

Opel Agila



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1. General introduction of the Opel Agila

1.1 Introduction

For the model year 2000½, Opel introduces the new Agila, a car that belongs to the so-called Mini People Carrier segment. With this vehicle Opel is the first European car manufacturer ever to built a Mini People Carrier. The Opel Agila is born out of a corporation with Suzuki, but Opel made his own specific modifications to meet their quality standards and give the Agila its own expression. The Agila is built in the Gliwice plant in Poland and is available as right hand drive as well as left hand drive.

The Agila is a Sub-S model, which means that the Agila is placed just below the Corsa (S-car) in the Opel car line.

There is only one body version of the Agila available with three different model variants:

- Base (model-code F68)
- Comfort (model-code L68)
- Elegance (model-code P68)






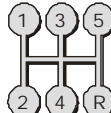
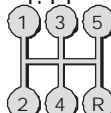
1.2 Car features

Active safety:

- Mc Pherson front wheel suspension
- Electronic Power Steering
- Anti-lock brakes (optional)

Passive safety:

- Headrests available on all seats
- 3-point seatbelt on all seats
- Pyrotechnical pre-tensioners for the front seat belts
- Body structure
- Drivers airbag (standard)
- codrivers airbag (optional)
- Third brake light

		
Z10XE	F12 - 4.39 	—
Z12XE	F12 - 4.11 	—

Comfort:

- Electrically adjustable mirrors
- Electronic power steering
- Air conditioning (optional)
- Power windows (optional)

Performance:

The Agila is available with two different engines:

- 1.0 litre 12V engine (Z10XE) with 58 Hp
- 1.2 litre 16V engine (Z12XE) with 75 Hp

The Agila comes with a 5-speed manual transmission (F12) only.

Some engine features:

- Double oxygen sensor
- Drive by wire (E-gas)
- Return-less fuel system
- Catalytic converter welded to exhaust manifold
- Plastic intake manifolds for both engines
- Maintenance free direct ignition system
- Maintenance free camshaft drive

The Z- emission stands for the internal definition of the compliance to Euro IV emission regulations, that will be effective by 2005.



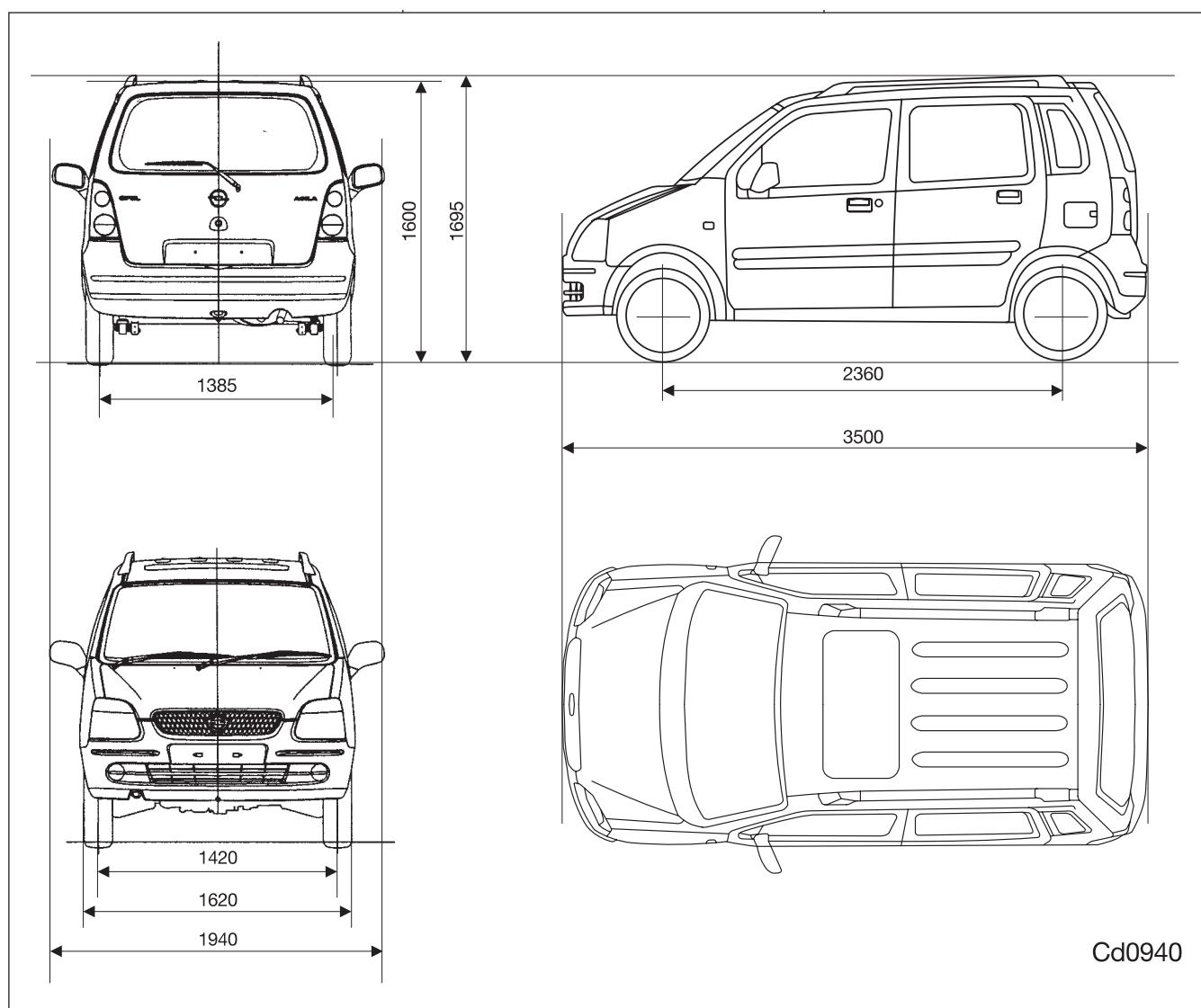
1.0 litre engine Z10XE



1.2 litre engine Z12XE

1.3 Dimensions and weights

The different dimensions of the Agila are shown in the picture below.



Dimensions of the Agila in mm

The Agila has a turning circle of 10.6 m from wall to wall.

The luggage compartment has a volume of 248 litres behind the second seat row. With the second seat row folded down, the volume of the luggage compartment increases to 597 litre.

Weight of the Agila:

Z10XE: 975 Kg (987 Kg with AC)
Z12XE: 990 Kg (1002 Kg with AC)

Permissible gross vehicle weight of the Agila:

Z10XE 1325 Kg (1325 Kg with AC)
Z12XE 1340 Kg (1340 Kg with AC)

The maximum roof load for the Agila is 30 Kg.

The fuel tank has a capacity of 41 Litre.

1.4 Models

As mentioned before, the Agila is available in three different model variants, each with their own specific equipment level:

The equipment levels indicated here are based on the European specifications and may vary from country to country.

Agila Base:

- Electric power steering
- Driver airbag and seatbelt pretensioners
- Power mirrors

Agila Comfort:

- Painted front and rear panelling
- Tinted windows
- Load compartment cover
- Wheel covers

Agila Elegance

- 14" light alloy wheels
- Front fog lights
- Black B-pillar

Furthermore the following options are available:

- Central door locking
- Power windows
- Passenger airbag
- Air-conditioning
- Anti lock brakes
- Manual sunroof
- Radio CAR 2001, 2003, 2005

1.5 Vehicle Identification

The VIN (Vehicle Identification Number) can be explained using the following table:

VIN-number

| *Digits*
| /

W	1	Defined code for manufacturer of vehicle:
O	2	WOL = ADAM OPEL AG
L	3	
O	4	GM code for manufacturer: zero (or specifically defined letter)
H	5	GM code for vehicle type: S = Corsa, Combo, Tigra H = Agila T = Astra, Zafira E = Speedster J = Vectra V = Omega
A	6	Model designation which indicates the version of the model: G for Astra-G, A for Agila-A, B for Corsa-B etc.
F	7	GM code for body style
6	8	
8	9	
Y	10	Model Year: W = 98, X = 99, Y = 00
G	11	Manufacturing plant: 1 = Rüsselsheim 2 = Bochum 3 = Azambuja 4 = Zaragoza 5 = Antwerp II 6 = Opel Eisenach 7 = Luton 8 = Ellesmere Port B = Bertone D = Chin Chuang, Taiwan F = Zamalek, Egypt G = Gliwice, Poland H = Halol, India J = Bekasi, Indonesia N = Norwich S = Szentgotthard, Hungary P = Warszawa, Poland Z = Izmir, Turkey
0	12	Serial number:
1	13	14915th vehicle of modelyear 2000
4	14	
9	15	
1	16	
5	17	

1.6 Interior

Thanks to its body shape, Agila offers a generous interior space. The Agila design provides maximum interior space vs. the small exterior size. The height of the Agila offers maximum headroom.

Height adjustable headrests on the front seats are standard. The rear seats are placed a little higher than the front seats to create more leg space and a good all around view.

The rear seat features 50/50 split and two-seater capacity.



50/50 split rear seat

Some interior features:

- Storage tray below the instrument on the drivers side.
- Storage tray below the instrument panel on the passenger side.
- Glove box with open lid.
- Large front door pockets for the driver and passenger.
- Cup holder on central floor console.
- Sliding trays below driver and passenger seat.
- Storage unit with cup holder for rear passengers on central floor console.

- Map pocket on the back of the front seat.
- Large pockets on rear doors.
- Full-size spare wheel in cargo floor.

For the Agila three different fabric colours are available.

1.7 Exterior

The Agila has the following features related to the exterior.

The Agila front design is characterised by its large headlamps with integrated side blinkers (orange bulbs). The grille is integrated into the front panelling as well as the (optional) fog lights.

The Agila is available with roof railing as well as glued side mouldings. The electrically adjustable outside mirrors are foldable.



Foldable outside mirrors

On the rear window a centre high mounted stop light is installed.

The size of the tyres of the Agila is 155/65 R14. Currently only produced by the manufacturers Kleber and Michelin. Alloy rims (6 spoke design) are available as an option only in combination with larger tyre size 165/60 R14.



Alloy rim

The Agila will be available in 10 exterior colours, seven of these exterior colours are two-coat metallic/mica paints.

1.8 Accessories

The listed items below are some of the accessories to compliment the factory options:

- Central armrest
- Towing hitch
- Fog lights
- Opel FIX child seat
- Boot storage box
- Low profile base carrier
- Opel i-line interior and exterior accessories
- Sunroof



Opel i-line exterior spoiler



Sport Interior

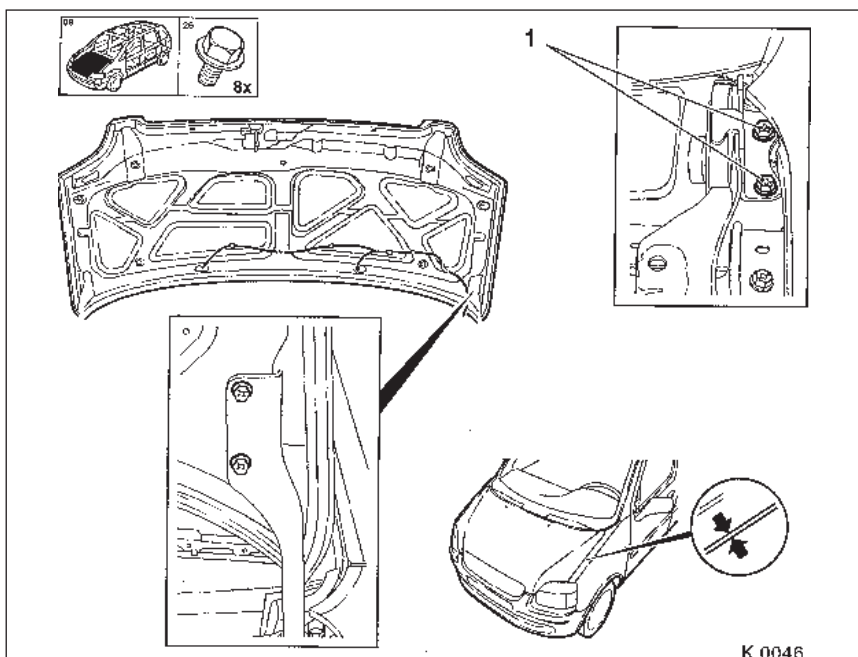


2. Body and Safety features

2.1 Body equipment

2.1.1 Bonnet

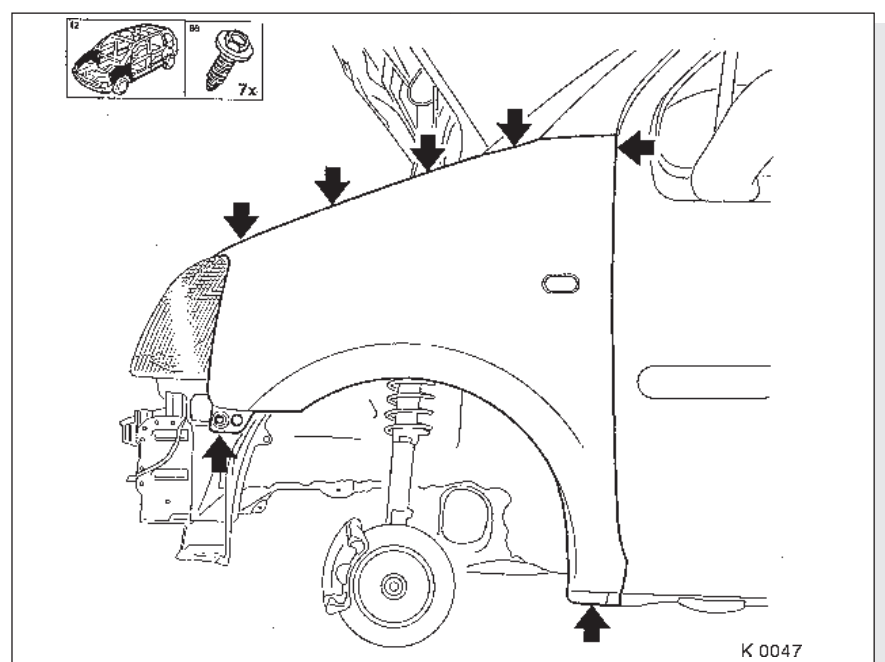
The bonnet is connected to the body with two scissor-type hinges. With these two scissor-type hinges it is possible to adjust the bonnet perfectly to the body work.



Scissor-type hinges

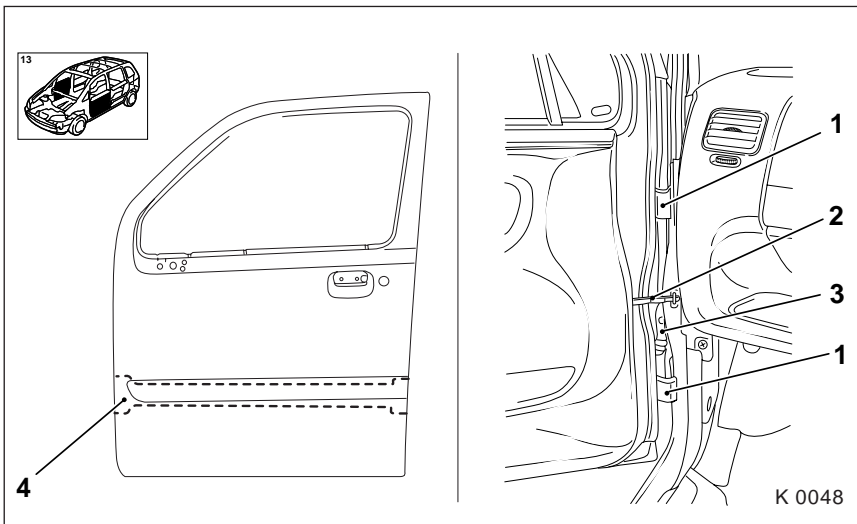
2.1.2 Wings

To remove the front wings, the front bumper and wheel arches must be removed from the body. The front wings are connected to the body with several screws as shown in the picture below.



2.1.3 Front/rear doors

To increase the passive safety level of the Agila the doors are equipped with side impact door bars. It is not allowed to adjust or replace these door bars. The hinges are welded to the body.

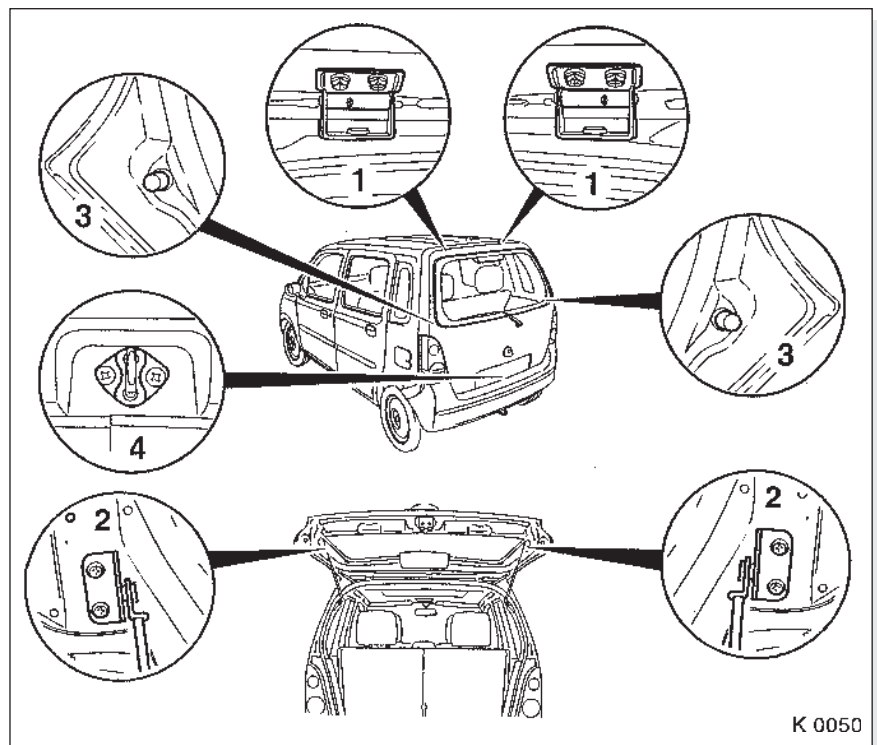


1. Hinges
2. Check link
3. Connector
4. Side impact door beam

2.1.4 Trunk lid

Two dampers support the trunk lid with opening and closing. The trunk lid can be adjusted by replacing the strike plate. The strike plate must be adjusted in such a way that the rubber stoppers have a pre load.

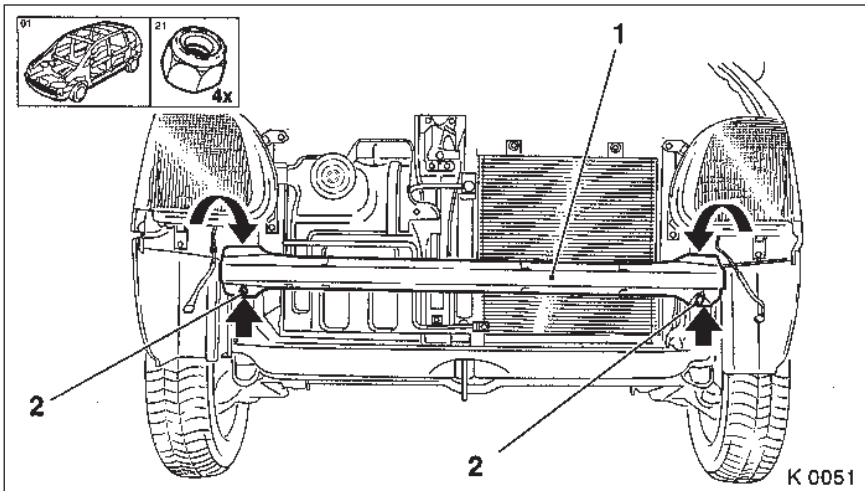
1. Trunk lid hinge
2. Mounting points dampers
3. Rubber stoppers
4. Strike plate



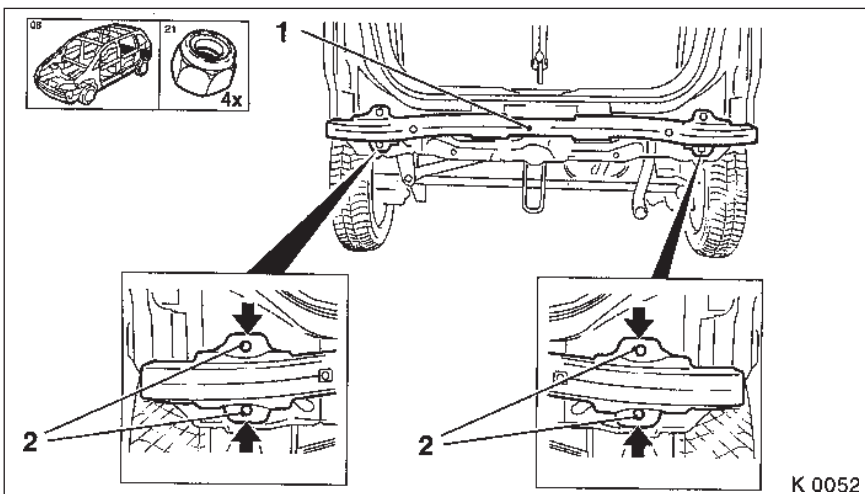
2.1.5 Bumpers

To reduce repair costs in the event of a collision the front and rear members are connected with nuts to the chassis, when the front or rear member is removed, parts mounted behind the bars are easy accessible.

After every disassembly of the front or rear bar new self-locking nuts must be used.



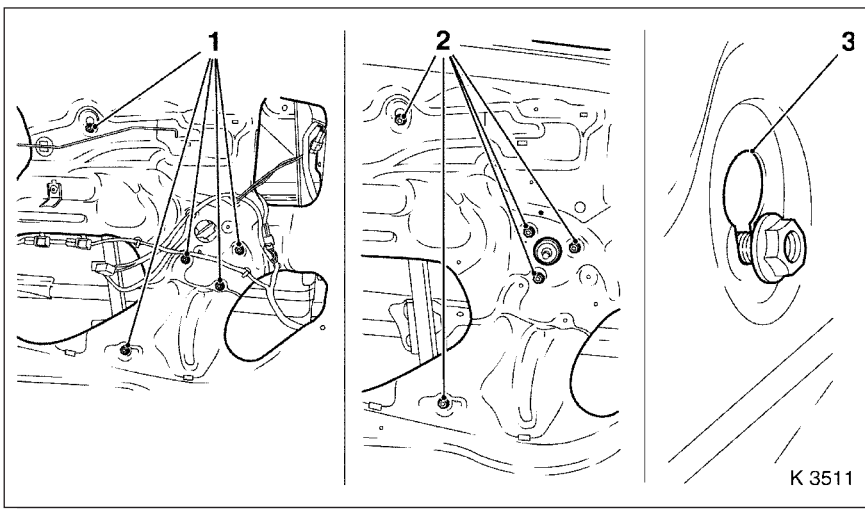
- 1. Front member
- 2. Self-locking nut



- 1. Rear member
- 2. Self-locking nut

2.1.6 Side windows

The Agila will be available with manual operated windows and optional with electrically operated windows. Electrically operated windows are only available on the front doors. The manual operated windows of the front and rear doors are similar.

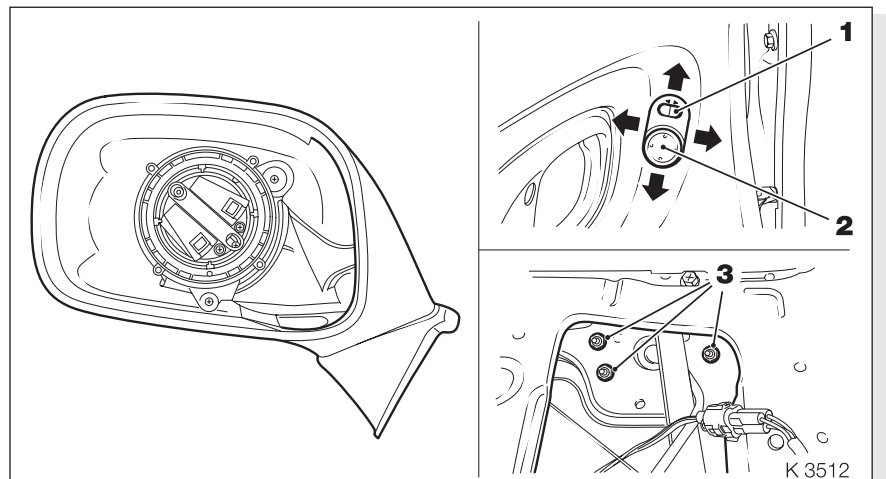


1. Fixing points electrically operated windows
2. Fixing points manual operated windows
3. Catch nut

2.1.7 Outside rear-view mirror

Electrically controlled outside mirrors are standard on all model variants. The mirror glass is clipped onto the adjusting mechanism. To remove the outside mirror, the door panel on the inside must be removed. The outside mirror is fixed to the door with three screws.

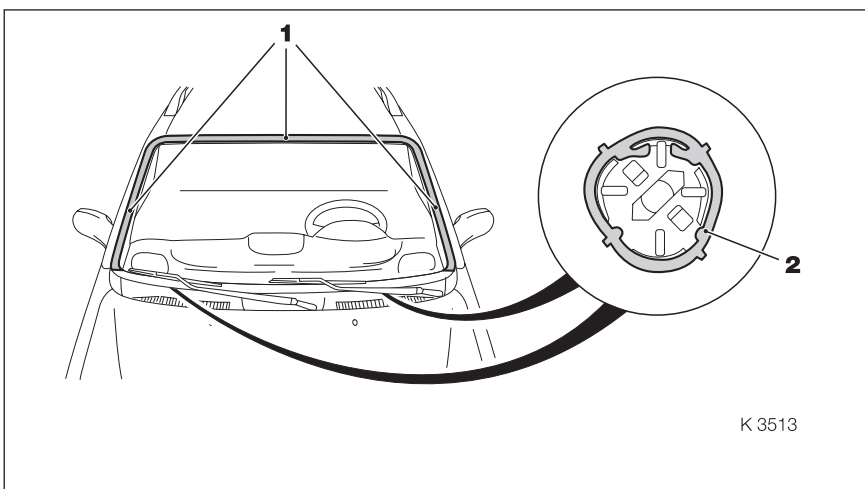
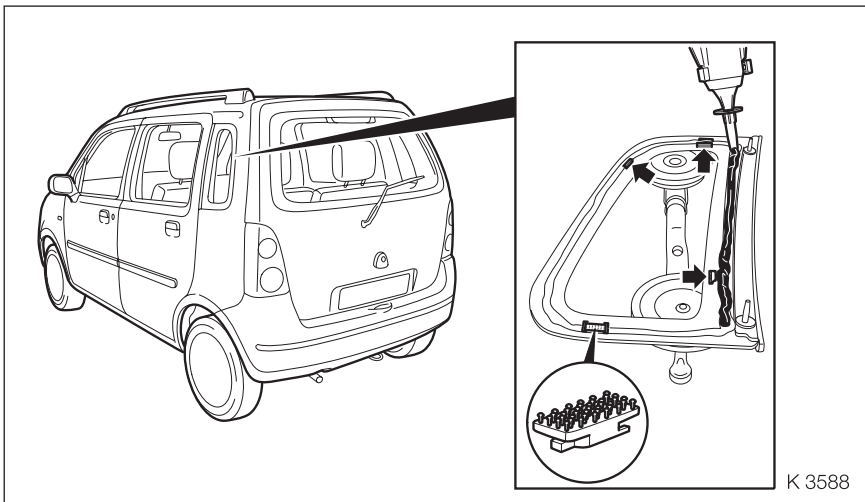
1. Switch for left or right outside mirror
2. Multi switch for mirror adjustment
3. Fixing points



2.1.8 Outside/Windows

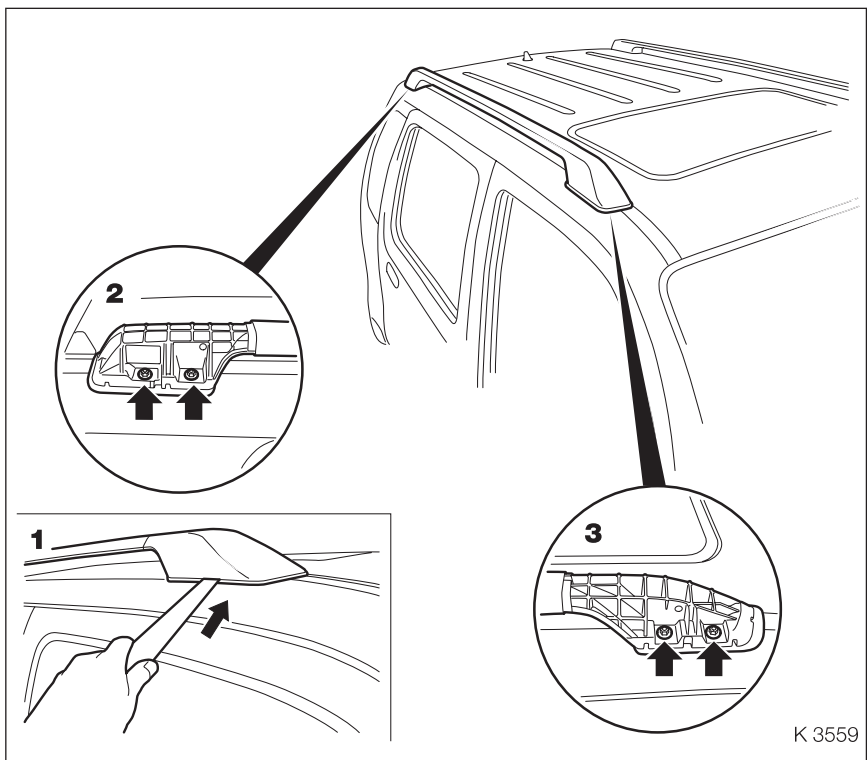
The front windscreen, the small side windows and the rear window are all glued to the body. The front window has positioners to adjust the window in the right position.

For the Agila is a sunroof available as an option. This sunroof is similar to the sunroof available for the Astra-G. The body mouldings on the Agila are glued and can be removed by heating them with a hairdryer.



2.1.9 Roof railing

On the standard equipped Agila a roof railing is only available as an option. With all other model variants the roof railing is standard. The roof railing is fixed on the roof with four nuts. The maximum roofload is 30 Kg.



Roof railing

2.1.10 Inside

The Agila is standard equipped with two headrests on the front seats and optional two headrests on the rear seats. All headrests are height adjustable and can be removed. Underneath both driver and passenger seat a storage box is installed.

2.2 Safety Features

2.2.1 Freewheeling lock cylinders

The front doors and the trunk lid are equipped with freewheeling lock cylinders. These freewheeling lock cylinders prevent the car from theft and protect the lock against damage when the correct key is not used. The working principal of the freewheeling lock cylinders are the same, but the lock in detail is different from the freewheeling lock cylinders used on the e.g. Astra-G.



2.2.2 Airbag system

The new Agila comes standard with a drivers airbag and seat belt pretensioners. A passengers airbag is available as an option. The airbag units of the driver and passenger are similar to the units used for the driver and passenger of the Astra-G.

The control unit is manufactured by Siemens and is placed between the two front seats as always with Opel. Because side airbags are not available for the Agila the control

module can handle max. four squibs. Two for the front airbags and two for the seatbelt pretensioners.

The control unit is serviceable with the TECH II. The data list contains the following parameters:

- System voltage (V)
- Power reserve (V)
- Airbag loops
- Airbag configuration
- Pretensioner configuration
- Driver airbag squib circuit (Ohms)
- Passenger airbag squib circuit (Ohms)
- Driver pretensioner squib circuit (Ohms)
- Passenger pretensioner squib circuit (Ohms)

In the event of a rearend collision the seatbelt pretensioners can be activated.

The control unit must be replaced after 1 airbag ignition or after 3 ignitions of the safety belt pretensioners. The pretensioners must be replaced after each activation.

2.2.3 Seatbelt pretensioner

The known seatbelt pretensioners from Opel are all located at the lock of the safety belt. The pretensioners on the safety belts of the Agila are located in the retractor gear. The working principal of these seatbelt pretensioners is not very different to a seatbelt pretensioner located at the lock of a safety belt.

As written before the working principal of the seatbelt pretensioner of the Agila is similar to the known seatbelt pretensioners. So there is also a pyrotechnical load. That means that all the safety precautions must be taken very serious.

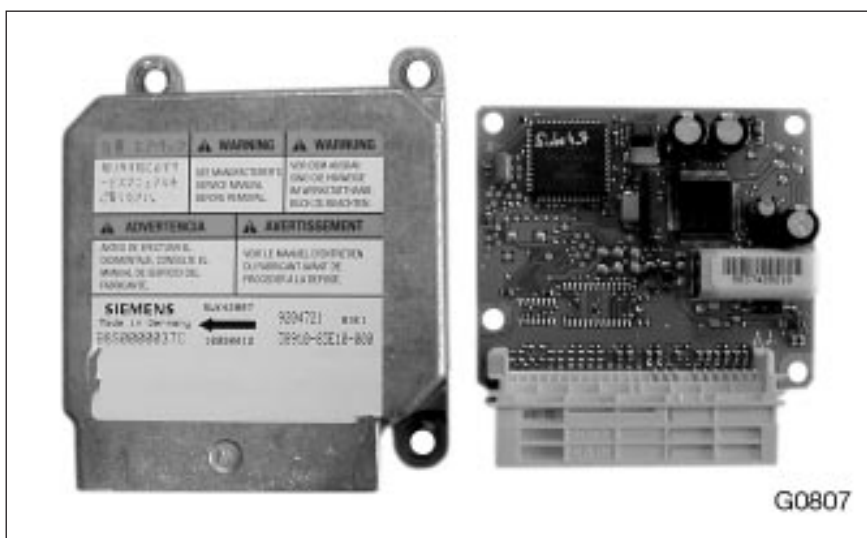


But because the retractor is a rotating gear the construction is very different.

Seatbelt pretensioner

In this pretensioner the safety belt is tensioned by turning the axle on which the belt is wrapped. So in case of a frontal accident the retractor gear is driven by the pyrotechnical load and tensions the safety belt which makes that the occupant is protected.

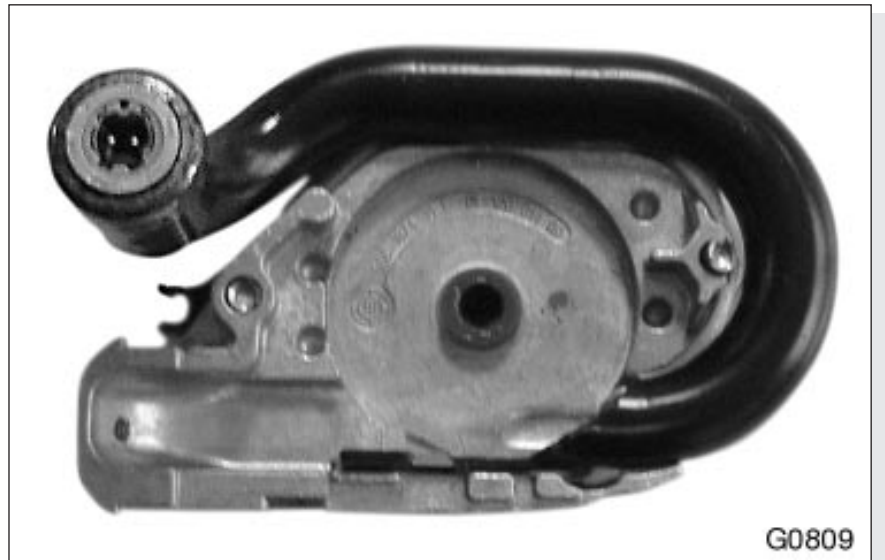
Control Unit



How is the energy of the pyrotechnical load brought to the axle of the retractor gear?

The energy of the pyrotechnical load is not brought to the retractor by a cable like all other seatbelt pretensioners Opel uses. The manufacturer (Autoliv) of this seatbelt pretensioner invented a new way for this energy transmission.

The pyrotechnical load is located in the top of a bent iron pipe. In this iron pipe are also 14 balls, kept in place on one side by a small piston and at the other side by a security pin.



1. *Bent iron pipe with pyrotechnical load and 14 balls inside*



1. *Retractor gear in the shape of the balls*

If the car is involved in a frontal accident and the deceleration reaches the set values which makes sure that the seatbelt pretensioners are ignited. Now the pyrotechnical load, which is located in the top of the bended iron pipe, will expand and forces all bullets in the same direction: out of the iron pipe. The security pin will break and release the balls out of their position. When the balls move out of the tube, they drive a special gear which is mounted on the axle of the retractor right after the iron pipe. This retractor gear has the shape of the balls and that contributes to a maximum energy transmission. So now the retractor axle rotates and makes sure that the safety belt is pulled into the retractor mechanism. At the end of the activation the belt is blocked in the pulled position.



Seatbelt pretensioner

2.2.4 Force limiter

The forces generated by the seatbelt pretensioners on the belt are very high. The forces are even higher than necessary. The airbag and the seatbelt pretensioners working closely together, that means that not all kinetic energy, that the human body contains in the event of a front collision, needs to be taken by the seatbelts. To reduce the impact of the seatbelts on the body, force limiters are introduced. The seatbelts with force limiters make sure that the body will hit, in the right time and with reduced energy, the airbag. So the combination of these systems makes sure the injuries of the occupants are minimized.

How is the force limiter created?
For a quick reaction of the seatbelt pretensioner on the ignition from the control module, we need a certain

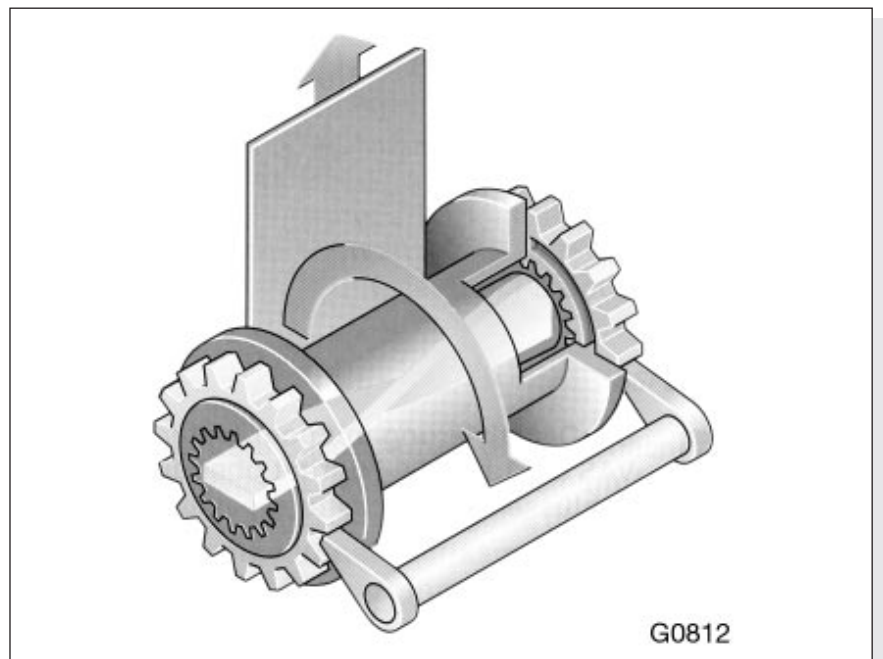
pyrotechnical load. This pyrotechnical load creates the force on the seatbelt. To decrease the force on the seatbelt we can insert a smaller pyrotechnical load in the pretensioner, but than the time on which the belt reaches its requested tension will be delayed. This means that this is not the right way.

The load limiter on the pretensioners of the Agila is created by a torsion bar in the retractor. When the safety belt reaches a certain force the torsion bar will be twisted and the force on the seatbelt will be shortly reduced. At this moment the occupant will reach the airbag and in this way the injuries on body and

head are reduced.

The two three point safety belts on the rear seats have a special system to secure a child seat. Pull out the belt all the way, than slowly release the belt. You can hear a clicking sound, this means that it is not possible any more to pull out the belt. And now you're able to secure a child seat tightly to the rearseat.

The pedal release system is standard for the clutch and the brake pedal on the Agila.



Force limiter

3. Heating, ventilation and air-conditioning

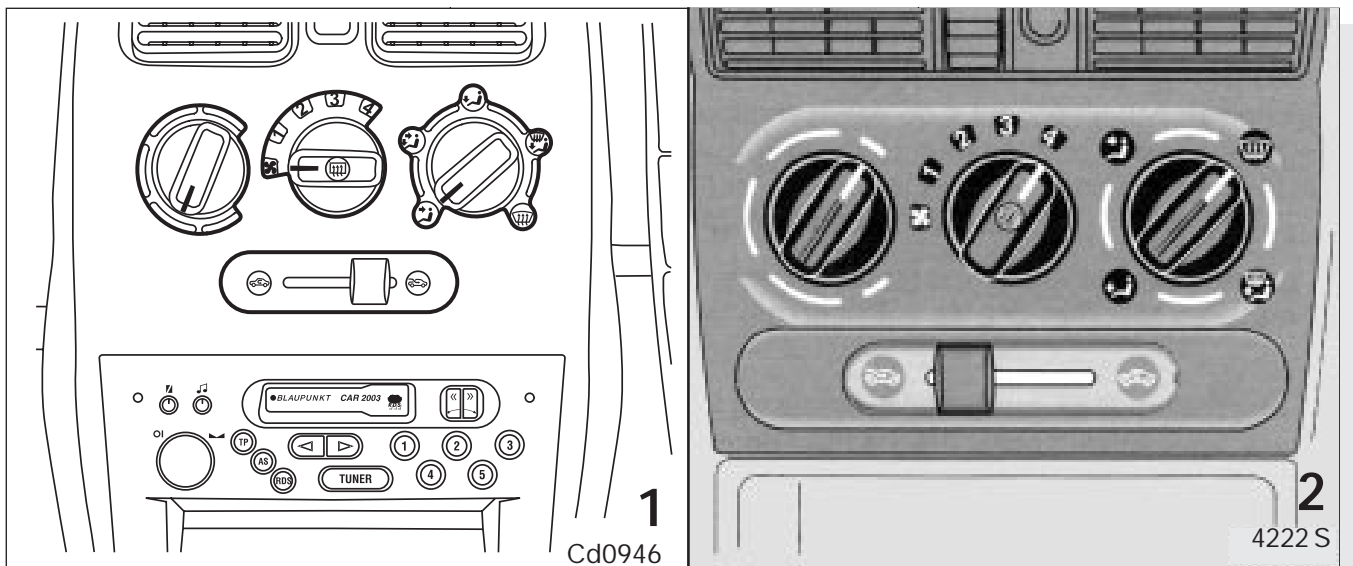
The Opel Agila is standard equipped with a conventional heating and ventilation system. On both engine versions air conditioning is optionally available, as well for the left hand drive versions as for the right hand drive versions.

3.1 Heating and ventilation features

The control panel for heating and ventilation looks similar to the panel used on the current S-car (Corsa, Tigra and Combo). The shape of the control knobs and sliders and the lay-out of the panel resembles the ones used on Corsa-B. The illustration below shows the similarities.

The following features can be identified:

- A four speed fan is used.
- Pull the fan speed switch to switch on the rear screen defogger.
- The air distribution knob has five positions
- The air distribution knob cannot be rotated completely as on the Corsa-B.



1. Control Panel Agila
2. Control Panel Corsa-B

Although the controls resemble the ones of the Corsa-B the operation is completely different

The operation of the temperature control knob and fan speed switch is similar to the ones used on Corsa-B.

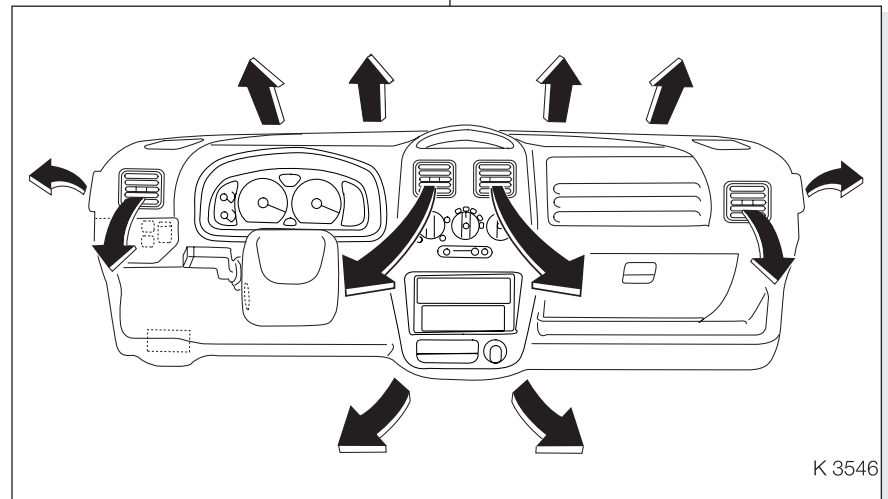
- The air recirculation slider operates just opposite to the slider of the Corsa-B.
- The slider frame cover is not prepared for the switches for seat heating.
- The air recirculation can be adjusted in the position fresh air and the position recirculated air and any position in between.
- Recirculated air can be mixed with fresh air.

The controls and the heater housing of the heating and ventilation system have the following features.

- The heater housing flaps are mechanically connected to the control panel using non-adjustable bowden cables.
- Currently, Calsonic is the only manufacturer of the heater housing. There is no second supplier.
- A pollen filter is located between the recirculation flap and the blower intake on all versions.
- The dash panel contains 10 air vent outlets, as shown in the illustration. Vent holes for the rear passengers are not available. The outer dashboard vents have adjustable doors. The Centre outlets have no doors.
- The blower motor is controlled via conventional serial resistors. The resistors are mounted in the exhaust channel of the fan of the heater housing to cool the resistors.
- The heater core is conventional. It can only be replaced when the heater housing is removed.
- Quick fittings for the coolant hoses are not used.

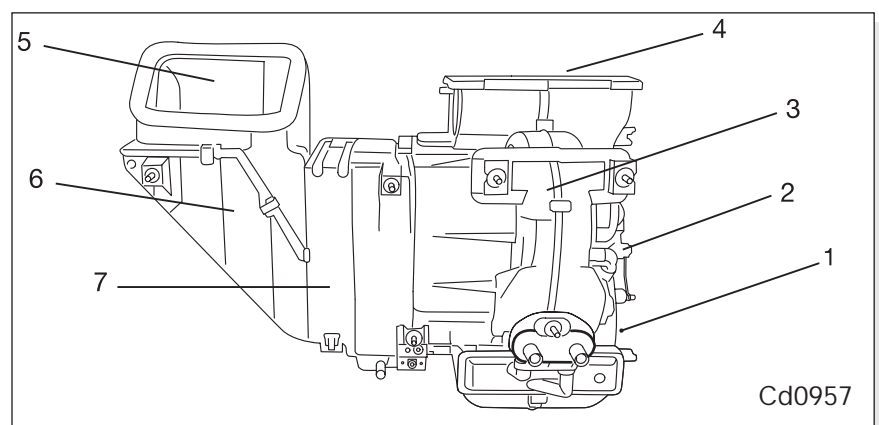
The following illustration shows a cross section of a LHD heater housing.

3.2 Heating and ventilation operation

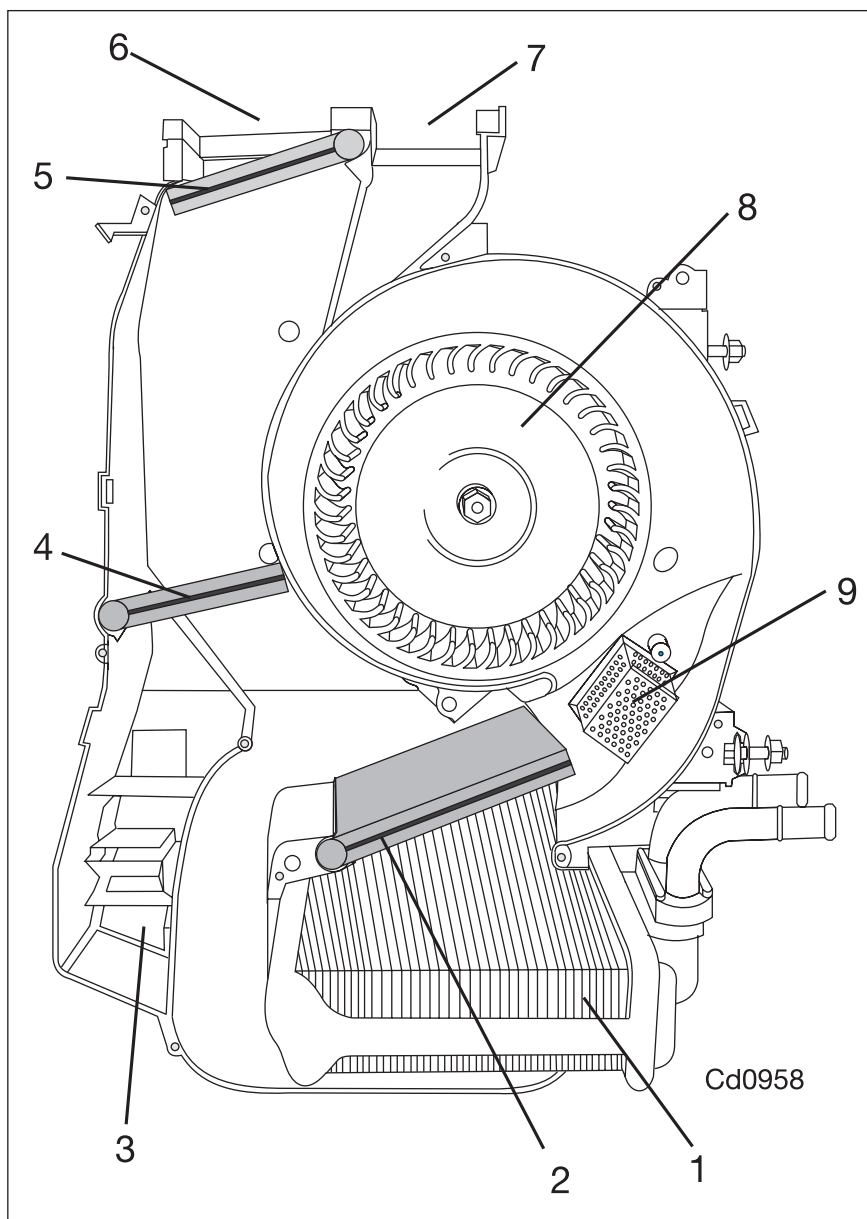


Dash panel air vent holes

The heating and ventilation system of the Opel Agila has 10 outlets. The distribution of the air is controlled with the right knob on the control panel, controlling the flaps in the heater housing.

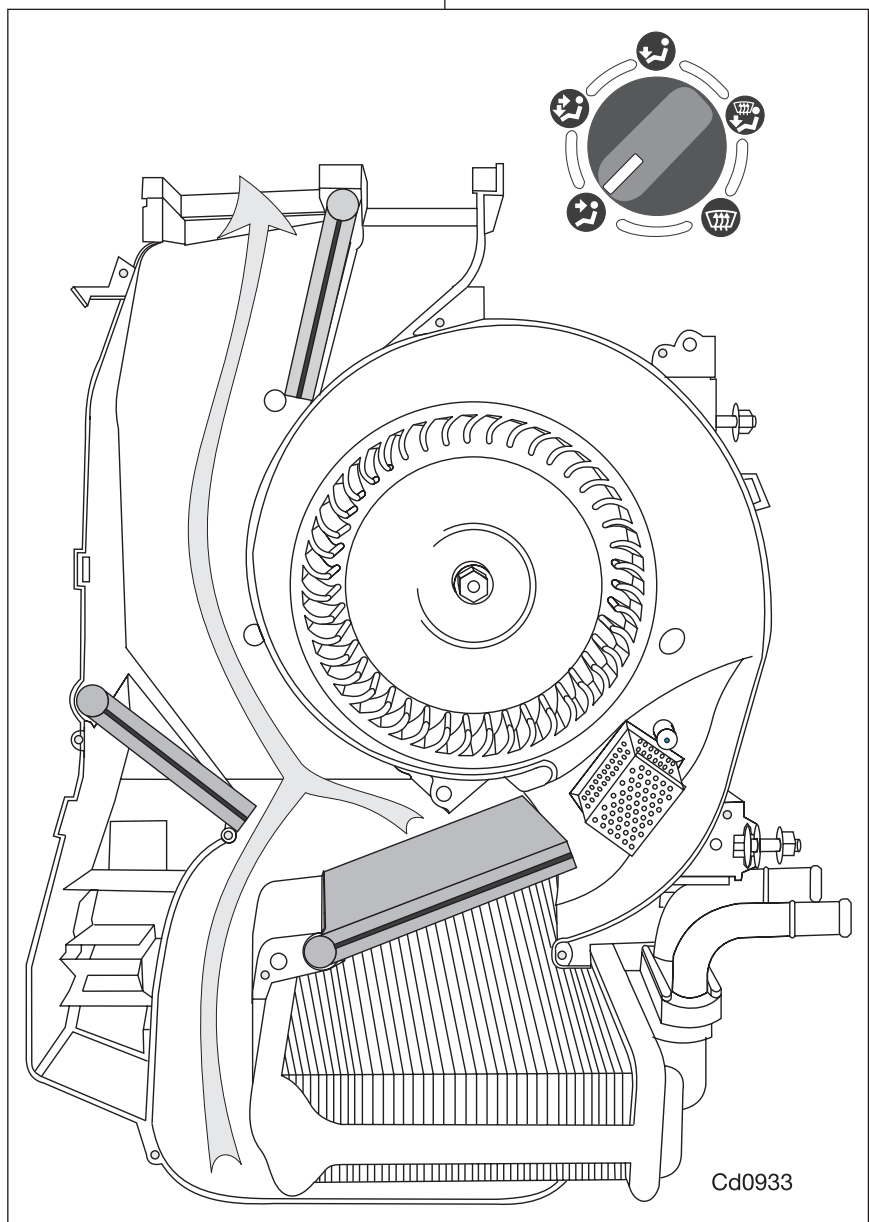


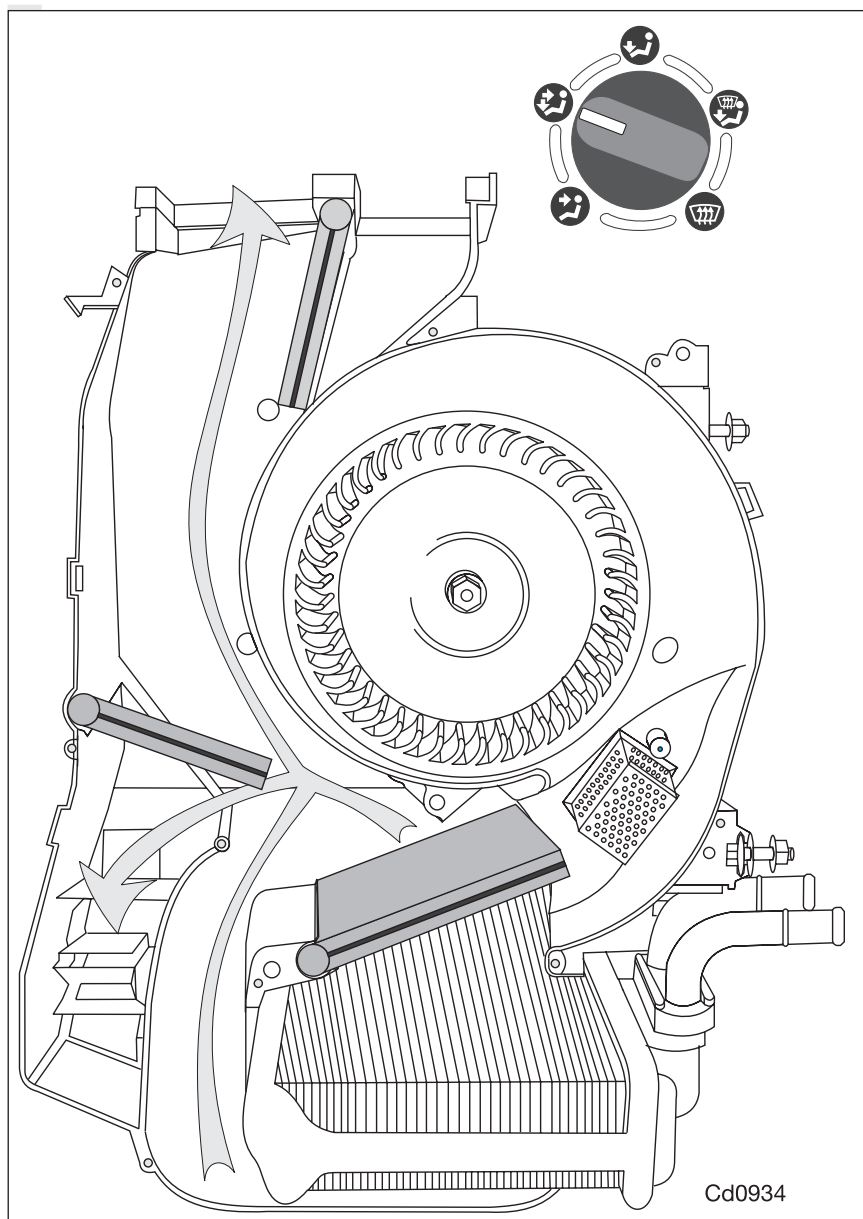
1. Heater core
2. Blower
3. Heater housing with control flaps
4. Outlets to dashpanel air ducts
5. Intake
6. Recirculation flap section
7. Pollen filter section

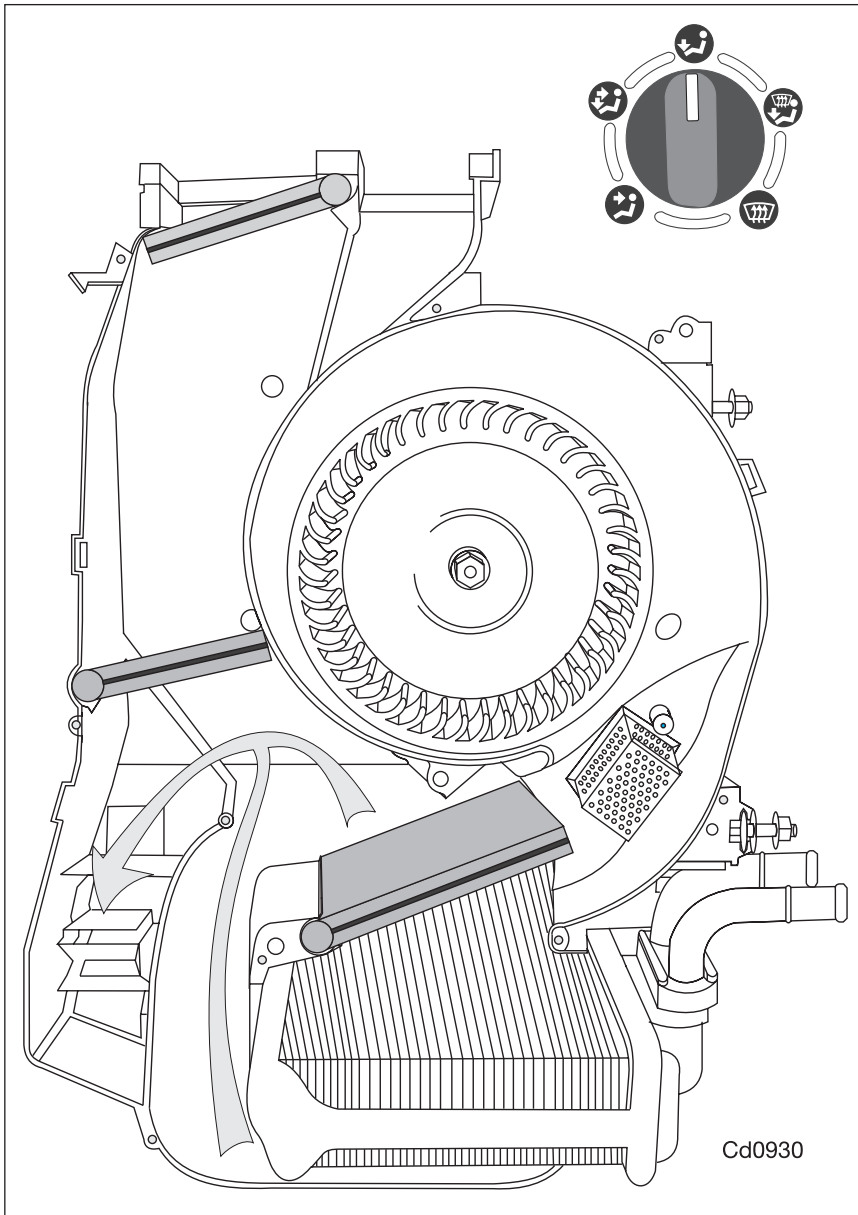


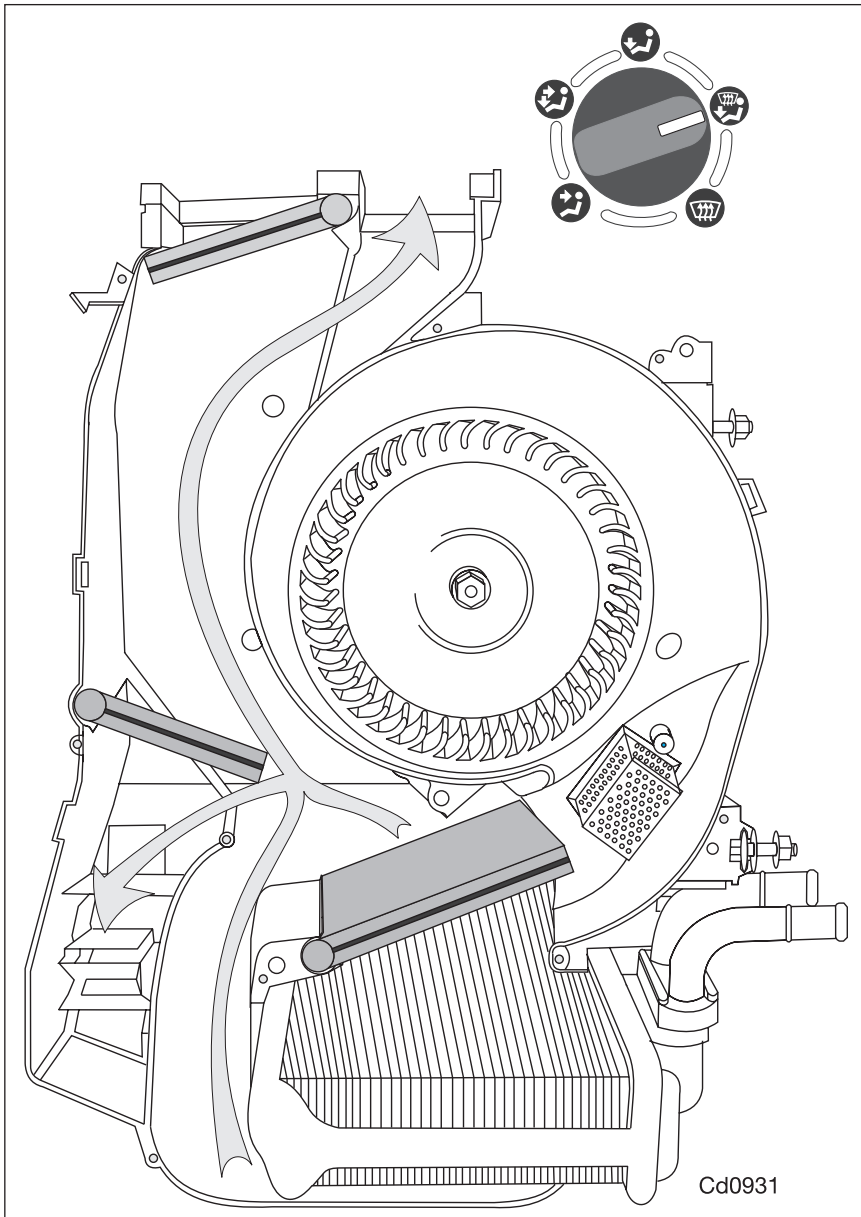
1. Heater core
2. Temperature control flap
3. Feet outlets
4. Feet outlet control flap
5. Center outlet control flap
6. Center outlets
7. Defrost outlets
8. Blower
9. Resistor pack

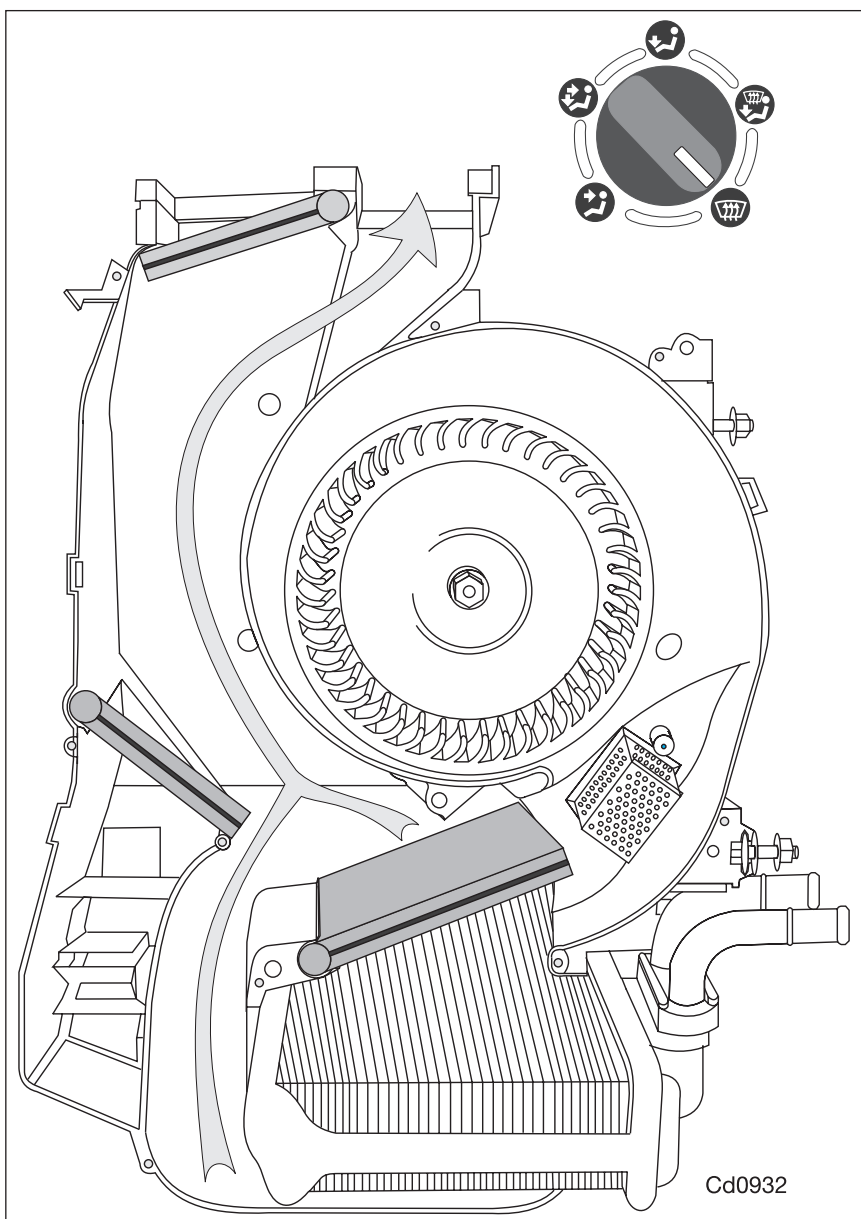
The following illustrations show the air flow through the heater housing, depending on the air distribution control knob position.





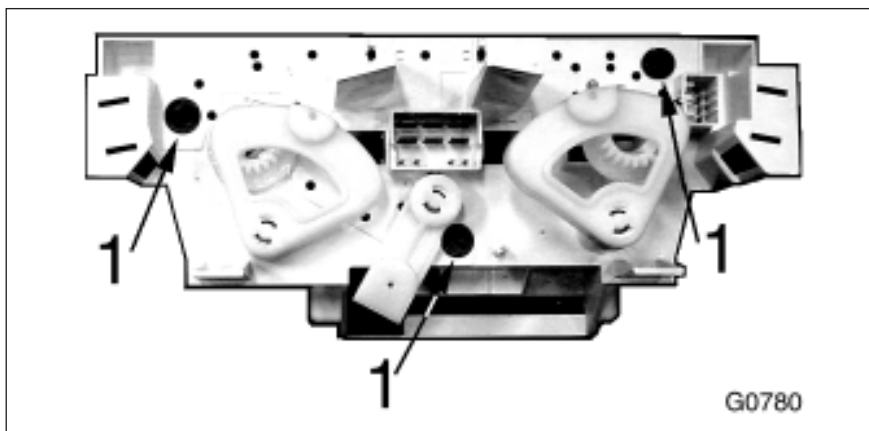






The hatched flap for foot outlets allows a certain airflow to the upper outlets even when the flap is positioned for maximum air flow to the feet. The upper flap for the dashboard outlets does not regulate the airflow to the outer dashboard outlets. These channels have separate doors, located in the outlets. The centre outlets do not have these doors as with other Opel models.

The recirculation flap is equipped with a small additional flap that allows a certain amount of recirculation even when the recirculation slider is in the fresh air position. This flap also allows air to escape from the vehicle interior when the doors or the tailgate are closed rapidly, to avoid too much compression of the air trapped in the car when the recirculation slider is in the recirculation position. The recirculation flap and pollen filter are located in a separate housing on the passenger side of the heater housing.



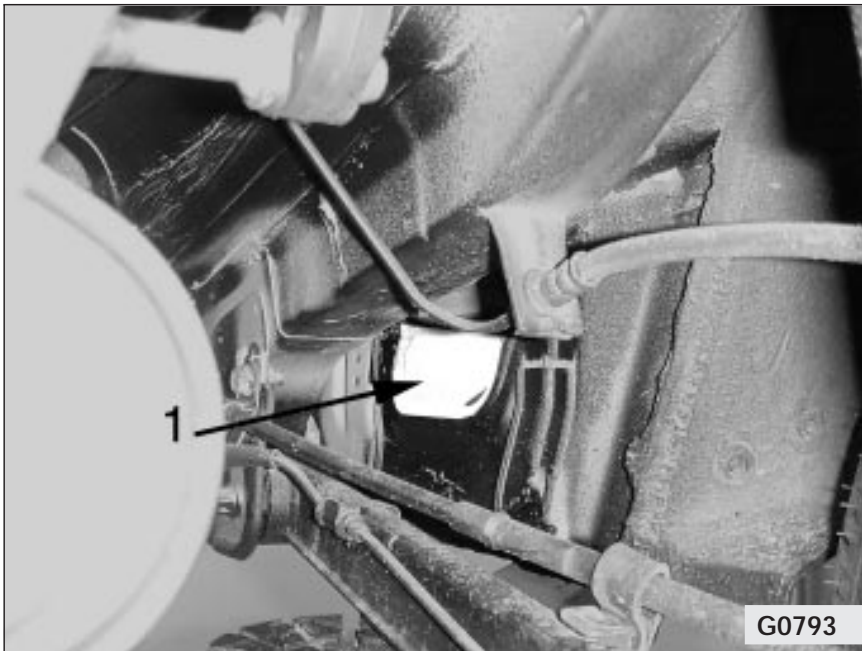
1. *Bulb*

The control panel bulbs are replaceable separately. The control panel must be removed to have proper access to the bulbs. The location of the bulbs is indicated in the illustration above.



1. *Body vents*

The required body vents are located on the rear end of the car, behind the impact limiter (bumper) and on the inside of the rear doorsill panel members.



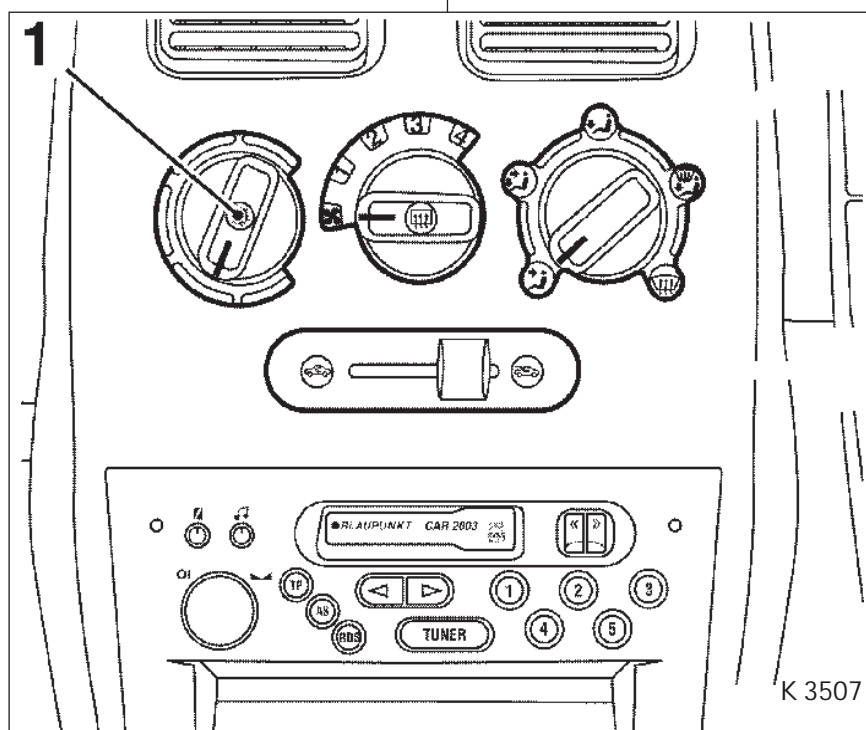
1. *Body vents*

The additional small flap in the recirculation flap also adds to the decompression during the closing of the doors and the tailgate. The vents contribute to a better airflow in the interior and therefor help to demist the windows.

3.3 Air conditioning features

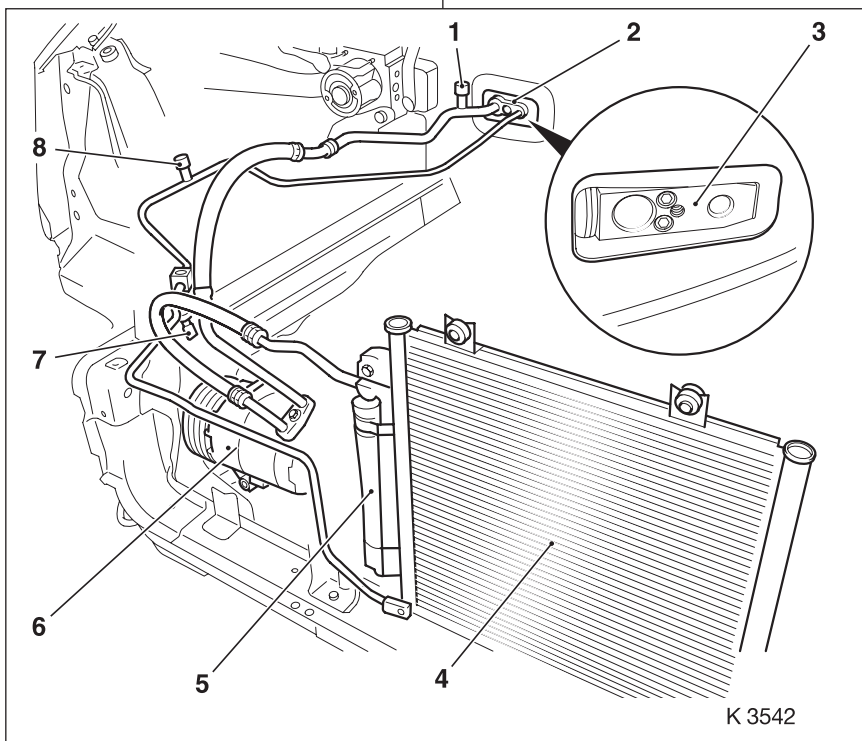
The air conditioning system of the Opel Agila is an add-on unit. The system has a new design, according to the Opel standards. The system is designed for the use of R134A refrigerant only. The air conditioning system of the Opel Agila contains the following components:

- Compressor
- Condenser
- Evaporator
- Expansion valve
- Control switch
- Receiver / drier
- Muffler
- ECU with AC-control
- Cooling fans
- Water drain



1. Air conditioning switch

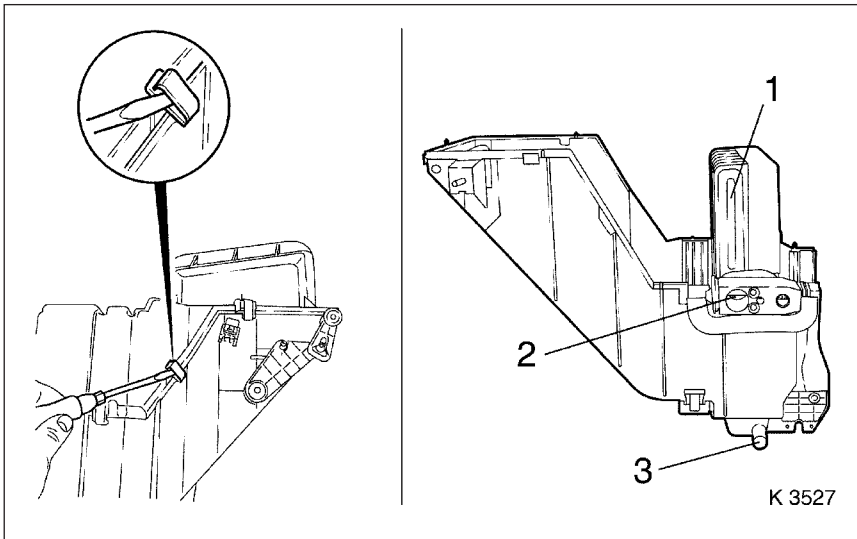
The air conditioning switch is, similar to Corsa-B, integrated in the temperature control knob on the left. Pull the switch to enable the air conditioning.



Engine compartment

1. *Low pressure service port*
2. *Pipe connection*
3. *TXV*
4. *Condensor*
5. *Receiver / dryer*
6. *Compressor*
7. *Linear pressure sensor*
8. *High pressure service port.*

The compressor, condenser, receiver / dryer and the ECU are located in the engine compartment at the usual locations. The compressor is the same as the one used on the Corsa-B X10XE and X12XE.



Heater housing with evaporator

- 1. *Evaporator*
- 2. *TXV*
- 3. *Water drain*

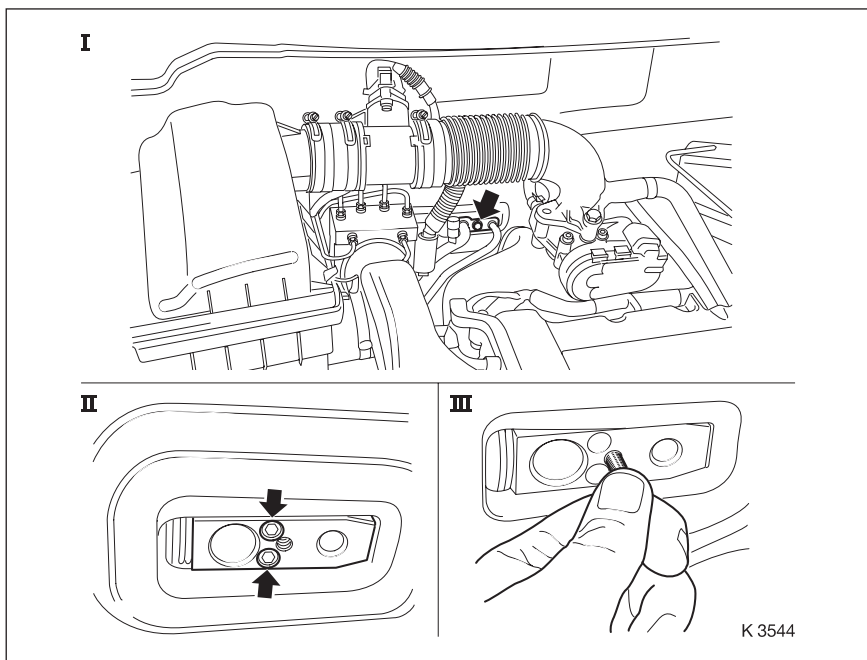
The evaporator is positioned in the plastic casing mounted on the left side of the heater housing on RHD cars and mounted on the right side of the heater housing on LHD cars. This casing also contains the recirculation flap, the pollen filter, the water collector and water drain. The evaporator is positioned between the pollen filter and the blower. A coolant cut-off valve is not used on the Opel Agila. This means that there are no additional switches in the control panel. Underneath the evaporator are the water collector and the water drain. The drain hose is routed through the firewall to the engine compartment

TXV

The expansion valve type used is a TXV. The valve is located in the firewall. To be able to remove the TXV the bolt must be inserted after the pipes have been removed to push the TXV from its recess.

The service ports are located in the refrigerant lines coming from and going to the TXV.

A muffler is installed in the suction line of the compressor to equalise the pressure pulses.



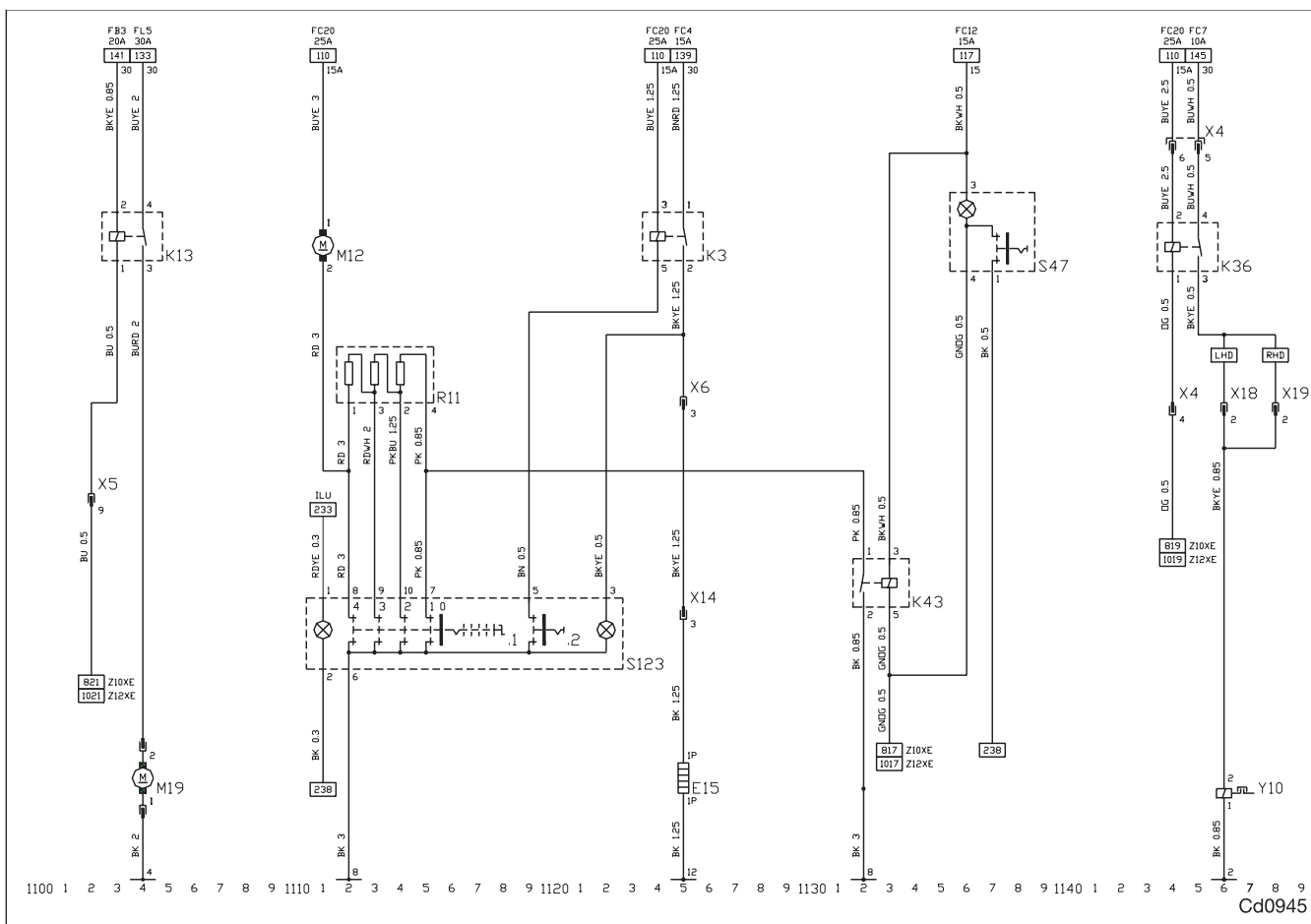
TXV valve position and disassembly

Refrigerant circuit

The condenser is mounted behind the radiator. The receiver / drier is positioned directly on the condenser. The receiver / dryer can be replaced separately. The linear refrigerant pressure sensor is positioned in the high-pressure liquid line from the condenser to the TXV, close to the longitudinal front member. The sensor is similar to the used on from the Opel Astra-G.

3.4 Air conditioning operation

An Engine Cooling Module (MKM) as used on the Opel Astra-G is not used on the Opel Agila. Instead, the engine control unit (ECU) controls the cooling fans and the compressor clutch via relays, based on the sensor inputs from the coolant temperature sensor, linear refrigerant pressure sensor and the dashboard switch.



Circuit diagram airconditioning control

The illustration shows the electrical circuits for air conditioning and cooling fans. The following components are shown:

Circuits

- Engine cooling 1102 - 1104
- Heating 1111 - 1115
- Heated back window 1119 - 1125
- Air conditioning 1132 - 1148

Grounding points

- 2 Engine compartment, right
- 4 Engine compartment, left
- 8 A - pillar, front passenger
- 12 Tailgate, left

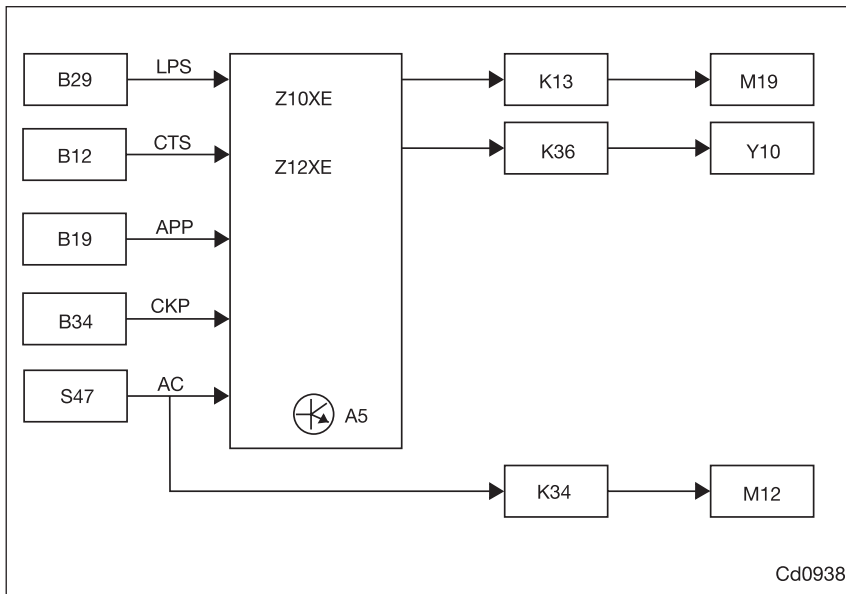
Abbreviations

- LU Illumination light
- LHD Left - hand drive
- RHD Right - hand drive

Component codes

- E15 Heated back window
- K3 Relay - Heated back window
- K13 Relay - Radiator fan
- K36 Relay - Compressor, air conditioning
- K43 Relay - Blower, heating, passenger compartment
- M12 Motor - Blower, passenger compartment
- M19 Motor - Radiator fan
- R11 Preresistor - Blower, heating
- S47 Switch - Air conditioning
- S123 Switch - Blower / Heated back window
- S123.1 Switch - Blower, heating
- S123.2 Switch - Heated back window
- X4 Body front & Instrument panel
- X5 Body front & Instrument panel
- X6 Instrument panel & Body rear
- X14 Body rear & Tailgate
- X18 Body front & Air conditioning
- X19 Body front & Air conditioning
- Y10 Clutch - Compressor, air conditioning

The following block diagram provides an overview of the components connected to the air conditioning of the Opel Agila.



Air conditioninng block diagram

A5	Engine control unit
B12	Coolant temperature sensor
B19	Accelerator pedal sensor
B29	Linear pressure sensor
B34	Crankshaft position sensor
K13	Relay cooling fan
K34	Relay blower
K36	Rely compressa clutch
M12	Blower motor
M19	Fan motor
Y10	Compressor clutch
S47	Switch

The following control features are used on the air conditioning control circuits:

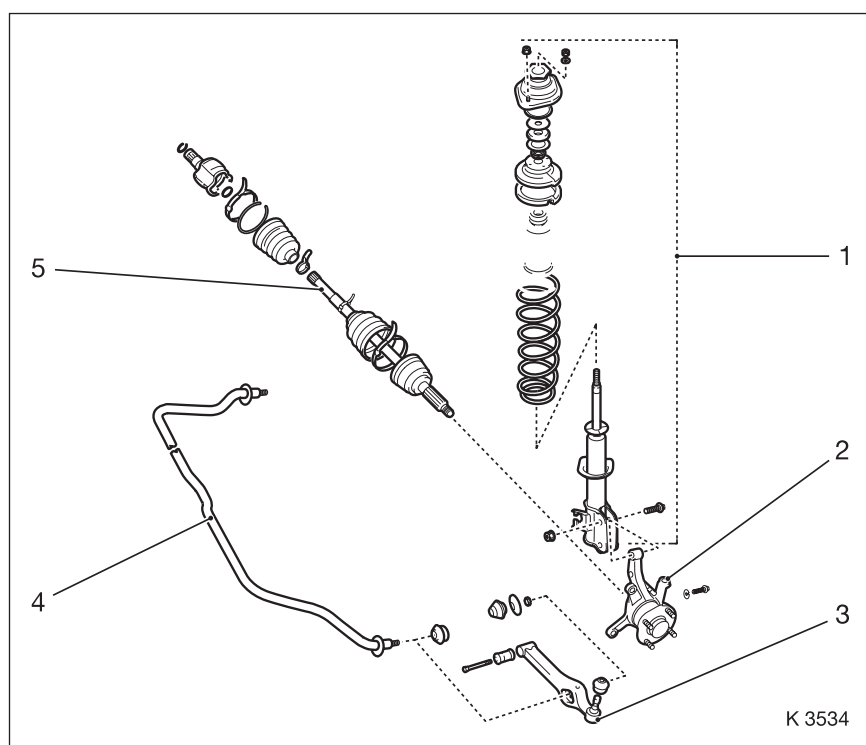
- When the air conditioning is switched ON the blower will run at first speed if it was not activated yet using relay K43. This feature is an Opel standard.
- The engine control unit (ECU) controls the cooling fan relay, based on the refrigerant discharge pressure and the coolant temperature measured. Only one fan is used and only one speed is available.
- The ECU controls the compressor clutch relay, based on the engine speed, accelerator position, switch and refrigerant pressure.
- An anti-icing sensor or switch in the evaporator is not used.

4. Suspension

4.1 Front suspension

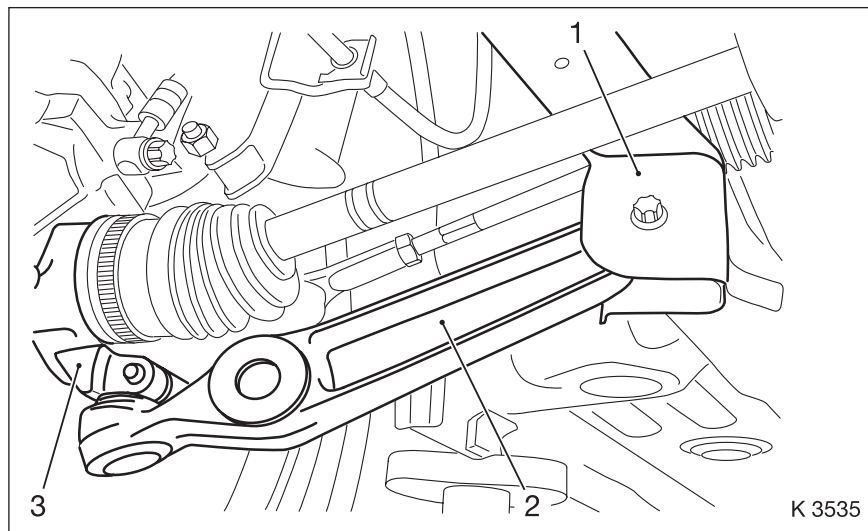
General description

The front suspension of the Opel Agila is designed using Mc Pherson type struts in combination with a stabiliser bar used as a trailing rod. The stabiliser bar has a constant diameter. The layout and tuning of the front suspension of the Z10XE version is equal to the Z12XE version. The same springs, shock absorbers and stabiliser bars are used, and equipment on the car (ABS, air conditioning, etc.) requires the same setting too.



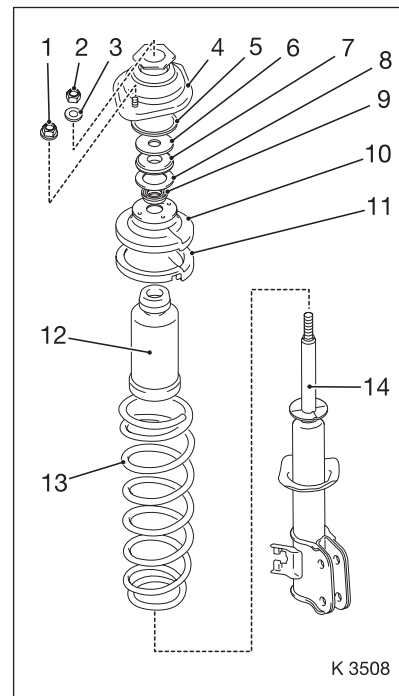
1. *Mc Pherson strut*
2. *Steering knuckle*
3. *Lower control arm*
4. *Stabiliser bar*
5. *Drive shaft*

Service



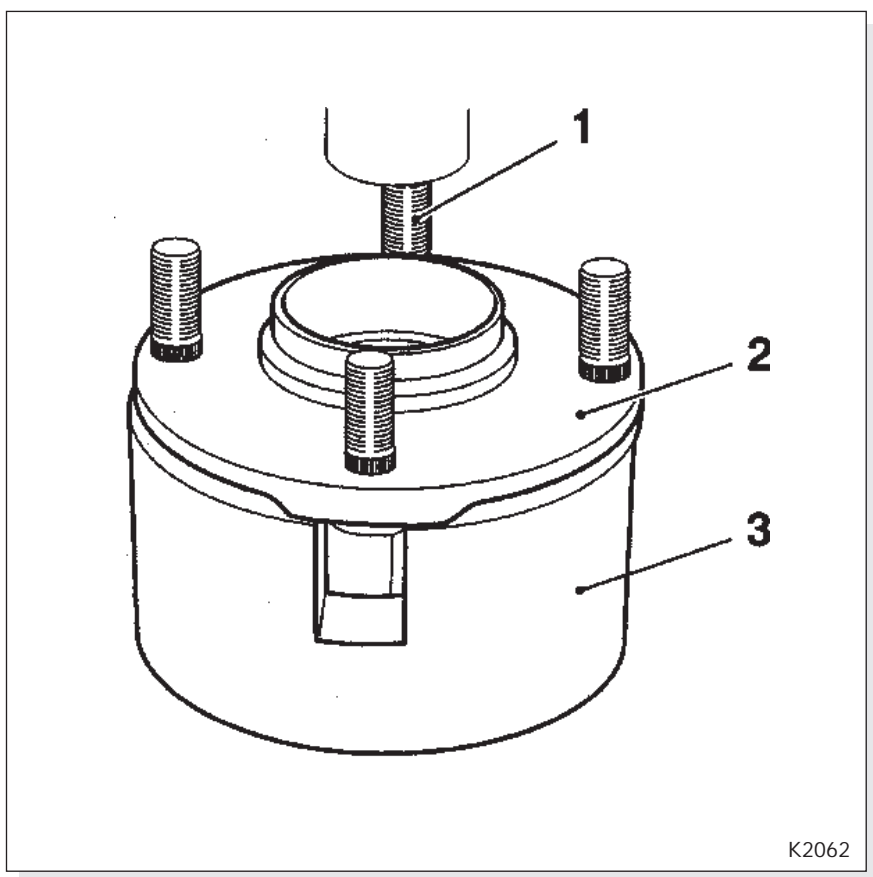
1. Lower control arm mounting
2. Lower control arm
3. Steering knuckle with wheel hub

The lower control arm can only be replaced as an assembly. No separate parts, such as bushings, can be ordered. In the illustration above the stabiliser bar is already removed.



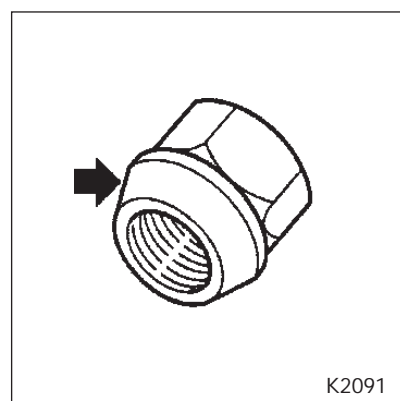
1. Self-locking nut
2. Nut
3. Ring
4. Support bearing
5. Upper seal
6. Ring
7. Bearing
8. Lower seal
9. Spacer
10. Upper spring collar
11. Spring collar damper
12. Hollow buffer
13. Front spring
14. Shock absorber assembly

The indicated components in the illustration above can be replaced separately. The shock absorber assembly is not equipped with a separate shock absorber insert.



K2062

1. Special wheel bolts
2. Hub
3. KM 6142



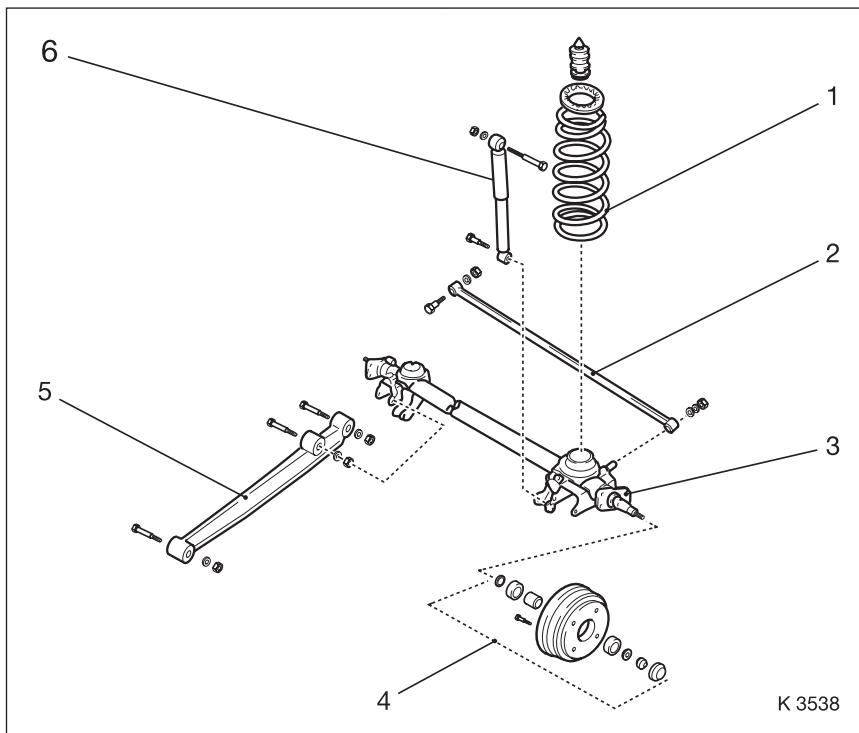
K2091

The hubs are equipped with four special bolts(1) to fix the rims, in combination with nuts. The normal tightening torque for the nuts is 85 Nm and dry nuts should be greased slightly. The nuts are equipped with only ONE conical side. The conical side should face the rim. If nuts are not properly installed accidents could occur.

The special bolts should be removed and installed using a press and KM 6142. The removed bolts may not be used again.

4.2 Rear suspension

General description



1. *Rear spring*
2. *Panhard rod*
3. *Rear axle body with wheel hub*
4. *Wheel drum with bearing*
5. *Trailing link*
6. *Shock absorber*

The rear suspension of the Agila is a combination of a semi-independent torsion type rear axle with a Panhard rod. The journals form one assembly with the axle body. The trailing links are replaceable separately. The damping bushings cannot be ordered separately. If bushings must be replaced a complete link must be ordered. The bearings in the brake drums are not adjustable.

4.3 Adjustments on the front and rear suspension

The front suspension wheel alignment values are listed in the table below:

Wheel alignment Front Axle	All versions	Tolerance	
		min.	max.
Camber	-0° 20'	-1° 20'	0° 40'
Toe-in	-0° 10'	0° 00'	-0° 20'
Caster	3° 40'	1° 40'	5° 40'

The rear suspension wheel alignment values are listed in the table below:

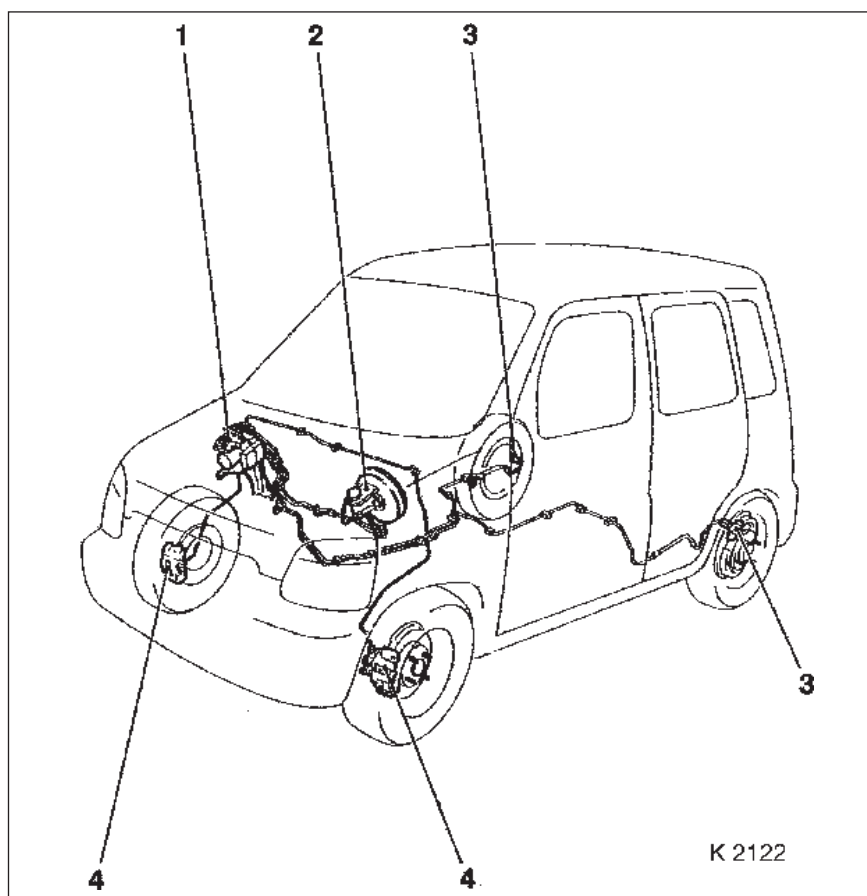
Wheel alignment Rear Axle	All versions	Tolerance	
		min.	max.
Camber	0° 00'	-0° 30'	0° 30'
Toe-in	0° 00'	-0° 30'	0° 30'

On the rear axle no wheel alignment adjustments are possible.

5. Brakes

The general features of the brake system of the Opel Agila are:

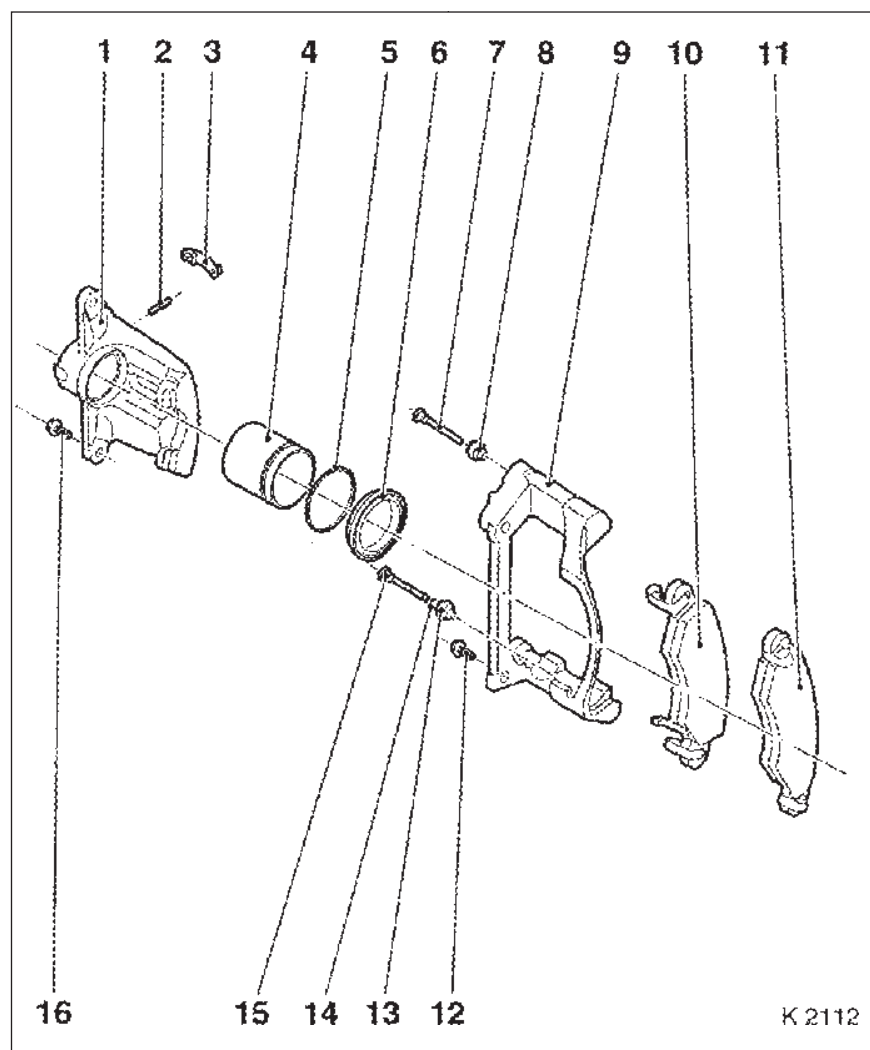
- Diagonal split 4-channel brake system.
- Front disc brakes (non-ventilated) and rear drum brakes are used.
- Bowden cable operated park brake on the rear wheels
- A vacuum brake booster as standard equipment.
- Safety brace assembly for the Pedal Release System (PRS).
- Optional ABS on all versions.
- A load sensing proportioning valve for the rear brakes on all non-ABS versions.



- 1 ABS control unit and hydro-unit (optional)
- 2 Master cylinder and brake booster
- 3 Rear drum brakes
- 4 Front disc brakes

5.1 Front brakes

The front brakes are equipped with non-ventilated discs and floating callipers.



- 1 Calliper housing
- 2 Bleeder valve
- 3 Dust cap
- 4 Piston
- 5 Seal ring
- 6 Protector ring
- 7 Guide pin
- 8 Protector sleeve

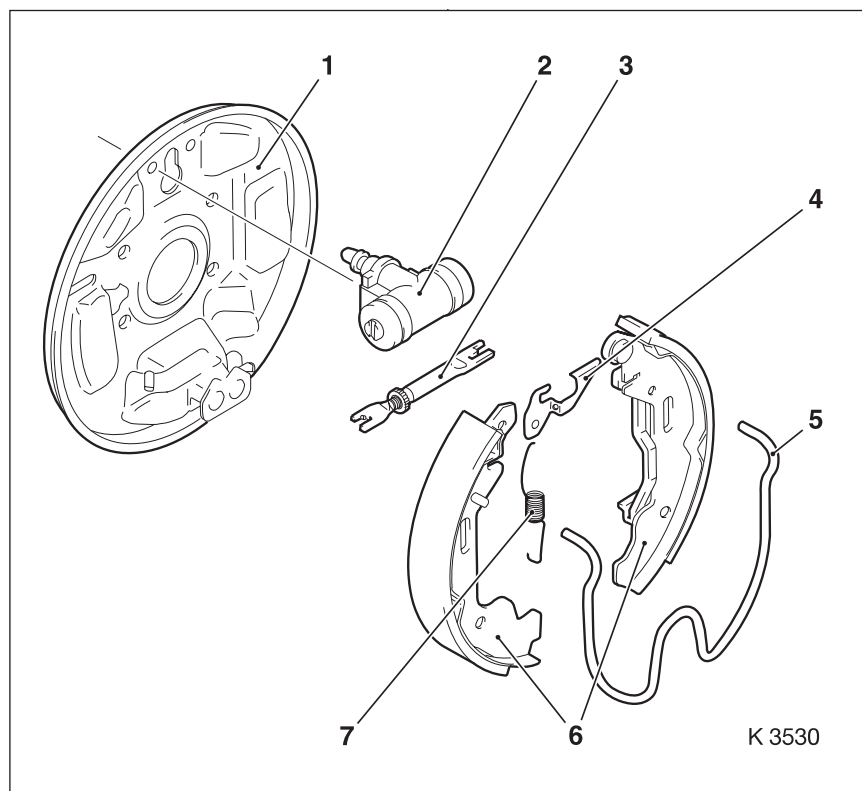
- 9 Calliper frame
- 10 Pad (inner)
- 11 Pad (outer)
- 12 Bolt
- 13 Protector sleeve
- 14 O-ring
- 15 Guide pin
- 16 Bolt

The callipers, supplied by Bosch, can be tipped backwards for service. Be careful. If the calliper is tipped backwards there is a potential risk that the brake hose kinks and breaks or tears. During brake pad replacements the pistons must be pushed back using the same special tool as used with the brakes of the Opel Astra-G.

The inner brake pads are equipped with audible wear indicators. There are no electrical sensors used, because MID is not available on the Opel Agila. The anti-resonance springs are mounted on the brake pads.

5.2 Rear brakes

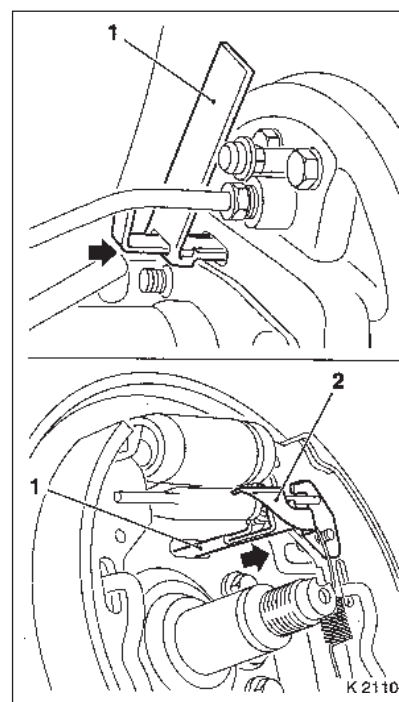
Drum brakes are used with an automatic adjustment system. The automatic adjustment system is a system that is also used on other Opel cars with drum brakes. The brake lining is glued to the brake shoes. Instead of coil springs a W-shaped retracting spring is used to return the brake shoes into the normal position. The wheel brake cylinders and pistons are aluminium castings.



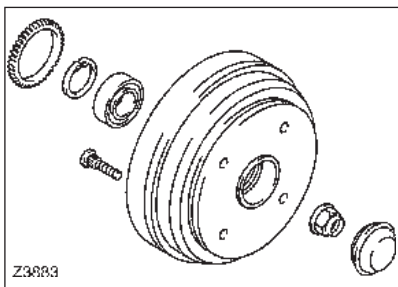
Rear drum brake assembly

- 1 Anchor plate
- 2 Wheel brake cylinder
- 3 Adjuster rod
- 4 Adjuster lever
- 5 Retracting spring
- 6 Brake shoe and lining
- 7 Adjuster spring

Regarding maintenance and repair some aspects have to be taken in consideration. Special tool KM 6145 can be used to reset the adjusting mechanism if the brake drums are worn and hard to remove. This is shown in the illustration below.



- 1 KM 6145
- 2 Adjusting mechanism



Brake drum and bearing assembly

The brake drums are an assembly with the bearings as with Corsa-B. To remove the drums the bearing nuts must be removed. Instead of a cotter pin (Corsa-B) a special nut is used on the Opel Agila. To secure the nut the outer edge must be bent into a recess in the spindle. To enable a quick inspection of the brake linings, without removal of the drums, an inspection hole with plug is provided in the anchor plate.

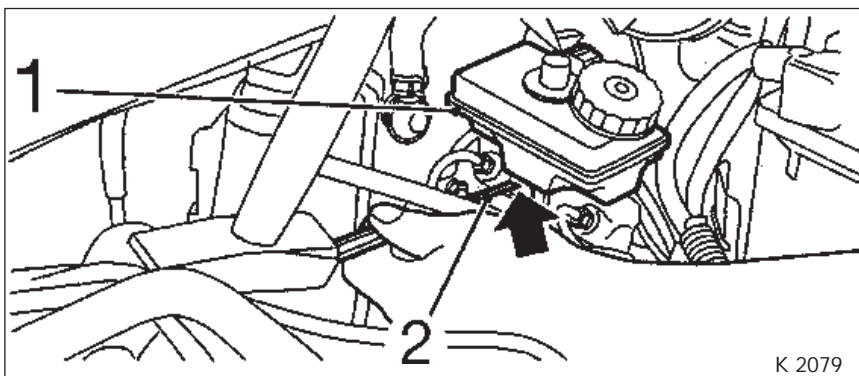
5.3 Brake actuating components

The following items will be explained concerning the brake actuating components:

- Brake booster
- Master cylinder
- Load sensing proportioning valve
- Brake pipes and hoses
- Park brake system
- Maintenance and repairs

Brake booster

The brake booster is a vacuum-type 8 inch booster with a single diaphragm. Its vacuum non-return valve can be replaced separately. Brake booster repairs are not supported, only assembly replacements can be performed. The piston rod, connecting the brake booster to the master cylinder is not adjustable.



- 1 Brake Fluid reservoir
- 2 KM6144

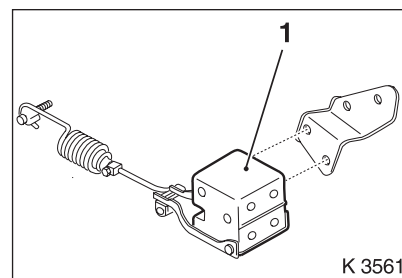
Master cylinder

The master cylinder comes in two versions. One for the regular version and one for the ABS version. The regular version has four brake pipe connections, the ABS version has two brake pipe connections. The piston diameters of both versions are different.

To remove of the brake fluid reservoir special tool KM 6144 is necessary. With this tool the pin fixing the reservoir to the master cylinder can be removed using a hammer. Master cylinder overhaul is currently not supported.

Load sensing proportioning valve

The load sensing proportioning valve is only used on the versions without ABS. The valve is located near the fuel tank behind the rear axle. The Service Instructions provide a special procedure to remove, install and adjust this valve.

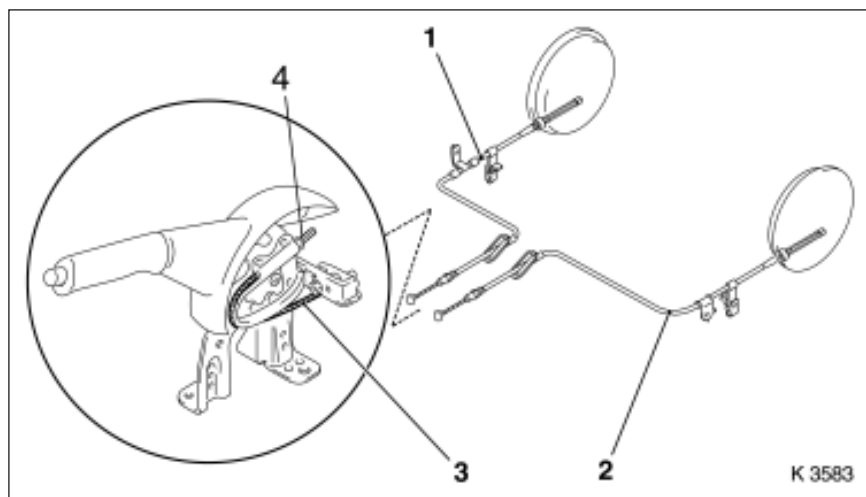


1. Load sensing proportioning valve

Park brake system

The park brake system layout shows similarities with the other Opel passenger cars. The system is designed using the following components:

- Park brake lever assembly
- Park brake cable left
- Park brake cable right
- Lever assemblies in the rear brakes
- Park brake telltale switch



The park brake cable consists of three pieces. The centre piece is an integral part of the park brake lever assembly. The left and the right drum brakes are attached to the lever assembly via the left and the right park brake cables. Besides the park brake telltale switch no separate parts are available for the lever assembly. Park brake adjustments should be performed in the car, not under the car. Refer to the Service Instructions for the exact procedure.

Park brake system

- 1 Right park brake cable
- 2 Left park brake cable
- 3 Park brake lever assembly
- 4 Adjustment nut

Maintenance and repairs

Regarding brake maintenance and repairs, mentioned in the Service Plan and the Service Instructions, the Opel Agila should be treated similar to the other models in the Opel range. The following features ensure the safety of the drivers and the occupants.

The Opel Agila brake system is designed for the use of DOT4 SAE J-1043 brake fluid only. Currently wheel break cylinder overhauls and master cylinder overhauls are not supported. Assembly replacement should be applied if necessary.

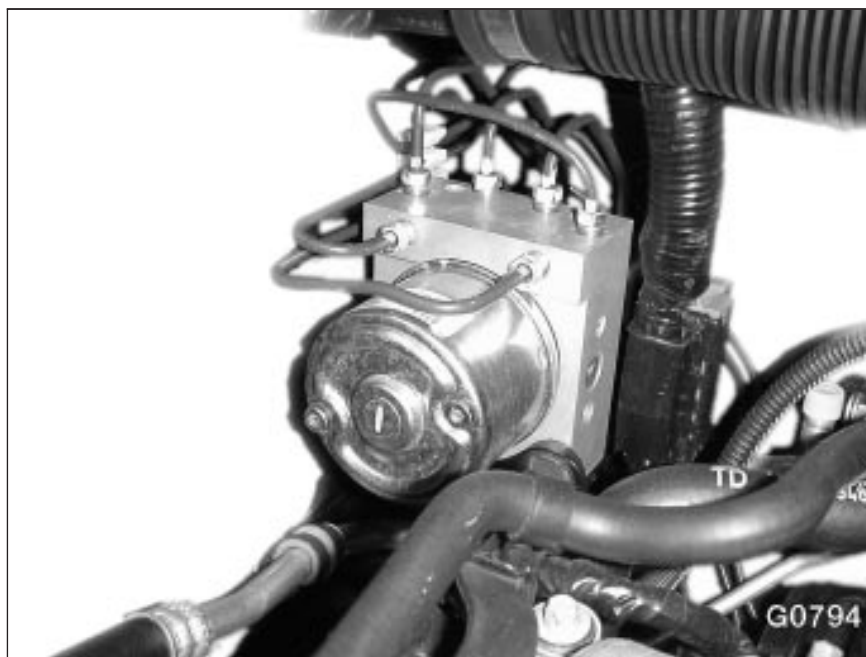
The brake fluid should be replaced every two years, according to the regulations of the Opel/Vauxhall Service Plan. The brake system bleeding procedure requires 2.0 bar system over-pressure.

5.4 ABS

Anti Lock Brakes (ABS) is optional on all versions. The ABS is a Nissin product. This system uses an integral unit with controller and hydraulic modulator in one assembly.

Traction control is not available. Dynamic rear brake proportioning is integrated in the ABS. This is why the ABS-versions do not require a load sensing proportioner valve.

The ABS is a 4 sensor - 4 channel system and is equipped with a TECH 2 diagnostic interface.



This ABS provides driver feedback during ABS intervention by means of pump and solenoid noise and brake pedal vibration. Conventional wheel speed sensors on the front steering knuckles are used (no integral bearing-hub-sensor assemblies).

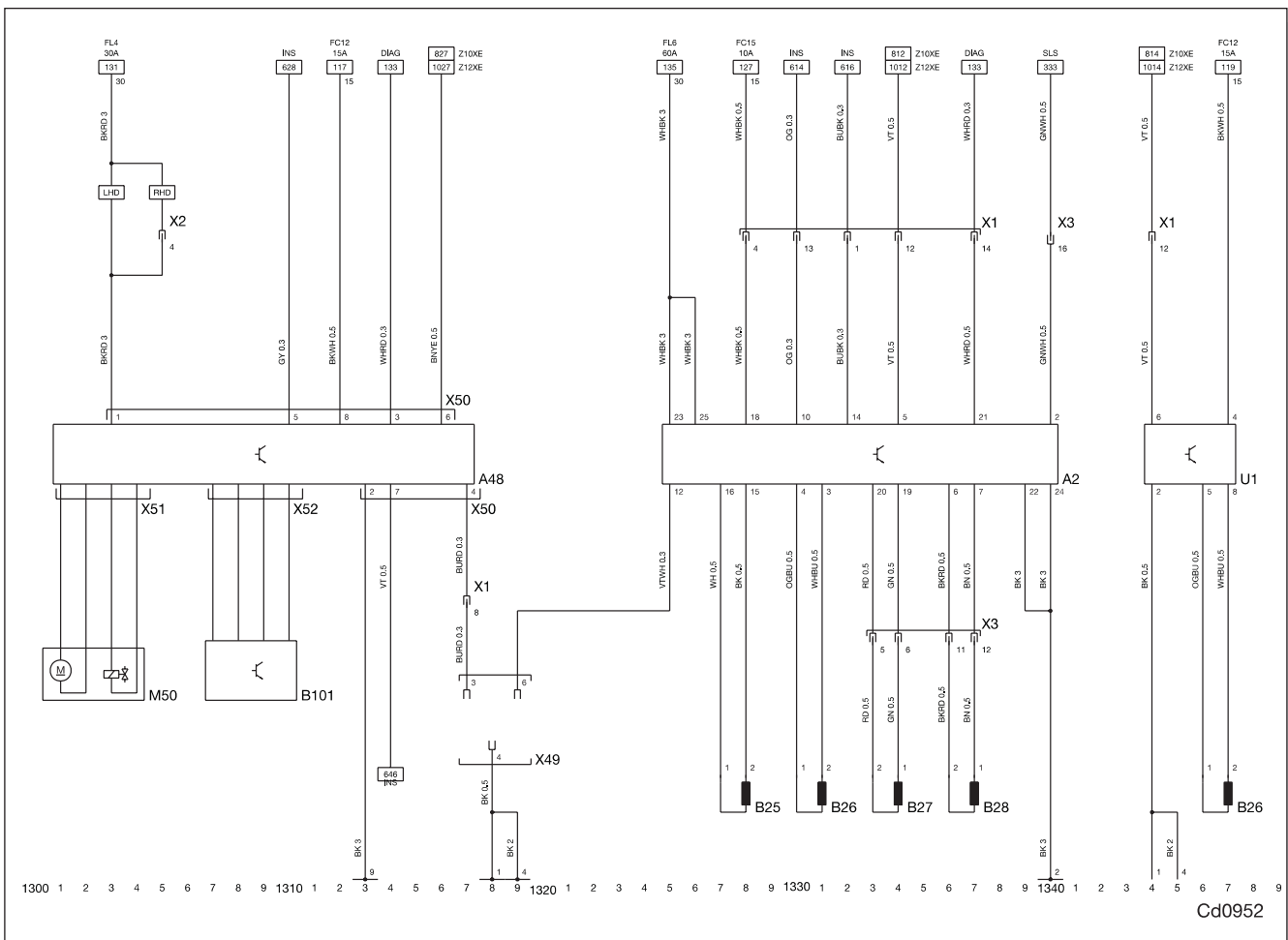
The rear wheel speed sensor gear is mounted on the inner hub part of the brake drum. The sensor nose measures the speed of the passing teeth radially instead of axially, seen from the sensor. No adjustments are necessary or possible on any component of the ABS. The master cylinder is modified for the use of an ABS system.

The sensor gear in rear brake drum can be replaced, but will be destroyed during removal with a puller. Special tools are necessary.

The hydraulic modulator and control unit are combined in one assembly. Repairs of this assembly are not supported and separate components are not available. The hydraulic modulator comes filled with brake fluid from Parts & Accessories (P&A). The standard bleeding procedure (mentioned in the Service Instructions), as used on other Opel vehicles, can be used on the Agila too.

Electrical and electronic features

The ABS of the Opel Agila incorporates dynamic rear brake proportioning. The ABS versions are not equipped with a load sensing proportioning valve. When ABS is in emergency mode dynamic rear brake proportioning is not operational. This will lead to unlimited rear brake pressure and that causes the rear axle to be overbraked.



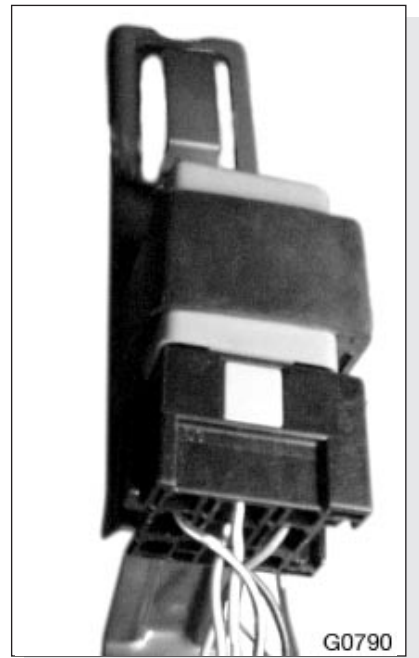
Circuit diagram ABS (1325-1350)

A2 ABS control unit
 B25 Frt. left wheel speed sensor
 B26 Frt. right wheel speed sensor
 B27 Rr. left wheel speed sensor
 B28 Rr. right wheel speed sensor

U1 Signal converter module
 X49 Diagnostic link

Regarding the circuit diagram the following features can be identified:

- The ABS wheel speed sensors are connected to the control unit by means of twisted pair wiring.
- The control unit provides two diagnostic interfaces. Pin 12 is connected to a diagnostic plug, X49. This plug is located on the A-pillar on the passenger side. This plug provides an additional blink code request for the ABS and EPS control units, by grounding the wires. Opel does not use the blink codes for diagnostic purposes, because there is a better diagnostic interface, using the TECH 2 and pin 21, providing more facilities to isolate the fault.
- The pins 10 and 14 are connected to the instrument to control the telltales. Pin 10 is used for the telltale of the brake system. Pin 14 is used for the ABS telltale. The telltales are controlled in the instrument via an additional controller in the unit. This controller is able to switch on the brake system telltale when the ignition is switched on to verify the correct operation of the telltale. A grounded signal wire to the instrument causes the telltale to illuminate.



Signal converter module (U1)

The front right wheel speed sensor is used to generate a vehicle speed signal for the the engine management system only. The other systems on board using a vehicle speed signal (radio, TID, instrument and EPS) receive this signal from a separate vehicle speed sensor in the transmission (B24). The versions without ABS have a dummy control unit or signal converter (U1), instead of the ABS control unit, to generate the speed signal for the ECU. Only one wheel speed sensor (front - right) is used with this configuration. Both configurations use a violet wire to transfer the vehicle speed signal. More about these vehicle speed signals will be explained in chapter 10.

6. Engines

6.1 Engine Types

The new New Opel Agila is available with two different engines:

- The Z10XE a 1.0 litre 12V petrol ECOTEC engine with 43 kW (58 PS)
- The Z12XE a 1.2 litre 16V petrol ECOTEC engine with 55 kW (75 PS)

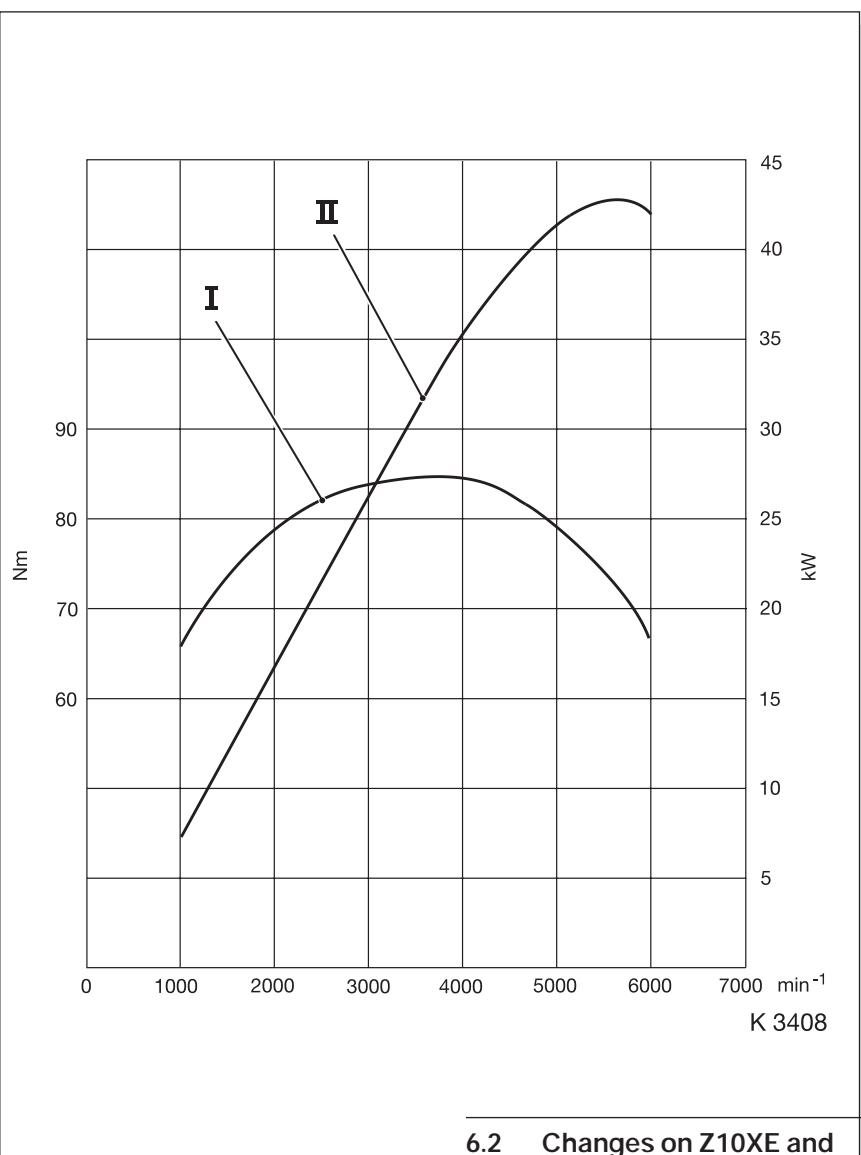
These both engines are ready to meet the "Euro 4" emissions regulations.

Although there are several new features, the Z10XE and the Z12XE engines are based to the X10XE and X12XE engine out of the Corsa-B.

Engine data

Z10XE

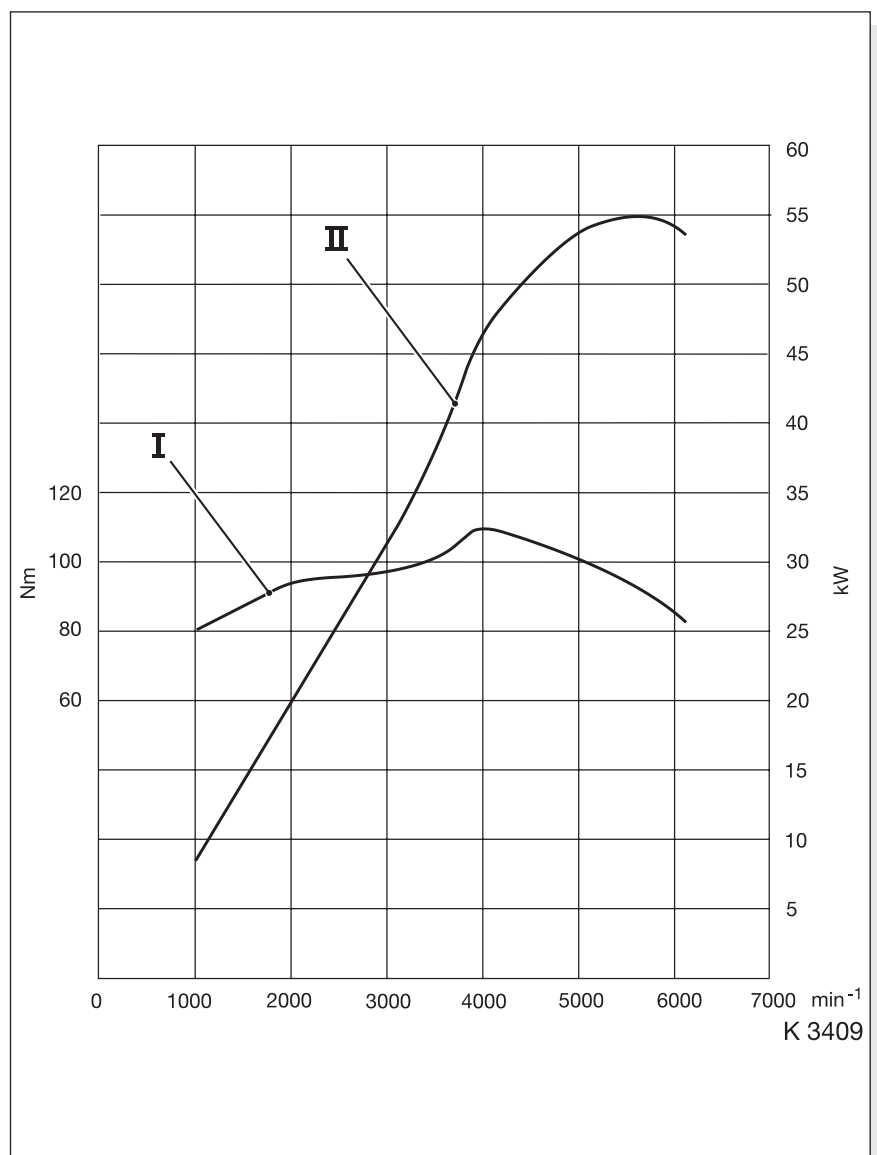
Output	43 kW/58 PS at 5600 rpm
Torque	85 Nm at 3800 rpm
Top speed	142 km/h
Acceleration 0-100 km/h	18.0 sec
Fuel consumption (Lt/100km)	
- Urban	7.5
- Country	5.6
- Combined	6.3



Engine data

Z12XE

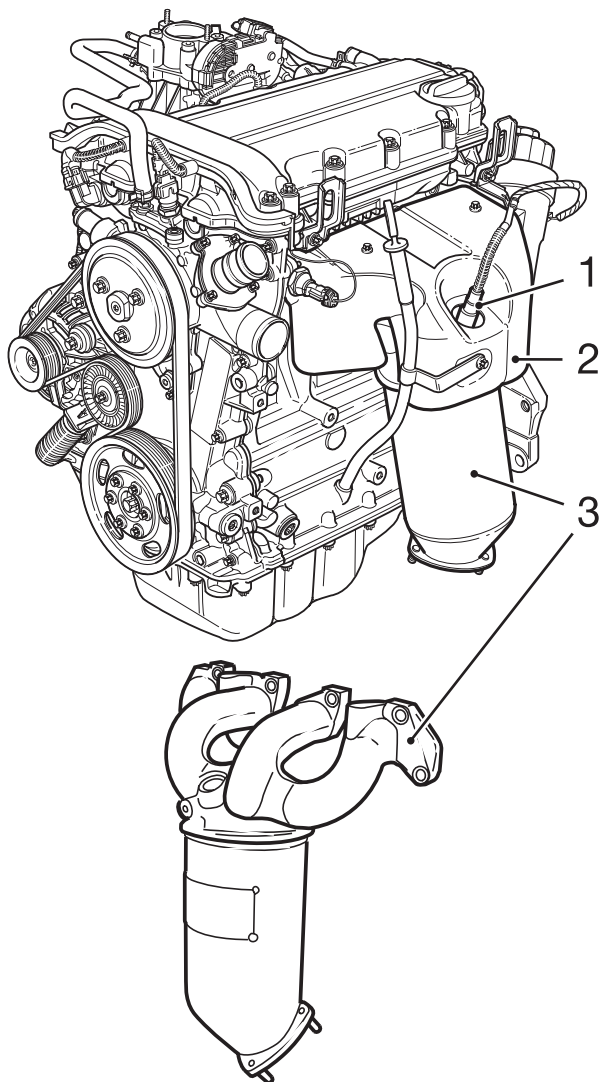
Output	55 kW/75 PS at 5600 rpm
Torque	110 Nm at 4000 rpm
Top speed	155 km/h
Acceleration 0-100km/h	13.5 sec
Fuel consumption (Lt/100 km)	
-Urban	8.0
-Country	5.7
-Combined	6.5



	X10XE,X12XE		Z10XE,Z12XE
Engine management system	Motronic M 1.5.5		Motronic ME 1.5.5
Number of oxygen sensors	1		2
Fuel system	X10XE Fuel supply and return and line, pressure regulator on fuel line	X12XE Returnless fuel sytem pressure regulator is component of the in-tank module	
Intake manifold	Aluminium	Plastic	
Exhaust manifold	Conventional		Welded to catalytic converter
Throttle valve control	Conventional with cable		Electronic throttle body and accelerator pedal position sensor (E-gas)

Z12 XE compared with X10XE and X12XE

On the new Z engines is the catalytic converter welded onto the exhaust manifold.



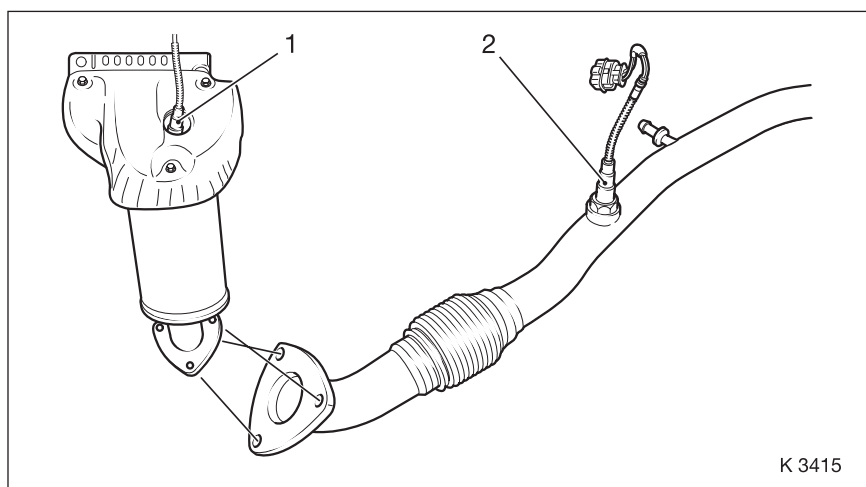
K3407

1. Heated oxygen sensor controls the mixture
2. Heatshield
3. Exhaust manifold with catalytic converter

Oxygen sensors

The new Z engines are ready for the EOBD regulations, these regulations require that the catalytic converter is controlled on its function. For this reason there are two heated oxygen sensors placed on the exhaust system of these Z engines. One is placed on top of the catalytic converter, this one controls the mixture. The second oxygen sensor is placed after the catalytic converter and evaluates the oxygen storage capacity (OSC) of the catalytic converter.

For removal and installation of the oxygen sensor, a special tool is available: KM-6129. For installation a special grease should be used (Cat.nr 19 48 602/Part. Nr. 90 295 397)



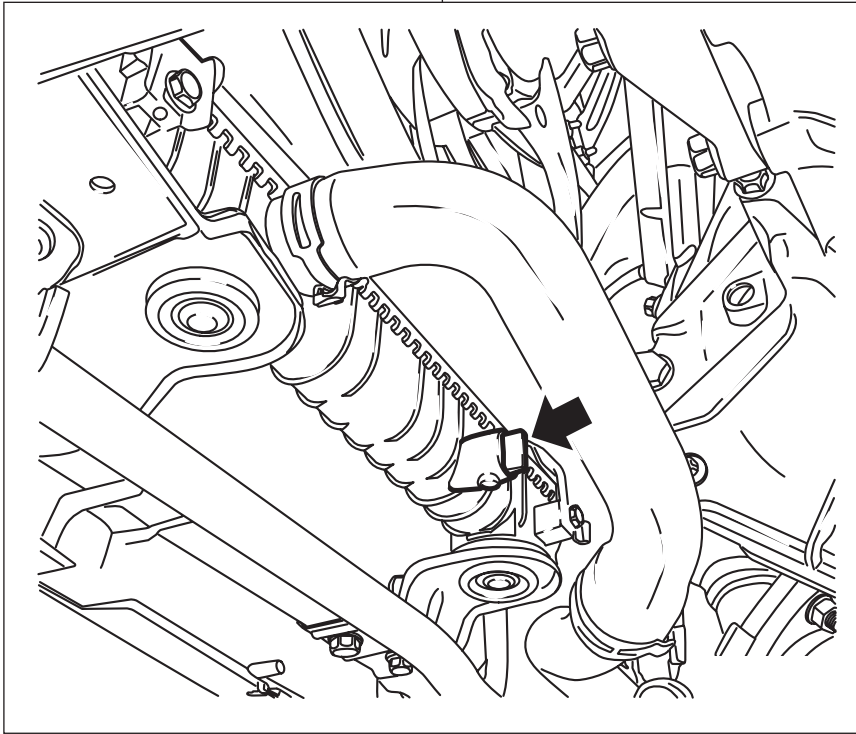
1. *Oxygen sensor for mixture control*
2. *Oxygen sensor checks catalytic converter*

Cooling system

The cooling systems on the Z10XE and Z12XE are so called open cooling systems. When the temperature of the cooling fluid increases the cap valve will open and the fluid flows to the cooling fluid reservoir. When the temperature of the fluid decreases a vacuum is created, the cap valve opens in the other direction and the cooling fluid is sucked back into the system.

The level of cooling fluid in the system can be checked on the cooling fluid reservoir. This check must be done with a cold engine. Corrections on the cooling fluid level are only allowed via this cooling fluid reservoir.

To release all the cooling fluid out of the system a special tap is fitted on the lower half of the radiator.



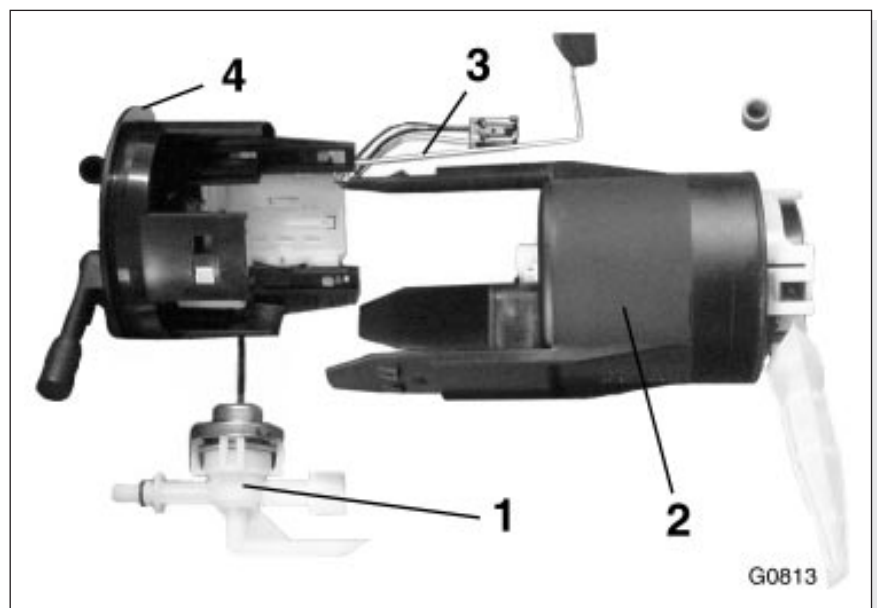
Tap to releas cooling fluid of sytem.

To fill up the cooling system use the service documentation group J.

Fuel system

On both engines in the Agila is a return less fuel system used. This means that where normally two fuel lines (supply and return) were mounted between engine and fuel tank now only one fuel line connects the fuel tank with the engine. This is achieved by making the fuel pressure regulator a component of the intank module, instead of mounting it on the engine. The fuelsystem operates under a pressure of 3.8 Bar.

- 1 Pressure regulator
- 2 Fuel pump
- 3 Tank content sensor
- 4 Filter unit



G0813

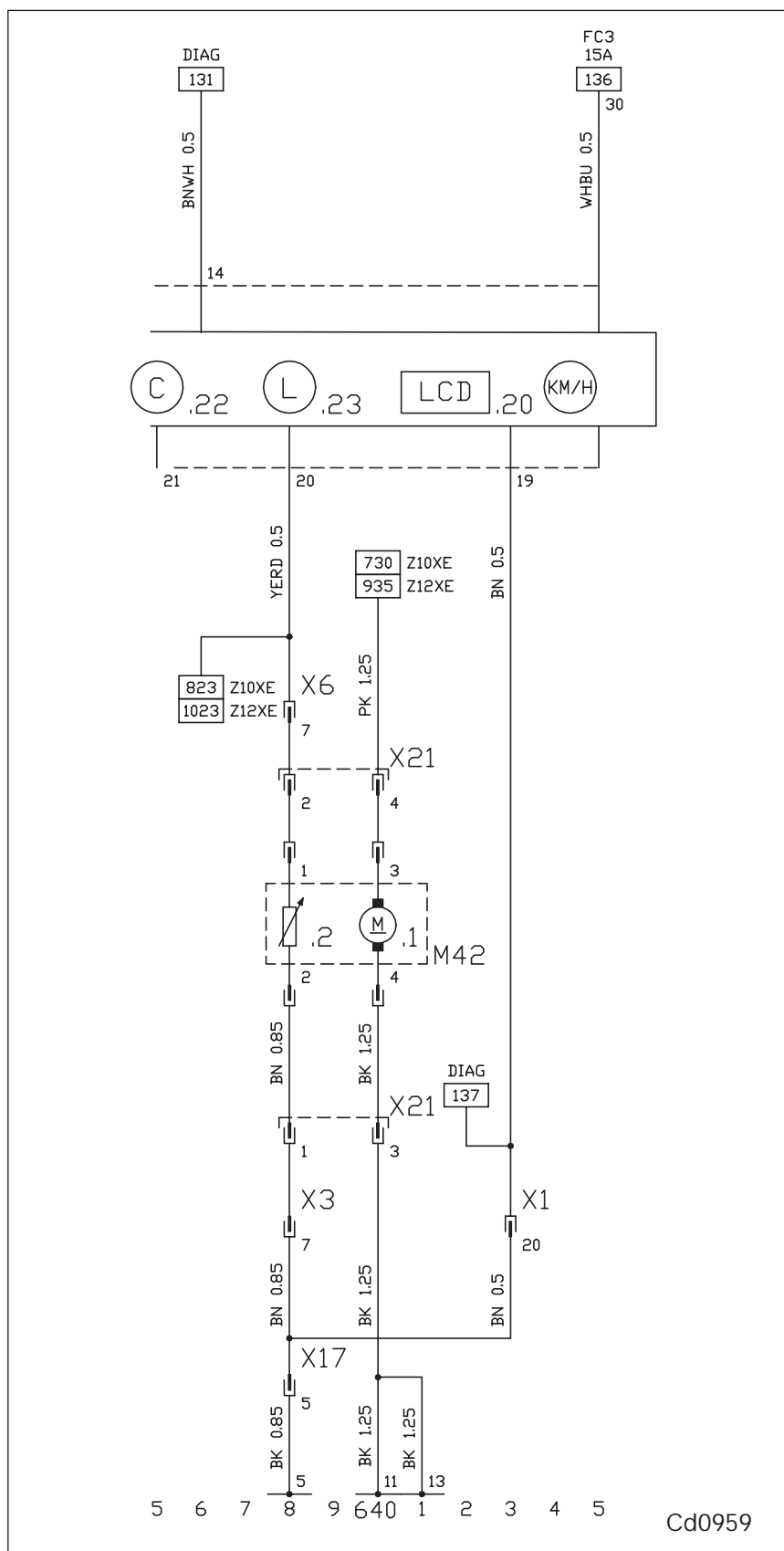
The intank module contains the following components:

- Fuel pump
- Pressure regulator
- Fuel level indicator
- Filters

All components of the in tank module are maintenance free.

The in tank module is connected to the engine management system with four wires, two for the fuel pump and two for the Fuel tank content sensor.

- M42 Intank module
- M2.1 Fuel pump
- M2.2 Level indicator



Cd0959

6.3 Engine management motronic ME 1.5.5 system

Both engines in the Agila are equipped with the Motronic ME 1.5.5 engine management system, this engine management is able to let the engines pass the 'Euro 4' emission regulations. The following components are new or modified:

- Accelerator pedal position sensor
- Throttle body
- EGR valve
- Second oxygen sensor after catalytic converter

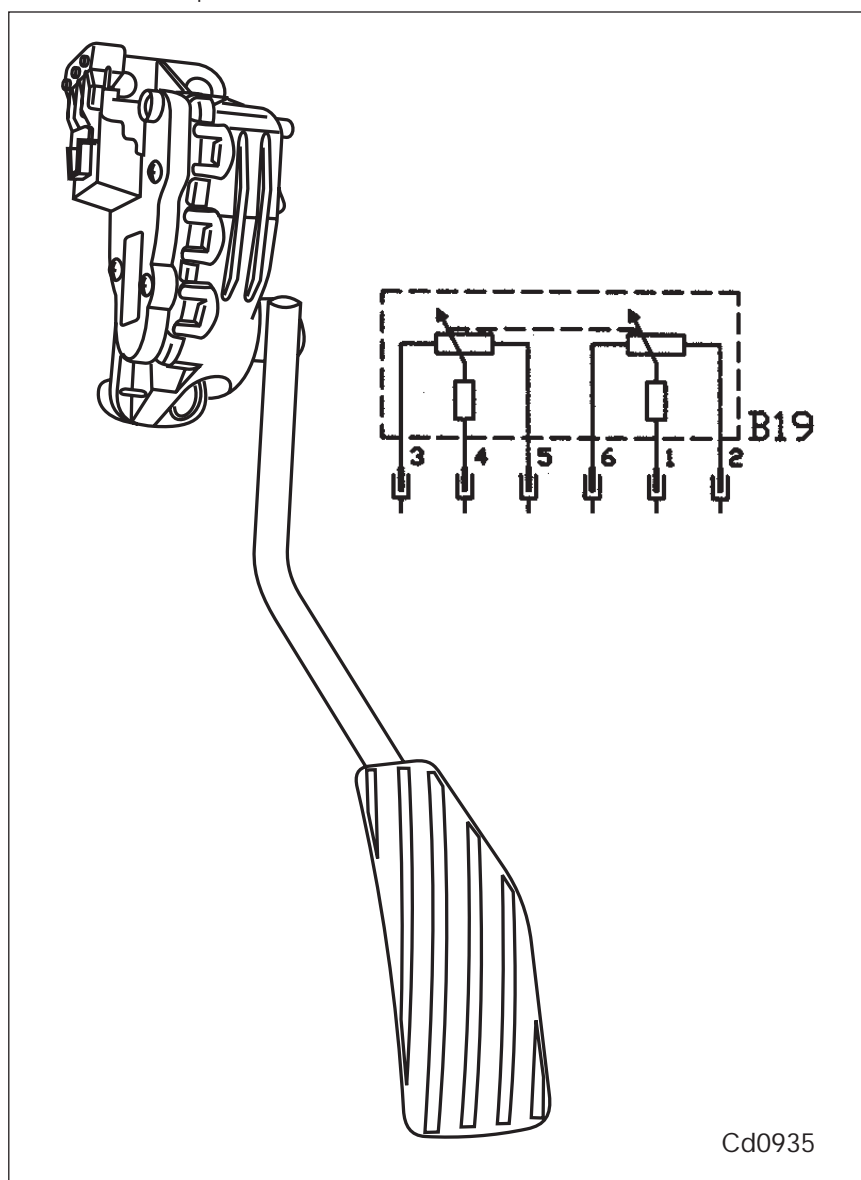
E-gas

In addition to the Y16XE and the Y22XE, the Z10XE and Z12XE are also equipped with E-gas. The main components of the E-gas system are:

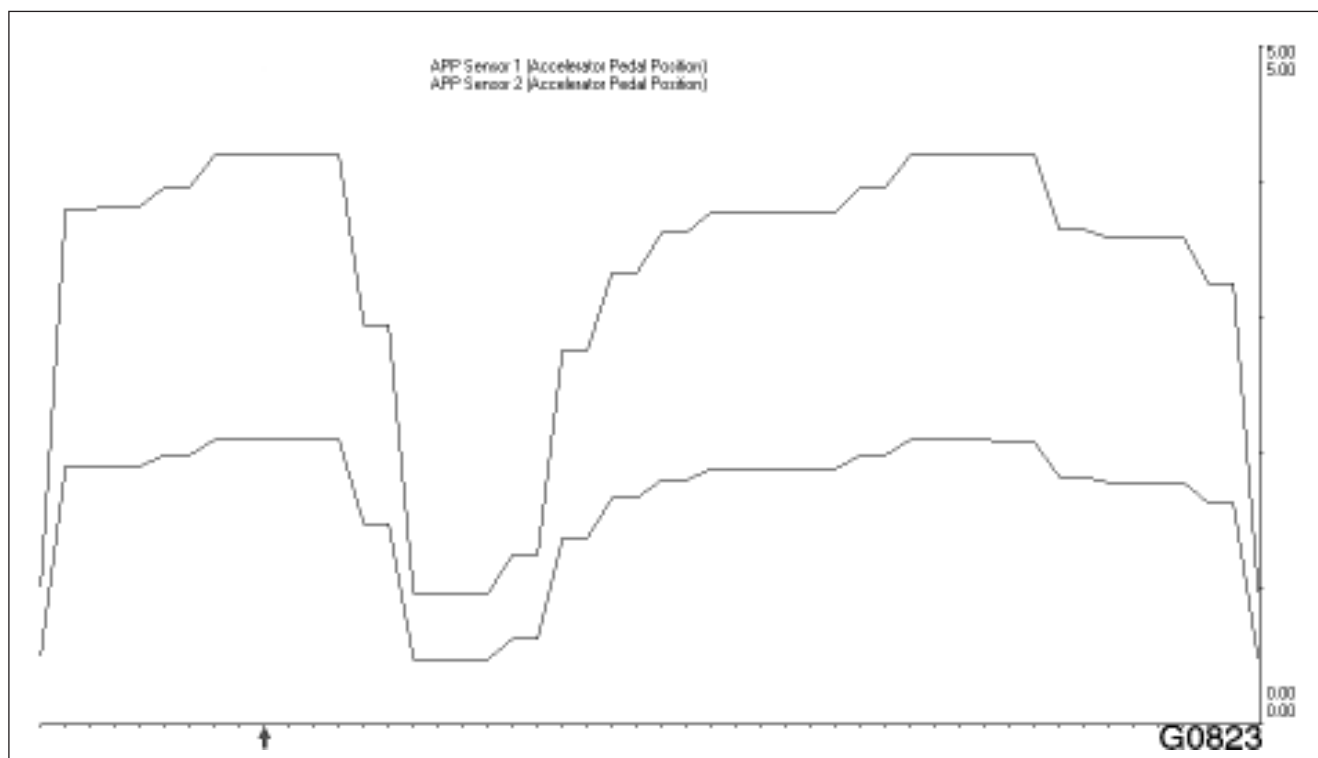
- Throttle body
- Accelerator pedal position sensor

The working principal of the sensor pedal position is the same as the one used on the Y engines. It contains two potentiometers and no idle switch. The sensor pedal position is connected to the engine management system with a six pins connector (3 wires for each potentiometer). The signal of both potentiometers increases with pedal actuation. The pedal position potentiometer 1 signal ranges from 0 to 5 Volts. The pedal

position potentiometer 2 signal ranges from 0 to 2.5 Volts. This potentiometer checks potentiometer 1.



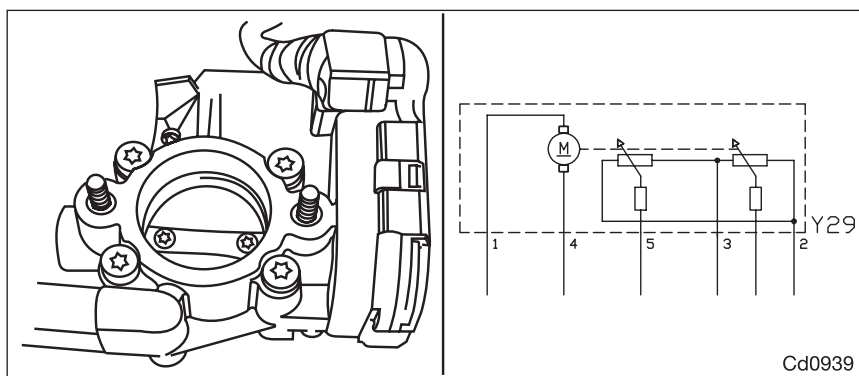
Sensor pedal position



During normal operation the signal voltage of both potentiometers is never equal. The signal of potentiometer 1 must always be higher than the signal voltage of potentiometer 2.

The throttle body contains the throttle valve, the throttle positioner (motor) and two potentiometers. The throttle body is connected to the motor management system with a six pins connector. This is

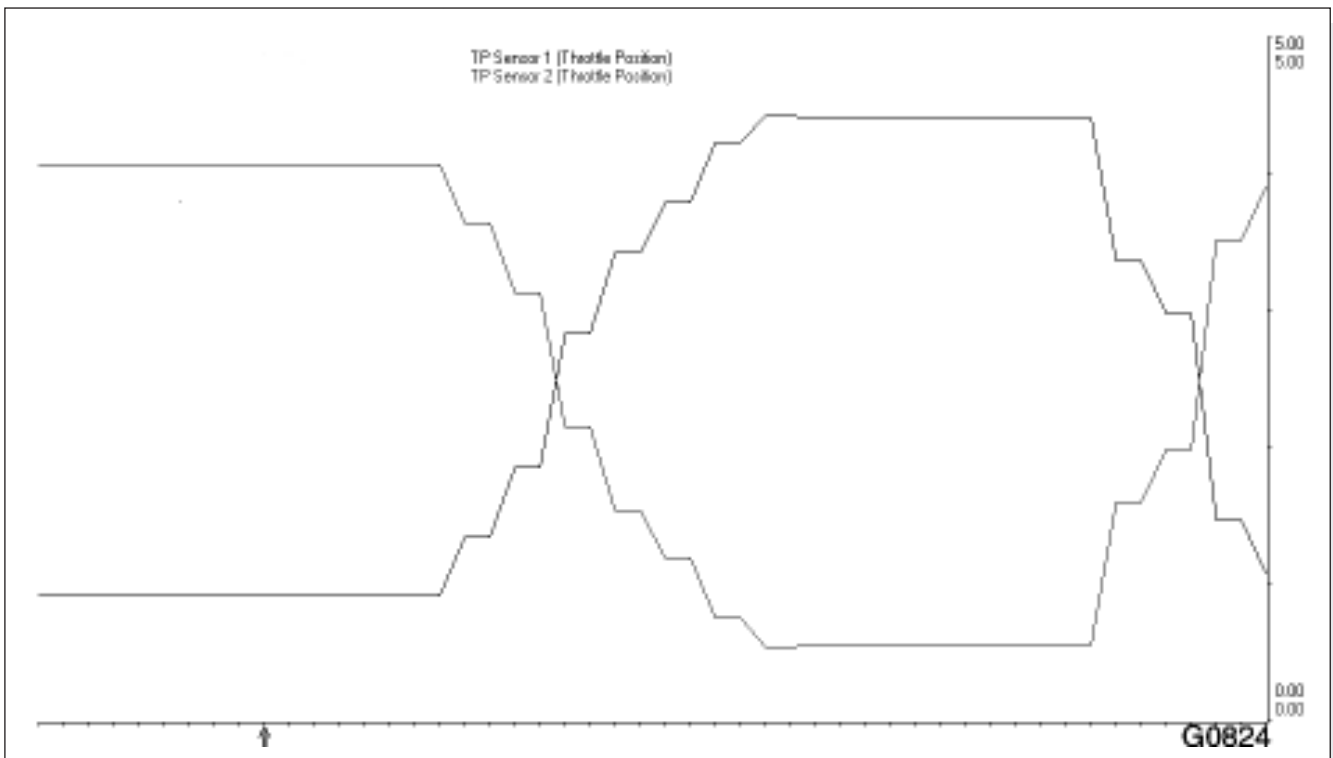
different to the throttle bodies of the Y16XE and the Y22XE engine, these have an eight pin connector. The throttle body of the Z10XE and the Z12XE uses the same ground and power supply for both of the potentiometers.



Throttle body

The voltage of throttle potentiometer 1 increases as the throttle valve opens. The signal voltage range of this potentiometer is 0 to 5 Volts.

Where as, throttle potentiometer 2 shows a decrease in signal voltage when the throttle valve opens. The signal voltage range of this potentiometer is 5 to 0 Volts.



The throttle positioner works in the same way as the one used on the Y16XE and Y22XE.

When the accelerator is operated, the ECU receives a signal from the pedal position sensor potentiometers. The ECU then calculates the required output signal for the throttle positioner. The movement of the throttle valve is monitored by the throttle body potentiometers. In the event of a fault arising it is possible for the throttle positioner to be switched off. When the throttle positioner is switched off, the valve rests at a preset position.

The throttle valve is forced into this preset position by a spring. In this preset position the throttle valve is partially open, allowing an engine speed of 1000 RPM (approx). This is to drive the vehicle and ensure a good engine breaking on overrun.

The signal the throttle positioner receives from the ECU is a PWM (Pulse Width Modulation) signal, as mentioned before the throttle valve is forced into a preset position when it is switched off or disconnected (1000 RPM). At this position the valve opening is greater than the opening at idle speed (800 RPM). For the engine run at idle speed the valve must be closed a little. On acceleration the valve must first go back to the preset position in which the spring forces it. After this position the valve must be opened to reach the speed the driver demands.

So first, the valve must be closed a little, and when accelerating, the valve must be opened.

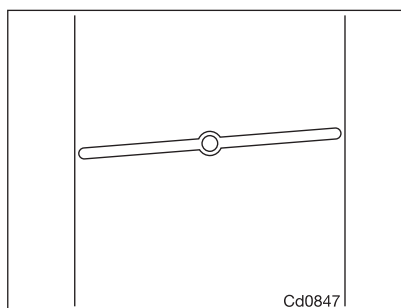
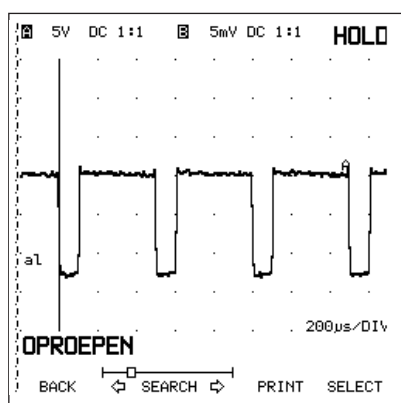
The opening and closing of the throttle valve is carried out by the throttle positioner that works in two directions.

In the circuit diagrams, the throttle positioner is connected to the ECU with two wires. This is done for technical reasons. Because the connections to the wiring harness connector are very small they weren't able to connect this output on one pin for this reason they used two pins. We can see this feature also with the connection of the pintel positioner of the EGR valve.

PWM signals

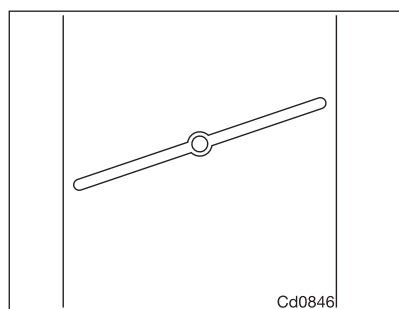
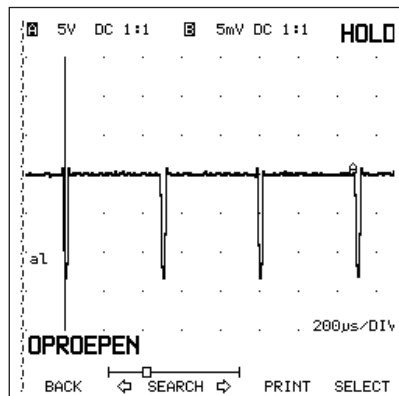
The graphs of the throttle positioner are made with use of the Tech 31. The ground probe is connected to pin 1 and the signal probe to pin 4, both of the connector on Y29.

Idle speed



This graph shows the PWM signal from the ECU to the throttle positioner at idle speed. This signal makes sure that the throttle valve is closed a little until the programmed idle speed is reached.

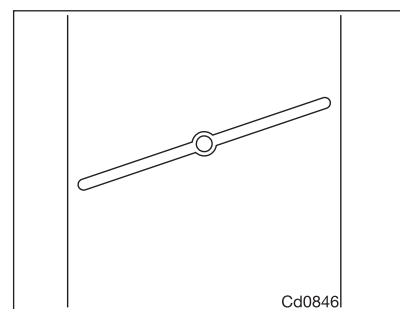
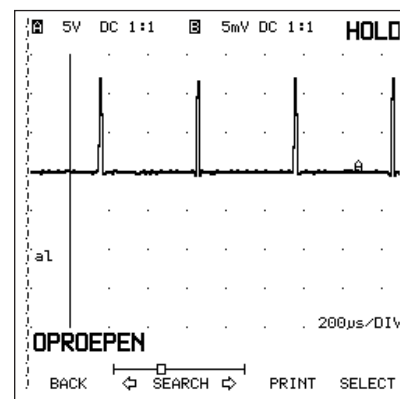
900-1000 RPM



On light acceleration the throttle valve is approaching the preset position. The force required to maintain the throttle valve in this position is low (low spring pressure). For this reason the pulse widths are reduced in comparison to at idle speed.

On further acceleration the throttle valve reaches the preset position. The spring pressure becomes neutral. For the throttle valve to open further, the throttle positioner must force the spring in the opposite direction. For this to happen the throttle positioner needs to work in the opposite direction. This is achieved by changing the PWM signal from negative to positive.

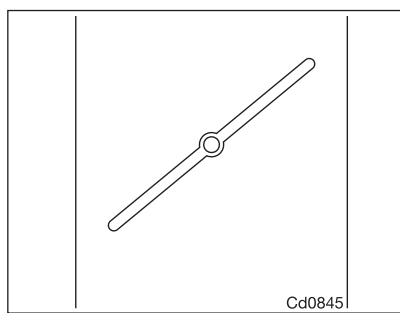
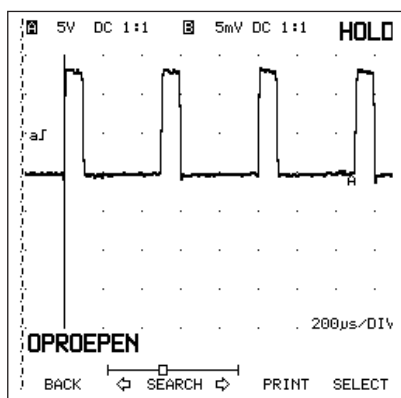
1000 – 1100 RPM



This graph shows the PWM signal after the valve has opened a little further than the preset position. The throttle positioner works in the other direction and the signal changed from negative to positive.

1100 - RPM

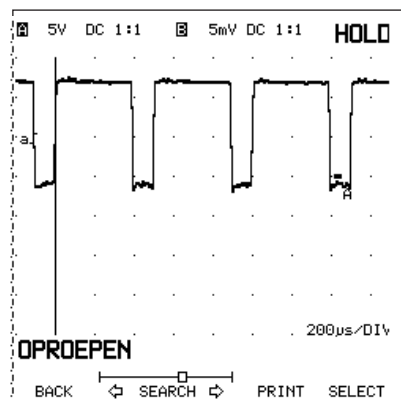
On increased acceleration, the throttle valve opens further until the engine reaches the demanded RPM. The throttle positioner maintains the throttle valve in this position (cruise position).



This PWM signal maintains the throttle positioner in position. This signal is consistent for all throttle valve positions above the preset position.

On acceleration the throttle valve position must be changed, the pulse width will now change to achieve this as additional force is required to open the throttle valve.

Hard acceleration



This graph shows the PWM signal during hard acceleration. The pulse widths are very wide due to demand for fast throttle valve opening.

Exhaust gas recirculation

The Z10XE and Z12XE engines are equipped with a modified linear exhaust gas recirculation valve (1). This electronically controlled component enables precise control of the exhaust gas recirculation, which reduces emission of nitrogen oxides. The solenoid valve is not dependent on the vacuum and can therefore be opened or closed in all load conditions. The quantity of exhaust gas is checked by the control unit. The control unit measures engine parameters such as speed, load condition and temperature via the sensor input signals and calculates the required exhaust gas quantity.

The exhaust gas recirculation valve consists of the following components:

Solenoid valve

The valve opening is dependent on the coil current and is controlled by a pulse-width modulated (PWM) signal from the control unit. The restoring force required to keep the exhaust gas recirculation valve closed when it is dead, is applied via a spiral spring.

Piston position sensor

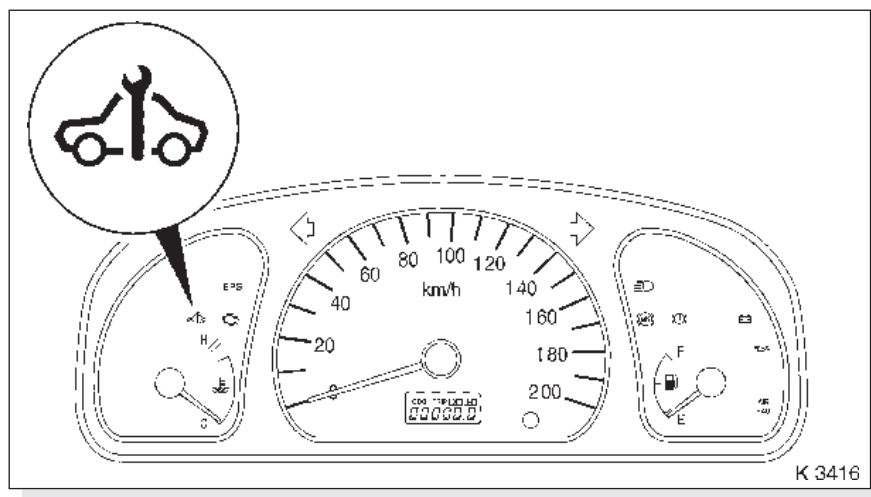
This sensor tells the control unit how wide the valve is opened. The piston position sensor is required for assessing the exact position of the solenoid valve.

Fan control

To reduce the components the fan is controlled by the ECU, this means that the ECU sends a signal to a relay, which switches on the fan. Because of this the pressure sensor air-conditioning is directly connected to the ECU.

Telltale for engine electronics

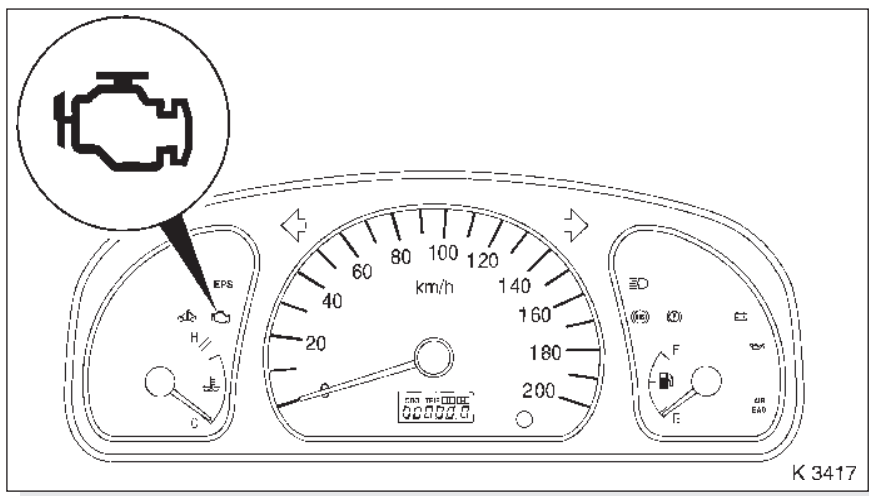
The telltale for engine electronics informs the driver about malfunctions in the engine electronics and immobilizer.



Telltale for engine electronics

Emission control telltale (MIL)

The emission control telltale informs the driver about malfunctions that lead to increased emissions or malfunctions that can damage the catalytic converter. This telltale is required by EOBD.



7 European On Board Diagnosis

7.1 Introduction

With the introduction of the Mini People Carrier Agila for MY 2000 ½, Opel was obliged to incorporate the European On Board Diagnosis (EOBD) system into this car's engine management system. The appliance of the European On Board Diagnosis system is mandatory for newly type approved passenger cars up to 2500 kg's as of 01-01-00.

For Opel the Agila and later on the Speedster will have to comply with these regulations. As of 01-01-01 all newly sold vehicles will have to comply with these regulations. This means that for the next Model Year Opel must incorporate EOBD into all of its petrol engines.

Part of the measures taken to improve the air quality in Europe was the introduction of the EOBD system by the European Union.

This despite the fact that:

- the amount of automobiles increases.
- the amount of driven km's increases.
- the amount of trucks remains the same but the amount of driven km's of each truck increases.

7.2 History of On Board Diagnosis (OBD)

On Board Diagnosis was introduced in the early 80's using flash codes. In 1988, the California State (USA) required all manufacturers to provide a system, that could identify a fault in an Electronic Control Unit (ECU), or the components connected to this ECU. This was the introduction of the OBD I.

For Opel, OBD was introduced in 1985 on the C13LZ in the Corsa A. This system stores a DTC if an electrical defect is detected on a component or a reduced functionality of this component has been recognised. The system is capable of recognising DTC's, storing DTC's as well as displaying the DTC and its status.

In Model Year 1996, OBD standardisation was introduced for all cars in regards to the indication of DTC's on certain components. Furthermore the communication protocol between diagnostic tester and ECU was standardised as well as a 16-pin diagnostic link.

At the same time these standards were set for OBD II and in 1996 all car manufacturers were required to meet these standards.

OBD II is required to monitor and perform diagnostic tests on vehicle emission systems.

If the emissions were to rise above 1-1 ½ times the FTP (Federal test procedure) standards, then a malfunction indicator lamp (MIL) must be illuminated. The DTC's were also standardised as of Model Year 1996.

The next step was to create a system that not only reduces the emissions, but also check emission relevant components, for a given period. Also the EOBD compels an in-field conformity so the cars must be monitored for a period of 5 years or 80000 km.

How this in-field conformity is going to take place is, at this moment not decided yet.

		HC	CO	NO _x	HC+NO _x
EWG	1992		2,72		0,97
EG	1996		2,2		0,5
EURO III	2000	0,2	2,3	0,15	
EURO IV	2005	0,1	1,0	0,08	

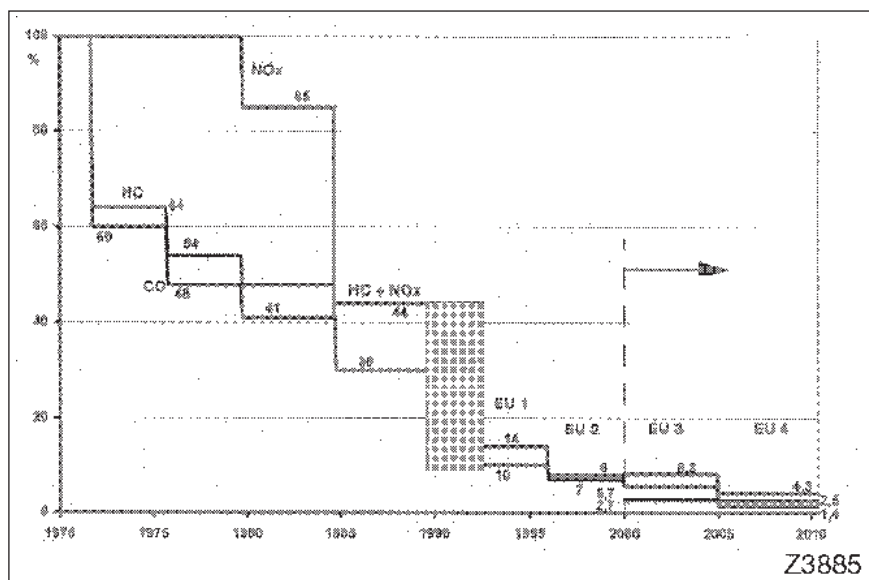
7.3 EOBD

7.3.1 European Union

One of the measures taken by European Union (EU) to improve air quality was a further reduction of allowable exhaust emissions. This is achieved by checking the exhaust emission relevant components constantly, and by recognising and indicating emissions increasing, during the car's lifetime.

The European comity has made an objective in corporation with transport, industry and environmental organisations.

Phases of reducing the exhaust emissions in Europe are shown in the next column.



The objective is to reveal emission failures in an early stage, by lighting a control lamp. Remember that in earlier days the emission failures only were detected when the car was serviced.

EOBD and OBD II (USA) are broadly similar in the areas of emission limits, diagnosed components and the list of defects with the potential to trigger the MIL.

Minor differences relative to the OBD II system are rooted in the respective legislative requirements. These points include:

- Different calibrations for many malfunction thresholds.
- No evaporative leak system.
- Catalytic converters are monitored for HC and NOx conversion.
- Freeze frame data covering the distance travelled since the last activation of the MIL.

7.3.2 EOBD & US OBD requirement comparison

	US OBD I	US OBD II	Typical Industry Standard	European OBD
MIL	Yes	Yes	Manufacturer Dependent	Yes
Standard codes	Yes	Yes	No	Yes
Connector & Communica tion Protocols	No	Yes	No	Yes
Misfire	No	Yes	No	Yes
Cataytic converter	No	Yes	No	Yes
Comprehen sive Component Monitor	No	Yes	Yes	Yes
O2	No response test	Yes	No response test	Yes
EGR	No intrusive test	Yes	No intrusive test	Yes
EVAP	No	Yes	No	Yes No leak test
Fuel	Yes	Yes	Manufacturer Dependent	Yes
Sec.AIR	No	Yes	No	Yes

7.3.3 The features of the EOBD system.

The regulations are compelled for Europe (newly sold cars) as of Model Year 2001:

1. Checks the exhaust emissions, now on long terms too.
2. Protects the catalytic converter.
3. Sets Default Tracing Codes (DTC's) if the emissions exceed the emission-standards.
4. More (standardised) DTC codes are used.
5. Enables service personnel to read the DTC's and their supplemental information.

The EOBD system is not capable of checking the exhaust gas quality, but can only check the components that are responsible for the exhaust gas quality.

If within this frame the ECU calculates a deviation, than the ECU will inform the driver by illuminating the MIL. An acoustic signal is allowed as well.

Malfunction Indicator Lamp (MIL) management is submitted to legislative requirements.

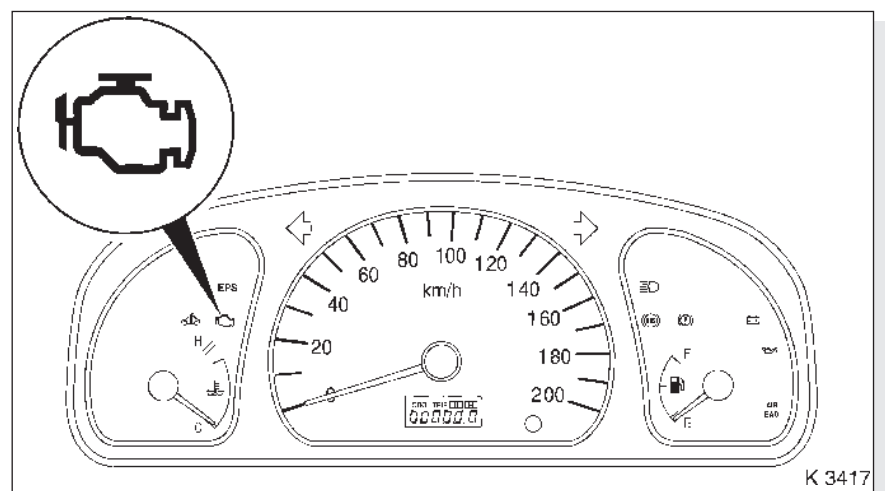
The MIL will be illuminated if:

- The level of misfire is sufficient to result in catalytic converter damage at the current operating conditions.

Remark; the MIL will flash as long as the fault is present. More information about the circumstances is covered in a later stage.

- The self-test of the ECU has failed.
- Ignition is switched on(position "III") with the engine not running (lamp check)
- An emission related fault occurs in two or three consecutive trips.

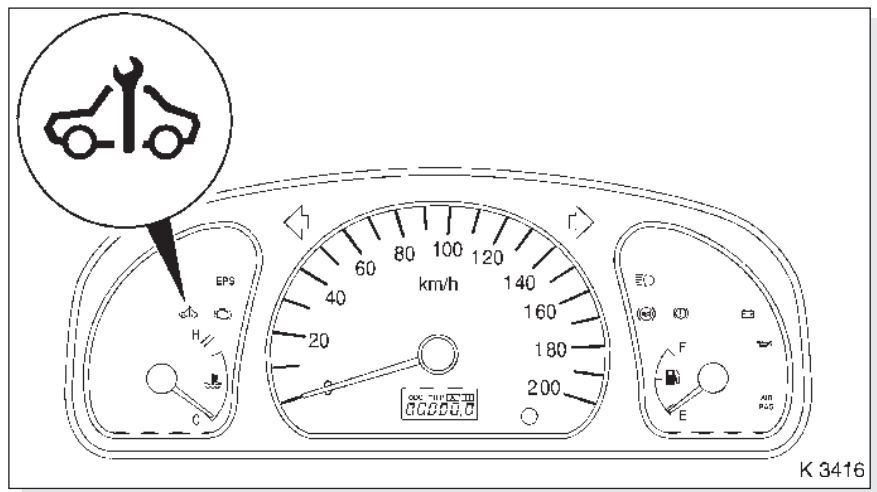
The exact circumstances for storing a DTC and illuminating the MIL is discussed at 7.06.



MIL (Malfunction Indicator Lamp)

EOBD uses an additional telltale for not emission-related defects, called the engine electronics telltale (formerly known as the Service Vehicle soon SVS lamp)

This telltale illuminates when a defect arises which is **not** emission relevant.



Control lamp for engine electronics

7.4 Test cycle for EURO III

7.4.1 European Type approval

The method for analysing exhaust gases for the European type approvals are done at a dynamometer. The test consists of imitated lifelike drive cycles on which exhaust gas is being analysed. The manufacturer has to prove that this test is run through two times without exceeding the prescribed emissions and without defects. The test contains of the following steps;

Step 1 (city cycle, to be run 4x in a row)

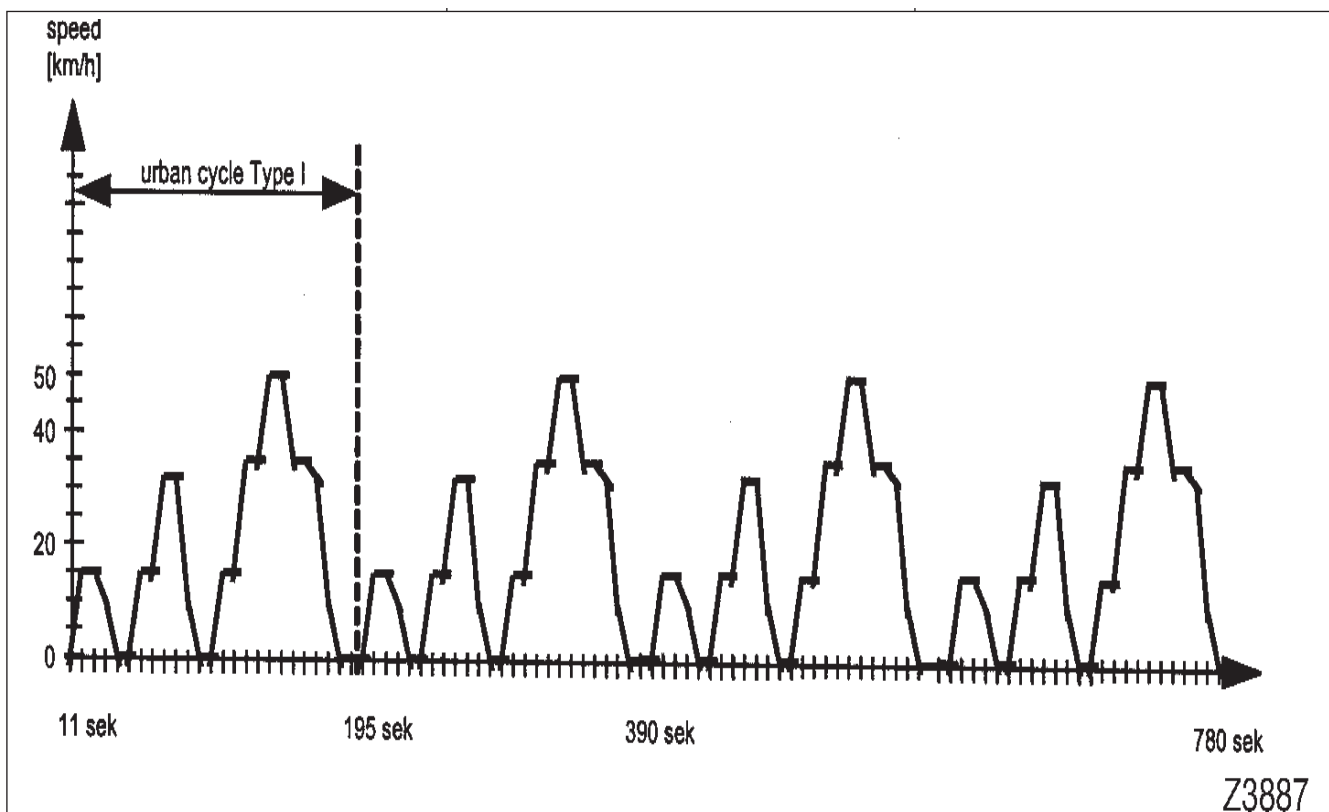
- Effective running time: 195 seconds
- Distance travelled: 1.013km
- Average speed: 19 km/h

Step 2 (extra urban cycle, to be run 1x)

- Effective running time: 400 seconds
- Distance travelled: 6.955km
- Maximum speed: 120 km/h
- Average speed: 62.6 km/h

The test for Euro 4 is changed compared to Euro 3 considering the period immediately after the start. For Euro 4 the period just after the start is measured as well.

Note: Consider that the Euro 3 method begins to measure 40-second after the engine starts running.



7.4.2 EOBD

For EOBD, some systems and components will be checked once a drive-cycle others are checked permanently.

Permanent check.

The systems that are checked permanently, are temperature dependent and will be checked immediately after a 20° C start. If a defect on one of these systems occurs the emission telltale will be illuminated.

The following systems are checked permanently.

- Misfire detection.
- Injection time.
- Exhaust emission relevant components.

Cyclic test.

Those systems that are checked upon once a drive cycle, will only registrar the defect if certain circumstances have passed. Therefore it is impossible to check the system, by starting the engine and switching it off again.

The following systems are checked once a drive cycle:

- Working of the oxygen sensors
- Working of the catalytic converter

Be aware of the fact that under some driving conditions not all required conditions are passed. Therefore not all checks will be passed.

Warm-up cycle

Warm-up cycle conditions are fulfilled if the engine temperature is above a certain temperature. (Opel 71°C).

If the sensor is damaged the temperature must be calculated using the back-up value.

Driving cycle.

A driving cycle consists of starting the engine, exceeding the idle speed (driving), decelerating and switching of the engine.

The following graph shows the drive cycle in which all EOBD relevant tests are passed.

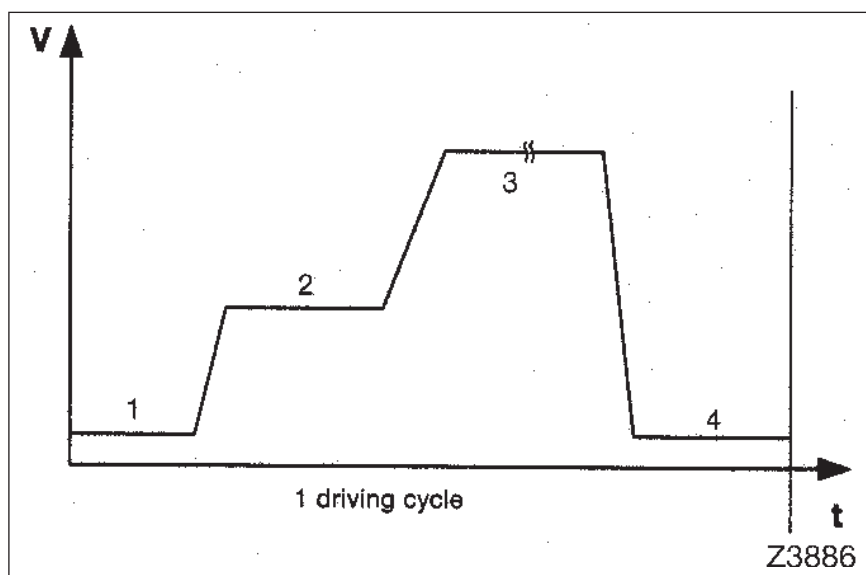
1. Cold start, idle speed, approx. 3 minutes:
Checked function: Secondary air system. (If present)
2. Driving at constant speed between 40 –50 km/h , approx. 4 minutes:
Checked: oxygen sensor, monitor voltage and response rate.

3. Driving at constant speed between 60 – 100 km/h, approx. 15 minutes, In between sufficient deceleration is detected.
Checked: Catalytic converter, oxygen sensor monitor voltage and response rate.
4. Only used in the U.S.

Note: the test will be interrupted if;

- The engine speed exceeds 3000 rpm,
- Strong variations of the Accelerator Pedal Position (APP),
- The vehicle speed exceeds 100 km/h.

These tests can be executed at a dynamometer or test-track.



One driving cycle

7.5 EOBD tests

7.5.1 Tests of systems and components that are exhaust emission relevant.

EOBD tests the following systems;

- Catalytic converter
- Misfire detection
- Fuel system
- Oxygen sensors
- Operation of the secondary air system
- Evaporation system
- EGR system
- Tank fillings
- Electronic Control Unit

Also the ECU runs tests on the components of the before mentioned systems.

The component test consists of three tests;

- 1 short to ground
- 2 short to B+
- 3 interruption

Each of these tests is performed under certain conditions. In order to reproduce faults, the criteria for the tests must be met.

The new EOBD regulations prescribes the function test of the following systems:

7.5.2 Catalytic converter: monitoring requirement

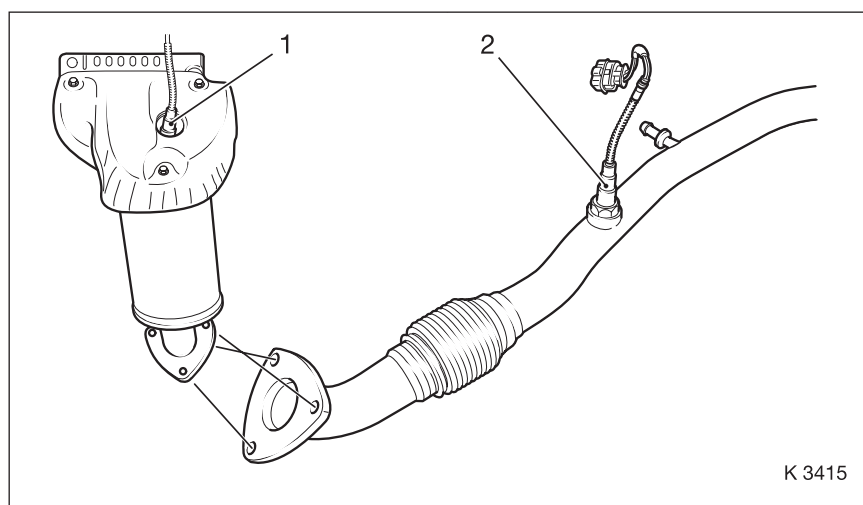
According to the new EOBD regulations, the catalytic converter's efficiency must be monitored once a drive cycle.

This is done by using two oxygen sensors, one before and one after the catalytic converter.

The first oxygen sensor (control sensor) is installed directly to the exhaust manifold in front of the catalytic converter and determines the remaining oxygen content of the non-purified exhaust gases. The ECU uses this sensor to control the air-fuel ratio.

The second oxygen sensor (monitor sensor) is installed behind the catalytic converter and determines the remaining oxygen content of the purified exhaust gases.

The ECU will compare the signals from the two oxygen sensors. It therefore monitors the catalytic converter efficiency.

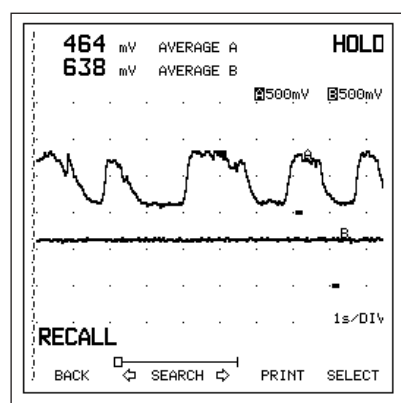
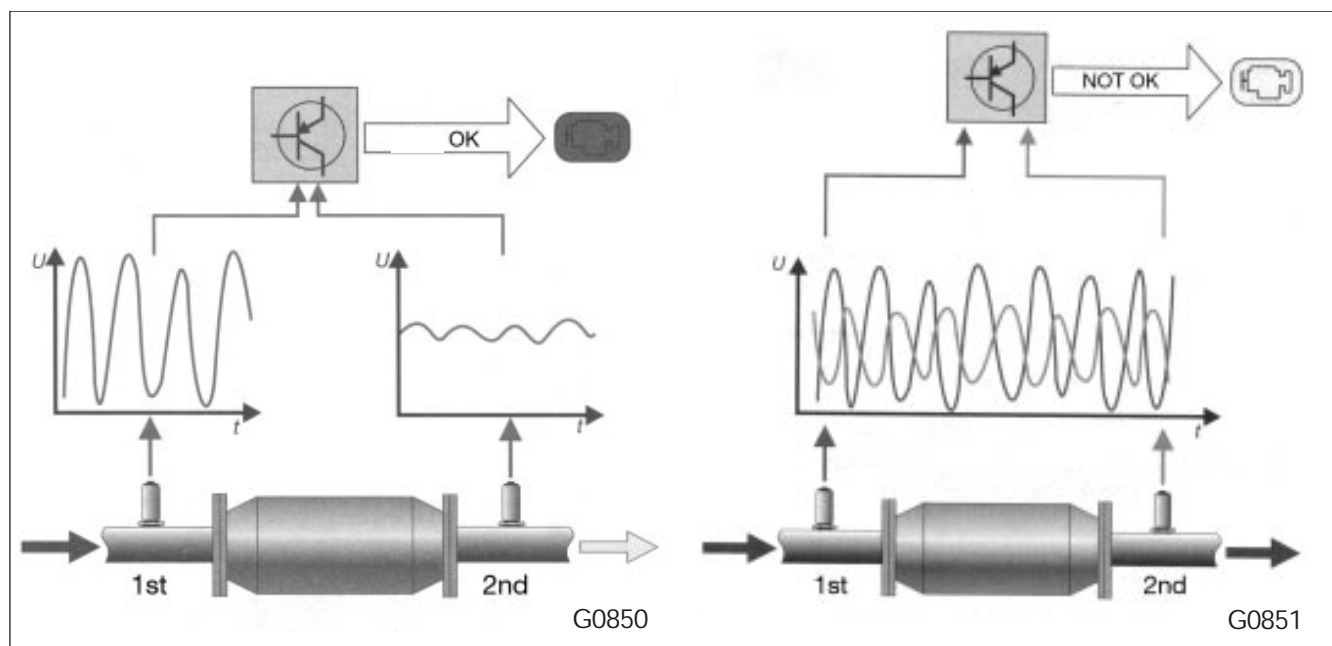


1. Control sensor
2. Monitor sensor

In case of an optimal functioning catalytic converter, the oxygen is fully consumed.

Therefore the voltage of the second oxygen sensor will be relatively constant at a high level of approx. 0.7 V. In case of deceleration the catalytic converter will store oxygen, because of its Oxygen Storage Capacity (OSC). This causes the second oxygen sensor to vary in a greater voltage area.

In case of deterioration of the catalytic converter the OSC will reduce and therefore the voltage of the monitor sensor will vary in higher amplitudes. The signals of the two oxygen sensors will look alike. This will be recognised by the ECU and a DTC is stored.



The graph on the left was made using a two-channel oscilloscope with ground as a reference and terminal 8 on channel A and terminal 57 on channel B of connector X47.

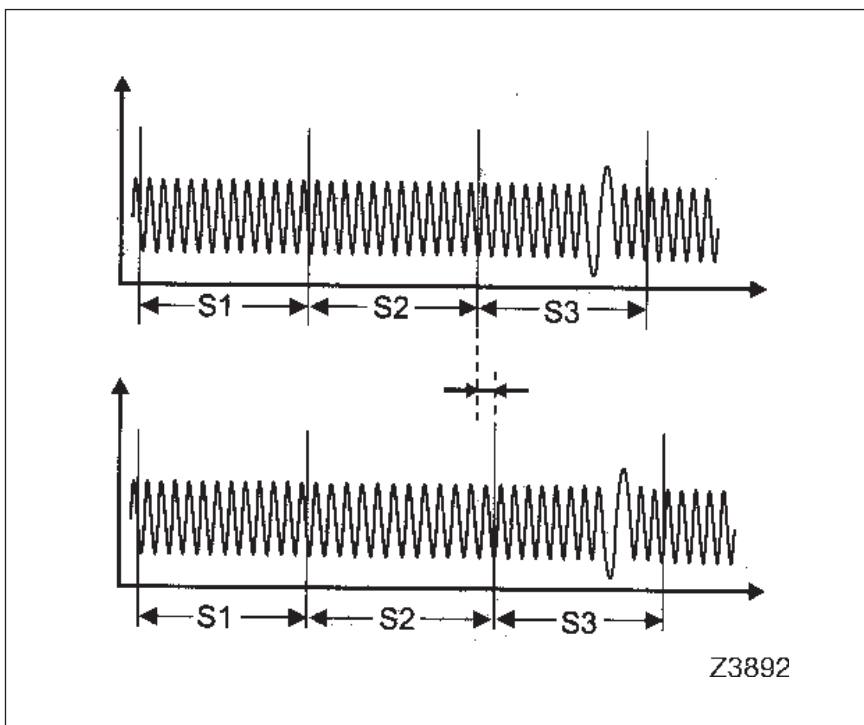
7.5.3 Misfire detection

The phenomenon **misfire detection** is when an ignition (combustion) in a certain cylinder does not take place, caused by either a fuel or ignition system problem.

Monitoring misfire is based on the principle that the crankshaft rotational velocity fluctuates as each cylinder contributes power input. When the engine misfires, the crankshaft slows down momentarily.

The ECU monitors crankshaft rotational velocity using the crankshaft sensor.

The camshaft sensor is used for cylinder identification.



EOBD requirements.

EOBD requires misfire detection under the following criteria:

1. Catalytic converter damaging

A level of misfire sufficient to result in a catalytic converter damage at the current operating conditions.

- Detects misfire within 200-1000 crankshaft revolutions
- Upon detection, sets a DTC and flashes the MIL.
- When catalytic converter damaging misfire is no longer present, the MIL will stay ON steady

2. Emission threatening

A level of misfire resulting in exceeding emission levels.

- Detects misfire within 1000-4000 crankshaft revolutions
- First trip arms the DTC
- Third consecutive trip fails, sets DTC in history and MIL will illuminate.
- This DTC can be set and the MIL will illuminate on a non-consecutive trip if the misfire occurs under the same operating conditions (within 375 RPM of engine speed and 20% of engine load and similar coolant temperature) within 80 trips.

The ECU monitors the following parameters:

- Crankshaft revolution speed
- Engine speed
- Cylinder number

Conditions for misfire detection

- 1. Misfire amount during 200 revolutions
à Overheat and damage to Catalytic converter. (MIL flashes)
- 2. Misfire amount during 1000 revolutions
à No damage to Catalytic converter, but can cause the emission level to exceed the thresholds. (MIL steady ON)

The ECU maintains a record of a certain amount of crankshaft revolutions.

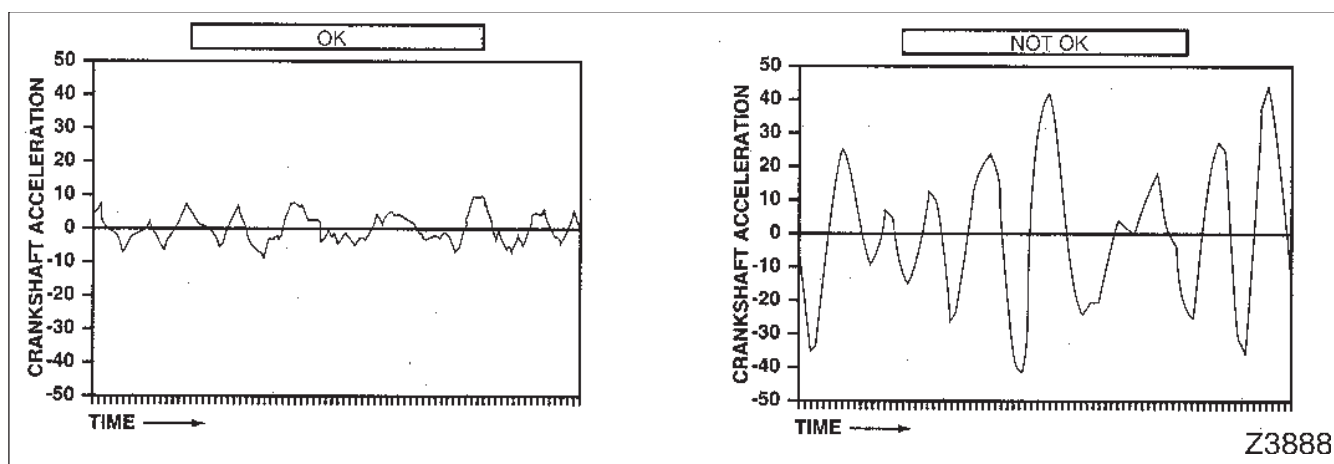
If within this given record circumstances as in 1 or 2 occur, a DTC will be set and the MIL will flash or will stay ON steady depending on the severity of the misfire.

The misfire is detected in one revolution of the crankshaft (measured at every 180 degrees crankshaft).

- **NOTE:** No misfire detection on rough road.

To detect misfire correctly, misfire will not be executed while vehicle is travelling on a rough road.

The crankshaft sensor recognises rough road conditions.



Note; If a car is driving with snow-chains, misfire detection will not be executed.

Monitoring of the misfire will not be executed if the fuel tank amount is less than 10 litres.

Monitor the presence of misfire up to 4500 RPM above the positive torque line.

7.5.4 Fuel system

The injection time is being monitored for EOBD depending on engine speed, load and oxygen quantity in the exhaust, measured by the control sensor.

The air-fuel ratio is constantly being adapted by the ECU depending on the control sensor signal.

7.5.5 Fuel trim diagnostics

For maintaining the ideal air-fuel ratio the ECU is capable to adapt under all circumstances.

For instance the altitude, humidity, outside temperature, fuel quality etc.

The adaptation is only capable to correct small deviations.

Used are a multiple adaptation and an additive adaptation, for different circumstances:

1. At idle and load and a partial engine speed the additive adaptation is executed, also known as short-term trim.
2. During driving under high load and engine speed the multiple adaptation is executed, also known as long-term trim.

These parameters are shown in the TECH 2 as; long term fuel trim, B1 short-term fuel trim, B2 short-term fuel trim.

7.5.6 Heated Oxygen sensors (2HO2S)

The air- fuel ratio is constantly kept within the optimal area.

This is done by measuring the composition of the exhaust gases. The amount of oxygen is normative for this and is being adjusted by increasing or decreasing the amount of fuel injected. Obvious is, that everything has to operate correctly.

Example: If the monitor sensor reports a rich mixture than the ECU will decrease the injection time in order to decrease the injected amount of fuel.

As a part of the EOBD all oxygen sensors have to be checked separately on the following functions:

1. Sensor voltage.
2. Time to activity.
3. Response time.

Some of the conditions to check the oxygen sensors are; the engine is warmed up and that there is no Limp home situation.

In case of a registered malfunction, the misfire detection, catalytic converter efficiency control and the air-fuel ratio check are being postponed.

1. Sensor Voltage test

This test is executed permanently under normal driving conditions. This test concerns the wiring, connectors or signal abnormalities. The test looks for the following:

- Inactive sensor.
- Shorted to voltage.
- Short to ground conditions.
- Rich and lean shifts of the fuel system.

The Heated Oxygen Sensor (HO2S) voltage test, also samples sensor voltage over a period of time and detects a fault if the voltage is beyond the threshold calibrations in the ECU for a specified time period. Therefore the deterioration can be spotted and the driver will be warned by the MIL.

2. Time to activity (warm-up time)

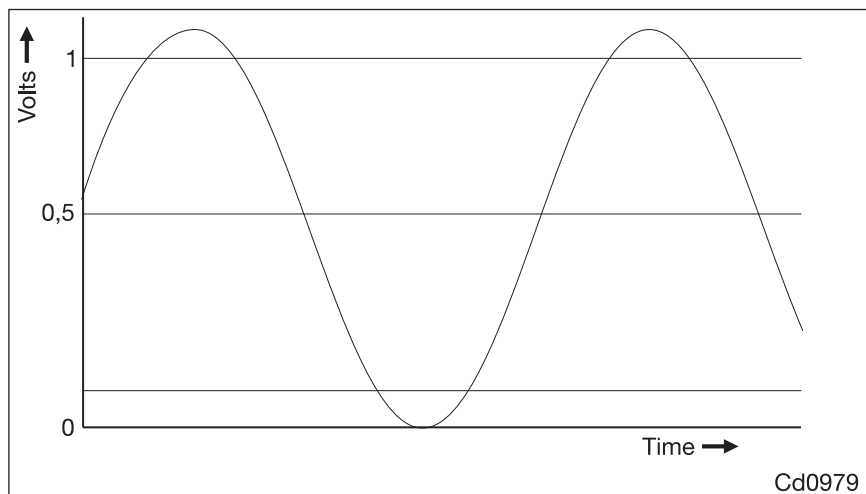
The 'Time to activity' test, monitors the sensor's heater system by measuring the time the sensor requires to become active and compares this result to calibrated fail parameters in the ECU. If the heater circuit is failing, the time to activity will increase and the test will fail. This test can only be run following a cold start.

3. Response time

To enable the oxygen sensor to measure the oxygen content, the sensor needs to be heated. Response time test monitors the lean-to-rich and the rich-to-lean transition times of the pre-catalytic converter Heated Oxygen sensor. Transition times are compared to calibrated fail parameters in the ECU to determine fail or pass of the test. If the time between the transitions is too long, the test will fail.

If one of these tests fail, the MIL will be illuminated.

Note: The vehicle operating conditions, quality of the fuel used and the condition of the catalytic converter can affect the operation of the oxygen sensors. Check for possible conditions, such as an exhaust leak, before servicing the oxygen sensor.



7.5.7 Evaporative Emissions System

The EVAP system is used to collect fuel vapour from the fuel tank. These vapours are stored in a canister filled with activated carbon. The EVAP system allows the vapours to be drawn from the canister and routed to the intake manifold or throttle body during certain operations. This is called canister purging since the vapours are purged from the canister. EOBD requires only the testing of the electrical operation of the EVAP system.

7.5.8 Fuel level

The tank level sensor measures the fuel level of the tank.

This information is used for misfire detection.

The misfire detection is ignored when the content is less than 20 percent.

7.5.9 Electronic Control Unit (ECU)

The ECU carries out an internal test. If a failure occurs, the MIL will be illuminated.

7.5.10 Exhaust Gas Recirculation (EGR)

EOBD requires that the EGR system be monitored for abnormal low and high flow rate malfunctions. The EGR system is considered malfunctioning when an EGR component fails, or a change in the EGR flow rate results in the vehicle exceeding the calibrated fail parameters in the ECU.

The linear EGR pintle diagnostics detects the "component hard failures", such as open circuits, short circuits and stuck valves. The linear EGR Flow rate detects a reduction in EGR flow.

The ECU can recognise this by using the MAF sensor and a pintle sensor as known in several systems, e.g. X20DTL.

7.6 DTC memories and types

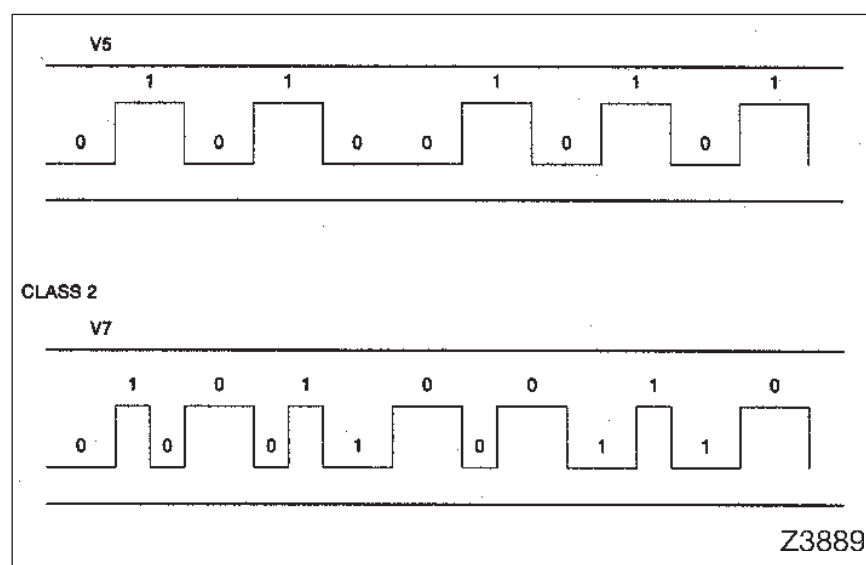
7.6.1 Diagnostic scan tool

The Diagnostic Trouble Codes (DTC's) are transmitted from the engine control unit to the generic scan tool in digital form by way of standardised data transmission formats. Three formats are currently in use; the readout device itself must recognise the format in which the communication takes place. An important demand is a universal entrance for monitoring emission related Defective Trouble Codes (DTC's) by using a generic scantool or the TECH 2.

At this moment three different protocols for transmitting data are used.

Form of data protocols in CARB and ISO versions:

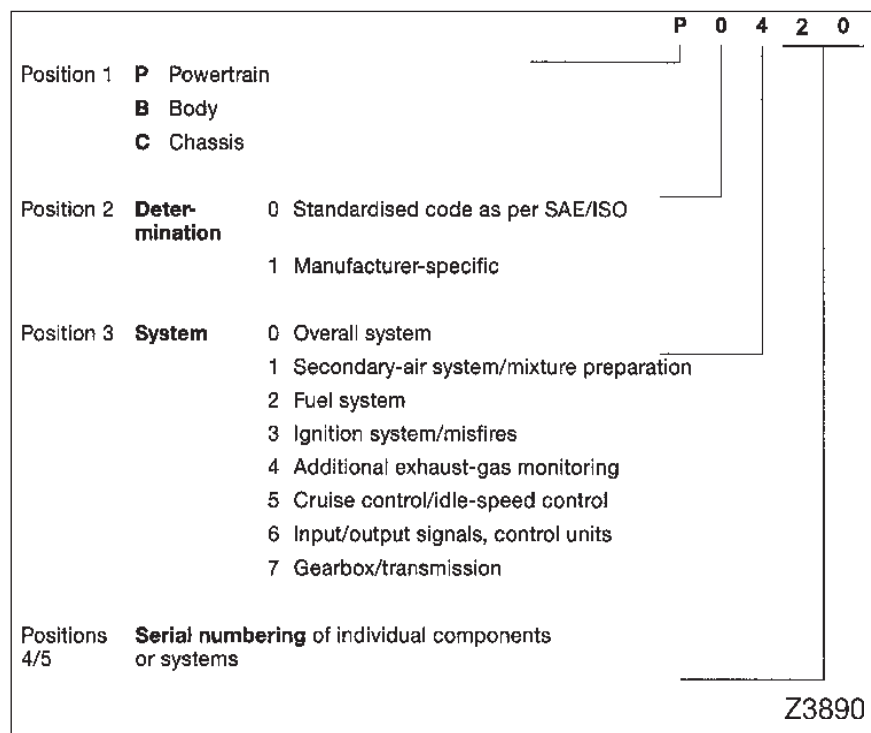
1. CARB protocol (California Air Research Board)
2. ISO protocol (International Standardising Organisation)
3. Keyword 2000 protocol (to be introduced from 2000)



7.6.2 Diagnostic Trouble Codes (DTC)

The Society of Automotive Engineers (SAE) compelled the diagnostic trouble codes for the OBD II systems (USA). For EOBD, the DTC's were adopted accordingly after being internationally standardised.

The DTC's can be identified by means of their alphanumeric structure.



Position 1

- P Powertrain
- B Body
- C Chassis

Position 2

Determination

- 0 Standardised code as per SAE/ISO
- 1 Manufacturer-specific

Position 3

System

- 0 Overall system
- 1 Secondary-air system/mixture preparation
- 2 Fuel system
- 3 Ignition system/misfires
- 4 Additional exhaust-gas monitoring
- 5 Cruise control/idle-speed control
- 6 Input/output signals, control units
- 7 Gearbox/transmission

Positions 4/5

Serial numbering of individual components or systems

- The DTC's are not only stored when the indicator lamp lights up.

Failure Type

Illumination

MIL

Engine

Counter for MIL

Electronics

Telltale

OBD I, not critical (eg. Immobilizer)

N/A

Off

7.6.3 DTC Types

For fault detection priority and storage, Opel distinguishes between four different fault types:

- **Normal Fault**

Under a normal fault, Opel understands the detection of a clear detectable electronic problem, open circuit, circuit short to ground and circuit short to battery.

For this types of DTC's it is not necessary to wait until a later trip or driving cycle.

The DTC is stored in the memory and the MIL shall be illuminated.

When the DTC is stored, the ECU must store a freeze frame.

- **Emission Fault**

For emission faults defined for EOBD, a safe and clear detection is difficult.

To make sure that no wrong detection will occur, this fault shall be stored finally up to the end of a later trip.

To read out DTC's which are detected the first time, without activation of the MIL, the data will be stored. When the DTC occurred the first time, the ECU must store a freeze frame.

This freeze frame can be overwritten, if the same DTC will not be stored, or if a misfire DTC occurs.

- **Misfire detection**

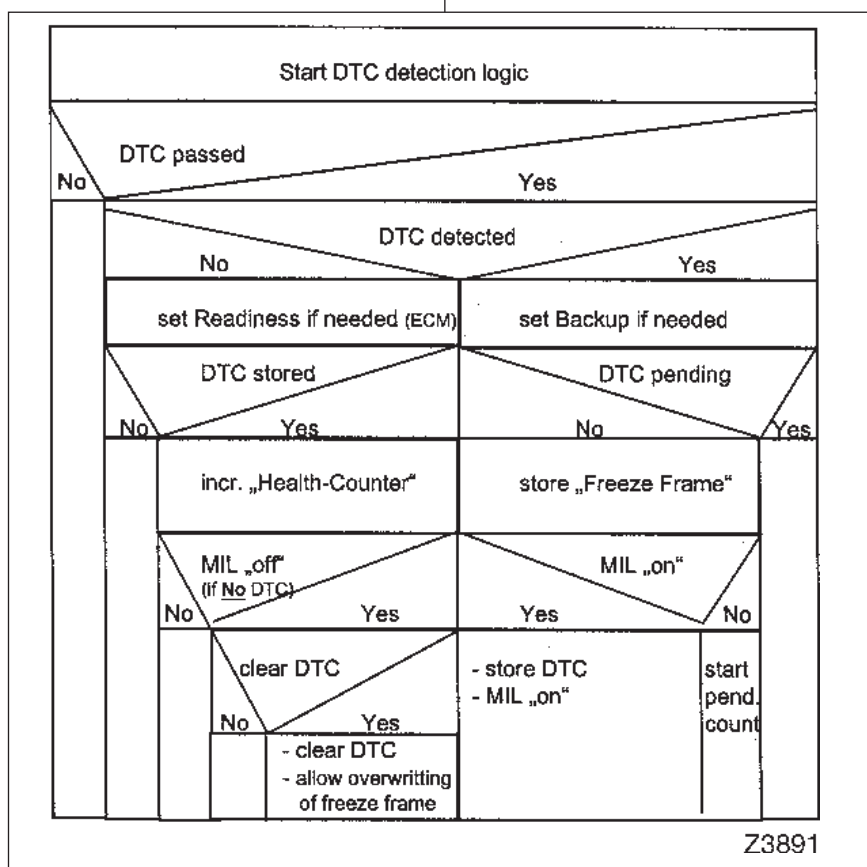
One of the exceptions of the EOBD DTC's is the misfire monitoring. If misfire is detected, the catalytic converter is highly jeopardised. This DTC shall be stored immediately, with a blinking MIL.

EOBD distinguishes between two different misfire faults. A hard fault detected over 200 revolutions and an intermitted fault detected over 1000 revolutions.

- Limp home failures

If one of the emission systems comes into a limp home or back up mode, a DTC will be stored, the telltale engine electronics illuminates immediately, the MIL illuminates after the second trip.

Fault detection Flow Chart



7.6.4 DTC Freeze Frame

The Diagnostic Executive in the ECU records certain vehicle operating conditions when an emission related Diagnostic Trouble Code is stored as a history DTC. The ECU only stores one type of Freeze Frame record. Freeze Frame data is stored for the *first* failed test that sets the DTC and illuminates the MIL.

A Freeze Frame is not updated if the test fails a second time. However, fuel trim and misfire DTC's take priority over all other DTC's. Fuel trim and misfire DTC's always overwrite the Freeze Frame record unless a fuel trim or misfire DTC is already stored. Any previous information related to DTC's stored in the Freeze Frame that are overwritten due to a priority DTC setting is lost.

If the second drive cycle is not completed, the third drive cycle will be accepted as the consecutive drive cycle.

The MIL will illuminate if the three consecutive drive cycles detect the same fault.

7.6.5 MIL/telltale engine electronics illumination overview

On

OBD I, critical (eg. Vehicle Speed)	N/A	Off	On
OBD II, w/o Missfire (O2 esnsor's)	3rd	On	On
Missfire	1st	Flashing	Off

MIL ON

The MIL will illuminate if any emission fault is clearly detected and stored.

If misfire is detected the MIL will be flashing with the frequency of 1 Hz.

MIL OFF

The MIL can be switched OFF after two or three driving cycles. (Value can be calibrated)

7.6.6 Deletion of DTC

A DTC can be deleted if 40 failure-free warm-up cycles have passed, and the DTC was no longer detected. A DTC can also be cleared using a delete command from a generic scan tool. The procedure for the Freeze Frame is identical.

7.7 Consequences of EOBD for the customer

The consequences for the customer are to be kept to a minimum, for comfort reasons. It is a fact that the average customer is not environmental minded.

With the introduction of EOBD and in some countries "EOBD tax reduction" the customer might become more environmental-conscious.

But nevertheless the customer will have to pay the price for research, more expensive parts and environmental friendly fuel. The customer can only use unleaded fuel to refill the tank to avoid damage to the catalytic converter and oxygen sensors.

On the other hand the customer will experience reduced running costs due to maintenance-free features.

The customer can be faced with two different kinds of telltales, control indicator for emission control and the control indicator for engine electronics.

The customer will have to know that the emission control indicator can either flash or illuminate steady. In case of an illuminated telltale, the customer will have to consult the Opel dealer.

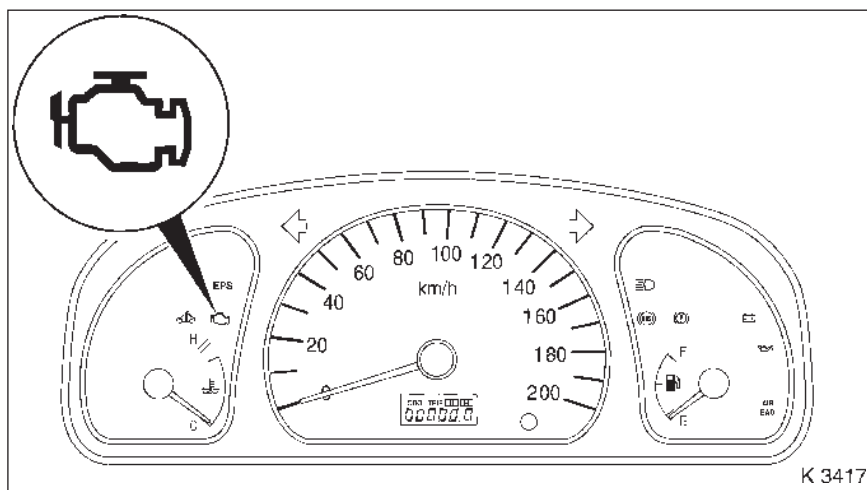
The customer is advised to never carry out any repairs or adjustments and maintenance work on the engine.

7.8 Consequences of EOBD for the after-sales organisation.

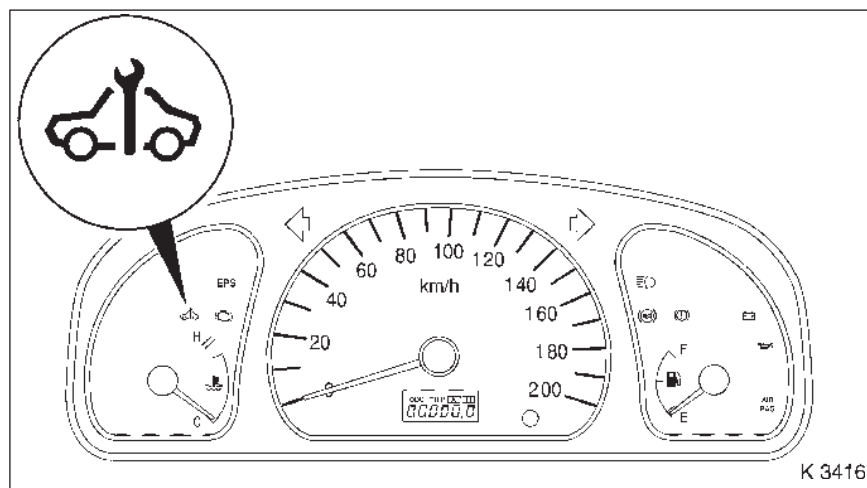
7.8.1 Engine control lights

With the introduction of the Z10XE and the Z12XE the function of the engine control lights has been changed.

The after-sales service organisation has to inform the customer about the importance of the Malfunction Indicator Lamp (MIL) and the telltale engine electronics. Correct operation of the emission control system must be guaranteed for 5 years or 80000 km's.



MIL (Malfunction Indicator Lamp)



Control lamp engine electronics

7.8.2 Malfunction Indicator Lamp

When deviations will be recognised, compared to the fixed values, a corresponding DTC will be stored in the ECU memory.

When an emission related DTC would be recognised three times, the Malfunction Indicator Lamp will be activated. The Malfunction Indicator Lamp informs the driver about emission relevant failures, exceeding of emission standards or catalytic converter damage.

The Malfunction Indicator Lamp indicates two different failures.

Case 1

When the ignition is switched on and during cranking the MIL illuminates for a function control, once the engine is running at idle the MIL extinguishes.

When an emission related failure has been detected for the third time, the MIL will be illuminated and a DTC is stored in the ECU.

Case 2

Blinking of the MIL during driving indicates danger of catalytic converter damage, Reducing the engine load, will stop the flashing and the MIL will be steady ON.

In both cases the driver will be advised to visit an Opel service station.

7.8.3 Telltale engine electronics

The telltale, engine electronics, illuminates when a system or engine failure will be recognised by the engine control unit.

Illumination of this telltale informs the driver of an engine management failure, the emergency program takes over, which results in higher fuel consumption and a reduced engine performance.

Switching the engine off and on again can reset a failure. Repeated illumination of the control light informs the driver to visit an Opel service station.

If it lights up briefly and goes out again this is of no significance.

If the control light flashes when the ignition is on there is a fault in the immobiliser system.

7.8.4 Future developments

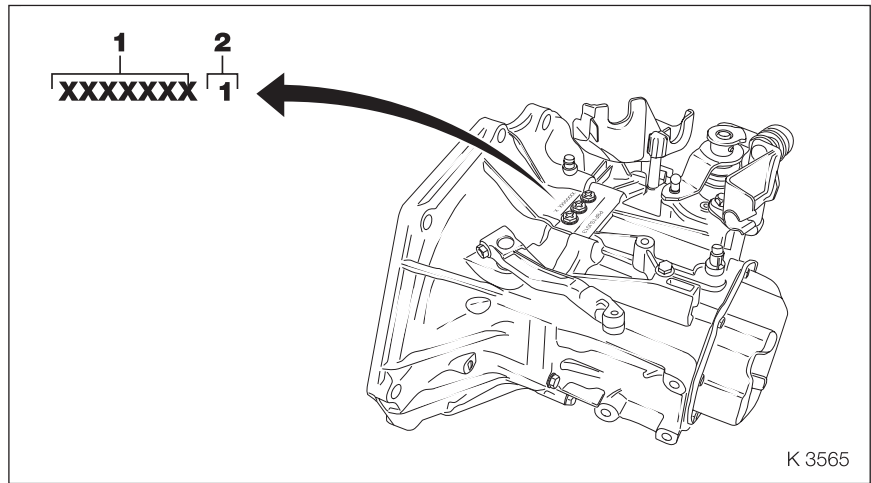
In an attempt to minimise the exhaust emissions, lots of innovative ideas have been released, or even already taken in production.

Some of them are described below.

- Optimising the combustion chamber.
- Variable valve opening times.
- Optimise the intake manifold.
- Turbo-charger with variable turbine-geometric.
- Direct fuel injection, most important and viable one.

8. Transmission and clutch

8.1 The new F12 transmission

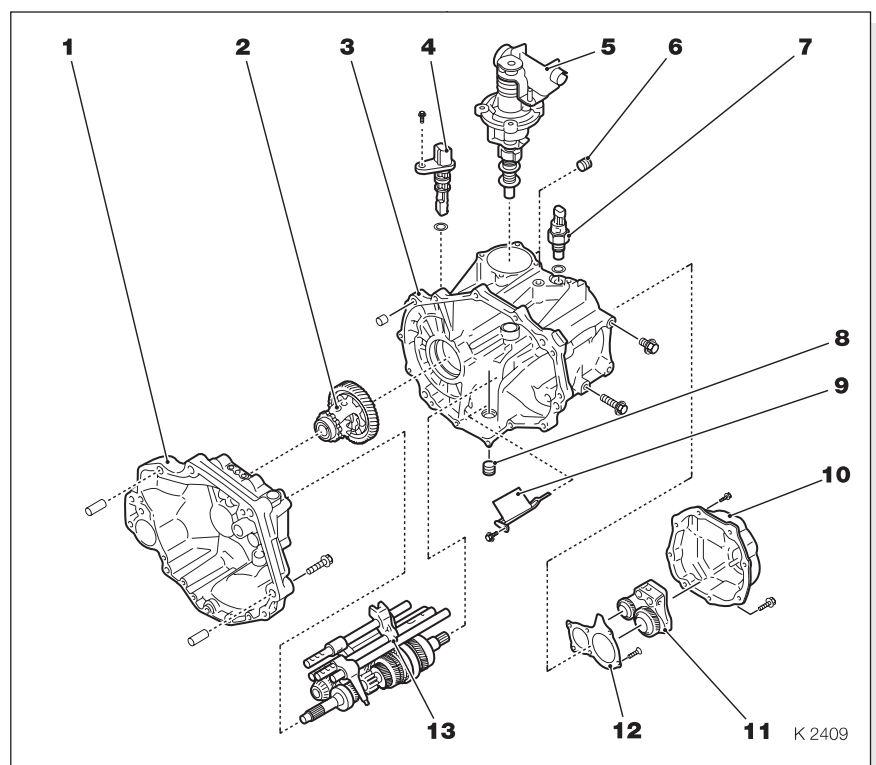





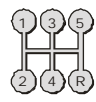
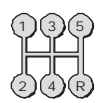
1. Serial number
2. Transmission description

All Opel Agila versions will be equipped with a new transmission, coded with the designation F12. An automatic transmission is not available. The transmission code area reveals the following information.

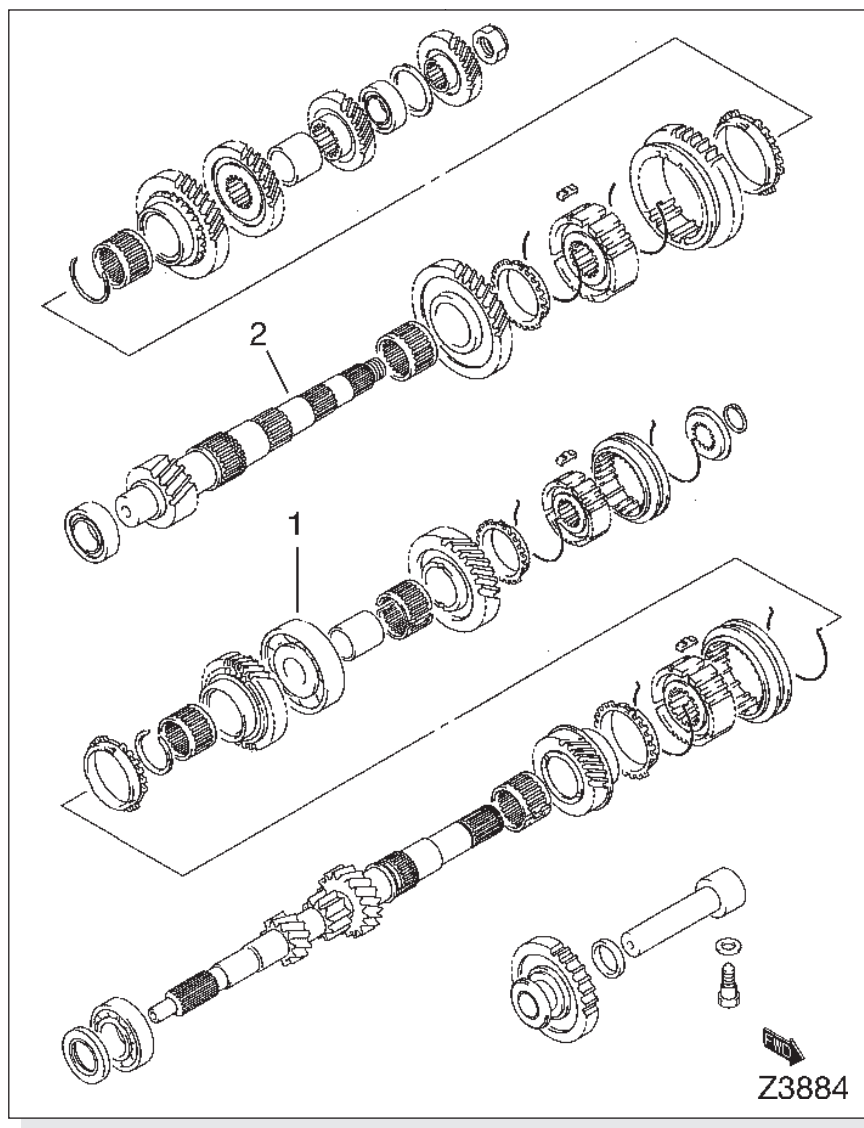
The F12 transmission is a five speed manual transmission. The forward gears are synchronised, the reverse gear is not synchronised. The transmission is operated using bowden cables. The clutch is also cable operated.

1. Clutch housing
2. Final drive
3. Transmission housing
4. Vehicle speed sensor
5. Shift housing
6. Oil plug
7. Reverse switch
8. Drain plug
9. Oil collector
10. Transmission housing cover
11. Countershaft 5th gear
12. Lock plate
13. Input shaft and mainshaft with shift forks



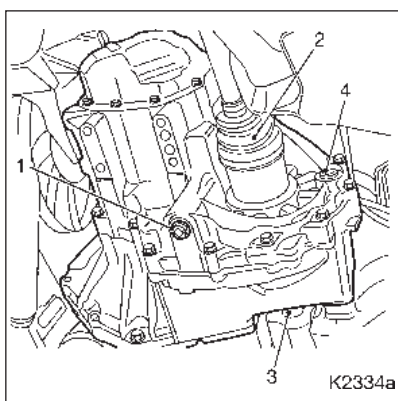
		
Z10XE	F12 - 4.39 	4,39
Z12XE	F12 - 4.11 	4,11

The transmissions with clutch for the Z10XE and Z12XE versions are the same, except the final drive gears, the left hand bearing of the input shaft (1), the countershaft (2) and the shims.



As a result of the shorter engine block of the Z10XE, and the fact that the front right engine mounts of the Z10XE and the Z12XE are equal, the transmission is mounted a few centimetres more to the right of the vehicle on the Z10XE. This difference requires changes in the following components, comparing the Z10XE to the Z12XE version:

- Clutch cable length
- Drive shaft lengths
- Shift cable lengths
- Drive shafts



1. Oil drain plug
2. Constant velocity joint on left drive shaft
3. Tripod joint on right drive shaft
4. Filler plug

All joints on the drive shafts are constant velocity joints, except the transmission joint on the long (right) drive shaft. This joint is a tripod type joint. The transmission oil is scheduled to be replaced after 30,000 km or two years. After this replacement the transmission oil is maintenance free.

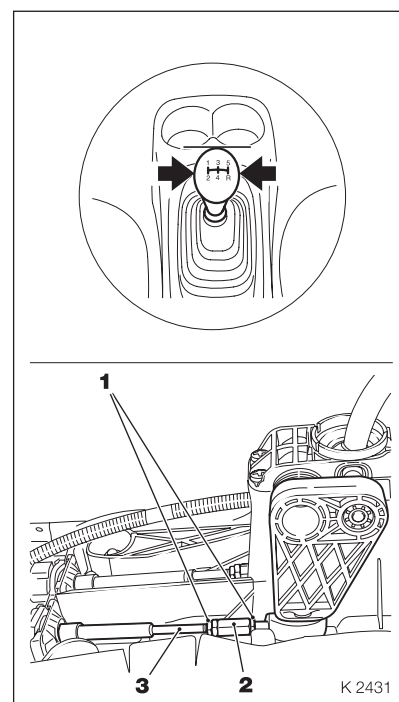
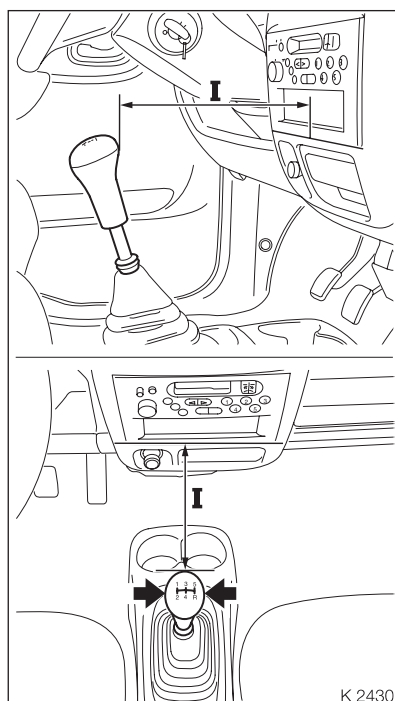
Currently, the only repairs possible on the F12 transmission are Replacement and adjustments of the bowden cable system. Replacement and sealing of the gear shift guide assembly. Sealing of all external components.

This means that repairs and replacements of major transmission components is currently not possible. If such a component should be replaced or repaired the transmission assembly should be replaced.

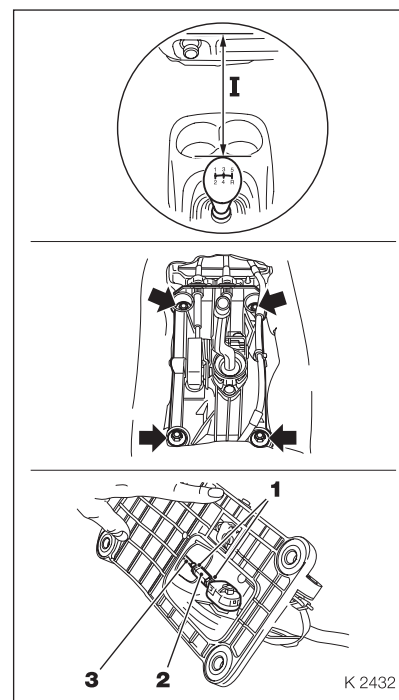
8.1 Adjustments on transmission and clutch

8.1.1 Transmission

The transmission is operated using a bowden cable system. The cable system should be adjusted when the transmission has been removed or when there are complaints about shifting quality.



1. Lock nut
2. Adjustment nut
3. Adjuster



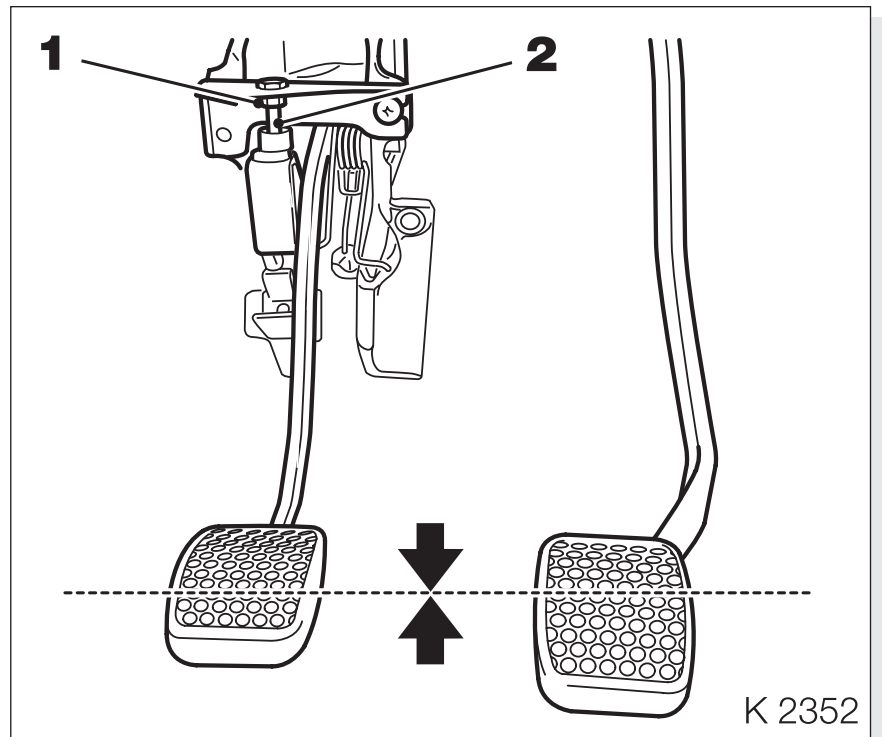
1. Lock nut
2. Adjustment nut
3. Adjuster

To be able to check the correct adjustment of the cable system:
The transmission must be in neutral position.
The gear lever must be in the lateral centre position (gearshift lever console as reference).
The gear lever must have a nominal longitudinal distance from the centre dash panel console.

Deviations from the nominal values within 10 millimetre are acceptable.
If the actual gearshift position is out of range the cables can be adjusted using the adjustment nuts.

8.1.2 Clutch

The clutch pedal height and clutch pedal free play can be checked and adjusted on the Opel Agila. A special procedure should be used to check and adjust these values.



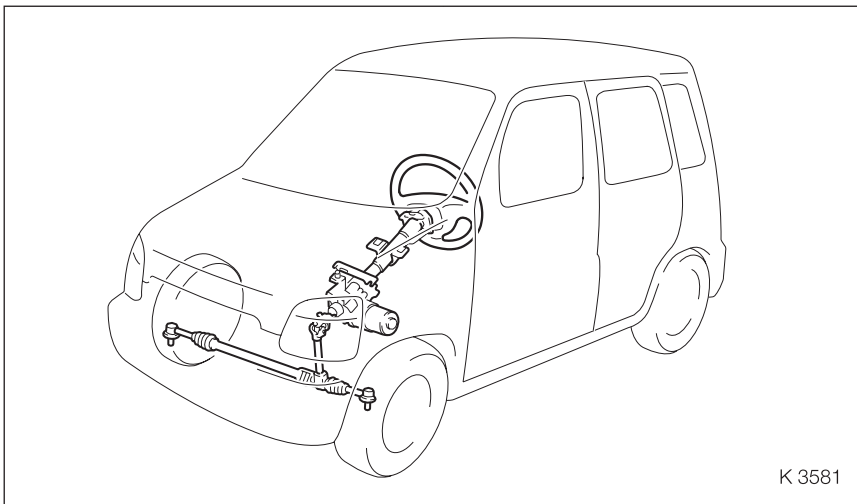
1. Lock nut
2. Adjustment bolt

First the clutch pedal should be adjusted to the same level as the brake pedal. Then the clutch pedal free play can be adjusted.

9. Steering

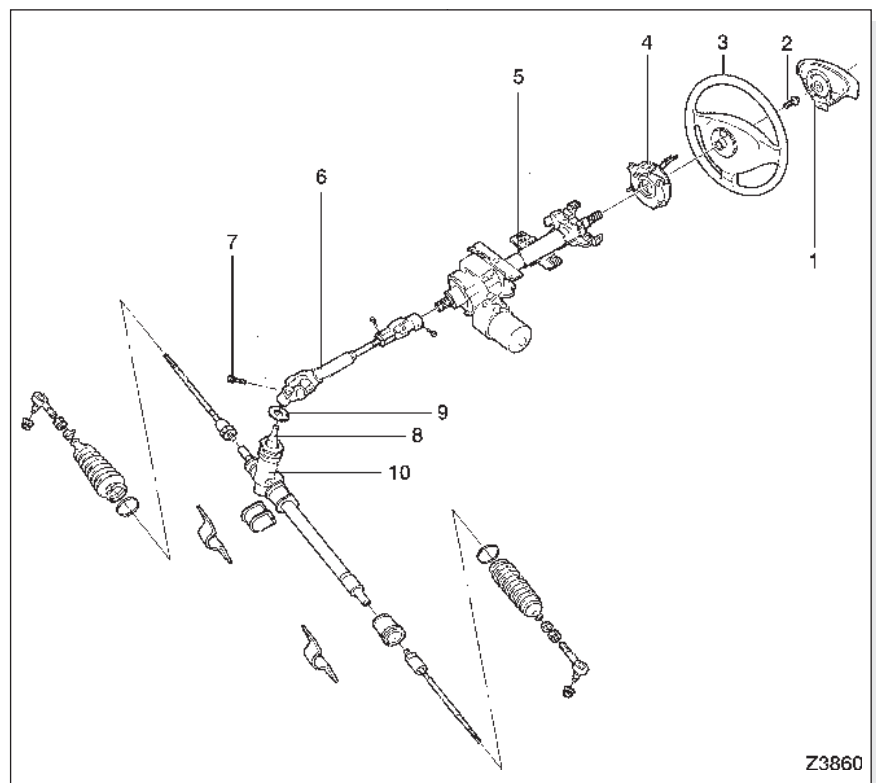
9.1 Introduction

The Agila has a conventional rack and pinion steering system. The Agila is standard equipped with Electric Power Steering (EPS).

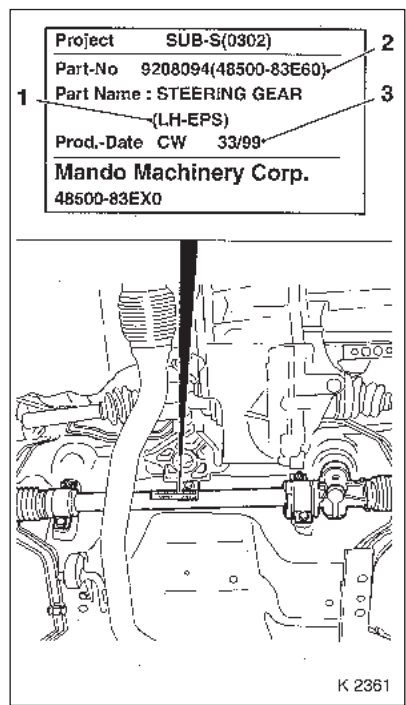


The steering system consists of the following components:

1. Airbag unit
2. Steering bolt
3. Steering wheel
4. Contact unit airbag
5. Steering column
6. Intermediate shaft
7. Clamping bolt
8. Steering shaft
9. Sealing ring
10. Steering gear



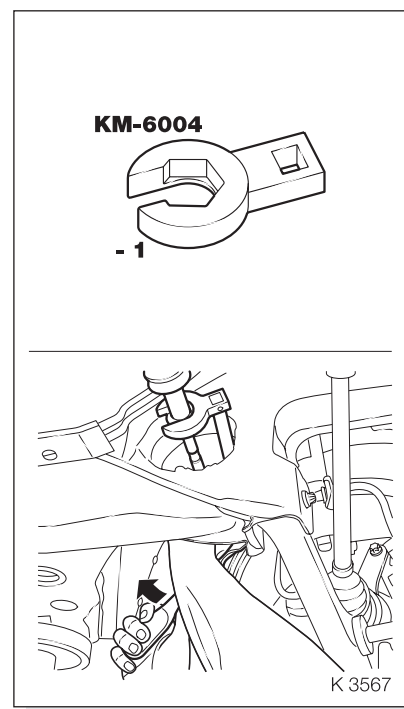
An identification plate is located on the steering gear; it contains the following information:



1. Version
2. Part number
3. Production date

The only difference in version is left- or right-hand drive; this can be identified by LH-EPS for left-hand drive or RH-EPS for right-hand drive. The production date is reflected in a calendar week and year of production.

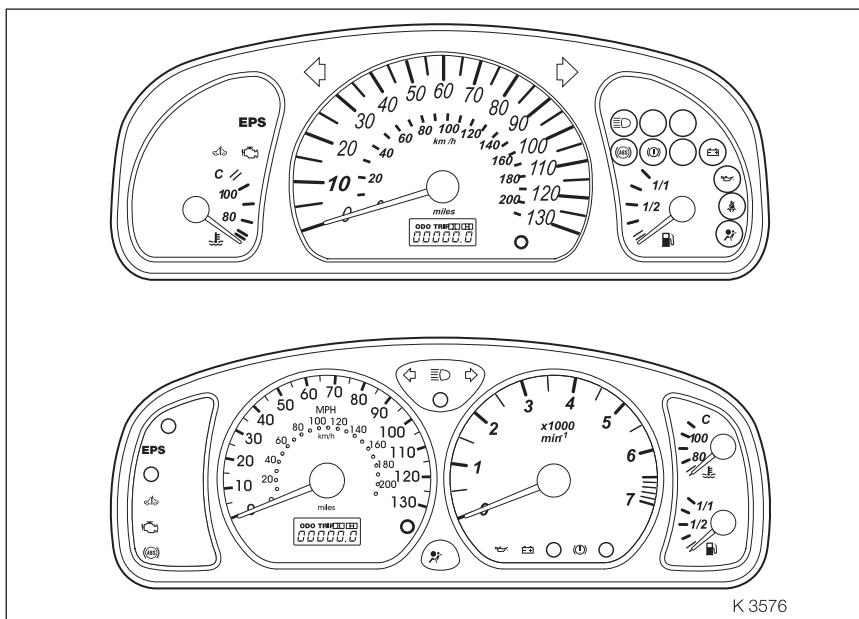
The steering ratio is 37.6 mm/revolution and the total steering ratio is 17.6:1. For the assembly and disassembly of the tie-rods special tool KM-6004-1 is required.



KM-6004-1

9.2 Electric Power Steering

The new Opel Agila will be introduced with an Electric Power Steering system. The designation "Electric Power Steering" is abbreviated as EPS, which appears on the control light on the instrument panel.

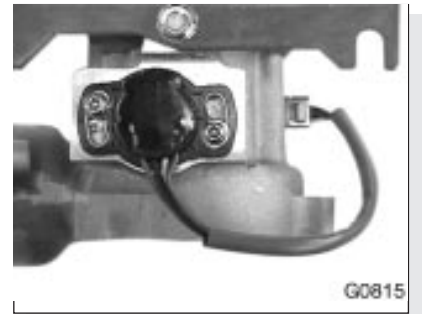


The EPS is positioned at the steering column and consists mainly of the following components:

- EPS control unit
- Torque sensor (or deviation sensor)
- Electric motor with electric-magnetic clutch



EPS control unit



Torque sensor EPS

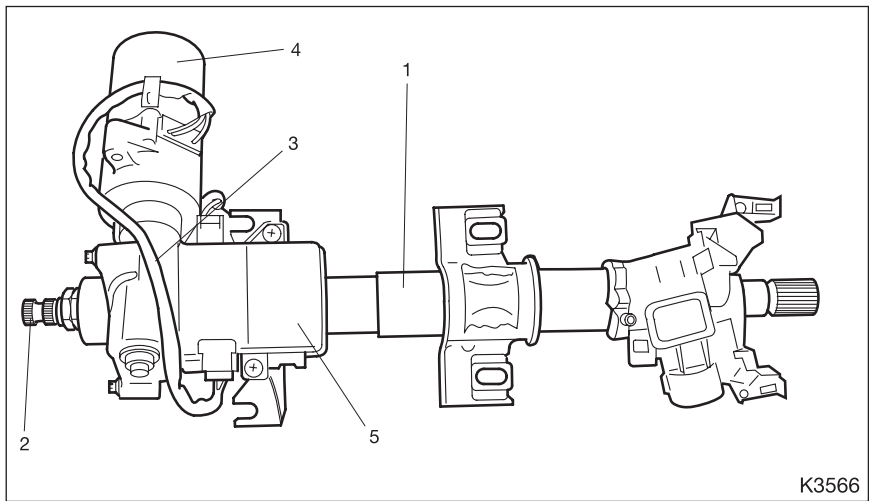


Motor EPS

Compared to hydraulic power steering, EPS has the following advantages:

- Fuel saving
- Weight saving
- Absence of all hydraulic components
- Absence of "Oil level-power steering" maintenance point
- No need for hydraulic oil disposal when recycling old vehicles

The following picture shows an overview of the components used on the EPS steering column:

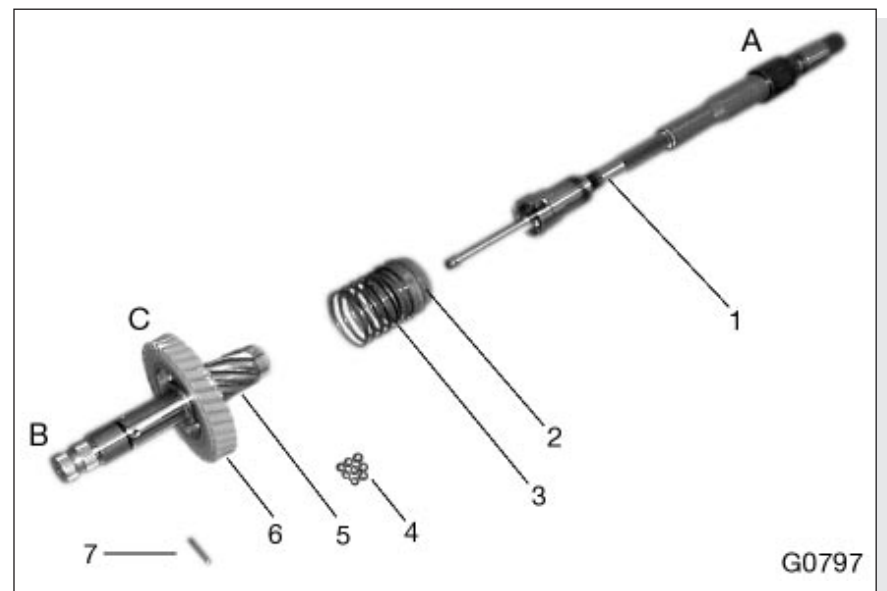


1. Steering column jacket
2. Steering spindle
3. Worm gear
4. Electric motor
5. EPS control unit

K3566

9.3 Working principle EPS, mechanical

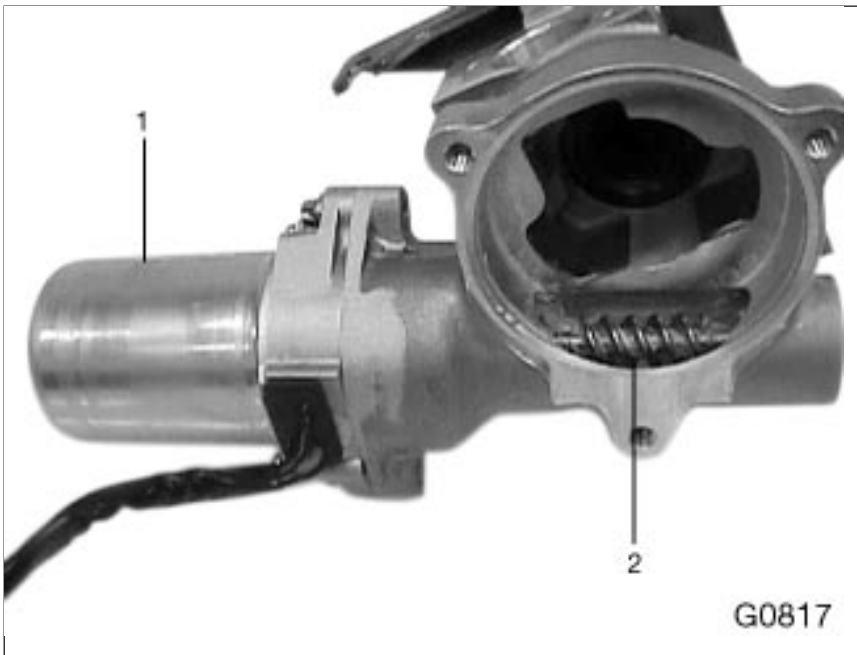
The Electric Power Steering system mainly consists of two components, the steering shaft assembly and the electric motor assembly.



G0797

- A. Steering wheel side
- B. Steering joint side
- C. Worm side
1. Steering shaft
2. Contact ring

3. Spring
4. Bearing balls
5. Spindle
6. Worm gear
7. Locking pin



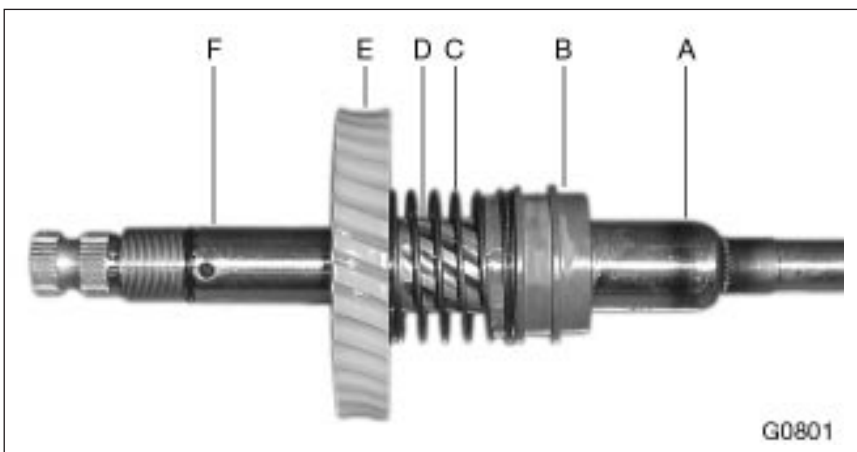
1. Electric motor
2. Worm

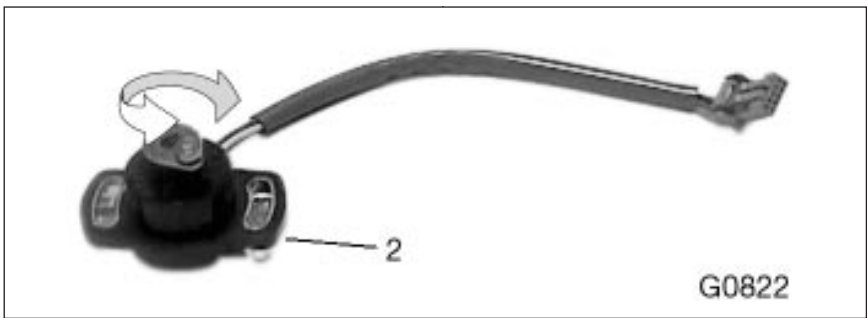
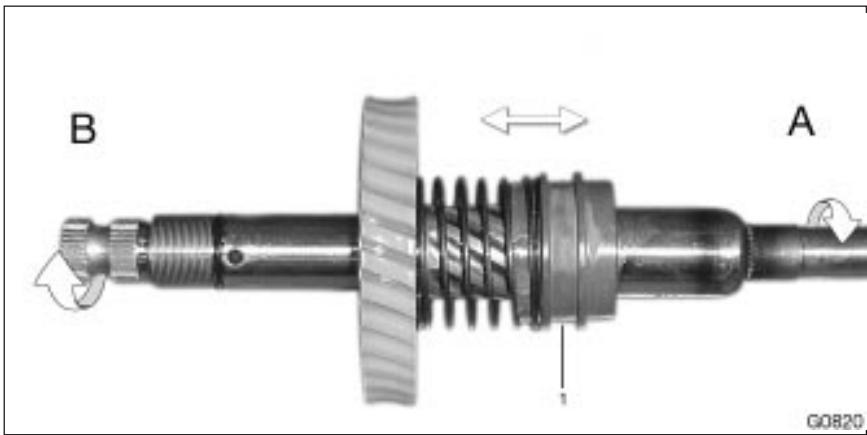
When necessary the worm of the electric motor assembly will be driven by the electric motor, which will result in the turning of the worm gear. The worm gear can be considered as one assembly with the steering shaft. If the worm gear turns, the steering shaft turns and its turning movement will assist the steering wheel.

- a. Steering shaft steering wheel side
- b. Contact ring
- c. Spring
- d. Spindle
- e. Worm gear
- f. Steering shaft joint-side
- g. Worm
- h. Steering column

When the front wheels experience much resistance during turning the driver wants steering assistance. To detect wheel-turning resistance, the EPS system is equipped with a torque sensor.

In case of wheel-turning resistance a certain torque in the steering shaft occurs. This torque causes the contact ring to move up- or down-wards, depending on the steering direction, because of the bearing balls that are underneath and slide over the spindle. The torque sensor moves via a little pin with a small bearing in a groove on the contact ring.





- A. Steering wheel side
 B. Steering joint side
 1. Contact ring
 2. Torque sensor

The torque sensor is a double potentiometer that can move in two directions. If the contact ring moves up- or down wards the potentiometer turns, which will be detected by the EPS control unit.

The electric motor unit consists of an electric motor and an electric-magnetic clutch. The electric-magnetic clutch engages the electric motor with the worm gear when the engine is running and disengages as soon as the engine stops running.



1. Electric motor
 2. Electric-magnetic clutch

The electric-magnetic clutch is not engaged under the following circumstances:

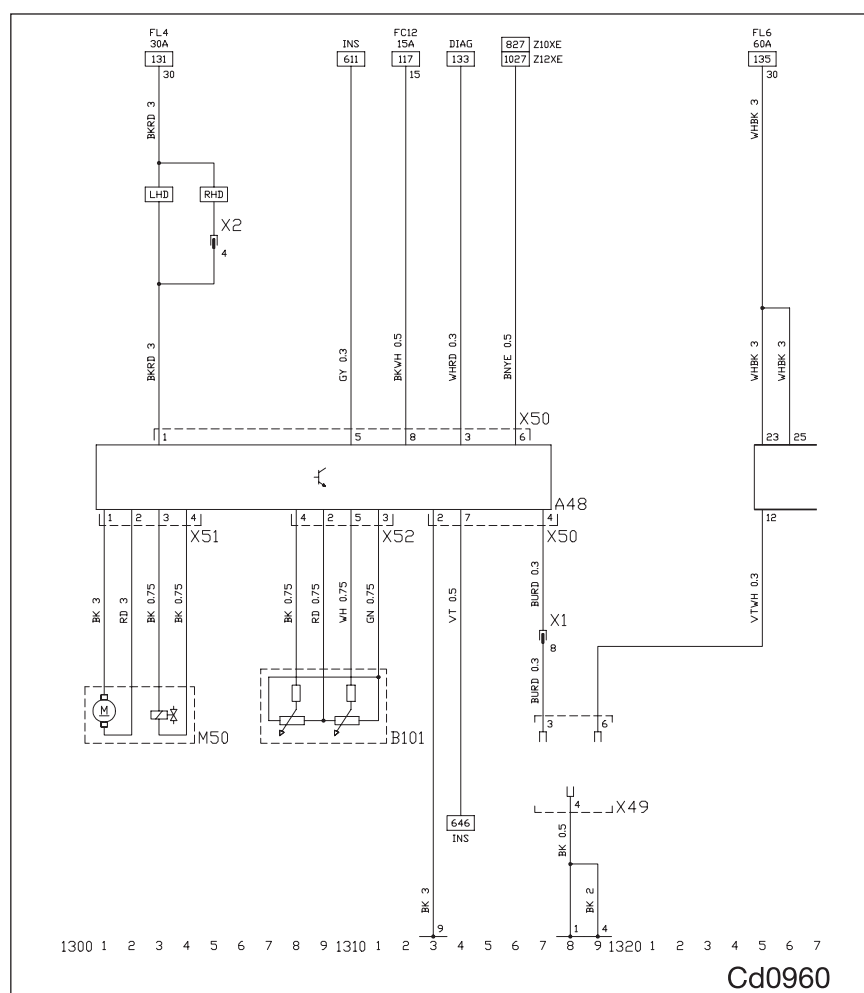
- Engine not running
- Trouble code present in EPS

This also means when the electric motor for any reason blocks during driving, the EPS control unit will set a trouble code and the electric-magnetic clutch disengages. Normal steering will be possible.

9.4 Working principle EPS, electrical

The circuit diagram of the EPS system shows the following components:

- EPS control unit
- Torque sensor (Deviation sensor)
- EPS motor with electric-magnetic clutch
- Input and output signal connections



DIAG Diagnostic link

INS Instrument

A48 Control unit-EPS

B101 Sensor-steering deviation

M50 Motor-EPS

Terminal 5 of the EPS control unit leads to the telltale in the instrument, at terminal 7 the vehicle speed signal enters the EPS control unit and at terminal 6 the engine revolution signal enters the EPS control unit.

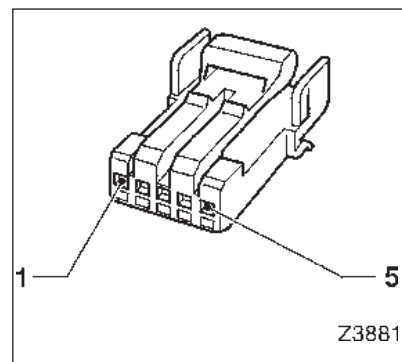
The torque sensor has 4 wires with the following functions:

Red wire: 5 Volts power supply

Green wire: ground

Black wire: signal

White wire: signal



1. Not used
2. Red wire
3. Green wire
4. Black wire
5. White wire

The torque sensor, or deviation sensor, only turns if the steering system experiences resistance. If the steering system experiences no resistance, the torque sensor is in its central position and 2.5 Volts will be supplied via both the black wire (terminal 4 of connector X52) and the white wire (terminal 5 of connector X52) to the EPS control unit.



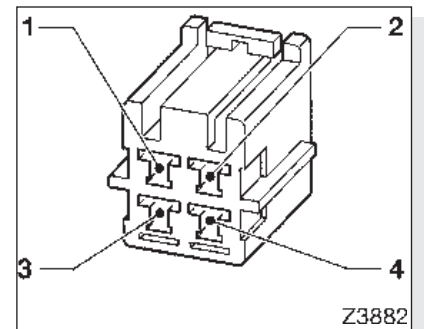
Torque Sensor

The maximum voltage on terminals 4 and 5 of connector X52 is 5 Volts. If the steering wheel turns and the steering system experiences resistance, the torque sensor turns to one direction and because of the double potentiometer the 5 Volts are divided between the black and white wire. For instance:
 Terminal 4 of connector X52/black wire: 3.8 V
 Terminal 5 of connector X52/white wire: 1.1 V

If there is no steering resistance, thus no steering assistance is wanted the torque sensor is in its central position and the EPS control unit must be supplied with 2.5 Volts of terminals 4 and 5 of the connector X52. In case of a deviant value coming from the terminals 4 and 5, in the situation no steering assistance wanted, the EPS control unit will set a trouble code and the EPS system does not function anymore.

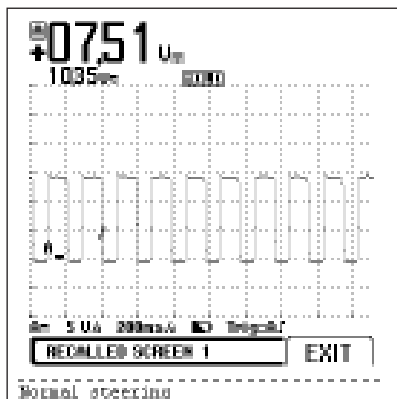
Note: according to the service instructions it is not allowed to slacken or remove the torque sensor because the pre-set will be lost!

The electric motor is connected to the EPS control unit via connector X51 and contains 4 wires. Two thick wires (red and black) are used for the power supply to the electric motor and the other 2 (black) wires are used for the power supply to the electric-magnetic clutch.

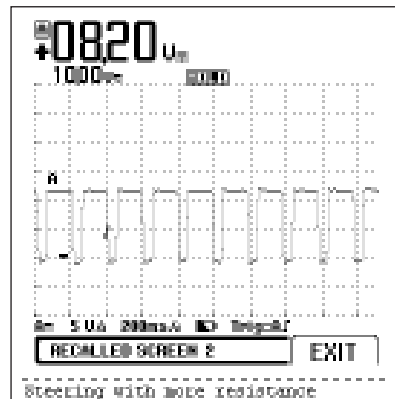


1. Black wire (1.25 mm²)
2. Red wire (1.25 mm²)
3. Black wire (0.75 mm²)
4. Black wire (0.75 mm²)

The required steering assistance is vehicle speed dependant, which means that the current through the electric motor must be regulated. The EPS control unit receives via terminal 7 (connector X50) the vehicle speed signal, via connector X52 the signal from the torque sensor and via terminal 6 (connector X50) the engine speed signal. Due to these signals the EPS control unit determines the direction and level of the current through the electric motor. The regulation of this current is achieved by a Pulse-Width-Modulation (PWM) signal.



This PWM-signal can be positive, > 0 Volts, or negative, <0 Volts, depending of the desired current flow through the electric motor turning the steering wheel clockwise or anti-clockwise. The pulse-width becomes wider as the current must be higher in case of more resistance in the steering system (e.g. parking the vehicle).



The EPS system is fitted with overload protection. If the electric motor current exceeds a limit for a specified period of time, the current is set back to a minimum value to ensure safe steering. This is the case, for example, if full lock is applied for some time when the vehicle is stationary. This prevents both, thermal overload and a drained battery.



10. Electrical systems

10.1 Introduction

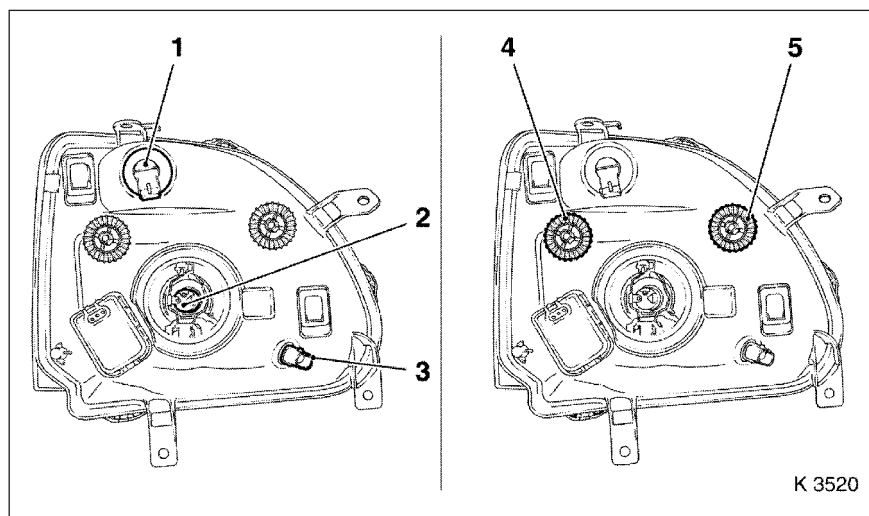
The Agila which is the smallest car in the Opel range contains the following sophisticated electrical systems such as a 2nd generation Immobiliser system, Electric Power Steering (EPS) and Central Door Locking System with deadlock feature. Some other electrical features are Triple Info Display (TID), double LCD odometer, Power Windows, Anti-lock Brake System (ABS) and a Vehicle speed converter module.

The following features will be mentioned in this chapter:

- Lighting, signalling and instrument
- TID & Audio systems
- Power windows
- Central locking
- Immobiliser
- Vehicle Speed Sensor
- Vehicle Speed Converter Module
- Fuses, Relays and Grounding points

10.2 Lighting, signalling and instrument

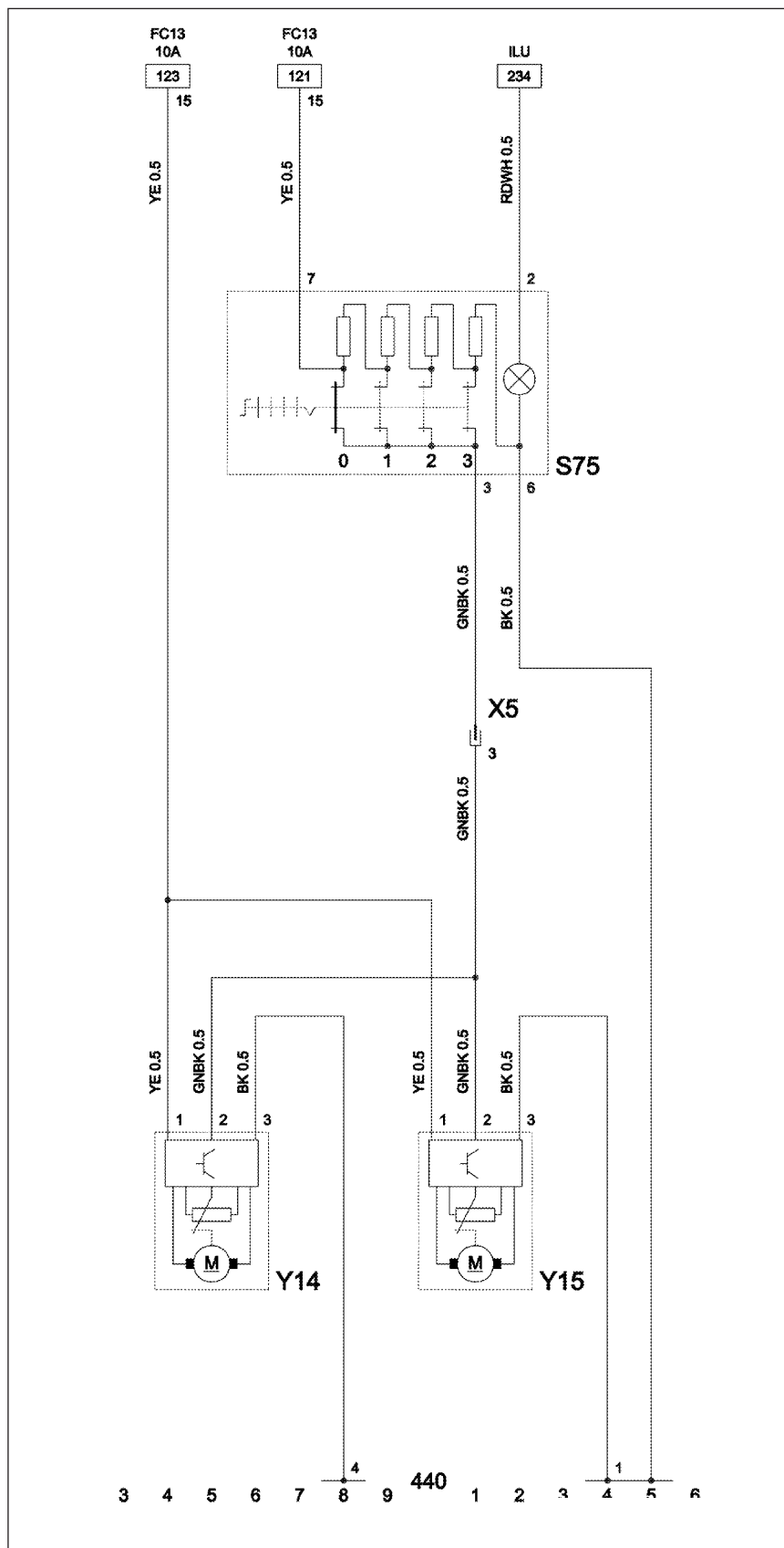
The Opel Agila has plastic headlight lenses, which may not be cleaned with abrasive or caustic agents. It is only allowed to clean them with car shampoo.



1. Indicator
2. Dipped head-light and high beam (H4 12V 60/55 Watt)
3. Parking lamps
4. Height-adjustment
5. Width-adjustment

The indicator bulbs of the front and rear lights have an orange colour.

The headlamp levelling switch is power supplied via terminal 15 (switch voltage). One of the items concerning Pre Delivery Inspection (PDI) is to adjust the headlamp levelling.

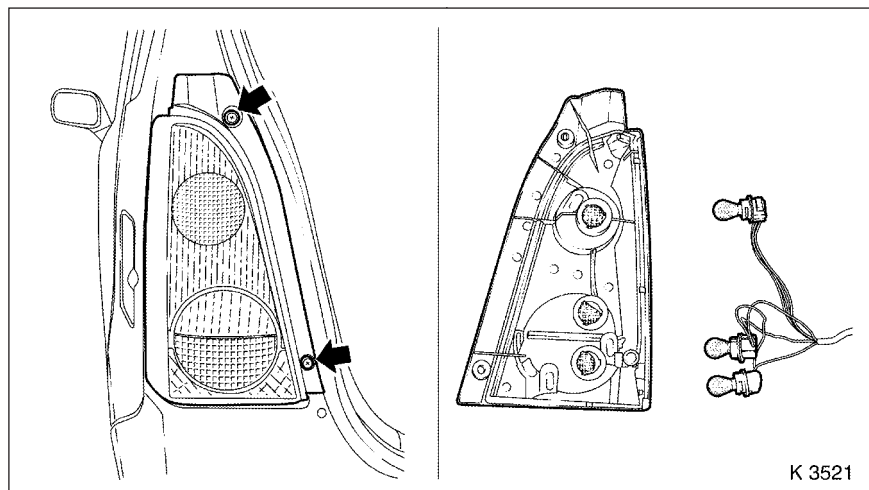


Head lamp levelling

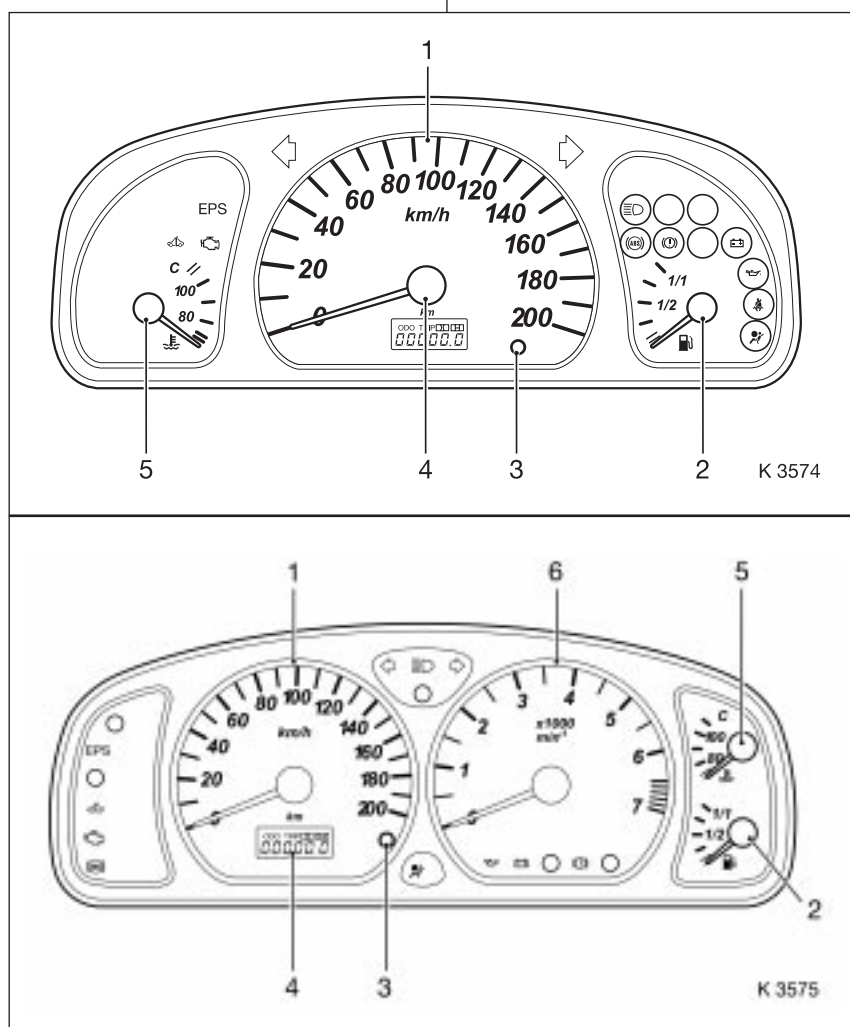
- ILU Illumination light
- S75 Switch-Headlamp levelling
- X5 Body front & Instrument panel connector
- Y14 Headlamp levelling-Left
- Y15 Headlamp levelling-Right

The Agila has no single parking light feature but does contain a preparation for additional fog lights in the wiring harness. The prepared fog lights connectors can be found behind the bumper close to the built-in location for fog lights.

The rear light units must be removed to replace the bulbs.



An instrument with tachometer is optional for the Agila. The instrument of the Agila contains double trip odometer.



1. Electronic speedometer
2. Fuel indicator
3. Reset knob trip odometer
4. LCD odometer
5. Indicator coolant temperature
6. Tachometer

At the back of the instrument the warning buzzer is mounted. As soon as the driver opens his door, this buzzer warns the driver when the key is still in the ignition switch or when the lights are still ON.

When the door is opened with the key still in the ignition lock, the warning buzzer creates a beep with an interval of approximately 2 Hz. If the lights are still ON and the door opens, the warning buzzer produces a constant beep. The 'key-in' warning has priority over the light warning.

The instrument of the Agila is accessible for TECH 2. For the following TECH 2 software features concerning instrument are available:

Actuator tests:

- ABS Telltale test
- EBD Telltale test
- Odometer LCD test
- Key-in warning
- Light-On warning

Programming

- Code index programming
- Odometer programming

ECU control

- Coolant temperature control
- Instantaneous tank content control
- Engine speed control
- Vehicle speed control (km/h)
- Vehicle speed control (m/h)

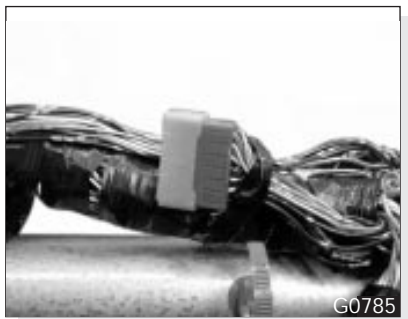
The following Diagnostic Trouble Codes (DTC) concerning instrument are possible:

DTC

- B0021 Trip reset button stuck
- B0051 Replace Electronic Control Unit (ECU)-EEPROM failure.
- B0052 Reprogram program memory.
- B0055 Replace Electronic Control Unit (ECU).
- B0164 Coolant temperature incorrect signal.
- B0165 Coolant temperature signal low input.
- B0166 Coolant temperature signal high input.
- B0167 Tank gauge voltage low input.
- B0168 Tank gauge voltage high input.

10.3 Triple Info Display & Audio systems

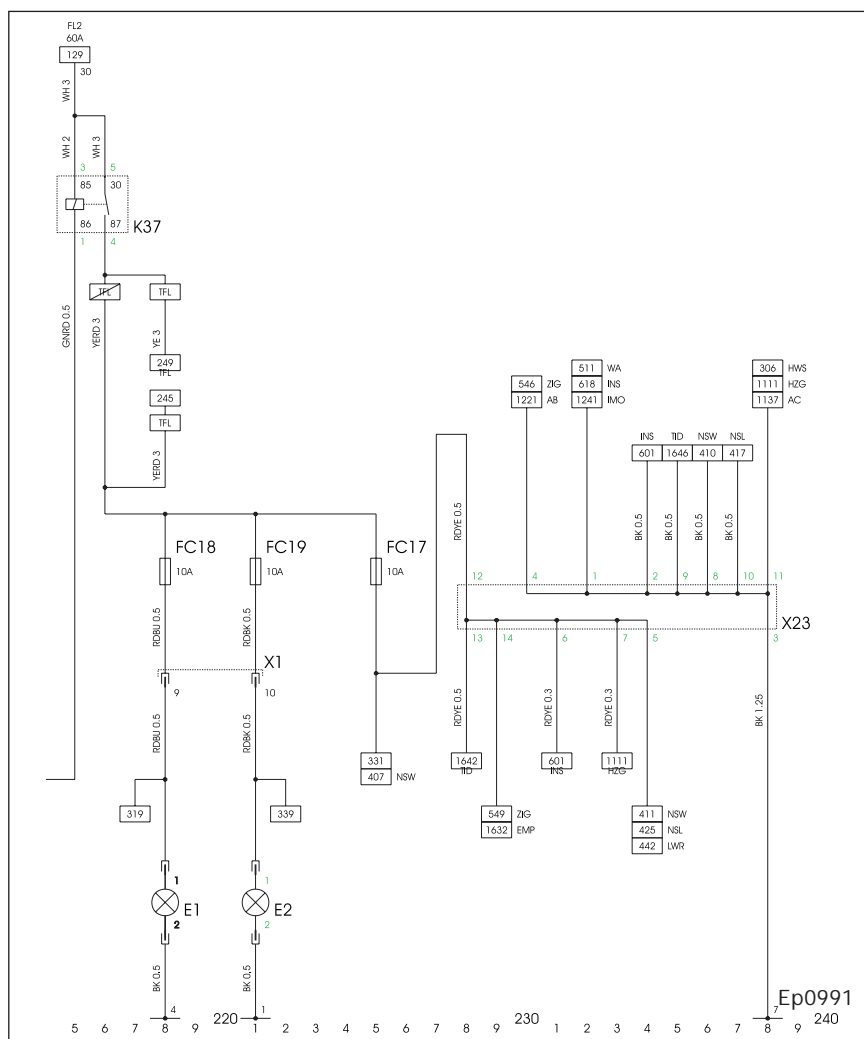
The optional Triple Info Display (TID) of the Agila is the same as used on the Astra-G with the exception of splice connector X23. This connector is fixed on the wiring harness, close to the instrument and leads along the cross member behind the dash panel.



The connector X23 has two functions:

1. Collecting point for 7 ground wires.
2. Distribution points for 5 power supply wires.

These 5 power supply wires provide power for the illumination of different components when the lights are switched ON.



Abbreviations

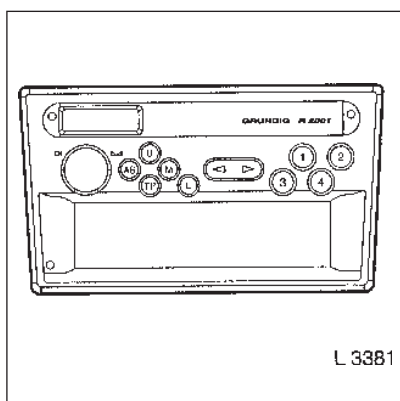
- AB Airbag
- AC Air conditioning
- EMP Radio
- HWS Hazard warning switch
- HZG Heating
- IMO Immobiliser
- INS Instrument
- LWR Headlamp levelling
- NSL Fog lamps, rear
- NSW Fog lamps, front
- TFL Daytime running light
- TID Triple Info Display
- WA Washer
- ZIG Cigarette lighter

Component codes

- E1 Parking lamp, left
- E2 Parking lamp, right
- FCx Fuse
- K37 Relay-Tail lamp
- S2 Switch unit-light
- X1 Body front & Instrument panel
- X23 Splice connector

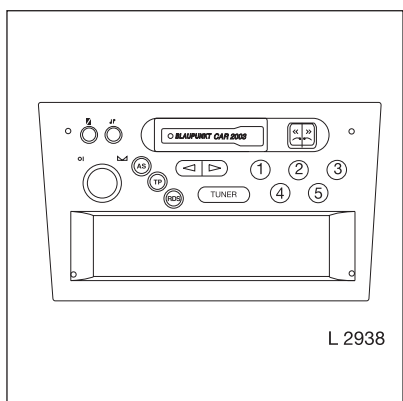
The standard audio system of the Agila exists of the radio R2001 with two 7-Watt front speakers and 4 pre-settings.

The R2001 has its own display and therefore it will not display information on the TID. All other optional radios will display information on the TID.



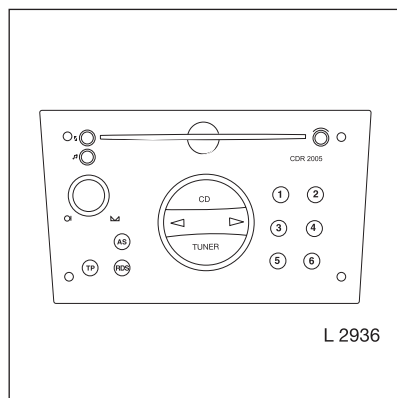
R 2001

All available radios for the Agila have double DIN connectors and telephone mute. Optional, two other radios can be ordered in the Agila, the CAR 2003 and the CDR 2005.



CAR 2003

The CAR 2003 comes with four 7-Watt speakers, 5 pre-settings, a cassette recorder, treble, base and fade control.



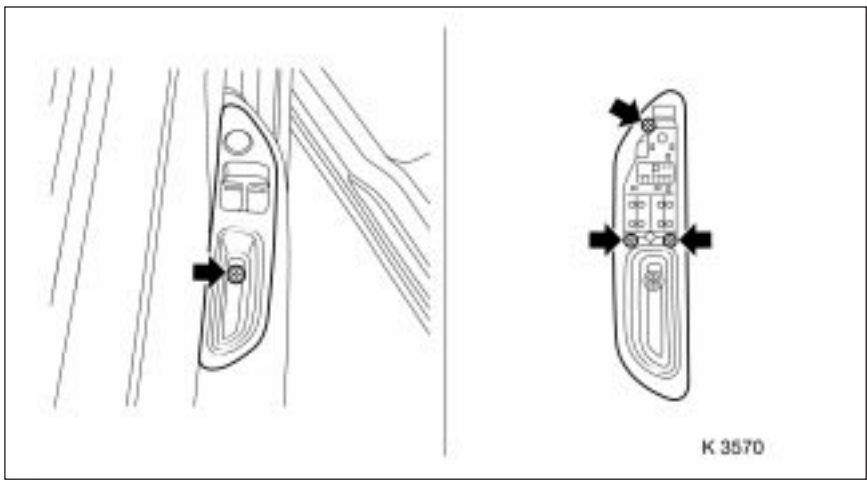
CDR 2005

The CDR 2005 comes with four 20-Watt speakers, 6 pre-settings, a CD player and also treble, base and fade control. Another feature of the CDR 2005 is the speed dependant volume control.

The speakers are located in the corners of the dash panel and, in case of a CAR 2003 or CDR 2005, in the rear roof trim. The antenna with internal amplifier is the same for all radios and is similar to the one used in the Astra-G.

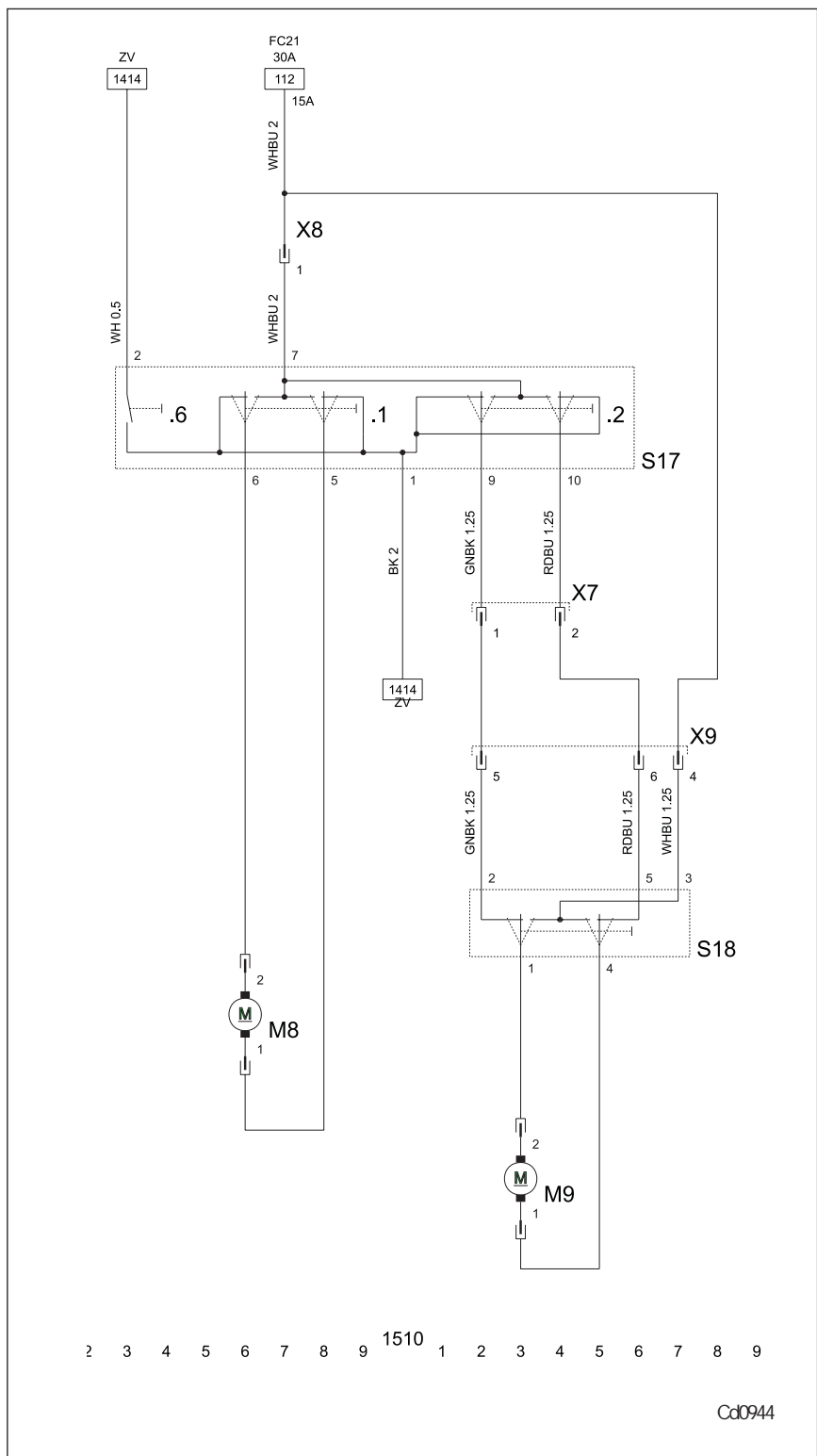
10.4 Power windows

The front windows of the Agila can be equipped with power windows and are always combined with central door locking. Therefore the switch unit of power windows is combined with the lock/unlock button for the central door locking system.



The power window system does not include a pinch-guard feature and a comfort closing feature (closing the windows from the outside). The switch for the window lifters is supplied via terminal 15a and the ground for the power windows motors is shared with the central door locking system.

If the battery has been disconnected it is not necessary to reprogram the memory.



- ZV Central door locking.
- M8 Motor-window lifter, driver door.
- M9 Motor-window lifter, front passenger door.
- S17 Switch-window lifter.
- S17.1 Switch-window lifter, driver door.
- S17.2 Switch-window lifter, front passenger door.
- S17.6 Switch-central locking.
- S18 Switch-window lifter, front passenger door.
- X7 Instrument panel & Driver door.
- X8 Instrument panel & Driver door.
- X9 Instrument panel & Front passenger door.

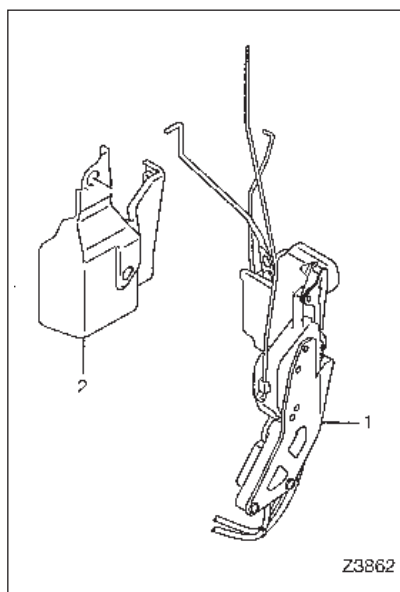
If the battery has been disconnected it is not necessary to reprogram the memory.

Power windows-Left-hand drive

10.5 Central door locking system

With the help of the central door locking system of the Agila, it is possible to lock and unlock all doors simultaneously. The central door locking system, also called central locking, consists of the following components:

- Control unit central locking
- Motors central locking/door lock units
- Switch lock front doors
- Door contact switches
- Lock/unlock switch
- Car key



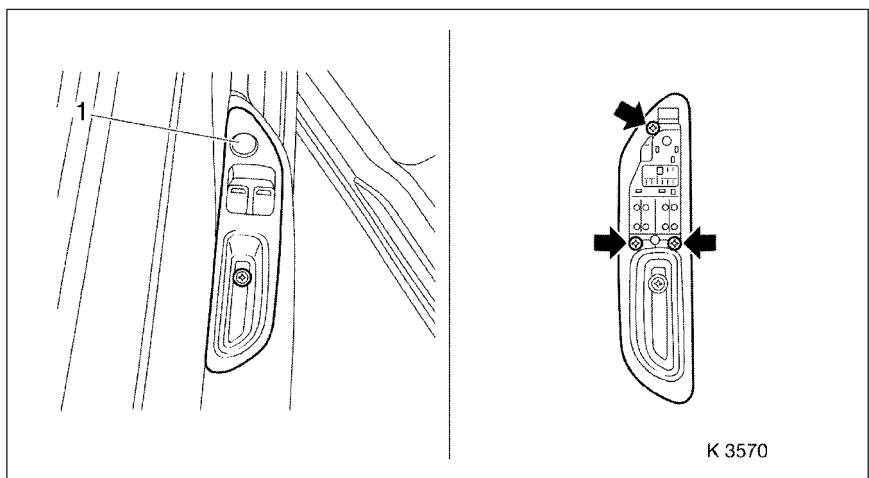
1. Latch assembly
2. Protector



Control unit Central locking

The control unit of central locking is located nearby the fusebox at the A-pillar inside the vehicle. The motor and the door lock unit form an assembly that is mounted inside each door. The door contact switches of the front doors are mounted in the B-pillar and for the rear doors in the C-pillar. The lock/unlock switch is mounted in the front door trim, together with the switches for the power window system.

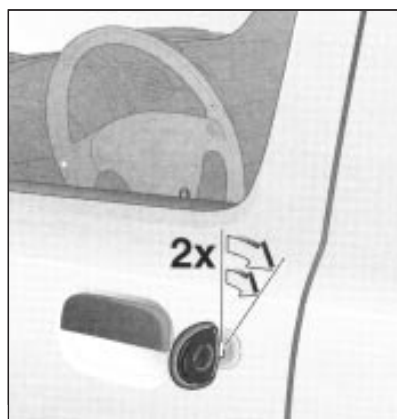
The central door locking system is operated by the key for the driver's and the passenger's door. It is also possible to lock or unlock all doors simultaneously using the lock/unlock switch in the door panel.



1. Lock/unlock switch.

Turning the key clockwise once results in simultaneously locking all doors. When this is repeated within ± 3 seconds, all motors except the tailgate motor will be deadlocked.

The central door locking system of the Agila has no overload protection.

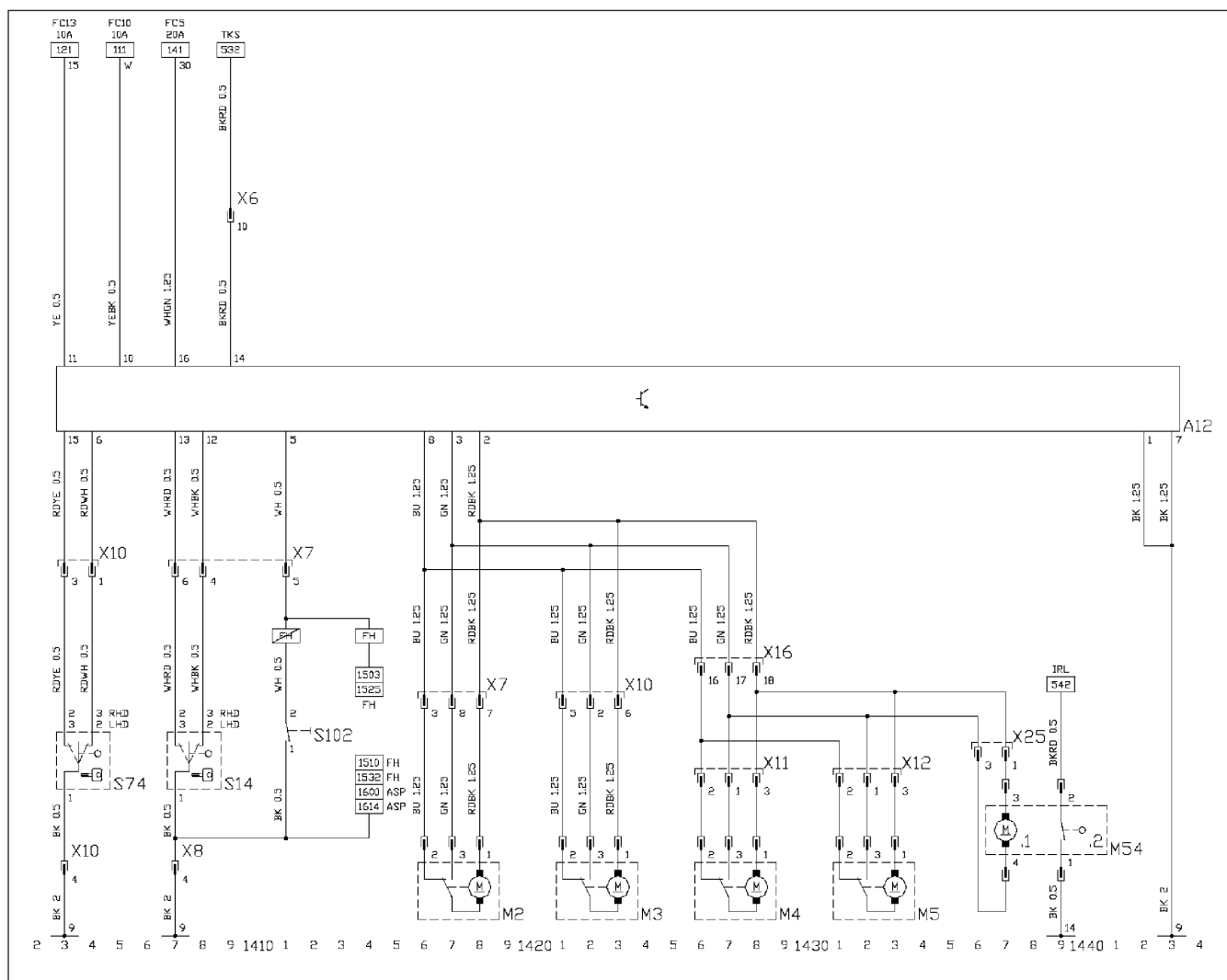


Turning the key anti-clockwise once results in opening of that particular door only. When this command has been repeated all doors will be unlocked. This second command is not limited in time.

After unlocking and opening the driver's door using the key, it is also possible to close and lock the driver's door manually. This is realised by first pushing the door-knob down, lifting the door-handle and then closing the door.

If one of the door switches is operated (grounded) because one of the doors is open or not fully closed, it is possible to lock all doors simultaneously but not possible to unlock all doors simultaneously or deadlock the system. When the key is turned anti-clockwise only that particular door will be unlocked.

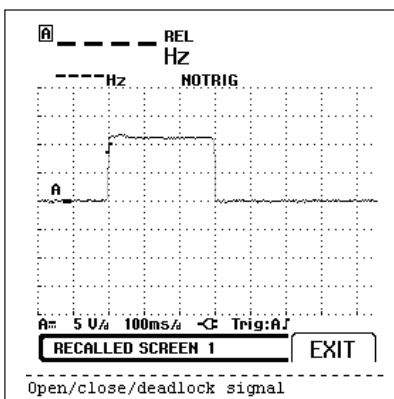
The fuel filler flap cannot be locked, it is no part of the central locking system. The fuel filler cap can be locked via a separate lock operated by the ignition key.



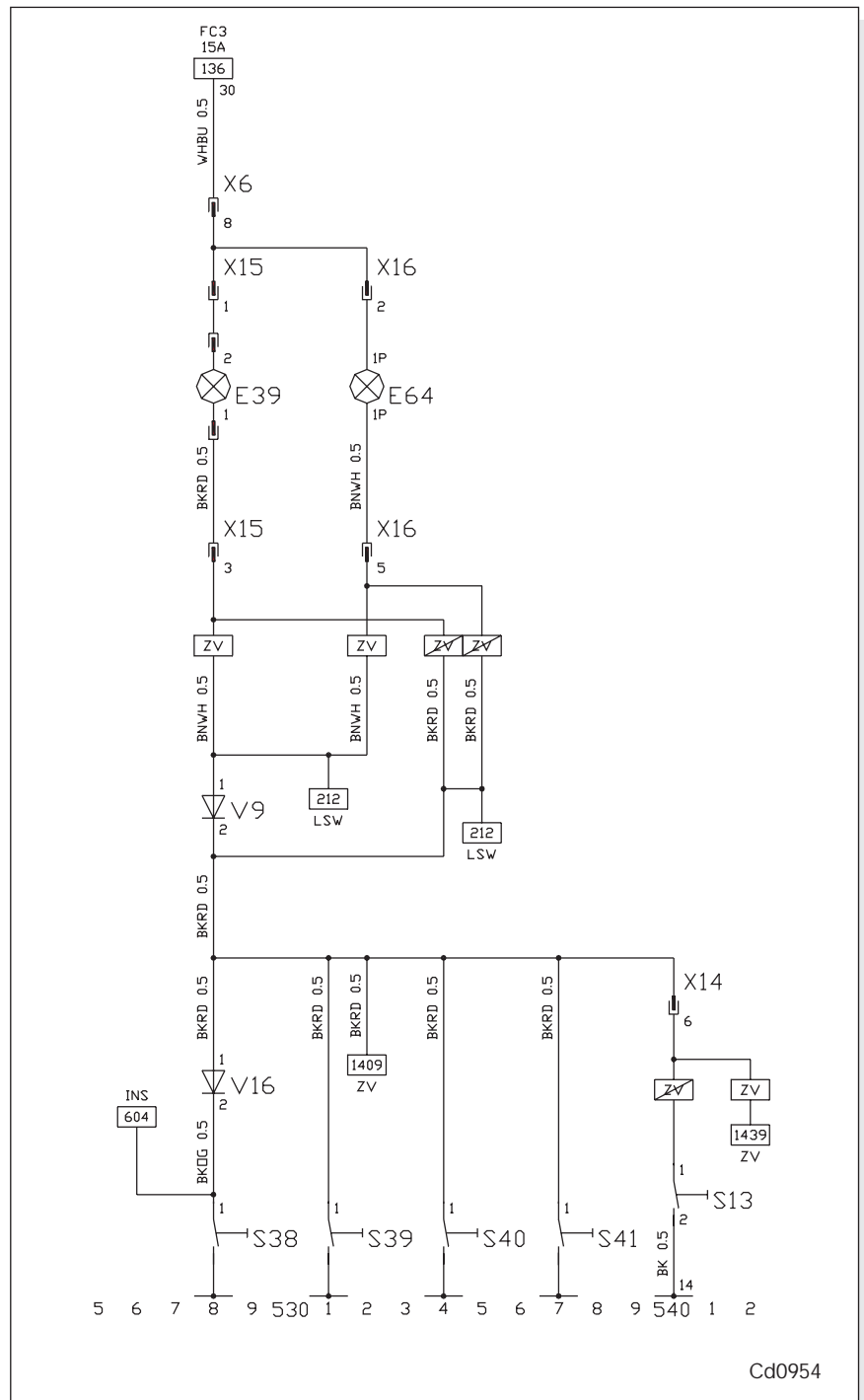
Central door locking

- | | | | | | |
|-------|---|---------|---|-------|---|
| • ASP | Outside mirror | • M54 | Unit-Lock tailgate/lid trunk | • X7 | Instrument panel & Driver door |
| • FH | Window lifters | • M54.1 | Motor-Central locking | • X8 | Instrument panel & Driver door |
| • IRL | Interior lamp | • M54.2 | Switch-Lamp, passenger compartment | • X10 | Instrument panel & Front passenger door |
| • TKS | Door contact switch | • S14 | Switch-Central locking, lock driver door | • X11 | Body rear & Rear door, left |
| • A12 | Control unit-Central locking | • S74 | Switch-Central locking, lock front passenger door | • X12 | Body rear & Rear door right |
| • M2 | Motor-Central locking, driver door | • S102 | Switch-Central locking | • X16 | Body rear & Roof rear |
| • M3 | Motor-Central locking, front passenger door | • X6 | Instrument panel & Body rear | • X25 | Body rear & Tailgate |
| • M4 | Motor-Central locking, rear door, left | | | | |
| • M5 | Motor-Central locking, rear door, right | | | | |

When central locking is available, the motor (M54) on the hatch door (tailgate) has an internal switch for the lock/unlock switch (S102) is shared with the ground for power windows. The signal for lock, unlock and deadlock is the same, only the direction of current through the motor changes.



Note: be aware that the circuit diagram of the central door lock system is drawn in the dead-locked position!



On path number 532 the control unit of central locking is connected. This way the control unit detects if one of the doors is open with the result of an improper functioning central door locking system (as described before).

On path number 531 the interior light switch is connected. Diode V9 prevents the control unit of central locking from detecting the interior light switch as closed and consider this as a 'door-open-signal'.

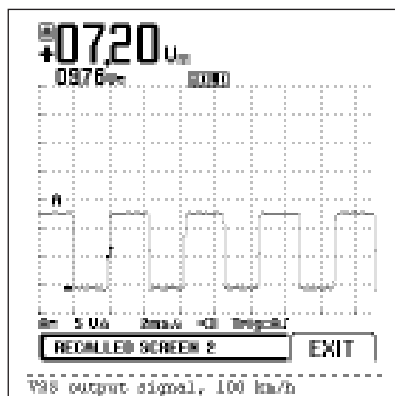
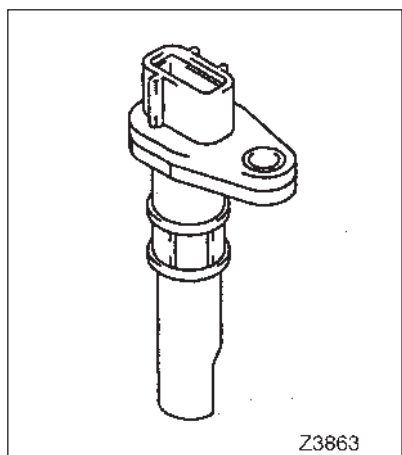
10.6 Electrical features

Immobiliser

The immobiliser system from the Agila is of the 2nd generation. The operation of this system is described in the New Technical Features of Astra-G.

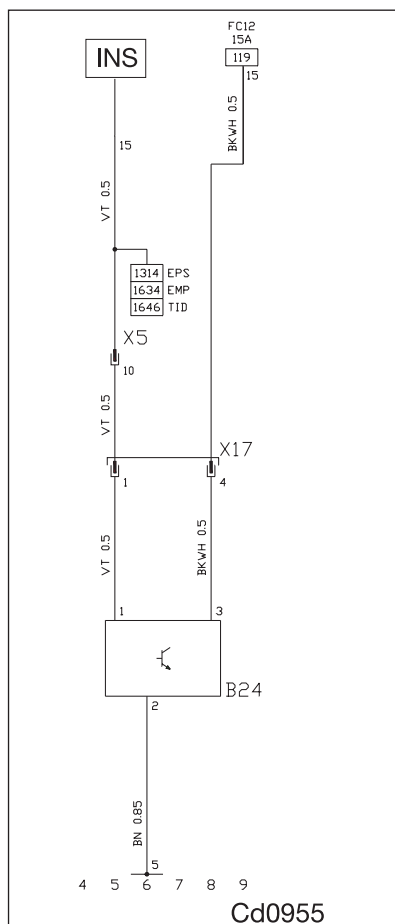
Vehicle speed sensor

The vehicle speed sensor is mounted on the transmission and is a Hall-type sensor. It provides a 12 Volts block signal to the instrument, the control unit for electronic power steering, the radio and the triple info display.



Vehicle speed output signal

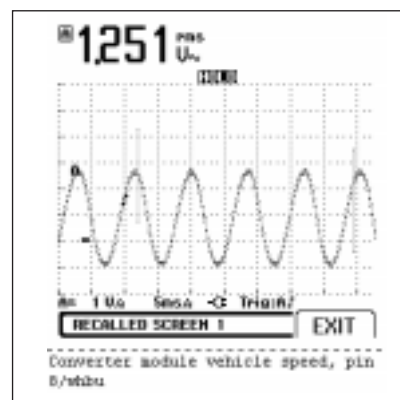
This sensor generates 25,714 pulses/km ($\pm 5\%$) with the standard size tyres installed on the Agila.



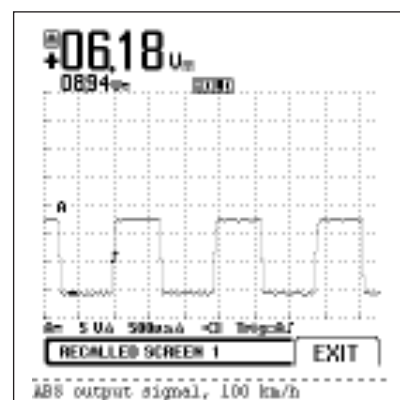
Vehicle Speed Sensor

Wheel speed sensor

The wheel speed sensor, which is used to provide the vehicle the speed signal to the Anti-lock Brake System (ABS) and the Motronic Control Unit, is an inductive-type sensor and produces a sine curve. For this reason a signal converter module is enforced on the non-ABS versions. This signal converter module converts the speed sine signal into a block signal that is sent to the Motronic control unit.

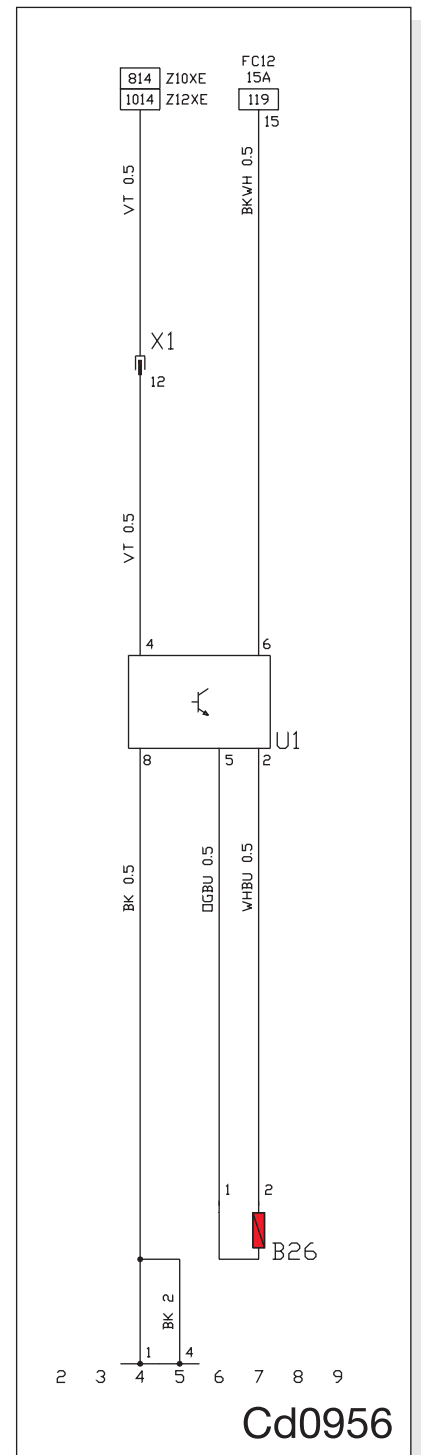
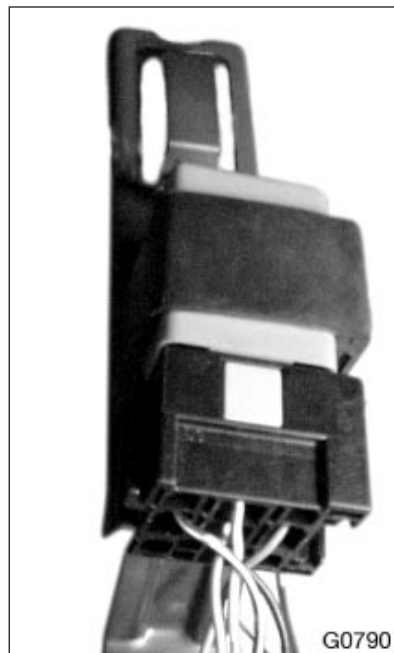


Wheel speed sensor input signal at 100 km/h



Wheel speed converter module output signal at 100 km/h

This module and/or the ABS generate 8844 pulses/km. This value is also the K-factor of the instrument. This programming parameter can be displayed using the odometer display of the instrument. If the odometer-reset button is pressed for a period of 5 seconds or longer, the programming display appears. The code index and the code version are displayed for 2 seconds. The next 2 seconds the K-factor is displayed. After this, the display returns to the odometer display mode.

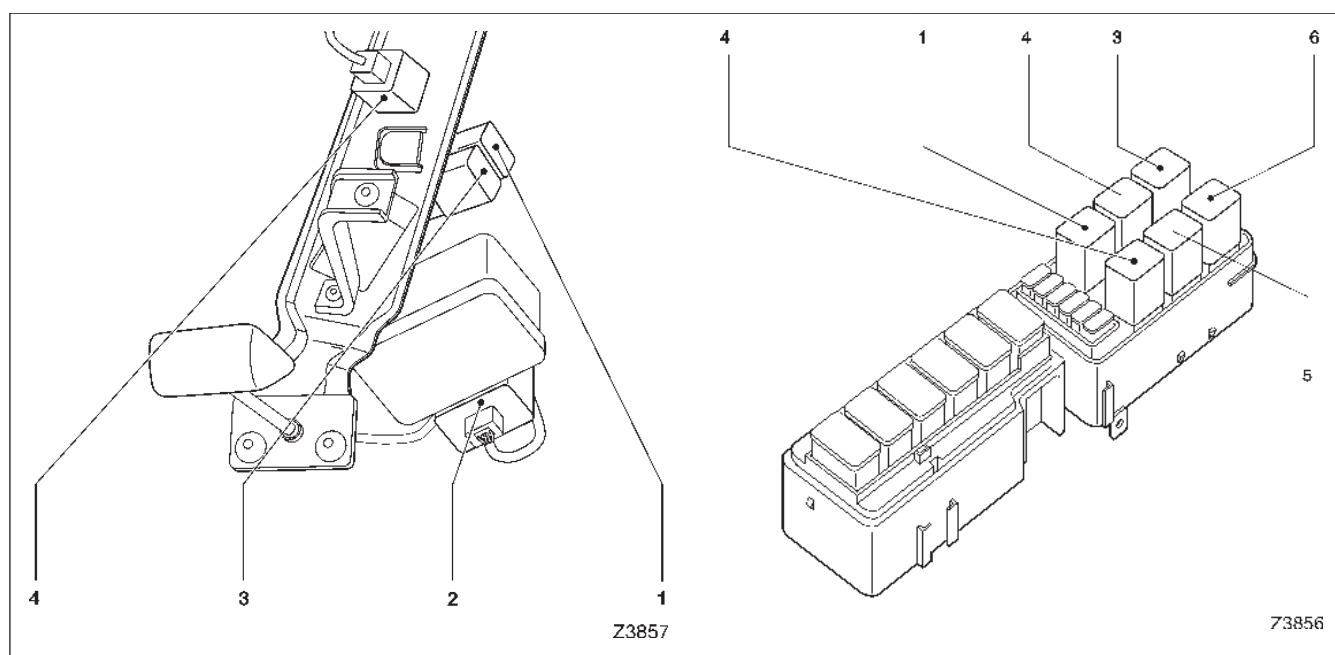


- B26 Sensor-wheel speed, front right
- U1 Signal converter module-vehicle speed
- X1 Body front & Instrument panel

Fuses & Relays

In the circuit diagram 3 abbreviations can be found for the fuses: Fc, Fb and FI. The fuses indicated as Fc are located inside the vehicle. The abbreviation Fb indicates to mini fuses that are located in the engine compartment. The abbreviation FI indicates to maxi fuses that are located in the engine compartment.

Relays can be found in the engine compartment, nearby the A-pillar (fuse box) and behind the glove compartment.

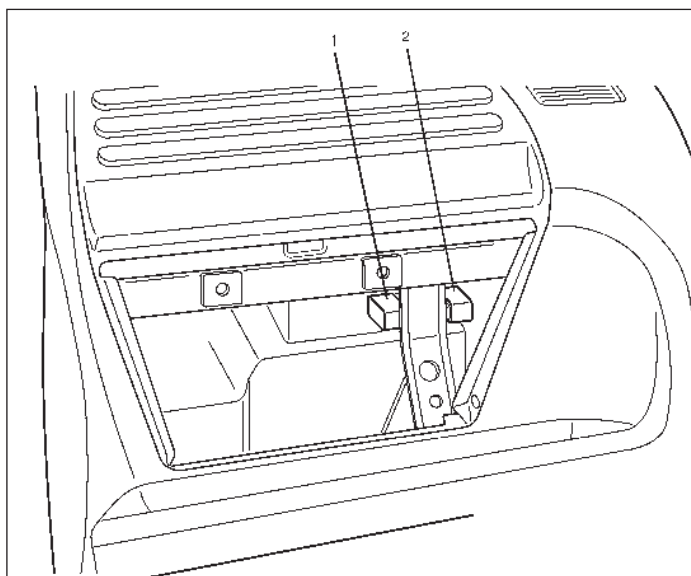


Interior

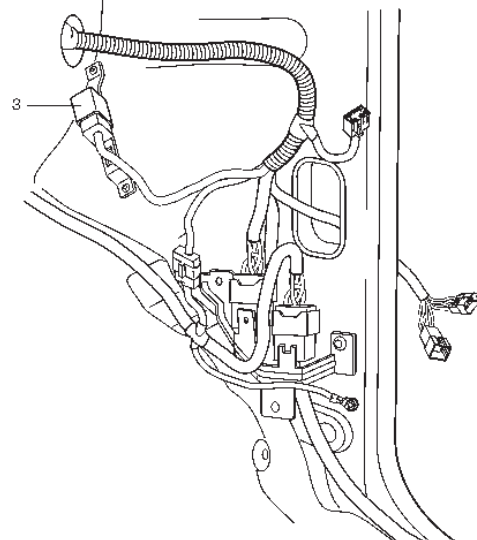
1. K3, Heated back window
2. K5, Fog lamp rear
3. K37, Tail lamp
3. K31, Flasher unit

Engine compartment

1. K12, Trumpet horn
2. K13, Radiator fan
3. K16, Fuel pump
4. K18, Engine control unit
5. K36, Compressor air conditioning
7. K4, Fog lamp front



Z3858

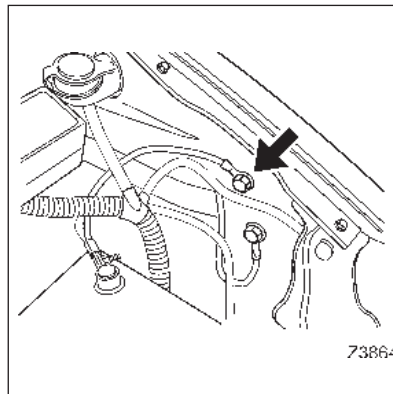


Z3859

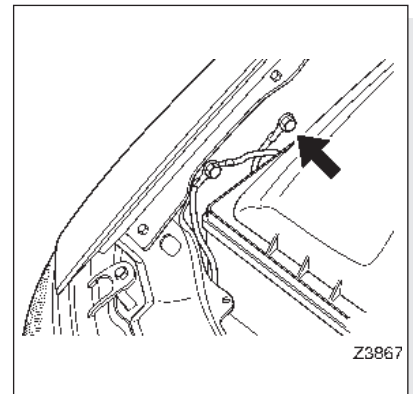
1. K45, Interval wiper, windscreen
2. K43, AC Blower 1st speed
3. U1, Speed signal converter module

Ground points

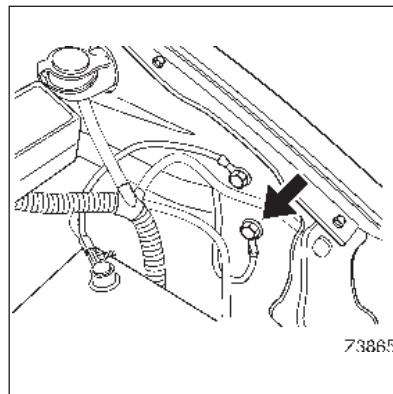
The following pictures indicate the 15 grounding points of a Left Hand Drive-Agila.



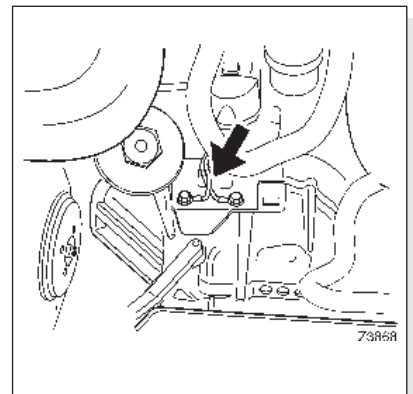
1. Engine compartment, left



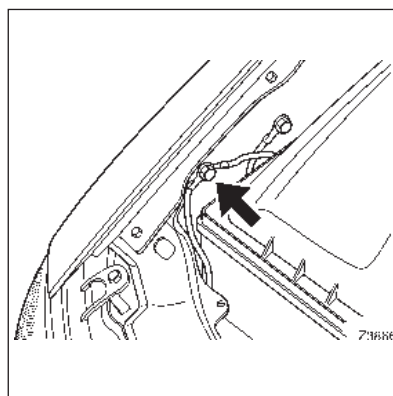
4. Engine compartment, right



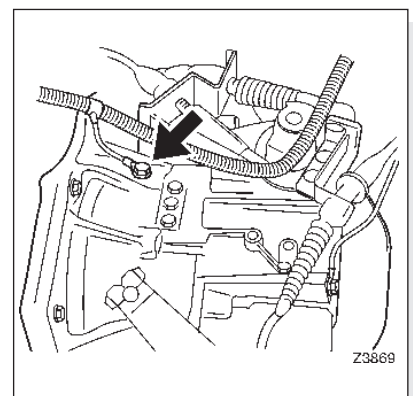
2. Engine compartment, left



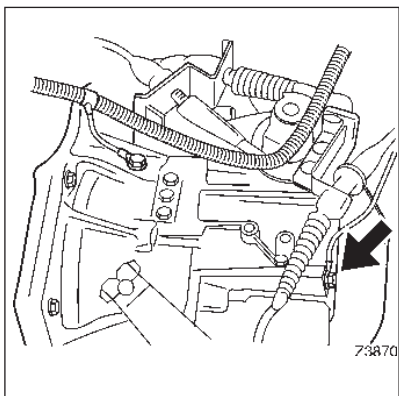
5. Engine, left



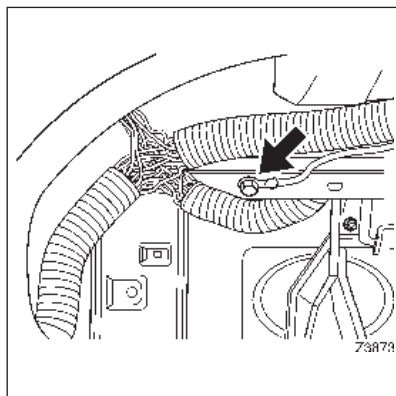
3. Engine compartment, right



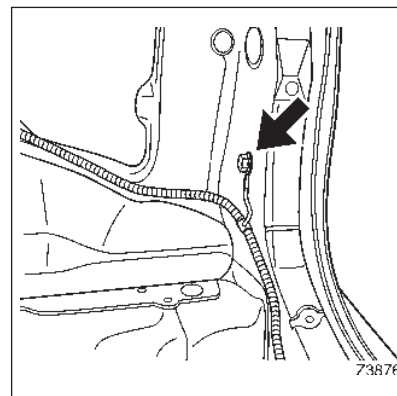
6. Flywheel housing



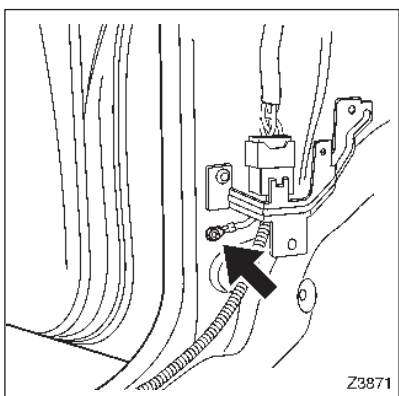
7. Transmission housing



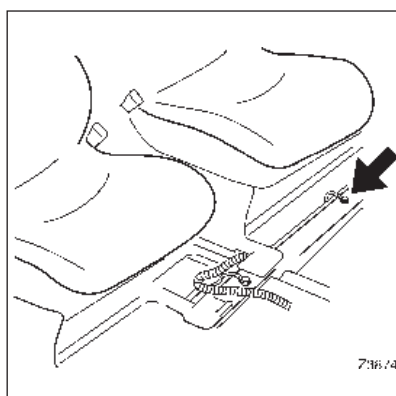
10. Bracket steering column/cross member



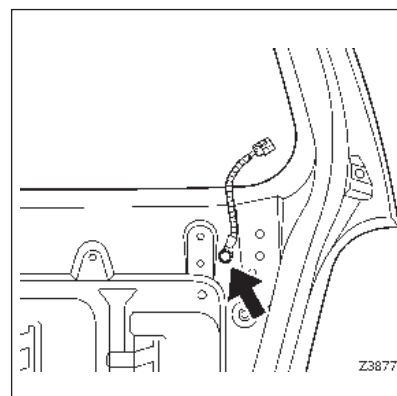
13. D-pillar, right



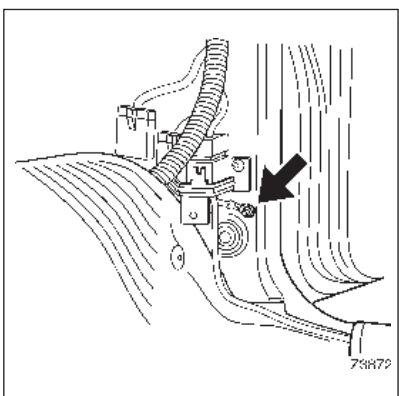
8. A-pillar, driver's side



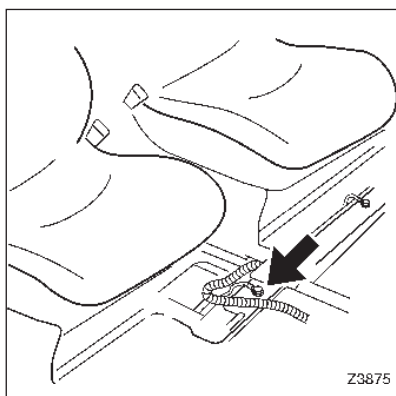
11. Chassis under seat, left



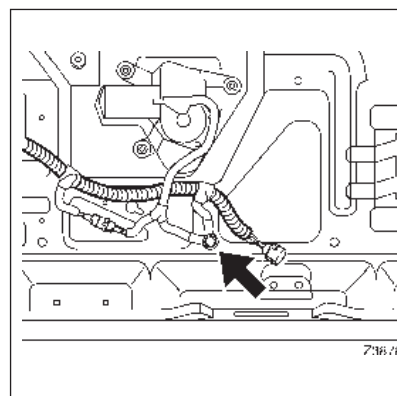
14. Tailgate, left



9. A-pillar, passenger's side



12. Tunnel



15. Tailgate centre

11. Service

11.1 Service

The service plan for the Agila is almost similar to the service plan of the Corsa-B

11.2 Pre-delivery inspection

A new form for the pre delivery inspection of the Agila and the Astra-G Coupe is added to the current valid pre delivery inspection brochure. This form contains specific data, tables, work instructions and checklists.

11.3 Opel service booklet Modelyear 2000 ½

- The service brochure modelyear 2000 ½, KTA 1924/6, can be used for all passenger cars including Agila and Astra-G Coupe.
- The service brochure KTA-1942/5, edition 8/99 was only valid till end 99, the reason for this are the changed maintenance periods for the timing belt of the Fam I, 16 Valves engines (X14XE, X16XE, X16XEL, Y16XE, X18XE1 from 2000 ½)

11.4 New features for servicing the Agila

- Changed adjustment of clutch pedal
- Parking brake is adjusted on the fourth tooth
- Air cleaner cartridge change on 60000 Km (??)
- Gearbox F12 oil change at 30000 or 2 years once
- Wheels tightened with torque of 85 Nm

11.5 Service plan brochure

There is a new service plan brochure KTA-2348 which is valid from to MY 99 till MY 2000 ½ and contains Agila and Astra-G Coupe. The service plan brochure KTA-2265 valid from MY 99 till MY 2000 is not valid anymore.

11.6 Exhaust emission test brochure

There is a new version of the exhaust emission test brochure MY98 till MY2000 ½, version 12.99, KTA-2266. With this new version the current version KTA-2049 and its supplement KTA-2143 lose their validation.

In the new version the emission data of the Agila is added and these engine are tested according the demands of EOBD (European On-Board Diagnosis).

11.7 Techline

The following systems can be diagnosed with the TECH 2:

Motormanagement system:

- Motronic ME 1.5.5 Hybrid

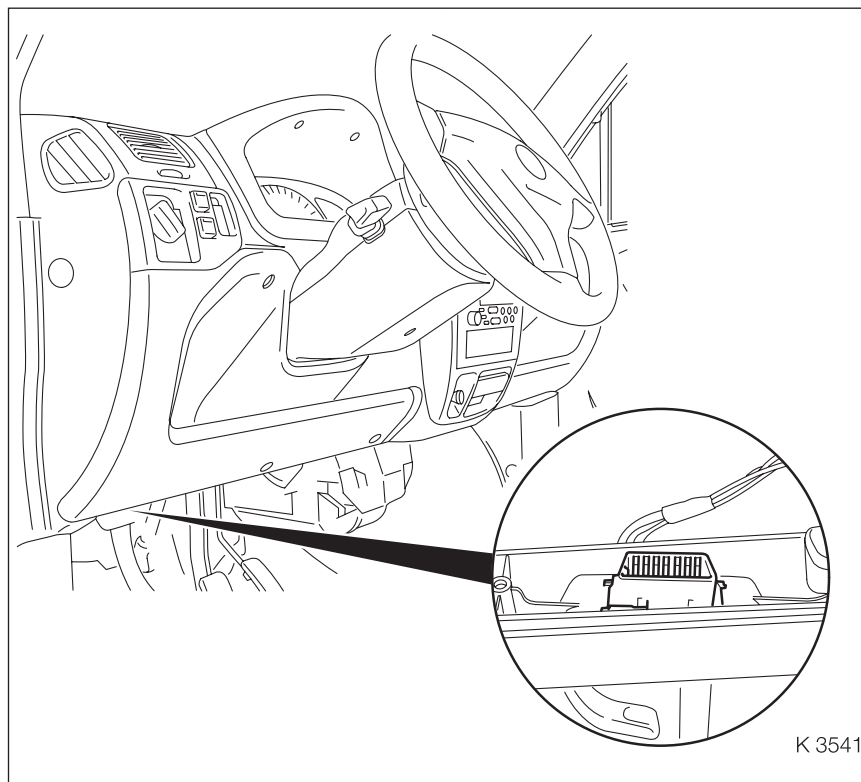
Body systems:

- Triple Info Display (TID)
- Radio CAR 2003
- Radio CAR 2005
- Airbag
- Immobilizer
- Instrument

Chassis systems:

- ABS (Anti-lock brakes)
- ESP (Electronic power steering)

The diagnostic plug is located under the storage box on the driver's side



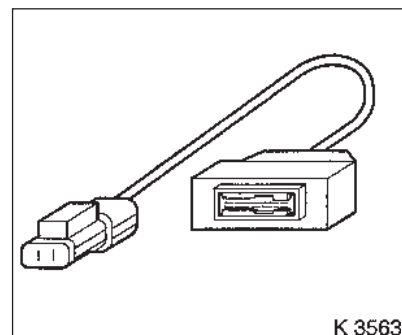
11.8 Special Tools

11.8.1 Body

KM-799-11

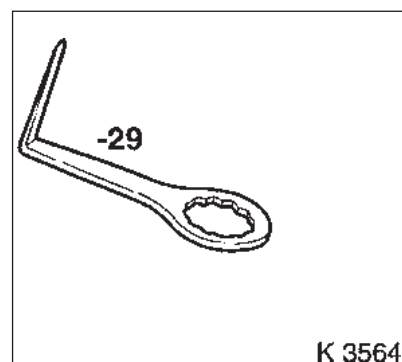
Adapter cable

For activation of airbag units and seatbelt pretensioners when fitted in the car.



MKM-846-29

Knife for removal of the small side window



11.8.2 Front wheel suspension, wheel and tyres

KM-6138

Fixing point

Support of steering knuckle when wheel bearing is pressed in with KM-6139

KM-6139

Press tool for pressing wheel bearing in steering knuckle with KM-6138

KM-6140

Fixing point

Support wheel bearing with pressing wheel hub in steering knuckle

KM-6141

Fixing point

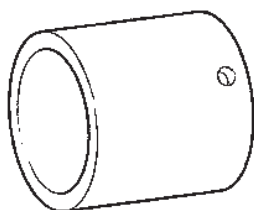
Support splash shield brakes and steering knuckle with KM-6118-1 with removing wheel hub from steering knuckle with KM-466-5

KM-6142

Fixing point

Support wheel hub when pressed in or pressed out

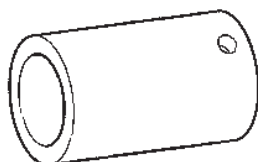
KM-6138



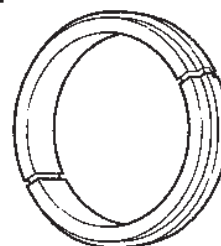
KM-6139



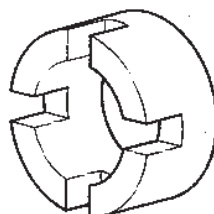
KM-6140



KM-6141



KM-6142



K 3557

KM-6133

Installation tools

Installation ABS sensor on hub of
drum brake

KM-6143

Adapter

Removal ABS sensor of rear hub
with KM-161-B

KM-6144

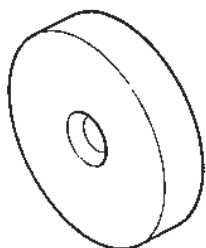
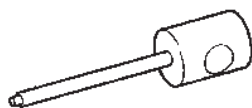
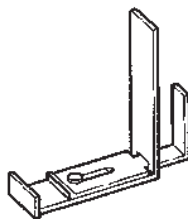
Punch

To remove spring pin brake fluid
reservoir

KM-6145

Reset tool

To reset the adjusting mechanism of
the drum brakes

KM-6133**KM-6143****KM-6144****KM-6145**

K 3558

11.8.3 Engine

KM-6054

For removal and installation of engine with KM-904 and KM-6056

KM-6056

Supports the engine with removal and installation with gearbox with KM-6054

KM-6103

Supports engine with installation and removal of cylinder head and for maintenance on ECM side.

KM-6129

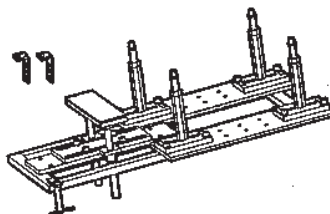
Installation and removal tool for Oxygen sensor with MKM-611
KM-6130

Pin for blocking poly V belt tensioner (only with AC)

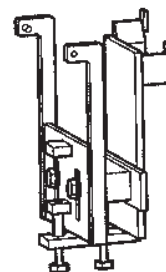
KM-6131

Installation tool for tensioning poly V belt

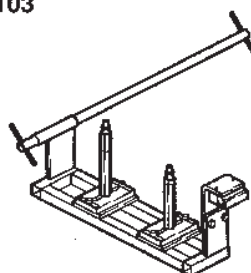
KM-6054



KM-6056



KM-6103



KM-6129



KM-6130



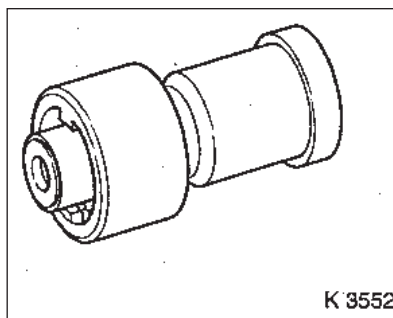
KM-6131



K 3551

KM-6132

Adapter for testing the cooling system with KM-471

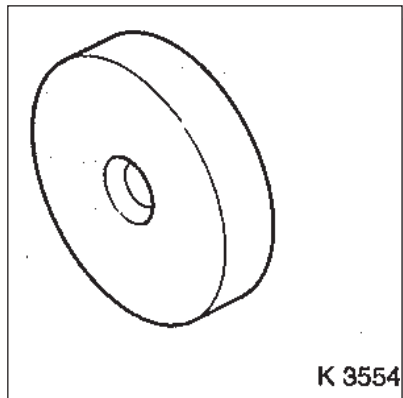


K 3552

11.8.4 Clutch and gearbox

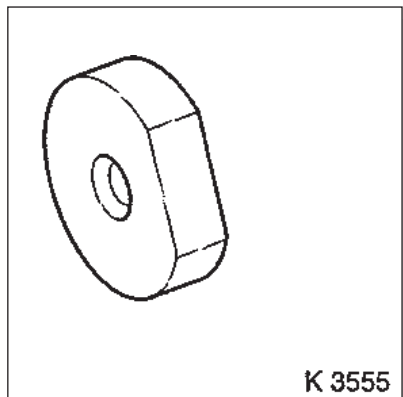
KM-6133

Installation tool for sealing of crank shaft left with KM-523-1



KM-6134

Installation tool for sealing of crank-shaft right with KM-523-1



KM-6135

Centre pin for clutch plate

