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LuK Tractor Torsion Dampers

24/7

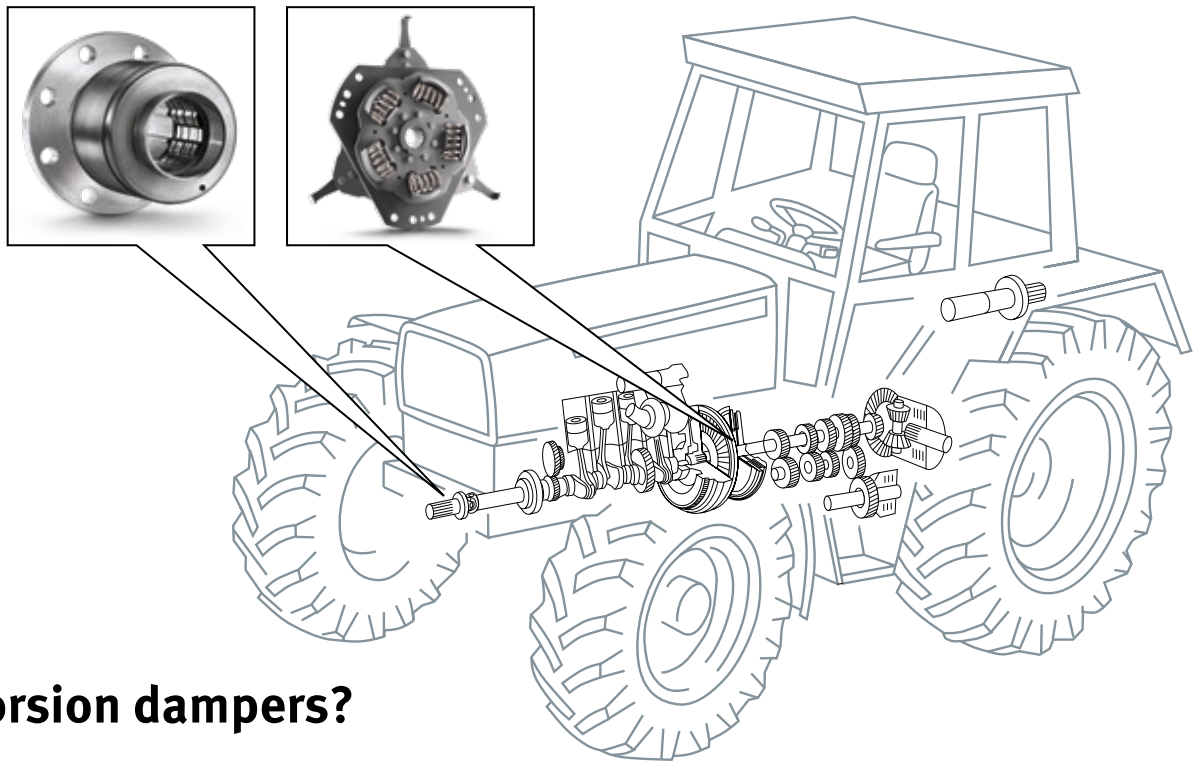
LuK Tractor Clutches: No. 1 in the field at all times!

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.

Installation positions of the torsion dampers



Why torsion dampers?

Torsion dampers have the task of reducing torsional vibration between the engine and transmission. To understand the function of a torsion damper, we must first understand a little about the way in which an engine works.

Variations in torque

Unlike electrical motors and turbines, internal combustion engines do not deliver a continuous torque. Instead, the crankshaft is continuously both accelerating and decelerating as each engine cylinder “fires”. These variations in torque and crankshaft speed are passed into the transmission causing both noise and unpleasant vibration throughout the tractor. Torsion dampers are designed to minimise both the noise and vibrations and provide a comfortable driving environment.

Piston movement

The 4-stroke diesel engine used in today’s tractors mixes air and fuel in a combustion chamber where it burns and creates heat energy, which rapidly expands the trapped gas, creating pressure energy. The piston is forced down the cylinder by the expanding gas and, through the mechanism of the connecting rod and crankshaft, the linear mechanical energy in the piston is converted into rotational mechanical energy through the transmission, thus turning the wheels.

During this cycle, the crankshaft will turn through 2 complete revolutions (720 degrees), to complete the induction, compression, power and exhaust strokes. If we examine the complete cycle carefully, we will find that it is only the power stroke which is creating power and, although we think of this as representing 180 degrees of the complete cycle, the real work is being done in a much shorter time.

Speeding up. And slowing down

Although fuel starts being injected into the combustion chamber before the piston reaches the top of its stroke, the piston is already on its way down the power stroke before the really high cylinder pressures are reached. As the piston continues down the cylinder, the gas above it is cooled by the cylinder walls and the pressure reduces rapidly. Of course, the engine designer tries to create the maximum pressure in the cylinder at the point where the connecting rod and the crankshaft are at the greatest angle which will generate the maximum turning moment (torque) in the crankshaft. In reality, the length of time that the high pressure gas is doing real work on the piston is often less than 70 degrees in a full cycle of 720 degrees.

A 3-cylinder 4-stroke engine generates 3 short torque peaks in each full cycle, each peak being 240 degrees rotation apart. Each torque peak causes the engine to speed up momentarily, before slowing down again.

Moderating the effects: flywheels

This effect of speeding up and slowing down between each cylinder's power stroke is moderated by using a heavy flywheel attached to the crankshaft. The flywheel absorbs the torque peaks coming from the cylinders and maintains this inertia throughout the engine cycle.

However, using a heavy flywheel also has disadvantages, especially with regard to the engine's response to load changes, and its overall fuel consumption.

Gearbox rattle

The result of this acceleration and deceleration is to "excite" all of the shafts and gears in the transmission (especially those not actually transmitting torque), making them rattle against each other at high frequency - generating uncomfortable noise and vibration throughout the vehicle. The effect is reduced proportionally by increasing the number of cylinders in the engine.

In the diagram below you can see the measurement results taken from a 3-cylinder tractor with no torsion damper fitted. The blue line reveals that, when idling, the engine speed fluctuates between 735 and 775 RPM. Because of the excitation, the transmission input speed is fluctuating between 730 and 780 RPM.

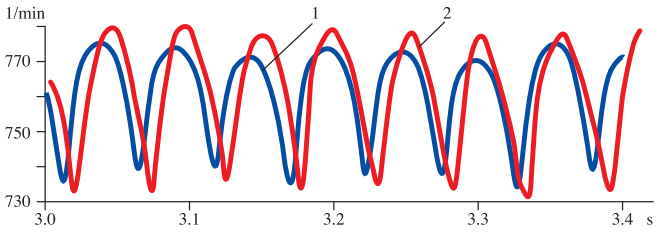
LuK: Analysis for exact solutions

LuK has developed sophisticated computerised measuring equipment, which precisely records the speed of the engine crankshaft and the drive train at various points between the gearbox input and final drive. Following analysis of these measurements and the transmission design on a particular tractor, LuK engineers were able to design a torsion damper which is mounted directly into the flywheel to transmit the engine torque to the transmission and/or conventional PTO or from the front of the engine to drive a front PTO unit.

These dampers 'smooth out' all of the engine torque peaks and eliminate excitation in the drive train under all operating conditions including engine idling, full load and overrun (engine braking).

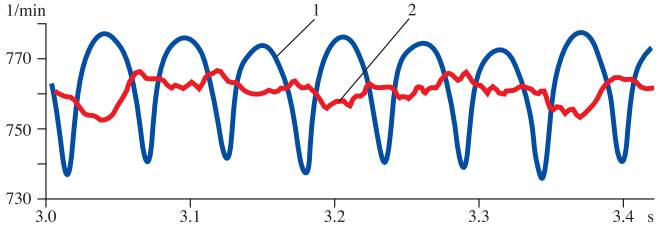
Result: Good driving characteristics

In the diagram below you can see the results from the same tractor, but now fitted with a LuK torsion damper. Whilst the engine exhibits the same fluctuation in speed, the damper has almost completely eliminated the fluctuations in the transmission input speed, making the tractor quiet, vibration free, and a pleasure to drive.



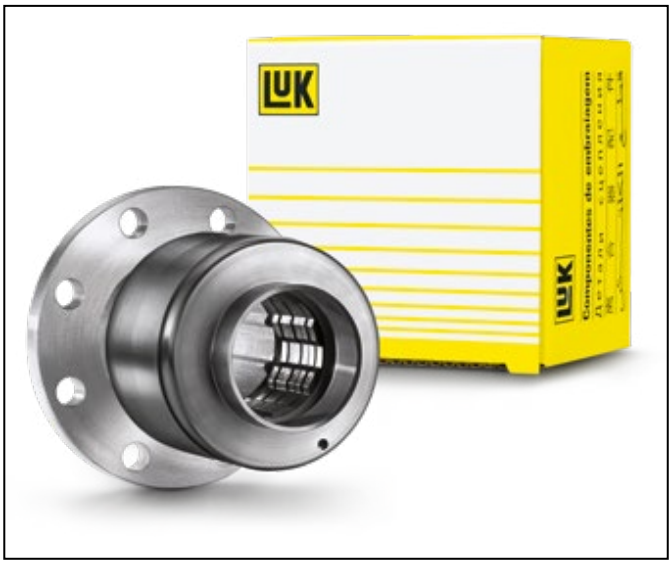
3-cylinder engine without LuK damper

1 = Engine
2 = Transmission



3-cylinder engine with LuK damper

1 = Engine
2 = Transmission



Front PTO damper

The LuK product range

With the growing trend from tractor manufacturers towards power-shift type transmissions, the requirement for damping between the engine and transmission has grown considerably in the last few years. LuK has led the way and today is able to offer a range of products specifically designed to suit the characteristics of each tractor, including axial spring dampers, long travel dampers, flywheel PTO dampers and front PTO dampers.

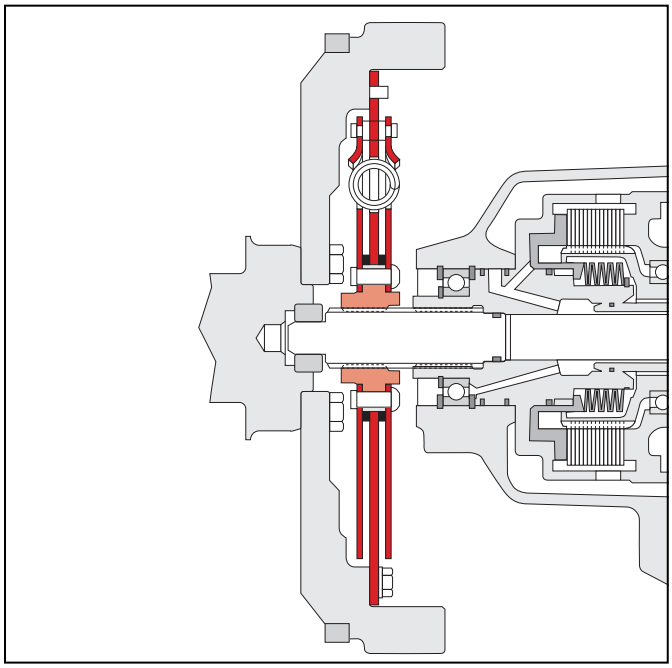
All of these dampers are designed to absorb the engine's torque peaks and provide a smooth, constant and quiet drive from the engine into the transmission and front PTO unit.

Without these technically advanced dampers the tractor would be noisy and uncomfortable for the operator.

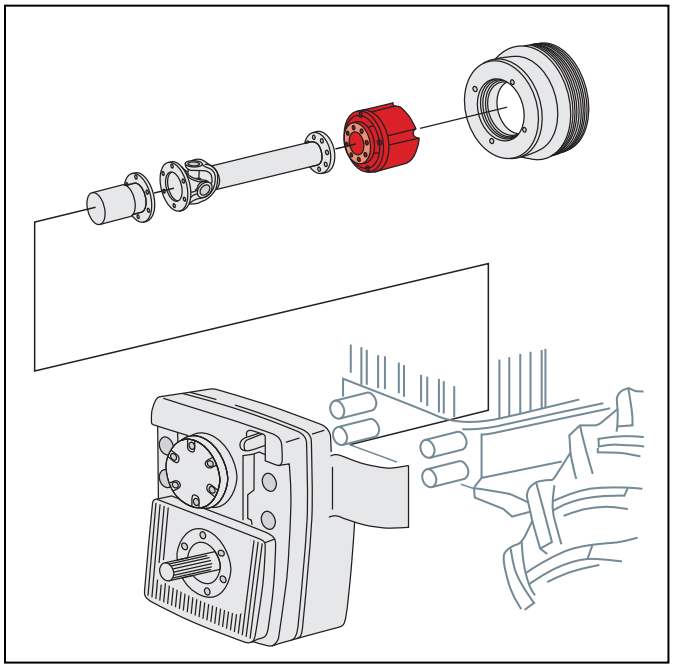
A normal process: wear-off

As with any moving part the damper will, over time, begin to wear in accordance with the nature of the work that the vehicle is undertaking, and as a result will be less effective in damping the engine output.

Whilst the tractor will continue to run with a worn and poorly functioning damper, it will not only be noisy and uncomfortable to drive, but the risk of accelerated wear and possible damage to the transmission and front PTO will be considerably increased.



Transmission



Front PTO

Different dampers for different engines

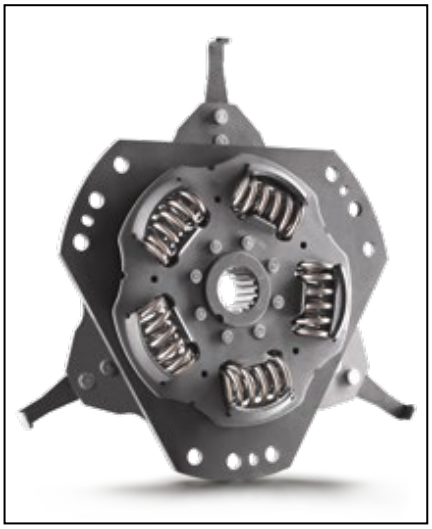
Every damper can be simply described as having two separate parts which are effectively connected through the damping springs. With transmission dampers, the first part, or ‘primary’ as it is often called, is usually connected directly to the engine flywheel using bolts around the outer flange of the damper. The second part, or ‘secondary’, is connected directly to the transmission input shaft via a splined hub or flange in the centre of the damper.

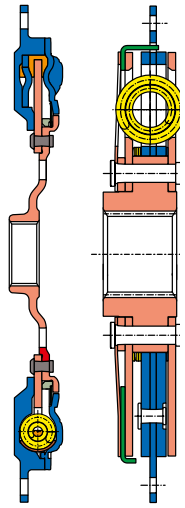
Front PTO dampers may be bolted directly between the engine crankshaft and the front PTO unit. The secondary part of the damper is then driven by the primary through the damping coil springs or other energy absorbing elements which are able to compress and “damp out” all of the torque peaks and eliminate excitation in the transmission.

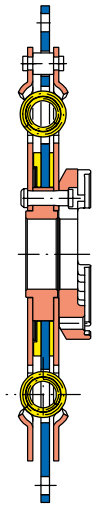
Simple axial dampers use a series of small coil springs mounted within a clutch disc centre which are compressed by each torque axial spring damper peak, smoothing the torque flow into the transmission.

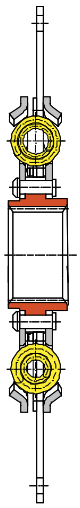
Using 2 or 3 different strengths of springs can accommodate the full torque output of the engine between idling and maximum engine output. This type of damper frequently has an articulation of between 10 and 25 degrees.

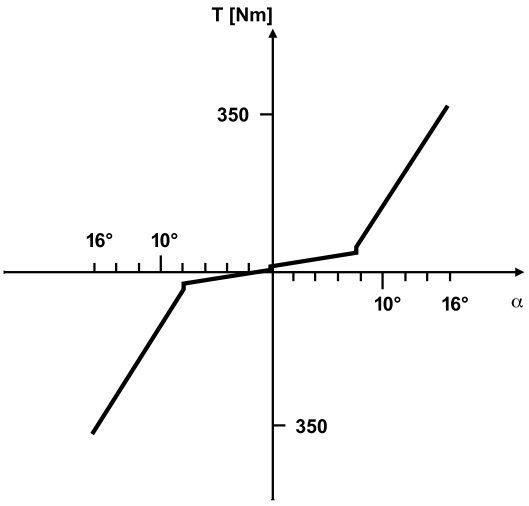
At the other end of the scale is the LuK designed Long Travel Damper which uses “arc” springs to provide exceptional damping ability under all operating conditions. This damper design is particularly suited to higher powered engines and can have an articulation in excess of 40 degrees.

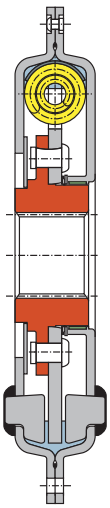


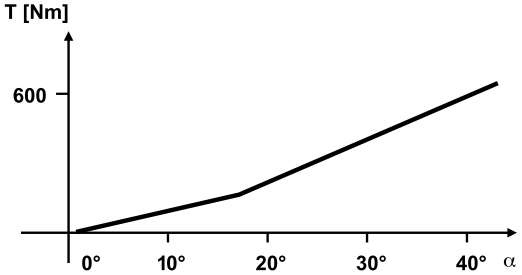












Torsion Dampers Fault Diagnosis

LuK torsion dampers are specifically designed and manufactured to fit a particular engine and transmission group, and will provide a long service life under all normal tractor operating conditions. This will include all types of pulling work together with PTO driven machines.

The maximum torque that the torsion damper can transmit is higher than the maximum engine output torque by a considerable safety margin.

However, if the tractor experiences exceptional load conditions from external sources, the torsion damper can be subjected to accelerated wear, and possibly irreparable damage.

A worn or defective damper may be recognised by the following:

- Rattling in the transmission at any speed, or at engine start up and shut down.
- lncreasing noise from the transmission – either in a specific gear or all gears or loads.
- Unusual noises from the area between the engine and transmission.
- A loss of drive to the wheels and PTO.

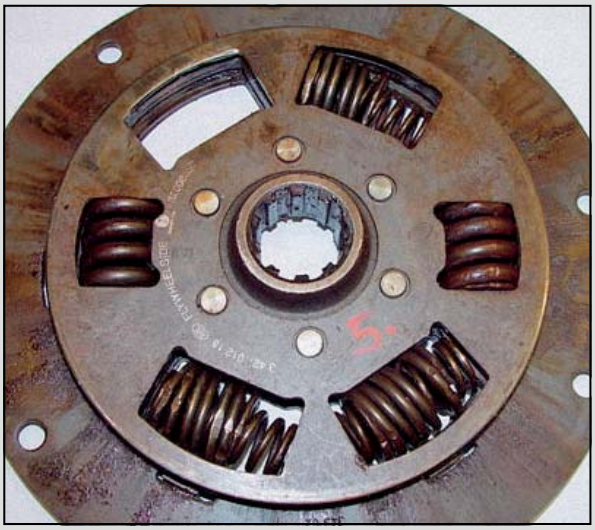
For example:

- If the tractor is working with a heavy PTO driven machine and the PTO shaft has simple 2 piece universal joints then whenever the PTO shaft is not straight, it will accelerate and decelerate the drive train during each revolution. If, due to the tractor turning, or the machine being raised, the PTO shaft joints reach a severe angle, the acceleration and deceleration resonance can destroy the torsion damper very quickly.

- Incorrect transmission downshifting whilst towing a heavy load can generate substantial inertial reverse torque loads through the drivetrain, possibly in excess of the torsion damper safety limits, resulting in severe damage.

- If oil leaks from either the engine or transmission and penetrates the damper, then the special friction elements within the damper hub assembly, which are designed to eliminate gear rattle at low power outputs, will become ineffective. This will result in transmission noise especially during periods of engine idling.

Torsion damper wear and fractures



Torsion damper contaminated with oil / grease

It is difficult to accurately predict when a torsion damper will require replacement due to the wide variety of work each tractor undertakes. Typically, a LuK torsion damper will provide between 4,000 and 6,000 hours of service under normal operating conditions.

If the engine/transmission housing is opened for any reason, the damper can be visually inspected for obvious wear and damage. However testing the damper against its design parameters requires specialist equipment so precautionary replacement of the torsion damper is often the preferred option if any doubt exists as to its continued effectiveness.

Under normal use, LuK strongly recommends that torsion dampers are replaced well before the more serious signs of imminent failure (like excessive noise and rattling or loss of drive) are evident.

This will ensure that the tractor transmission continues to be fully protected and that the tractor continues to be as comfortable and quiet to operate as it was when new.

Therefore, rely on the genuine LuK portfolio and trust on our original equipment manufacturing quality when replacing torsion dampers.

LuK torsion dampers are cost-effective and guarantee the best results. They ensure a long operating life that will support you in the best possible way. In other words: You will have the freedom to work your field 24/7.

LuK Tractor Torsion Dampers – quality parts from the innovation-leader

Damper Part Number	Damper Type*	Diameter (mm)	Spline Qty	Techn. Bulletin	OEM	OEM Part Number
328 0388 10	ZG	276	24		Case New Holland McCormick	A190182
328 0393 10	ZG	276	21		Case New Holland	A190183
370 0001 10	ZA	225	16		Claas / Renault	7700019282
370 0002 10	ZA	263	26		Claas / Renault	7700046743
370 0003 10	ZA	320	26		Same Deutz-Fahr	0.014.9430.3 0.008.5394.3/20
370 0004 10	ZA	295	26		Claas / Renault	7700052774
370 0007 10	ZA	348	26	TB 1309	Claas / Renault	7700050636
370 0008 10	ZA	352	26	TB 1062	Claas / Renault	7700053637
370 0009 10	ZA	263	10		Case New Holland	82008857
370 0010 10	ZA	348	14	TB 1063	Case New Holland	87304267 5165710 5187845
370 0011 10	ZA	350	14		Case New Holland	5153359
370 0013 10	ZA	348	26	TB 1064	Claas / Renault	0026213180 7700057918
370 0016 10	ZA	225	14		BCS & Ferrari	58173493 58171703
370 0019 10	ZC	164	n/a	TB 1084	Mercedes-Benz	4052600050 4052600250
370 0020 10	ZA	352	26	TB 1065	Massey Ferguson McCormick	3792346H1 3909719M1 705972A1

***Damper Type**
ZA: Axial Spring transmission damper
ZB: Long travel arc spring transmission damper
ZC: Axial spring front PTO damper
ZD: Axial spring PTO damper
ZE: Torque limiting transmission damper
ZG: Oil immersed slip clutch transmission damper
ZJ: Axial spring PTO damper

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Damper Part Number	Damper Type*	Diameter (mm)	Spline Qty	Techn. Bulletin	OEM	OEM Part Number
370 0021 10	ZA	348	26	TB 1066	Massey Ferguson	3790735M2
370 0022 10	ZA	295	26		Landini	3652970M91
370 0023 10	ZA	295	26		Massey Ferguson	3792448M2
370 0024 10	ZA	295	26		Massey Ferguson	3790734M2 3790734M3
370 0025 10	ZA	263	16	TB 1103	Landini	3648843M91 3648843M92
370 0026 10	ZB	320	25	TB 1067	Massey Ferguson	3820069M1
370 0027 10	ZA	348	26	TB 1181	Massey Ferguson	379364H1 379648H1 3793648M1
370 0028 10	ZD	116	10	TB 1084	Case New Holland	5181872
370 0029 10	ZA	348	14	TB 1182	Case New Holland	5185207
370 0030 10	ZA	263	24		Same Deutz-Fahr	0.011.3942.4
370 0032 10	ZA	348	14	TB 1180	Case New Holland	47127097 87302871 87542609
370 0034 10	ZB	354	13	TB 2043	Case New Holland McCormick	451350A1 440444A1
370 0035 10	ZB	354	n/a	TB 2003	Case New Holland McCormick	376596A1 432896A2
370 0038 10	ZJ	193	23		John Deere	AL120061
370 0040 10	ZA	295	26		Claas / Renault	7700067040
370 0041 10	ZA	295	25		Massey Ferguson	3815739M2
370 0043 10	ZJ	236	27		John Deere	AL120060
370 0044 10	ZB	354	13		McCormick	452441A1
370 0045 10	ZB	354	n/a		McCormick	701468A1
370 0052 10	ZB	352	22		Valtra	35303500 35652400
370 0055 10	ZC	170	n/a	TB 1084	Claas / Renault	7700065940
370 0056 10	ZC	64	8	TB 1084	John Deere	AL158563
370 0059 10	ZB	348	26		Claas / Renault	7700065620
370 0060 10	ZA	262	16		Case New Holland	5196061
370 0061 10	ZA	280	14	TB 1307	Landini	4205236M91
370 0062 10	ZA	348	16	TB 1183	Case New Holland	47127700
370 0066 10	ZD	136	10	TB 1084	Case New Holland	47133433
370 0067 10	ZC	122	8	TB 1084	Case New Holland	47126789 47565082
370 0070 10	ZA	225	16		BCS & Ferrari	58177653
370 0074 10	ZD	133	21	TB 1084	Massey Ferguson	4300586H1 4300586M1
370 0076 10	ZB	348	26		Massey Ferguson	4301337H1 4301337M1
370 0079 10	ZB	348	26		Claas / Renault Massey Ferguson	11113940 4304869H1 4304869M1
370 0081 10	ZA	262	24		Same Deutz-Fahr	010.0231.4/10 010.0231.4/30
370 0082 10	ZA	295	24		Same Deutz-Fahr	0.010.4977.4/10
370 0083 10	ZB	373	16	TB 2051	Same Deutz-Fahr	4455029
370 0084 10	ZA	262	14	TB 2036	Case New Holland	87527552
370 0085 10	ZA	395	16		Case New Holland	87527558
370 0086 10	ZA	295	26		Claas / Renault	7700067039
370 0087 10	ZB	352	22		Valtra	35652300
370 0088 10	ZC	172	n/a	TB 1084	Claas / Renault	11082561 11082562 11082563
370 0089 10	ZE	288	n/a		John Deere	AL120063 AL70432
370 0091 10	ZB	348	26		Massey Ferguson	4304870M1

Damper Part Number	Damper Type*	Diameter (mm)	Spline Qty	Techn. Bulletin	OEM	OEM Part Number
370 0093 10	ZA	314	13		Case New Holland	87652184
370 0094 10	ZB	330	16		Case New Holland	84409815
370 0095 10	ZB	330	16	TB 1185	Case New Holland	84392203
370 0097 11	ZA	348	26		Massey Ferguson	4312901M5
370 0098 10	ZB	348	16		Case New Holland	47407903
370 0105 10	ZD	133	30		Massey Ferguson	4314621M1 4314621M2
370 0109 10	ZB	328	21	TB 1104	Claas / Renault Same Deutz-Fahr	11563760 0.014.4020.4/10
370 0113 10	ZA	225	14		BCS & Ferrari	581A2277
370 0114 10	ZD	133	30		Massey Ferguson	4362628M1
370 0115 10	ZD	133	30	TB 1421	Massey Ferguson	4314621M3
370 0116 10	ZB	328	26	TB 1199	Same Deutz-Fahr	0.013.2797.3 0.013.8769.4/10 0.013.8769.4/20
370 0117 10	ZB	294	26	TB 1422	Massey Ferguson	4358031M1
370 0118 10	ZA	325	36	TB 2067	Case New Holland	9825201
370 0119 10	ZA	395	16	TB 1395	Zetor	26.023.902
370 0120 10	ZA	395	16	TB 1285	Case New Holland	47665051 84524066
370 0121 10	ZB	328	18	TB 1265	Landini	6504574M92 6504574M93
370 0122 10	ZB	294	16	TB 1388	BCS & Ferrari	581A2710
370 0123 10	ZD	86	21	TB 1084 TB 1240	John Deere	AL211402
370 0124 10	ZA	264	16	TB 1209	Zetor	65.023.901
370 0126 10	ZB	375	12	TB 1419	Agritalia Massey Ferguson Ursus	374725 VA205684 MAT-TRA-01519
370 0127 10	ZA	348	16	TB 1330	Case New Holland	47699912
370 0128 10	ZA	262	21	TB 1236	Same Deutz-Fahr	0.014.0034.4
370 0129 10	ZB	294	26	TB 1420	Massey Ferguson	4367295M1
370 0130 10	ZB	294	26	TB 1423	Massey Ferguson	4367354M2
370 0131 10	ZA	354	n/a	TB 2067	Case New Holland	248408A2
370 0132 10	ZA	354	n/a	TB 1292	Case New Holland	47983575 84146340 248049A2
370 0133 10	ZB	379	n/a	TB 1284	JLG	1001180244
370 0136 10	ZB	325	24	TB 1362 TB 1365	John Deere	SJ293168
370 0137 10	ZB	325	24	TB 1407	John Deere	SJ13435
370 0138 10	ZB	325	24	TB 1402	John Deere	SJ19433
370 0140 10	ZB	436	n/a	TB 1359	Case New Holland	48097866 84539806
370 0141 10	ZB	358	22	TB 1289	Valtra	39552600
370 0142 10	ZB	338	22	TB 1385	Valtra	ACV0117090
370 0144 10	ZB	320	14	TB 1371	Case New Holland	47554840
370 0145 10	ZA	395	16	TB 1393	Case New Holland	84576726 84524066
370 0149 10	ZA	263	16	TB 1453	Landini	3686 053 M92
370 0150 10	ZB	348	26	TB 1454	Claas	00 2153 632 1

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