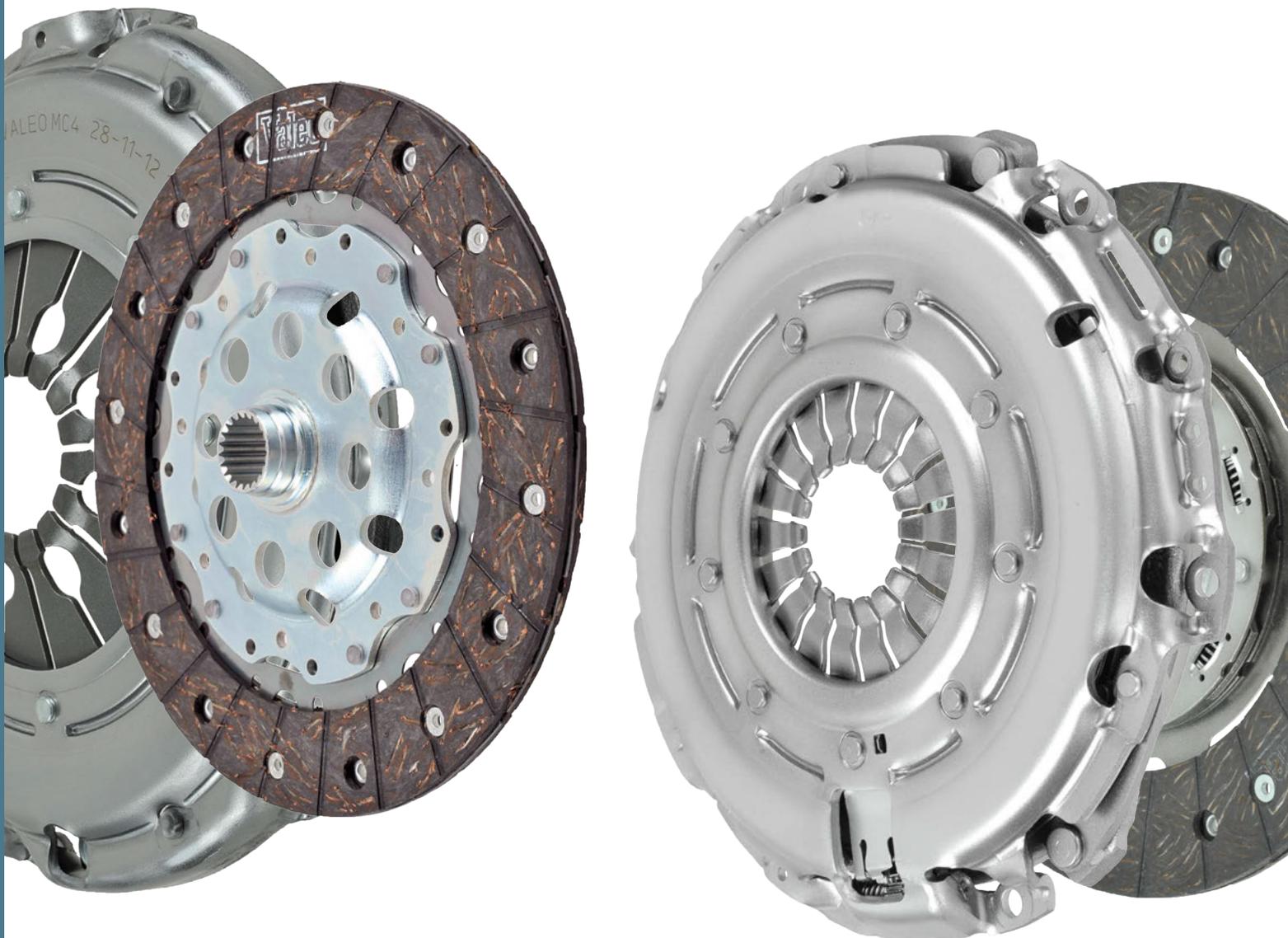




## Transmission Systems

Self Adjusting Technology (S.A.T.)  
High Efficiency Clutch (H.E.C.)



# Valeo clutches, expertise & innovation dedicated to customer satisfaction



## Self Adjusting Technology (S.A.T.)

- **Compact and robust design**
- **High torque capacity**
- **Comfortable:**  
Constant diaphragm position and pedal load.
- **Reliable:**  
Contains mechanism against over-adjustment.
- **Increased durability:**  
Compact design as the S.A.T. device is integrated in the clutch cover. Axial compactness due to increased release travel.
- **Efficient:**  
Friction wear is detected by position (and not by balance of load); wear detection is thus independent from the diaphragm curve.
- **Easy to fit:**  
Valeo S.A.T. does not require special tools for installation. It is a standard clutch that can be installed using standard garage equipment.
- **Enhanced clutch life**

## High Efficiency Clutch (H.E.C.)

- **Easy to fit:**  
Valeo H.E.C. is installed just like a standard clutch and does not require any additional tooling or training.
- **Reduced fitting times:**  
The H.E.C. is fitted just like conventional clutches. No additional operations and checks are required.
- **Comfortable:**  
Constant and optimum pedal effort during the entire clutch life thanks to Valeo high-quality friction material with very low wear.
- **Reliable:**  
Simple and robust design, no complex and sensitive components.
- **Improved clutch life:**  
Valeo high-quality and very low-wear friction technology increases clutch life under normal driving conditions.



# Valeo

# Table of Contents

## MORE ABOUT VALEO S.A.T.?



[qr.valeodrive.com/998121/003443](http://qr.valeodrive.com/998121/003443)

1. Disclaimer	P3
2. Valeo, your Transmission Systems Multi-Specialist	P4
3. valeo-techassist.com	P6
4. Self Adjusting Technology (S.A.T.)	P7
4.1. Why S.A.T.?	P7
4.2. S.A.T. composition and design	P9
4.3. S.A.T. kits with shipping spacer (first generation)	P14
4.4 S.A.T. main advantages	P12
5. High Efficiency Clutch (H.E.C.)	P15
5.1. Why H.E.C.?	P15
5.2. H.E.C. design and composition	P16
5.2.1. Clamp load characteristics	P16
5.3. H.E.C. main advantages	P18
6. Technical support	P19
6.1. After dismantling the gearbox from the engine	P21
6.2. Preparation of the clutch for fitting	P21
6.3. Fitting the clutch	P21
6.4. Re-assembling the gearbox	P22
6.5. Verify that the clutch is functioning correctly	P22
7. F.A.Q.	P23

# Foreword

## Our Multi-specialist expertise is rooted in our genes.

As one of the leading automotive system designers and manufacturers, nothing is more natural for Valeo than to deliver 14 product lines for passenger cars and 8 products lines for heavy-duty vehicles, serving all distribution channels from car makers' networks to independent aftermarket and modern distribution, in more than 120 countries all over the world.

Valeo Transmission Systems' mission is to be the supplier of choice for all powertrain architectures with innovative technologies developed for efficient and comfortable power transfer from the engine to the transmission, whilst reducing fuel consumption.

All Valeo clutches are designed and manufactured using Valeo's highest quality standards. As a result Valeo products are highly efficient, reliable and ensure customer satisfaction.

Efficient because Valeo's expertise in research and development allows the reduction of clutch noise and vibrations along with enhanced driver comfort through better gear changes, giving consumers a smoother and more comfortable ride.

Reliable because Valeo clutches are able to perform in the most hostile operating environments. Valeo aftermarket customers benefit from this Original Equipment (O.E.) expertise, rigor and quality.

The worldwide vehicle car park consists of 69% passenger cars and is growing by 3.9% per year. More and more car manufacturers demand new clutch technologies to increase comfort for the driver. As a consequence the Self Adjusting Technology is designed to provide a constant pedal effort over the lifetime of the clutch.

Since 2000 Valeo has been producing clutches with Self Adjusting Technology. As an alternative solution Valeo has introduced also the High Efficiency Clutch to replace the original clutch kit with self-adjusting function. This technical handbook is the opportunity to explain you the design, composition and related advantages of the two technologies. You will find as well the answers to the most frequently asked questions.

**Valeo - from original equipment leadership to aftermarket excellence**



# Disclaimer

Whilst we endeavour to ensure that the information included in this training documentation is correct, we do not warrant its completeness or accuracy; nor do we commit to ensuring that the material in the documentation is kept up to date.

To the maximum extent permitted by applicable law, we exclude all representations, warranties and conditions relating to this documentation and the use of this documentation (including, without limitation, any warranties implied by law in respect to satisfactory quality, fitness for purpose and/or the use of reasonable care and skill).

Nothing in this disclaimer will: (a) limit or exclude our or your liability for death or personal injury resulting from negligence; (b) limit or exclude our or your liability for fraud or fraudulent misrepresentation;

(c) limit any of our or your liabilities in any way that is not permitted under applicable law; or (d) exclude any of our or your liabilities that may not be excluded under applicable law.

The limitations and exclusions of liability set out in this section and elsewhere in this disclaimer: (a) are subject to the preceding paragraph; and (b) govern all liabilities arising under the disclaimer or in relation to the subject matter of this disclaimer, including liabilities arising in contract, in tort (including negligence) and for breach of statutory duty.

To the extent that this documentation and this training documentation are provided free of charge, we will not be liable for any loss or damage of whatsoever nature.





# Valeo, your Transmission Systems Multi-specialist

Valeo is an automotive supplier, partner to all automakers worldwide. As a technology company, Valeo proposes innovative products and systems that contribute to the reduction of CO<sub>2</sub> emissions and to the development of intuitive driving.

In 2013, the Group generated sales of €12.1 billion euros and invested over 10% of its original equipment sales in research and development. Valeo has 124 production sites, 16 Research centers, 35 Development centers and 12 distribution platforms, and employs 74,800 people in 29 countries throughout the world.

Valeo consists of 4 Business Groups: Powertrain Systems, Thermal Systems, Comfort and Driving, Assistance Systems and Visibility Systems.

Together, these 4 Business Groups comprise 16 Product Groups and supply both the Original Equipment (O.E.) market and the aftermarket. The Transmission Systems product portfolio is part of Valeo's Powertrain Systems Business Group.

# Valeoscope library

## Technical handbooks



**Air Conditioning**  
Ref: 998321



**Lighting Systems**  
Ref: 998542

## Product focus



**Transmission Systems  
Clutch HEC-SAT**  
Ref: 998121



**Transmission Systems  
Clutch Hydraulics**  
Ref: 998123



**Transmission Systems  
Clutch KIT4P**  
Ref: 998102



**Transmission Systems  
Dual-Mass Flywheel DMF**  
Ref: 998120

## Diag & Fit



**Truck Brake Pad**  
Ref: 957100



## valeo-techassist.com

You will benefit from Valeo TechAssist all through the workshop service process:

- Get product information: product data sheets provide details in addition to the catalogue information.
- Find common failures: step-by-step failure diagnosis guides about typical faults.
- Keep you updated about Valeo Service products: full access to all Technical Service Bulletins.
- Find help when it is needed: answers to frequently asked questions and contact with the Valeo Service technical hotline
- Use Valeo workshop tools efficiently: retrieve user manuals, service manuals and software updates on Valeo Service tools
- Learn about new technologies: online training modules (e-learning) and self-study documents about most modern product technologies. In addition, you have access to some advanced features:
  - Add comments to any document: give personal feedback to Valeo Service and contribute to a continuous service improvement.
  - Fill in your evaluation: provide feedback on your satisfaction.
  - Write a fitting testimony: share your experience with other users.



Valeo TechAssist is a web-based application, specifically developed for repair workshops, automotive spare parts distributors and technical trainers.

Valeo TechAssist is available at any time, and 10 languages are implemented to date. Just connect to the website [www.valeo-techassist.com](http://www.valeo-techassist.com).

Valeo TechAssist is not only a technical database, but also a learning platform and a forum for information exchange. It covers passenger cars and all Valeo product lines.

The information in Valeo TechAssist is structured in four comprehensive domains:



### 1. Product documentation

### 2. Technical assistance

### 3. Workshop tools

### 4. Technical training

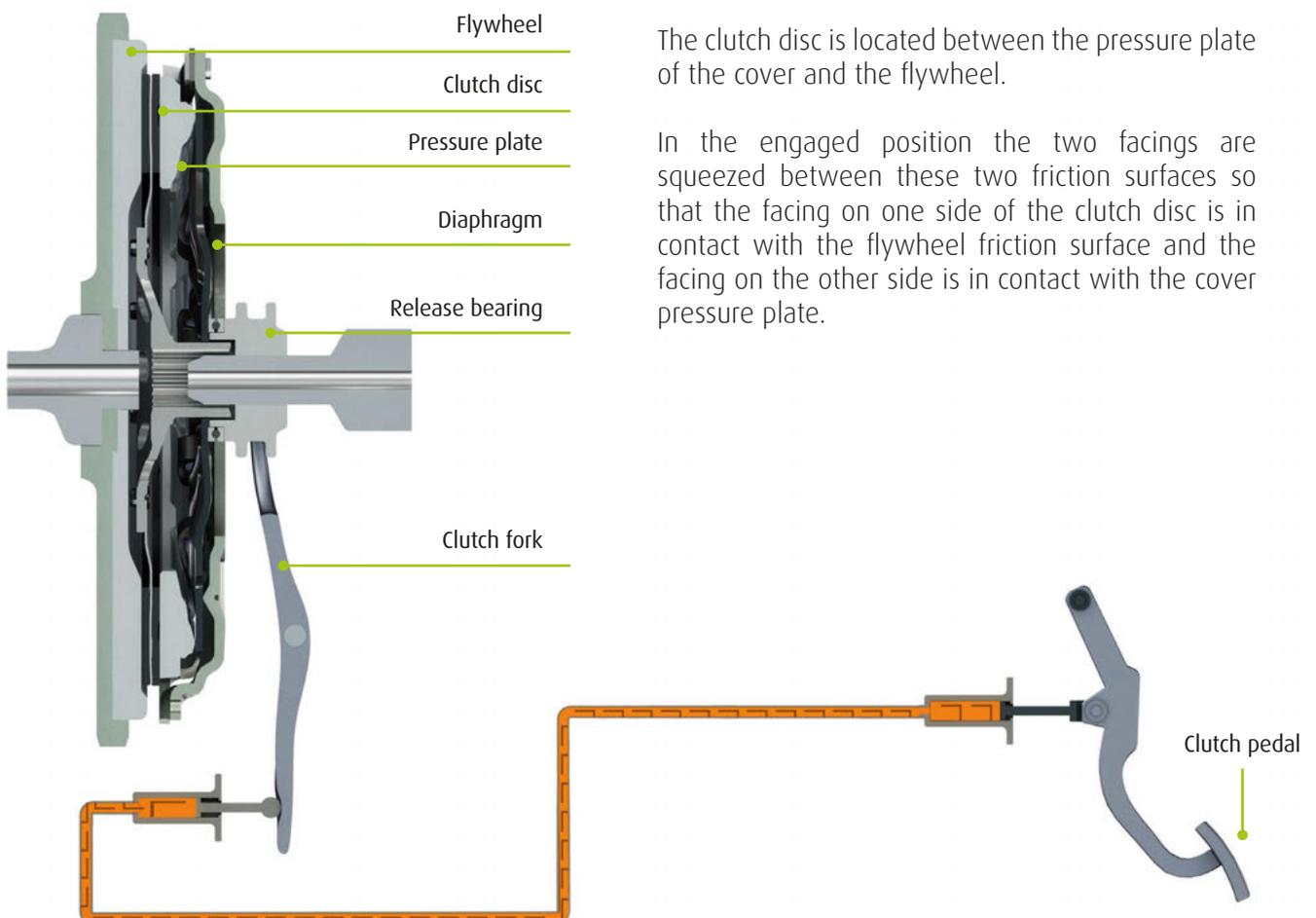
# 4

## Why Self Adjusting Technology (S.A.T.)?

A clutch is the interface between the engine and the gearbox, enabling the interruption of torque transfer for gear change. When the clutch is engaged, the full engine torque is transmitted to the gearbox input shaft.

The clutch disc is located between the pressure plate of the cover and the flywheel.

In the engaged position the two facings are squeezed between these two friction surfaces so that the facing on one side of the clutch disc is in contact with the flywheel friction surface and the facing on the other side is in contact with the cover pressure plate.



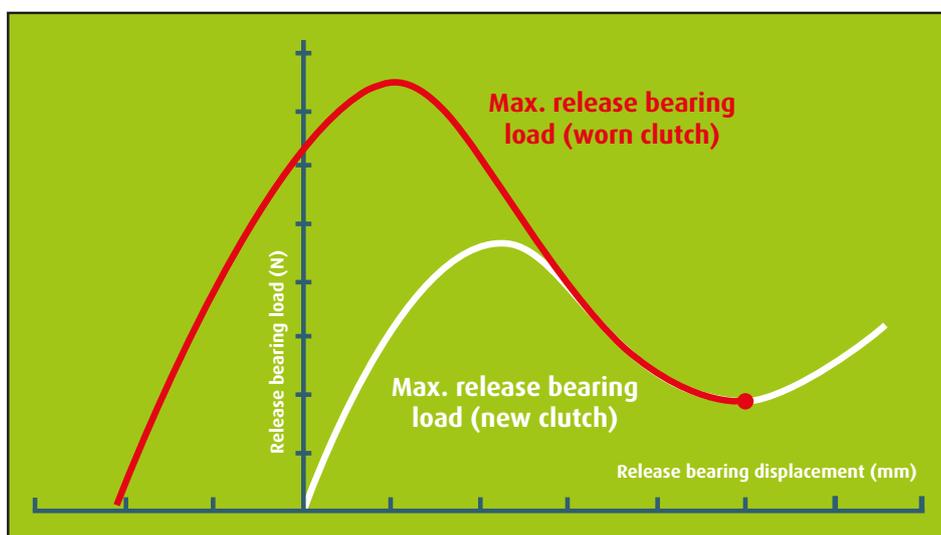
*Clutch layout and actuation with a semi-hydraulic system*

## 4. Why Self Adjusting Technology (S.A.T.)?

Despite different qualities and technologies, these facings are subject to wear over time. Due to the loss of thickness of the facings, the pressure plate moves towards the flywheel, and the diaphragm in contact with the pressure plate changes angle accordingly.

The actuation force that needs to be applied to the cover via the clutch pedal increases. As a result the pedal effort for the driver becomes greater.

*This value is 8 to 12 kg\* when the clutch is new and increases to 15-20 kg\* when the clutch is worn.*



\*1 kg ~ 9.8 N



The same pedal effort can be maintained throughout the entire clutch life thanks to the Self Adjusting Technology (S.A.T.).

The constant pedal effort is obtained by increasing the effective thickness of the pressure plate.

Valeo has been producing S.A.T. clutches to the car manufacturers since 2000.

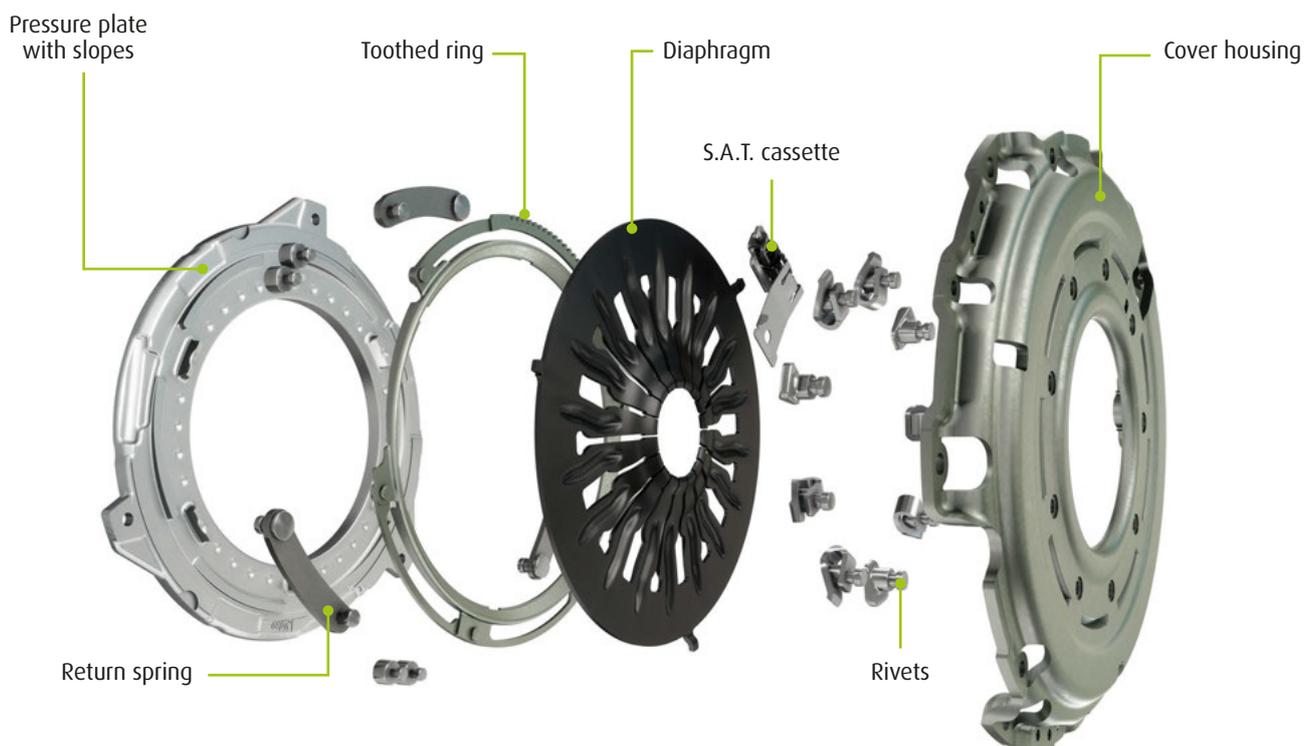


## S.A.T. composition and design

A standard cover assembly without self-adjusting device is composed of

- a diaphragm providing a clamp load
- a pressure plate with significant mass to dissipate heat and to form the friction surface to the disc facing

The initial S.A.T. design comprises a wear compensation cassette riveted to the cover housing. The second design came with the cassette welded to the cover housing in order to achieve a more compact design and facilitate serial production. The working principle remains the same while the new compact design reduces the number of components (now 14 pieces in total versus 31 pieces in the initial design) and is, hence, more suitable for serial production in large quantities and with automated assembly lines.



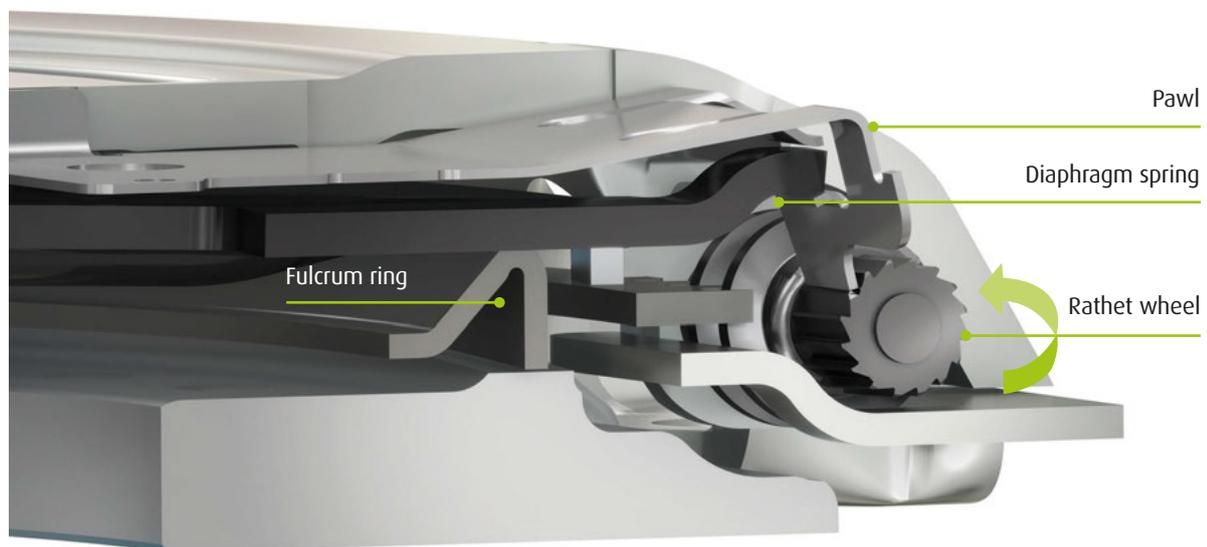
Composition of the Valeo cover with Self Adjusting Technology

## 5. S.A.T. composition and design

In an S.A.T. clutch a **wear compensation** system is located between the pressure plate and the diaphragm. Wear is detected by the position of the pressure plate and the diaphragm, and wear compensation is obtained by means of the fulcrum ramp and a toothed ring.

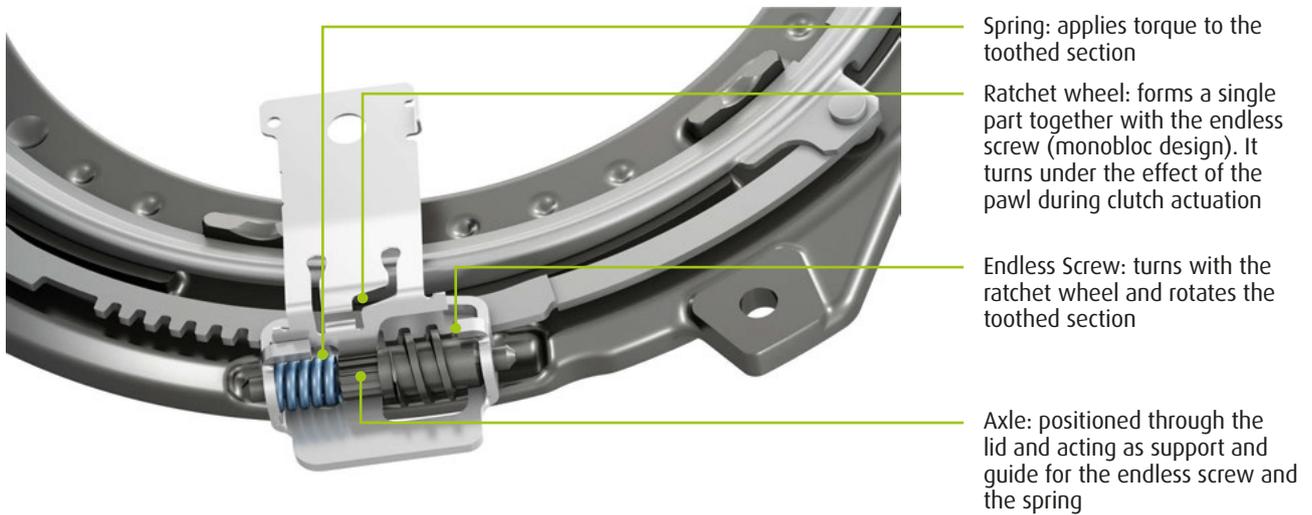


*The position of the fulcrum ring is adjusted via a worm gear to compensate the wear*



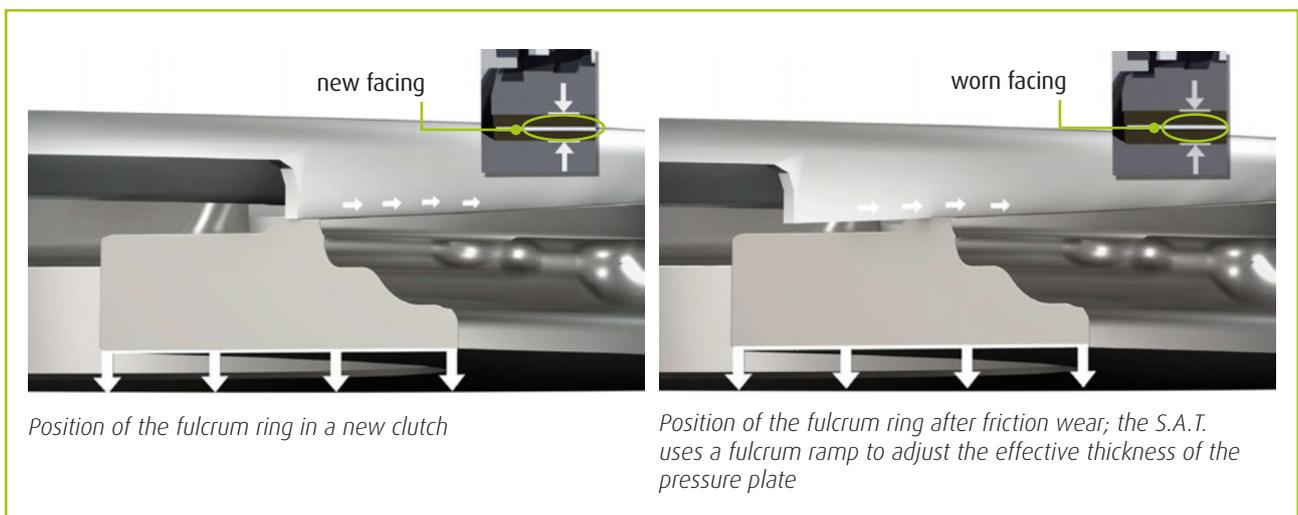
Toothed section cord crawls: positioned against the pressure plate and turns on the slopes of the pressure plate to adjust the effective thickness of the pressure plate.

Pawl: installed between the cover and the diaphragm it is actuated by a lobe on the diaphragm and turns the ratchet wheel in proportion to the wear of the facing.



With increasing facing wear, the pressure plate moves towards the flywheel, and the diaphragm in contact with the pressure plate moves accordingly. The diaphragm exerts pressure on the pawl, which pushes down the ratchet wheel. The ratchet wheel

and the worm gear rotate the fulcrum ramp via the toothed ring. This increases the effective thickness of the pressure plate and compensates for the facing wear.



# 6

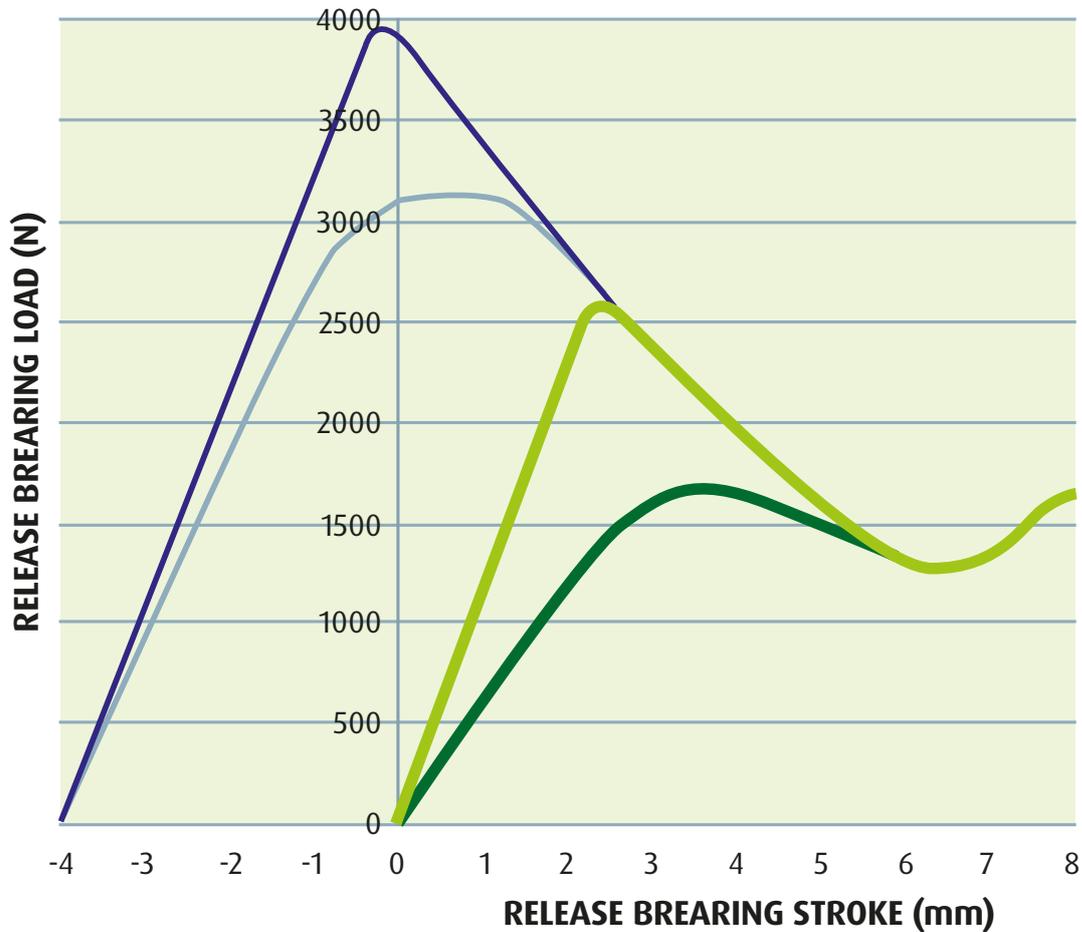
## S.A.T. main advantages

In Valeo SAT Clutches the diaphragm is always operating in the same angle. This keeps the bearing load - and hence, pedal load - constant, improving driver comfort.

- **High torque capacity**
- **Comfortable:** constant diaphragm position, constantly low bearing load and pedal effort

The release bearing load impacts the clutch pedal effort. When a standard clutch without self-adjusting function is used, the release bearing load will increase due to wear of the facings, and the pedal effort will increase as a consequence. The S.A.T. kit ensures that a constantly low release bearing load is maintained throughout the entire clutch life.

## Release Bearing Load Comparison



- CLUTCH COVER WITH DISC AS NEW POSITION OR S.A.T. AS NEW & WORN POSITION
- CLUTCH COVER TRAD ALONE AS NEW OR PPCS S.A.T. ALONE AS NEW & AS WORN POSITION
- CLUTCH COVER TRAD WITH DISC AS WORN
- CLUTCH COVER ALONE AS WORN

- **Compact and robust design**
- **Reliable:** contains mechanism against over-adjustment
- **Increased durability:** compact design as the S.A.T. device is integrated in the clutch cover. Axial compactness due to increased release travel
- **Efficient:** friction wear is detected by position (and not by balance of load); wear detection is thus independent from the diaphragm curve
- **Easy to fit:** Valeo S.A.T. does not require special tools for installation. It is a standard clutch that can be installed using standard garage equipment
- **Enhanced clutch life**

## S.A.T. kits with shipping spacer (first generation)

Certain S.A.T. kits are provided with a “shipping spacer” that protects the S.A.T. device during transportation. When the cover assembly is positioned over the flywheel via fitting bolts the spacer will come loose. The spacer can then easily be removed by hand; no specific tool is needed.

*The shipping spacer must be removed from the cover after assembly.*



*Shipping spacer*



*S.A.T. Cover with shipping spacer*

# 8

## High Efficiency Clutch (H.E.C.) Why H.E.C.?

When a standard clutch is engaged, pressure plate and diaphragm positions are dependent on the thickness of the facing. The wear can be compensated over lifetime with a self-adjusting device. However, an alternative solution is to virtually eliminate wear of the friction material so that no compensation is required anymore. Such a solution actually exists: the Valeo High Efficiency Clutch!

Valeo offers the High Efficiency Clutch (H.E.C.) to replace the original clutch kit with self-adjusting function. This cost-effective solution also ensures high customer satisfaction thanks to good clutch function and long clutch life.

Perfect fit and function is guaranteed for the H.E.C., even though its appearance differs from the original clutch with wear compensation technology. This product has been designed and validated to offer a reliable and economical alternative aftermarket solution. In this brochure you will see that the H.E.C. not only provides economical benefits, but also decreases fitting time and complexity of the installation.

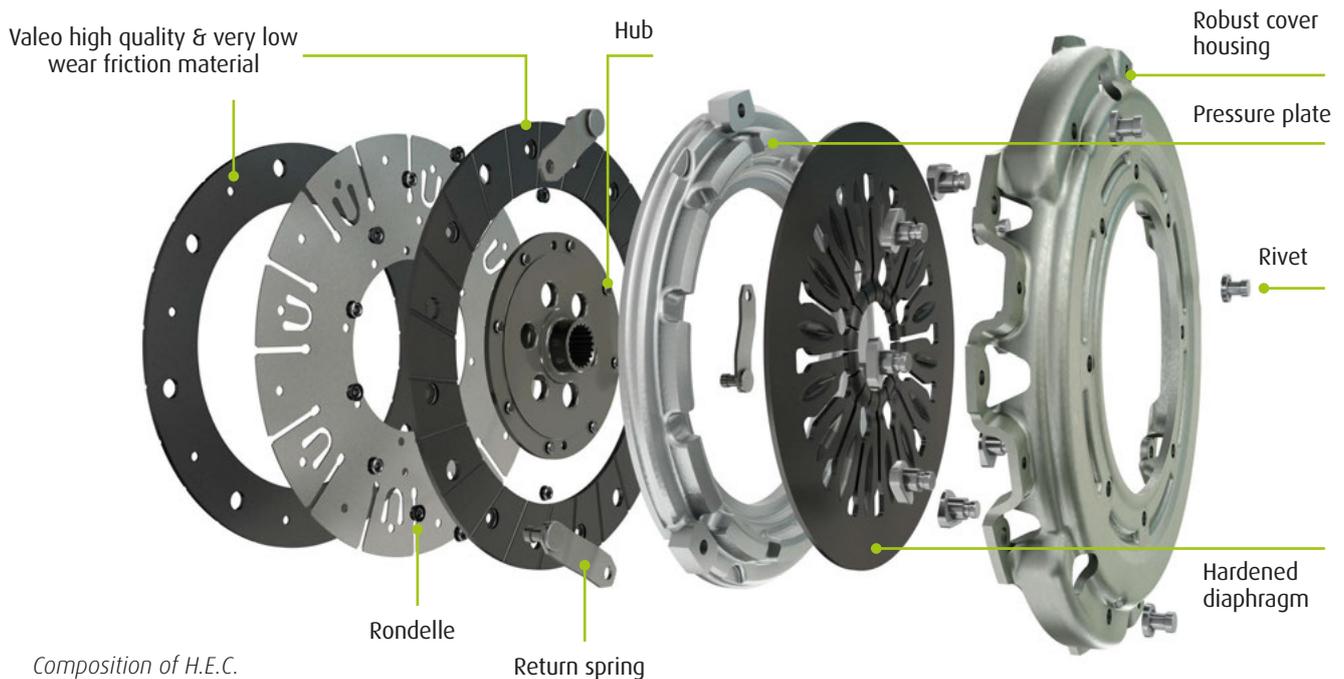


Valeo H.E.C.

# 9

## H.E.C. desing and composition

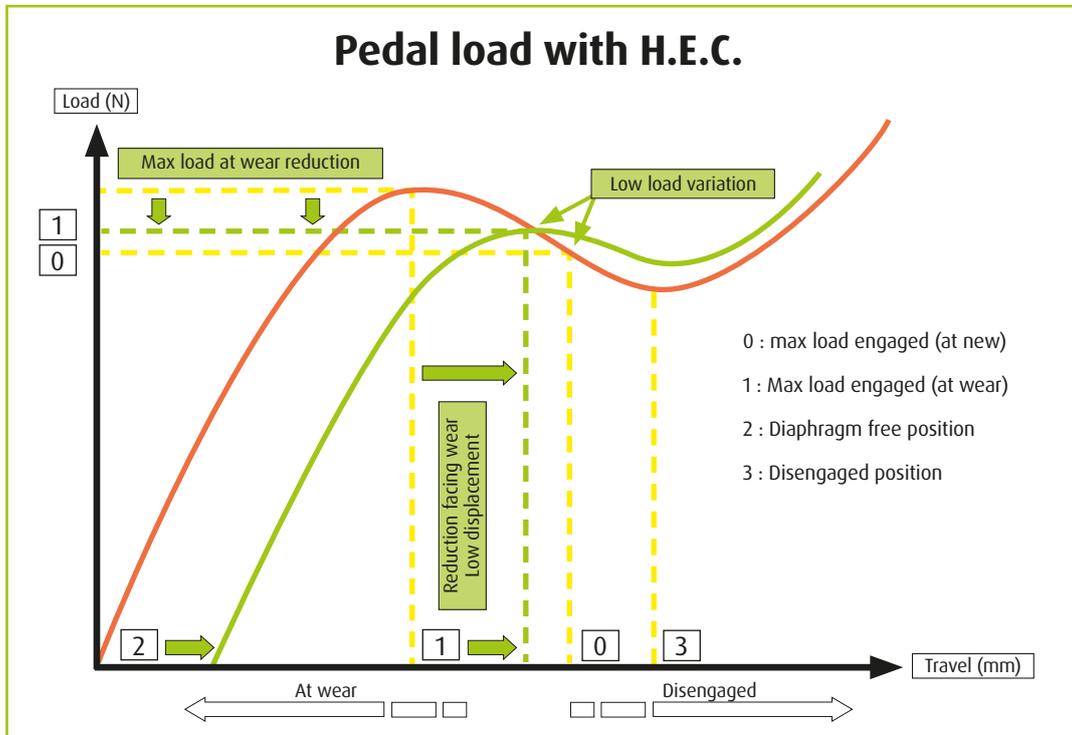
H.E.C. is a combination of an improved facing material and a robust clutch cover assembly.



### 9.1 Clamp load characteristics

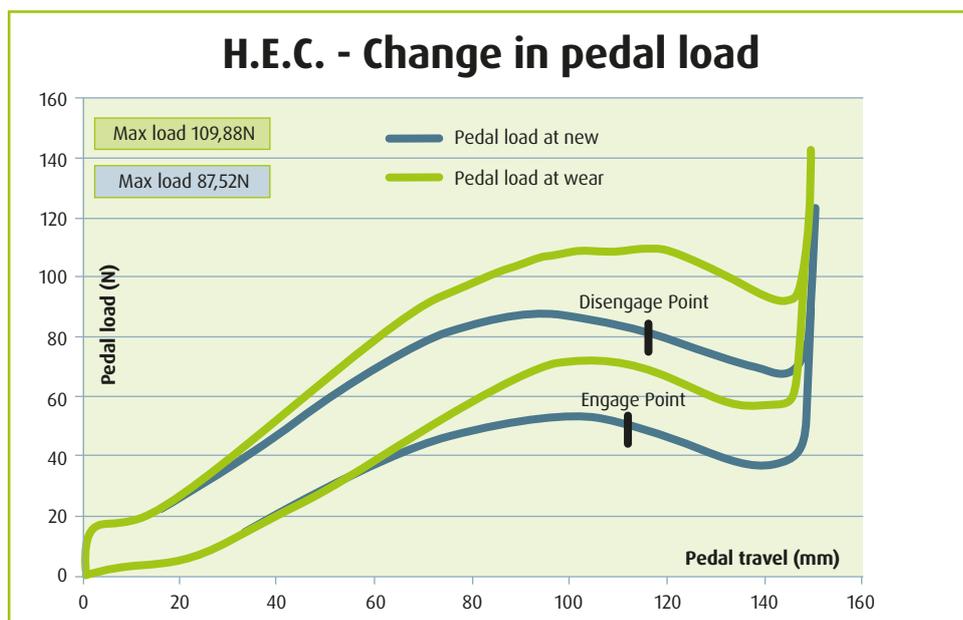
The clamp load is the load exerted by the diaphragm to clamp the disc between the pressure plate and the flywheel. The high-resistance facing material prevents pressure plate displacement and thus keeps the clamp load almost constant.

The graph below shows the H.E.C. clamp load variation for a new clutch and for a used clutch. The clamp load is constant over the lifetime of the clutch to ensure effective torque transfer.



The graph below shows the pedal load measurement on a popular car application using a 228 mm HEC clutch. The pedal load is measured with a new clutch and at the end of the clutch life.

The pedal load remains at the desired level both in new clutch (approx. 9 kg) and in a worn clutch (11 kg) to provide constant driving comfort.



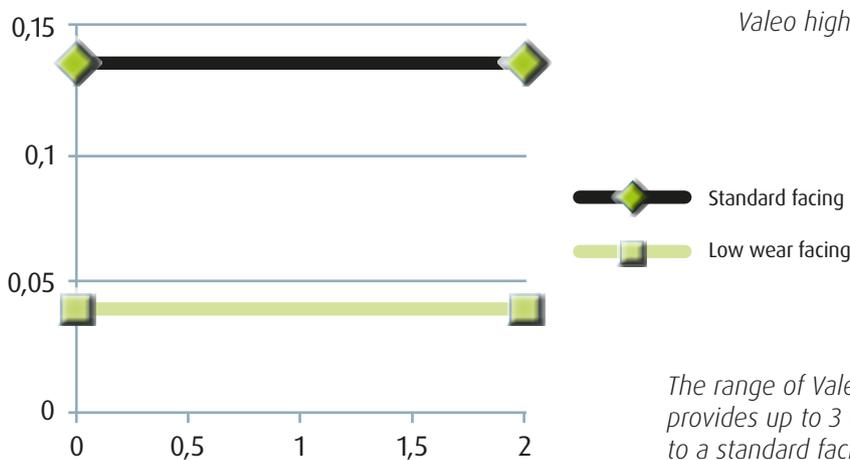
# 10

## H.E.C. main advantages

- **Easy to fit:** Valeo H.E.C. is installed just like a standard clutch and does not require any additional tooling or training
- **Reduced fitting times:** the H.E.C. is fitted just like conventional clutches. No additional operations and checks are required
- **Comfortable:** constant and optimum pedal effort during the entire clutch life thanks to Valeo high-quality friction material with very low wear
- **Reliable:** simple and robust design, no complex and sensitive components
- **Improved clutch life:** Valeo high-quality and very low-wear friction technology increases clutch life under normal driving conditions



### Facing wear ratio comparison



*Valeo high quality & very low wear friction material*

*The range of Valeo low-wear facing materials provides up to 3 times lower wear ratio compared to a standard facing, improving clutch life.*

# 11

## Technical support

Valeo S.A.T. and H.E.C. are easy to fit on the vehicle. The clutch is installed in the conventional way, and there is no need for a special tool. The sequence for assembly follows the usual sequence for the clutch assembly.

### H.E.C. Technical Fitting Instructions

Valeo clutch experts create technical fitting instructions that provide a step-by-step installation guide. These easy-to-follow instructions are prepared and validated in real vehicle trials at research and development sites. The results are confirmed through drive tests conducted by specialists.

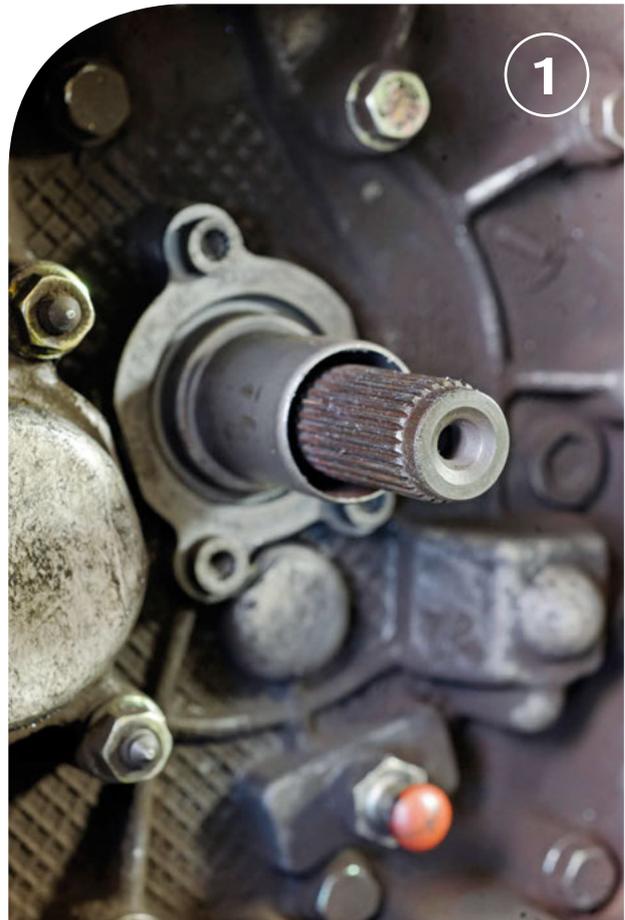
Fitting instructions and more info on H.E.C. are available in the Valeo Electronic Catalogue, on the Valeo Tech-Assist website and Tecdoc®. For detailed info on fitting instructions please contact your Valeo representative for your region.



# 11. Technical support

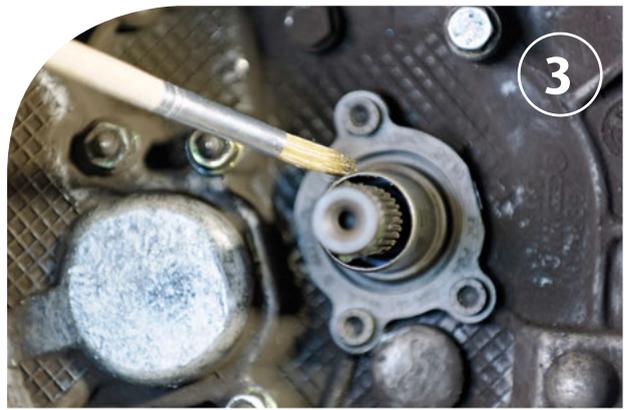
## 11.1. After dismantling the gearbox from the engine

- Check the engine crankshaft seal and verify that there is no oil contaminating the flywheel
- Check the condition of the gearbox input shaft splines (1)
- Check flywheel and friction surface, fitting bolts
- Check the gearbox input shaft seal
- Check the clutch actuator (guiding tube surface, clutch lever, receiver push rod or concentric slave cylinder) (2)



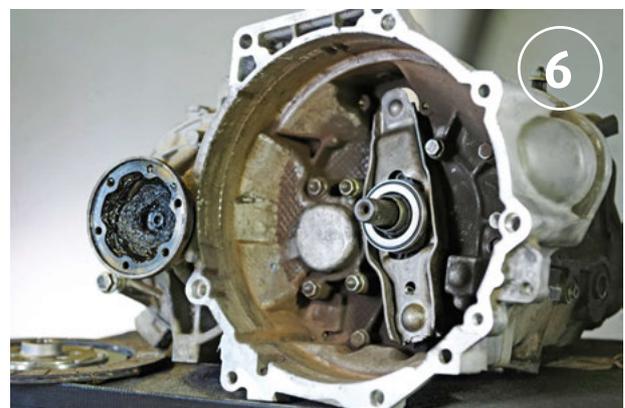
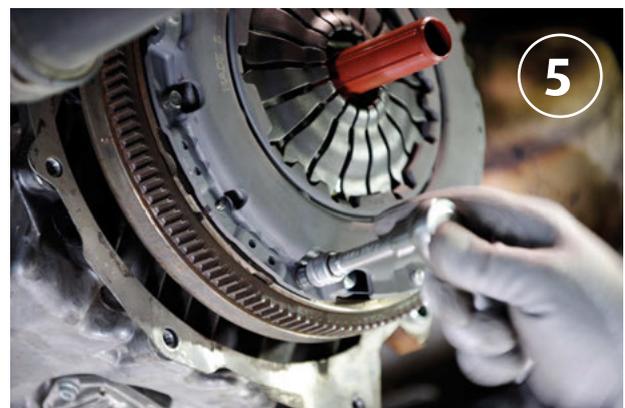
## 11.2. Preparation of the clutch for fitting

- Apply a small quantity of grease to the hub splines, to the internal diameter of the release bearing and to its contact with the lever as well as to the contact point of guide tube and clutch lever (3)
- A 1gr grease bag is available inside the box and it is enough to grease all components (4)



## 11.3. Fitting the clutch

- Position the disc over the flywheel using the centering tool.
- Position the cover centering it using the pins and tightening three screws by  $120^\circ$  while checking that the disc remains stable and well-centred thanks to the centring tool
- Slowly tighten the screws slightly in a star-shaped pattern. The diaphragm fingers have to move as uniformly as possible. Repeat the sequence three times (5)
- Completely tighten the screws to the given tightening torque using a torque wrench
- Assemble the release bearing on the guide tube and check if it slides correctly (6)



## 11. Technical support

### 11.4. Re-assembling the gearbox

- Check condition of the block pins
- Position the gearbox coaxially with the engine crankshaft, support the gearbox weight with appropriate tools (7)
- Set the gearbox input shaft into the disc hub and take care to avoid shock or excessive force
- Avoid that the weight of the gearbox is supported by the clutch disc during assembly
- Ensure that the gearbox is in full contact with the engine block and the centring pins are correctly fitted
- Bolt the gearbox to the engine block using appropriate torque



### 11.5. Verify that the clutch is functioning correctly

- Disengage and reengage the clutch, shifting each gear (8)
- Check that there is no abnormal noise during clutch engagement/disengagement
- Check that there is no abnormal noise at idle speed and while accelerating up to 4000 rpm
- Check that there is no abnormal clutch sliding while driving



# 12

## F.A.Q.

***“Can I reuse the old clutch cover and replace only the disc of an S.A.T. clutch?”***

The S.A.T. changes the position of the cover over the fulcrum ring to compensate for facing wear. Therefore, it is not possible to reset the device to its initial position for reuse. Always buy a new clutch kit to replace a self-adjusting clutch.

***“Do I need a specific tool for Valeo S.A.T. or H.E.C. clutches?”***

Valeo H.E.C. and S.A.T. clutches are installed using the standard fitting procedure and normal garage tooling. A special tool for mounting other self-adjusting clutches is sold in the market but must not be used for Valeo S.A.T. clutches (risk of actuating the S.A.T. device) and is not necessary for the H.E.C. clutches. Assembly is performed in the conventional way. The bolts are fitted in the usual, normal sequence for the clutch assembly.

***“What are the differences between Valeo S.A.T. technology and competitor products?”***

The robust Valeo S.A.T. design detects friction wear by position and keeps the diaphragm spring position constant throughout the clutch life. Apart from design, a great advantage of the Valeo S.A.T. is its easy installation in the vehicle. You do not need any specific tooling to install the Valeo S.A.T. clutch.

***“Which steps must be followed while mounting or dismounting an S.A.T. clutch?”***

Valeo S.A.T. installation is the same as for a standard clutch. The fitting procedure is identical, and normal garage equipment is sufficient to dismount or mount an S.A.T. clutch.

***“How can I identify S.A.T. or H.E.C. clutches in the Valeo catalogue or in Tecdoc?”***

Valeo S.A.T. and H.E.C. clutches are identified at the product title (Clutch Kit SAT / Clutch Kit HEC) on Tecdoc and with notes linked to the Valeo reference (S.A.T., H.E.C.) in the printed catalogue.

***“Does the H.E.C. technology provide an extended clutch life or is it the same as for the original clutch?”***

The H.E.C. clutch contains a high-quality friction material with very low wear. The friction material alone lasts up to 3 times longer than a standard friction material. However, clutch life is impacted by other components and drive conditions. Under normal drive conditions, clutch life is increased compared to a clutch kit with standard friction material.

***“What should I do when my H.E.C. clutch is worn and needs replacement?”***

When the H.E.C. needs replacement, a new complete clutch kit must be obtained. Please contact your sales representative or refer to the Valeo electronic catalogue for part identification.

***“On which applications the self-adjusting clutch is used?”***

More and more car manufacturers require a self-adjusting clutch in order to provide increased driving comfort. It is used widely in passenger vehicles and is also available for light and heavy duty commercial vehicles.

***“What car range does the H.E.C. cover?”***

Valeo offers H.E.C. on the independent after market as an alternative solution to the original self adjusting technology. Due to its main advantages and strong demand, H.E.C. development is a key to Valeo IAM R&D activities. The range today covers most popular European passenger car applications with specific focus on German car makes.

***“What is the lifetime of a self-adjusting clutch?”***

The lifetime of a self-adjusting clutch is the same as that of a conventional clutch.

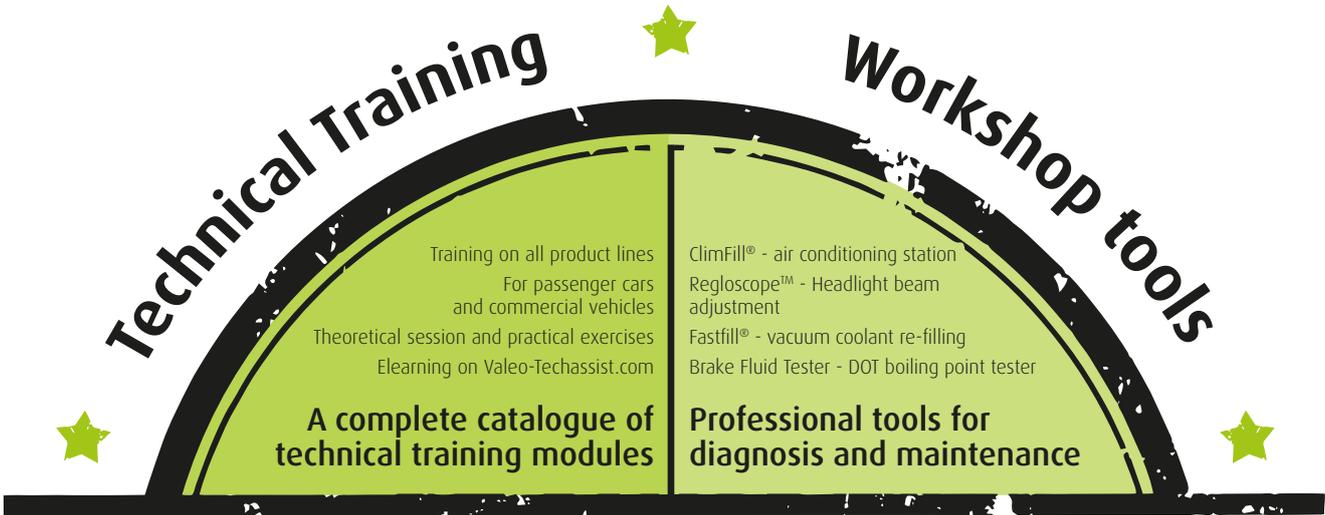
***“Is there a loss of comfort (noise and vibrations) because of different friction material or design?”***

Each H.E.C. is designed and tested to provide the same clutch function as the original clutch, including the filtration of noises and vibrations generated by the engine. Even when a clutch with self-adjusting function is replaced with H.E.C. technology, Valeo ensures correct functioning of the clutch on the vehicle.

# Tech'Care

## Delivering Technical Expertise

A range of technical and support services from your multi-specialist



# TECH' CARE



**CONTACT YOUR VALEO TECHNICAL PROMOTER FOR A DEMO !**



valeo added 

Automotive technology, naturally





## Valeo, your Multi Specialist partner.

Our mission is to be the supplier of choice for all powertrain architectures with innovative technologies developed for efficient and comfortable power transfer from the engine to the transmission, whilst reducing fuel consumption.

More and more car manufacturers demand new clutch technologies to increase comfort for the driver. As a consequence the Self Adjusting Technology is designed to provide a constant pedal effort over the lifetime of the clutch. Since 2000 Valeo has been producing clutches with Self Adjusting Technology.

As an alternative solution Valeo has introduced also the High Efficiency Clutch to replace the original clutch kit with self-adjusting function.

This technical handbook is the opportunity to explain you the design, composition and related advantages of the two technologies. You will find as well the answers to the most frequently asked questions.

### Valeo Service

70, rue Pleyel  
Cedex 93285 - Saint Denis - France  
Tel. : (+33)149 453 232  
Fax : (+33)149 453 201

[www.valeoservice.com](http://www.valeoservice.com)



Automotive technology, naturally