LuK Self-Adjusting Clutch (SAC)

Technology
Special tool/User instructions

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Content

1	**Development History of the Self-Adjusting Clutch (SAC)**	**7**
2	**Comparing Standard Diaphragm Spring Clutches and Self-Adjusting Clutches**	**8**
3	**Self-adjusting diaphragm spring clutch SAC** (force controlled)	**10**
3.1	Self-adjusting diaphragm spring clutch SAC I	10
3.2	Self-adjusting diaphragm spring clutch SAC II	12
3.3	Self-adjusting diaphragm spring clutch SAC III	13
3.4	Multiple-disc self-adjusting clutch	14
4	**Self-adjusting diaphragm spring clutch** (travel controlled)	**15**
6	**Special tools for SAC disassembly/installation without applying counteracting forces**	**17**
7	**Centring the clutch disc**	**18**
7.1	Universal centring pin – assembly options	18
7.2	Centring procedure on BMW models	19
8	**Mounting the SAC** (force- and travel controlled)	**20**
8.1	Sample installation – spindle carrier with 3-hole pitch	21
8.2	Sample installation – spindle carrier with 4-hole pitch	23
8.3	Installation instructions for BMW models	25
8.4	Designs with pilot bearing support in the crankshaft	26
8.5	Designs with pilot bearing in the primary shaft	27
8.6	Note on mounting pre-tensioned Audi, SEAT, Škoda and VW self-adjusting clutches	29
8.7	Disassembly of the SAC	31


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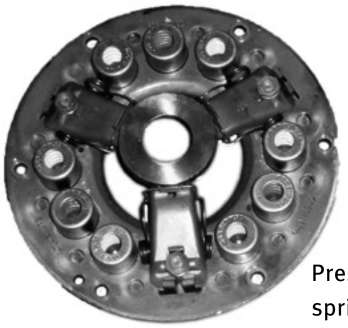
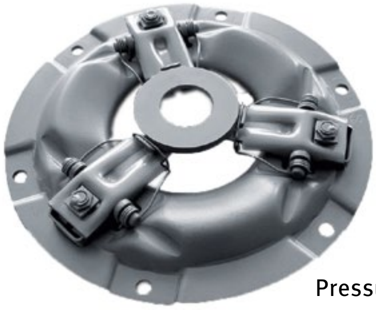
1 Development History of the Self-Adjusting Clutch (SAC)

In 1965, Dr. Georg Schaeffler and Dr. Wilhelm Schaeffler founded LuK GmbH (multi-disc and clutch production) in Bühl, Germany. The company was the first clutch manufacturer to set itself the challenge of replacing the coil spring clutch with the diaphragm spring clutch and introducing it into passenger car production across Europe. It was initially mass produced for the VW midsize model “Type 3”.



Pressure plate of a coil spring clutch

The benefits were such that from the beginning of the 1970s, pressure plates with coil springs gradually disappeared from car manufacturing. First it was a closed disc spring then a split disc spring that provided the necessary clamp load to transmit the engine torque. For the driver, this meant even more driving comfort in comparison to the coil spring clutch, as the lower release load required far less pedal effort.



Pressure plate of an early diaphragm spring clutch

It took a number of years before vehicles of every performance class were finally fitted with this type of clutch. But from the 90s onwards, ever greater technological progress led to a rapid increase in engine torque, and with that came new challenges for the old diaphragm spring clutch. One of these challenges was in the linear relation between the transmissible engine torque and the required actuation force. Despite the increasing engine power, the driver could not be expected to apply proportionately more force to the clutch pedal. The greatest challenge by far was the increasing actuation force required in the case of lining wear – an unwanted behavior of the disc spring. This can increase by up to 40% over its service life compared to a new clutch.

Pressure plate of a standard diaphragm spring clutch

In light of this, it became evident that the diaphragm spring clutch could no longer do long-term justice to the needs of high-power vehicles. And so the company got to work on a system that would reliably compensate for the impact of the lining wear over the entire service life of the clutch. The resulting self-adjusting clutch (SAC) is now an integral part of high-performance drives. It provides for excellent comfort over the entire service life, even when high torques need to be transmissioned.

Pressure plate of a self-adjusting clutch

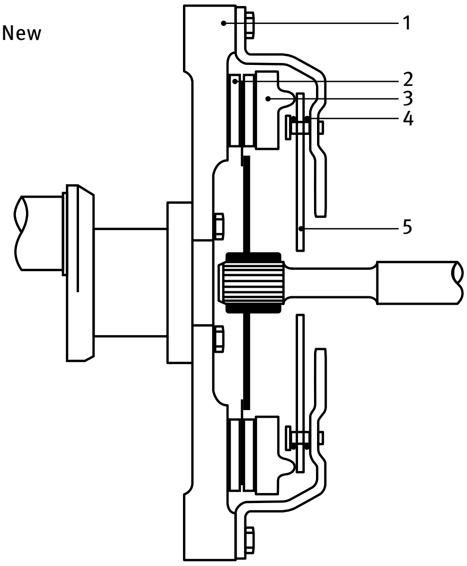
2 Comparing Standard Diaphragm Spring Clutches and Self-Adjusting Clutches

Standard Diaphragm Spring Clutch

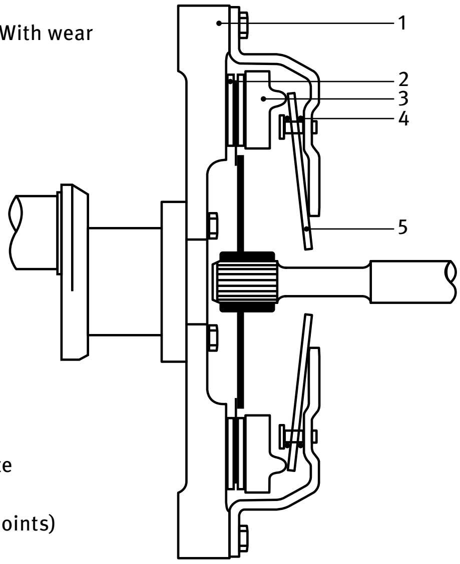
Its operating principle is based on different types of friction. Sliding friction means that the start-up is stick-slip free. But friction also leads to wear debris. This mainly affects the clutch linings. And so the lining is worn down over the service life – like the wear of brake pads on a vehicle. Inside the clutch, this reduces the distance between the pressure plate and the flywheel.

It also affects the disc spring, because its outer radius activates the pressure plate. As the disc spring is set in the clutch cover like a rocker between two fixed pivot points – the "pivot rings" – the changes transfer directly to their inner radius. This causes the disc spring to rub against the clutch release bearing if there is lining wear.

New



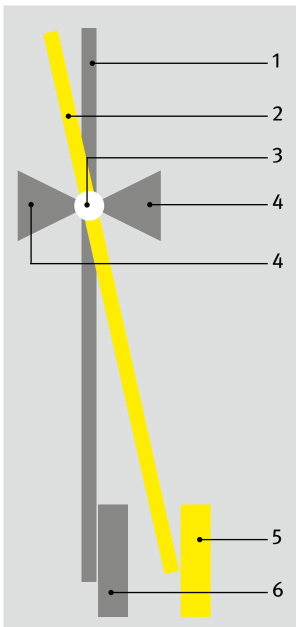
With wear



1 Flywheel
2 Clutch lining
3 Pressure plate
4 Pivot rings (fixed pivot points)
5 Disc spring

The "rubbing" of the disc spring leads to the unwanted side effect of having to increase the actuation force. This increase must be taken into account in the design of a clutch, because it should be smooth to operate for its entire lifetime. If the requirements on the transmissible torque increase with the same size clutch, the clamp load must be increased at the cost of the pedal force. For powerful engines, this would lead to a significant drop in ease of use in the final phase of the clutch life. It soon becomes clear that the transmissible torque cannot be increased as required with a standard diaphragm spring clutch. We could reduce the actuation force with more powerful release systems, but not to the extent to which the requirements have increased. Up to a certain torque level, the technology of the standard diaphragm spring clutch is sufficient, and that is why it is still the most popular type of clutch. However, it does not have the capacity for powerful drive concepts. It is also difficult to use in auto-shift gearboxes due to the wear-related changes in power and travel.

If wear has occurred, the angle of the disc spring changes to the reset position



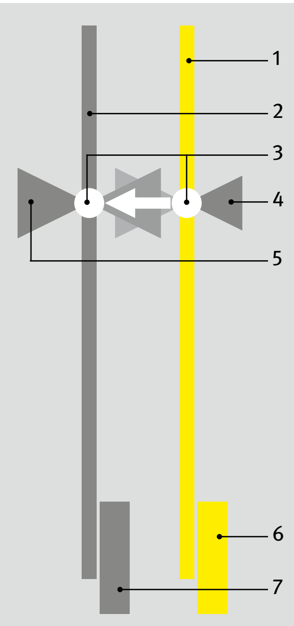
1 Reset position of the disc spring with new lining
2 Reset position of the disc spring with worn lining
3 Fixed pivot point of the disc spring
4 Fixed pivot point (pivot ring)
5 Reset position of the clutch release bearing with worn lining
6 Reset position of the clutch release bearing with new lining

These challenges were reason enough to turn to a new type of solution. The foundations were set for the development of the self-adjusting clutch.

Self-Adjusting Clutch (SAC)

The SAC is a self-adjusting diaphragm spring clutch, which, regardless of the lining wear, features a constant actuation force at constant actuation travel. In contrast to the conventional clutch, the disc spring moves between variable pivot points in the self-adjusting clutch. These are shifted with the help of a power or travel-controlled system. It responds to changes in the diaphragm spring load or pressure plate travel. The pivot points are always shifted exactly according to the amount of lining wear in the clutch cover. This keeps the angle conditions as well as the force and travel properties of the disc spring constant over its entire service life.

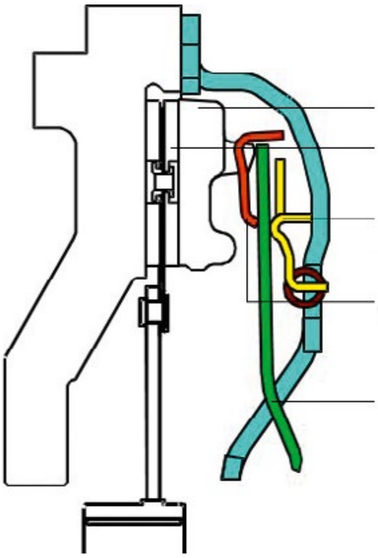
In case of wear, the angle of the disc spring remains unchanged in the reset position



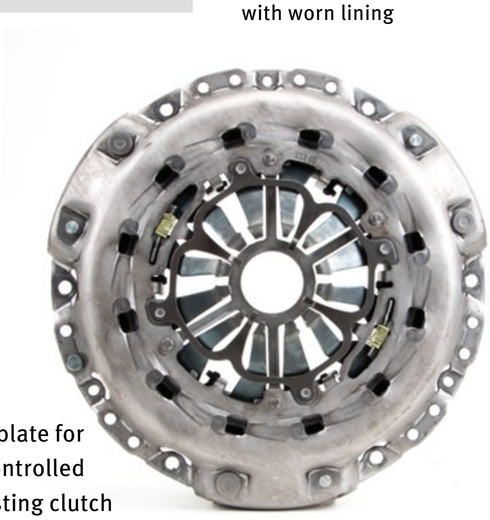
1 Reset position of the disc spring with new lining
2 Reset position of the disc spring with worn lining
3 Variable pivot point of the disc spring
4 Variable pivot point (ramp ring)
5 Variable pivot point (e.g. sensor disc spring)
6 Reset position of the clutch release bearing with new lining
7 Reset position of the clutch release bearing with worn lining

In the force-controlled self-adjusting clutch shown below, the pivot points of the disc spring are shifted using a spring system which responds to changes in the operating force.

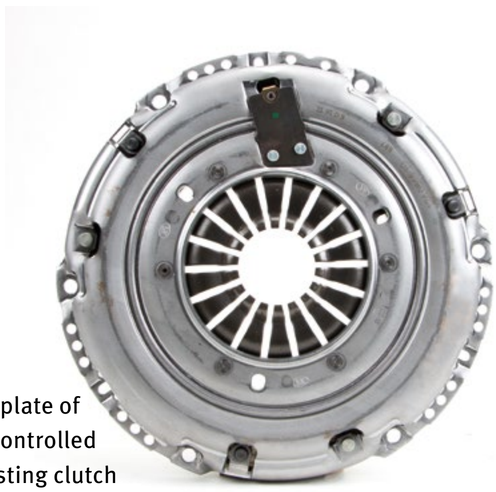
Structure of a force-controlled self-adjusting clutch



The travel-controlled self-adjusting clutch uses changes in the pressure plate travel to adjust the pivot points of the disc spring if wear has occurred. Force and travel-controlled pressure plates are used by reputable vehicle manufacturers. This brochure describes the structure and function of both self-adjusting clutch systems.



Pressure plate for a force-controlled self-adjusting clutch



Pressure plate of a travel-controlled self-adjusting clutch

3 Self-adjusting diaphragm spring clutch SAC (force controlled)

3.1 Self-adjusting diaphragm spring clutch SAC I

In recent years, the increase in torque in new engines has developed at a remarkable pace. This has inevitably led to clutch systems with increased clamp loads, which in turn results in higher actuation forces. The resulting compromise on comfort is effectively countered by the Self-Adjusting Clutch (SAC).

Operating principle of the SAC self-adjusting clutch

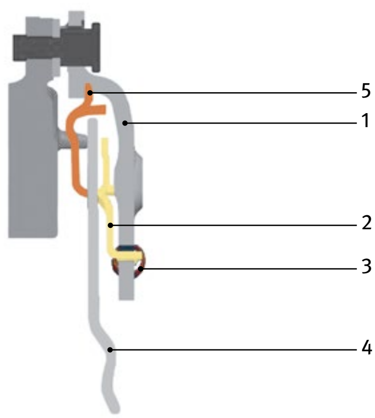
On a clutch with wear adjustment, a sensor detects the increased release load due to wear and correctly compensates for the reduction in lining thickness (wear compensation with force control). The key difference between this and a conventional clutch is that the (main) diaphragm spring is supported by a 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. As soon as the amount of force rises slightly above the release load, the sensor diaphragm spring deforms. As long as the release load is smaller than the load of the sensor spring, the pivot point of the main diaphragm spring remains stationary when the clutch disengages. When lining wear increases, the release load increases, the counterforce of the sensor diaphragm spring is overcome and the pivot point moves toward 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 by a ramp ring.

Wear adjustment function

The force sensor with the thickness adjustment wedge can be realized in a simple and elegant manner with ramps that move towards each other. In comparison to a conventional clutch, the only additional parts required are a sensor diaphragm spring (red) and an adjuster ring (yellow). The sensor diaphragm spring is suspended in the cover and supports, together with its inside fingers, the main diaphragm spring. The ramps bring about the self-adjustment effect. Due to the centrifugal forces, they are arranged in a circumferential direction. The ramp ring runs on opposing ramps in the cover. It is preloaded in the circumferential direction via pressure springs that force the ring to fill the gap between the diaphragm spring mount and the cover when the sensor spring deflects.

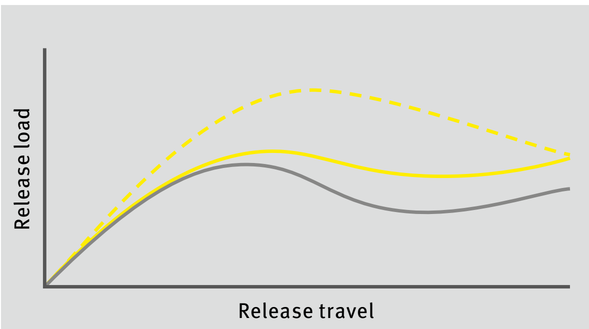
Schematic representation of the SAC system

1 Clutch cover
2 Ramp ring
3 Pressure spring
4 Diaphragm spring
5 Sensor diaphragm spring



The Figure below shows the release load profiles for a conventional clutch with new and worn linings. In contrast, the characteristic curve of the much lower release load of the self-adjusting clutch (SAC) remains virtually unchanged over its service life. An additional advantage is the higher wear reserve, 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 3 mm for small and up to 10 mm for very large clutches. This represents a decisive step toward the development of clutches with longer service lifetimes.

Comparison of release loads of a conventional clutch with those of the SAC



- Conventional diaphragm spring clutch, with wear
- Conventional diaphragm spring clutch, new
- Self-adjusting clutch, new and with wear

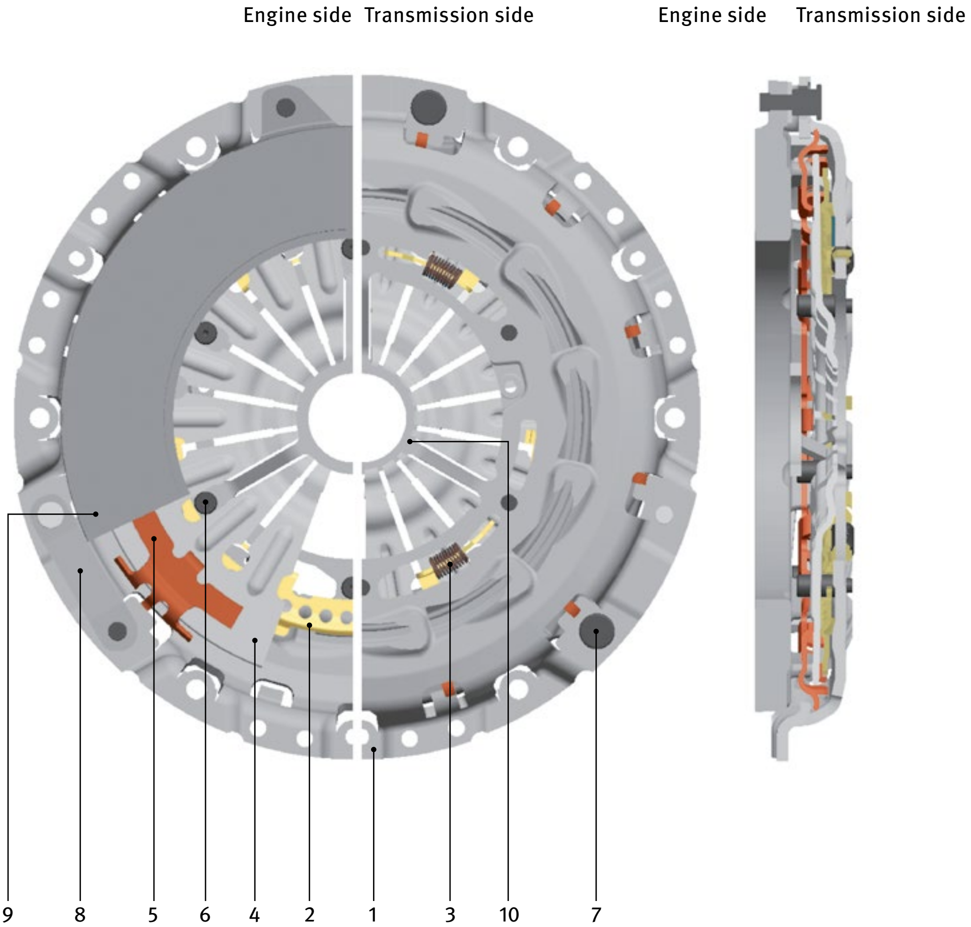
The key features of this design compared to the previous versions are:

- Lower release loads remaining virtually constant over the clutch life
- This increases driving comfort over the entire life of the clutch
- Increased wear reserve and consequently extended service life thanks to automatic wear adjustment

This results in a number of advantages:

- Simplified release systems
- Shorter pedal travel
- Constant pedal forces across the entire engine model range
- New ways of reducing the clutch diameter (torque transfer)
- Smaller release bearing working range throughout the service life

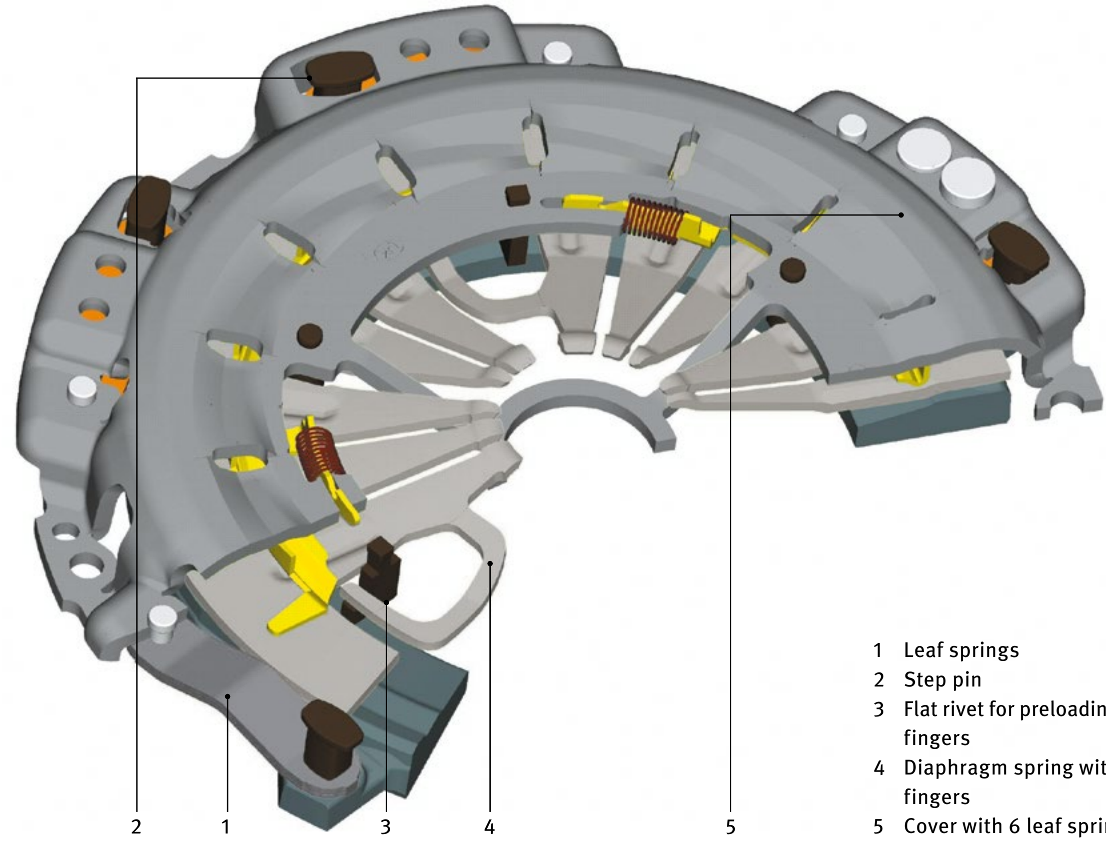
Sectional view of self-adjusting clutch



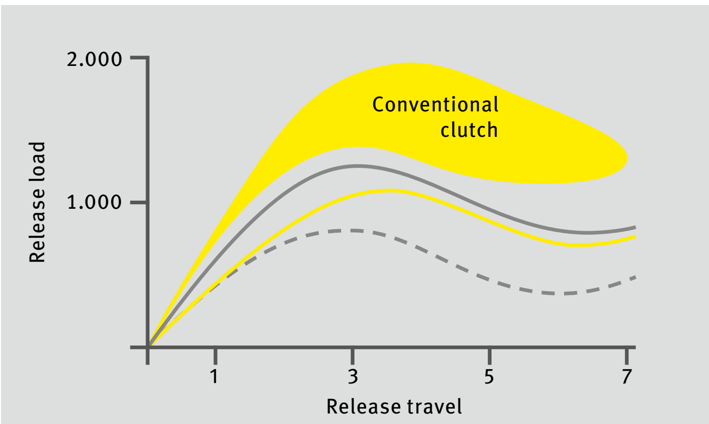
1 Clutch cover
2 Adjuster ring
3 Pressure spring
4 Diaphragm spring
5 Sensor diaphragm spring
6 Bolt
7 Bolt
8 Tangential leaf spring
9 Pressure plate
10 Cover stop

3.2 Self-adjusting diaphragm spring clutch SAC II

One approach to reducing the actuation forces, or optimizing the actuation force profile, is the refinement of the previous SAC I design. With this clutch type, the force sensor has altered so much in terms of its characteristic curve that with large actuation strokes, the clutch is less sensitive to self-adjustment. This is achieved by leaf springs with a regressive characteristic curve and a sensor diaphragm spring with a linear characteristic curve that attacks outside the pivot point of the main diaphragm spring. In many cases, this sensor diaphragm spring can also be formed directly from the diaphragm spring in the form of sensor fingers. This completely eliminates the need for the sensor diaphragm spring. The SAC II is able to reduce actuation forces by up to 15% with the same transmittable torque. Alternatively, the maximum actuation force can be left at the original level and the ensuing potential used to optimize the characteristic curve slope.



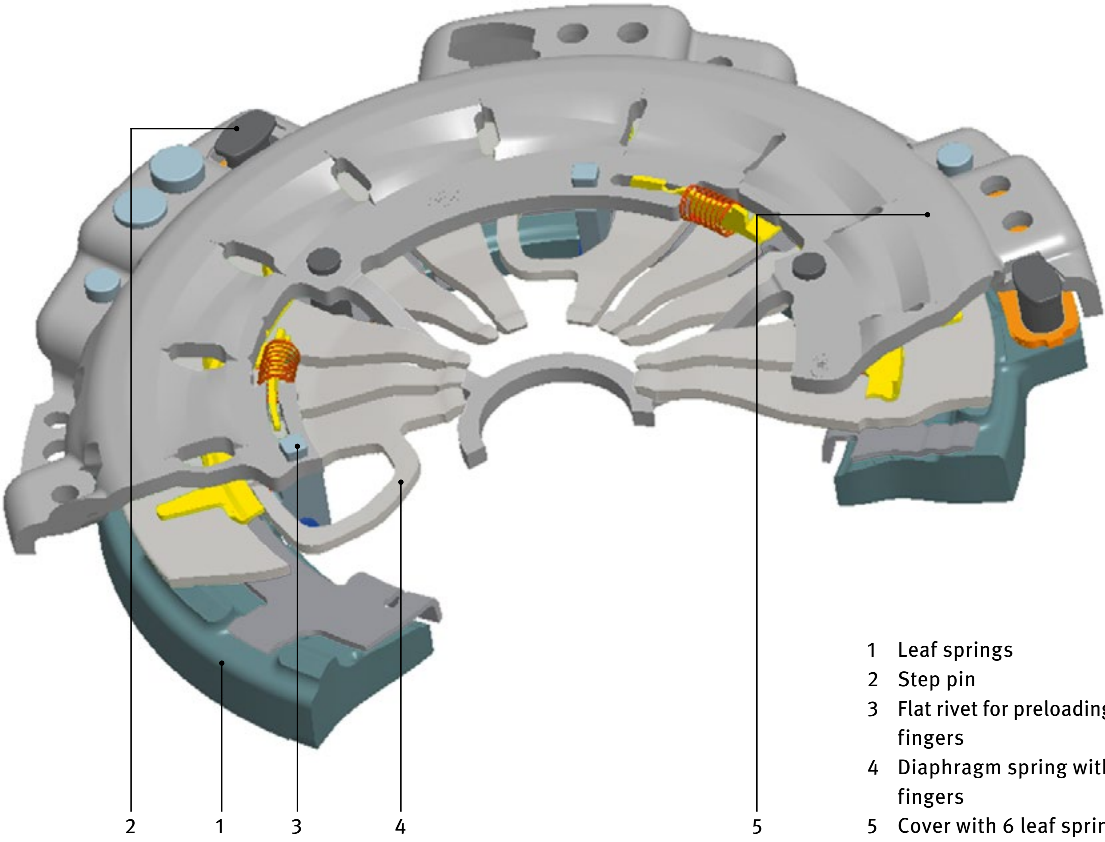
1 Leaf springs
2 Step pin
3 Flat rivet for preloading the sensor fingers
4 Diaphragm spring with sensor fingers
5 Cover with 6 leaf spring shackles



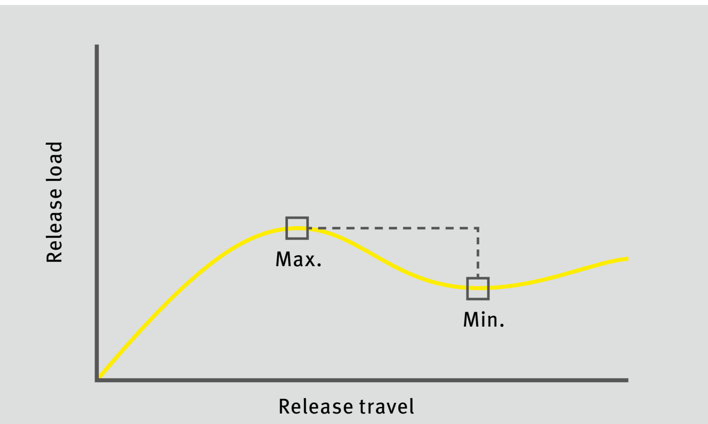
SAC I for pedal actuation
SAC II for pedal actuation
SAC II für automatic clutch

3.3 Self-adjusting diaphragm spring clutch SAC III

The SAC III is a further step in the development of the self-adjusting clutch. To further reduce the difference between the maximum and minimum operating force (Figure: Self-adjusting clutch III with reduced power difference), certain aspects of the earlier SAC II design were changed to achieve a more uniform force profile in the clutch pedal. Consequently, this version meets even the toughest comfort requirements of the premium segment.



1 Leaf springs
2 Step pin
3 Flat rivet for preloading the sensor fingers
4 Diaphragm spring with sensor fingers
5 Cover with 6 leaf spring shackles

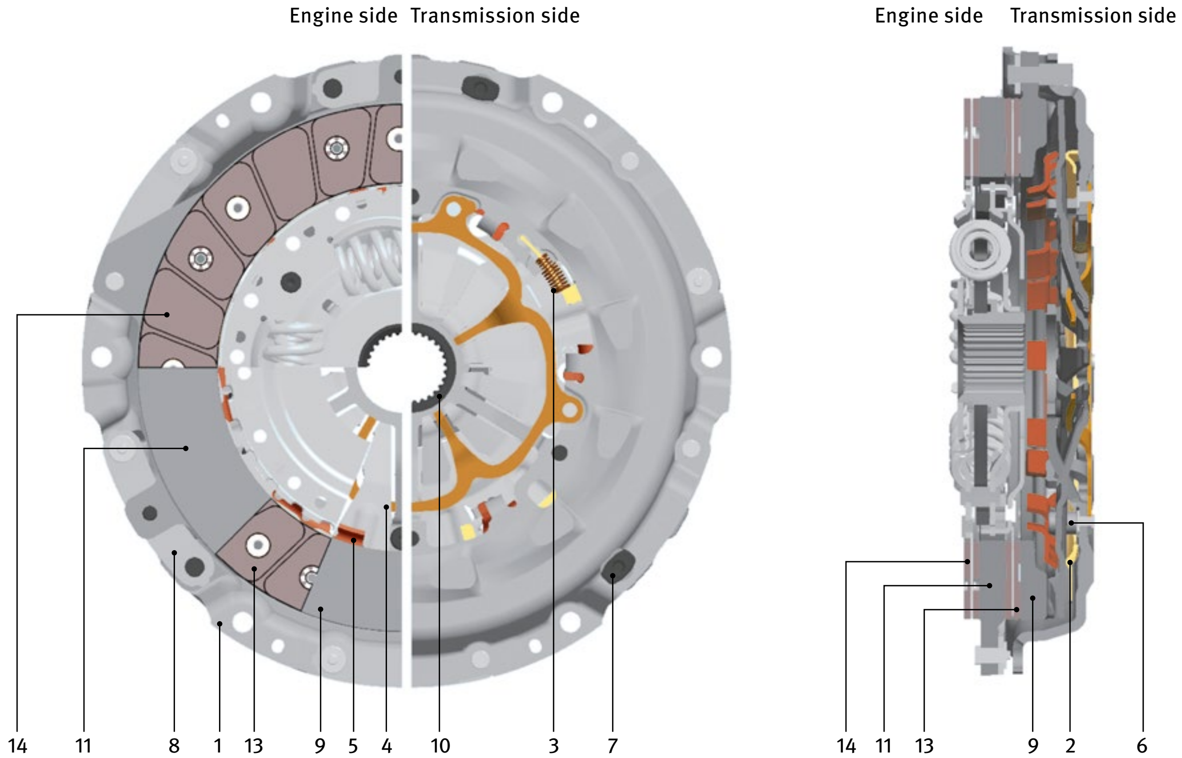


SAC III with reduced force difference

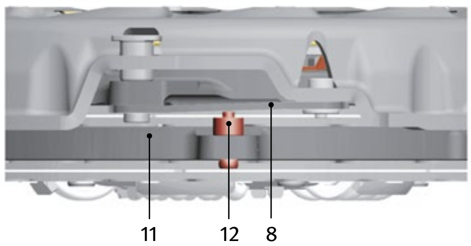
3.4 Multiple-disc self-adjusting clutch

More powerful engines with torques › 500 Nm also require clutches with higher transmitted torques. This involves an almost inevitable increase in pedal forces despite the use of self-adjusting clutch systems.

A variety of technological approaches (e.g. improved release systems) helped to keep the increase within reasonable limits; however, calls for a clutch with reduced actuation forces grew louder.



1 Clutch cover
2 Adjuster ring
3 Pressure spring
4 Diaphragm spring
5 Sensor diaphragm spring
6 Bolt
7 Bolt
8 Tangential leaf spring
9 Pressure plate
10 Cover stop
11 Intermediate pressure plate
12 Lift-off rivet
13 Clutch disc 1
14 Clutch disc 2



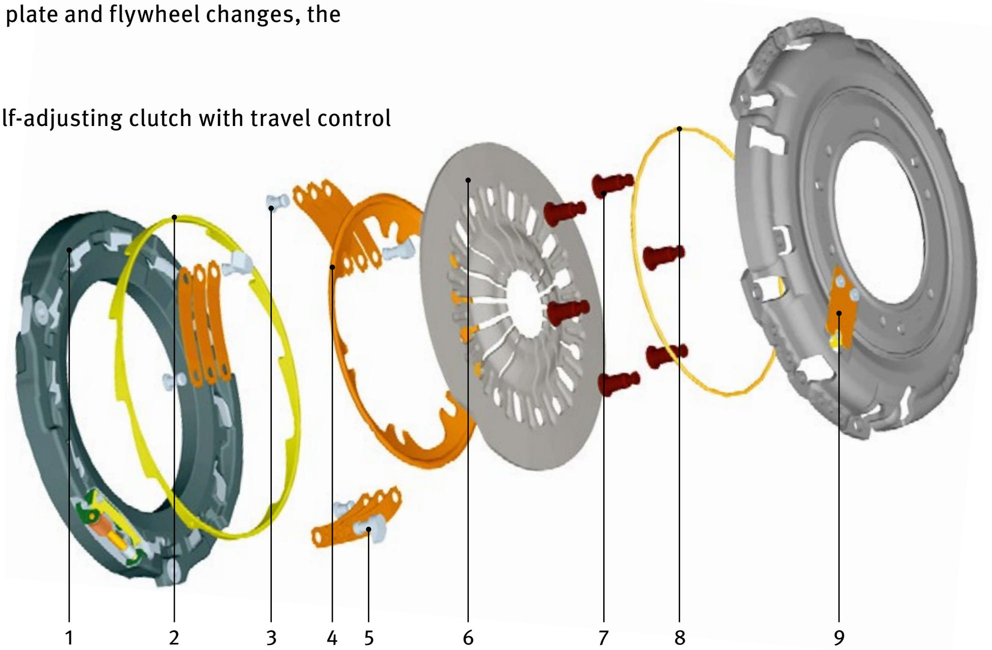
Two clutch discs increase the transmittable torque. The main difference compared to the single-disc version is the addition of an intermediate pressure plate and three further tangential leaf spring assemblies to the SAC to guarantee the lift of the intermediate pressure plate. To ensure even wear of both clutch discs, so-called lift-off rivets are used to control the intermediate pressure plate. They make sure that the lift of the intermediate pressure plate is half as much as the lift of the pressure plate. A special version of the clutch disc can be modeled to suit vehicle applications that require a damped clutch disc to provide better insulation. The benefit of the multiple-disc SAC is that it allows a reduction in release load for the same engine torque or, conversely, an increase in engine torque transfer at the identical release load level. With engine concepts where high engine torque is accompanied by high engine speeds, the multiple-disc SAC also offers the option of decreasing the outside diameter of the lining, which in turn improves the burst speed characteristic of the clutch disc. 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 the same size.

4 Self-adjusting diaphragm spring clutch (travel controlled)

Unlike the force controlled wear compensation function of the SAC clutch, the adjustment process with this version is effected by the travel measurement during engagement and disengagement. If the distance between the pressure plate and flywheel changes, the axial travel change is converted into a radial movement of the adjuster ring by a pinion with a directly coupled spindle. The distance is then compensated by the ramp system known from the SAC.

Components of the self-adjusting clutch with travel control

1 Pressure plate with adjuster unit
2 Ramp ring
3 Rivet
4 Support spring
5 Step pin
6 Diaphragm spring
7 Centering bolt
8 Support ring
9 Cover with adjuster spring

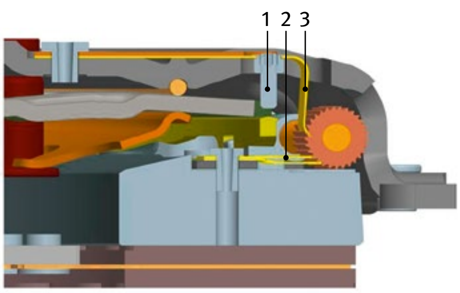


Function

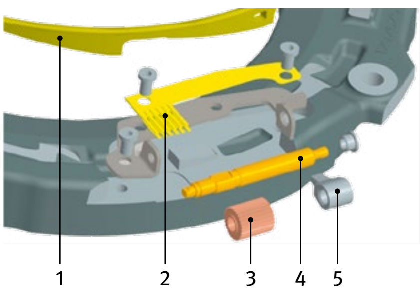
The diaphragm spring (figure below left) is connected to the drive pawl/adjuster spring (3) of the self-adjustment mechanism via a spacer bolt (1). Owing to the lift of the diaphragm springs, the spacer bolt is raised further as wear increases; the drive pawl is therefore also achieving a higher lift. This movement is transferred from the drive pawl/adjuster spring to the pinion. A detent (2) stops the pinion in the opposite direction. If the thickness of the friction lining and hence the travel changes, the pinion turns and the clutch adjusts.

In order to achieve finely tuned self-adjustment (figure below right), there is also a detent (2) split into interim phases, as well as the drive pawl. This allows the pinion (3) to be turned in very small increments. The torsion of the pinion drives the spindle (4) and induces an axial movement of the nut (5). This is fitted with a driver, which engages into the ramp ring (1). The transmission ratio between pinion and nut effectively compensates the height at the ramp ring in 2/1000 mm increments. As a result, a lining wear of 0.2 mm over the course of 100 clutch actuations is adjusted. There is no other system with such a sensitive self-adjustment mechanism. As a result, the operating comfort of the clutch remains at a constant high level from the start through to the wear limit.

Sectional view of adjustment mechanism



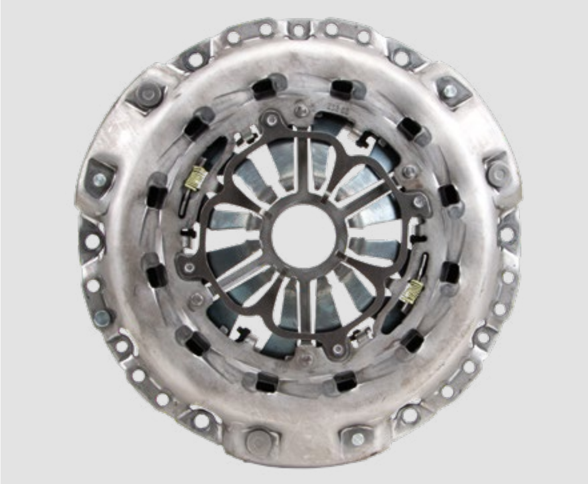
Components of the adjuster unit



5 Visual Differences between Clutch Pressure Plates

NON-ADJUSTING DIAPHRAGM SPRING CLUTCH

FORCE-CONTROLLED SELF-ADJUSTING CLUTCH



FORCE-CONTROLLED SELF-ADJUSTING CLUTCH WITH LOCKING UNIT

TRAVEL-CONTROLLED SELF-ADJUSTING CLUTCH

Note:
Power and travel-controlled self-adjusting clutches must be mounted without counter force and if re-using (e.g. when sealing the engine), removed in the same way!

Exception:
Force-controlled self-adjusting clutches with locking units are already pre-tensioned. They can be mounted without special tools.

6 Special tools for SAC disassembly/installation without applying counteracting forces

Using a special tool is an absolute must to ensure correct installation of the Self-Adjusting Clutch. No counteracting forces must be applied during installation to prevent early rotation of the adjusting ring in the clutch pressure plate.

For any questions concerning the SAC or the correct use of the special tool (item no. 400 0237 10) call us on: +49 6103 753-333.

1 Six different tapered bushings to spread both white tensioning/centring elements (15-28 mm) to support the clutch disc
2 Universal centring pin with guide and tensioning element
3 Three screw-on centring pins of varying diameter (12 mm, 14 mm, and 15 mm) for pilot bearing
4 Pressure piece and spindle carrier with 3- and 4-hole pitch
5 Centring sleeve (BMW)
6 Four studs M6, M7 and M8
7 Four knurled nuts
8 Thread closing cover to protect the inner thread
9 Two tensioning/centring elements (12-28 mm) to fit pilot bearing and crankshaft bore
10 Four special centring pins (BMW) of varying diameter and corresponding screw
11 Face spanner/releasing tool for pre-tensioned clutches (Audi, SEAT, Škoda and VW)

7 Centring the clutch disc

It is essential to centre the clutch disc to ensure that the gearbox is correctly mounted and that the clutch works properly. Correct centring of the clutch disc also allows the primary shaft to be positioned in the clutch disc hub smoothly, which minimises the risk of clutch disc or hub profile damage.

We offer a universal centring pin with add-on components developed to fit virtually every vehicle make and model. There is a wide variety of assembly options to suit individual repair needs.

7.1 Universal centring pin – assembly options

Basically, the universal centring pin can be used on every type of vehicle. Normally, a pilot bearing is installed in the crankshaft bore. The bearing's inner diameter is smaller than that of the hub. What makes the universal pin special is its ability to be used even on applications without a pilot bearing, where the inner diameter of the crankshaft bore can be bigger than that of the hub.

Correct assembly of the centring pin is dependent on the inner diameter of the pilot bearing or crankshaft bore, and on the distance between the pilot bearing or crankshaft bore and the clutch disc's hub profile.

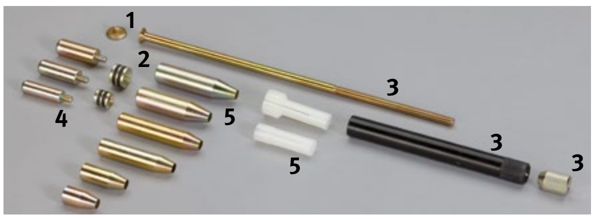
There are consequently two types of centring pin adapters:

- To fit pilot bearings with an inner diameter of 12 mm, 14 mm or 15 mm use the corresponding screw-on centring pins
- To fit all other applications use the variable tensioning/centring components with diameters ranging from 12-28 mm.

Individual components can be combined freely to suit specific centring pin requirements. However, be sure to assemble the components in the following order:

The graphic shows the order in which components need to be assembled. If none of the three screw-on centring pins are used, screw on the closing cover to protect the thread from dirt and impact.

Assemble the universal centring pin according to the specific requirements and insert into the crankshaft bore through the clutch disc hub. Ensure that the tensioning/centring elements are level with the crankshaft guide and the clutch disc hub. Tightening the tensioning element positioned at the tip of the centring pin spreads the individual components, thereby centring the disc.



1 Thread closing cover to protect thread from dirt ingress
2 Two tensioning/centring elements (12-15 mm and 15-28 mm) for pilot bearing or crankshaft bore
3 Universal centring pin with guide and tensioning element pilot bearing and crankshaft bore
4 Three screw-on centring pins of varying diameter to fit pilot bearing
5 Spreading of the white tensioning/centring elements (15-28 mm) to receive the clutch disc

7.2 Centring procedure on BMW models

In addition to the numerous possible combinations of the universal centring pin, the tool case also includes special pins to fit the latest BMW models.

Pre-tensioned SAC pressure plates on these applications are equipped with a locking device which has to be removed after installation by means of a hexagon socket spanner.

Choose the appropriate centring tool depending on the hub profile diameter of the clutch disc. The tool case contains the following parts:

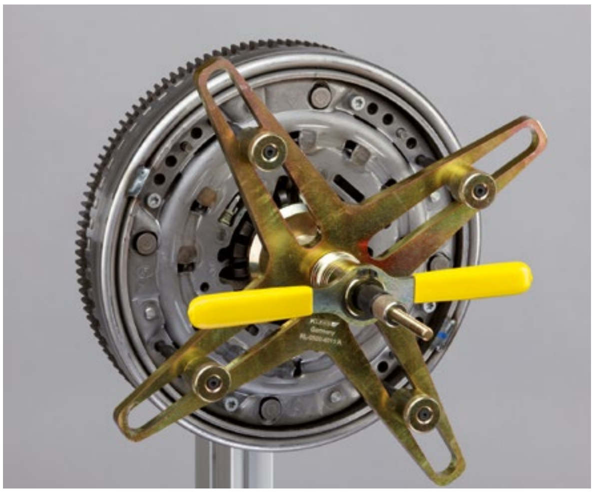
- Pin 15 mm/34 mm
- Pin 15 mm/28 mm
- Pin 15 mm/26.5 mm
- Pin 15 mm/23 mm
- Centring sleeve

Refer to chapter 8.3 for detailed step-by-step instructions on the use of these tools in this type of SAC.

8 Mounting the SAC (force- and travel controlled)

Example installation: travel-controlled self-adjusting clutch

Depending on the flywheel's hole pitch circle (six or eight screws) the pressure piece has to be modified using the corresponding spindle carrier



Example installation: force-controlled self-adjusting clutch

Use the 3-hole pitch on flywheels with six mounting threads, and the 4-hole pitch for flywheels with eight mounting threads.

Note:
The following instructions are for force-controlled self-adjusting clutches, by way of example. The steps for travel-controlled self-adjusting clutches are identical.

8.1 Sample installation – spindle carrier with 3-hole pitch

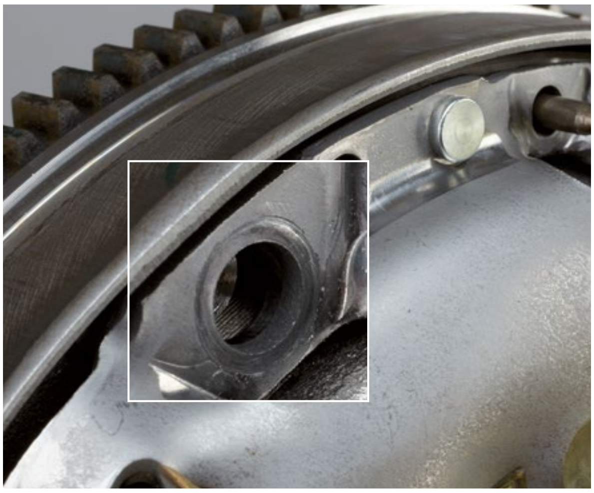
Adhere to the following procedure to install this type of SAC correctly:

- Assemble the centring pin according to the specific model – see chapter 7.1.
- Insert the centring pin into the hub profile of the clutch disc.
- Pre-tension the centring pin using the tensioning element at the pin's tip.
- Insert the pin and clutch disc into the pilot bearing or crankshaft bore.
- Tension the centring pin until the parts are perfectly centred.

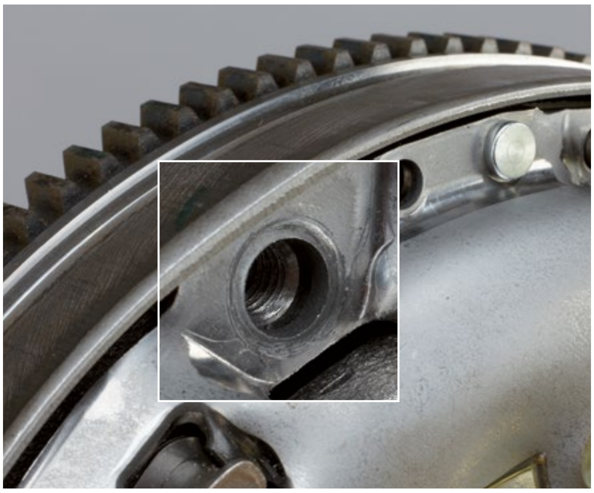
- Position the pressure plate on the flywheel; align dowels and bolt holes where necessary.
- Insert three studs through the mounting holes of the clutch pressure plate at a distance of 120° from one another and fix them in the threads of the flywheel.

- Position the pressure piece with spindle carrier on the centring pin and studs.
- Screw knurled nuts on studs until they fit snugly as shown in the picture; check with your finger.
- Turn the spindle of the pressure piece clockwise to move the pressure plate towards the flywheel

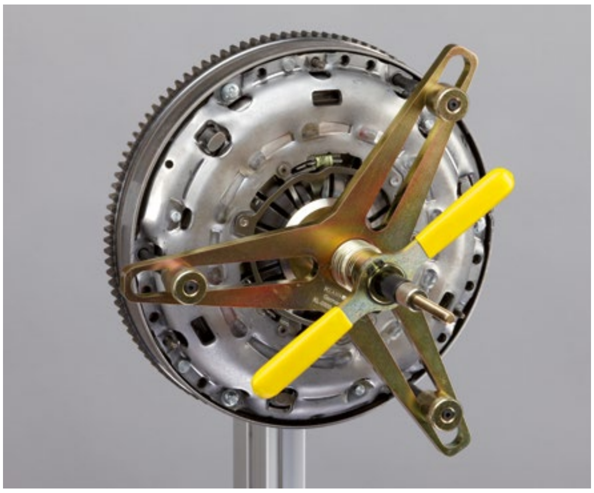
Note:
Stop rotating when the pressure plate housing rests against the flywheel. Check through the mounting hole!



Pressure plate housing is not touching the flywheel



Pressure plate housing is touching the flywheel



- Insert and tighten three fastening bolts of the clutch pressure plate.
- Turn the spindle of the pressure piece anticlockwise to relieve the diaphragm spring.

- When the diaphragm spring is completely relieved, remove the knurled nuts and pressure piece.

- Remove studs.
- Insert the remaining three fastening screws of the clutch pressure plate.
- Tighten them down to the specified torque.
- Slacken the knurled nut on the pin’s tip to relieve and remove the centring pin.

To remove the SAC using the special tool follow the above procedure in reverse order – see chapter 8.7.

8.2 Sample installation – spindle carrier with 4-hole pitch

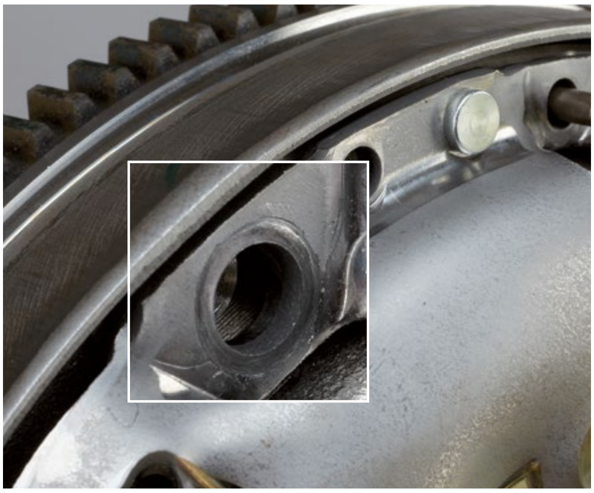
Adhere to the following procedure to install this type of SAC correctly:

- Assemble the centring pin according to the specific model – see chapter 7.1.
- Insert the centring pin into the hub profile of the clutch disc.
- Pre-tension the centring pin using the knurled nut on the pin’s tip.
- Insert the pin and clutch disc into the pilot bearing or crankshaft bore.
- Tension the centring pin until the parts are perfectly centred.

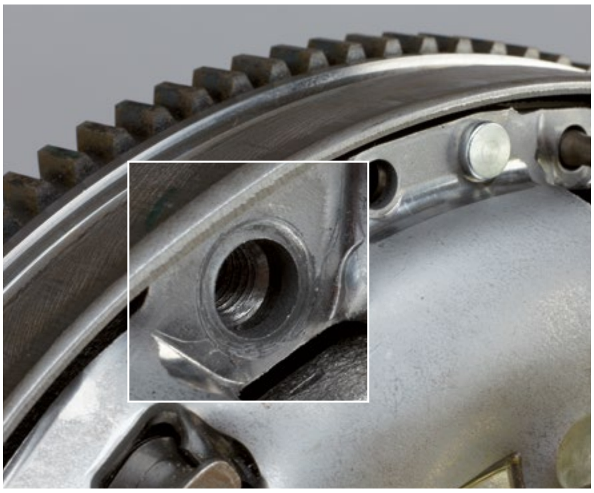
- Position the pressure plate on the flywheel; align dowels and bolt holes where necessary.
- Insert four studs at a distance of 90° from one another into the mounting holes of the clutch pressure plate and fix in the threads of the flywheel

- Position the pressure piece with spindle carrier on the centring pin and studs.
- Screw knurled nuts on studs until they fit flush as shown in the picture; check with your finger.
- Turn the spindle of the pressure piece clockwise to move the pressure plate towards the flywheel.

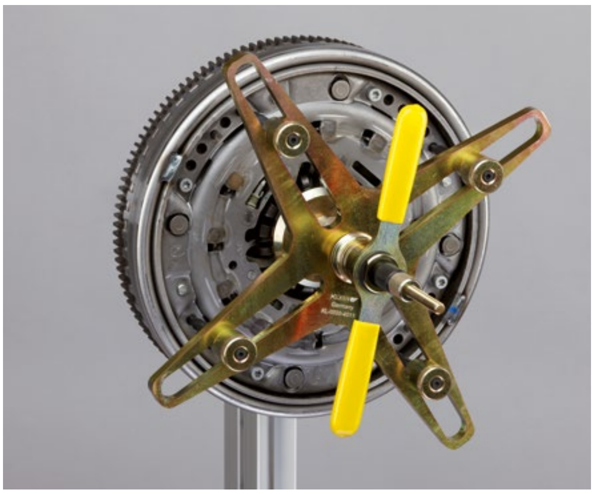
Note:
Stop rotating when the pressure plate housing rests against the flywheel. Check through the mounting holes!



Pressure plate housing is not touching the flywheel



Pressure plate housing is touching the flywheel



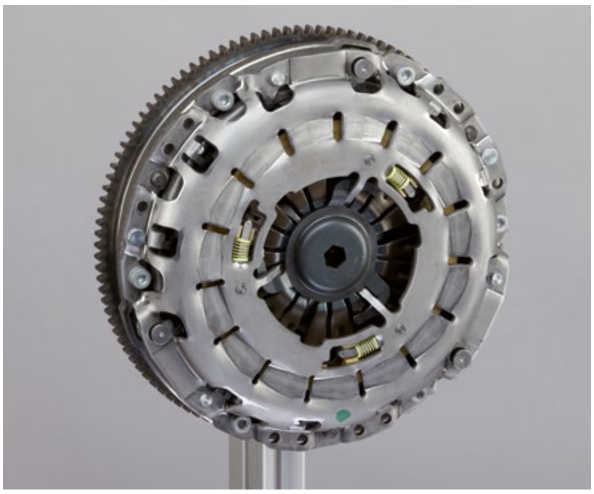
- Position and tighten four fastening bolts of the clutch pressure plate slightly.
- Turn the spindle of the pressure piece anticlockwise to relieve the diaphragm spring.

- When the diaphragm spring is completely relieved, remove the knurled nuts and pressure piece.
- Remove the studs.

- Insert the remaining four fastening screws of the clutch pressure plate.
- Tighten them down to the specified torque.
- Slacken the knurled nut on the pin's tip to relieve and remove the centring pin.

To remove the SAC using the special tool follow the above procedure in reverse order – see chapter 8.7.

8.3 Installation instructions for BMW models



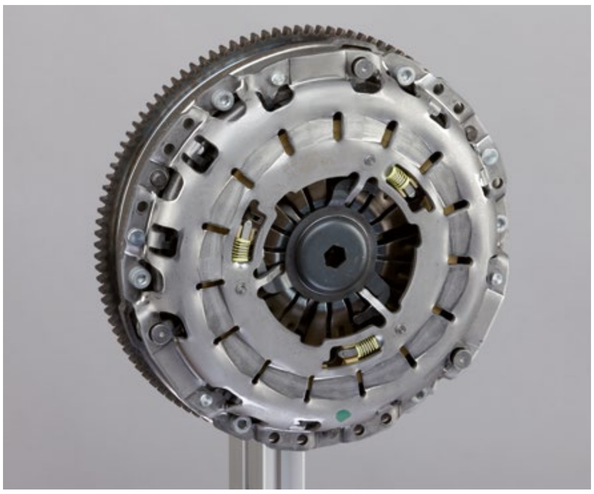
Clutch pressure plates on some BMW models are equipped with a locking device which makes the use of a conventional centring pin impossible. This is why a special pin design or centring sleeve is required.

> **Caution:**
> Risk of injury! Do not remove the locking device unless clutch pressure plate, clutch disc and flywheel are securely bolted to one another.

8.4 Designs with pilot bearing support in the crankshaft

Adhere to the following procedure to install this type of SAC correctly.

- Assemble the centring pin according to the hub diameter of the clutch disc and the pilot bearing.
- Insert the centring pin (without screw) through the hub profile of the clutch disc and the pilot bearing; the centring pin fits flush in the hub profile.



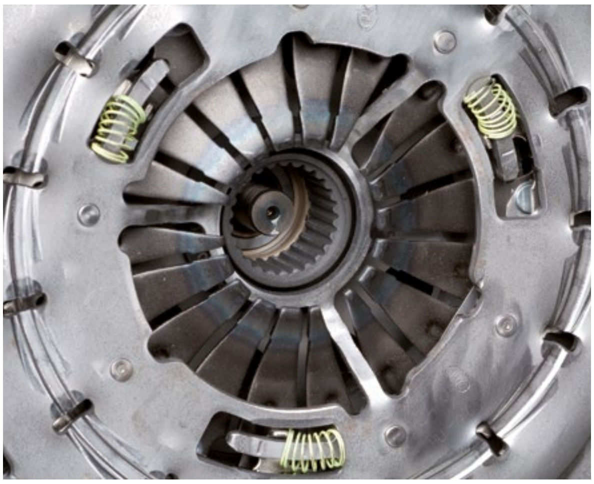
- Position the pressure plate on the flywheel; align dowels and bolt holes where necessary.
- Insert all fastening screws of the clutch pressure plate and tighten them down to the specified torque.

- Unscrew the locking device using an appropriate tool.
- Remove the locking device, it is no longer needed.

- Remove the centring pin using the appropriate screw.

To disassemble the SAC use the special tool according to the procedure detailed in chapter 8.7.

8.5 Designs with pilot bearing in the primary shaft



Adhere to the following procedure to install this type of SAC correctly.

- Screw bolt into the centring sleeve.
- Position the centring sleeve on the flywheel.
- Position clutch disc on the centring sleeve.

Note:
It is important to position the centring sleeve so that the threaded hole is on the gearbox side. Failure to do so will make it impossible to remove the sleeve with the corresponding screw after the SAC has been installed.

- Unscrew the bolt.

- Position the pressure plate on the flywheel and align dowels and bolt holes.
- Insert all fastening screws of the clutch pressure plate and tighten them down to the specified torque.

- Unscrew the locking device using an appropriate tool.
- Remove the locking device, it is no longer needed.

- Remove the centring sleeve using the screw.

To disassemble the SAC use the special tool according to the procedure detailed in chapter 8.7.

8.6 Note on mounting pre-tensioned Audi, SEAT, Škoda and VW self-adjusting clutches

Clutch pressure plates for these models can be equipped with a locking device. The clutch disc is centred by means of the universal centring pin.

> **Caution:**
> Risk of injury! Do not remove the locking device unless clutch pressure plate, clutch disc and flywheel are securely bolted to one another.

Adhere to the following procedure to install this type of SAC correctly:

- Assemble the centring pin according to the required model – see chapter 4.1.
- Insert the centring pin into the hub profile of the clutch disc.
- Pre-tension the centring pin using the knurled nut on the pin's tip.
- Insert the pin and clutch disc into the pilot bearing or crankshaft bore.
- Tension the centring pin until the parts are perfectly centred.

- Position the pressure plate on the flywheel; align dowels and bolt holes where necessary.
- Insert all fastening screws of the clutch pressure plate and tighten them down to the specified torque.

- Unscrew the locking device using the face spanner.
- Remove the locking device, it is no longer needed.

Slacken the knurled nut on the pin's tip to relieve and remove the centring pin.

- To disassemble the SAC use the special tool according to the procedure detailed in chapter 8.7.

8.7 Disassembly of the SAC

If a certain repair procedure requires the SAC to be disassembled and then re-installed, it is essential to use a special tool as this is the only means to ensure full operational reliability of the part after re-installation.

The following describes how to disassemble the SAC using the example of a spindle carrier with 3-hole pitch:

> **Note:**
> The use of the universal centring pin is essential. It prevents the clutch disc from falling when removing the pressure plate.

- Remove three fastening screws from the clutch pressure plate.
- Screw in three studs.
- Assemble the centring pin according to the required model – see chapter 7.1.
- Insert centring pin into the disc's hub profile and position it in the pilot bearing or crankshaft bore.
- Tension the centring pin using the knurled nut on the pin's tip.

- Position the pressure piece with the spindle carrier on the centring pin and studs.
- Screw knurled nuts on studs until they fit flush. Check with your finger as shown in the picture.

- Turn the spindle of the pressure piece clockwise to tension the diaphragm spring until it is visibly moved from the pressure plate.
- Check lift by rotating the centring pin and clutch disc. This ensures the adjusting ring is held in position and the SAC's current wear condition is maintained during re-installation.
- Remove the remaining three fastening screws from the clutch pressure plate.
- Turn the spindle of the pressure piece anticlockwise to relieve the diaphragm spring.

- When the diaphragm spring is completely relieved, remove the knurled nuts and the pressure piece.
- Unscrew the studs and remove the clutch pressure plate.

- Remove the centring pin along with the clutch disc.