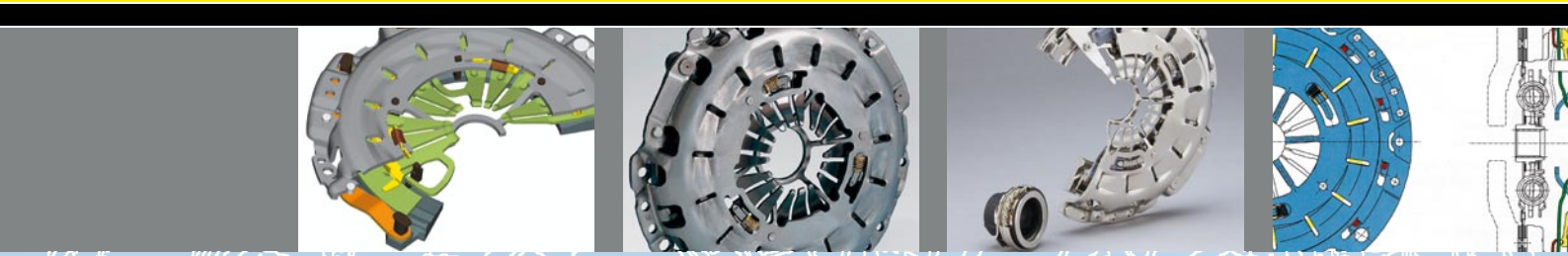
Self-Adjusting Clutch (SAC)

Technology

Special Tools



Self-adjusting clutch (SAC)

SAC for increased driver comfort!

As clutches are subject to constant wear and tear during operation, LuK, as the first clutch manufacturer worldwide, has invested tremendous efforts in the development of a wear adjustment solution which finally has been launched for volume production in 1995.

The self-adjusting clutch SAC has asserted itself in a large number of motor vehicles. In particular in cars with large engines, the actuation of the clutch is achieved far more comfortably with the SAC.

Increased clutch life due to the sensor diaphragm spring.

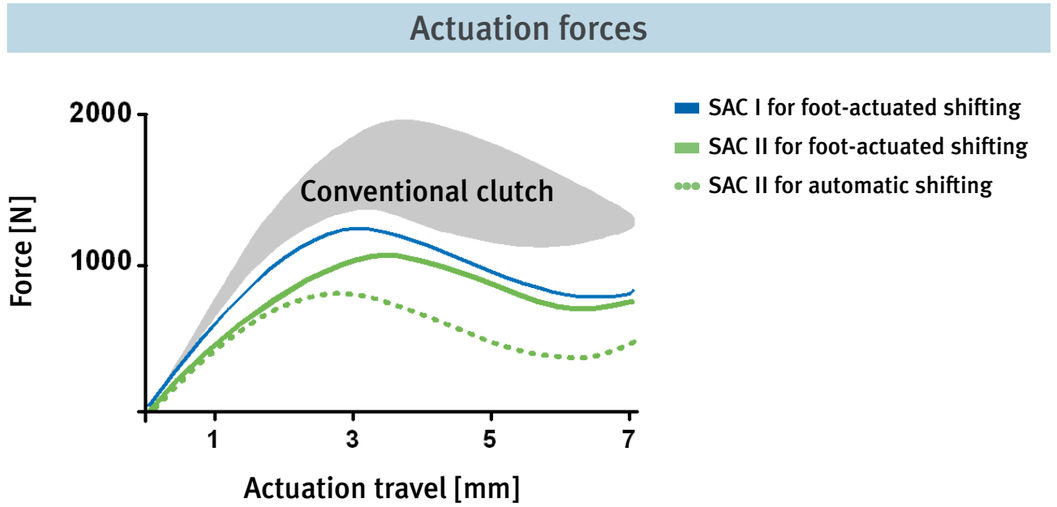
The self-adjusting clutch (SAC) uses a load sensor (sensor diaphragm spring) to activate its wear adjustment function by turning a ramp ring. This wear adjusting mechanism reduces the required actuation forces while increasing the service life of the clutch by around 1.5 times. In addition, the actuation forces remain nearly unchanged throughout the entire clutch life. The SAC wear-adjustment system – which consists of the sensor diaphragm spring (load sensor) and a deep-drawn steel adjusting ring – is characterised by its excellent functional accuracy. As clutch actuation comfort requires a harmonic operating load curve in addition to low actuation forces, the SAC was designed with the capacity to be tuned to each vehicle's specific characteristic curve. One such feature is the compensation spring, which is able to generate the flatter characteristic curves that are frequently desired.

Further improvement of the system by the newly developed SAC II.

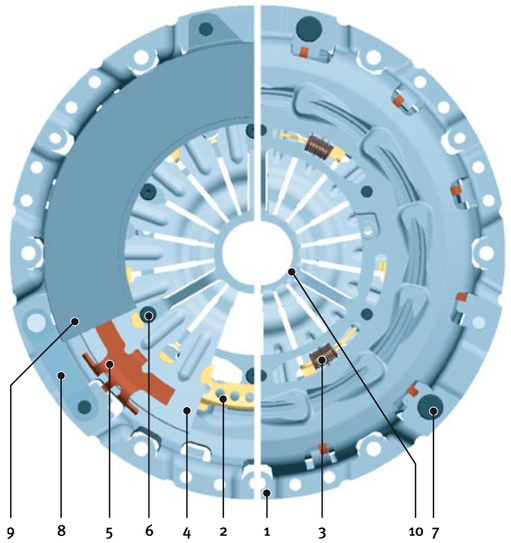
The new SAC II does not use a second diaphragm spring as load sensor, but sensor fingers formed from the main diaphragm spring and special tangential leaf springs with a regressive characteristic curve.

System optimisation through special designs

The modified SAC II concept allows for the further reduction of the actuation forces and/or optimisation of the actuation force curve. With this clutch type, the performance curve of the load sensor is modified in a way that makes the clutch adjustment mechanism less sensitive to large actuation strokes. This is achieved by using leaf springs with a regressive characteristic curve and a sensor diaphragm spring with linear characteristic curve which engages outside the pivot point of the main diaphragm spring. In many cases, the load sensor can be formed directly from the diaphragm spring in the form of sensor fingers. This design requires no sensor diaphragm spring at all. With the new SAC II the actuation forces can be decreased by up to 15% at an identical torque transfer capacity. Alternatively, the maximum actuation force remains unchanged to use the potential to optimise the characteristic curve.



Self-adjusting diaphragm spring clutch (SAC)



1 Engine side
2 Adjusting ring
3 Pressure spring
4 Diaphragm spring
5 Sensor diaphragm spring
6 7 Stud
8 Tangential leaf spring
9 Pressure plate
10 Cover limit stop

In recent years self-adjusting clutches have become the standard equipment in applications with higher engine torque or with increased requirements for wear reserve.

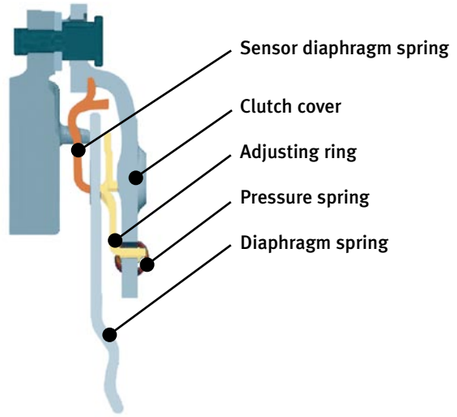
The essential advantages of the SAC over conventional designs are:

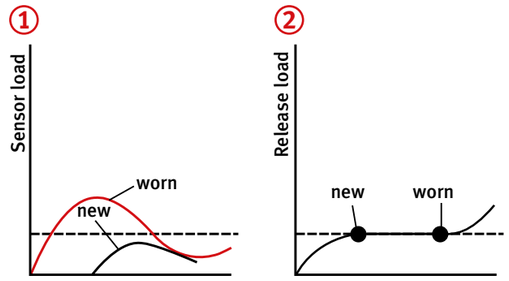
- low release loads which remain constant throughout the entire service life
- therefore, excellent driving comfort over the entire service life
- increased reserve for wear and consequently extended service life thanks to automatic wear adjustment
- release bearing over-travel is limited by the diaphragm spring end stop

This results in a number of further advantages:

- simplified release system layout
- shorter pedal travel
- new opportunities to reduce the clutch diameter (torque transfer)
- shorter release bearing travel throughout the bearing life

Operating principle of the SAC





Load sensor

On the clutch with wear adjustment the load sensor detects the increased release load due to wear and correctly compensates for the reduction in facing thickness. The graphic shows a function scheme of the SAC. Unlike the conventional clutch, the (main) diaphragm spring is supported by the so-called sensor diaphragm spring instead of being riveted to the cover.
In contrast to the strongly regressive main diaphragm spring, the sensor diaphragm spring provides a sufficiently wide range of almost constant load.
The constant load range of the sensor diaphragm spring is designed to be slightly higher than the desired release load. As long as the release load is smaller than the load of the sensor spring when disengaging the clutch, the pivot point of the main diaphragm spring remains stationary. When facing wear increases the release load increases, the counterforce of the sensor spring is overcome and the pivot point moves towards the flywheel to a position where the release load again falls below the sensor load. When the sensor spring deflects, a gap develops between pivot point and cover, which can be compensated for by introducing for example a wedge-shaped component.

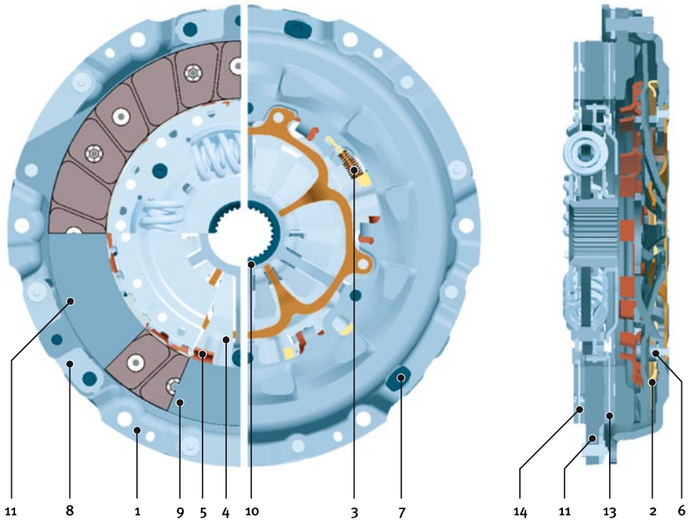
Design of a self-adjusting clutch with load sensor

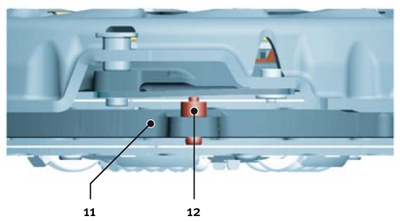
The load sensor with the thickness adjustment wedge can be realized in a simple and effective manner. In comparison to the conventional clutch, the only additional parts required by this design are a sensor diaphragm spring orange and a ramp ring yellow. The sensor diaphragm spring is suspended in the cover. Its inside fingers support the main diaphragm spring. Because of centrifugal forces, the wedges that provide the actual adjustment are positioned in circumferential direction. A steel adjusting ring with ramps moves on opposing ramps in the cover. The steel adjusting ring is pre-loaded in circumferential direction with pressure springs which force the ring to fill the gap between the diaphragm spring and the cover when the sensor spring deflects. Graph ① shows the release load curves for a conventional clutch with new and worn facings. In contrast, compare the significantly lower release load of the SAC as shown in graph ②, which has a characteristic curve that remains virtually unchanged over its service life. An additional advantage is the higher reserve for wear, which no longer depends on the length of the diaphragm spring curve (as in conventional clutches), but rather on the ramp height, which can easily be increased to 3mm for small and up to 10mm for very large clutches. This represents a decisive step towards the development of clutches with high durability.

Multiple-disc self-adjusting clutch SAC

High-performance engines which generate engine torques above 500Nm require clutches which are able to transfer these torques. This involves an almost inevitable increase in pedal forces despite the use of a self-adjusting clutch. A variety of technological approaches kept the increase within reasonable limits (e.g. improved release systems); however calls for a clutch with reduced actuation forces grew louder.

Multiple-disc SAC





1 Clutch cover

2 Adjusting ring

3 Pressure spring

4 Diaphragm spring

5 Sensor diaphragm spring

6 7 Stud

8 Tangential leaf spring

9 Pressure plate

10 Cover limit stop

11 Intermediate pressure plate

12 Lift bolt

13 Clutch disc 1

14 Clutch disc 2

In contrast to the single-disc version, the multiple-disc SAC has an additional intermediate pressure plate and three more tangential leaf spring packages which ensure the lift of the intermediate pressure plate. To realise even wear of both clutch discs lift bolts are used to control the intermediate pressure plate. They make sure that the lift of the intermediate pressure plate is half as big as the lift of the pressure plate. A special version of the clutch disc can be modelled to suit vehicle applications which require a damped clutch disc to provide better insulation.

The benefit of the multiple-disc SAC is that it permits a reduction in release load for the same engine torque or, conversely, an increase in engine torque transfer at the identical release loads level. With engine concepts, where high engine torque is paralleled by high engine speeds, the multiple-disc SAC also offers the option of decreasing the facing outer diameter, which in turn improves the burst speed characteristic of the clutch discs. Furthermore, the downsizing of the clutch disc helps to stabilize or even slightly decrease the disc's mass moment of inertia compared to a single-disc system of corresponding clutch diameter.

Special Tooling

Special tool for mounting of the SAC without counteracting force (part no. 400 0072 10).

Using a special tool is an absolute must for the correct mounting of the self-adjusting clutch.
The special tool is suitable for all vehicle types. Never engage an SAC without flywheel and clutch Driven plate to avoid the turning of the adjusting ring. Using the special tool for pre-loading the clutch prevents the adjusting ring from turning in the clutch pressure plate.

Failure to use the special tool can damage the clutch pressure plate and lead to a malfunction of the clutch assembly.

If you have questions concerning the SAC or the correct use of the special tool (part no. 400 0072 10) call our technical hotline at: +49 (0)1 801-753-333

Mounting of the SAC using the special tool (part. no. 400 0072 10)

(1)

(2)

- Centre the pressure plate using the special alignment punch.
- Position the clutch cover over the flywheel (observe the centering pins). Do not tighten the clutch pressure plate!
- Screw in 3 long studs at 120 degree intervals, respectively in long studs at 90 degree intervals.

(3)

(4)

- Use the studs to adjust the fixture on the clutch pressure plate.
- Secure it to the studs using knurled bolts.

Note: Use four-hole pitch depending on the application!

(5)

- Then turn the fixture until the diaphragm spring is engaged. Be careful to stop rotating when the clutch cover rests against the contact surface of the DMF.

(6)

(7)

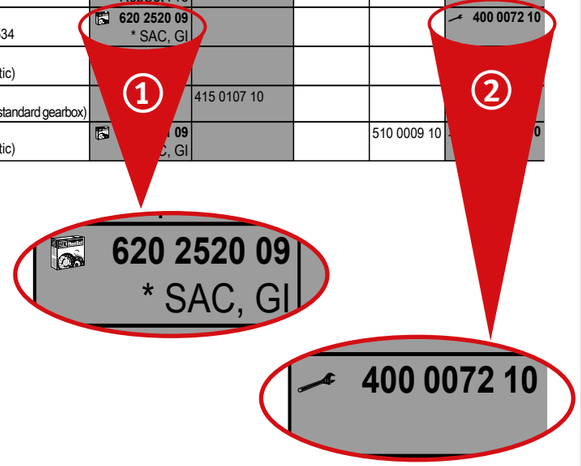
- When the diaphragm spring is engaged, turn in and torque down the cover bolts.
- Then rotate the fixture in the opposite direction to relieve the diaphragm spring, unscrew the knurled bolts and remove the fixture.
- Remove the alignment punch, tighten the bolt and fasten the remaining three-quarter inch screws of the cover.

New information in the LuK PC catalogue

Sample page from the LuK PC clutch catalogue

MERCEDES-BENZ

	2001... 2002... 2003...			LuK RepSet				SERVICE
MERCEDES-BENZ								
A-KLASSE/CLASS (W168)								
A 160 CDI	07.98 - 02.01	OM668.941; (44 KW)	168.007, →J 381534	**620 2520 33** * RepSet Pro			510 0009 10	
			168.007, →J 381534	**620 2520 09** * SAC, GI				**400 0072 10**
			168.007, (Semi-Automatic)					
			168.007, (Schaltgetriebe/standard gearbox)		415 0107 10			
A 160 CDI	02.01 - 08.04	OM668.940; (55 KW)	168.006, (Semi-Automatic)	**09** C, GI			510 0009 10	**0**



The information in the RepSet column in the revised edition of the LuK PC catalogue for passenger car and light van clutches now also indicates, whether the kit includes a self-adjusting clutch (SAC)[①]. In addition, the SERVICE column includes a reference to the special SAC mounting tool.[②]

Your notes

Your notes

 LuK	✓	✓	✓	✓	✓
 INA	✓	✓			
 INA	✓	✓	✓	✓	
 INA	✓	✓	✓	✓	
 INA	✓	✓			
 LuK	✓	✓	✓	✓	
 LuK	✓	✓			
 FAG	✓	✓	✓	✓	

Telefon: +49 (0) 1801 753-333
Telefax: +49 (0) 6103-753-297

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

999 6002 490 2187/2.0/8.2008/OD-GB