

## **BODY/EXTERIOR**

### **BODY**

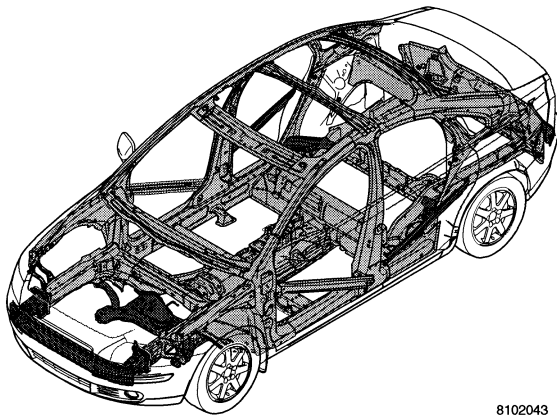
#### **GENERAL**

Four different grades of steel are used in the body of the S40/V50. In a collision the different materials work together to absorb and dissipate the forces generated.

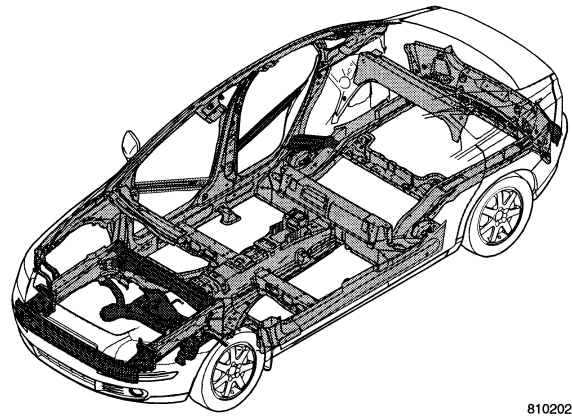
Boron steel is used on the inner sections of the bumper rails and in the reinforcement members of the doors.

The front side members have a new construction. The bumper rail and front sections of the side members are combined into one unit called a crashbox.

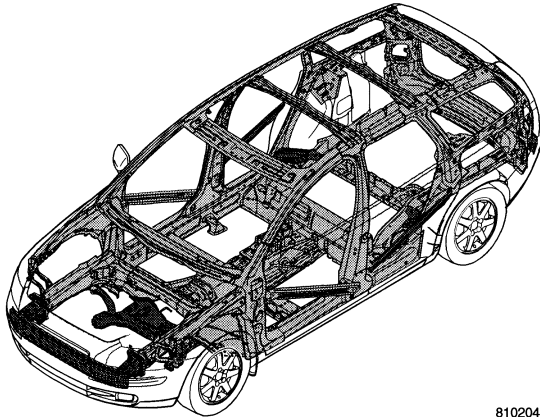
The crashbox is bolted onto the side members. This makes repairs easier after minor collisions when only the front end is damaged.



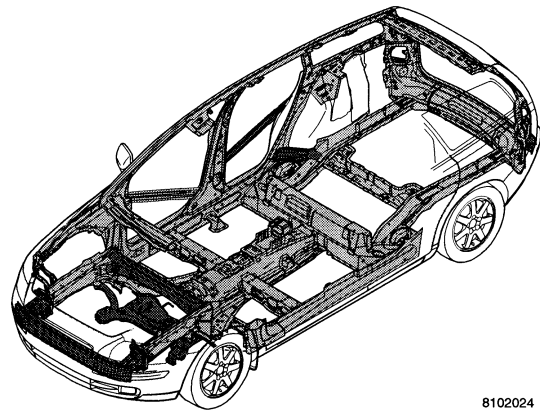
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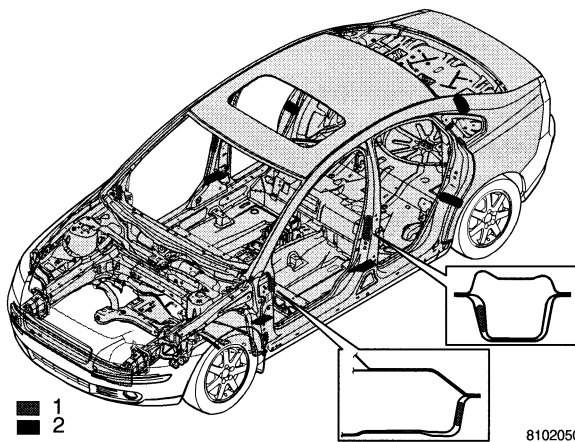
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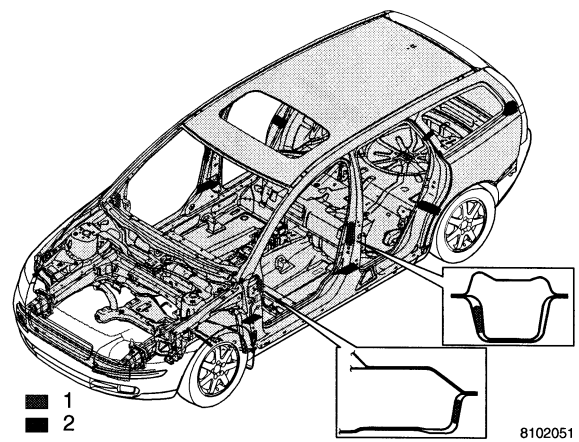
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## MEMBER STRUCTURE

- The development of the front member structure with the crashbox and the lateral member on the firewall differentiates the design from previous models.



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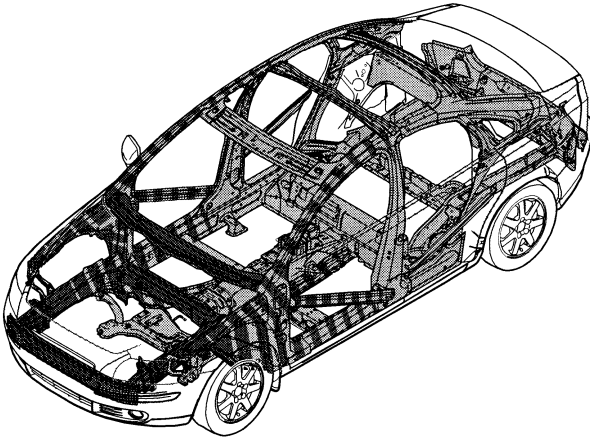
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1	Structural foam	2	Soundproofing
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## STRUCTURAL FOAM/SOUNDPROOFING S40

- The structural foam fills a cavity between two panels and stabilizes the A and B posts.
- When the force of a collision reaches the A post, the B post helps to dissipate the force.
- The soundproofing is the same material as used previously before and is positioned as illustrated.

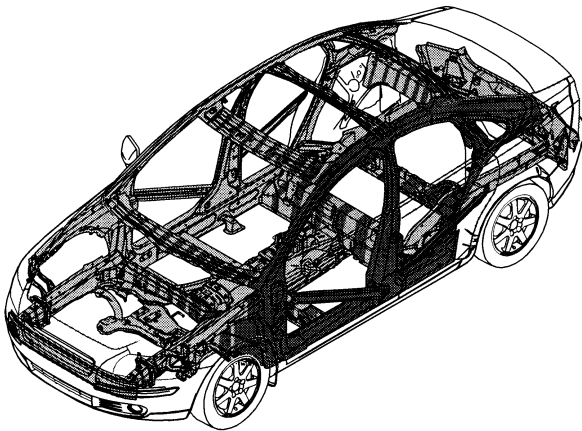
## DEFORMATION ZONES



### Front - S40/V50

Collision forces from the front are routed through the following zones:

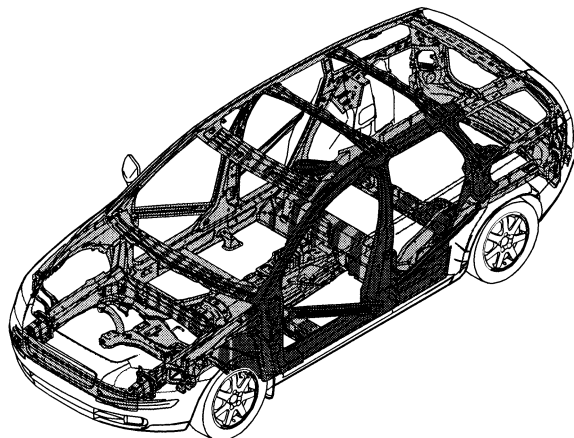
- Crashbox
- Front side members
- Upper front side members
- Lateral members firewall
- Sub frame
- A-posts - door posts
- A-posts - door sills

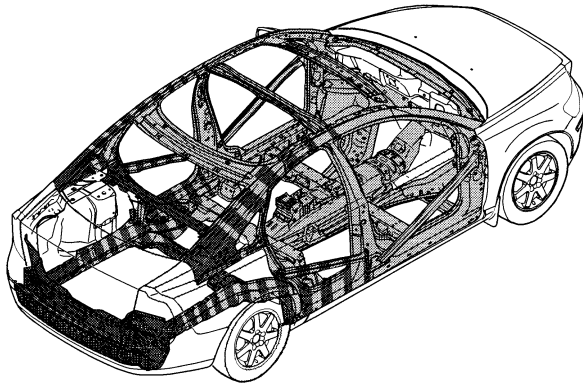


### Side - S40/V50

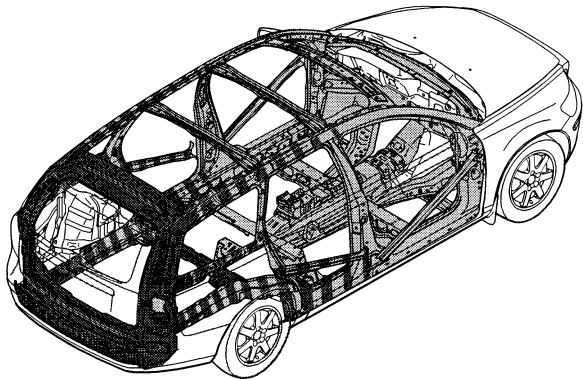
Collision forces from the side are routed through the following zones:

- Doors, door members
- Door sill
- Cross members on floor panel
- Cross member, rear floor
- A-posts
- B-posts
- C-posts
- Cross members, firewall
- Seat support, rear
- Lateral roof members
- SIPS box
  - Lateral bar in dashboard
  - Seat frame





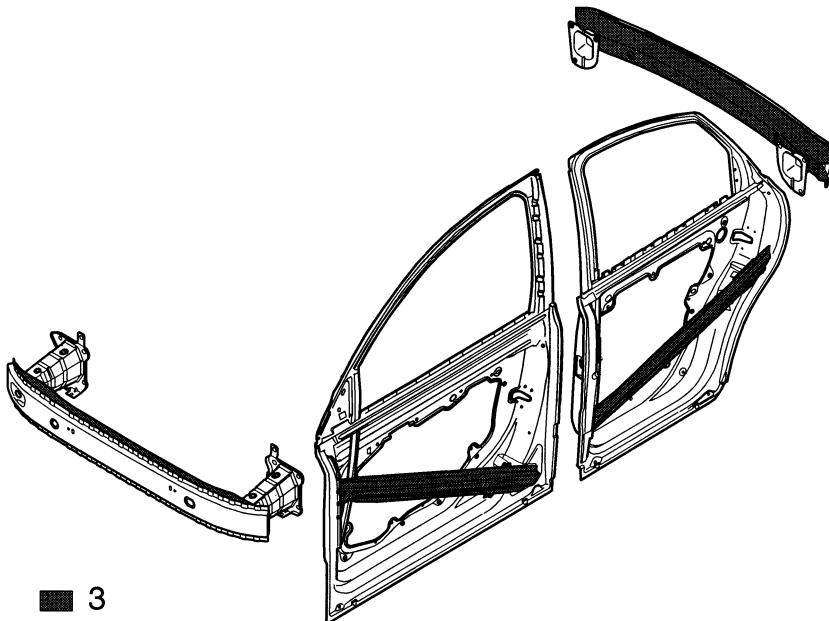
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### Rear - S40/V50

Collision forces from the rear are routed through the following zones:

- Bumper rail, rear
- Rear section (S40)
- Rear section/frame (V50)
- D-posts (V50)
- Rear side members
- Cross member, rear floor
- C-posts - door members
- C-posts - door sills



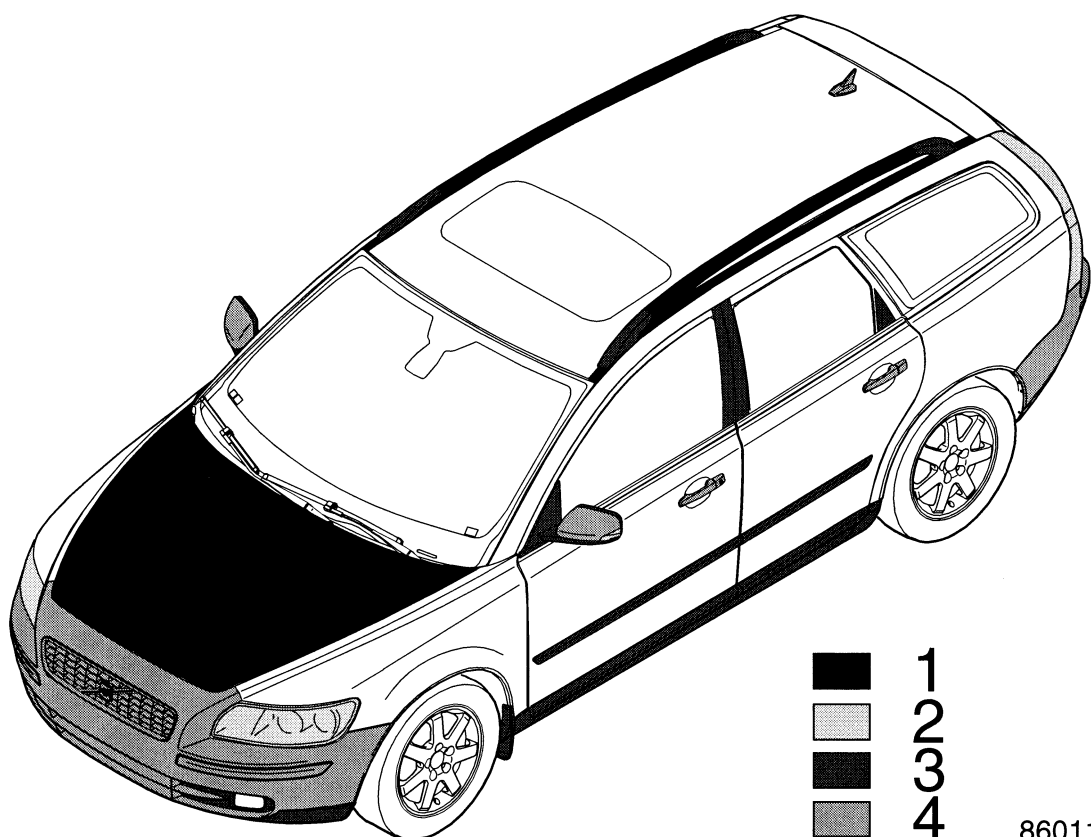
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3 - Boron steel

### Boron Steel

The items made of boron steel are:

- The inner sections of the bumper rails.
- The collision members in the doors.
- The reinforcements for the collision member mountings.



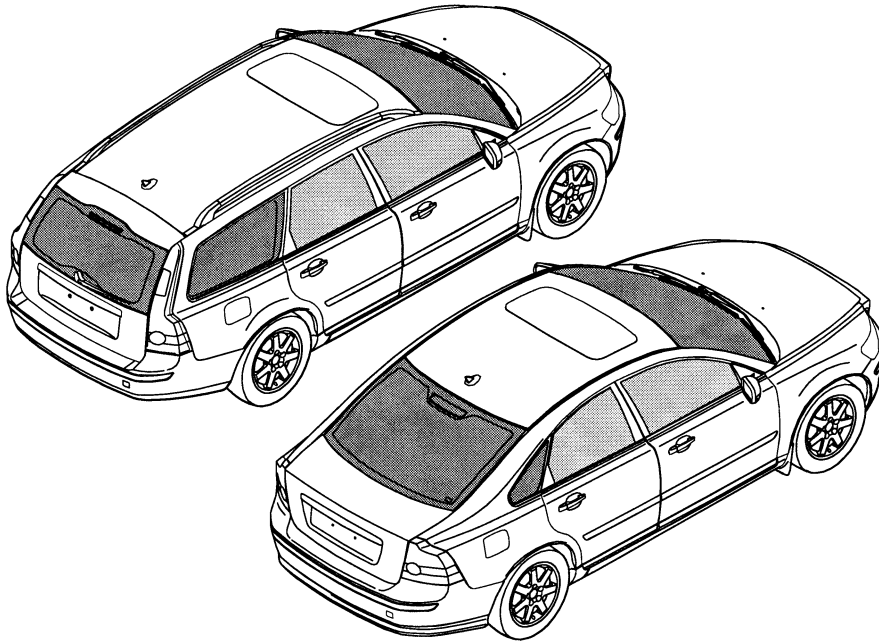
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## EXTERIOR

1	Aluminum	3	Plastic components
2	Transparent plastic	4	Painted plastic components

### Plastic/Plastic Material

- The hood is made of aluminum. The mountings for the hinges and hood catch are made of steel. These are joined by clinching.
- The bumper cover and grilles are made of PP+EPDM plastics.
- The door sills and lower trims are made of PP+EPDM T8 plastic.
- P-trim door, the center has PP+EPDM M26-plastic.
- The door mirror covers and rear spoiler are made of ABS plastic.
- The supports of the door mirrors are made of ASA plastic.
- The door handles are made of PA66 GF30 plastic.
- The tailgate / trunk lid handle is made of PC+ABS plastic.



## **WINDOWS**

The windows are lightly tinted green.

### **Windshield**

- Laminated glass, thickness 4.46 mm
- Available in two variants, with or without rain sensor

### **Door Windows**

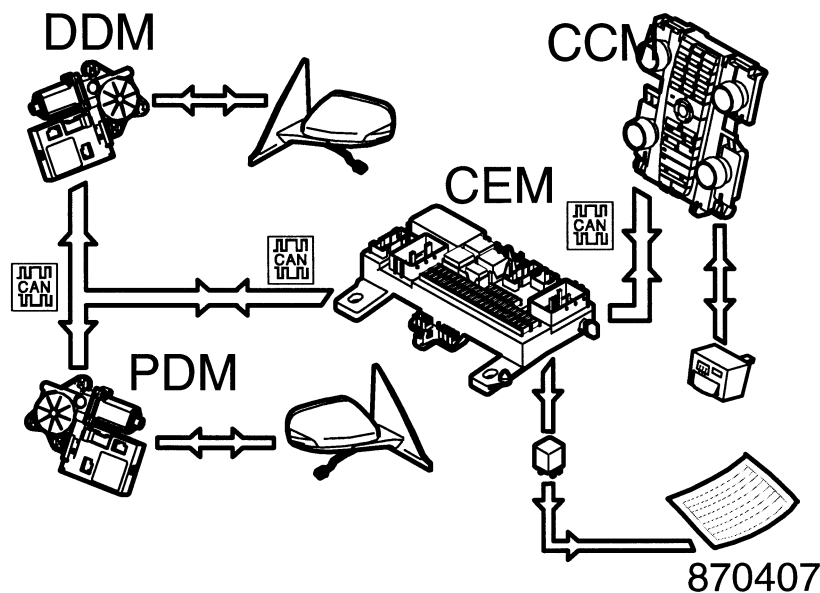
- Hardened glass, thickness 3.85 mm
- Laminated glass as option, thickness 4.96 mm

### **Side Windows**

- Hardened glass, thickness 3.85 mm
- The V50 has the AM/FM antennas.

### **Rear Windshield**

- Hardened glass, thickness 3.85 mm and heated
- The S40 has the AM/FM antennas and the FM diversity antenna.



## Demisting the Rear Window / Door Mirrors

Demisting the rear window and door mirrors is activated by the switch in the CCM.

The CCM transmits information about the selected status of demisting, via the CAN to the following control modules:

- CEM
- DDM
- PDM

### Rear Window

The OEM checks that the conditions for starting demist are met (for example, engine running). If the conditions are met the OEM activates the rear windscreen demist relay and the heating loops are supplied with power.

The OEM also transmits a request to light the LED in the switch back to the CCM via the CAN.

The function is automatically switched off after 12 minutes.

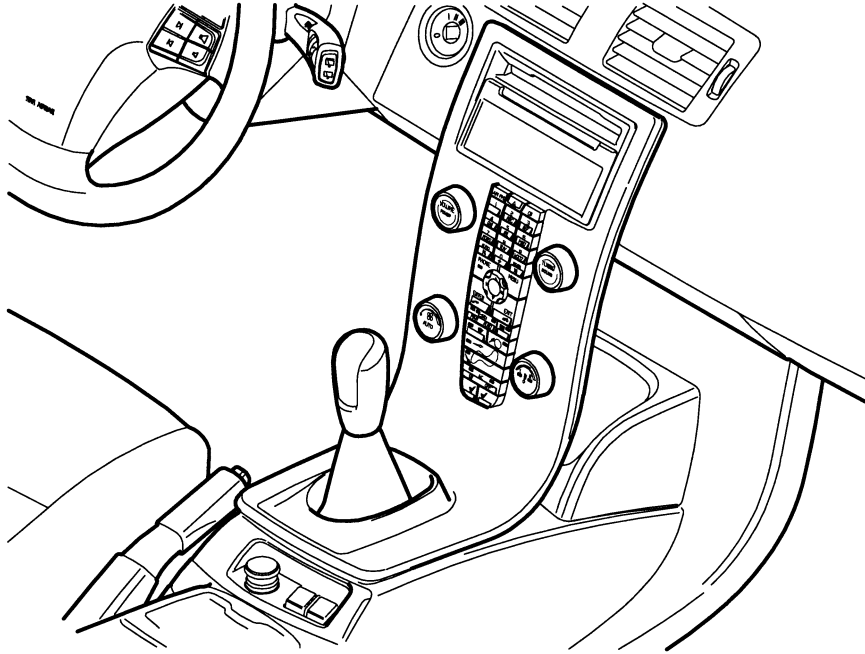
### Door Mirrors

The heating in the door mirrors is activated at the same time as the rear windscreen demist.

At the same time as the CCM transmits the signal to demist the rear windscreen, a signal is sent via the CAN to the DDM and PDM to activate the door mirror heating. When the DDM and PDM receive the signal the outputs to the relevant mirrors are supplied with power.

The function is switched off at the same time as the rear windscreen demist is switched off, which can occur in three ways:

- If the rear windscreen/door mirror demist button is pressed again after activation. (Occurs via a signal from the CCM.)
- The door mirror heating is automatically switched off four minutes after activation. The DDM and PDM receive a signal from the CCM requesting that the function is deactivated.



## INTERIOR

### CENTER CONSOLE (CENTER STACK)

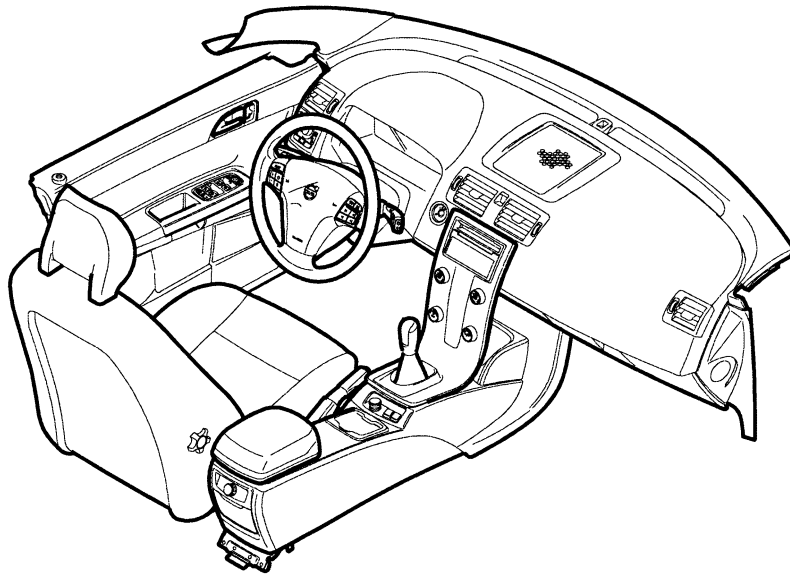
The S40/V50 has a completely new type of center console.

- The console is the same regardless of model and version.
- The keypad, lighting and wiring are integrated in the thin panel.
- The front side of the console is lit by two LEDs located in the roof console.

Different versions of the decorative panels are available:

- Standard (gray)
  - Aluminum
  - Wood effect
  - Transparent (Iced Aqua)
- The center console has an illuminated storage pocket on the rear side.





The upper section of the center console has the functions for Infotainment, (AM/FM is standard on all models) and integrated telephone.

The lower section are the controls for the climate control system.

There are two basic versions of the climate control system:

- MCC (Manual Climate Control)
- ECC (Electronic Climate Control)

NC and particle filters are standard for both MCC and ECC.

As an option the ECC can be equipped with an Air quality system.

## **INTERIOR TRIM**

### **Seats**

Power front seats are available as an option. All settings are made using the controls on the outside of the seat. An integrated memory stores three different settings.

Folding backrest on the front passenger seat is an option.

The backrest of the rear seat can be folded forward to facilitate carrying long loads.

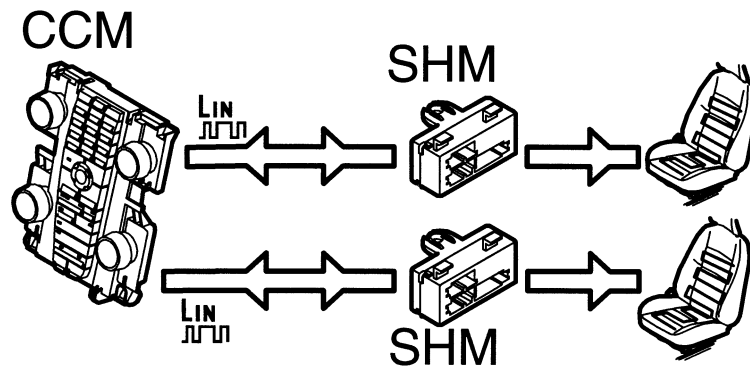
The rear backrest splits 60/40.

The center position of the rear seat can be equipped with an optional folding armrest.

### **Doors**

The door mirrors, window lift mechanisms and central locking system are operated by controls in the door panels.

- All doors have built in armrests.
- The center console between the front seats has an upper section that functions as an armrest and storage compartment.



## Examples of other functions checked by the CCM

### Controlling Seat Heaters

The seat heaters are controlled by the switches on the CCM. When the seat heating is activated, the first position is high temperature, pressing the button again gives low temperature. The status of the activation is shown by LEDs. The CCM transmits information about the selected temperature to the relevant Seat Heating Module (SHM) via the relevant LIN bus. The SHM then controls the current to the heater pad.

The SHM transmits the present status to the CCM.

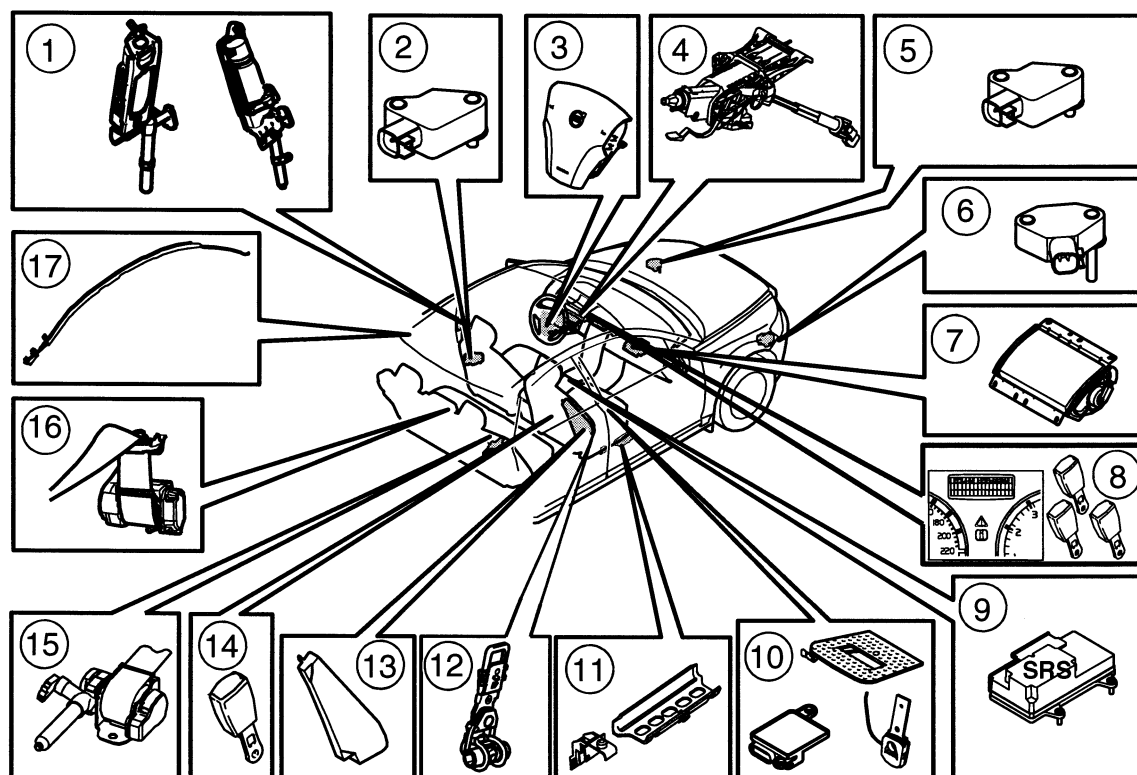
The communication between the CCM and the relevant SHM occurs in the following way:

- SHM left on LIN bus 1
- SHM right on LIN bus 2.

The CCM receives information from the GEM about the type of seat and upholstery via the CAN.

The levels of high and low temperature are adapted to the present seat and upholstery by the CCM.

The levels for high and low temperature can be adapted for the customer via VADIS.

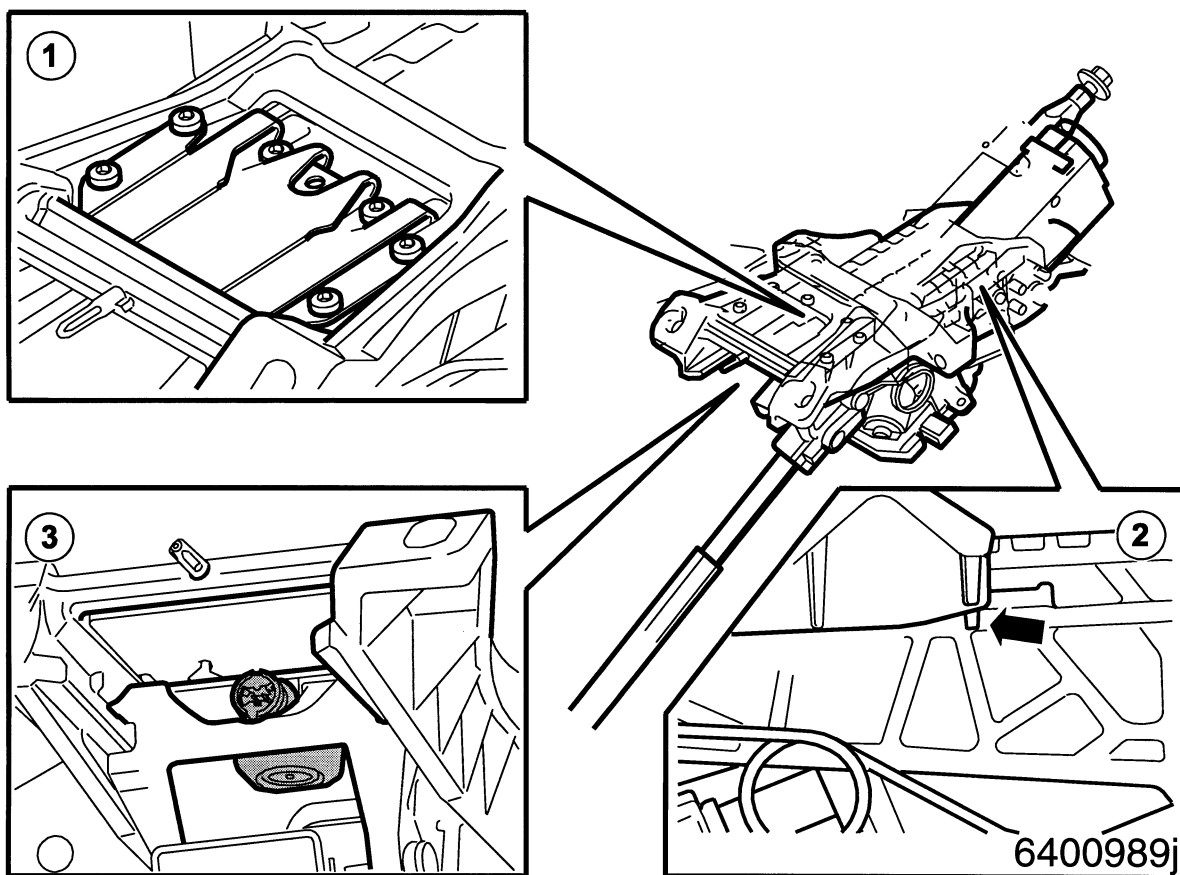


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## SAFETY SYSTEMS

### COMPONENT LOCATION

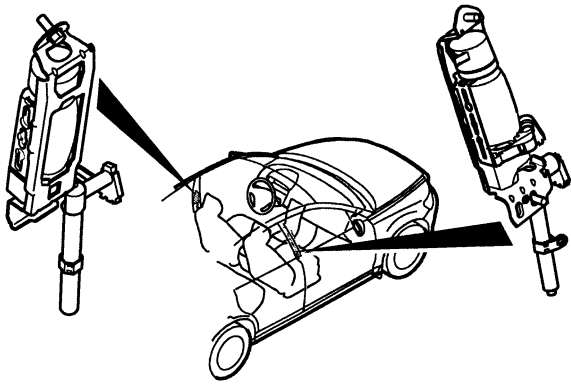
Num	Description	Num	Description
1	Adaptive seat belt (inertia) reel left and right sides front	10	OWS (Occupant Weight Sensor) system
2	Side impact sensor right and left B and C posts	11	Seat position sensor left and right sides front
3	Driver's airbag	12	Seatbelt force limiter lower seat belt mounting front, right and left side
4	Adaptive steering column	13	Side Impact Protection System (SIPS) bag left and right front.
5	Frontal collision sensor left front.	14	Seat belt buckle left and right sides front.
6	Frontal collision sensor right side front.	15	Seat belt (inertia) reel with pretensioner, left and right sides rear.
7	Passenger airbag.	16	Seat belt (inertia) reel, middle
8	Seatbelt information	17	Inflatable curtain left and right sides.
9	Supplemental Restraint System module (SRS)		



### ADAPTIVE STEERING COLUMN (USA/CANADA ONLY)

1	Deformation element	2	Marking	3	Igniter unit
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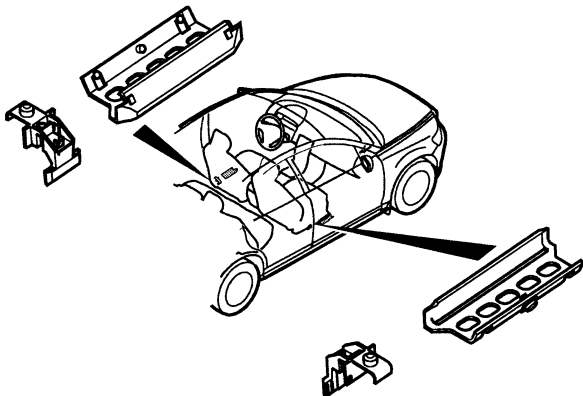
- When the collision protection system in the adaptive steering column is activated, a pin is deployed which makes the steering column adjustable longitudinally. If the level of a frontal collision exceeds a certain level, the steering wheel will be pressed into the dashboard to greater extent than with a rigid steering column.
- The steering is not affected when the pin has been deployed. The collision protection system in the adaptive steering column only functions if the driver is wearing a seat belt and when the airbag deploys. If the collision protection system in the adaptive steering column has deployed, the whole steering column must be replaced.
- The steering column has a marking which shows that the steering column has been compressed.



### Front Seat Belts

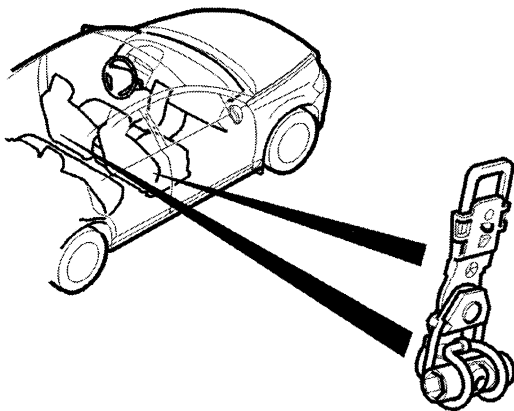
The front seat belts have a number of functions.

- Multi-stage adaptive force limiting
- Seat belt position sensor
- Seat belt tensioner



### Seat Position Sensor (SPS)

- SPS detects the position of the seat. This information can be used to determine what size passenger / driver is sitting on the seat.
- A short driver has the seat further forward to reach the pedals while a taller driver has the seat further back. It is important to determine the size of the passenger / driver sitting in the car so that the information can be given to the adaptive safety systems such as force limiter and airbags.
- The principle of SPS is only usable on the passenger seat. The principle can also be used on the driver's side.

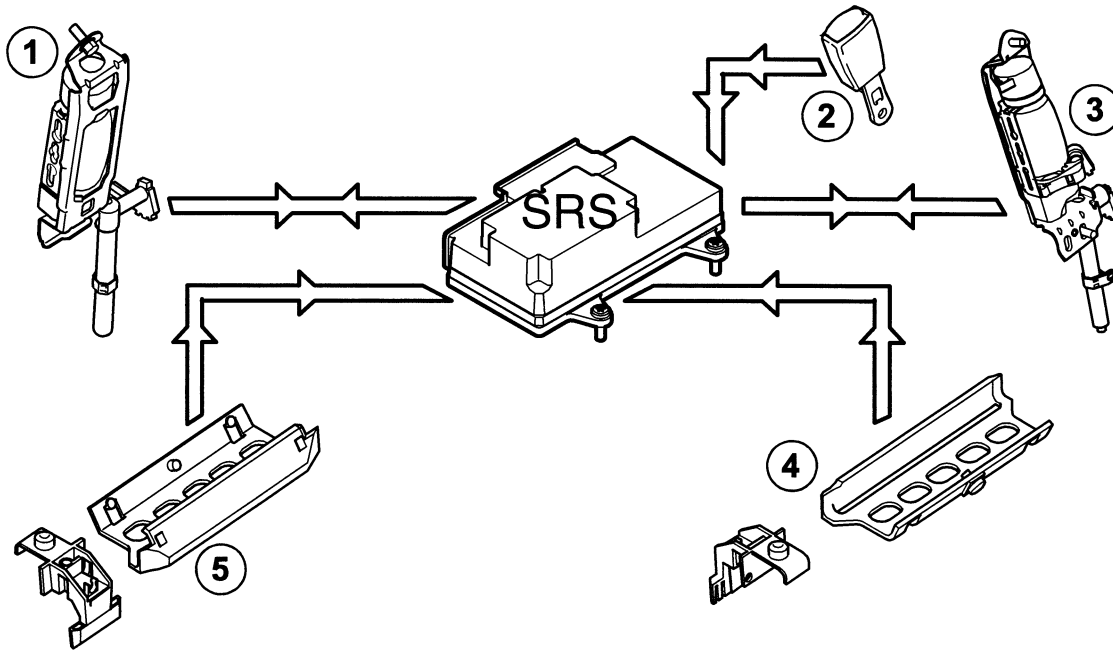


### Lower Force Limiter

Anchor Plate Load Limiter (APLL)

- APLL is a hard metal eyelet which is secured at one end to the seat belt mounting and at the other is twisted around a shaft like spring. The unit is mounted in the seat frame.
- The force against the seat belt makes the eyelet open and the metal stretches and the seat belt mounting moves up.

There is a controlled stretching of the seat belt which stops when the metal eyelet meets the mounting screw for the shaft.

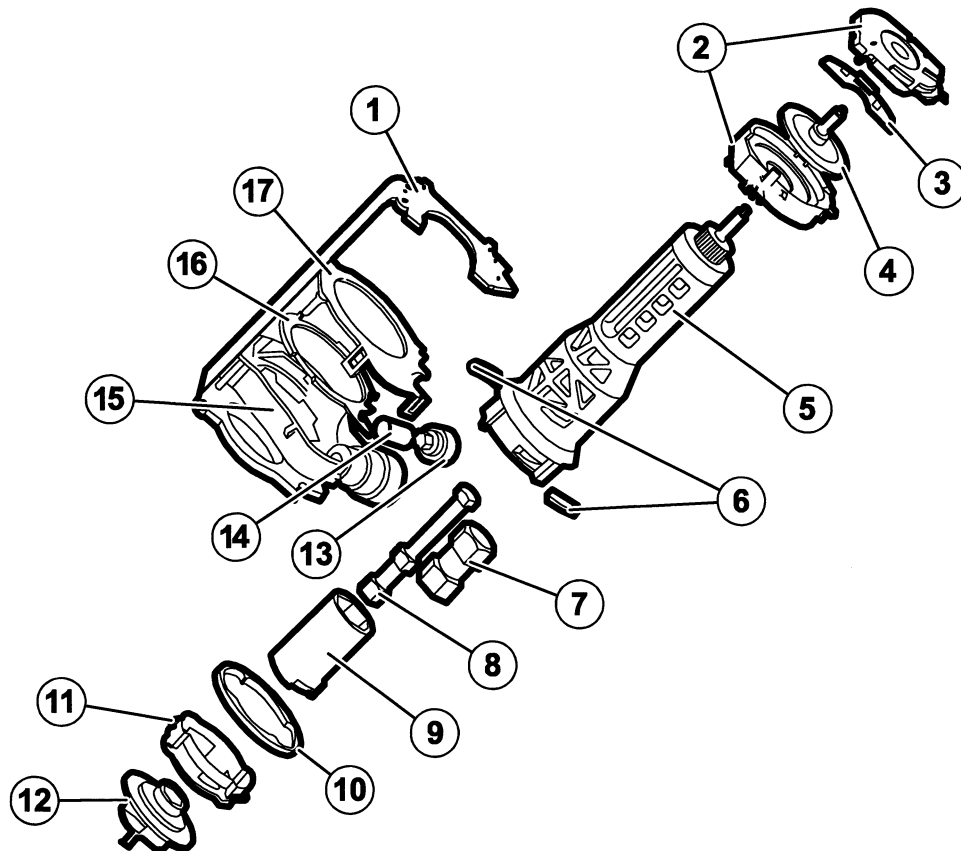


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1	Seat belt (inertia) reel passenger side with pyrotechnical force limiter and seat belt tensioner	3	Seat belt (inertia) reel passenger side with pyrotechnical force limiter and seat belt tensioner.
2	Seatbelt with hall sensor front, right and left side	4-5	Seat position sensors left and right front seats

## ADAPTIVE FORCE LIMITER - USA/CANADA

- The front adaptive seat belt force limiters have the task of improving seat belt function and giving all travelers, regardless of size, optimal protection.
- Both the adaptive seat belt force limiters are electrically separated from each other. The adaptive seat belt force limiters have a pyrotechnic charge which modifies the seat belt force to a lower level to reduce forces on the chest.
- The adaptive seat belt force limiter, seat belt reel, seat belt reel sensor and the seat belt tensioner are installed in one unit. In the event of a fault in a component the entire unit must be replaced.

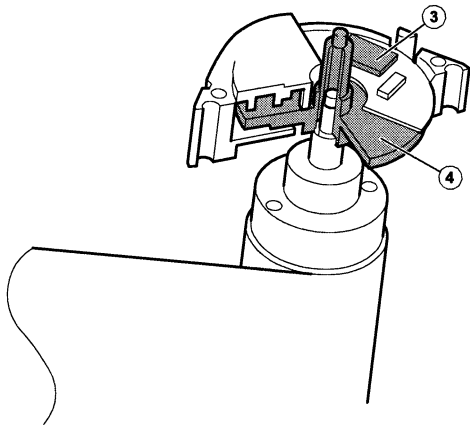


1	Seat belt housing	10	Stem washer
2	Housing seat belt position sensor	11	Bearing
3	Printed circuit board with hall sensor	12	Lock sleeve
4	Code disc	13	Gas generator
5	Mandrel	14	Piston
6	Inhibitor lugs	15	Gear housing
7	Torsion sleeve	16	Gear ring
8	Torsion shaft	17	Cover
9	Sleeve		

### ADAPTIVE SEAT BELT (INERTIA) REEL

- Because passengers vary in both weight and height, it is desirable to have a safety system which can tell the difference. In the event of a collision the safety system must not capture a smaller person (110 lbs) in the same way as a large person (230 lbs).
- Three stage force limiters have three levels of force limitation which gives the possibility of adapting the force limiting to a specific situation.
- When the force limiters should be reduced is determined by the characteristics of both the person wearing the seat belt and the severity of the collision.



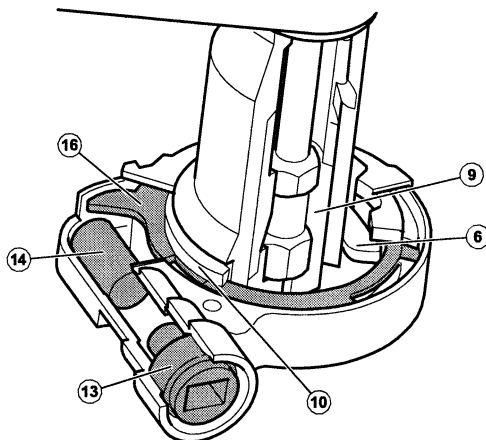
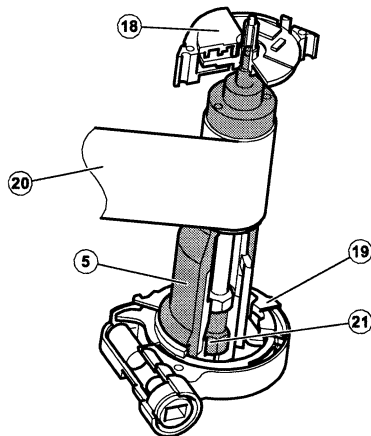


### BOBBIN ROTATION SENSOR (BRS)

- The seat belt position sensor is on the upper section of the seat belt (inertia) reel between the seat belt housing and the seat belt mandrel.
- The seat belt sensor measures the rotations of the shaft in order to calculate the seat belt feed.
- The BRS has a code disc (4) which is read off by a hall sensor (3) which measures the rotation.

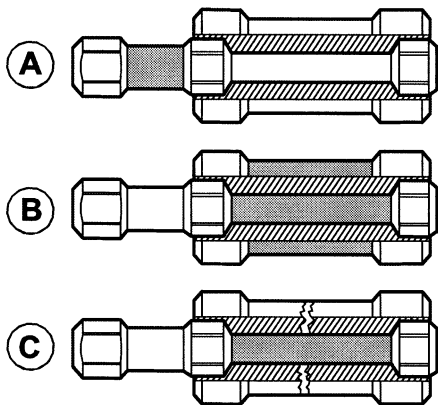
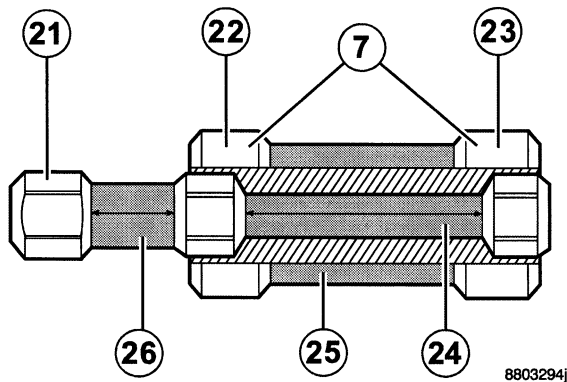
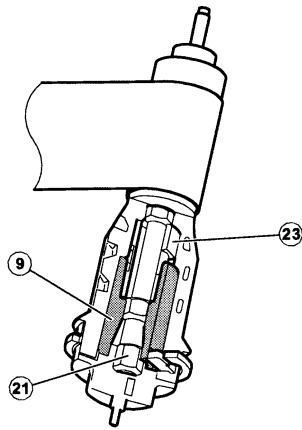
The code disc is magnetized with North and South poles in sections of 7.5°.

The disc is fixed to the mandrel and the hall sensor in the housing.



### COLLISION EXTENT (50th Percentile):

- When the seat belt is connected, the seat position sensor transmits information to the Supplemental Restraint System module (SRS).
- In the event of a collision, the SRS module transmits a signal which after 7ms triggers the tensioner and the mandrel tightens the belt.
- The function of the BRS is also checked.
- After tensioning the reel is locked.
- In this position BRS is zeroed.
- The body starts to put load on the belt. When the force on the belt reaches 5kN the lower section of the torsion shaft starts to turn and the mandrel feeds the seat belt out.
- After 60mm (24pulses) of seat belt feeding out, the BRS transmits a signal to the SRS.
- The SRS module checks that it is 50% or higher and triggers the gear mechanisms gas generator (13).
- The gas generator forces the piston (14) away which meets the gear ring (16). The gear ring starts to rotate against the ramps, moves upwards and presses up the stem washer (10). When the stem washer is moved up, the inhibitor lugs are released (6).
- The sleeve (11) presses the inhibitor lugs out (12) and releases itself from the mandrel and the 2-stage section starts to turn and gives a 4kN force limiter level in 40mm followed by a 2.5kN force limiter level.



## TORSION UNIT

### General

- The torsion shaft in the three-stage adaptive force limiter system is separated into two sections which have different diameters (position 24 and position 26). The narrower section of the shaft is surrounded by a sleeve (position 9) to give a third stage. By routing the force through the different sections of the torsion shaft different force limit levels can be achieved.

### Levels

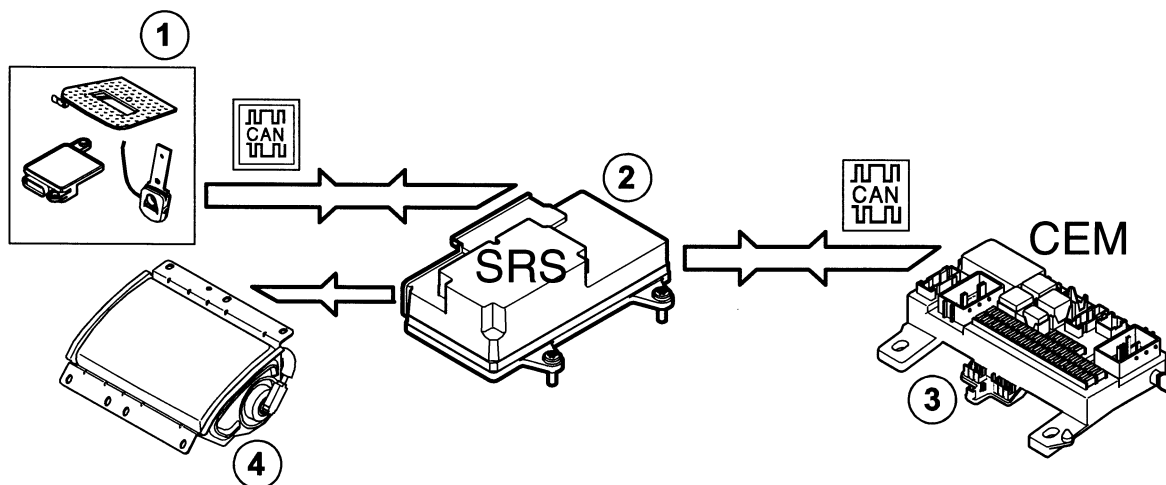
- The highest level is achieved by the force going through the thickest section of the torsion shaft (26). See position A.
- The next highest level is achieved by the force going through the thinner section of the torsion shaft (24) combined with the sleeve (9). See position B.
- The lowest level is achieved when the sleeve breaks and the force is only absorbed by the thinnest section of the torsion shaft (24). See position C.

### Function

- When force limiting starts the lower section of the torsion shaft (21) is fixed in the gear housing (15) which is fixed in the seat belt reel housing and surfaces (22) and (23) on the sleeve (9) are fixed in the mandrel. This means that only the surface (26) is used to limit force (see figure A).

The change to the next stage occurs when the pyrotechnical charge is activated.

- The charge forces the piston away which meets the gear ring (16). The gear ring starts to rotate against the ramps, moves upwards and presses up the stem washer (10). When the stem washer is moved up the inhibitor lugs are released (6). The sleeve (11) presses the inhibitor lugs out (12) and releases itself from the mandrel and the two-stage section starts to turn.
- The force now passes through the whole torsion shaft. The combination of the thin section of the shaft (24) and sleeve (9) is weaker than the thicker section of the shaft (26). This means that this combination (see figure B) takes up all the force.
- The Torsion sleeve is made of aluminum and breaks after a certain rotation of the shaft. When the sleeve has broken the thin section of the shaft takes all the force (see figure C).



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1	OWS	3	CEM
2	SRS control module	4	Passenger airbag

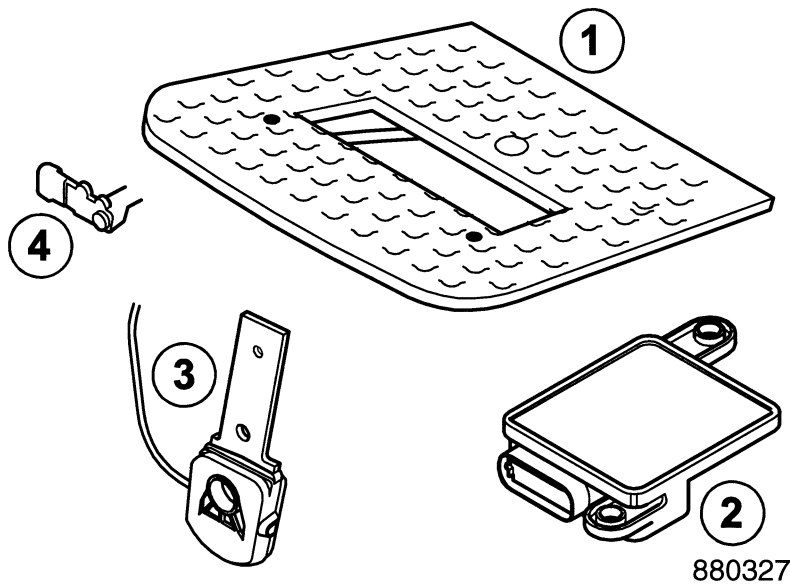
## OCCUPANT WEIGHT SENSOR (OWS) SYSTEM

The OWS consists of three cooperative components:

- Pressure sensor, installed under the seat cushion of the front passenger seat. The pressure sensor and the OWS module are linked by a hose. The pressure sensor has the task of registering the pressure experienced by the seat cushion, for example when someone is sitting on the seat.
- Seat belt force sensor, mounted on the seat belt mounting on the outside of the front passenger seat. The seat belt force sensor has the task of informing the OWS of the force with which the seatbelt is tensioned.
- OWS module, installed under the front passenger seat. Using information from both the pressure sensor and the seatbelt force sensor, the OWS module calculates the actual weight of the passenger.
- The OWS transmits signals continuously on the CAN network which the Supplemental Restraint System module (SRS) and the OWS are connected to.
- If the OWS does not function correctly the SRS module will:
  - deactivate the front passenger airbag.
  - light the passenger airbag warning lamp (PAD) in the roof console.
  - light the SRS indicator lamp and display the alert message in the DIM.
  - If a fault occurs in any of the components, the pressure sensor and the OWS module must be replaced at the same time.
- The seat belt force sensor can be replaced separately.

This system is designed to discriminate between a small adult, child seat, and an adult.

- Occupied
- Small adult



OCCUPANT WEIGHT SENSOR (OWS) SYSTEM

THE OCCUPANT WEIGHT SENSOR (OWS)

1	Pressure plate	3	Belt Tensioner Sensor (BTS)
2	OWS (Occupant Weight Sensor)	4	Pressure Sensor

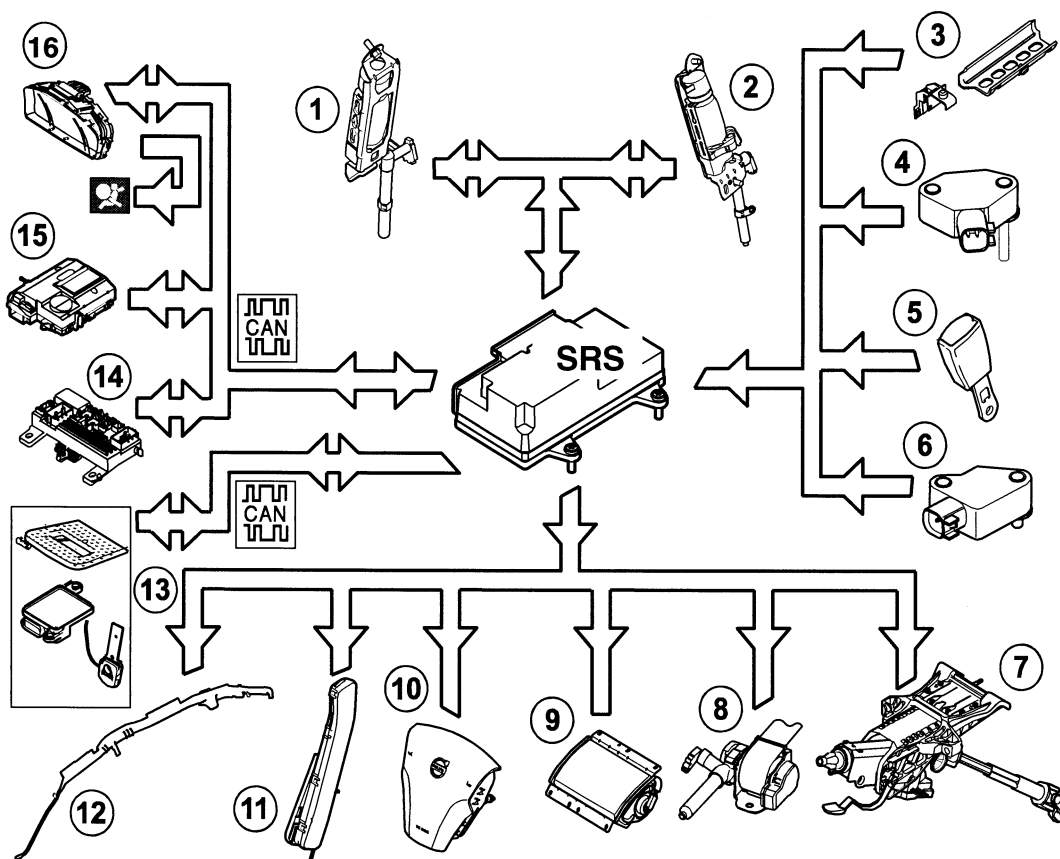
Occupant Weight Sensor (OWS) Function

Pressure plate (position 1)

- The OWS registers the pressure on the seat cushion of the passenger seat. The aim is to determine whether the seat is empty or not.
- The pressure plate measures the pressure in the seat when anyone sits in the seat
- The plate is filled with silicone oil. The oil is pressed via a hose to a pressure sensor.
- At a given pressure the pressure sensor transmits a signal to the OWS.
- The OWS can be calibrated using VADIS.

Belt Tension Sensor (BTS)

- Belt Tension Sensor (BTS) detects how hard the belt is stretched. It is located on the seat belt mounting.
- The aim of the sensor is to determine whether a child is sitting in the seat.
- To identify a child seat the tractive force in the seat belt is compared to the weight placed on the seat which is registered by the OWS.
- A child seat is usually pressed down into the seat at the same time that the seat belt is fastened, which means that the seat belt is secured with a high tension.
- Alone, the OWS would register a child seat as a heavy passenger, but by comparing the tractive force on the seat belt and the information from OWS, it can be determined if it is a child seat.



## SIGNAL SPECIFICATIONS, USA/CANADA

### INPUT SIGNALS

1	Seat belt position sensor left side	4	Side impact sensor B and C posts, right and left hand sides
2	Seat belt position sensor right side	5	Seat belt buckle front left / right side
3	Seat position sensor left / right side	6	Frontal collision sensor left / right side

### OUTPUT SIGNALS

1	Seat belt tensioner left front	9	Airbag passenger side
2	Seat belt tensioner, right front	10	Airbag driver's side
7	Adaptive steering column	11	Side impact protection (SIPS) bag left / right side
8	Seat belt tensioner left/right rear	12	Inflatable curtain left / right side

### SIGNALS VIA CAN COMMUNICATION

14	Central Electronic Module (CEM)	16	Driver Information Module (DIM)
15	PHone Module (PHM)		

### SIGNALS VIA LOCAL CAN COMMUNICATION

13	Occupant Weight Sensor (OWS)
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**Activation Levels, Airbags / Seat Belt Tensioners**

Collision level	Front seat		Rear seat	
	Seat belt not used	Seat belt used	Seat belt not used	Seat belt used
Level 1	No action is required	Seat belt tensioners are activated. The airbags are not deployed.	No action is required	No action is required.
Level 2	The airbags are activated with a slow pressure increase.	Seat belt tensioners are activated. The airbags are not deployed.	No action is required	No action is required.
Level 3	The airbags are activated with a slow pressure increase.	Seat belt tensioners are activated. The airbags are activated with a slow pressure increase. Collision protection system adaptive steering column is activated (USA/CANADA only). Adaptive seatbelt force limiter can be activated (USA/CANADA only).	Seat belt tensioners are activated.	Seat belt tensioners are activated.
Level 4	The airbags are activated with a fast pressure increase.	Seat belt tensioners are activated. The airbags are activated with a slow pressure increase. Collision protection system adaptive steering column is activated (USA/CANADA only). Adaptive seatbelt force limiter can be activated (USA/CANADA only).	Seat belt tensioners are activated.	Seat belt tensioners are activated.
Level 5	The airbags are activated with a fast pressure increase.	Seat belt tensioners are activated. The airbags are activated with a fast pressure increase. Collision protection system adaptive steering column is activated (USA/CDN only). Adaptive seatbelt force limiter can be activated (USA/CDN only).	Seat belt tensioners are activated.	Seat belt tensioners are activated.