SEAT

1.4L TSI engine with active cylinder management ACT

Self Study Programme no. 156

ENJOYNEERING

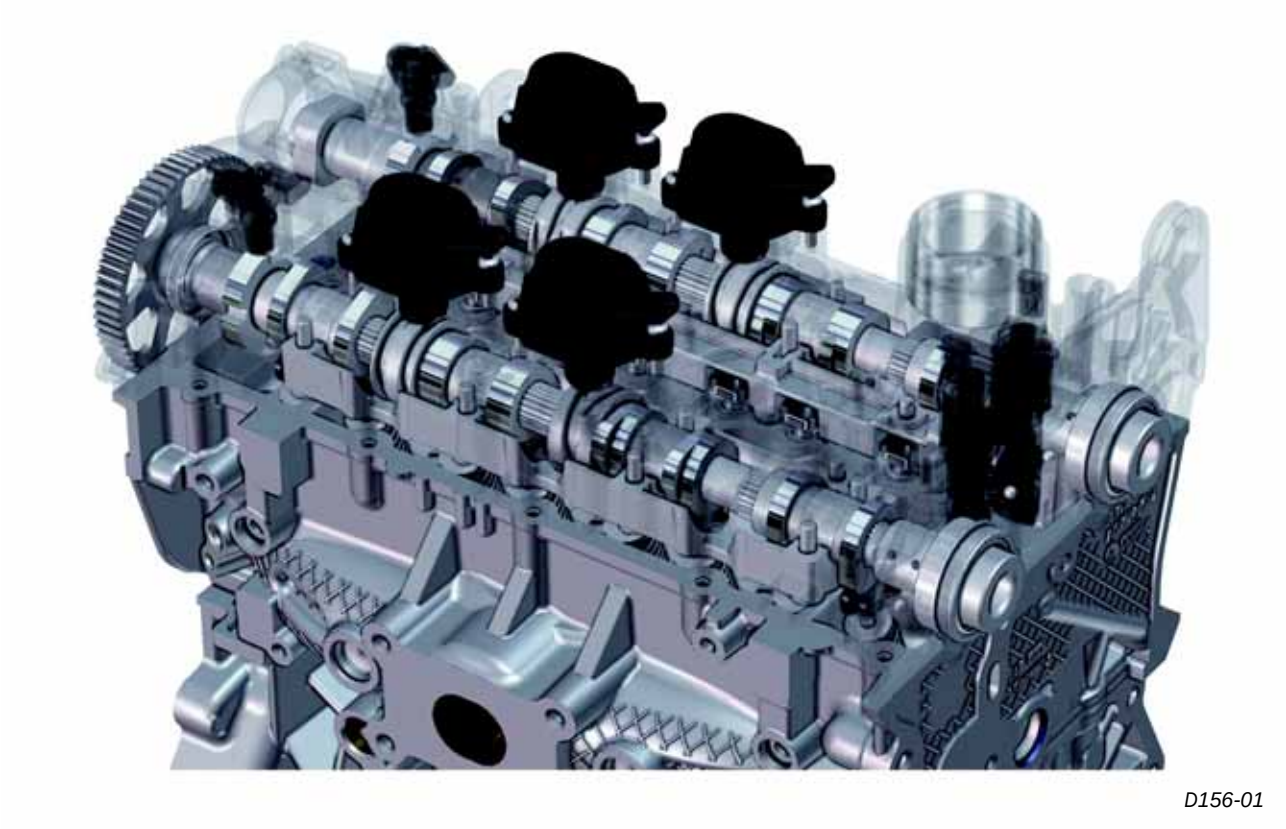
SEAT incorporates an new 1.4L TSI engine with designation letters PTA belonging to the EA211 petrol family of engines.

It is the first engine with an **active cylinder management system (ACT)**, a technology that deactivates two of the four cylinders momentarily.

The introduction of this new powertrain favours reducing fuel consumption and polluting gas emissions. Cylinder deactivation reduces 0.4 litres of fuel every 100km, which as a result reduces 10 grams CO2 per every kilometre driven.

With the launch of this new powertrain the brand moves one step ahead in the development of high efficiency, low consumption and environment respectful engines.

The contents of this self study programme illustrate the specific features of the ACT system and highlight the main changes to the engine compared to the same powertrain without the cylinder management system.



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The information described in this self study program is part of a technology shared by the VW Group brands.

Specific specifications of each brand are accompanied by their identification badge, in effect at the date of development of this current document: 07/13.

SUMMARY

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INTRODUCTION

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The 1.4l / 103KW engine with active cylinder management shows some **differences compared to the original powertrain.**

The most significant are:

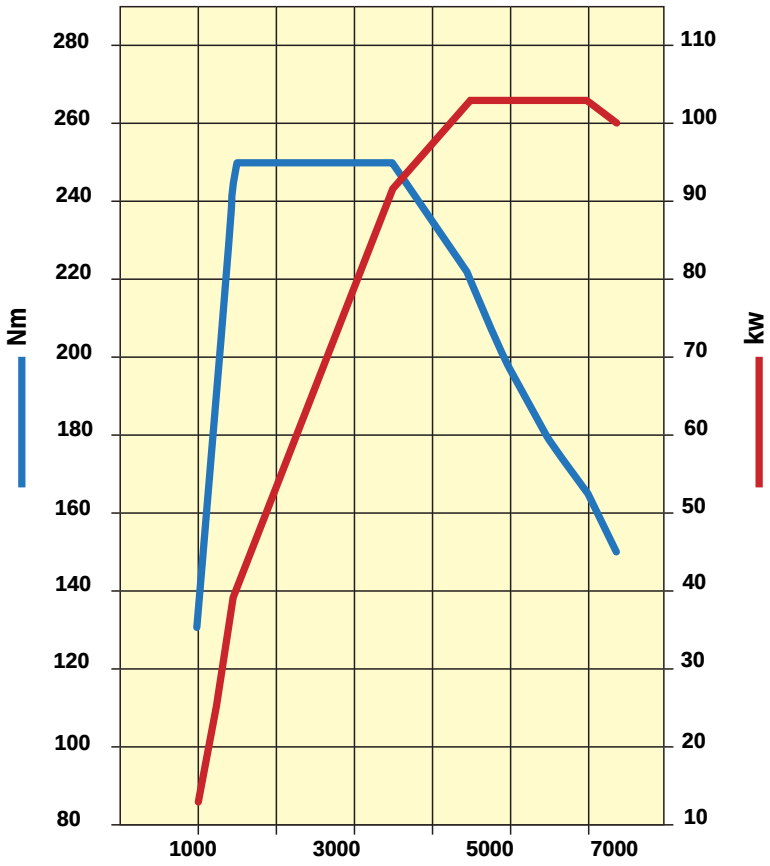
- **Adaptations implemented on the cylinder head** to incorporate the actuators and the mobile cam carriers.
- Changes to the **dual mass fly-wheel**.
- **Rectified exhaust** system.
- **Engine management** Bosch MED 17.5.21.

The **general features of the engine** to be highlighted, both for the cylinder disconnection version and for the original version are:

- **Aluminium engine block**.
- Timing **toothed belt** system.
- Exhaust gases **turbocharger** with electrical activation wastegate.
- **Exhaust manifold integrated in the cylinder head**.
- **Variable timing** on the intake and exhaust camshafts.
- Regulated oil pump.
- Coolant pump activated by the toothed belt through the exhaust camshaft.

Two-part sump.

- Oil separator at the lower end of the engine block.



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TECHNICAL DATA

Designation letters:.....CPTA
Capacity:.....1395 cm3
Bore and Stroke:.....74.5 x 80.0 mm
Compression ratio:.....10:1
Valves per cylinder:.....4
Maximum power:.....103 kW at 4500 - 6000 rpm
Maximum torque:..250 Nm between 1500 and 3500 rpm
Engine management:..Bosch Motronic MED17.5.21
Emissions Standard:.....EU5 Plus

The **new generation of engines EA211** has been subject to a significant **weight reduction**. Manufacturing of **lightweight components** such as the crankshaft, conrods, hollow bearing journals and aluminium pistons and engine block have favoured the development of an optimised weight engine. Also, the components implemented for deactivating the cylinders have only meant an **increase of 3 kilograms**.

INTRODUCTION

ACT ACTIVE CYLINDER MANAGEMENT

The cylinder management system implies **deactivating cylinders 2 and 3**. The **inlet and exhaust** valves **close** completely and both the **injection** and the **ignition** are **disconnected** to make the engine run on two cylinders.

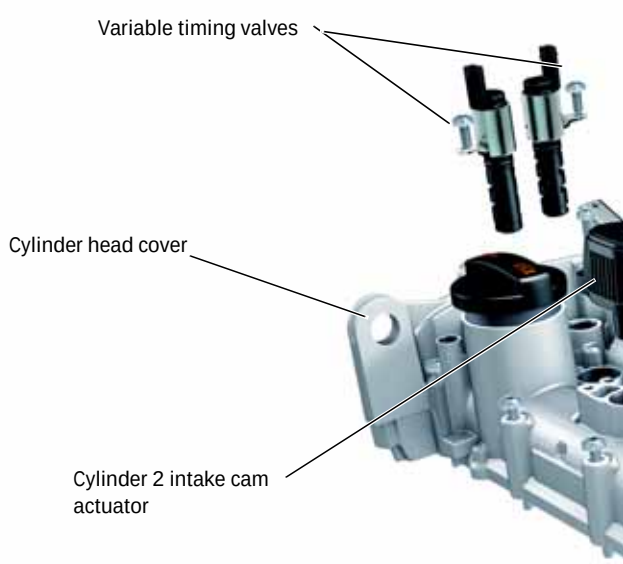
To deactivate the valves two cam actuators are used for the inlet and two for the exhaust, which is why the cylinder head is where more changes have been made to the engine.

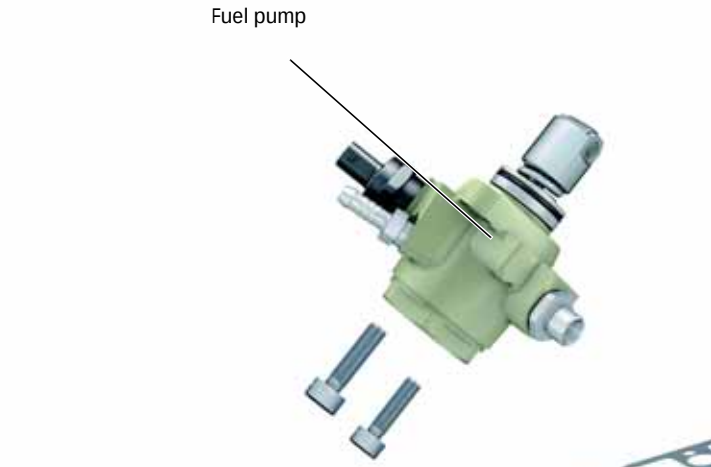
Also the camshafts have been modified, now they are fitted with displaceable cam carriers that vary the drive flank of the cams and force valve closing. For this, and for space reasons, the cam races and the floating rocker rollers have been reduced, and they are now narrower than in conventional engines.

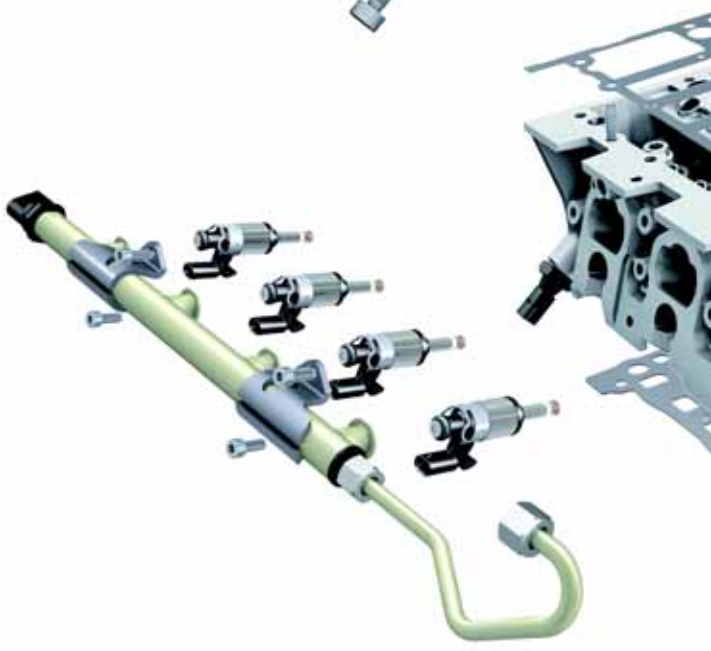
The flywheel and the front engine bearings have been adapted for implementing the system.

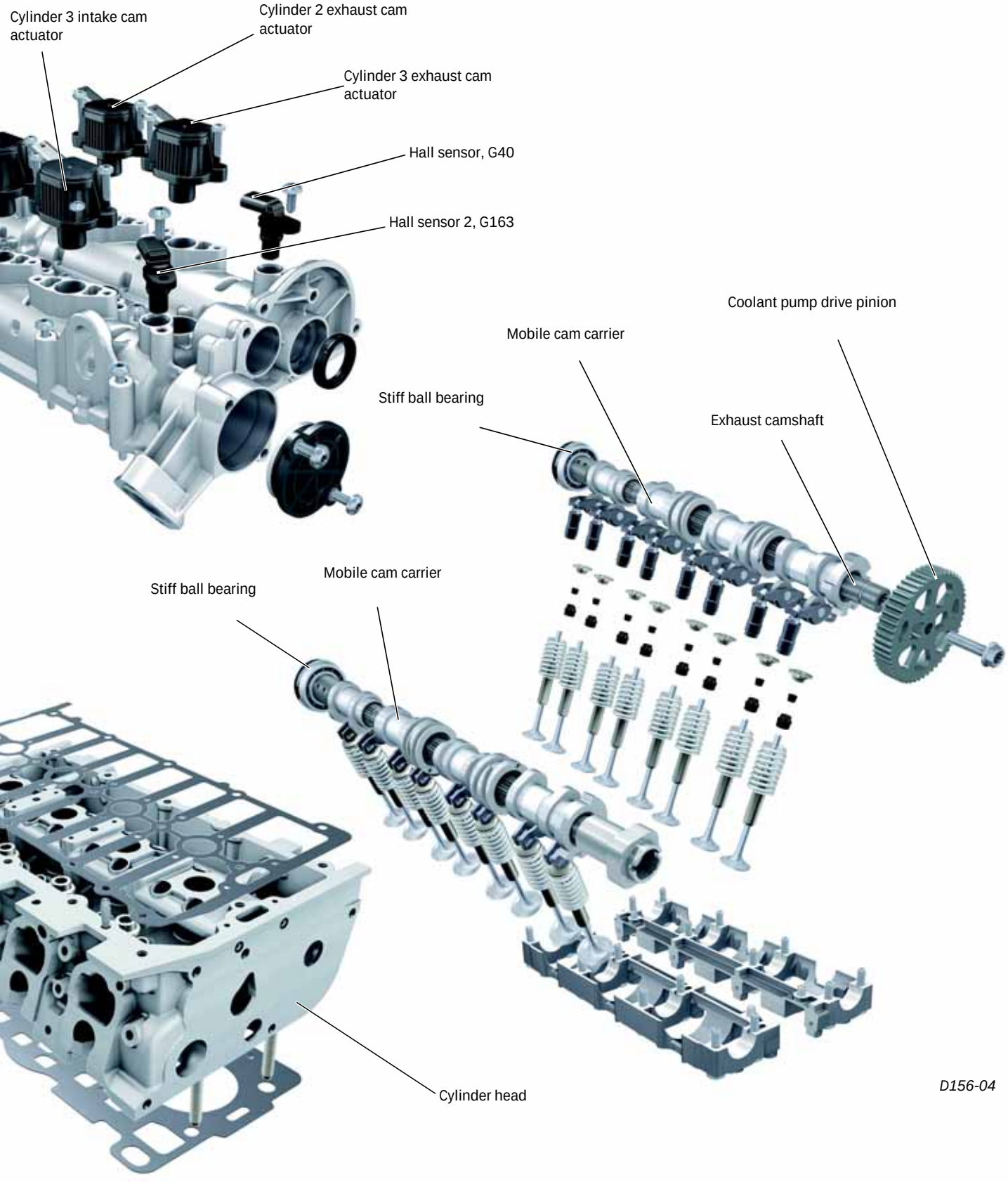
Some **requirements** the system management depends on are:

- **Engine revs**.
- **Oil temperature**.
- **Coolant temperature**.
- **Lambda** regulation.
- Engine **start-up** always takes place in **4-cylinder mode**.








Cylinder 3 intake cam actuator
Cylinder 2 exhaust cam actuator
Cylinder 3 exhaust cam actuator
Hall sensor, G40
Hall sensor 2, G163
Coolant pump drive pinion
Mobile cam carrier
Stiff ball bearing
Exhaust camshaft
Mobile cam carrier
Stiff ball bearing
Cylinder head
D156-04

OPERATION CONDITIONS

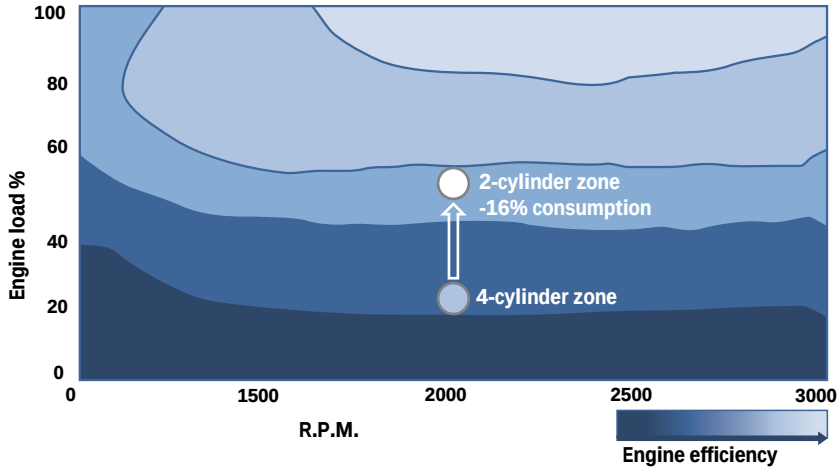
For cylinder disconnection to take place, certain conditions must comply:

- **Engine revs** should be between 1250 and 4000 rpm. For values below this range, if the engine was to run on 2 cylinders it would not work properly, and at higher values the effort on the cam carriers would be extremely high.
- **Maximum rotation torque** is 85Nm, depending on the revs.

With higher torques deactivation would be disabled and the 4-cylinder operation would activate.

Oil temperature is a highly conditioning factor for the system. The mobile elements of the system are lubricated with engine oil, and with oil at low temperature and highly dense the cams cannot switch-over.

- **Lambda regulation** must be active to prevent jerking when switching over.



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As well as the abovementioned conditions, there are other conditions that difficult deactivation or switch over from 2 to 4 cylinders:

- **Irregular or very sporty driving**. Analysis of the signal from the accelerator and brake pedals, and of the steering wheel movements make it possible to know whether it is possible to switch over to 2 cylinders, because sudden changes to the engine operation mode would have the opposite effect on the system, as it would increase fuel consumption instead of reducing it.
- **Heating demand,** because it needs having maximum heating power as soon as possible.
- **In sudden or strong accelerations** it would need the engine to provide the necessary maximum power available.
- In all cases **engine start-up** is done in 4-cylinder mode.
- **When going downhill,** switching over to 2 cylinders is also cancelled, because in these situations the idea is to have as much engine braking effect. For this the signal from the ABS J104 is used, from the wheel revs sensor and vehicle tilt sensor.

ADVANTAGES OF THE ACTIVE CYLINDER MANAGEMENT

UN-CHOKED OPERATION

A major disadvantage of petrol engines compared to diesel engines is the highly choked operation in the partial load margin.

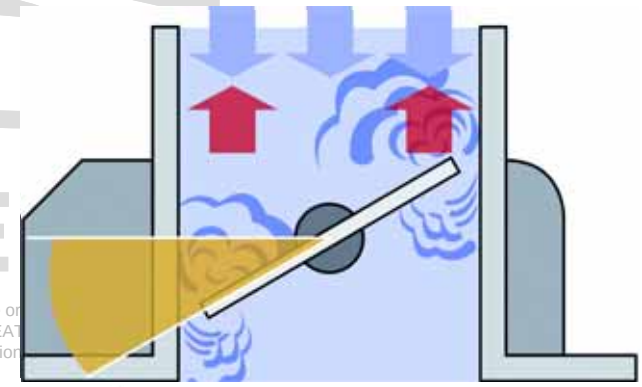
Whilst in the diesel engines operation is possible almost without choking and torque is regulated by the amount of fuel injected, in petrol engines the air/fuel ratio has to be regulated in almost all conditions with lambda = 1. It is only this way that the emission standards are complied with the three-way catalyst.

To explain the advantages of the 2-cylinder mode, the position of the butterfly throttle during partial load in 2 and 4 cylinder modes is shown. In both cases the engine control unit has calculated the necessary amount of outside air and fuel for the torque demanded.

4-CYLINDER MODE

As outside air is being supplied to all the cylinders, the butterfly throttle valve doesn't open much for the necessary torque.

When drawing-in air a strong swirl is generated in the butterfly throttle valve. Because of these swirls the engine has to draw in the air against a strong resistance. Fuel consumption rises as a result of these losses due to choking.



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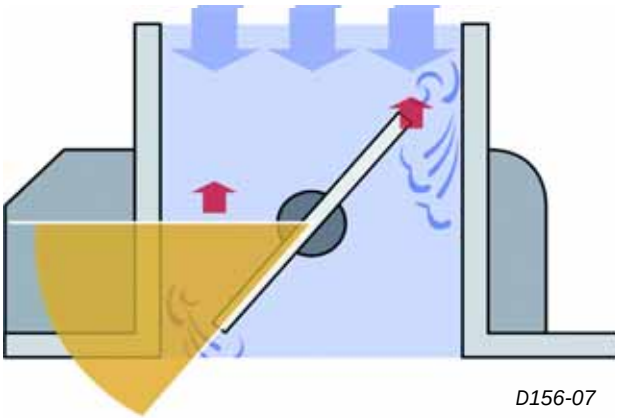
2-CYLINDER MODE

To deliver the same amount of torque in the 2-cylinder mode as in the 4-cylinder mode both cylinders have to be supplied with approximately the same amount of air as for the 4 cylinders. This is only possible by opening the butterfly throttle valve. Because of a greater opening angle there is less swirl generated in the butterfly throttle.

The engine draws in the air against a smaller resistance and fuel consumption is reduced.



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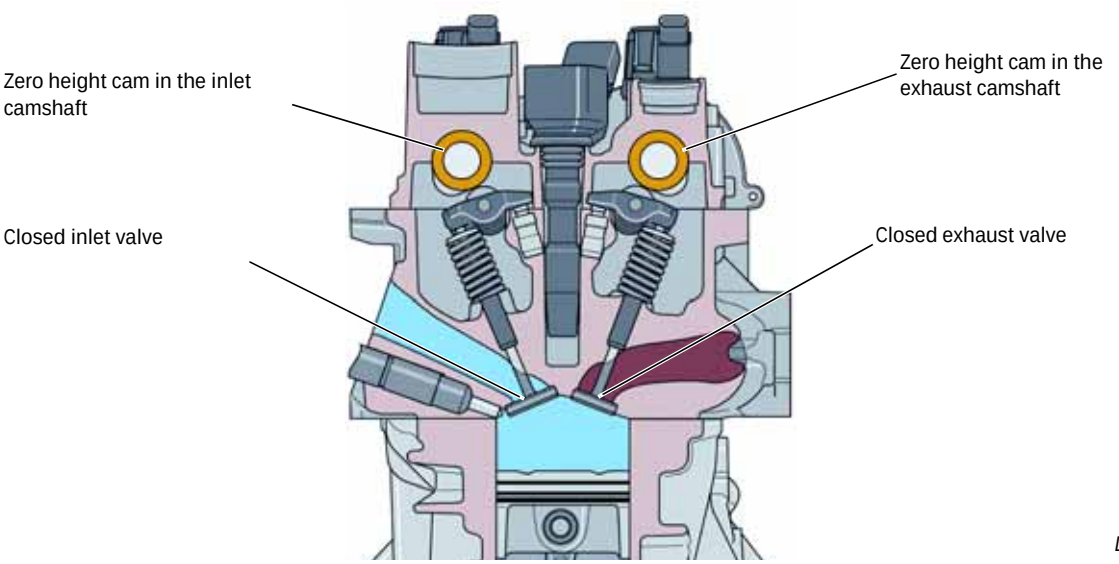
ADVANTAGES OF THE ACTIVE CYLINDER MANAGEMENT



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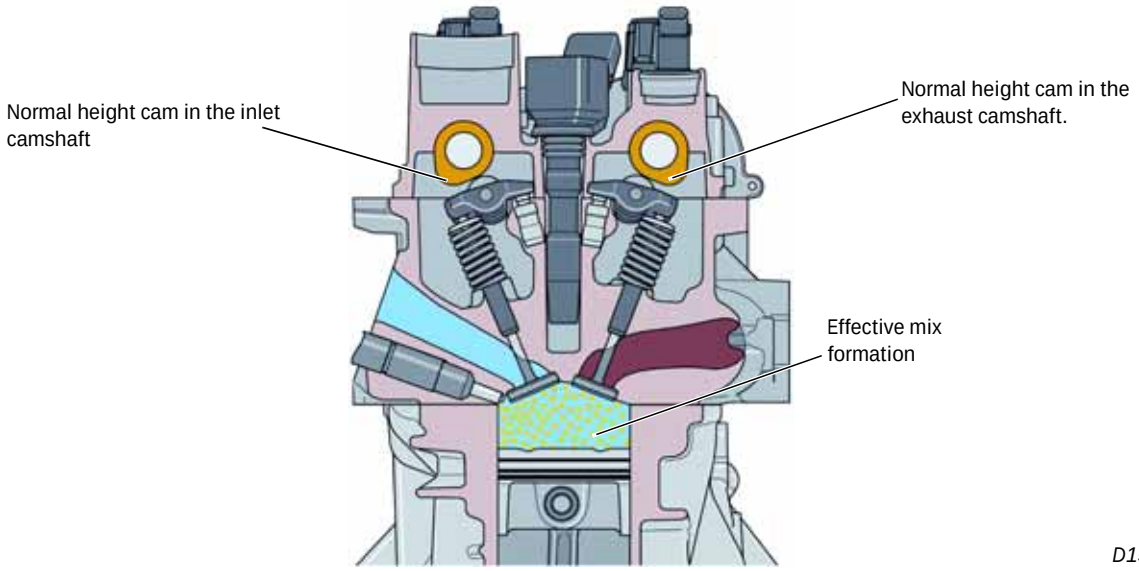
REDUCED LOSSES DUE TO GAS EXCHANGE.

Exchange of gases is completely eliminated with cylinders 2 and 3. The floating roller rockers of these cylinders operate with zero height cams, the valves remaining closed.

The engine does not have to supply power to the disconnected cylinders nor to open the valves or draw in and release air.



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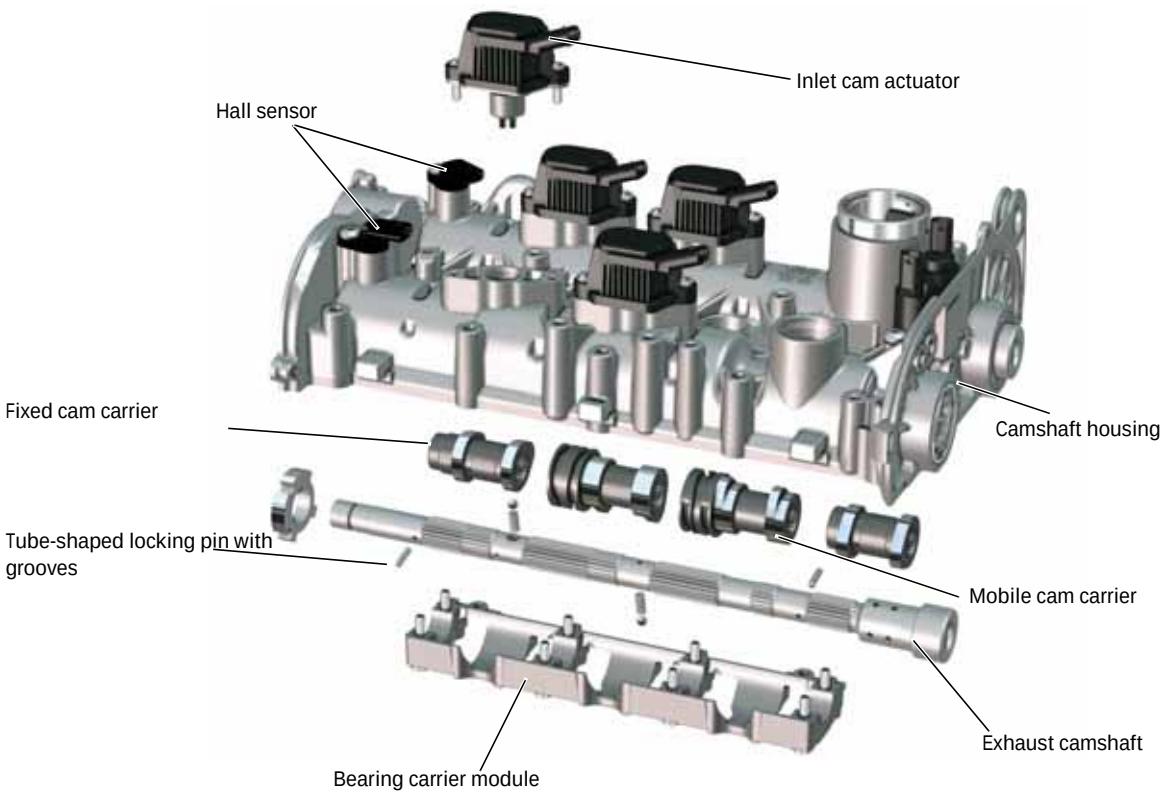
IMPROVED EFFICIENCY

Cylinders 1 and 4 are in charge of doing the work of cylinders 2 and 4, which are disconnected. Because of this, they work at a higher load range. In this margin mix creation and combustion are more effective. Also, in the deactivated cylinders heat generated in comsbustion is not transferred to the cylinder walls, meaning that the engine heat losses are reduced and thermal efficiency increases.



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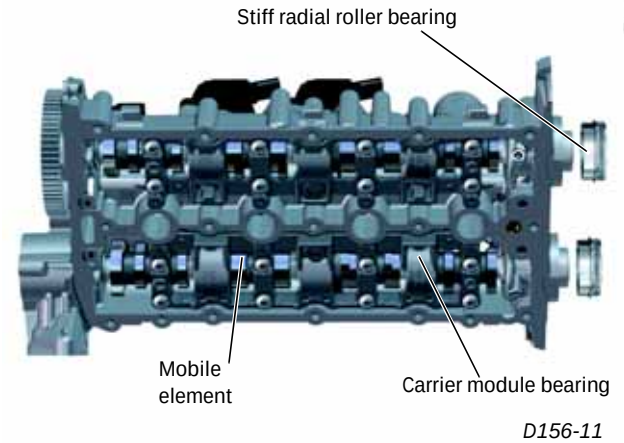
The cylinder head is the main component modified for adpating the system. The camshafts housing is made of aluminium cast and it is a single module.

Both camshafts are identical and they have teeth on the outside where the cam carriers are attached.

In each shaft there are:

- Two **fixed cam carriers** for cylinders 1 and 4.
- Two **mobile cam carriers** for cylinders 2 and 3, with two actuators that vary the height of the cams, both inlet and exhaust.



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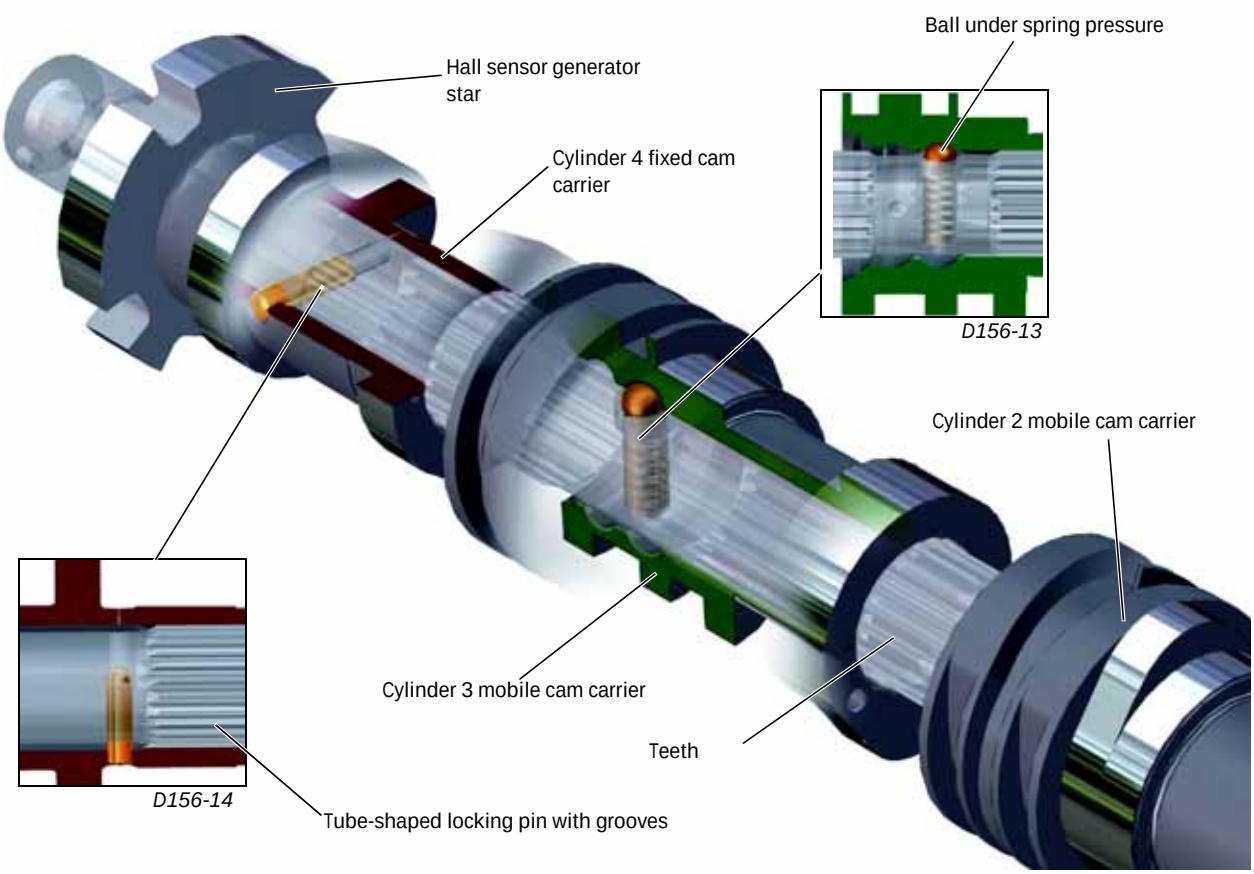
The camshafts are housed in the cylinder head housing and lean on two robust bearing modules. The cam carriers also work as pivoting point (fulcrum)

To reduce friction, the first bearing on each camshaft is the one under the greater effort from the toothed belt, and is made of a stiff radial roller bearing.

In the case of having to repair, the complete camshaft housing and the camshafts have to be replaced.



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CAMSHAFTS

There are two types of cam carriers both for the inlet and the exhaust camshaft.

For cylinders 1 and 4 the cam carriers are fixed on to the shaft through the shaft's teeth and the locking pin with slots.

For **cylinders 2 and 3**, which are the ones that close their valves for disconnection, the cam carriers are mobile, and they are secured by a ball submitted to the pressure of a spring, and they can be displaced longitudinally 7mm.

MOBILE CAM CARRIER

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2-CYLINDER MODE (ZERO CAM)

When the locking pin presses against the mobile cam carrier slot, it moves longitudinally on the camshaft and the cam shift takes place. Now the "zero cam" presses on the floating rocker without generating any alternative valve movement, which will remain closed until changing to the 4-cylinder mode.

After switching-over is completed, the locking pin returns to its initial position and remains at it until the next energising. When the locking pin returns to its initial position, it sends a signal to the engine control unit so that it memorises a successful switch-over.

This process is carried out for the inlet and exhaust cams and in cylinders 2 and 3.

4-CYLINDER MODE (WORKING CAM)

When 4-cylinder mode is required another locking pin secures the mobile cam carrier so that it moves in the opposite direction.

The cam that acts on the rocker in this case is of a normal flank so that the valves open and close as usual.

Like in the previous case, this process takes place on the inlet and exhaust valves in cylinders 2 and 3.

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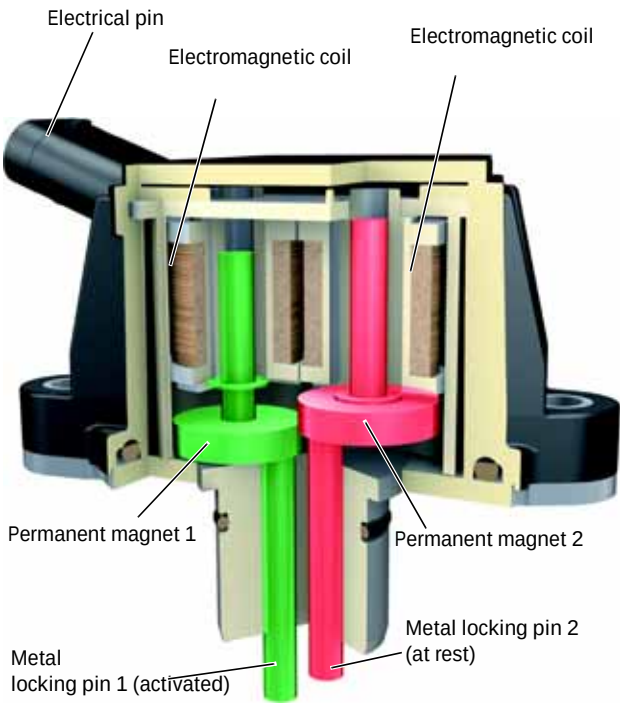

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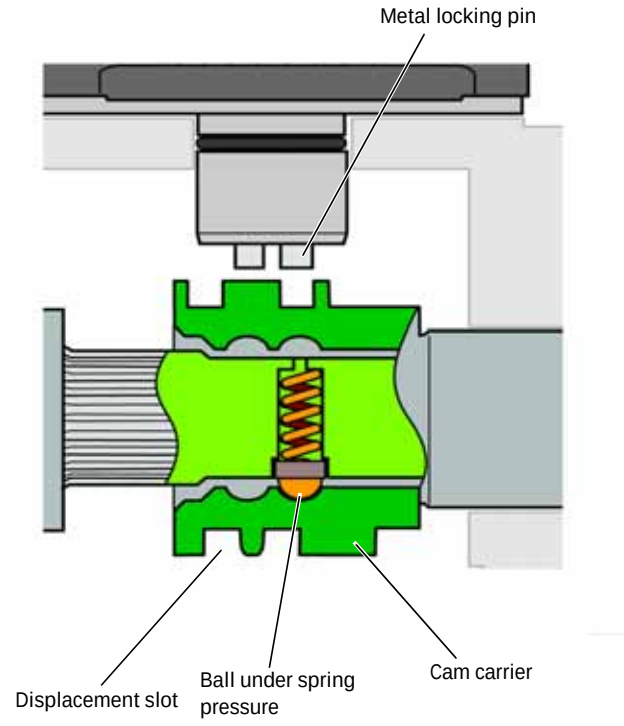
CAM ADJUSTMENT ACTUATORS

The cam actuators are located on the cylinder head. There is a total of 4 actuators:

N583- Inlet cam actuator for cylinder 2.
N587- Exhaust cam actuator for cylinder 2.
N591- Inlet cam actuator for cylinder 3.
N595- Exhaust cam actuator for cylinder 3 .

These actuators are similar to the Valvelift system of previous models, the difference being that there are two locking pins in the same actuator.



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CAM CARRIER LOCK

When the cam carrier has been displaced, a locking component is needed so that it does not move. For this a ball submitted to the force of a spring is used, which has two bearing positions and two functions:

- Secure the cam carrier during the setting process.
-Maintain the cam carrier in the current position up to the next setting process.

COMFORT MEASURES

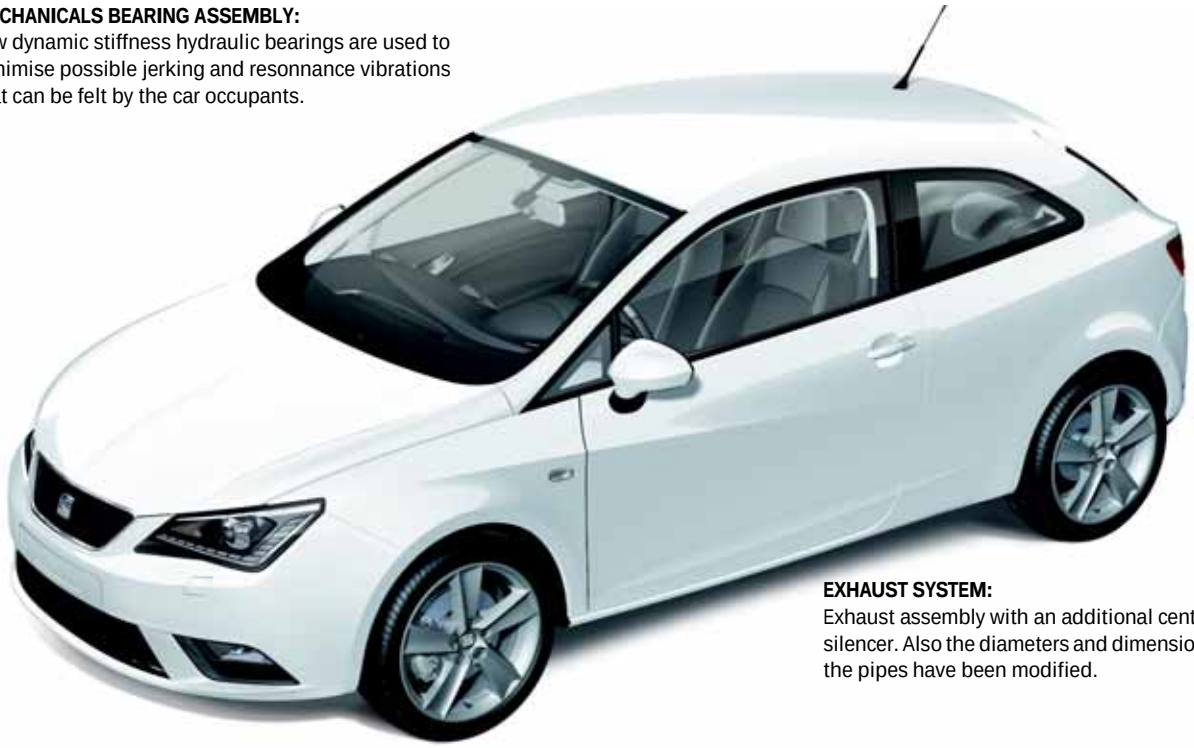
Something to be taken into account in the cylinder disconnection process is the necessary measures for preventing engine jerking and noise while running on two cylinders. Good engine performance is achieved because of the structure based on a solid engine build, a light crankshaft mechanism and transversal assembly position.

When deactivating cylinders 2 and 3 a uniform interval is maintained between the ignitions, however while in the 4-cylinder mode two ignitions per crankshaft rotation take lace, in 2-cylinder mode there is only one ignition. If measures are not taken, this generates more jerking and a harsher engine sound.

The most significant measures taken are:

- Mechanicals **bearing assembly.**
- **Exhaust system**.
- Adapted **dual mass flywheel**.

MECHANICALS BEARING ASSEMBLY:
Low dynamic stiffness hydraulic bearings are used to minimise possible jerking and resonnance vibrations that can be felt by the car occupants.



EXHAUST SYSTEM:
Exhaust assembly with an additional central silencer. Also the diameters and dimensions of the pipes have been modified.

DUAL MASS FLYWHEEL:
It incorporates a ZMS dual mass flywheel with an interspaced set of springs between the engine side and the gearbox side.

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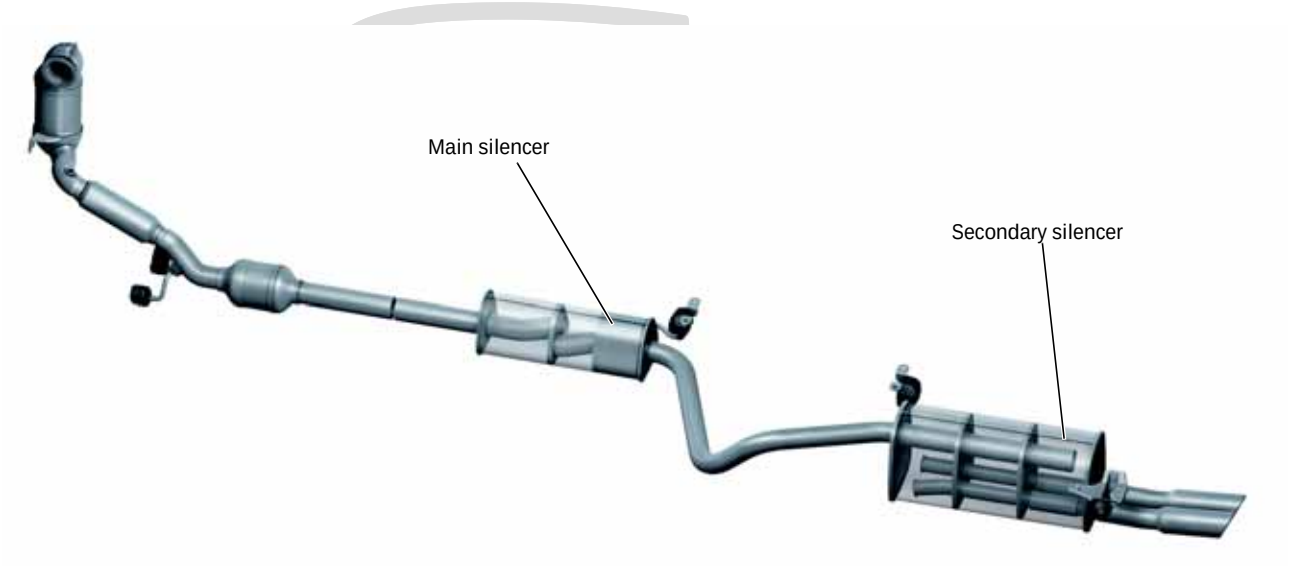
DUAL MASS FLYWHEEL

The ZMS dual mass flywheel should prevent vibrations and jerking reaching the transmission. For this the set of springs has been adapted between the inertia mass on the engine side and the gearbox side.

D156-20

EXHAUST SYSTEM

The exhaust gases release system has been modified to adapt to the difference between the 4 and 2-cylinder mode gases. Their pulses vary considerably between modes, that is why an intermediate silencer has been added and the dimension of of the pipes has also been modified.



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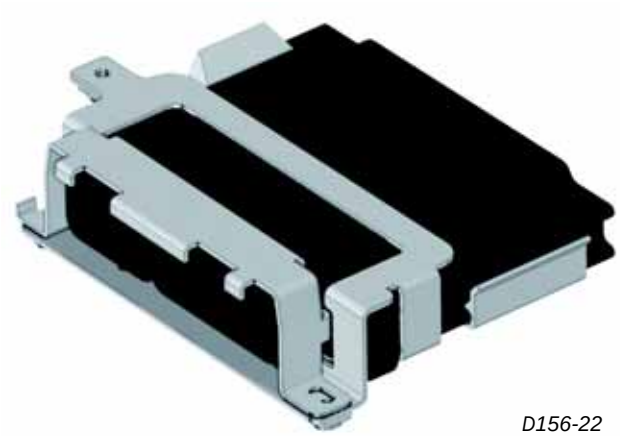
CYLINDER CONNECTING AND DISCONNECTING

ENGINE CONTROL UNIT

The engine control unit for the ACT system is managed by the Bosch Motronic 17.5.21. management system. To be highlighted among the unit's specific functions:

- Identify in each moment if consumption is higher with 2 or 4 cylinders, and connect or disconnect as required.
-Manage the connection and disconnection signals for the cam switch-over actuators.
- Activate and deactivate cylinders 2 and 3.
- Identify the system's incidents and register them in the diagnosis fault memory.



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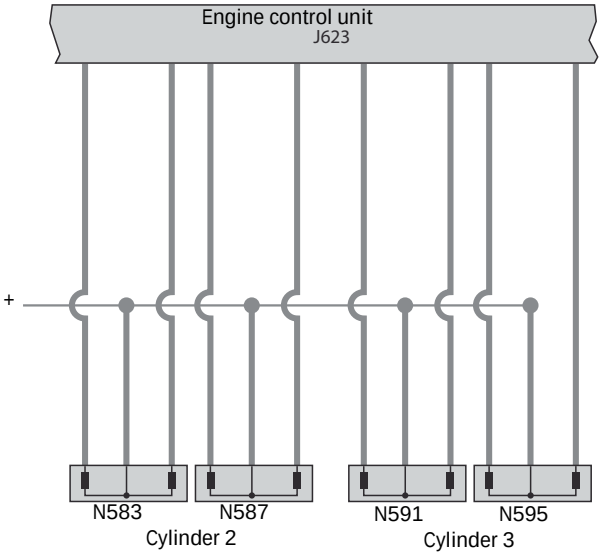
COMPONENT SIGNALS CAM CARRIER

When the cylinder connection/disconnection process takes place, the cam carriers in charge of displacing the cams send a signal to the engine control unit to indicate that switch over has been successful. Lack of this signal is interpreted as a system failure and an incidence is registered in the unit's fault memory.

N583- Cylinder 2 inlet cam actuator.
N587- Cylinder 2 exhaust cam actuator.
N591- Cylinder 3 inlet cam actuator.
N595- Cylinder 3 exhaust cam actuator.



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SELF-DIAGNOSIS

There is a test plan for the cam carriers. A sequence of cam carrier displacements is run at between 1500rpm and 3000rpm.

In order to spot the system faults more accurately, the locking pins are also identified in the diagnosis tester. For instance, for the inlet side of cylinder 2:

- **N584** cylinder 2 inlet cam actuator A.
- **N585** cylinder 2 inlet cam actuator B.

CYLINDER CONNECTING AND DISCONNECTING

DISCONNECTION PROCESS

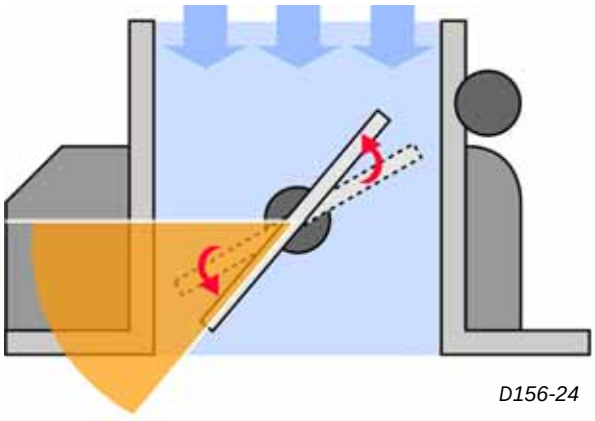
The aim of the cylinder disconnection process is to disable cylinders 2 and 3 completely; it is a process that hardly takes a few milliseconds and takes place during a complete camshaft rotation. During this time the driver should not feel any alteration to driving, load jumps or jerky engine.

It is also important that the sequence of operations is carried out properly as the lambda value should always be = 1.

Next the 5 phases of the deactivation process are described:

PHASE 1- BUTTERFLY THROTTLE POSITION. 4-CYLINDER MODE.

When cylinders 2 and 3 are disconnected cylinders 1 and 4 need to get the necessary amount of air for the torque demand in the 2-cylinder mode. For this the butterfly throttle valve opens more for the cylinders to take in approximately double the amount of air.



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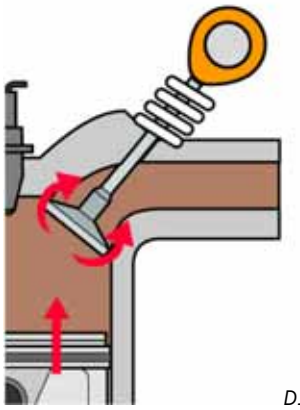
IGNITION MOMENT ADJUSTMENT. 4-CYLINDER MODE.

As the four cylinders are still connected and the amount of intake air is greater, this might result in higher rotation torque. To prevent this situation the ignition moment is delayed and performace suffers from it. Rotation torque will be constant.

D156-25

PHASE 2-EXHAUST GASES RELEASE. 2-CYLINDER MODE.

After the last cycle the exhaust gases are released and then the engine control unit energises the actuators that displace the mobile cam carriers via an earth signal. The rockers are now on the zero height cams, and **the exhaust valves** in cylinders 2 and 3 close completely.



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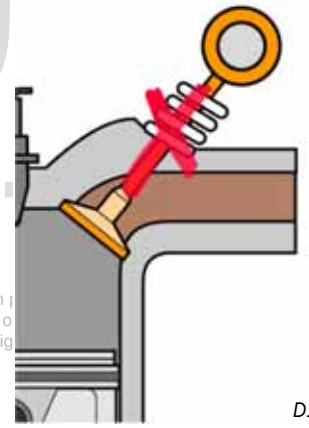
Exhaust gases release



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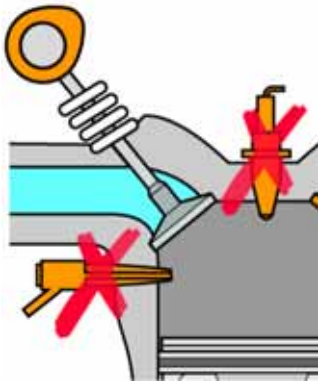
Valve closing

PHASE 3- INJECTION AND IGNITION ARE DISCONNECTED. 2-CYLINDER MODE.

During the 2-cylinder mode phase not only do the valves close, but the **injection and ignition are disconnected**. Cylinders 2 and 3 are completely disabled.



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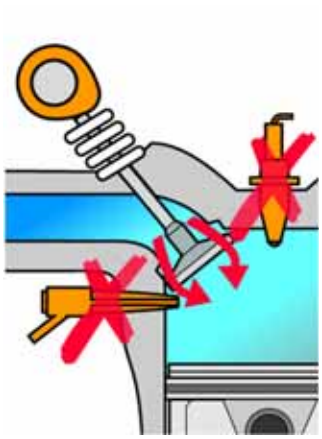
PHASE 4- INTAKE VALVES 2-CYLINDER MODE.

Before closing the inlet valves air is drawn-in again from the outside. This air is trapped in the cylinder and acts as a spring, so the necessary force for compressing it helps with the piston's down-stroke.

After drawing in the outside air the engine control unit energises the switches that displace the mobile cam carriers through an earth signal, so that the rockers act on the zero height cams and the inlet valves are closed. Injection and ignition continue disconnected.



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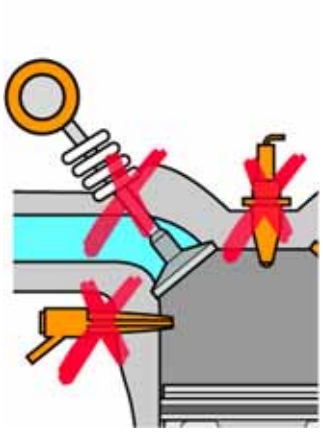
Drawing-in outside air (suction)



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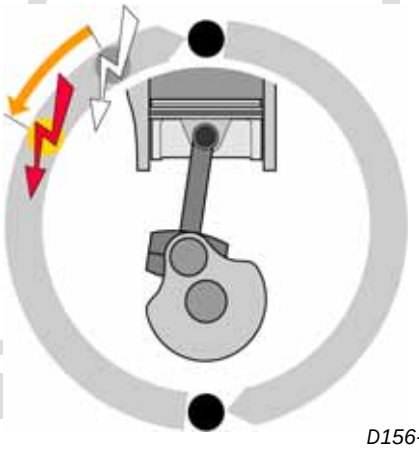
Valve closing

PHASE 5- IGNITION MOMENT SETTING. 2-CYLINDER MODE.

The ignition moments of cylinders 1 and 4 are regulated in advanced direction in order to achieve optimum performance.



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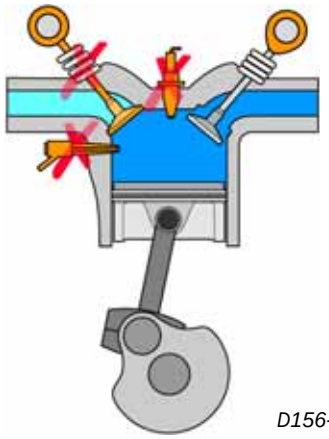
CONNECTION PROCESS

When the driving conditions allow it and the needs imply a 4-cylinder mode, cylinders 2 and 3 are connected. Like in the cylinder disconnecion process the driver should not feel any alteration to the running of the engine. This is why several measures have been taken regarding this process. As in the previous case, we have 5 phases for changing over correctly.

PHASE 1- EXHAUST VALVES. 2-CYLINDER MODE.

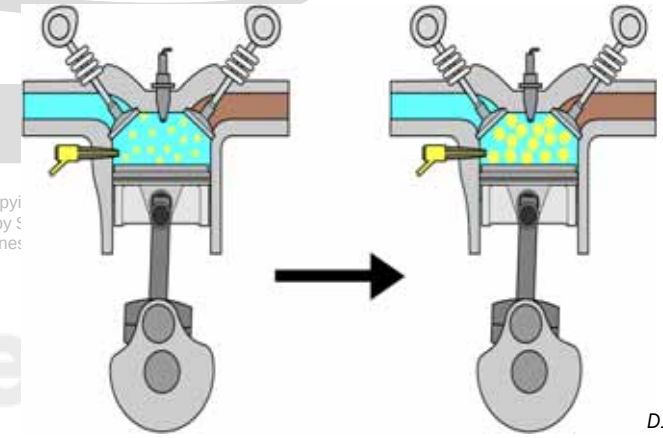
When conditions require it the engine control unit sends a signal to the exhaust cam actuators, which is when the cam carriers are set and the normal height cams act on the rockers. The exhaust valves of cylinders 2 and 3 are activated and the exhaust gases are released.



D156-32

PHASE 2- EXHAUST VALVES. 2-CYLINDER MODE.

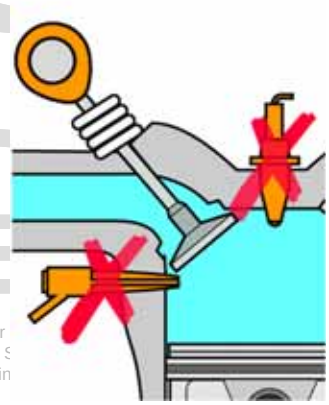
Because the gases released from cylinders 2 and 3 would affect the exhaust gases in the catalyst and the lambda value would rise above 1. Fuel injection in cylinders 1 and 4 will increase to reset the lambda value at 1.



D156-33

PHASE 3- INLET VALVES. 4-CYLINDER MODE.

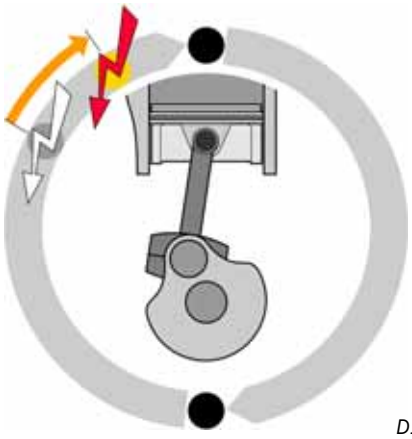
The cam carriers are regulated again and the floating rockers act again on the normal height inlet cams and air is drawn in again form the outside.



D156-34

PHASE 4- IGNITION MOMENT SETTING. 4-CYLINDER MODE.

Because the ignition and cylinder injection is already active in all the cylinders and the butterfly throttle valve is wide open, in the next cycle the rotation torque will increase considerably. For this reason the ignition moment is regulated, delayed, and performance drops. This will make the rotation torque constant.

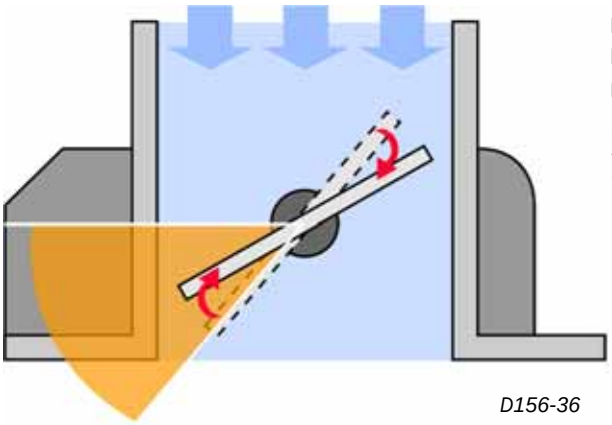


D156-35

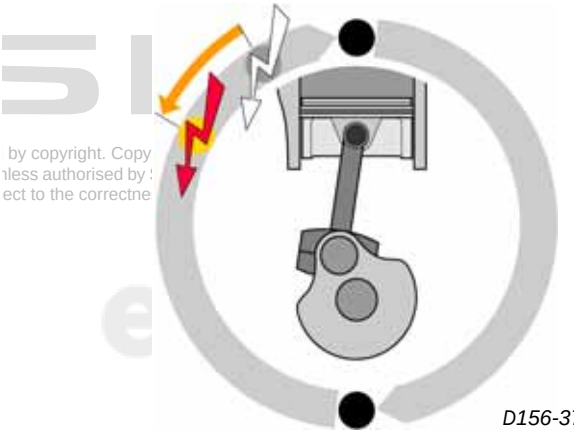
PHASE 5- BUTTERFLY THROTTLE POSITION. 4-CYLINDER MODE.

The butterfly throttle valve returns to its initial position. Now air has to be supplied to the four cylinders and torque jump has to be prevented.

Also, the ignition moments of all the cylinders are regulated again, this time they are advanced for optimum performance.



D156-36



D156-37

INSTRUMENT PANEL INDICATION.

According to the vehicle specifications it is possible to identify when it is driving in the 2-cylinder saving mode. In this case an indication can be seen on the instrument panel central display.

When driving in 4-cylinder mode there is no specific additional indication, the average current consumption is displayed.

The **K132 warning light** on the instrument panel warns the driver about possible system incidents.

D156-38

ENGINE MANAGEMENT

Inlet manifold pressure sensor**, G71**
Intake air temperature sensor, **G42**

Engine revs sensor**, G28.**

Hall sensor, **G40**

Hall sensor 2**, G163**

Butterfly throttle valve control unit, **J338**
Butterfly throttle sensors 1 and 2 (accelerator electronic control) **G187, G188**

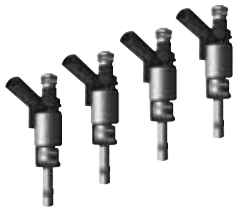
Accelerator position sensors, **G79, G185**.

Cylinders 2 and 3 intake cam actuators, **N583, N591.**

Cylinders 2 and 3 exhaust cam actuators, **N587, N595**

Engine control unit, J623

Instrument panel control unit, **J285**



Cylinder injector 1-4, **N30-N33.**

Ignition coil 1-4 with final power stages, **N70, N127,N291,N292**

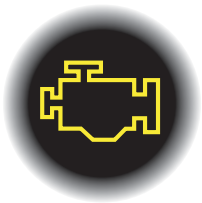
Butterfly throttle valve control unit, **J338**
Butterfly throttle sensors 1 and 2 (accelerator electronic control) **G187, G188**

Cylinders 2 and 3 intake cam actuators, **N583, N591.**

Cylinders 2 and 3 exhaust cam actuators, **N587, N595**

Data bus diagnosis interface, **J533**

Electronic accelerator control warning light**, K132**



Exhaust gases emissions warning light, **K83**

D156-39

HALL SENSORS G40 AND G163.

The Hall sensors are used to know the exact position of the camshafts. This signal and the crankshaft revs sensor signal and the engine control unit allow activating the cam switch-over metal locking pins at the right moment.

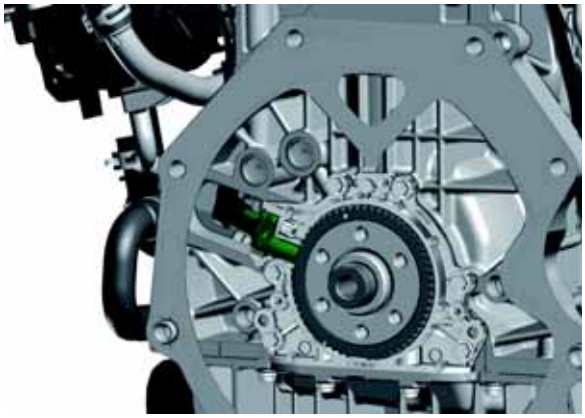
If the signal from any of these sensors is missing the engine will run in 4-cylinder mode. Also, the fault memory registers an incident, the K132 warning light will be activated on the instrument panel.

D156-40

ENGINE REVS SENSOR, G28.

Cylinders are disconnected at between 1250 and 4000rpm. The G28 engine revs sensor provides the engine control unit with constant information about the revs and indicates whether cylinders 2 and 3 can be disconnected.

If the signal from any of these sensors is missing the engine will run in 4-cylinder mode. Also, the fault memory registers an incident, the K132 warning light will be activated on the instrument panel.

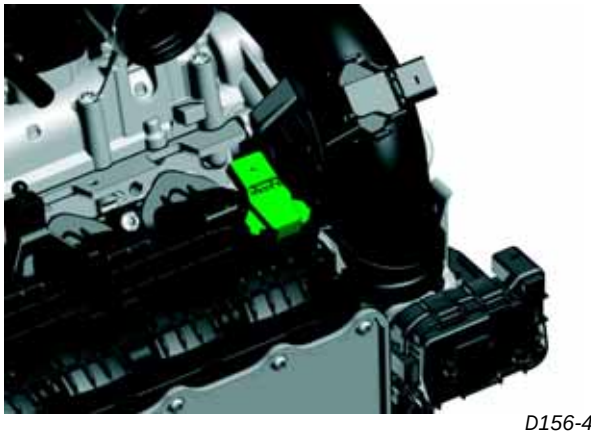


D156-41

INLET MANIFOLD PRESSURE SENSOR, G71, WITH INLET AIR TEMPERATURE SENSOR, G42.

The inlet manifold pressure signal is also very important for switching-over between 2-cylinder and 4-cylinder mode and vice-versa. When mode switch-over takes place, the valves open and close and the manifold pressure is altered, as it needs to comply with certain theoretical values for switch-over to take place.

Lack of this signal means that the engine control unit does not know the inlet manifold pressure and the cylinder management is disabled, the engine runs on 4 cylinders and the accelerator electrical control warning light, K132, is activated.

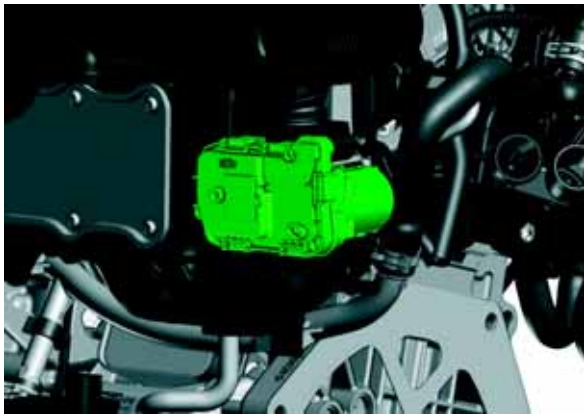


D156-42

BUTTERFLY THROTTLE VALVE CONTROL UNIT, J339, WITH BUTTERFLY THROTTLE CONTROL ANGLE SENSORS (ACCELERATOR ELECTRICAL CONTROL) G187, G188.

When switching over from one mode to another, the air mass must vary. For this, the butterfly throttle valve sensors indicate its position at all times and they change position if needed.

If the signal is lacking the cylinder management is disconnected and it is registered in the fault memory. The accelerator electrical control warning light, K132, is activated on the instrument panel.

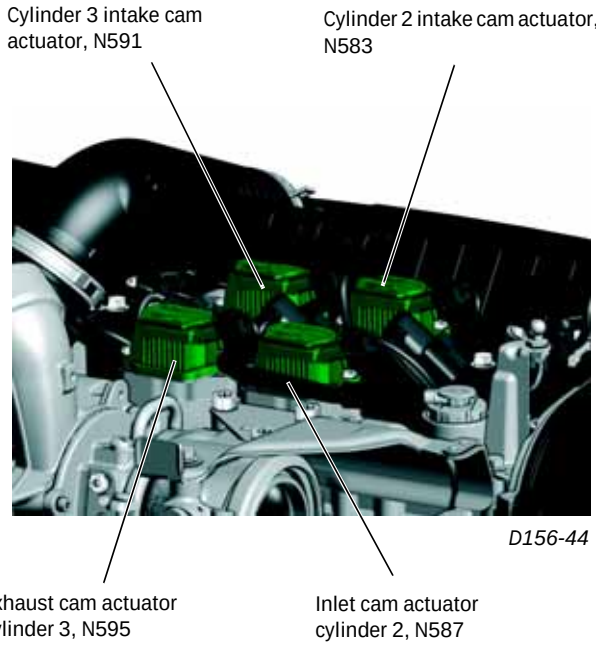


D156-43

INLET CAM ACTUATORS, N583, N591 AND EXAUST CAM ACTUATORS, N587, N595.

The engine control unit must know at all times the position of the cam carrier actuators, for this every time the locking pins return to their initial position the generate an induction voltage indicating the unit that switch-over has been completed successfully.

If the signal is lacking the cylinder management is disconnected and it is registered in the fault memory. The accelerator electrical control warning light, K132, is activated on the instrument panel.



The return signal from the locking pins that activate the cam carriers is used by the engine control unit to know that cylinder connection or disconnection has been successfully completed.

Depending on when there is lack of signal, engine performance will be vary.

- **During switching-over from 4-cylinder to 2-cylinder mode** it could happen that one of the valves in cylinders 2 and 3 does not close. This will make the engine control unit open the valves that had already closed, and the **engine will run in 4-cylinder mode**. The instrument panel warning light K132, will be activated and an incident will be registered in the fault memory.

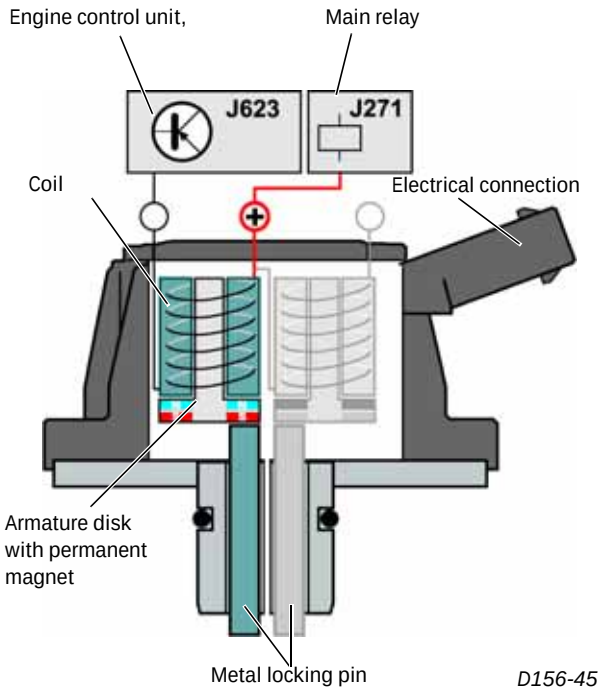
- When switching over from 2-cylinder to 4-cylinder mode, if it is detected that the cams of a cylinder - for instance cylinder 3- are not in normal height position and the cams cannot open, the ones which are in normal position will then open, that is the ones in cylinder 2. **The engine will run on 3 cylinders.** If a fault occurs in two of the cylinders the engine will then run on 2 cylinders.

- Engine start-up always takes place with 4 cylinders, if there is a fault memorised, the system will try and resolve it during the start-up cycle. In such case, the instrument panel warning light will remain deactivated and there will only be a sporadic incident in the fault memory. The system will be able to manage the cylinders without any problem.

METAL LOCKING PIN FOR THE MOBILE CAM CARRIER WHEN AT REST.

The engine control unit recognises that the mobile cam carriers are at their initial position as two permanent magnets remain at rest.

At this moment there is battery voltage in the electrical connection.

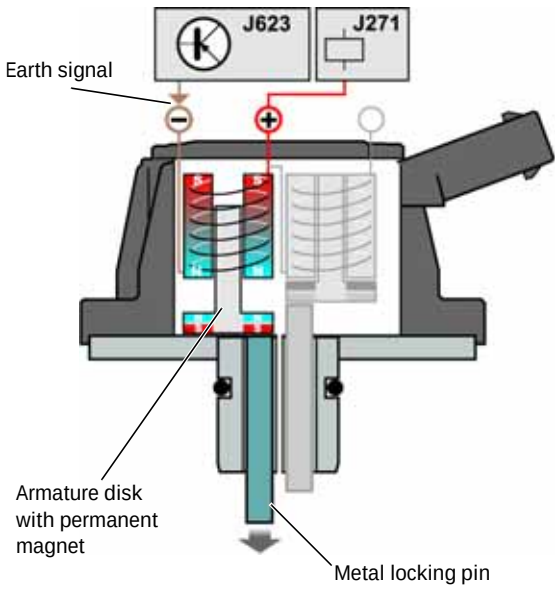


D156-45

METAL LOCKING PIN FOR THE MOBILE CAM CARRIER WHEN RELEASING.

When the actuator is energised, the engine control unit briefly applies an earth signal. In the electro-magnetic coil a magnetic field is generated which displaces the induced disk with a permanent magnet.

The permanent magnet keeps the metal locking pin released, which is the element that displaces the mobile cam carrier.



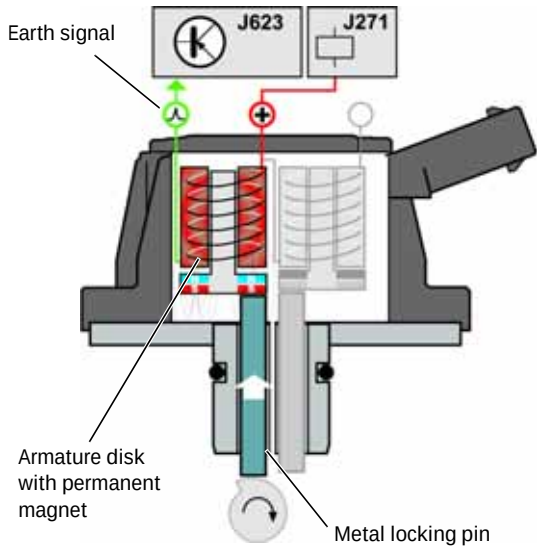
D156-46

METAL LOCKING PIN FOR THE MOBILE CAM CARRIER WHEN RELEASING.

The metal locking pin return and the permanent magnet induce a voltage in the electrical magnet electromagnetic coil.

The engine control unit recognises through the return signal that the cam carrier has been displaced and that the metal locking pin return has been successful.

The permanent magnet also holds the metal locking pin in its position here.

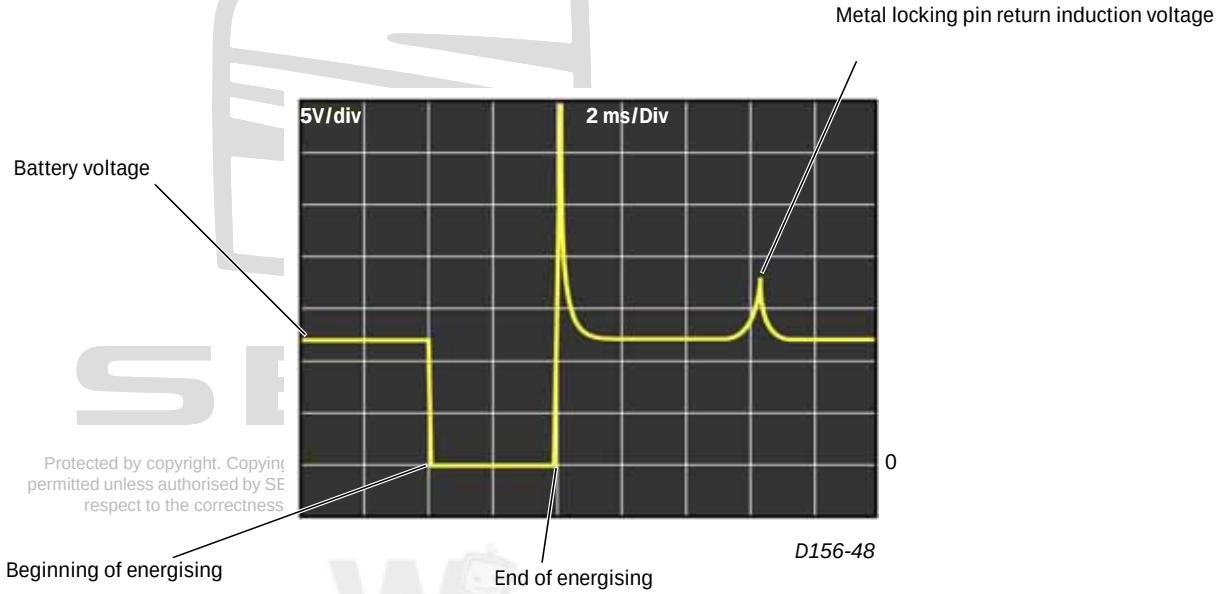


D156-47

During the 'at rest' period or when the function is deactivated there is permanent battery voltage in the actuators through the main relay, J271.

To activate the cam actuators:

- **The engine control unit** connects to earth for a brief period of time
- **The locking pin is released** and the process of displacing the cam carriers begins.
- After the cam carrier has been displaced **the locking pin returns to its initial position** and an induced voltage indicates that the process has taken place correctly.



D156-48

Note: *The exact instructions for checking, adjusting and repair are included in the ElsaPro application and in the diagnosis software.*

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