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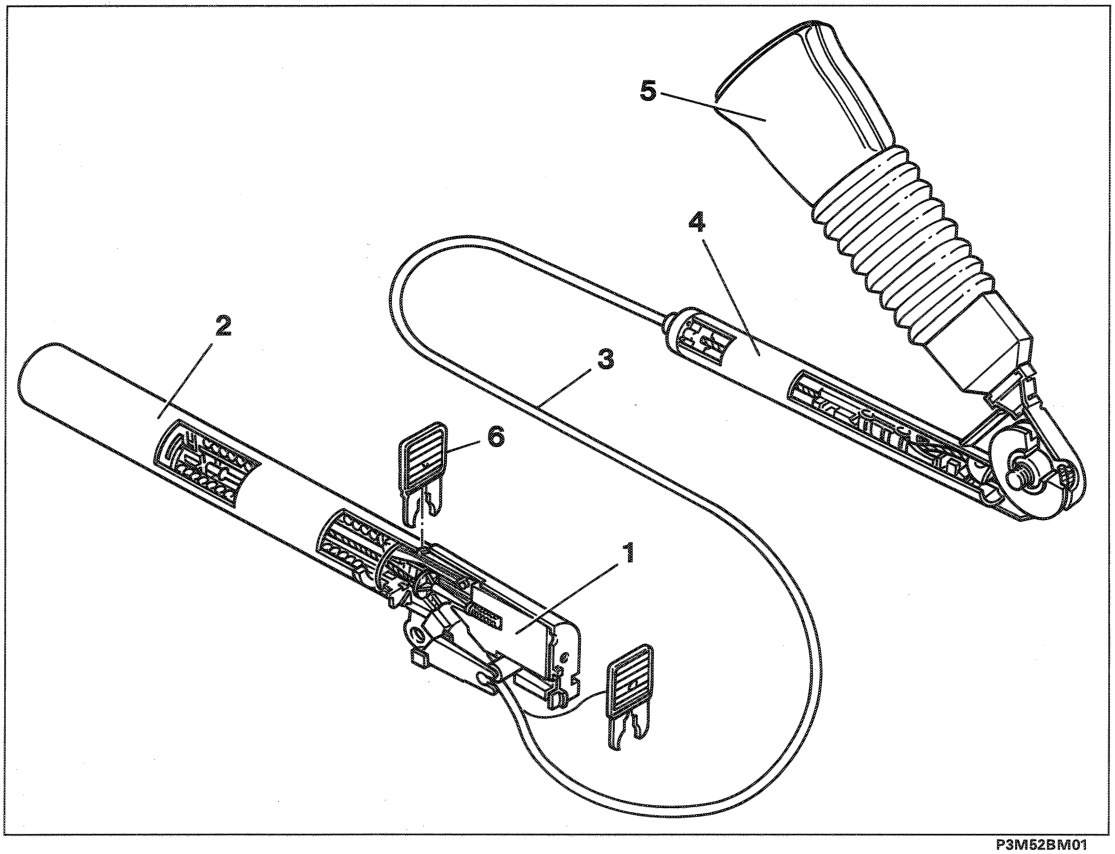
MECHNICAL FRONT SEAT BELT PRE-TENSIONER

Introduction

Pre-tensioners are safety devices which have the task of improving the efficiency of conventional seat belts.
In effect, they act on the seat belt webbing, in the case of an impact, further tensioning the belt, ensuring that the passenger stays firmly put in their seat.
This device, together with AIR-BAGS, considerably reduces the danger of injury to passengers in the case of serious head-on collisions.
The operation of the device is based on a suitably calibrated mechnical deceleration sensor which detects the impact condition; the sensor is made up of a mass which moves in the direction in which the vehicle is travelling, releasing a pre-tensioned spring, connected to a bowden cable which tensions the seat belt webbing.

Composition

The seat belt pre-tensioning system is an assembly which is fitted underneath the seat and is made up of the following elements:
- a sensor (1) which is capable of detecting the degree of deceleration of the vehicle;
- a power unit (2) which houses the pre-loaded spring;
- a bowden cable which has the task of transmitting the movement and the force from the power unit to the webbing locking system;
- a locking system (4) which allows the locking of the webbing (5) once the spring has been activated, preventing the webbing from being released on account of the counter-thrust of the actual spring;
- the webbing (5) which is capable of retracting up to a maximum of 8 cm once the system has been activated.



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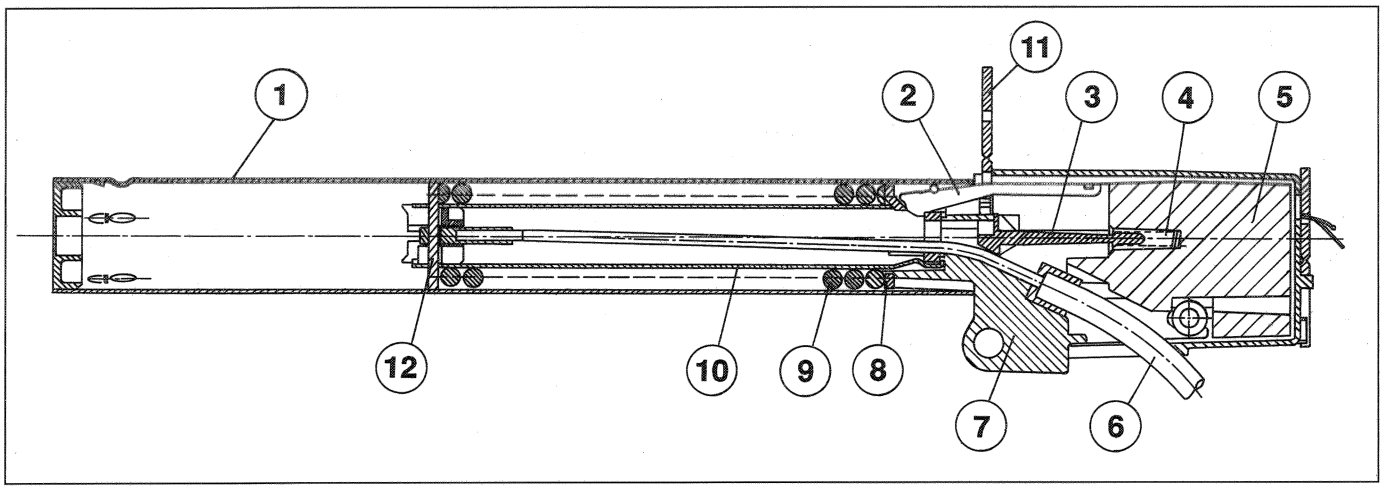
1. Deceleration sensor
2. Power unit
3. Bowden cable
4. Locking system
5. Seat belt webbing
6. Safety clip

Description of the components

Power unit

The power unit incorporates the deceleration sensor and the pre-loaded sprign which supplies the retraction force for the webbing.
Inside the outer casing (1) there is a power spring (9) and a moving element (10), connected directly to the bowden cable (6) which has the task of transmitting the movement of the spring to the webbing locking unit.
With the device ready for operation, the spring (9) is loaded between the end (12) of the moving element (10) and the reaction element (7) washer (8) fixed to the structure of the seat. In the rear of the power unit there is a deceleration sensor (mass) (5), a reaction element for the spring fixing it to the seat (7) and the device (2) release levers. The mass is kept in the non intervention position by the pin (3) and the reaction spring (4). The safety clip (11) avoids the activation of the device because it prevent the mass from moving forwards (in the direction of the mass) and releasing the levers (2) which keep the moving element loaded by the spring (9).



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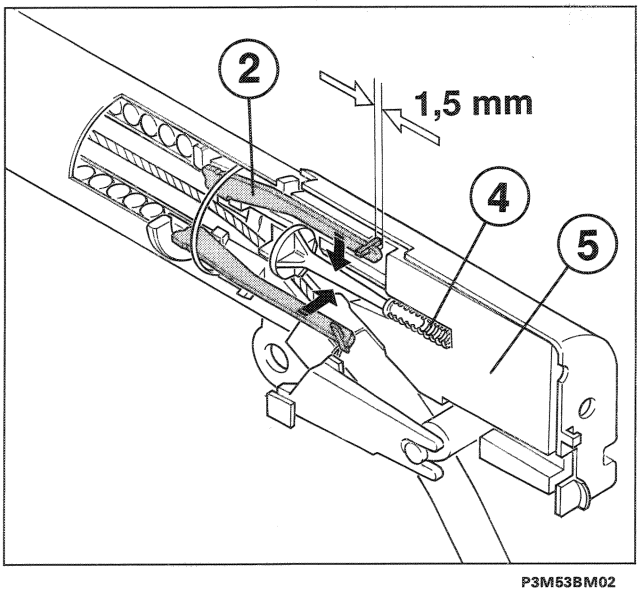
1. Outer casing
2. Locking lever
3. Pin
4. Reaction spring
5. Deceleration sensor (mass)
6. Bowden cable
7. Element for fixing to seat
8. Washer
9. Pre-loaded spring
10. Moving element
11. Safety clip
12. End of moving element



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At the moment of impact, the inertia mass (5) moves forwards overcoming the reaction force of the spring (4). Through a movement of about 1.5 mm, the step on the front part of the mass releases the locking levers (2) allowing the operation of the device.

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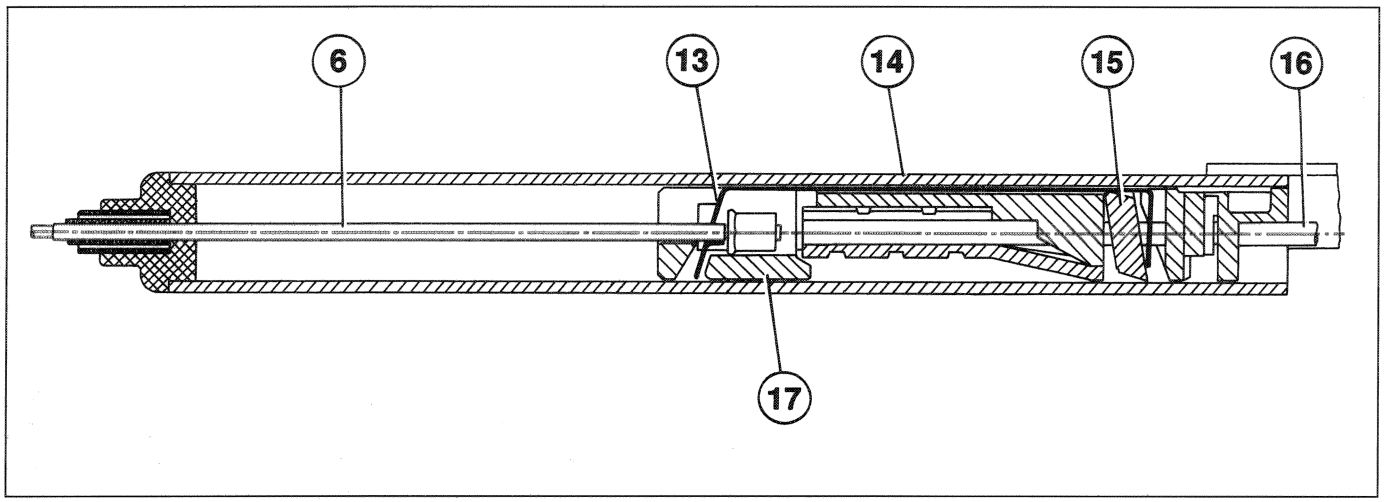
Locking device

The locking device by the seat belt attachment webbing has the task of preventing the belt from becoming loose on account of the counter-force created by the mass of the occupant of the seat when the force of the main spring for the power unit is reduces once it is fully extended.
The device is made up of an outer casing (14) with splining on the inner circumference, a connecting element (17) which can slide inside the casing (14) and a bowden cable (6) and retraction cable (16) for the actual webbing.
There is also a safety spring (13) and a locking ellipse (15) which have the task of allowing the movement of the connecting element and, consequently the webbing in one direction only (retraction); in effect, when the seat belt tends to become loose the locking ellipse thrust by the safety spring (13) tends to get stuck in the splining in the outer casing (14) circumference.



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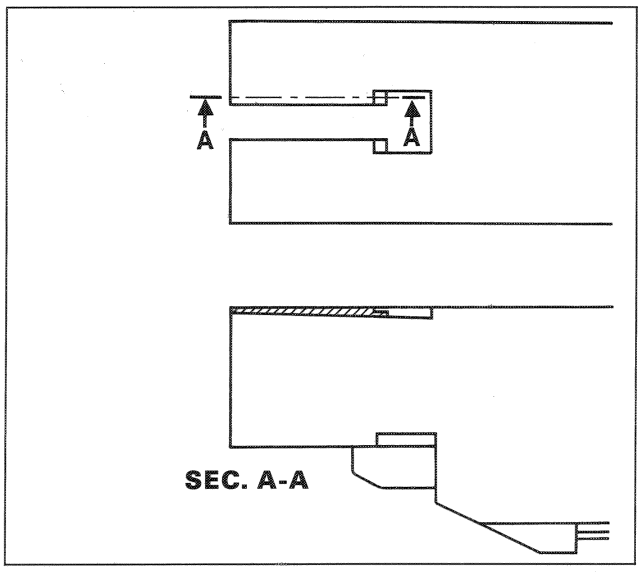
6. Bowden cable
13. Safety spring
14. Outer casing
15. Locking ellipse
16. Webbing retraction cable
17. Element connecting webbing retraction cable/end of bowden cable



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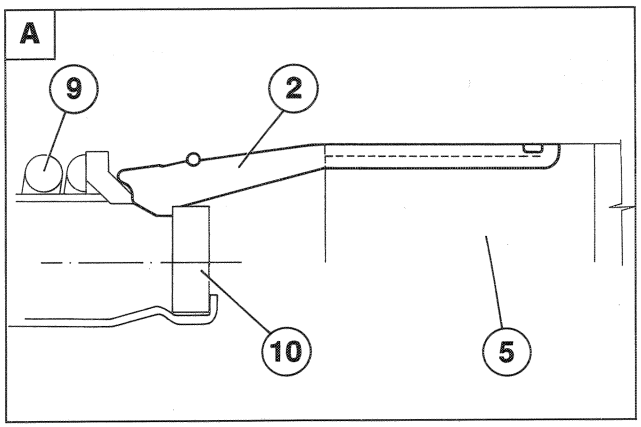
Operation

NOTE *The diagram shows the partial cross section of the deceleration sensor (5) which highlights the locking lever retaining tooth.*

The intervention of the seat belt pre-tensioning device takes place as follows:



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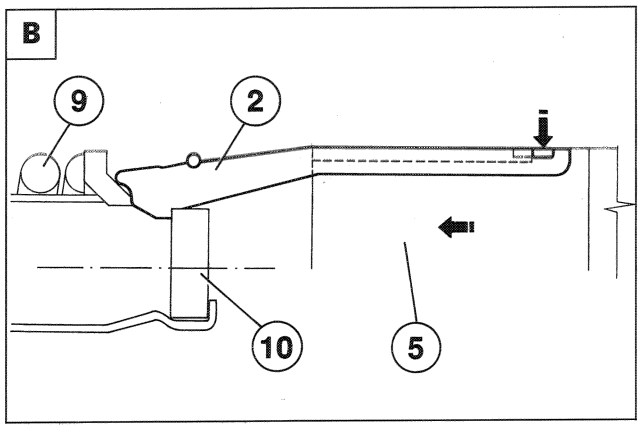
- in normal conditions the pre-loaded spring (9) for the power unit and the moving element (10) connected to it are kept in positin by the locking lever (2) kept in position, in turn, by the section of the front part of the deceleration sensor (5) (figure A);



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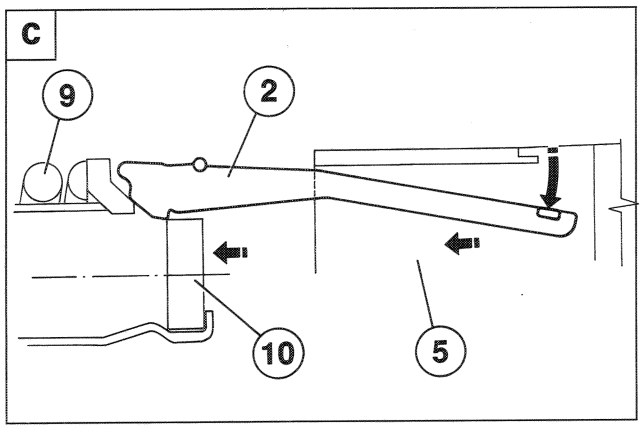
- in the case of an impact the deceleration sensor (5) moves in the same direction as the vehicle is travelling in, which releases the locking lever (figure B).



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NOTE *At this point the lever, subjected to the force of the main spring (9), is free to rotate releasing the moving element (10) loaded by the spring (figure C).*

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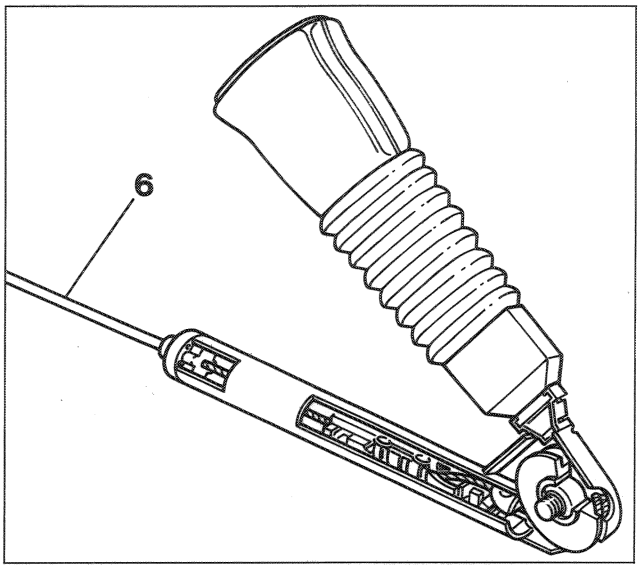

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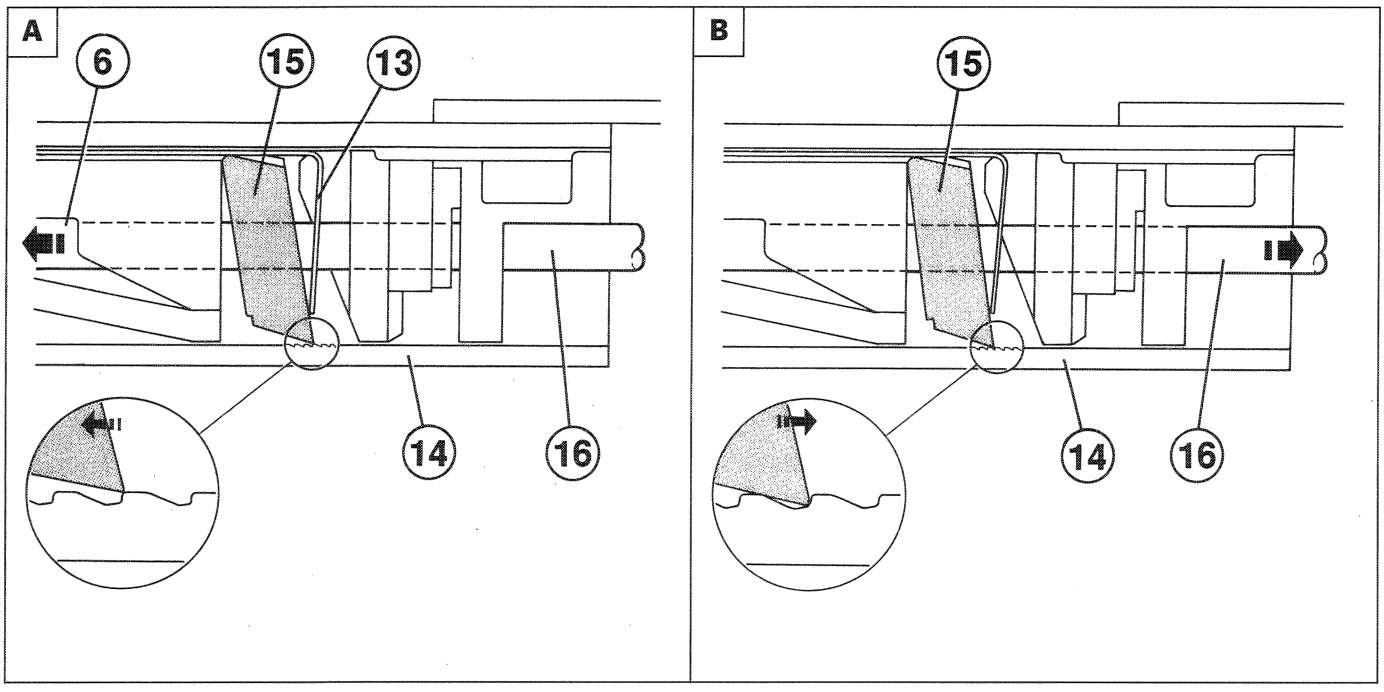
The action of the main spring (9) for the power unit tensions the bowden cable (6) connected to the locking cable, which, in turn, activates the retraction of the seat belt webbing.

On account of the tension induced by the passenger on the webbing and the counter-force of the main spring (9), once the device is activated, the belt tends to be released.
For this purpose a locking system has been introduced, incorporating a locking ellipse (15) in the anchorage cable which, at the end of the tensioning, is driven by the splining in the outer casing (14) and is kept there by the safety spring (13). This prevents the release of the belt.



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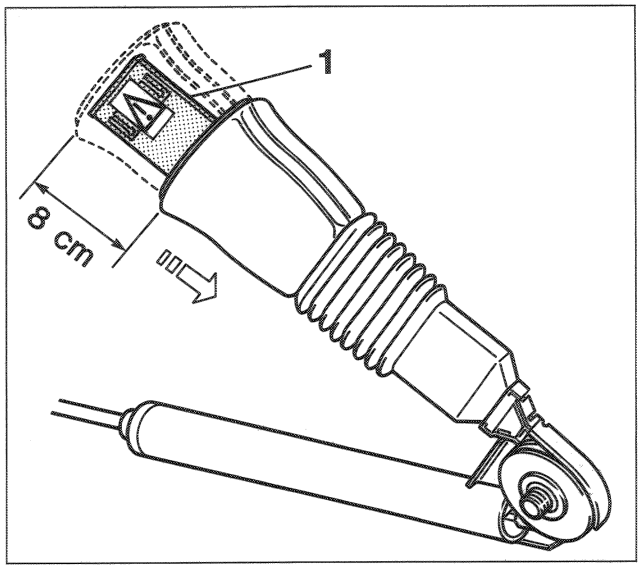
The diagram illustrates the webbing locking system. In detail A the locking ellipse (15) is driven by the splining in the outer casing (14) by the action of the safety spring (13) when the belt is retracted by the bowden cable. In detail B the ellipse (15) is locked when the webbing retraction cable tends to return to the original position.



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The operation of the device involves the retraction of the buckle by up to a maximum of 8 cm. At the same time a yellow coloured indicator (with a red label) (1) comes out of the actual buckle to indicate that the pre-tensioner has come into operation.

Once the device has come into operation it should be replaced in one piece.

WARNINGS FOR HANDLING THE PRE-TENSIONER

- Handle the device with extreme caution. Take care not to drop it.
- When working on the assembly, never, under any circumstances, use tools such as hammers or percussion screwdrivers which could transmit impacts to the tensioning device, activating the pre-loaded spring.
  The device is very simple on account of which the various components should not be forced when fitting. If there are problems, only adjust the seat if the tensioning device is not fitted.
- Always insert the safety clip if the system or the seat have to be removed-refitted from the vehicle.
- Never expose the power unit to impacts under any circumstances.
- Do not carry out any maintenance operations (dismantling-reassembly) to the pre-tensioner components.
- In order to replace the pre-tensioner the seat must be removed from the vehicle (see page 61).

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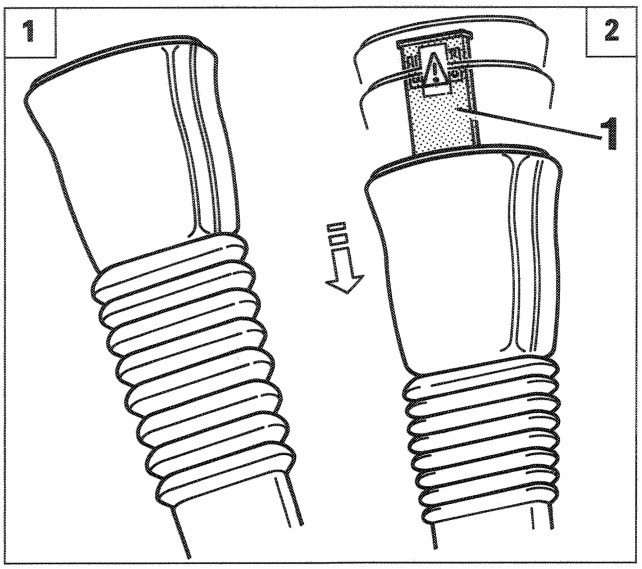
The pre-tensioners intervene, in the case of an impact, even if the seat belts have not been fastened; if the pre-tensioners have come into operation with the seat belts fastened, the belts must be replaced as well as the pre-tensioner.

Handle the pre-tensioner at the points shown by the black arrows when removing-refitting it.
Do not handle the seat at the points shown by the red arrows.

NOTE *In addition to the points indicated, never handle the device by:*
- *the branch of the buckle;*
- *the pre-tensioner power unit.*



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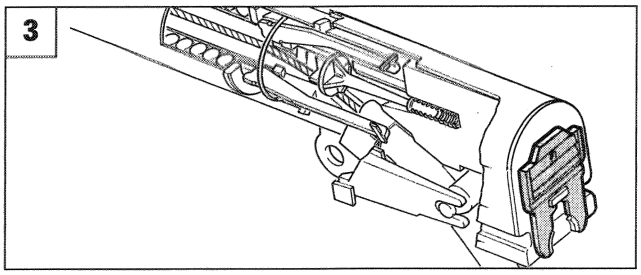

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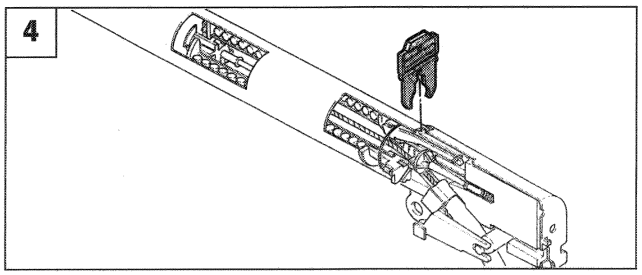

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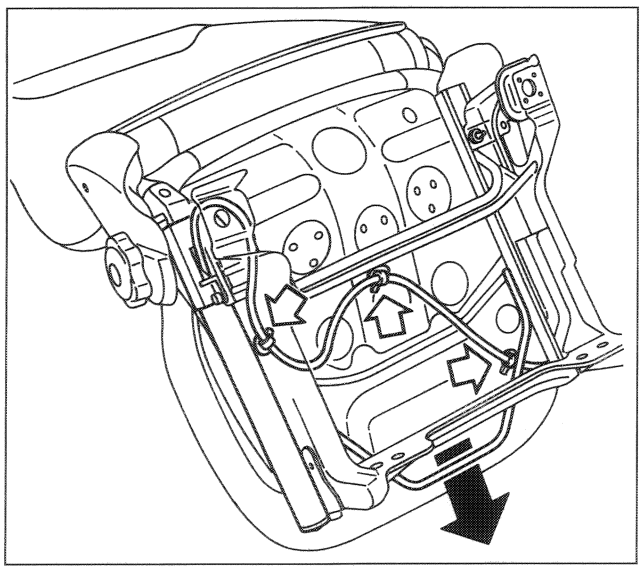

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REMOVING SEAT BELT PRE-TENSIONER

If the device has to be removed, work very carefully paying meticulous attention to the warnings listed below:

Removing a non activated pre-tensioner

NOTE *The buckle is in the normal position and the indicator is not visible (figure 1).*

Remove the safety clip, on the cover of the sensor frame (figure 3) and insert it perpendicularly in the protective pipe (figure 4).
Handle with extreme caution.
Do not use hammers or other similar tools.

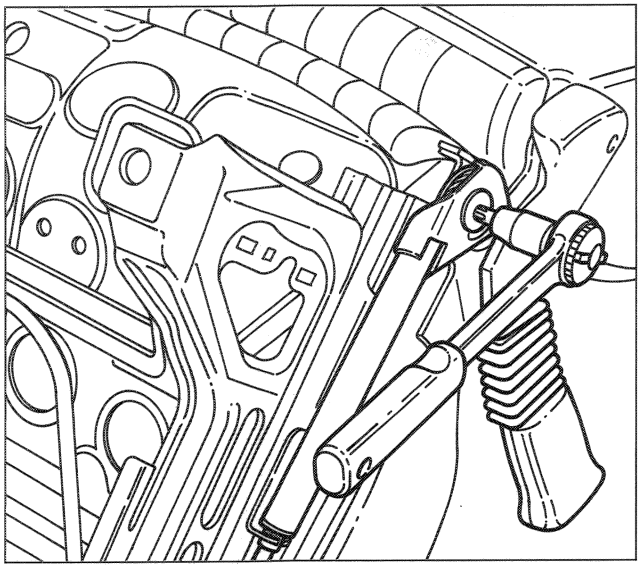
Removing an activated pre-tensioner

NOTE *The buckle is retracted and the indicator 1 is visible (figure 2).*

After having removed the complete seat from the vehicle, position it upsidedown, taking care not to damage the actual seat upholster, then proceed as described below:

- operate the guide control lever and slide the seat forwards to the end of travel position;
- release the bowden cable retaining bands.

The pre-tensioner cannot be reused, but must be replaced in its entirety.



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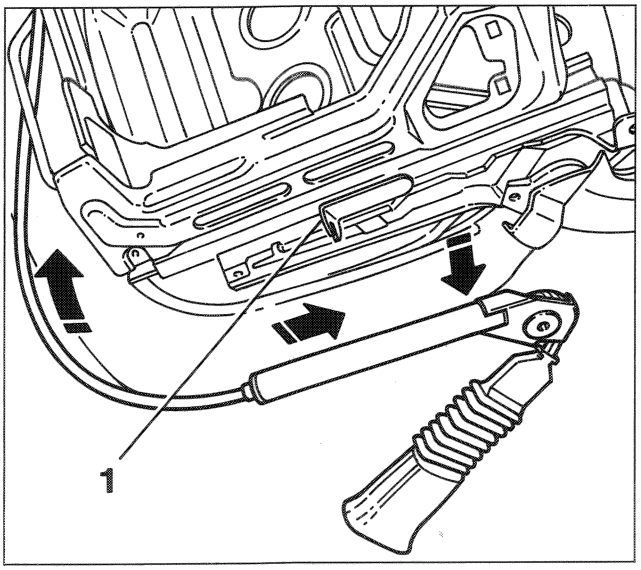
- release the pre-tensioner from the side of the belt mounting using a special spanner.



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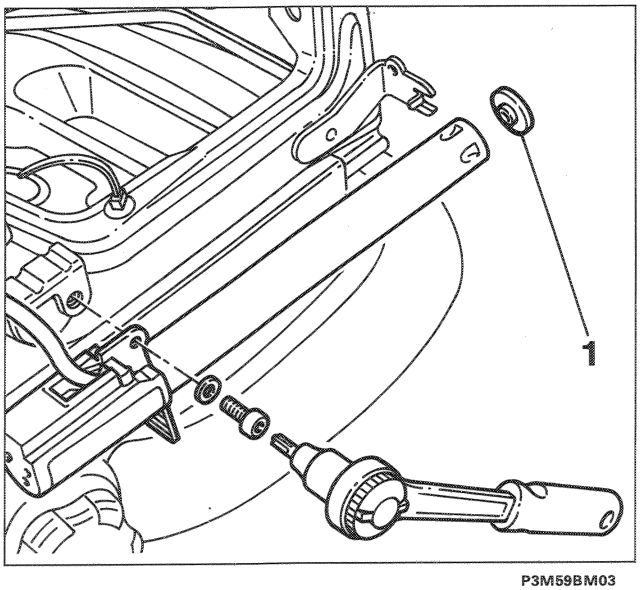
- separate the belt mounting, releasing the cable from the front bracket (1) through the special slot, then position it to the side of the seat;



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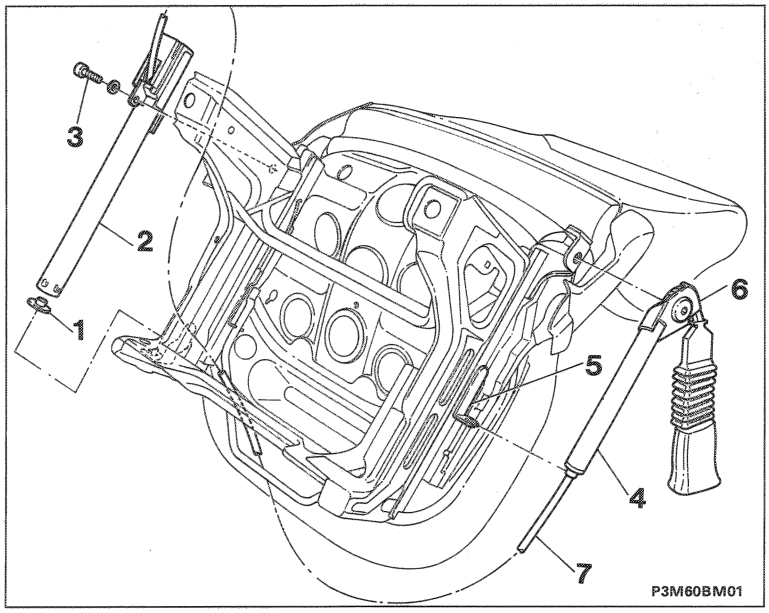
- remove the pre-tensioner, after having undone the fixing bolt indicated.

Recover the rubber mounting (1) positioned at the rear of the power unit, because it will be used when fitting the new pre-tensioner.



PROCEDURE FOR FITTING SEAT BELT PRE-TENSIONERS

- *Before refitting the pre-tensioner, make sure that the (blue) safety clip is properly inserted;*
- *do not force the fitting if for any reason the device cannot be fitted easily. Do not use hammers or other percussion tools. Do not open or remove.*

NOTE *The diagram illustrates the left seat.*

The following operations should be carried out for the fitting (see diagram above):

1. Position the mounting (1) between the power unit and the bracket on the seat.
2. Position the power unit (2) against the front bracket of the seat; align the opening in hte power unit with the one in the bracket, insert the hexagonal head bolt (3) and tighten it to torque (2.16-2.64 daNm).
3. Pass the locking unit and the seat belt buckle between the cross member and the bottom of the cushion in order to pass the bowden cable through; for the driver's seat, pass the cable between the release lever and the bottom of the cushion and for the passenger seat pass the cable above the release lever, as illustrated in the diagrams underneath.
4. Insert the front part of the locking unit (4) in the mounting bracket (5); proceed with fixing the rear part of the actual unit using the appropriate bolt (6) and tighten it (3.6-4.4 daNm).
5. Fix the bowden cable (7), using the special bands, introducing them into the openings in the lower side of the seat frame. Move the excess part of the bands aside.
6. Restore the seat to its correct position, sliding it along the guides using the control lever. Reposition the seta in the vehicle, taking care to only move it by the sides and make sure that the seat is moving normally.
   The safety clip can be extracted at this point, positioning it on the sensor frame cover; the front seat belt pre-tensioner device is operational.

NOTE *The cables have three white paint reference marks which indicate the attachment points for the bands to ensure the correct curvature radii.*

Diagram showing fitting of left seat

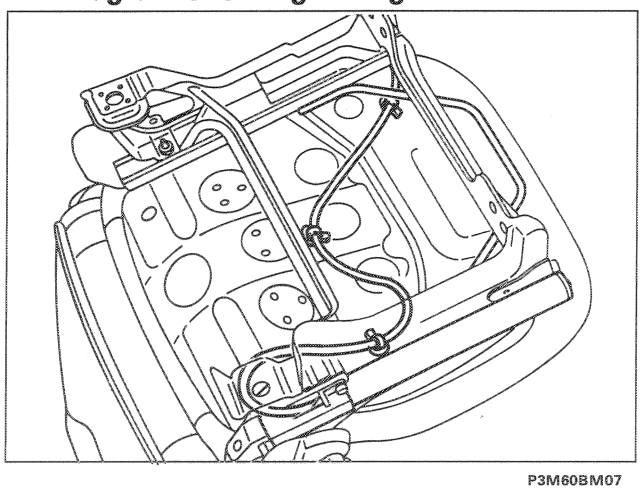
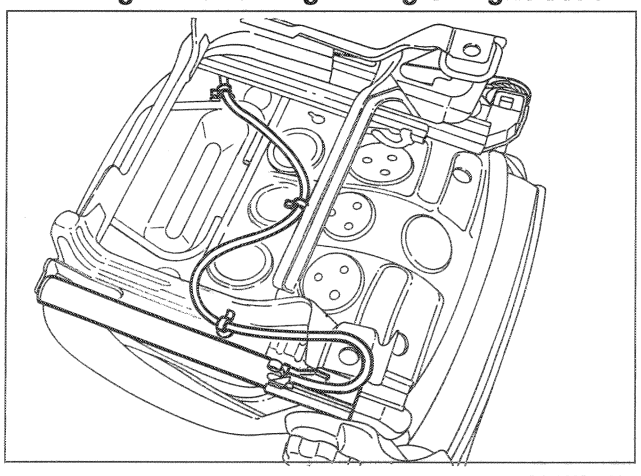
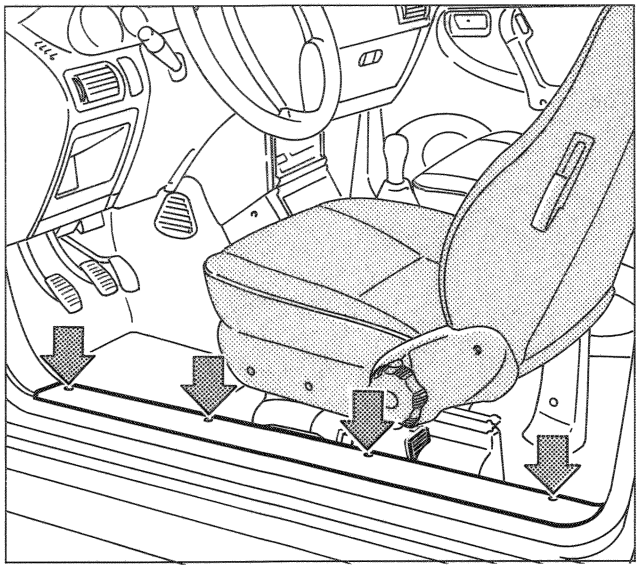


Diagram showing fitting of right seat





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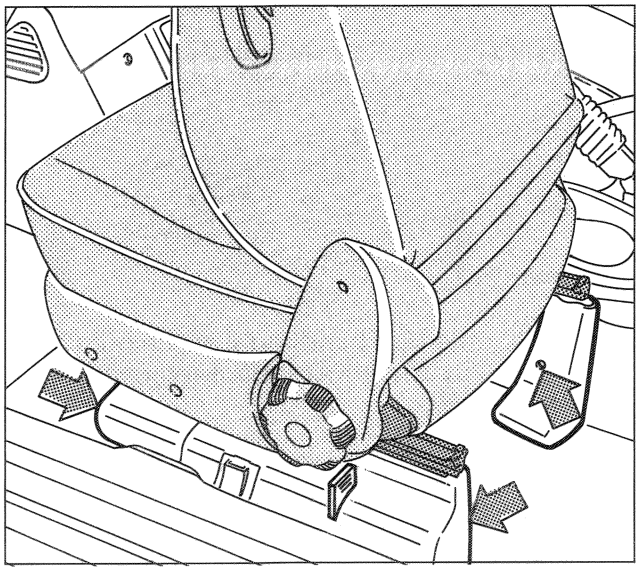
REMOVING-REFITTING FRONT SEAT

Before starting to remove the seat, observe the procedure described below to avoid activating the seat belt pre-tensioner.

- Insert the safety clip in the special slit in the seat belt pre-tensioner;
- remove the inner underdoor lining, acting on the bolts shown;



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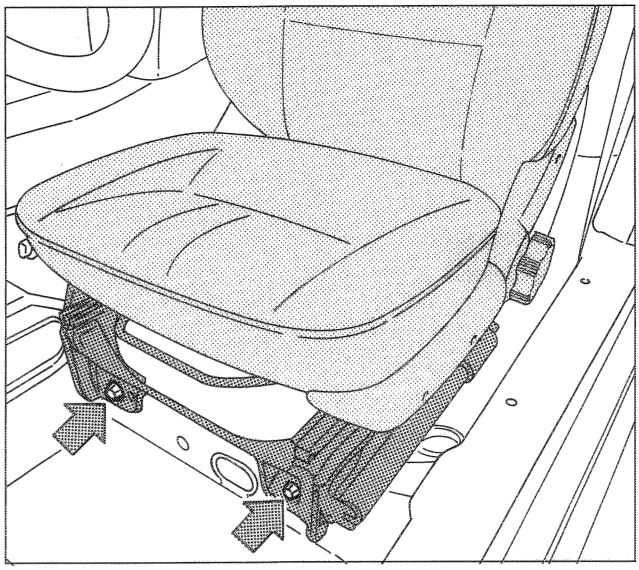
- remove the fixing bolts and extract the pre--tensioner lining;



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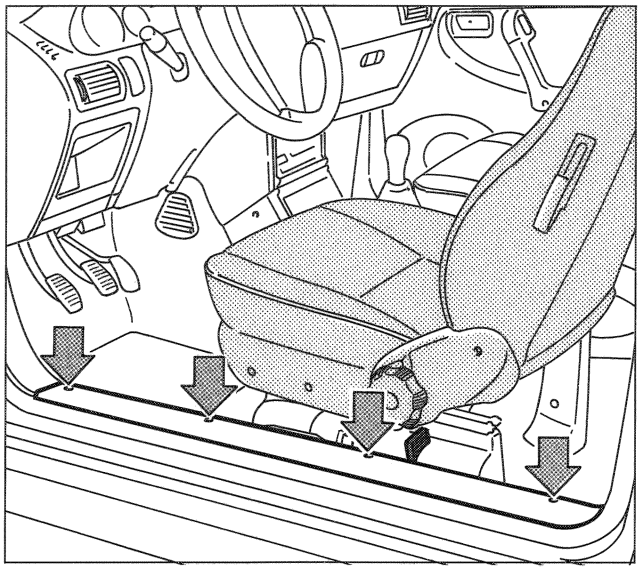
- undo the front bolts fixing the seat to the floor panel;

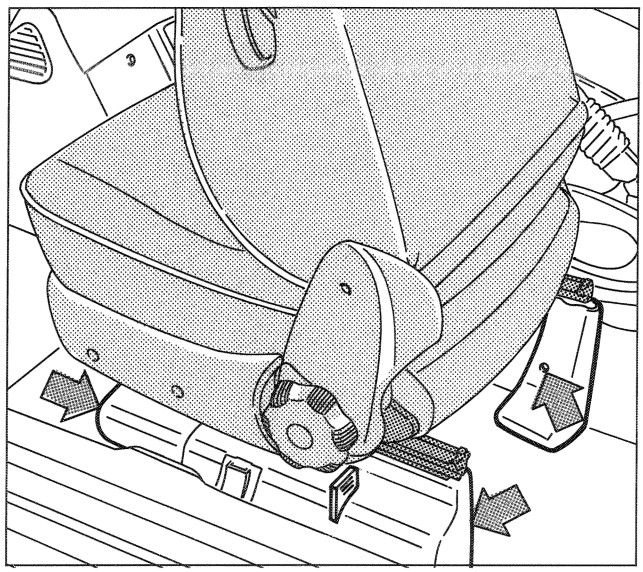
REMOVING-REFITTING FRONT SEAT



P3M61BM02 P3M61BM01

Before starting to remove the seat, follow the procedure given below to avoid activating the seat belt pre-tensioner.

- Insert the safety clilp in the special slit in the seat belt pre-tensioner;
- remove the underdoor inner lining, acting on the bolts shown;



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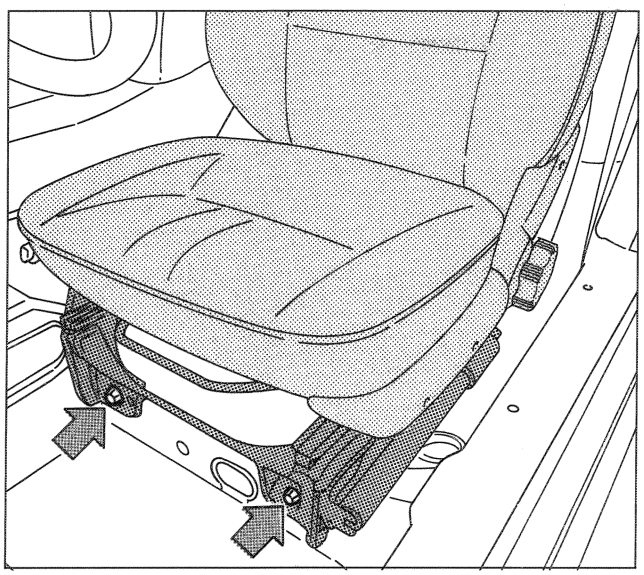
- remove the fixing bolts and extract the pre-tensioner cover;



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- undo the front bolts fixing the seat to the floor panel;

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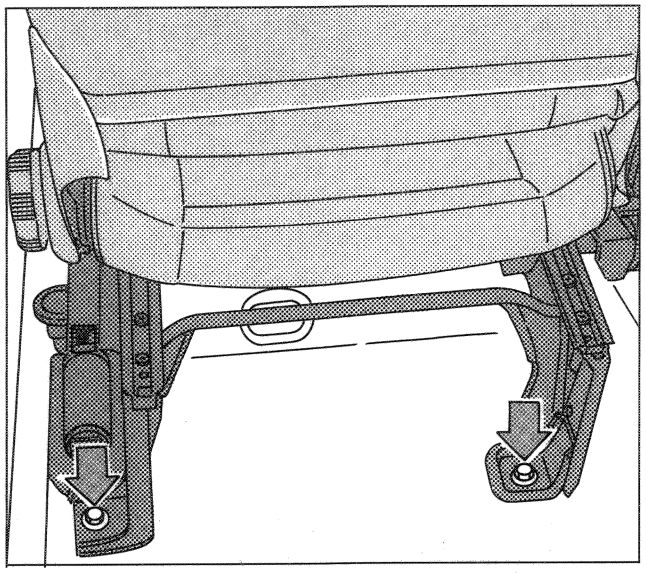

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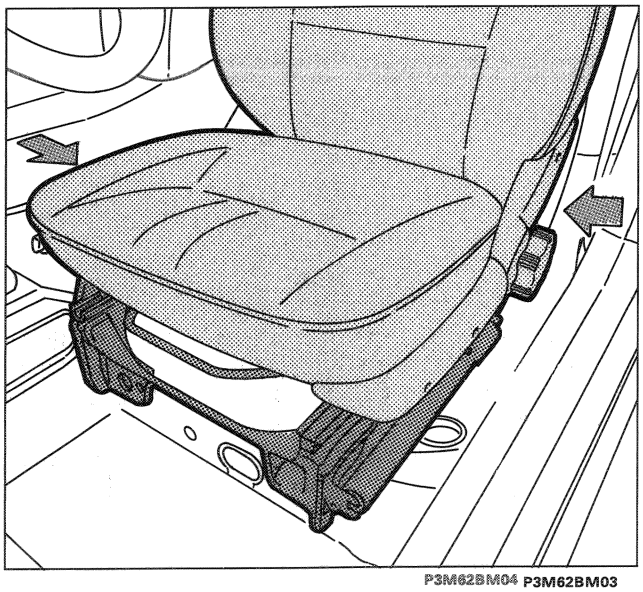
- remove the rear bolts fixing the seat to the floor panel;



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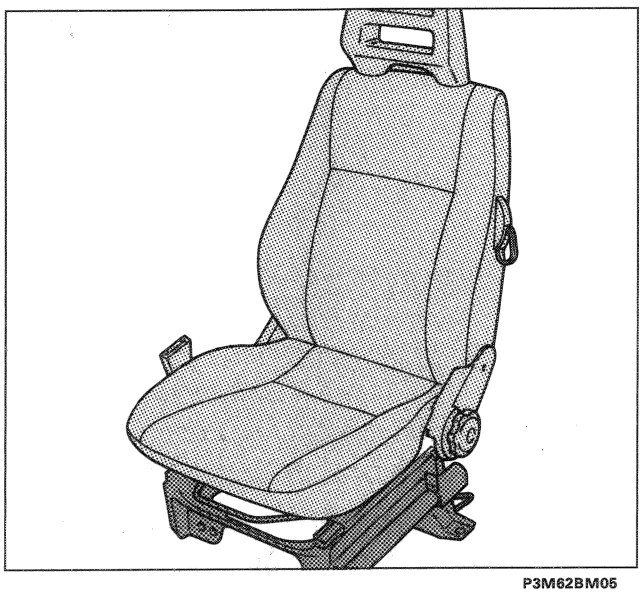
- extract the seat handling it at the points shown by the arrows, then remove it from the vehicle;

Do not hold the seat by the pre-tensioner power unit, then handle it very carefully so that it is not subject to impacts.



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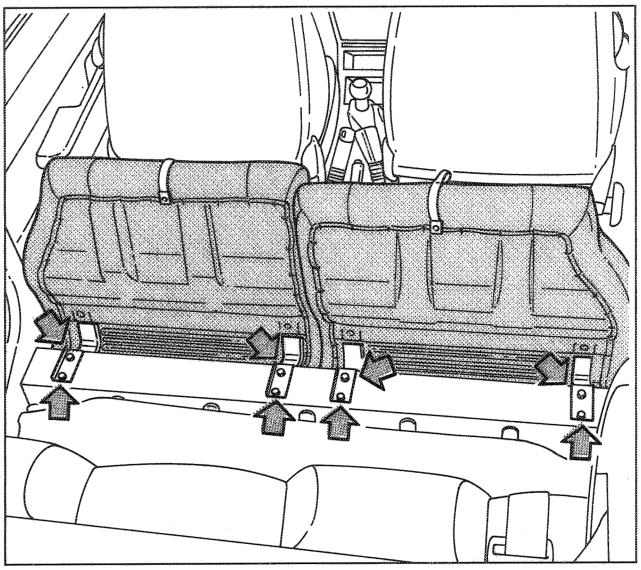
2,8 daNm

- refit the seat, then tighten the bolts fixing the seat to the floor panel to the recommended torque;
- complete the fitting, suitably reversing the order of the operations carried out for the removal.

REMOVING-REFITTING REAR SEATS



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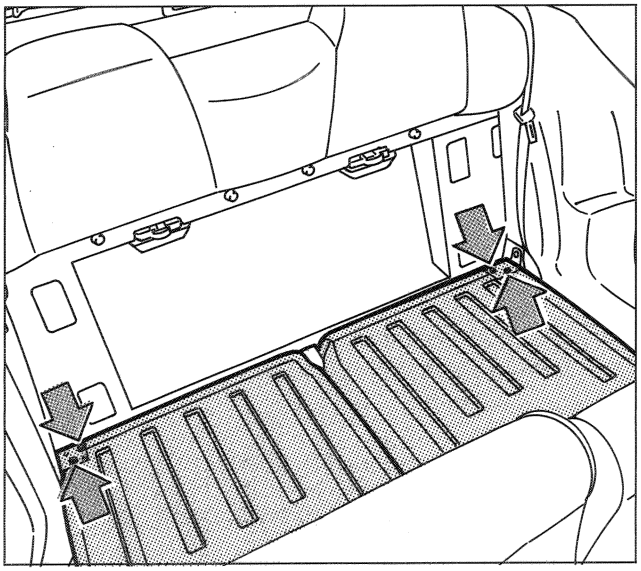
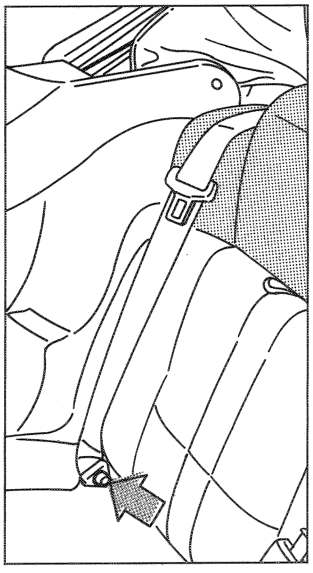
- Fold back the cushions, the remove them undoing the bolts shown;



P3M63BM04 P3M63BM03

- working from inside the luggage compartment, release the seat backrest control rod;
- undo the fixing bolts, then extract the backrest from the vehicle;
- to refit, simply reverse the order of the operations carried out for the removal.

REMOVING-REFITTING HEAD RESTRAINT



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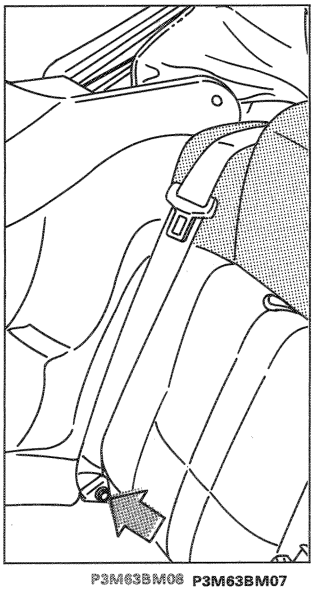

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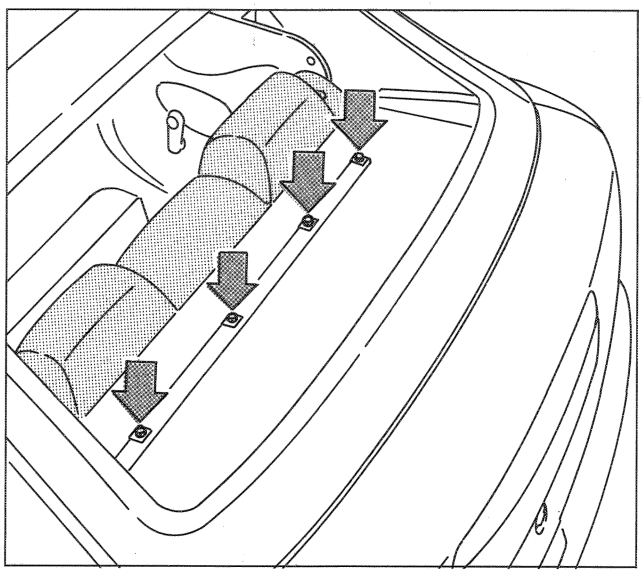
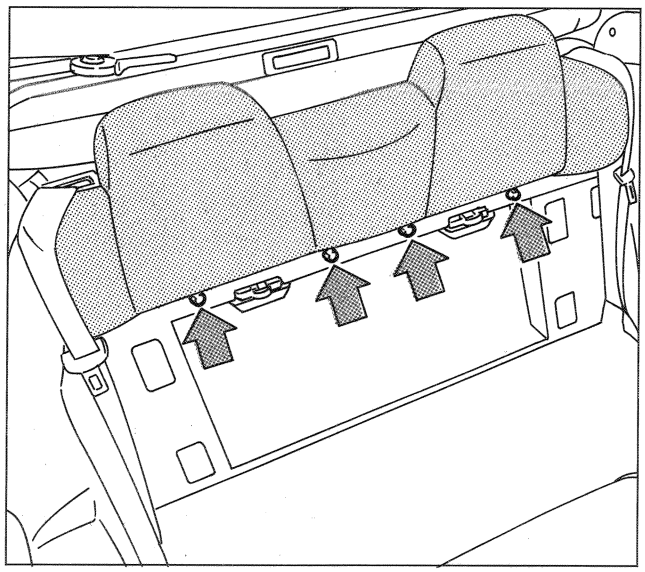
- Fold back the rear seat cusions;
- remove the lower fixing cover buttons for the seat belts;
- undo the fixing bolts underneath and separate the belts from the bodyshell;



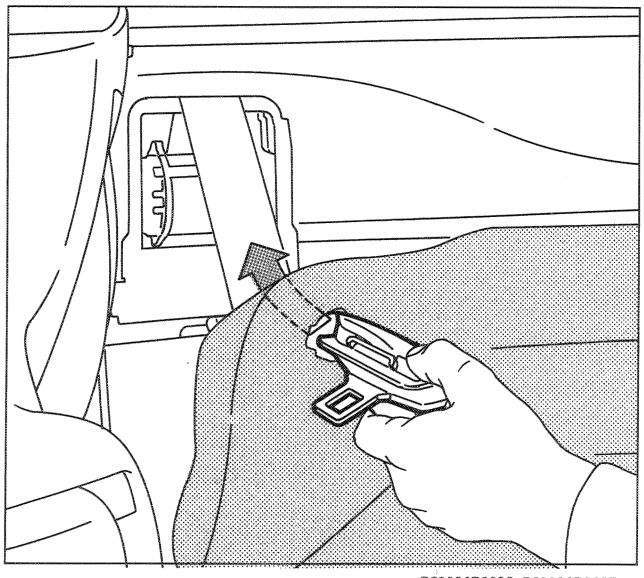
P3M64BM02 P3M64BM01

- move the rear parcel shelf lining aside and undo the rear bolts fixing the head restraint;

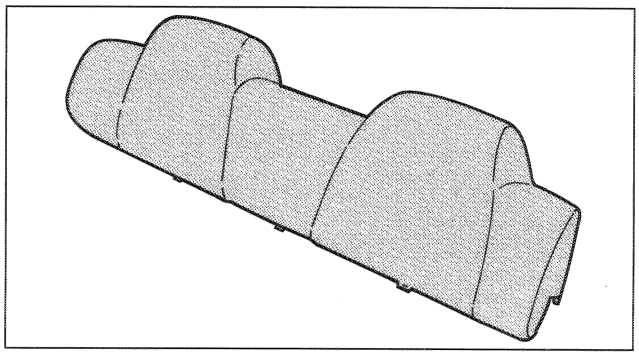


P3M64BM04 P3M64BM03

- lower the backrest after having released the lock control rod, then loosen the fixing bolts shown;



P3M64BM06 P3M64BM05



P3M64BM07

- remove the seat belt through the special slot, then remove the head restraint;
- to refit, simply reverse the order of the operations carried out for the removal.