



Dual Mass Flywheel (DMF)

Technology

Failure Diagnosis

Special Tool/User Instructions



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From conventional torsion damping to dual mass flywheel



The rapid development of vehicle technology over the last few decades has brought ever higher performance engines paralleled by an increased demand for driver comfort. Weight-saving vehicle concepts and wind tunnel-optimised bodies now allow other sources of noise to be perceptible to the driver. In addition, lean concepts, extremely low-speed engines and new generation gearboxes using light oils contribute to this.

Since the middle of the 1980s, this advancement has pushed the classic torsion damper as an integral part of the clutch driven plate to its limits. With the same or even less installation space available, the classic torsion damper has proved inadequate to outbalance constantly increasing engine torques.

Extensive development by LuK resulted in a simple, but very effective solution – the dual mass flywheel (DMF) – a new torsion damper concept for the drive train.

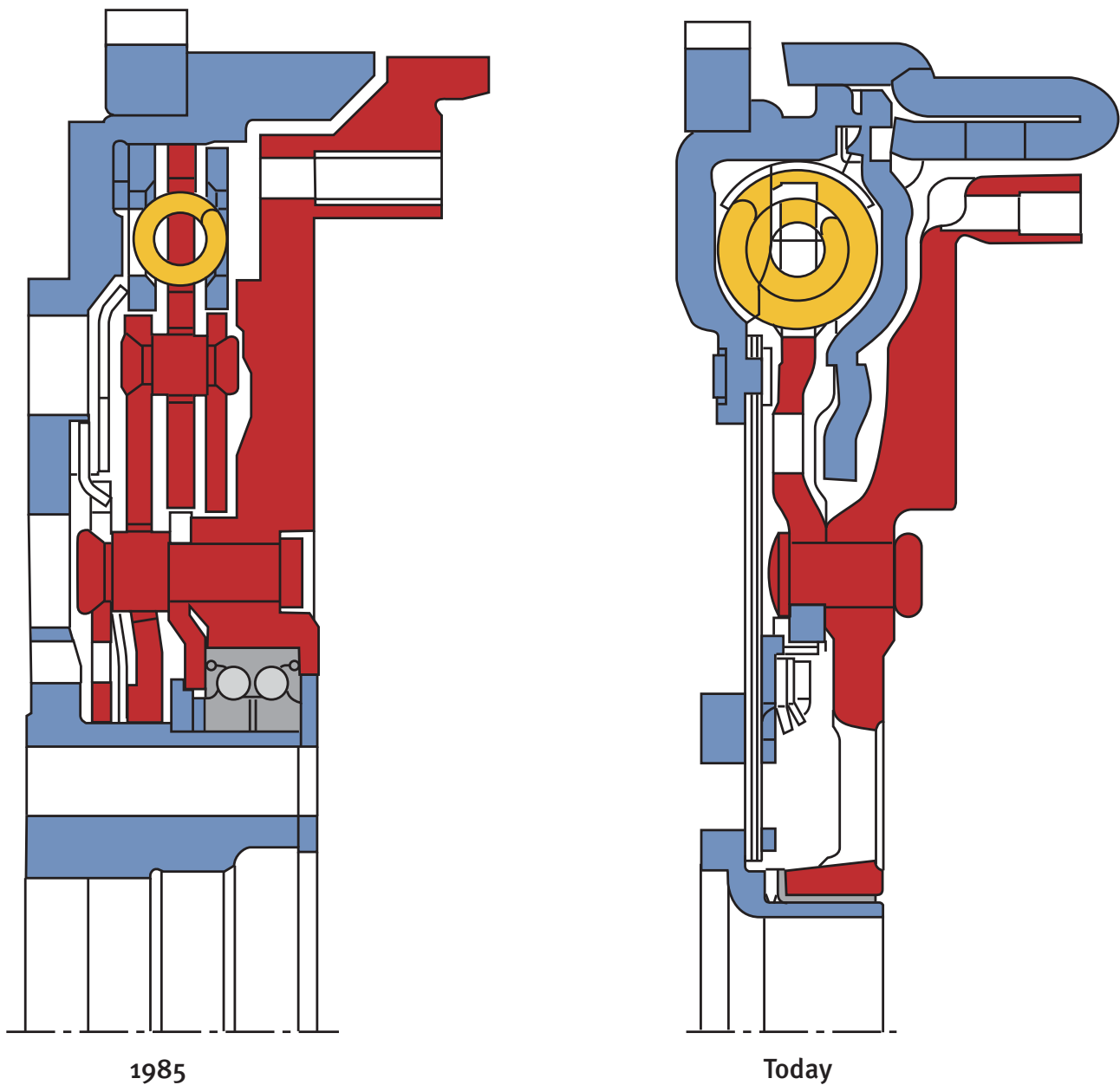


1 History

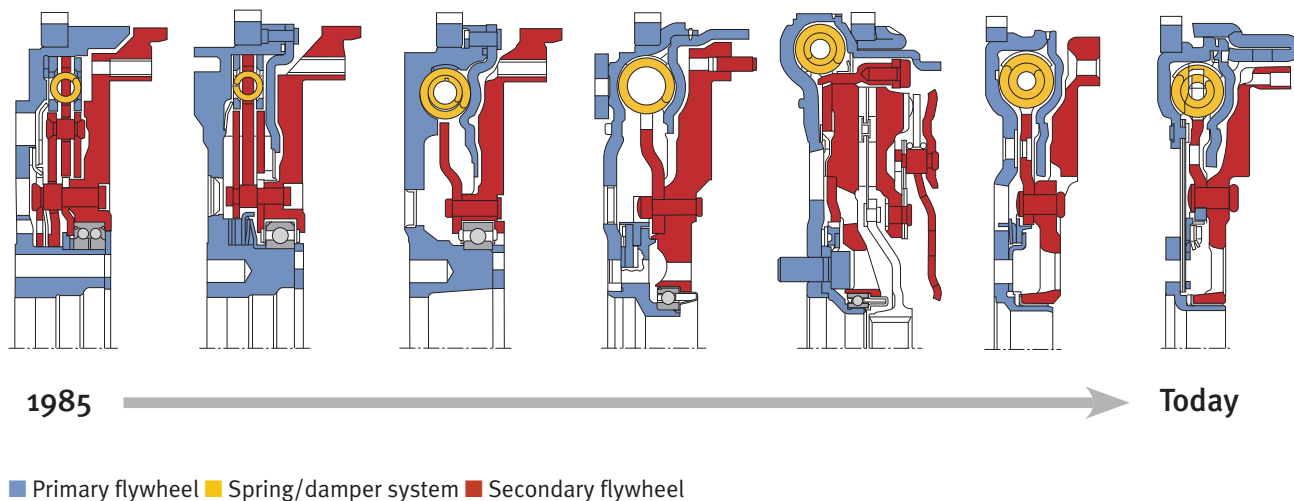
The configuration of the springs in the 1st generation DMF were identical to conventional torsion dampers, where the pressure springs are mounted in a radial direction close to the centre and can therefore provide only limited spring capacity. This design was sufficient to isolate vibration in 6-cylinder engines as these excite low resonance speeds.

In contrast, 4-cylinder engines induce higher irregularities and consequently higher resonance speeds. Re-positioning of the springs towards the outer edge and the use of large pressure spring diameters increased the damper capacity 5 fold without requiring more space.

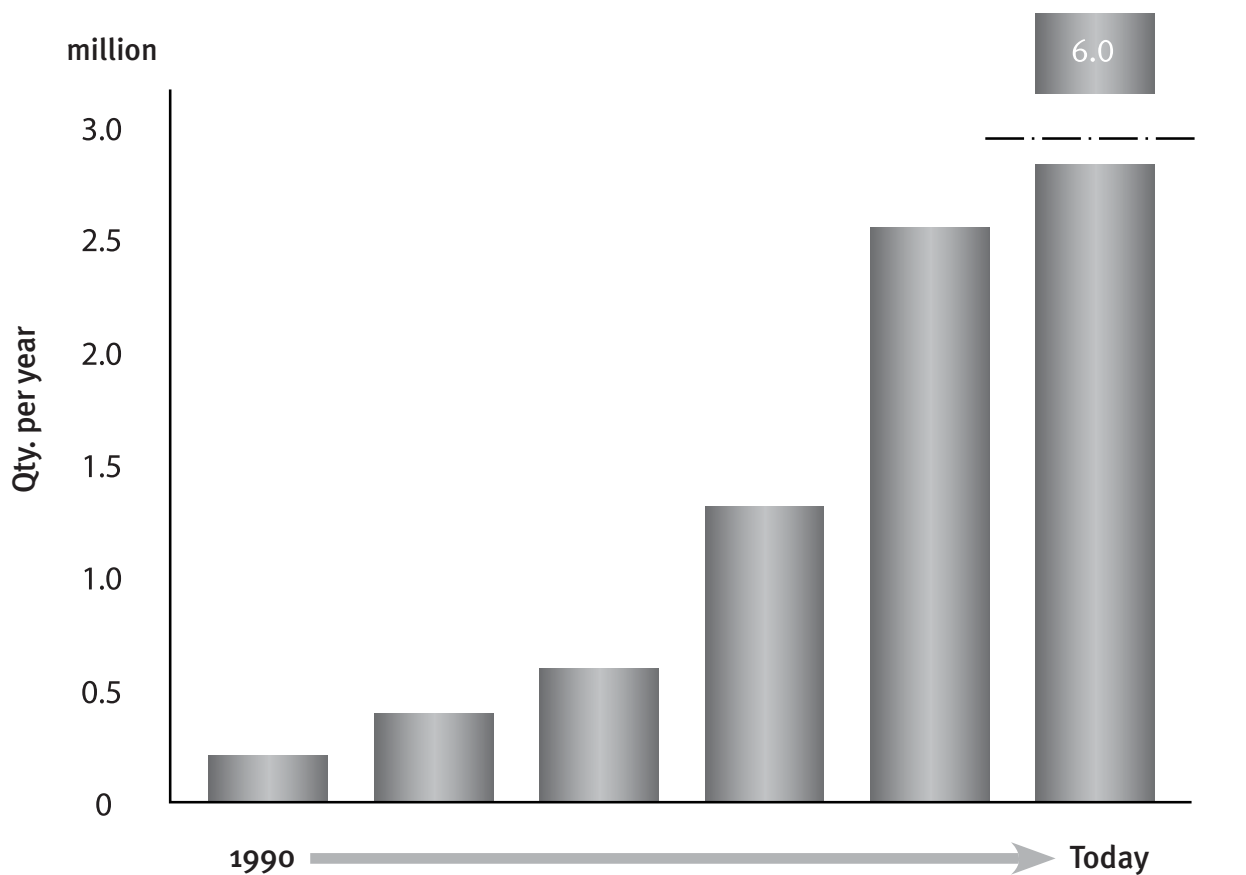
DMF function diagram



DMF – milestones in technology



Sales volumes 1990–Today



2 Dual mass flywheel – DMF

2.1 Why DMF?

The periodic combustion cycles of a 4-stroke engine produce torque fluctuations which excite torsional vibration to be passed down the drive train. The resulting noise and vibration, such as gear rattle, body boom and load change vibration, result in poor noise behaviour and driving comfort.

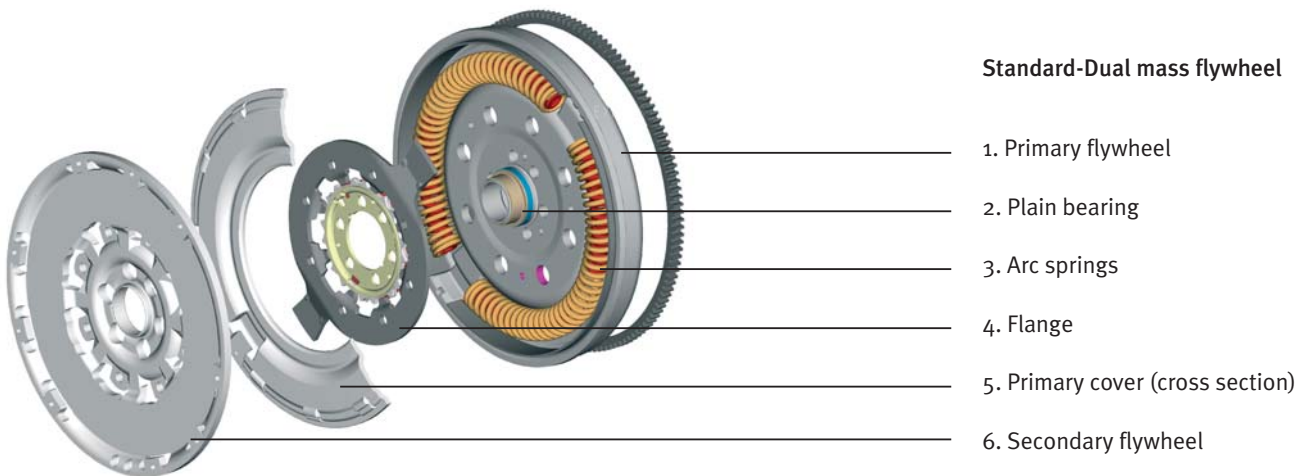
The objective when developing the dual mass flywheel was therefore to isolate as much of the drive train as possible from the torsional vibration caused by the engine's rotating mass.

Owing to its integral spring/damper system, the dual mass flywheel almost entirely absorbs this torsional vibration. The result: Very good vibration damping.



2.2 Design

A standard dual mass flywheel consists of the primary flywheel (1) and the secondary flywheel (6).



The two decoupled masses are connected via a spring/damper system and supported by a deep groove ball bearing or plain bearing (2) so they can rotate against each other.

The primary mass with starter ring gear is driven by the engine and tightly bolted to the crankshaft. It encloses, together with the primary cover (5) a cavity which forms the arc spring channel.

At the heart of the spring/damper system are the arc springs (3). They sit in guides in the arc spring channels and cost effectively fulfil the requirements of an "ideal" torsion damper. The

guides ensure correct guidance of the springs during operation and the grease around the springs reduces wear between the guides, channels and the springs.

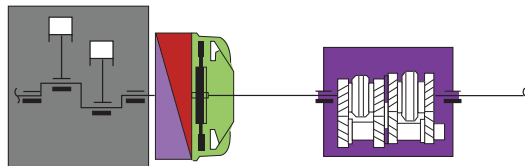
Torque is transferred via the flange (4). The flange is riveted to the secondary flywheel with its wings sitting between the arc springs.

The secondary flywheel helps to increase the mass moment of inertia on the gearbox side. Vents ensure better heat dissipation. As the DMF has an integral spring/damper system, a rigid clutch disc without torsion damper is normally used.

2.3 Function

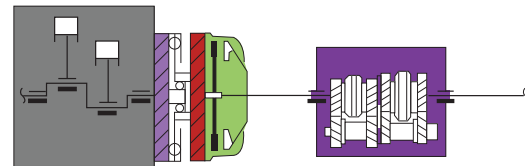
The functioning principle of a DMF is simple, yet efficient. Owing to the additional mass on the transmission input shaft, the vibration torque range, which is normally between 1,200 rpm and 2,400 rpm with original torsion dampers, is moved to a lower resonance speed range. This ensures excellent damping of engine vibration even at idle speeds.

With conventional flywheel



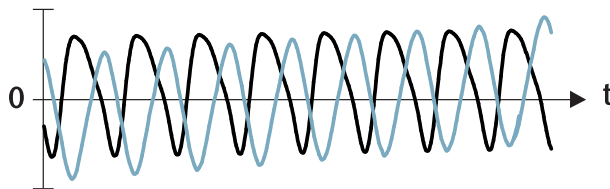
■ Engine ■ Clutch ■ Transmission □ Torsion damper ■ Primary flywheel ■ Secondary flywheel

With dual mass flywheel



Transfer of torsional vibration

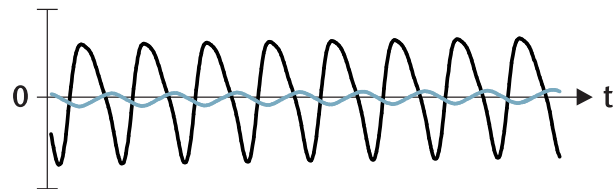
1/min



■ Engine ■ Transmission

With conventional flywheel: In the design that was previously common, with a conventional flywheel and torsion-damped clutch disc, the torsional vibrations in the idling range are transferred practically unfiltered to the gearbox and cause the gear teeth edges to knock together (gearbox rattle).

1/min



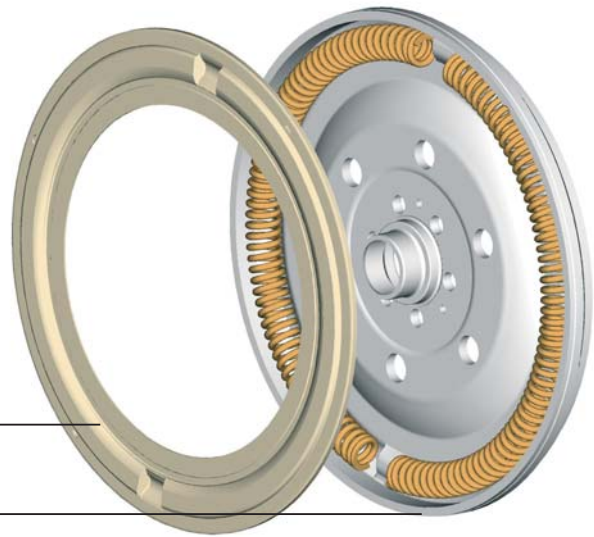
■ Engine ■ Transmission

With dual mass flywheel: In contrast, the spring/damper system of the DMF filters out torsional vibration caused by the engine. This prevents gearbox components knocking against each other – rattling does not occur and the drivers demands for higher comfort are fully met.

3 DMF Components

3.1 Primary flywheel

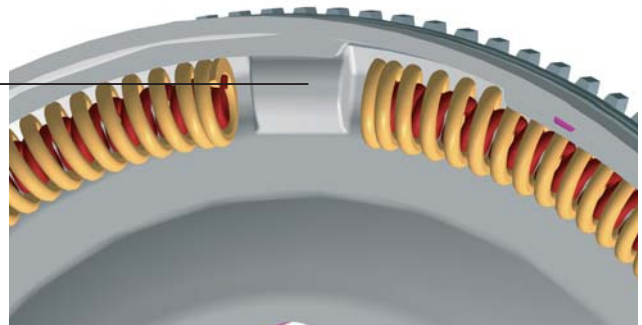
The primary flywheel is connected to the crankshaft of the engine. The inertia of the primary flywheel combines with crankshaft's to form one whole. Compared to a conventional flywheel, the primary mass of the DMF is significantly more flexible, which helps to relieve the crankshaft load. In addition, the primary mass – together with the primary cover – forms the arc spring channel which is typically divided into two sections, separated by the arc spring stops.



Primary cover

Primary flywheel

Arc spring stop



For engine starting, the starter ring gear is positioned on the primary flywheel. Depending on the type of DMF, it is either welded or shrunk on.



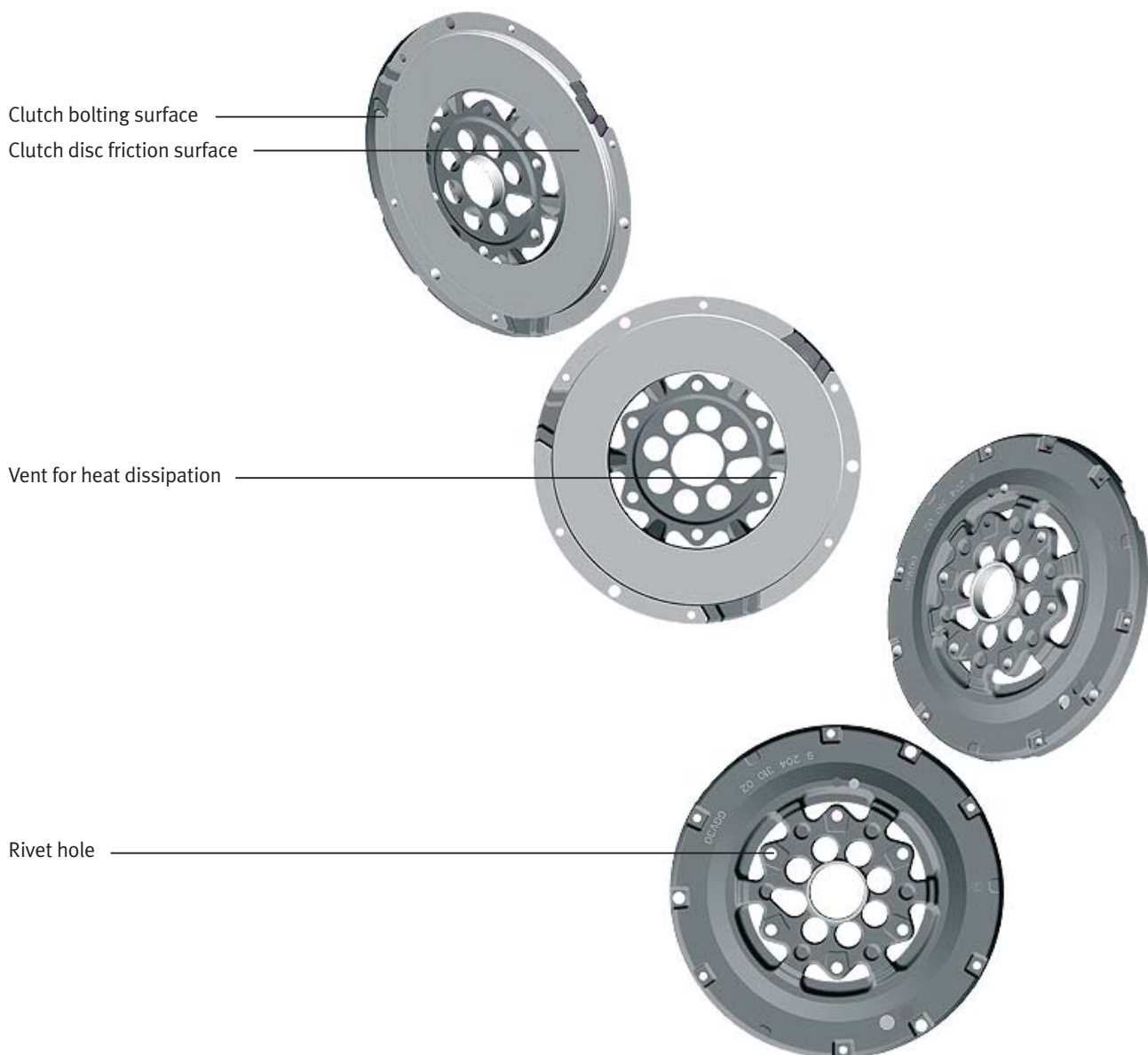
Starter ring gear

Primary flywheel

3.2 Secondary flywheel

Via the secondary flywheel the DMF connects to the drive train on the gearbox side. Interacting with the clutch, the secondary mass transfers the modulated torque away from the DMF. The clutch cover is bolted to its outer edge.

After the clutch has been engaged, the integral clutch spring mechanism presses the driven plate against the friction surface of the secondary mass. Torque is transferred by means of frictional engagement. The secondary flywheel mass mainly consists of the secondary mass and the flange. Torque is transferred via the wings of the flange sitting between the arc springs (refer to 3.4).

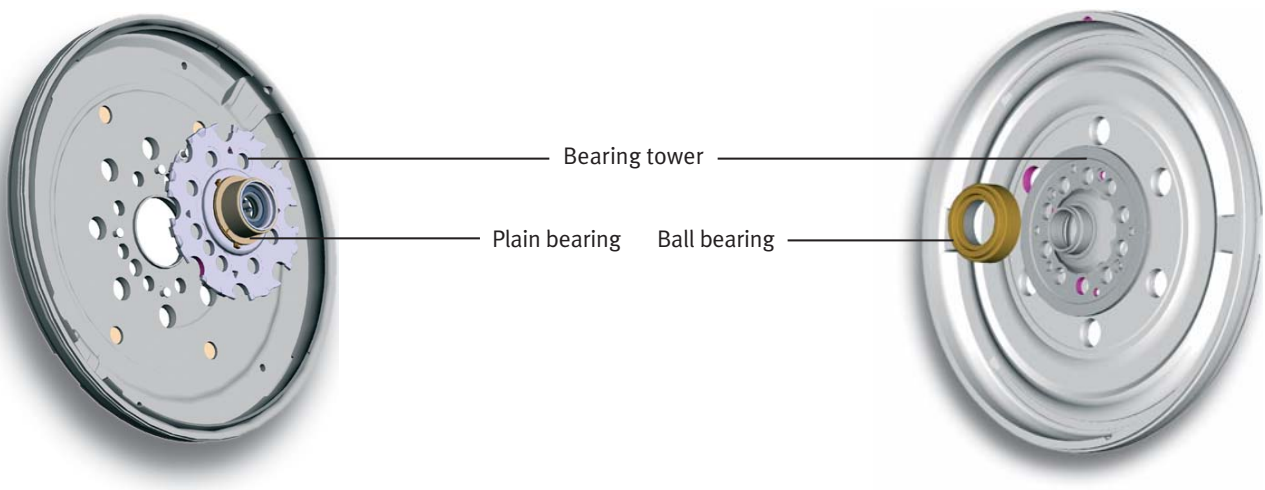


3 DMF Components

3.3 Bearing

Bearing position

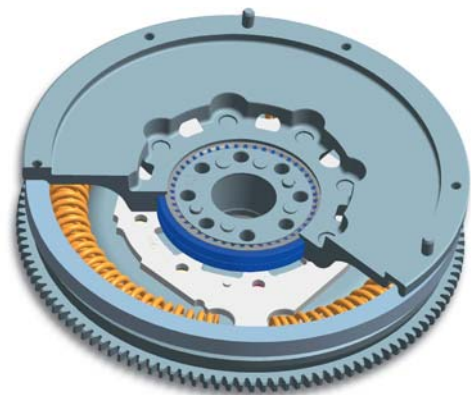
The bearing is positioned in the primary flywheel. The primary and the secondary flywheels are connected via a pivoting bearing. It supports the weight forces applied by the secondary flywheel and the clutch pressure plate. At the same time, it bears the release force applied on the DMF during clutch disengagement. The pivoting bearing allows not only both flywheels to rotate against each other, but also a gentle tilting movement (wobbling).



Types of bearings

Two different types of bearings can be used on a DMF

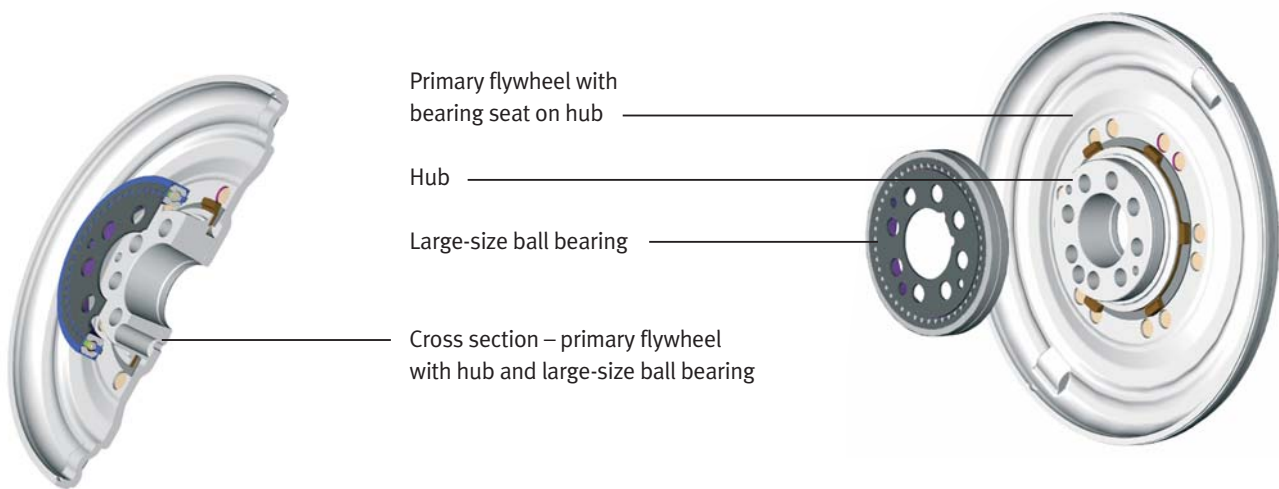
From early on, ball bearings have been used and continuous further improvement helped to ensure excellent durability.



Further technical improvement introduced the small-size ball bearing, then the plain bearing, which is now the common standard for DMF designs.

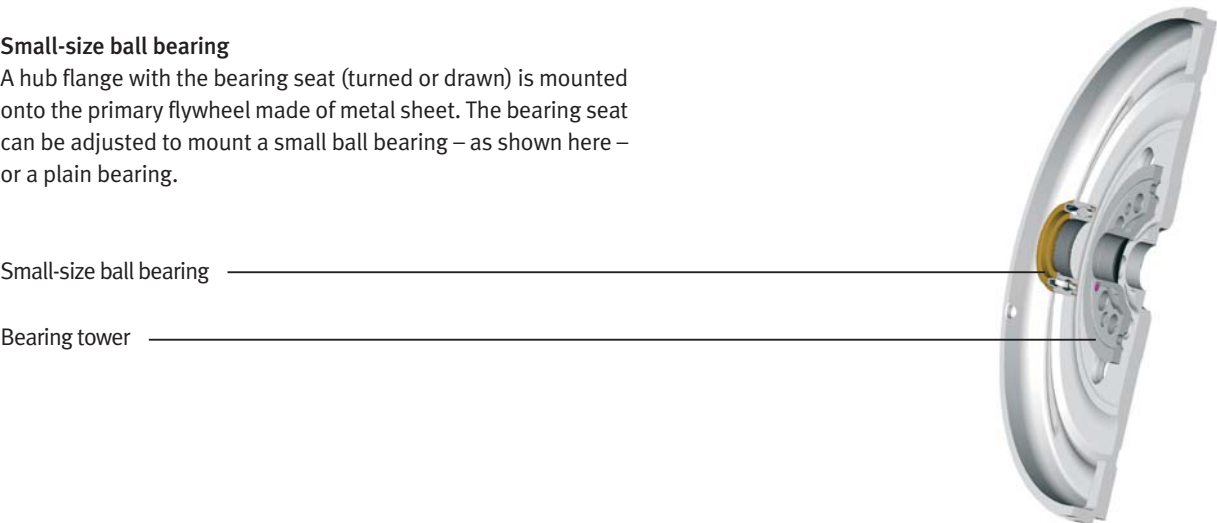
Large-size ball bearing

The primary flywheel is fitted with a turned hub on which the large-size ball bearing is fitted.



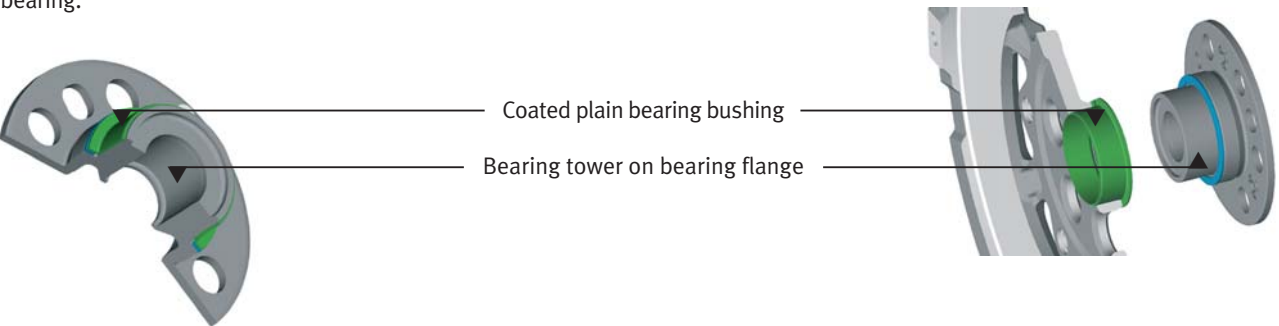
Small-size ball bearing

A hub flange with the bearing seat (turned or drawn) is mounted onto the primary flywheel made of metal sheet. The bearing seat can be adjusted to mount a small ball bearing – as shown here – or a plain bearing.



Plain bearing

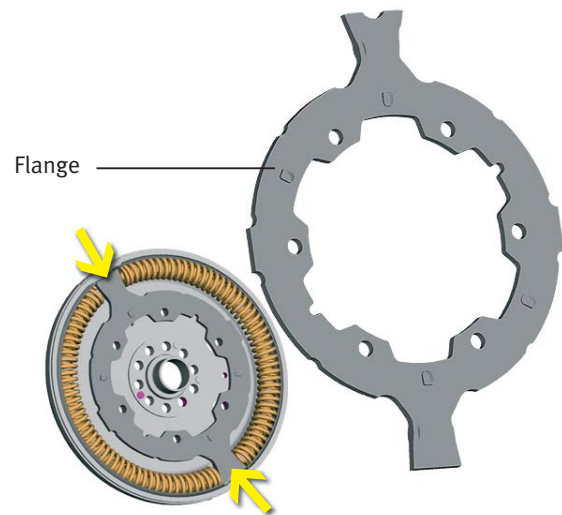
Further development on the ball bearing has lead to the plain bearing.



3 DMF Components

3.4 Flange

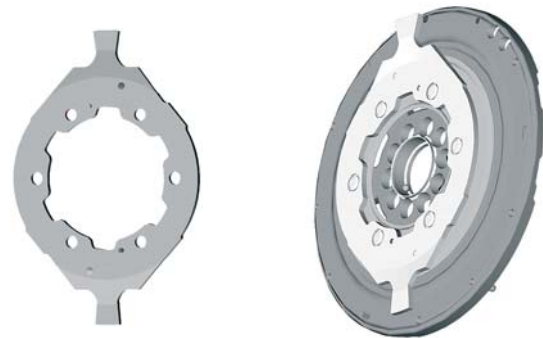
The task of the flange is to transfer torque from the primary flywheel via the arc springs to the secondary flywheel; in other words, from the engine to the clutch. The flange is tightly riveted to the secondary flywheel with its wings (arrows) sitting between the arc spring channel of the primary mass. The gap between the arc spring stops in the arc spring channel is big enough to enable the flange to rotate.



Flange designs

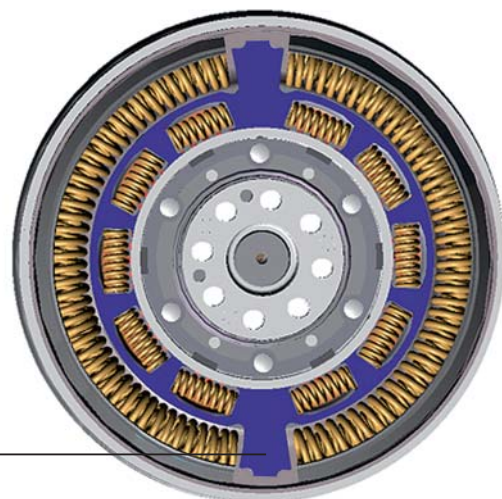
Rigid flange

On the rigid version, the flange is riveted to the secondary flywheel. To improve vibration damping, the flange wings are designed with different symmetries. The simplest form is the symmetrical flange, where pull and push sides are identical. Thus, load is applied on the arc springs via both outer and inner areas of the end coil.



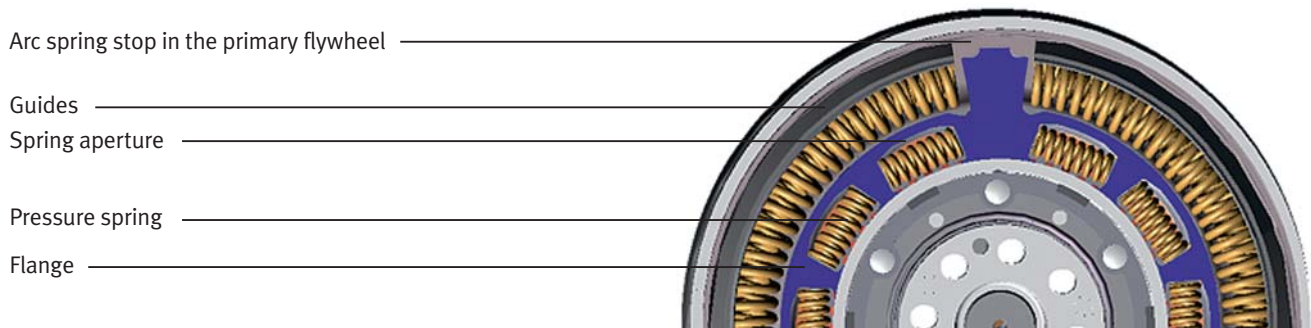
Flange with internal damper

The key function of the DMF is to isolate the transmission from the vibration generated by the engine. In order to compensate for the constantly increasing engine torques while the installation space remains the same, the wind-up curves of the arc springs must rise more steeply. Consequently, their vibration damping capacity deteriorates. Using friction-free internal dampers helped to improve vibration elimination during acceleration. Both the flange and the side panels are designed with spring apertures which house straight pressure springs. The excellent vibration damping characteristics of the DMF with internal damper are guaranteed even in the highest torque ranges.



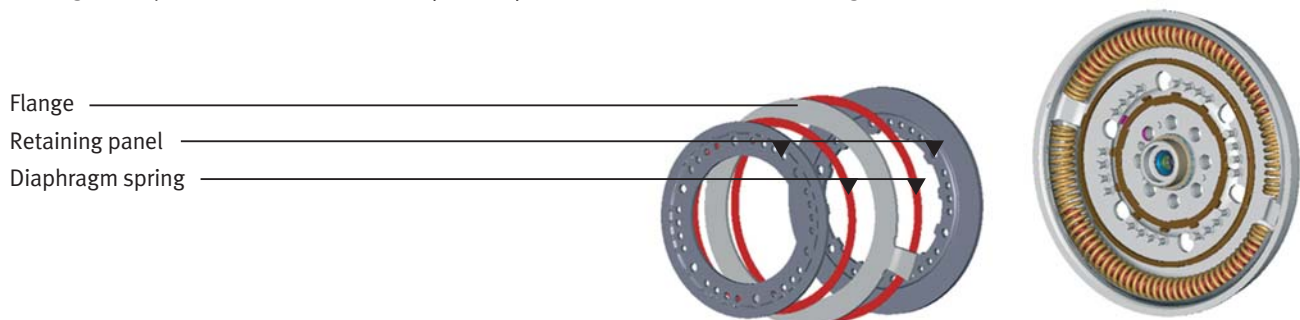
Flange with spring aperture (highlighted in blue)

At high engine speeds, the resulting centrifugal forces press the arc springs to the outside against the guides and the coils are disabled. Consequently, the arc spring stiffens and spring action is partly lost. In order to maintain sufficient spring action, straight pressure springs are mounted in the flange. Owing to their lower mass and mounting position on a smaller radius, these springs are subject to a lower centrifugal force. Additionally, the convex shape of the upper edge of the spring windows helps to minimise friction. This ensures that neither friction nor the effective spring rate will increase as engine speeds go up.



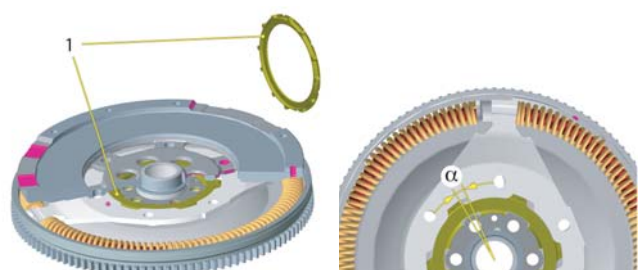
Flange with friction clutch

Unlike the rigid flange, this third type of flange is not riveted to the secondary flywheel. The flange is designed as a diaphragm spring. The diaphragm spring is held in position by two retaining panels at the edge. This way, a fork-type fixture is formed as shown in the cross-sectional view. The resulting friction torque between the fixture and the diaphragm spring ensures a reliable transmission of the engine torque. At the same time, the slip clutch prevents the DMF from overheating.



3.5 Friction control disc

In some models of dual mass flywheels, there is an additional friction device – the friction control disc (1). The friction control disc has a clearance angle (α), which means that the additional friction only occurs with larger torsional angles. This provides extra damping during operation, e.g. on starting or change of load.



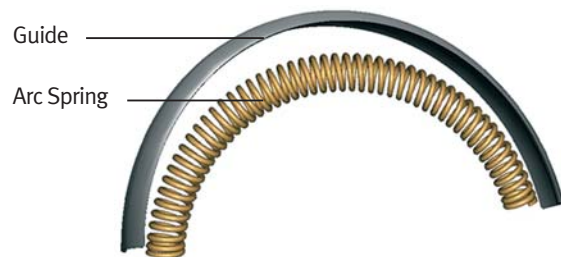
3 DMF Components

3.6 Arc springs

DMF systems help to improve the noise behaviour of the vehicle by using special torsion damper designs. As a direct result, less noise is generated and fuel consumption reduced.



In order to make ideal use of the available space, a coil spring with a large number of coils is fitted in semicircular position. The so called arc spring lies in the spring channel of the DMF and is supported by a guide. Under operation, the coils of the arc spring slide along the guide and generate friction and thereby damping. To prevent the arc springs from wear, the sliding contact areas are lubricated. The optimised shape of the spring guides helps to reduce friction significantly. Besides improved vibration damping, arc springs help to reduce wear.



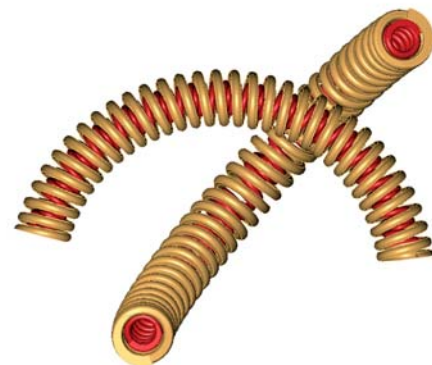
Benefits of the arc spring:

- high friction at large torsional angles (start) and low friction at small torsional angles (acceleration)
- low spring rate owing to good and flexible use of available space
- impact damping possible (damping spring)

Thanks to the diversity of arc spring designs, a DMF system can be manufactured to precisely match the individual load characteristics of each vehicle type. Arc springs of various designs and characteristics are used. The most frequent types are:

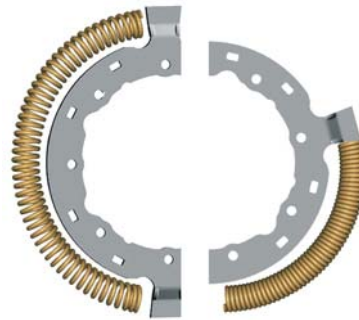
- **Single-stage springs**
- **Two-stage springs**
in either **parallel arrangement** with different layouts or **in-line arrangement**
- **Damping springs**

In practice, the spring types are applied in different combinations.

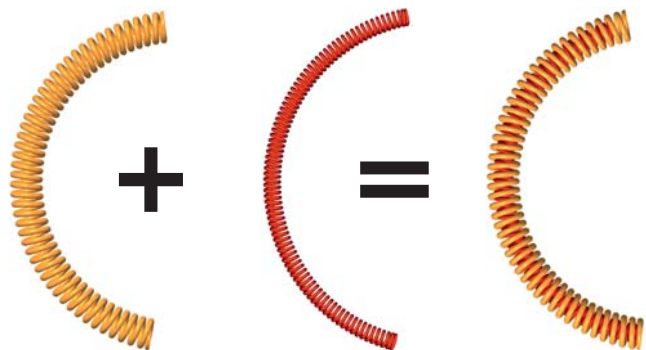


Single spring

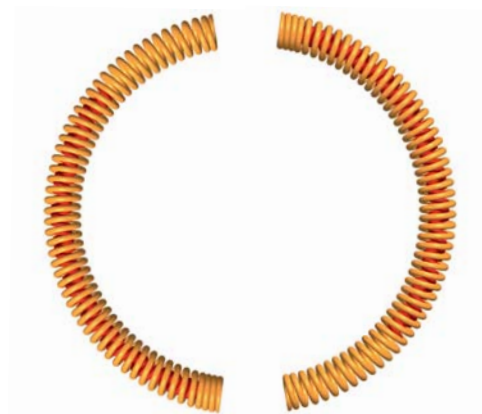
The simplest form of an arc spring is the standard single spring.

**Single-step parallel spring**

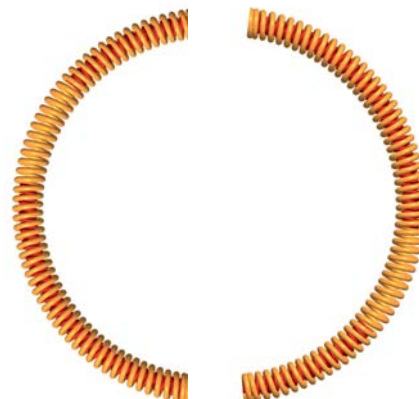
Today, the single-step parallel spring is the standard arc spring design. It consists of an external and internal spring, both with nearly the same length. Both springs are arranged in parallel. The individual characteristics add up to the spring set curve.

**Two-stage parallel spring**

Also in two-stage parallel springs, two arc springs are arranged one inside the other. The internal spring, however, is shorter, thus engaged later. The wind-up curve of the external spring is matched to the requirements at engine start. Here, load is applied only on the softer external spring, enabling the system to pass the critical resonance speed range faster. In the higher and maximum torque ranges, load is exerted on the internal spring as well. Both external and internal springs work together in the second stage. The interplay of both springs provides good damping at all engine speeds.

**Three-stage arc spring**

This type of arc spring consists of one external spring and two internal springs of different length arranged in-line. This design combines the benefits of the parallel and in-line arrangements and therefore allows for optimum torsion damping at each engine torque.



3. DMF Components

3.7 DMF special versions

Compact DMF (DFC)

DFC = Damped Flywheel Clutch

This special version of a dual mass flywheel is a pre-assembled modular unit consisting of a DMF, a clutch disc and a clutch pressure plate, which are perfectly synchronized to each other.



Clutch assembly comprising clutch pressure and driven plates



Secondary flywheel with flange

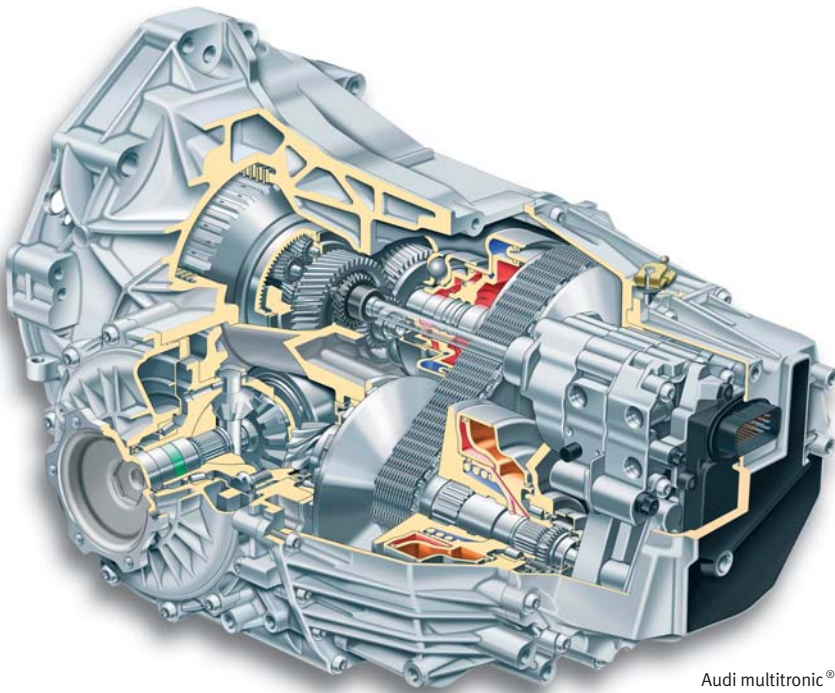


Primary flywheel

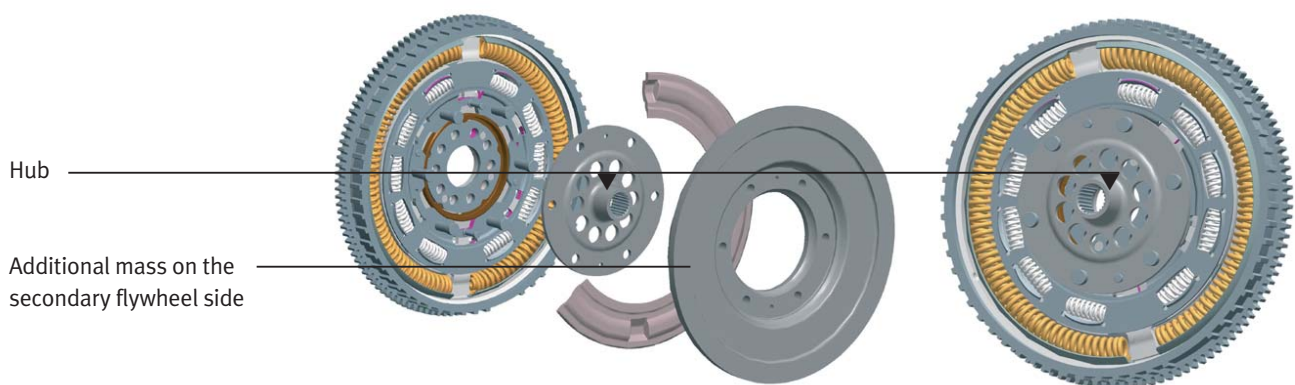


DMF for CVT

CVT = Continuously Variable Transmission



This version of a DMF is used for continuously variable transmissions and direct shift gearboxes. Here, power is transferred not via frictional engagement between secondary flywheel and clutch driven plate, but directly from the hub to the gearbox input shaft by means of positive engagement. This allows for a variety of gearbox types to be connected.



4 DMF Failure Diagnosis

4.1 General References

Always check the dual mass flywheel (DMF) when replacing the clutch. A worn and defective DMF can damage the newly installed clutch.

Ask your customer

In the event of a customer complaint, targeted questions help to identify the fault.

- Which component is not working, what is the customer's complaint?
- When did this problem first occur?
- When does the problem manifest itself?
 - From time to time, often, always?
- Under which operating conditions does the problem occur?
 - e.g. while driving-off, accelerating, shifting up/down, when the vehicle is cold
 - or at operating temperatures?
- Is the engine difficult to start?
- What is the total and annual mileage of the car?
- Are there extraordinary load conditions under which the vehicle operates?
 - e.g. towing a trailer, overloading, Taxi, fleet vehicle, driving school, is it chip tuned?
- Driving habits?
 - City traffic, short/long distance driving, Motorway driving?
- Have the clutch and transmission required an earlier repair?
 - If yes, at what mileage and for what reason?

General vehicle inspection

Check the following prior to proceeding with the repair:

- control unit fault codes (engine, transmission);
- battery power;
- condition and function of the starter motor;
- tuned engine (chip tuning)?

How to handle the DMF correctly

The following instructions provide important information on the correct handling of the DMF.

- A DMF that has been dropped must not be installed!
 - Risk of damaged ball or plain bearing, distorted sensor ring, increased imbalance;
- Remachining of the friction surface is not permissible!
 - The weakening of the friction surface results in insufficient burst speed characteristics.
- Do not apply high axial load on the secondary flywheel of a DMF with plain bearing!
 - This can damage the inner membrane of the DMF.
- It is not permissible to clean the DMF in a partswashing machine, or to use high pressure cleaners, steam cleaners, compressed air or any cleaning sprays.

Installation

What should be considered when installing a DMF?

- **Observe the specifications of the vehicle manufacturer!**
- Check the shaft oil seals (engine and transmission side) for oil leaks and replace, if necessary.
- Check starter ring gear for damage and tight fit.
- Always use new fixing bolts.
- Verify that the distance between the speed sensors and the DMF sensing pins/sensor rings is correct.
 - Varies depending on the vehicle make.
- Ensure the dowel pins are fitted correctly.
 - Dowel pins must not be forced into or pushed out of the dual mass flywheel.
 - Dowel pins forced further into the DMF score the primary mass (noise).
- Use a cloth dampened with solvent to clean the contact surface of the DMF.
 - No solvent must penetrate the interior!
- Ensure you use clutch bolts of the required length.
 - Bolts which are too long score the primary flywheel (noise) and can even lock it.
 - Bolts which are too long damage the ball bearing or extract it from its seat.

Special references

The following is permissible on some vehicle makes and models and has no effect on the operation of the clutch components:

- Small trails of grease on the DMF rear face (engine side) leading from the holes towards the flywheel edge.
- The secondary flywheel can be rotated by several centimetres against the primary flywheel and does not automatically return to its original position.
 - On a DMF with friction control disc a hard knock can be felt and heard.
- Depending on the design, axial play between the primary and secondary masses can be up to 2 mm.
 - On some models with plain bearing axialplay can be up to 6 mm.
- Each DMF has a tilting clearance.
 - For ball bearings it can be up to 1.6 mm, and up to 2.9 mm for plain bearings.
 - Primary and secondary flywheel must never knock against each other!

Multi-piece repair solutions

Many vehicle manufacturers choose to equip new models with a dual mass flywheel – and the trend is growing. This is thanks to the technical benefits provided by the DMF as well as the need for increasing noise comfort while reducing emissions of state-of-the-art engines. The DMF characteristics are precisely attuned to each vehicle and its engine.

The market offers alternative, multi-piece repair solutions to substitute the DMF. These kits typically include:

- a conventional rigid flywheel,
- a clutch pressure plate,
- a clutch driven plate and
- a release bearing.

Caution!

These multi-piece repair solutions do not comply with the vehicle manufacturer's specifications!

The clutch driven plate used on these applications is not able to provide full damping of the torsional vibration generated by the engine due to its smaller torsional angle in comparison with a DMF. As a result, noise emissions and vibration-induced damage to the power train can occur.

4.2 Noise

When diagnosing a DMF while it is installed, it is always important to determine, whether noise is emitted from adjacent components such as exhaust system, heat shields, engine mountings, accessories etc. Additionally, it is important to isolate any noise caused by front end accessories such as belt tensioning units or A/C compressors. To determine the source of the noise a stethoscope can be used.

Ideally, compare the affected vehicle to a car with identical or similar equipment.

Clicking noise when engaging or shifting gears, and during load changes can originate in the power train caused by excessive gear clearance in the transmission, play in the prop./driveshafts or in the differential. The DMF is not at fault.

When the gearbox is removed, the secondary flywheel can be rotated against the primary flywheel. Here, too, noise can be perceptible caused either by the flange hitting against the arc springs or the secondary flywheel knocking against the friction control disc. Here, too, the DMF is not defective.

There are various causes of humming noise, for example resonance in the power train or imbalance of the DMF exceeding admissible limits. A DMF can be severely imbalanced, if e.g. the balance weights on the back side are missing, or the plain bearing is defective. Whether imbalance is the root cause of humming noise can be determined quite simply. While stationary increase the speed of the engine. If vibration increases as engine speeds go up, the DMF is defective. Here, too, it is helpful to compare the vehicle to another car with an identical or similar engine version.

4 DMF Failure Diagnosis

4.3 Chip Tuning

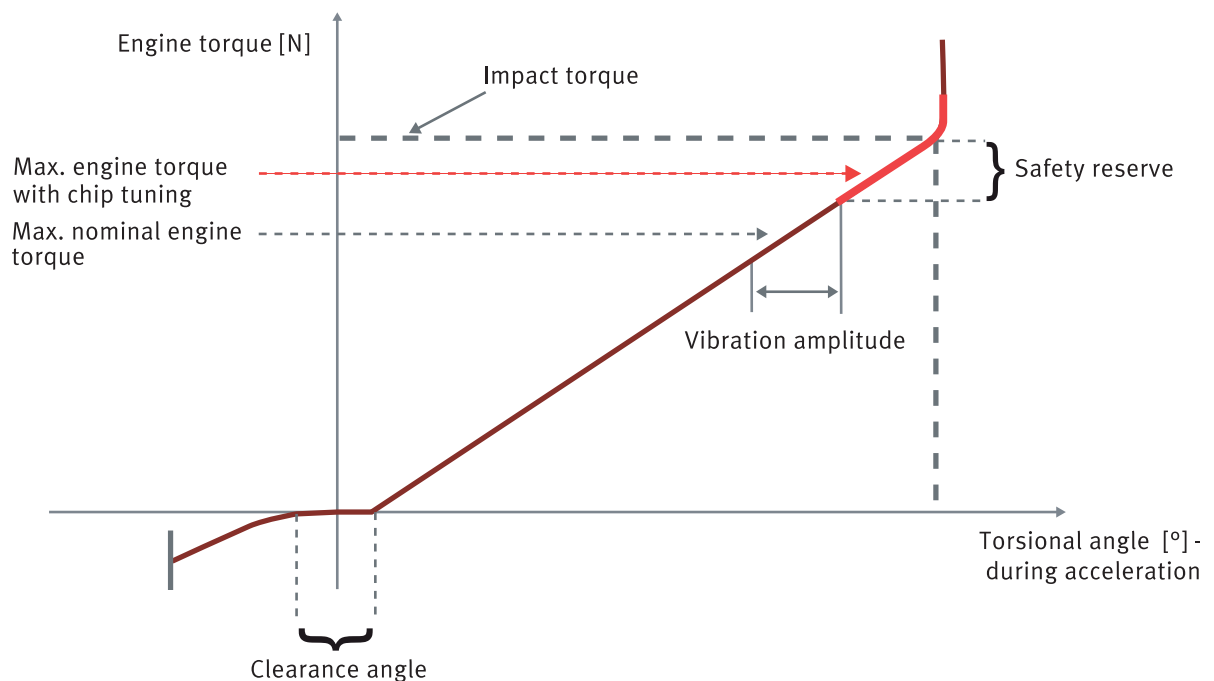
Chip tuning is a quick, easy and rather inexpensive way of increasing engine power output. For a relatively small amount of money you can easily increase the power of an engine by up to 30 %. Facts not normally considered are whether the engine is durable enough to withstand the higher outputs, e.g. thermal overloading, and also if the rest of the drive train can withstand the increase in torque/performance.

Usually the torsion damper system of a dual mass flywheel, just like the remaining parts of the drive train, is designed for the respective engine. In many cases the safety reserve of the dual mass flywheel is used up or exceeded by a torque increase by sometimes more than 30 %. As a consequence, the arc springs can already be completely compressed during normal driving, which deteriorates noise insulation and can cause the vehicle to jolt. As this is the case at half of the firing frequency, quickly, very high loads are produced and transferred not only to the dual mass flywheel, but also to the

transmission, which could result in damage to drive shafts and the differential. Damage stretches from increased wear to a catastrophic failure which results in a huge repair bill. The operating point of the dual mass flywheel is shifted toward its security reserve by the increase in power of the engine. During driving, the dual mass flywheel is permanently overloaded by the higher engine torques. This causes the damper springs in the dual mass flywheel to operate “fully loaded” more often than they are designed to. The consequence: the dual mass flywheel can be destroyed!

It is true that many tuners give a warranty on the vehicle when increasing power output. But what about when the warranty period is over? The increase in output can damage other components in the drive train slowly but continuously. Sometimes these components will fail at a later time (after expiration of any warranty given!) which means the repair costs have to be paid by the customer.

Arc spring curve – during acceleration (example)



Important!

Chip tuning and the resulting performance enhancement lead to the loss of insurance to operate the vehicle.

4.4 Visual inspection/damage patterns

Clutch driven plate

Description

Clutch disc burnt

Cause

Thermal overload of the clutch driven plate

→ occurring e.g. when the wear limits were exceeded

Effect

Thermal load applied on the DMF

Remedy

Perform a visual inspection for signs of thermal discolouration on the DMF

→ For damage assessment refer to:

- Low thermal load » page 24
- Mean thermal load » page 24
- High thermal load » page 24
- Very high thermal load » page 25



In-between primary and secondary flywheel

Description

Burnt residues of abraded clutch facing at the DMF's outer edge or in the ventilations holes

Cause

Thermal overload of the clutch driven plate

Effect

Residues of the abraded friction material can penetrate into the arc spring channel and cause malfunction

Remedy

Replace DMF



4 DMF Failure Diagnosis

Friction surface

Description

Scoring

Cause

Worn out clutch

→ Clutch lining rivets score on friction surface

Effect

Limited power transmission capability

→ The clutch is unable to generate the required torque

→ Damage to the DMF friction surface

Remedy

Replace DMF



Friction surface

Description

Localised, dark hot spots

→ sometimes many

Effect

None

Remedy

No remedial measures required



Friction surface

Description

Cracks

Cause

Thermal overload

Effect

Loss of the DMF's operational reliability

Remedy

Replace DMF



Ball bearing

Description

- Grease egress
- Bearing seized
- Sealing cap missing or discoloured brown due to overload

Cause

Thermal overload or mechanical damage/overload

Effect

Degradation of bearing lubrication

→ DMF fails

Remedy

Replace DMF



Plain bearing

Description

Damaged or destroyed

Cause

Wear and/or mechanical impact

Effect

DMF is defective

Remedy

Replace DMF



Plain bearing

Description

Worn out

→ In relation to the diameter, the maximum radial bearing clearance for a new part is 0.04 mm with an admissible increase throughout its service life up to 0.17 mm

Cause

Wear and tear

Effect

- ≤ 0.17 mm: None
- > 0.17 mm: Increased tilting of the secondary flywheel

Remedy

Replace DMF if bearing clearance > 0.17 mm



4 DMF Failure Diagnosis

Low thermal load

Description

Friction surface slightly discoloured (gold/yellow)

→ No tarnish at the outer edges of the DMF or in the rivet area

Cause

Thermal load

Effect

None

Remedy

No remedial measures required



Middle thermal load

Description

Friction surface discoloured blue due to temporary thermal load (220 °C)

→ No discolouration in the rivet area

Cause

Discolouration of the friction surface is a normal occurrence during operation

Effect

None

Remedy

No remedial measures required



High thermal load

Description

Tarnish in rivet area and/or at the outer diameter. No tarnish on the friction surface

→ The DMF was in continued operation after high thermal had occurred

Cause

High thermal load (280° C)

Effect

Depending on the duration of the thermal load applied, the DMF is defective

Remedy

Replace DMF



Very high thermal load

Description

DMF discoloured blue/purple at the lateral or back side and/or is visibly damaged, e.g. cracks

Cause

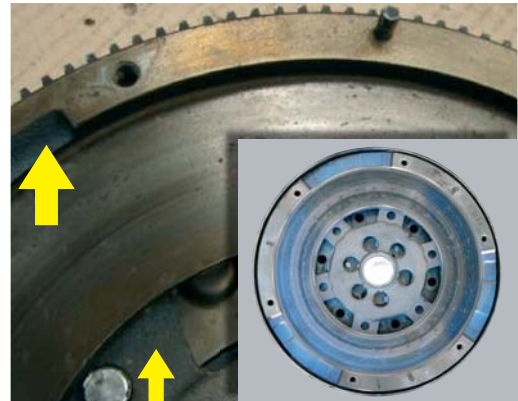
Very high thermal load

Effect

DMF is defective

Remedy

Replace DMF



Friction control disc

Description

Friction control disc melted

Cause

High thermal load inside the DMF

Effect

Limited operational reliability of the DMF

Remedy

Replace DMF



Primary flywheel

Description

Secondary flywheel scores the primary flywheel

Cause

Friction ring of the plain bearing worn out

Effect

Noise emission or starter motor operation impaired

Remedy

Replace DMF



4 DMF Failure Diagnosis

Starter ring gear

Description

Starter ring gear heavily worn

Cause

Defective starter

Effect

Noise occurring during engine start

Remedy

→ Replace DMF

→ Perform starter function test



Sensor ring

Description

Sensor ring teeth distorted

Cause

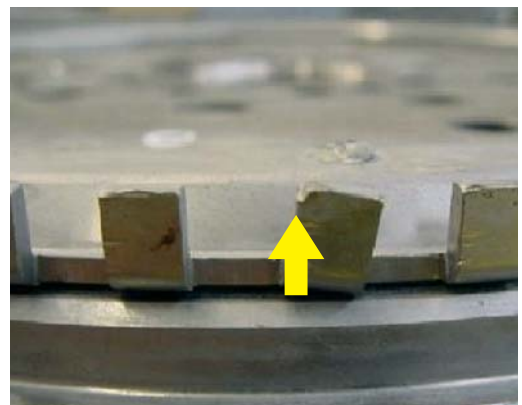
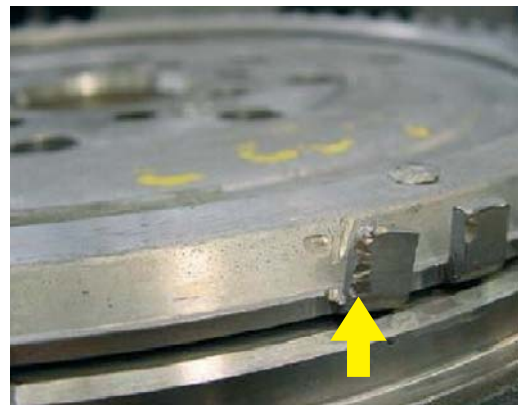
Mechanical damage

Effect

Engine runs uneven

Remedy

Replace DMF



Minor grease egress

Description

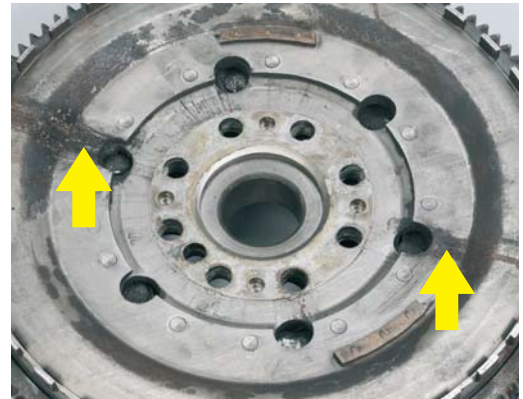
Slight trails of grease leaking from the openings or seal caps

Effect

None

Remedy

No remedial measures required



Heavy grease leakage

Description

Grease egress > 20 g

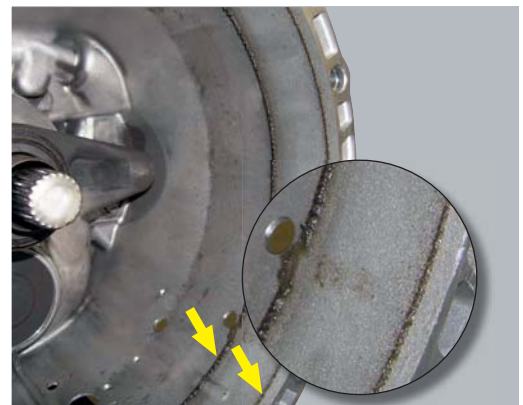
→ Housing covered with grease

Effect

Lack of lubrication of the arc springs

Remedy

Replace DMF



Balance weights

Description

Loose or missing

→ Indicated by clearly visible welding spots

Effect

DMF out of balance

→ Loud humming

Remedy

Replace DMF



5 Description of the DMF Special Tool

A 100 % functional test includes among other things testing the characteristics of the arcsprings in the dual mass flywheel (DMF) during compression. The testing must be performed at a special test facility as it cannot be carried out with standard workshop equipment. However, the LuK DMF special tool 400 0080 10 allows you to perform the most important measurements – freeplay angle and rock – in a workshop environment.

The freeplay angle is the angle at which the DMF's primary and secondary masses can be rotated against each other until load is exerted on the arc springs. Tilting clearance occurs, when the rotating masses of the DMF are tilted towards or away from one another.

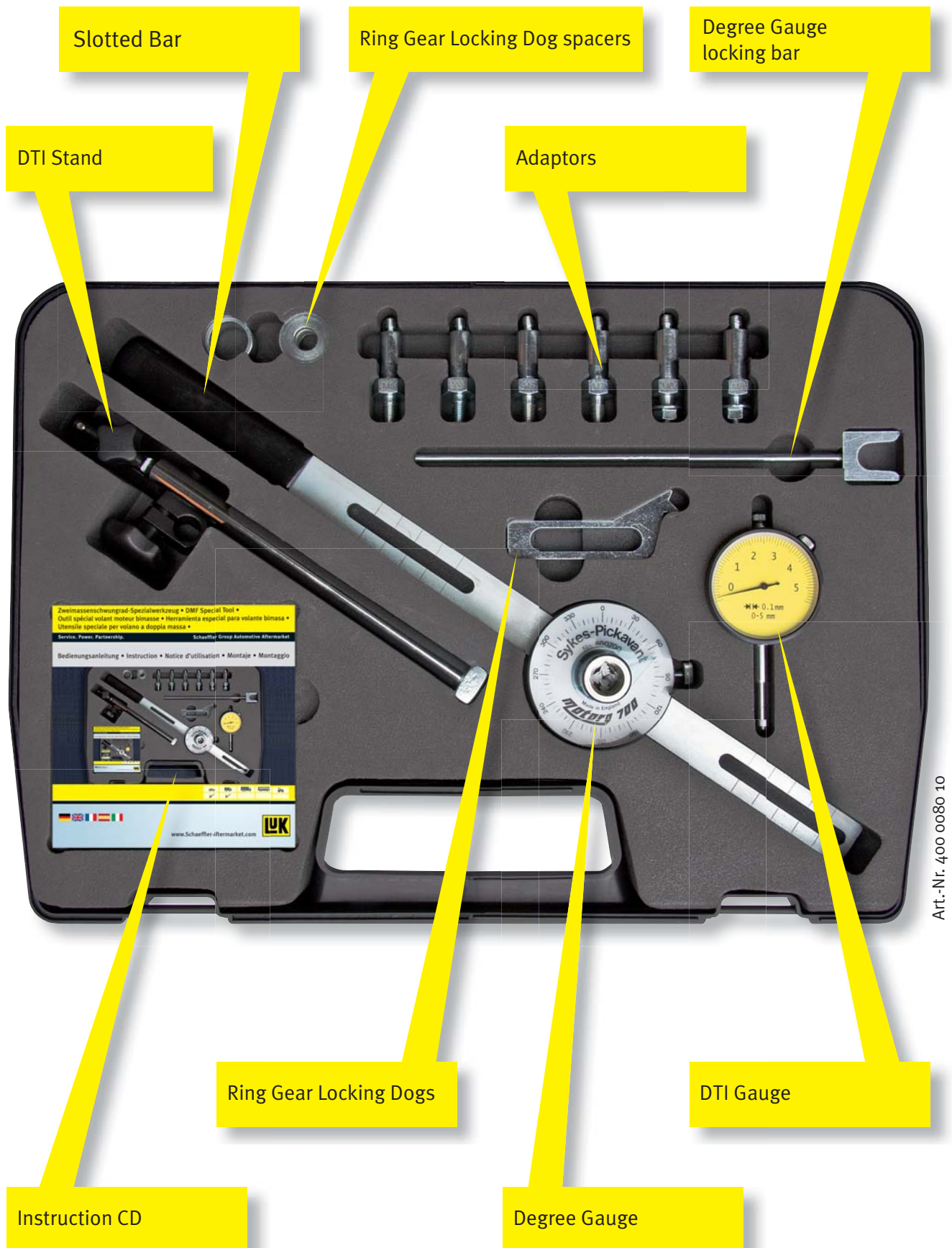
Art.-Nr. 400 0080 10



In addition, your assessment of the DMF's operational reliability should be based on the following criteria:

- grease egress;
- condition of the friction surface (e.g. signs of thermal load/thermal cracks);
- noise behaviour;
- condition of the clutch;
- loading condition of the vehicle (towing a trailer, driving school, Taxi, etc.);
- etc.

When uncertain, always replace the DMF along with the clutch. Further information on the design, function and failure diagnosis methods of a DMF can be found in the LuK technical brochure and on the DVD "dual mass flywheel – Technology & Failure Diagnosis".



6 DMF Function Tests

The LuK Special Tool allows you to perform the following tests on the dual mass flywheel:

- measuring the freeplay angle
- measuring the rock

These tests in combination with a visual inspection with regard to grease egress, thermal load, clutch condition, etc. allow for a reliable assessment of the DMF's operational condition.

The freeplay angle is the angle at which primary and secondary flywheels can be rotated against each other until load is exerted on the arc springs. The measuring points are both end stops in the left-hand and right-hand direction of rotation. The measured freeplay serves as a wear indicator. The measuring points for the freeplay in both directions is when the secondary mass is pushed against the spring and allowed to return to rest.

Caution!

Some DMF have a friction control disc that can be felt as a hard stop in one direction. In this case apply greater force to rotate the secondary mass a few more millimetres until spring resistance can be felt and then allow it to return. This also rotates the friction control disc in the DMF.

Rock describes the clearance between both DMF masses which allows them to be tilted towards and away from each other.

Caution!

Please note especially chapter 4.1 "General advice".

6.1 Which test suits which dual mass flywheel?



On dual mass flywheels with an even number of threaded holes to secure the clutch pressure plate the slotted bar can be mounted centrally making it possible to determine the freeplay angle using a degree gauge. As this measuring method can be used on almost all DMF types it should be the preferred method – see Chapter 6.2.



There are a few DMF types with an odd number of threaded holes for the clutch pressure plate making it impossible to mount the slotted bar centrally. In this case, the freeplay angle must be measured by counting the teeth of the starter ring gear – see Chapter 6.3.

The above distinction makes no difference when measuring rock – see Chapter 6.4.

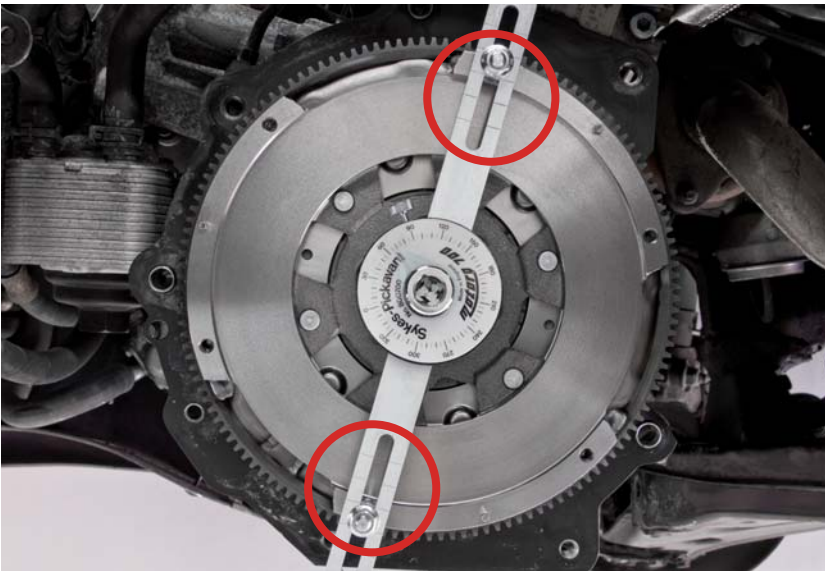
6 DMF Function Tests

6.2 Freeplay Measurement with Degree Gauge

1. Remove the gearbox and clutch according to the manufacturer's instructions.



2. Screw the appropriate adapters (M6, M7 or M8) into two vertically opposing clutch bolt holes on the DMF and torque down.



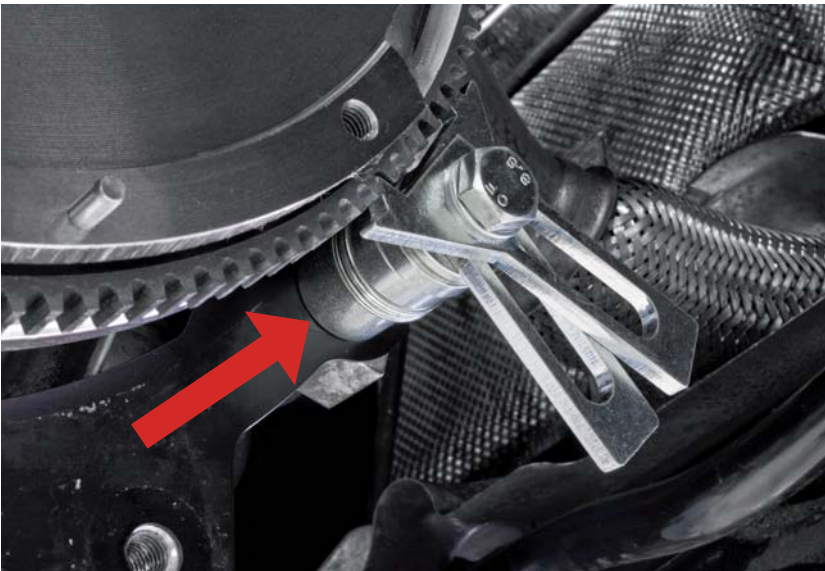
3. Centralise the slotted bar on the adapters by using the graduations and tighten the nuts.

The degree gauge must be positioned centrally on the DMF.



4. Lock the DMF using the locking dogs and, if necessary, appropriate spacers to align the locking tool flush with the starter ring gear.

If the distance exceeds the size of the provided spacers, use additional washers.



If the locking tool can only be mounted to hole with a dowel fitted, use the adaptor sleeve provided over the dowel.

6 DMF Function Tests



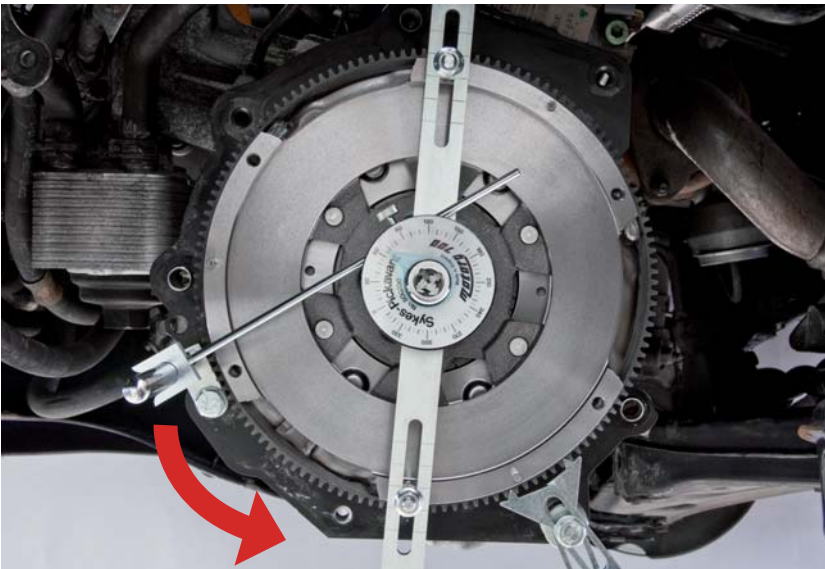
5. Bolt the dial gauge stand to the engine block using a suitable bolt i.e. a gearbox bolt and, if required, the adaptor sleeve can be used similar to the locking tool.



The same bolt can be used to fasten the locking dogs and the dial gauge stand if required.



6. Fit the degree gauge locking bar to the degree gauge and the Dial gauge stand and tighten the knurled screw.

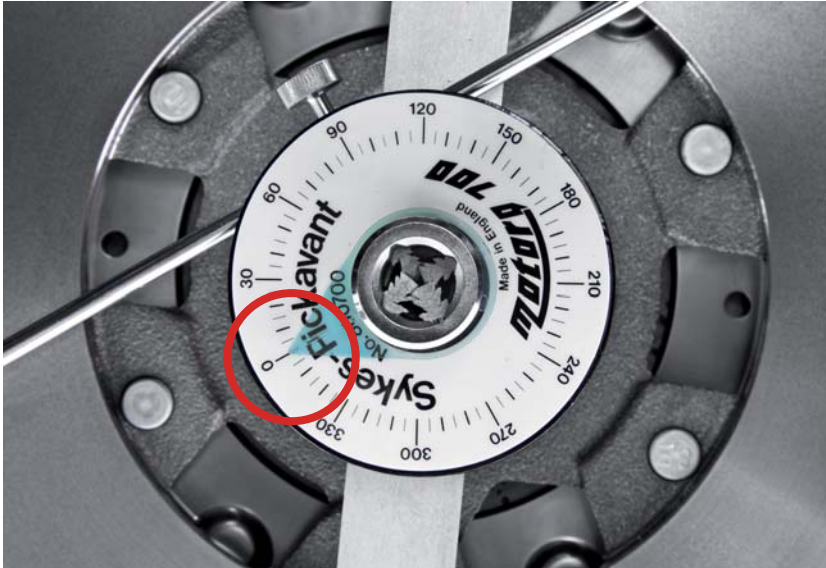


7. Use the slotted arm to rotate the secondary flywheel anticlockwise until the arc spring force can be felt.

Caution!

Some DMF have a friction control disc that can be felt as a hard stop in one direction. In this case apply greater force to rotate the secondary mass a few more millimetres until spring resistance can be felt and then allow it to return. This also rotates the friction control disc in the DMF.

6 DMF Function Tests



8. Slowly release the slotted arm allowing the arc springs to relax. Set the degree-gauge pointer to "0".



9. Use the slotted arm to rotate the secondary flywheel clockwise until the arc spring force can be felt.

Caution!

Some DMF have a friction control disc that can be felt as a hard stop in one direction. In this case apply greater force to rotate the secondary mass a few more millimetres until spring resistance can be felt and then allow it to return. This also rotates the friction control disc in the DMF.



10. Slowly release the slotted arm allowing the arc springs to relax. Read off the degree gauge and compare the measurement against the rated value – see rated value table in Chapter 7.

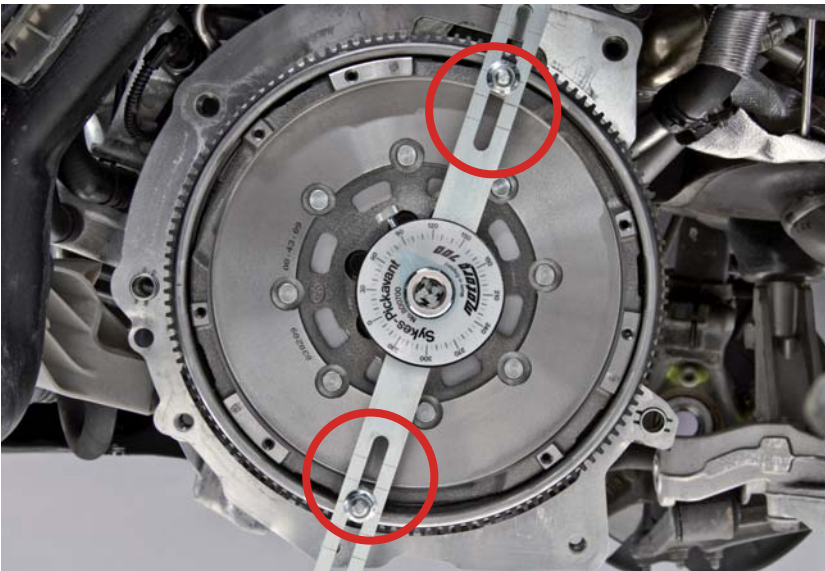
6 DMF Function Tests

6.3 Freeplay Measurement by counting starter ring gear teeth

1. Remove the gearbox and clutch according to the manufacturer's instructions.



2. Screw the appropriate adapters (M6, M7 or M8) into two approximately vertically opposing clutch bolt holes on the DMF and torque down.



3. Centralise the slotted bar on the adapters by using the graduations and tighten the nuts.

As there are an odd number of clutch bolt holes, the slotted arm cannot be fixed centrally on the DMF.



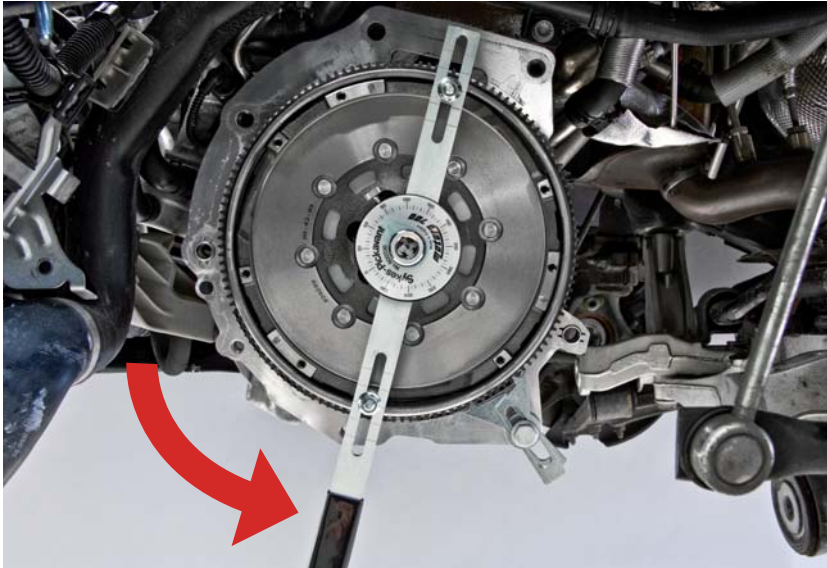
4. Lock the DMF using the locking dogs and, if necessary, appropriate spacers to align the locking tool flush with the starter ring gear.

If the distance exceeds the size of the provided spacers, use additional washers.



If the locking tool can only be mounted to hole with a dowelfitted, use the adaptor sleeve provided over the dowel.

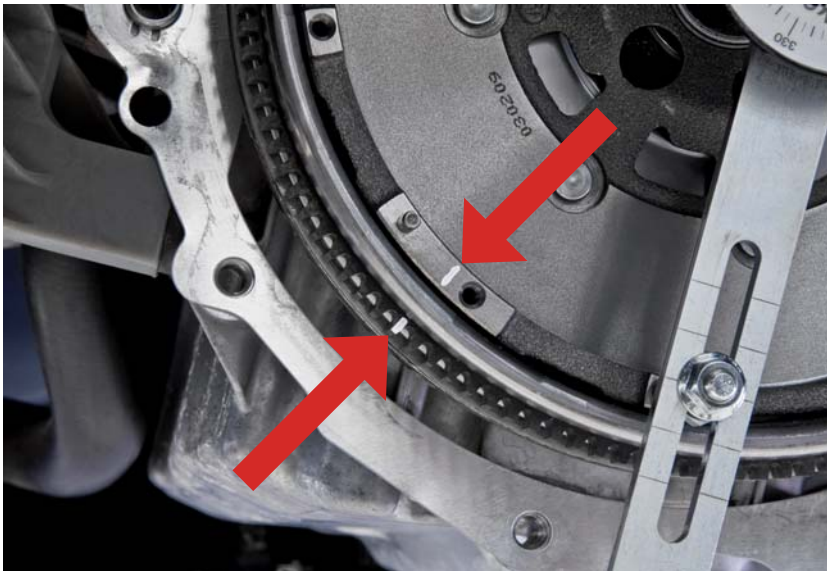
6 DMF Function Tests



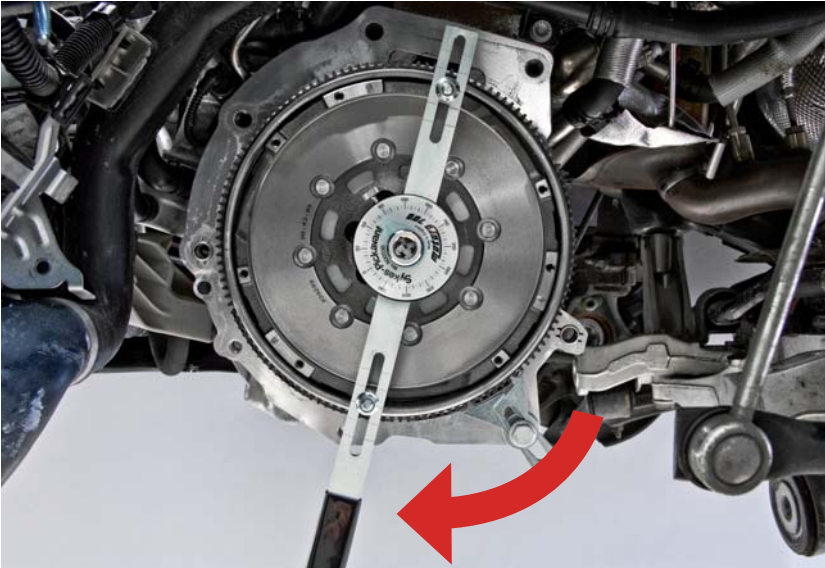
5. Use the slotted arm to rotate the secondary flywheel anticlockwise until the arc spring force can be felt.

Caution!

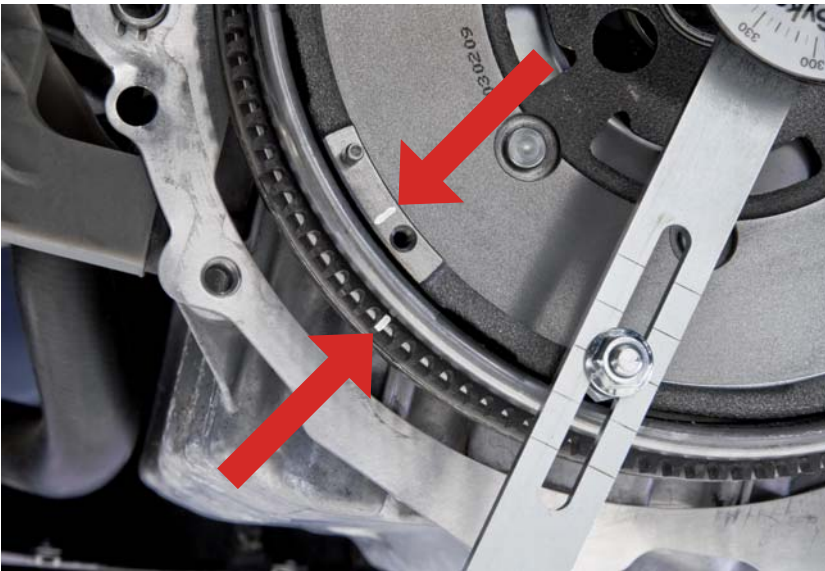
Some DMF have a friction control disc that can be felt as a hard stop in one direction. In this case apply greater force to rotate the secondary mass a few more millimetres until spring resistance can be felt and then allow it to return. This also rotates the friction control disc in the DMF.



6. Slowly release the slotted arm allowing the springs to relax. Mark the secondary flywheel and primary flywheel/startling ring gear with a line.



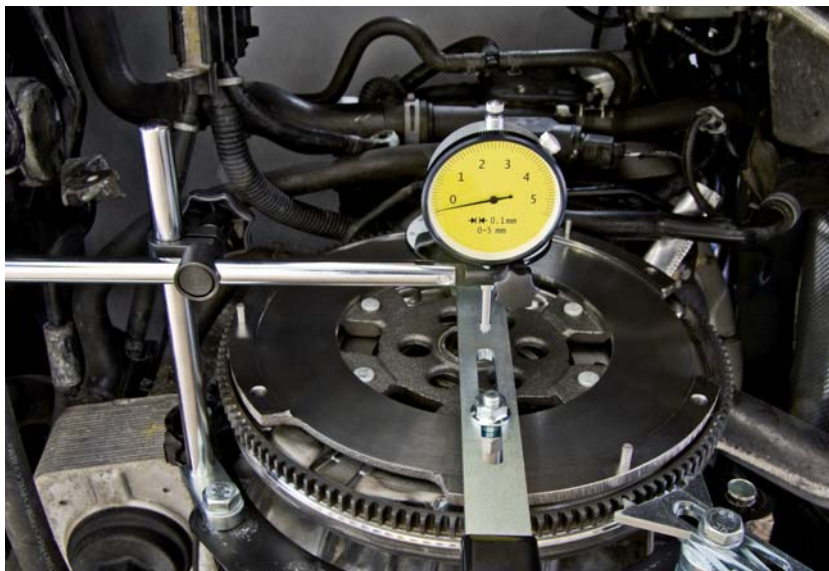
7. Rotate the secondary flywheel clockwise until the arc spring force can be felt. Slowly release the slotted arm allowing the arc springs to relax.



8. Count the number of teeth of the starter ring gear between the original mark and its current position and compare against the rated value – see rated value table in Chapter 7.

6 DMF Function Tests

6.4 Rock Measurement



1. Fit the Dial Gauge and arm to the dial gauge stand.



2. Centralise the dial gauge on the adapter and set to the required preload.

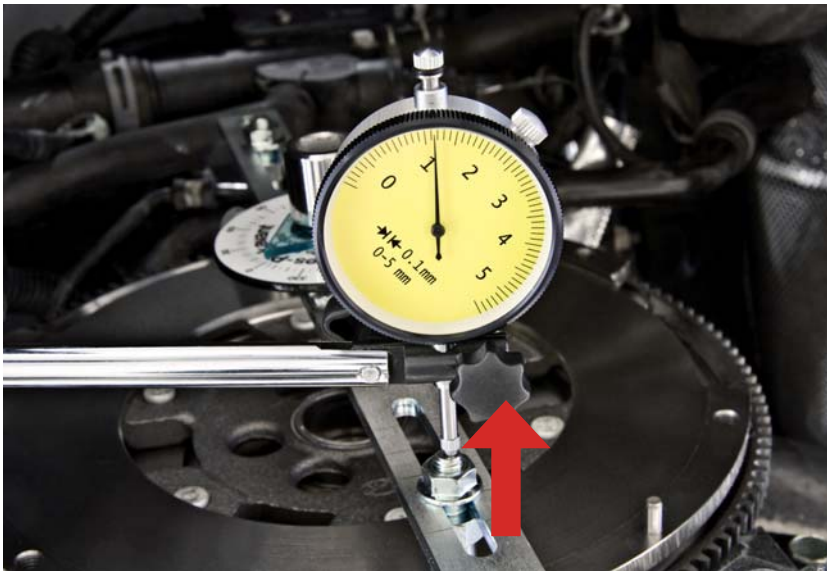
Caution!

The measurement **should** be done gently. Applying too much force will result in inaccurate measurements and could damage the DMF.



3. Gently push the slotted arm toward the engine (using for example your thumb) until resistance can be felt.

Keep the slotted arm in this position while setting the dial gauge to "0".



4. Pull the lever gently in the opposite direction (using for example your finger) until resistance can be felt. Read off the dial gauge and compare the measurement against the relevant rated value – see rated value table in Chapter 7.

7 Rated Values

The rated values for freeplay angle and rock vary depending on the type of DMF. Detailed information is available on this CD, the DMF DataWheel or on the Internet at:

www.RepXpert.com or

www.Schaeffler-Aftermarket.com
(navigate to Service, Special Tools, DMF Special Tool).

Rated value tables on the Internet are updated on a regular basis with new DMF / DFC introduced.

8 Bolts for dual mass flywheels (DMF) and compact DMF (DFC)

Professional replacement of DMFs or compact DMFs (DFC) should also include the use of new bolts. This is because the bolts used are stretch bolts and/or bolts with microencapsulation.

Why do the DMF/DFC bolts need to be replaced?

Due to continuous, strong alternating loads, specially designed bolts are used to secure flywheels. These are usually stretch bolts or bolts with microencapsulation.

Stretch bolts have an antifatigue shaft that only covers around 90 % of the thread core diameter.

When tightened to the torque specified by the vehicle manufacturer (in some cases plus a fixed angular value) the stretch bolt becomes an elastic bolt. The resulting torque is greater than the external force acting on the flywheel during operation. The elasticity of the stretch bolt means it can be stretched right up to the elastic limit.

As they do not possess these properties, normal set screws would break after a certain amount of time due to material fatigue, even if they were strong enough in their design.

Bolts with microencapsulation (these can also be stretch bolts) seal off the clutch chamber from the crankshaft chamber filled with engine oil. This is necessary because the threaded holes in the crankshaft flange are open to the crankcase.

These coatings also have adhesive and gripping properties, eliminating the need for any further bolt retaining devices.

Bolts that have already been used must not be used again. Experience has shown that these snap when they are tightened. In addition, their sealing and gripping properties are no longer effective.



Due to the aforementioned reasons, Schaeffler Automotive Aftermarket oHG supplies DMFs/DMCs incl. the necessary bolts and also offers sets of bolts that can be ordered separately.

Why are all DMFs not supplied with the necessary bolts?

The required bolts are already supplied together with some of the approx. 350 different article numbers that make up the delivery programme. However, for many DMFs, different bolts are required depending on the vehicle model.

For this reason, all DMFs have their own reference/order code, which indicates whether or not the bolts are included in the delivery.

In cases where the bolts are not included in the delivery of a DMF, Schaeffler Automotive Aftermarket oHG offers sets of bolts appropriate for the vehicle on which the DMF will be used.

Where can I find information on this topic?

All DMFs/DFCs available for sale are listed in our usual sales literature (online catalogue, RepXpert, Schaeffler catalogue CD, printed catalogue) and are linked to the corresponding vehicles.

Sets of DMF bolts, which must be ordered separately, can also be found there.

You can find the torques required for specific vehicles in the TecDoc online catalogue and the available repair information at www.Repxpert.com.

Notes

[illegible]

Notes

[illegible]

					
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Phone: +49 (0) 1801 - 753-333
Fax: +49 (0) 6103 - 753-297

LuK-AS@Schaeffler.com
www.Schaeffler-Aftermarket.com