td>Straps must not be kinked or show gaps between the leaves –</td>
</tr>
<tr>
<td></td>
<td>Any deformity will result in the pressure plate not lifting sufficient or evenly</td>
</tr>
<tr>
<td>Uneven clutch pressure plate lift</td>
<td>Caused by damaged tangential pressure drive straps or incorrectly set clutch levers</td>
</tr>
<tr>
<td>Fault within transmission</td>
<td>Worn or broken synchro rings – Lubrication level too low</td>
</tr>
<tr>
<td>Transmission input shaft splines</td>
<td>Ensure splines are free of all burrs, damage and rust – Lightly lubricate splines – use LuK</td>
</tr>
<tr>
<td></td>
<td>spline grease ref. 414 0014 10</td>
</tr>
</tbody>
</table>

Disc splined hub damaged / tight
Splines damaged during assembly or by gearbox misalignment.
3 What is clutch slip?

Another function of the clutch is to transmit the drive from the engine through the clutch into the transmission without any loss of power. Clutch slip occurs when the speed of the engine differs to that going into the transmission. This is evident by the engine revs increasing but the wheel or PTO speed failing to increase accordingly.

<table>
<thead>
<tr>
<th>Possible causes</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch disc friction worn out</td>
<td>The clutch disc friction has worn below its limits and the rivets have contacted the pressure plate face. The clutch disc has achieved a full service life – Replace clutch disc</td>
</tr>
<tr>
<td>Clutch disc friction damaged</td>
<td>The clutch disc friction has been damaged or destroyed through excessive heat input from slip or contamination – Replace clutch disc</td>
</tr>
<tr>
<td>Clutch disc friction contaminated</td>
<td>The friction material is contaminated with oil or grease – Excessive spline lubrication applied during tractor assembly or the engine crankshaft / gearbox oil seal is leaking – Replace the clutch disc</td>
</tr>
<tr>
<td>Clutch clamp load reduced</td>
<td>The clutch assembly diaphragm spring provides the clamping force for the clutch – Excessive heat input into the clutch will destroy the diaphragm spring – Replace the clutch</td>
</tr>
<tr>
<td>Binding within the clutch</td>
<td>Pressure plate lugs binding in the clutch housing</td>
</tr>
<tr>
<td>Incorrect release system adjustment</td>
<td>Release system has no free play causing the clutch to run partially disengaged, resulting in increased heat input to the friction disc due to clutch slip – Check the free-play adjustments</td>
</tr>
<tr>
<td>Hydraulic release systems</td>
<td>Incorrect adjustment can result in excessive release bearing pre-load resulting in clutch slip – Check that the master and slave cylinder adjustments are correct</td>
</tr>
<tr>
<td>Release system binding or fouling</td>
<td>Check that the release system has sufficient movement and that there is no fouling – Lubricate all pivots and bushes – Check the cables for binding</td>
</tr>
<tr>
<td>Tractor being used for incorrect work load</td>
<td>The Tractor is being used for operations beyond its design capabilities – Including: Towing too heavy a load – Operating external machinery that requires a greater HP (Kw) rating – Excessive front end loader work</td>
</tr>
<tr>
<td>Operator driving error</td>
<td>The operator can be responsible for inducing clutch slip via a poor driving style – Do not rest anything on the clutch pedal!</td>
</tr>
<tr>
<td>Restricted pedal travel</td>
<td>Check for any obstructions that may prevent a full pedal stroke          Check the pedal stop adjustment</td>
</tr>
</tbody>
</table>

**Condition of the flywheel wear face**

It is recommended that all flywheel wear faces must be refaced and any location step or pot depth must be re-established when the clutch is replaced – However, worn, uneven, grooved or highly polished wear surfaces must **always** be refaced.
**4 What is clutch judder?**

Clutch vibration (or clutch judder) is experienced by the operator during the engagement of the clutch. When this occurs it will be difficult for the operator to achieve a smooth take-up of drive and deliver precise tractor movements.

<table>
<thead>
<tr>
<th>Possible causes</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch disc has loose friction</td>
<td>Friction material retaining rivets are loose due to aggressive clutch engagement – Replace the clutch disc</td>
</tr>
<tr>
<td>Clutch disc cushioning damaged</td>
<td>Some clutch discs use cushioning segments between the riveted friction (to assist a smooth engagement of drive) which can be destroyed by high heat input – Replace the clutch disc</td>
</tr>
<tr>
<td>Clutch disc bent or distorted</td>
<td>Check that the disc is flat and has no sign of distortion – Damage can occur during transit or as a result of sub-standard installation</td>
</tr>
<tr>
<td>Clutch lever heights not even</td>
<td>Caused by incorrectly set clutch levers or by an uneven flywheel wear face or clutch mounting face – Ensure uneven or highly polished wear surfaces are refaced</td>
</tr>
<tr>
<td>Diaphragm spring fingers uneven</td>
<td>Caused by an uneven flywheel wear face, the clutch mounting face is not flat or the fulcrum ring has dislodged</td>
</tr>
<tr>
<td>Clutch pivots binding</td>
<td>The build-up of dust can cause excessive friction in the moving parts of the clutch – Additionally, the levers, pivots or diaphragm fulcrum points can also be affected by rust, causing heavy clutch operation</td>
</tr>
<tr>
<td>Flywheel wear face uneven</td>
<td>Reface the flywheel wear face to within 0.1mm and re-establish any pot or location step</td>
</tr>
<tr>
<td>Release system linkage / cable binding</td>
<td>Check all linkages are free and lubricated – Replace the cables</td>
</tr>
<tr>
<td>Damaged hub splines</td>
<td>Care must be taken during clutch installation to ensure that the cover and discs are correctly aligned using special tools – Discs must be free moving on the splines</td>
</tr>
<tr>
<td>Wear to release bearing, carrier and support snout</td>
<td>A loose or worn release bearing and carrier can vibrate during operation and may make contact with the fork or support snout</td>
</tr>
<tr>
<td>External influence – Cab mounts</td>
<td>Loose / worn cab mountings or wear in the tractor driveline</td>
</tr>
<tr>
<td>Clutch disc friction is contaminated</td>
<td>The friction material is either contaminated with oil or grease caused by excessive spline lubrication applied during tractor assembly or the engine crankshaft / gearbox oil seal is leaking – Replace clutch disc</td>
</tr>
</tbody>
</table>

**Clutch disc torsion damper faulty**

Damper springs can be damaged during installation due to poor gearbox alignment or coil spring breakage from excessive torque loadings – Replace the clutch disc.
5 What is clutch noise?

Clutch noise may be as a result of parts failure or system wear. Noise during clutch disengagement is normally related to the release system. However, noise during engagement and drive is usually related to disc cushioning or damping.

<table>
<thead>
<tr>
<th>Possible causes</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faulty release bearing</td>
<td>Replace the release bearing</td>
</tr>
<tr>
<td>Release bearing retainer clip or spring damaged</td>
<td>Replace the damaged components</td>
</tr>
<tr>
<td>Clutch disc idle torsion damper defective</td>
<td>The first stage damper which controls engine idle damping may have loose or broken coil springs as the result of an aggressive driving style or poorly tuned engine</td>
</tr>
<tr>
<td>Clutch disc secondary main torsion damper defective</td>
<td>The second stage damper controls and absorbs the vibration generated by the engine and prevents it from entering the transmission drivetrain – Failure can also be caused by the disc reaching the end of its service life, an aggressive driving style, excessive torque loadings or material failure</td>
</tr>
<tr>
<td>Badly worn splines</td>
<td>Excessive spline wear can cause the disc to ‘chatter’ or vibrate</td>
</tr>
<tr>
<td>Clutch disc cushioning defective</td>
<td>Cushioning between the clutch disc friction has collapsed due to high heat input, resulting in a high pitched engagement ‘squawk’</td>
</tr>
<tr>
<td>External influence</td>
<td>Wear or damage within the tractor drive line or transmission causing noise and vibrations, or loose cab mountings causing the cab to foul against the chassis</td>
</tr>
<tr>
<td>Flywheel / centre bearing collapsed or seized</td>
<td>Replace the affected bearings</td>
</tr>
<tr>
<td>Clutch disc incorrectly fitted</td>
<td>Ensure the clutch disc is fitted the correct way round in accordance with the product markings</td>
</tr>
</tbody>
</table>

Incorrectly installed release bearing

Release bearing fouled due to incorrect installation – Ensure the bearing is aligned correctly and fitted the right way round.
6 Single clutch with independent drive for P.T.O. (split torque)

1 Cover housing
2 Pressure plate
3 Diaphragm spring (with reinforced fingers)
4 Fixed P.T.O. hub
5 Rivet
6 Fulcrum ring
7 Tangential strap
8 Headed rivet
7 Combined clutch for tractors (special design)

1 Cover housing
2 P.T.O. pressure plate
3 Flywheel plate
4 Pressure plate (transmission)
5 Diaphragm spring
6 Coil spring
7 P.T.O. disc (with organic friction)
8 Pivot pin
9 Fixing hole
10 Shipping bolt
11 P.T.O. adjusting screw
12 Link
13 Clutch lever
14 Anti-rattle spring
15 Lever adjustment screw
16 Balance hole
17 Rivet
8 Double clutch with independent P.T.O.

1 Cover housing
2 Main drive pressure plate
3 P.T.O. pressure plate
4 Diaphragm spring
5 Main drive clutch disc (with sintered pads and torsion damper)
6 Main drive lever
7 P.T.O. lever
8 P.T.O. lever eyebolt
9 Transmission lever elbow
10 Adjusting screw
11 Lock nut
12 Adjusting nut
13 Anti-rattle spring
14 Pivot pin
15 Fulcrum ring
9 Twin plate clutch for transmission drive

1 Cover housing
2 Main drive pressure plate (transmission side)
3 Main drive pressure plate (flywheel side)
4 Diaphragm spring
5 Main drive clutch disc with sintered pads and torsion damper (transmission side)
6 Main drive clutch disc with sintered pads and torsion damper (flywheel side)
7 Main drive lever
8 Transmission lever eyebolt
9 Transmission lever elbow
10 Adjusting screw
11 Lock nut
12 Adjusting nut
13 Anti-rattle spring
14 Pivot pin
15 Fulcrum ring
16 Rivet
17 Balance hole
18 Disc spline
10 Single safety P.T.O. clutch with fixed transmission damper

1. Cover housing
2. P.T.O. pressure plate
3. P.T.O. coil spring
4. Fixed transmission damper
5. Friction device
6. P.T.O. lever
7. Pivot pin
8. Anti-rattle spring
9. Adjusting nut
10. Transmission damper spring
11. P.T.O. lever eyebolt
12. Rivet
11 Double clutch with safety P.T.O.

1 Cover housing
2 Main drive pressure plate
3 P.T.O. pressure plate
4 Diaphragm spring
5 Main drive disc (with sintered pads and torsion damper)
6 Pivot pin
7 Main drive lever
8 P.T.O. lever
9 Fulcrum ring
10 P.T.O. lever eyebolt
11 Transmission lever elbow
12 Adjusting screw
13 Lock nut
14 Adjusting nut
15 Anti-rattle spring
16 Coil spring
17 Balance hole
12 Front P.T.O. clutch

1. Housing cover plate
2. Diaphragm spring
3. Separator discs
4. Drive discs (with sintered pads)
5. Lower pressure plate
6. Secondary drive hub
7. Support bearing
8. Primary drive hub
9. Rivet
10. Housing bolt
11. Fulcrum ring
12. Coil spring
13 Long travel torsion damper

1. Location plate (primary)
2. Damper housing
3. Drive shaft location flange (secondary)
4. Arc spring
5. Friction device
6. Location holes
7. Rivet
8. Central carrier plate (secondary)
14 Axial spring torsion damper

1. Location plate (primary)
2. Carrier plate (secondary)
3. Sensor wings
4. Torsion springs (idle)
5. Torsion springs (second stage)
6. Torsion springs (third stage)
7. Friction device
8. Location hole
9. Rivet
10. Splined drive hub
11. Backplate
15 Drive disc (with sintered or organic friction)

1 Friction pad
2 Friction backplate
3 Torsion damper spring
4 Splined drive hub
5 Carrier plate
6 Cushioned friction carrier plate
7 Friction device
8 Rivet
9 Cushion rivet
16 Concentric Slave Cylinder (CSC)

1  Housing
2  Release bearing
3  Hydraulic port
4  Piston
5  Piston seal
6  Pre-load spring
7  Plastic dust shield