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LuK Impact Torque Limiter for Light Commercial Vehicles

Design and Function

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Our products are based on a comprehensive systems approach. Innovation, technical expertise, and the highest material and manufacturing quality make us not only one of the leading development partners for vehicle manufacturers, but also a pioneering provider of value-retaining spare parts and complete repair solutions for clutches and clutch release systems, engine and transmission applications, and chassis applications in original-equipment quality – right up
to the appropriate special tools.

For over 50 years, we have offered everything needed for transmission repair under the LuK brand. Besides the LuK RepSet family and products for the entire hydraulic release system for professional clutch repair, the portfolio also includes the dual mass flywheel and components for expert repair of transmissions and differentials. It also includes professional solutions for transmission repair of commercial vehicles and tractors.

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1 Introduction

Overload protection for a longer lifespan

Light commercial vehicles have to endure extreme stresses: full loads up to the permitted gross vehicle weight, a particularly long (and therefore sensitive) rear-wheel drive train, and the driving behavior brought about by the immense cost and time pressures which are ubiquitous in the transport sector. Stop-and-go traffic and frequent changes of driver are par for the course for a light commercial vehicle – and they too ratchet up the stress to which the vehicle is exposed. Breakdowns of these vehicles can be an expensive affair. If a vehicle is out of commission, the operator can incur costs of up to EUR 1000 a day. In order to avoid overloading the drive train and at the same time protect the vehicle against premature failure, Schaeffler has developed a mechanism for limiting peak torques in the drive train: the Impact Torque Limiter (ITL) as special equipment for the Dual Mass Flywheel (DMF).

What are peak torques (impacts)?

Peak torques occur in the drive train if there is a sudden and significant difference in speed between the rotating masses of the engine and the rotating masses of the drive train. This temporarily results in torques that are many times higher than the maximum engine torque. Events of this kind are typically caused by driver errors in vehicles with manual transmissions. The risk of this happening in vehicles with fully automatic or automated transmissions is zero, since safety circuits in the engine and transmission control systems prevent potential peak torques from occurring in the first place.

What causes peak torques?

Internal combustion engines need a torque acting uniformly on the crankshaft in order to maintain momentum during idle strokes. Inertial masses (rigid or dual mass flywheels) are used for this purpose. They absorb kinetic energy during power strokes and discharge it during idle strokes. An inertial mass can therefore be described as an energy storage device which–just like a car battery–stores energy and discharges it when necessary.

If an inertial mass accelerates or slows down abruptly, all of the momentum or kinetic energy is released within a very short period of time. This results in a sudden torque shock, also called peak torque or impact.

Examples:

- The driver's foot slips off the clutch pedal while starting up
- The engine stalls
- The driver starts the vehicle in first gear and with the handbrake applied
- The driver misjudges a gear shift, resulting in abrupt engagement

2 How does a DMF work?

In a DMF, the engine torque is transferred from the crankshaft to the primary mass. From there it travels via the arc springs to the flange vanes, the flange, and then the secondary mass. The secondary mass transfers it via the clutch to the gearbox and the downstream drive train. A DMF operates within its damping capacity while the vehicle is in motion, meaning that the arc springs compensate for rotational irregularities within their intended spring travel. During this process, the secondary mass twists in relation to the primary mass within a certain angle range – known as the torsion angle.

Standard DMF

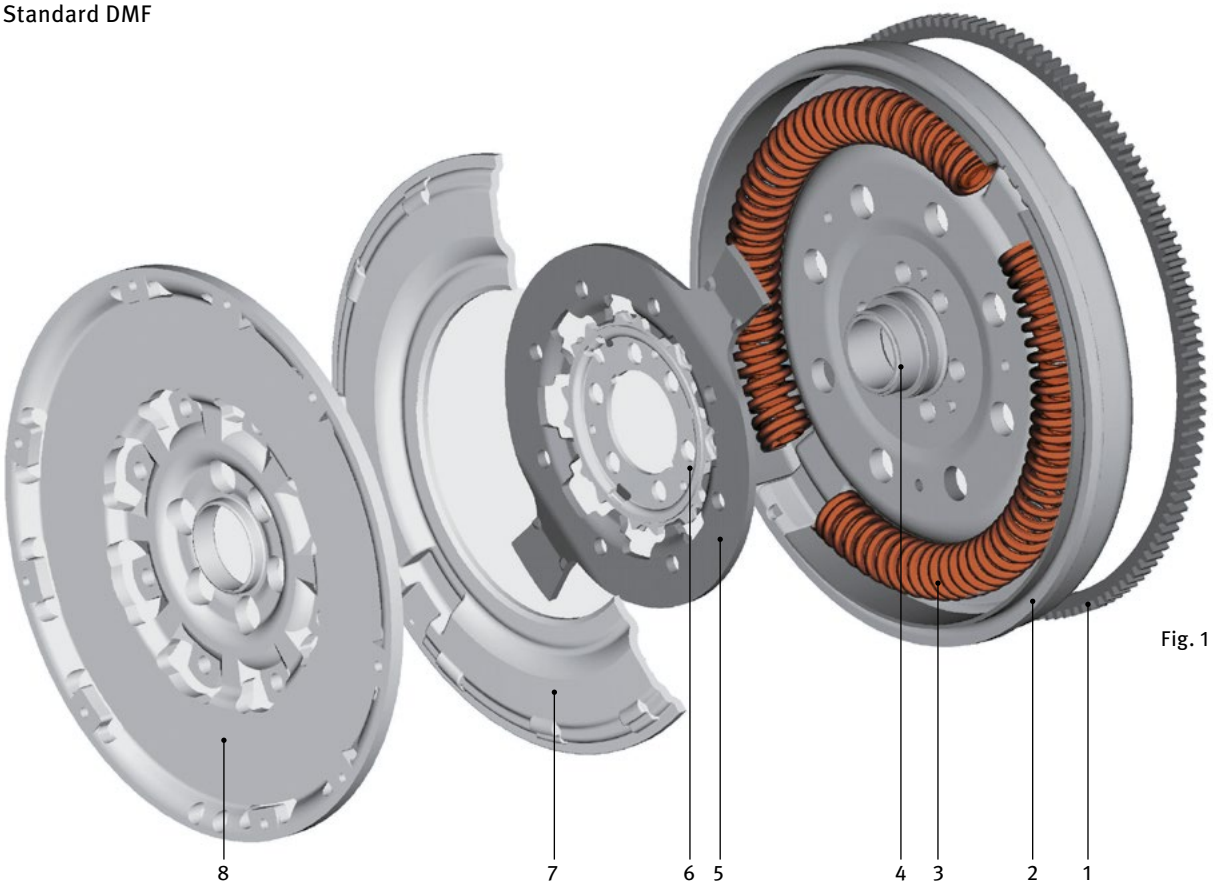


Fig. 1

1 Ring gear
2 Primary mass
3 Arc spring
4 Plain bearing
5 Flange
6 Floating pivoted reaming holder
7 Primary cover (cross section)
8 Secondary mass

Why do peak torques damage the DMF and the powertrain?

When a peak torque occurs, the effective torque exceeds the damping capacity of the arc springs. They are compressed to such an extent that their coils converge and form a rigid connection. The full torque is then transferred without damping. The temporary application of very high forces greatly exceeds the flange's load limit. Depending on how often this happens, the outcome can be a deformed or even broken flange vane. A DMF which has suffered such extensive damage must be replaced.

Peak torques not only place an exceptionally high load on the DMF, but can also cause damage to all of the downstream drive train modules (clutch, gearbox, cardan shaft, differential and drive shafts) and upstream engine modules (timing drive, auxiliary drive).

The end result of frequent peak torques: a broken flange vane

BROKEN FLANGE VANE IN THE DMF

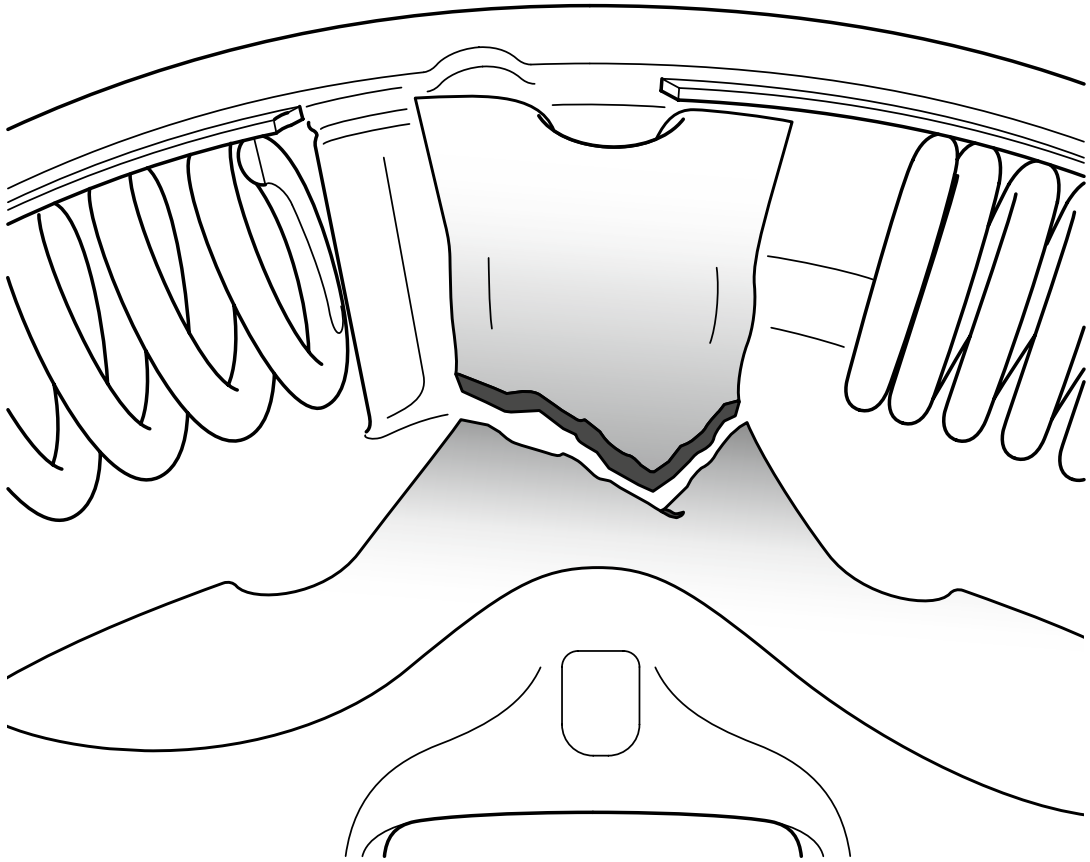


Fig. 2

SCHAEFFLER'S SOLUTION: THE IMPACT TORQUE LIMITER

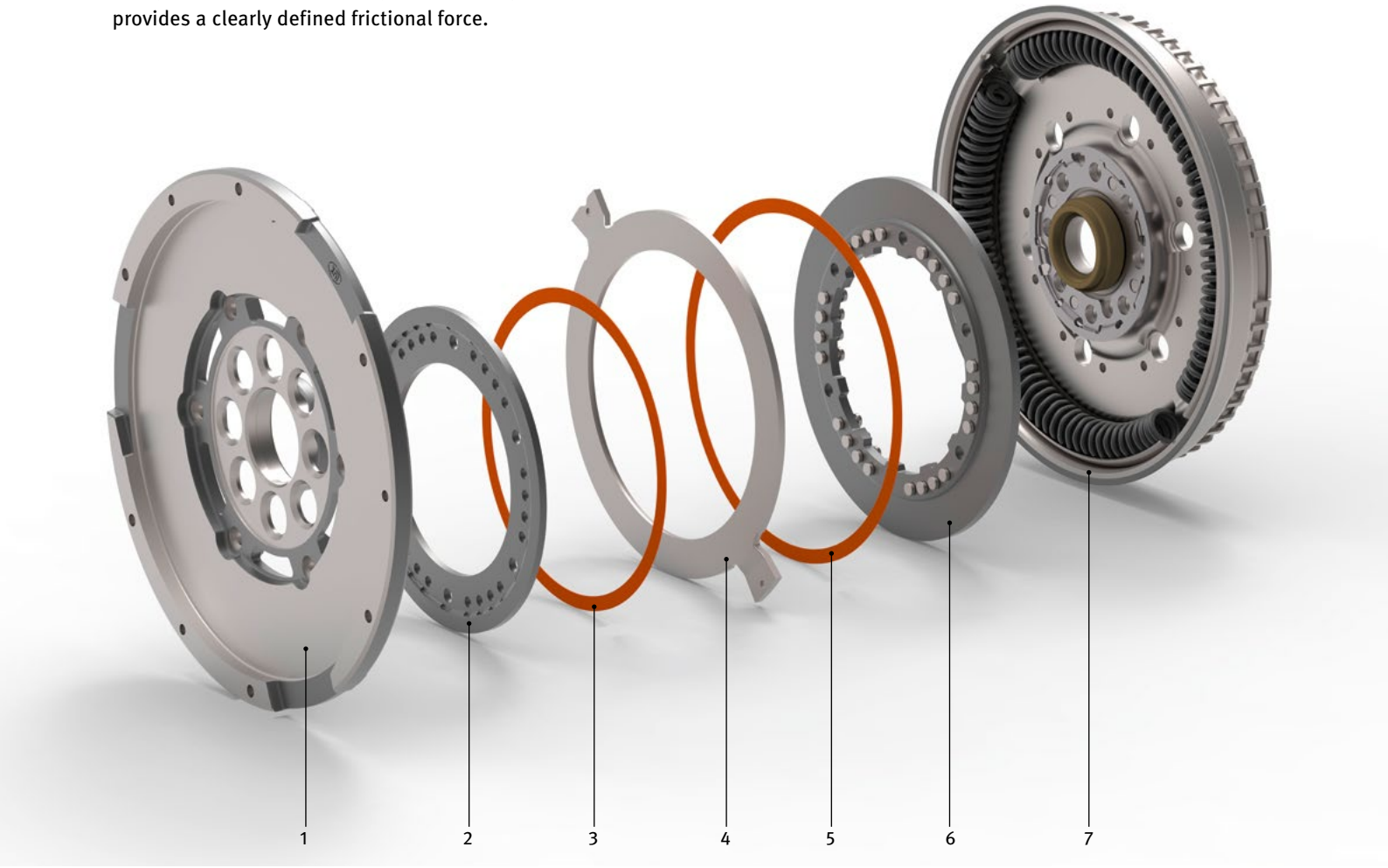
The Impact Torque Limiter which has been developed by Schaeffler is integrated into the DMF as a form of overload protection. The friction-based system compensates for torque peaks and protects the entire drive train against their damaging effects. This delivers significant advantages in terms of reliability and durability for drive trains in light commercial vehicles. It also substantially reduces downtimes and the high costs these entail.

3 The Impact Torque Limiter – Design and Function

Design

The Impact Torque Limiter is a specially designed DMF flange. It consists of two retaining plates, each with a friction lining, and a centrally positioned flange which acts as a disc spring. By riveting both retaining plates, the spring force of the flange preloads the system and provides a clearly defined frictional force.

The entire unit is connected to the DMF's secondary mass. The design principle is similar to that of a slipping clutch, which is capable of reducing overload without harmful impacts.



1 Secondary mass
2 Cover plate
3 Friction lining
4 Disc spring flange
5 Friction lining
6 Cover plate
7 Primary mass

Fig. 3

Components of the Impact Torque Limiter

FLANGE

Fig. 4

RETAINING PLATES WITH FRICTION LININGS

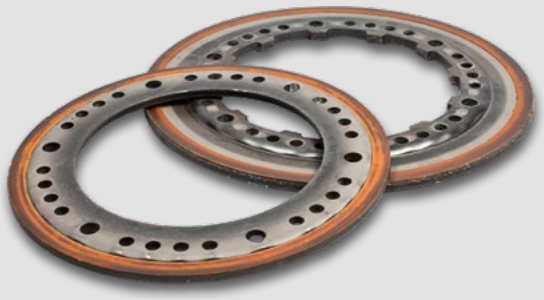


Fig. 5

IMPACT TORQUE LIMITER (IN THIS CASE WITHOUT RIVET CONNECTION)

Fig. 6

Function

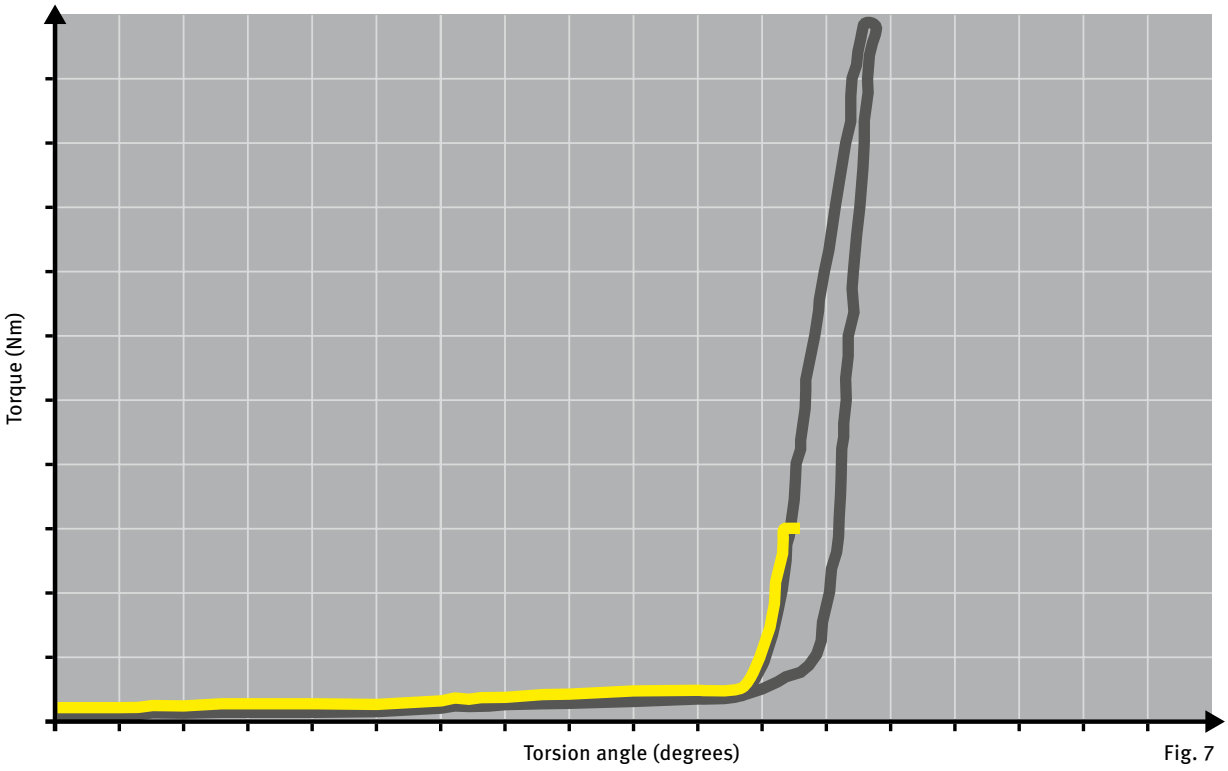


Fig. 7

Without Impact Torque Limiter
With Impact Torque Limiter

If a peak torque occurs, the flange twists in the retaining plates until the excess torque has been dissipated through friction. This prevents harmful loads on the flange vanes and the rest of the drive train components.

The diagram shows the torque curve of a peak torque in relation to the torsion angle of the DMF's secondary mass:

- Without Impact Torque Limiter (gray): All of the peak torque is transferred to the drive train
- With Impact Torque Limiter (yellow): The peak torque is only transferred up to a defined trigger threshold. Torque values above this threshold are dissipated through friction and are therefore no longer transferred to the secondary mass as rotary motion

Benefits:
Schaeffler's Impact Torque Limiter is almost space-neutral and offers comprehensive protection against the effects of peak torques in many DMF applications. Downtimes caused by unforeseen damage are particularly costly in heavily used fleet vehicles. Schaeffler's Dual Mass Flywheel with Impact Torque Limiter is targeted in particular at the light commercial vehicle segment, which includes vehicles such as the Ford Transit and IVECO Daily. The Impact Torque Limiter protects the clutch, the engine, and the drive train.

INSTRUCTIONS FOR SERVICING

The Impact Torque Limiter is only actuated if harmful peak loads occur. When this happens, the secondary mass twists by a few degrees in relation to the primary mass and then remains in this position. In some cases the DMF screws may no longer be accessible via the mounting holes. This is not necessarily an indication of a defect. It simply indicates that the powertrain was exposed to one or more peak torques. Use of the **LuK inspection tool (part no. 400 0080 10)** is recommended for reliable DMF diagnostics.

Important:
The secondary mass cannot be returned to its original position using garage equipment. The dividers between the mounting holes may need to be removed in order to reach the DMF screws during removal. If this happens, the DMF must not be reused!

OFFSET MOUNTING HOLES ON A DMF WITH IMPACT TORQUE LIMITER

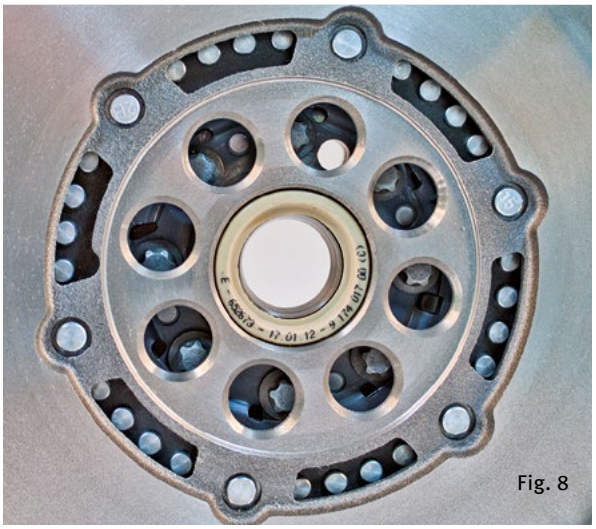


Fig. 8

4 Product Overview: LuK DMF for LCVs with Impact Torque Limiter

Part no.	Manufacturer	Model series	OE references	
415037510	Citroen Fiat Peugeot	Jumper Ducato Boxer	0532.R3 504088657 71724087	
415067310	Fiat	Ducato	504328874	
415038810	Ford	Transit	1748420 1858770 4568121	4C11 6477 BA 4C11 6477 DA 4C11 6477 DB
415043810	Ford	Transit	1373311 1517983 1747871	6C11 6477 CA 8C11 6477 CA 8C11 6477 CB
415056010	Ford	Transit	1461737 1768245 1865776	8C11 6477 AA 8C11 6477 EA 8C11 6477 EB
415056210	Ford	Transit Transit Tourneo Transit Custom	1731726 1734638 1802927 1857693	BK21 6477 CA BK21 6477 CB BK21 6477 CC BK21 6477 CD
415062810	Ford	Transit	1731748 1734637 1857694 1932320	BK31 6477 BB BK31 6477 BC BK31 6477 BD BK31 6477 BE
415087810	Ford	Transit	GK21 6477 AB GK21 6477 AA 2321159 2011389	GK21 6477 BB GK21 6477 BA 2321157 2011390
415088010	Ford	Transit	JB31 6477 DA 2329922 GK31 6477 AB	GK31 6477 AA 2305083 2011397
415022110	Iveco	Daily (Generation: III, IV, V, VI) Daily Line Daily Tourys Daily Citys	504053152 504196244	
415022210	Iveco	Daily	5040 40865 504040865 5041 77013	
415026810	Iveco	Daily (Generation: III, IV)	500055941 5041 92021 504241882	
415073810	Iveco	Daily (Generation: V, VI)	504382924	
415080810	Iveco	Daily (Generation: VI)	504385700	

Note:
The range of DMFs for light commercial vehicles is constantly expanding. Find the latest details in Schaeffler's online catalog:
https://webcat.schaeffler.com/web/

999601254O/6-2019