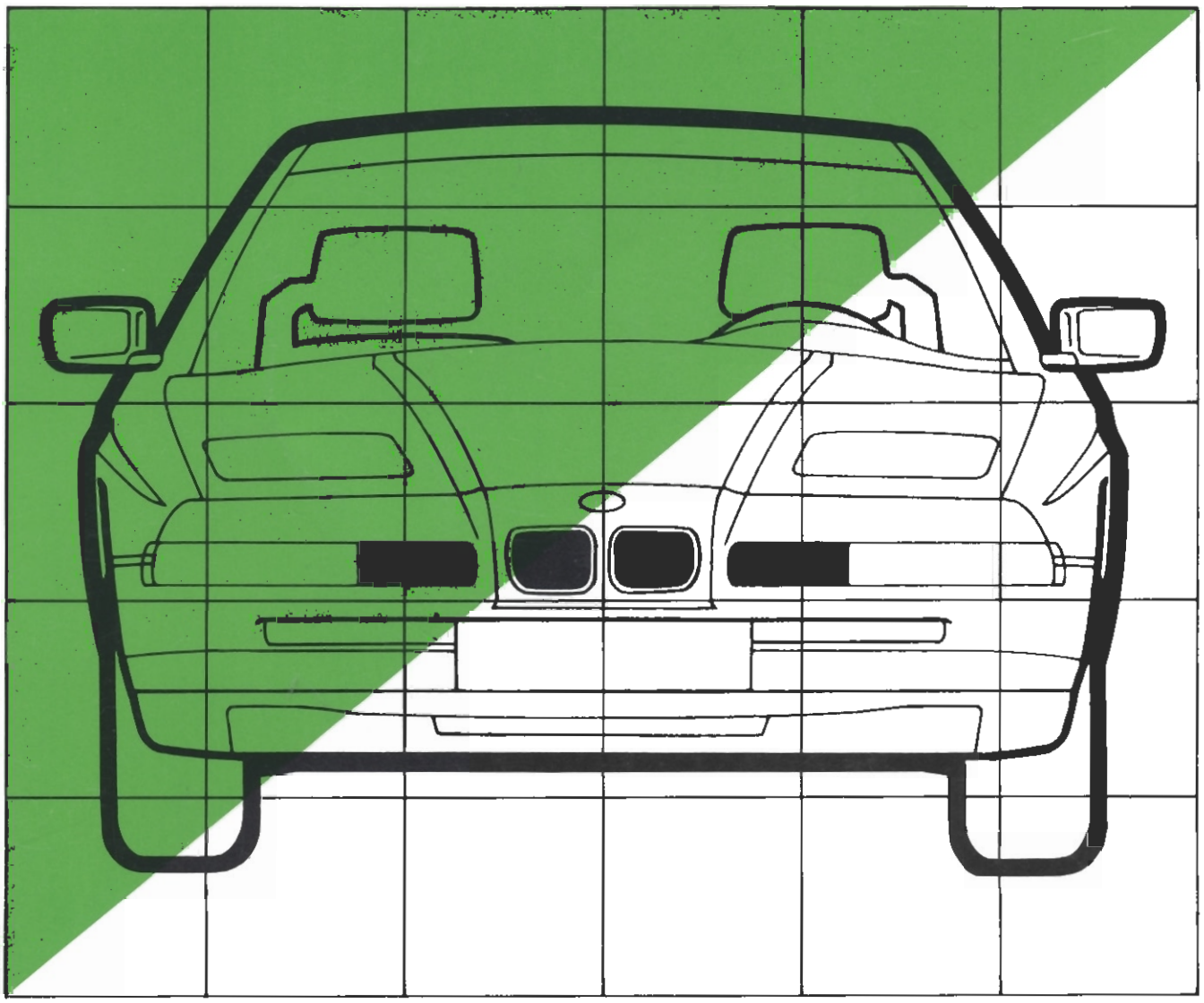
E 31 – complete car

Seminar working material



BMW AG
Service
Training Centre

Note

The information in this training booklet is intended only for the use of those taking this BMW Service Training School course.
Information updated to: November 1989

For details of amendments or additions to technical data, please refer to the latest information issued by the Central Service Department.

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External features

The BMW 850i is a 2 + 2-seater coupé with a markedly sporting image.
It has a new folding (pop-up) headlight system.
The front and rear bumpers are fully integrated into the body.
There is no B-post above the window sill line.
The aerodynamic door mirrors have a drag coefficient (c_D) of less than 0.3.

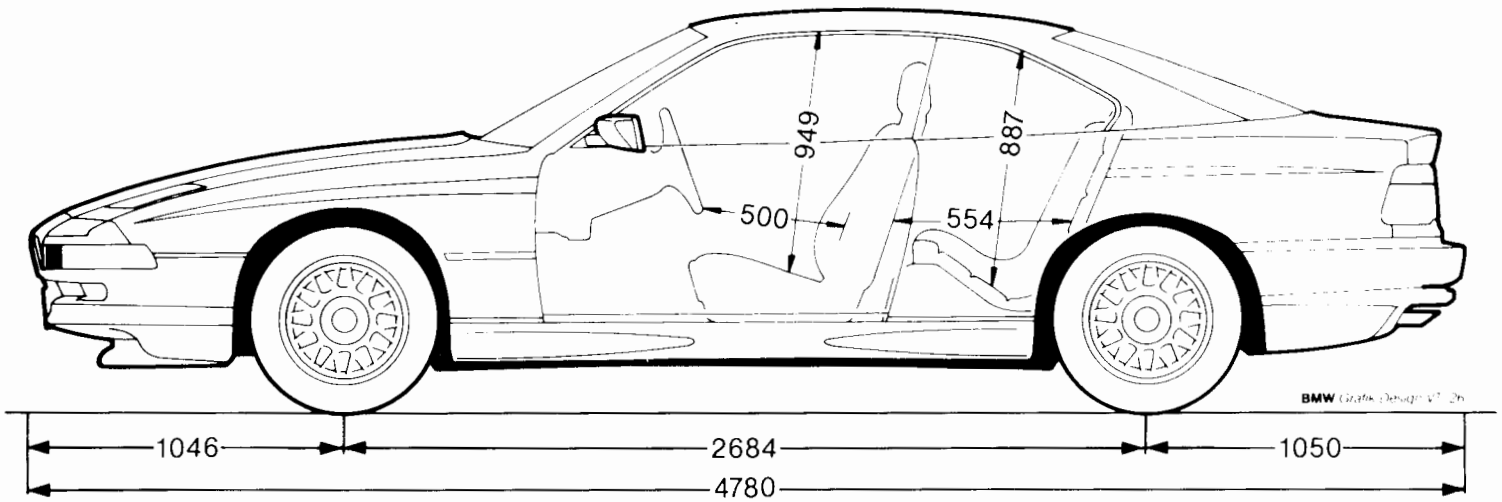


Fig. 1:
Dimensions

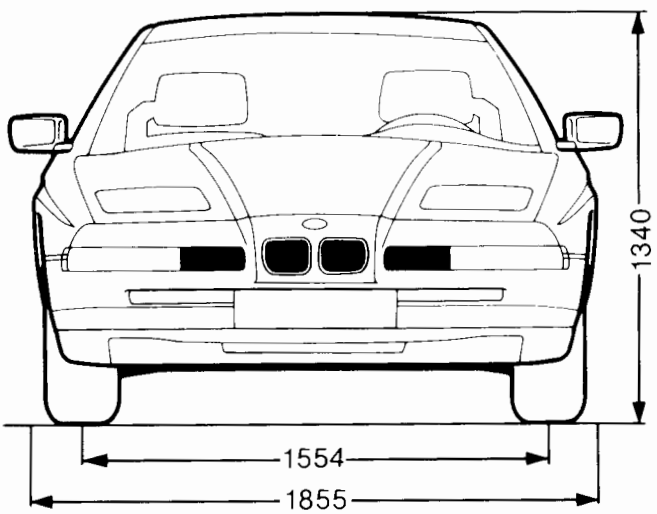


Fig. 2:
Dimensions

Interior features

Centre console with Multi-Information Display (MID), radio and automatic air conditioning control panel.

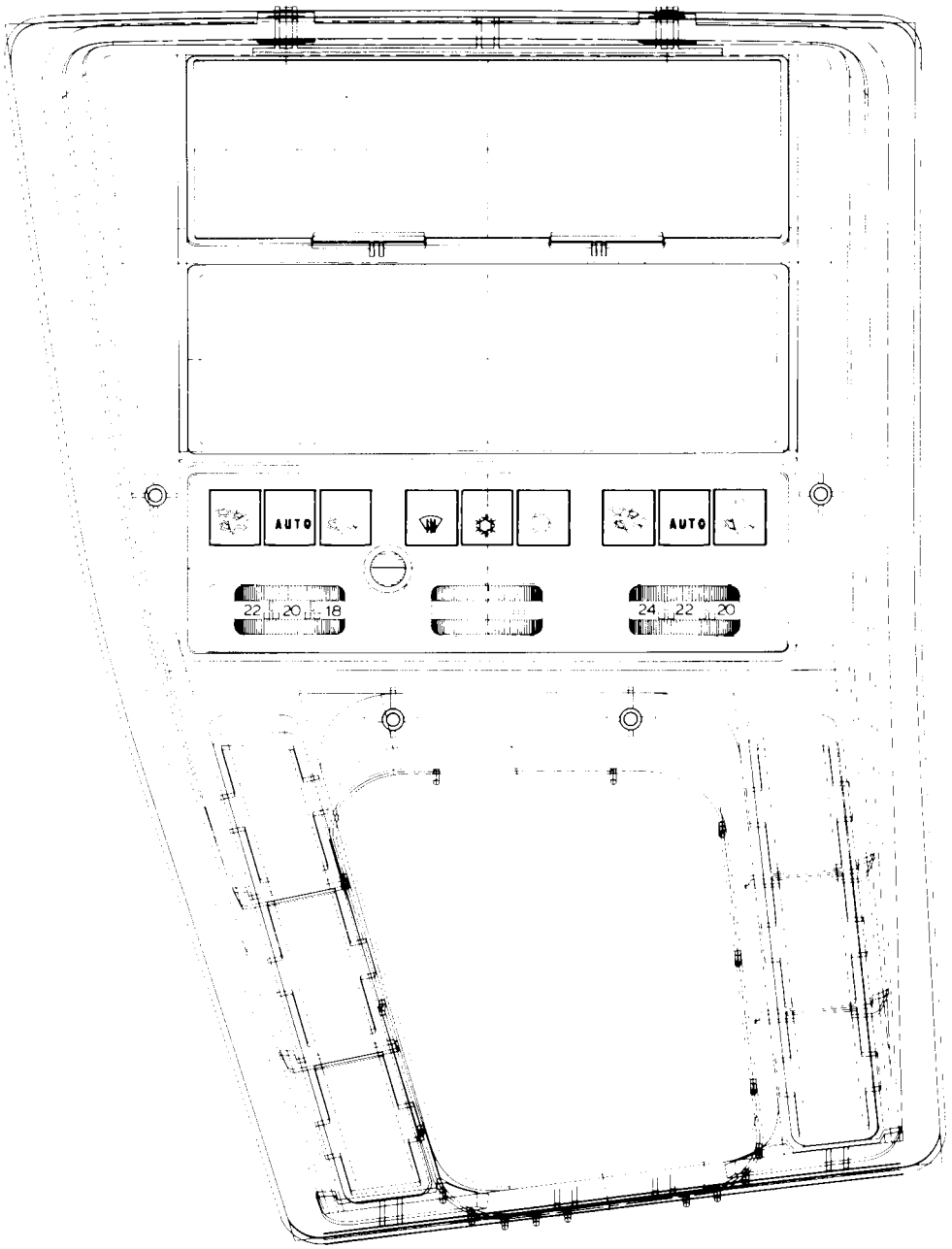


Fig. 3
Centre console

Door sealing system

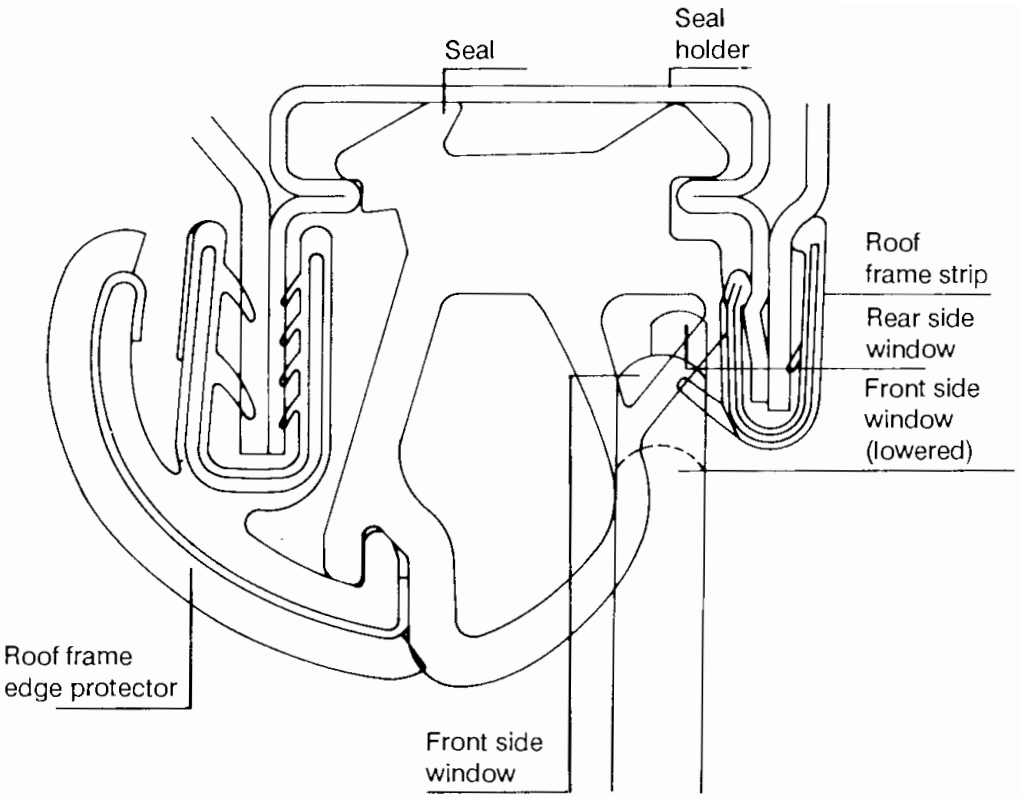


Fig. 4:
Door window location and sealing - a new development

This new door sealing system provides optimum protection against unwanted environmental effects and at the same time ensures outstanding aerodynamics.
The glass is held secure as a result of the cross-section of the seal, not by any form of pre-loading.

Door window location

Opening:
When the outside door handle or the inside release knob is operated, the door window is automatically lowered by about 6 mm, and remains in this position while the door is open.

Closing:
When the door is fully closed (in other words when it has reached the second catch), the window automatically runs back up into the door sealing system.

If any electronic defect occurs, the door can be closed normally, but in this case the door window will be pressed inwards as the door is closed.

Folding (pop-up) headlights

Each pop-up headlight unit contains three lights:

Low (dipped) beam (outer):	ellipsoidal principle
Fog light (centre):	ellipsoidal principle
Main (high) beam (inner):	parabolic reflector

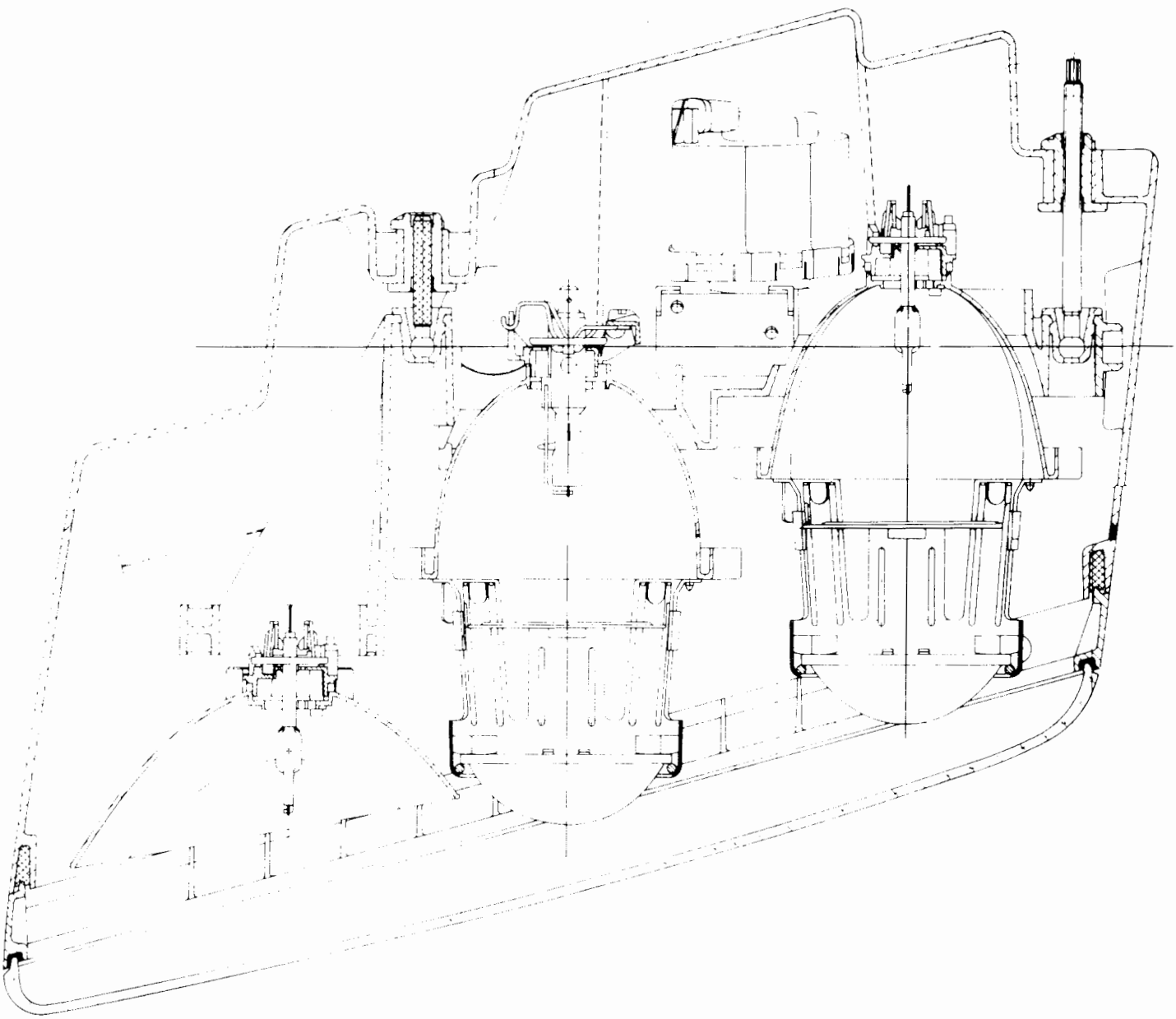


Fig. 5:
Pop-up headlight unit (sectioned drawing)

All three reflectors are mounted on a common support frame, and can therefore be adjusted together. The support frame is moved vertically and laterally by means of two threaded rods.

These threaded rods have a combined action: when a vertical adjustment is made, the beam also moves to one side, and vice versa:

- upper adjusting screw - primarily for vertical adjustment
- lower adjusting screw - primarily for lateral adjustment

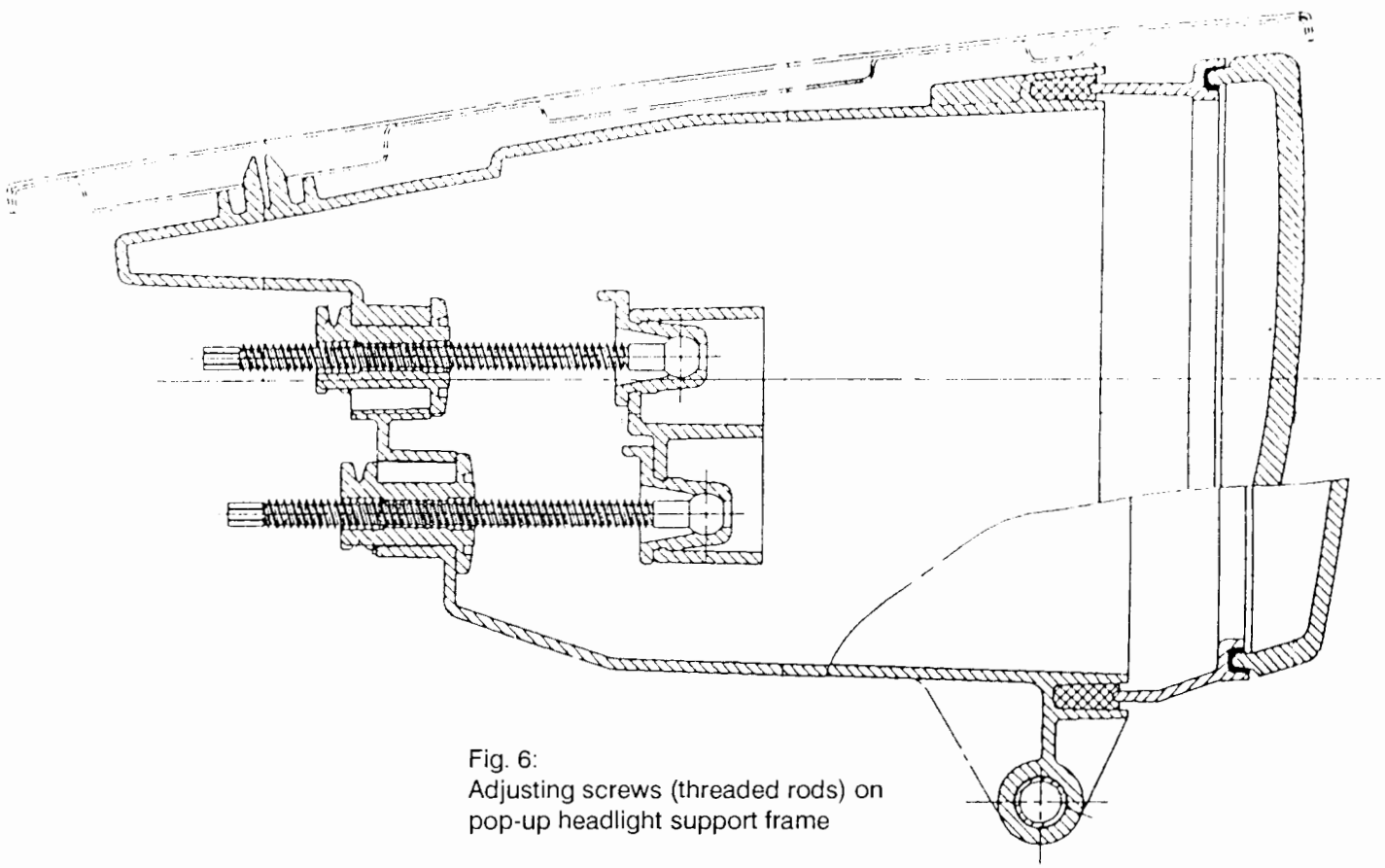


Fig. 6:
Adjusting screws (threaded rods) on pop-up headlight support frame

Special features:

- The pop-up action can only take place when the lights are switched on.
- In the event of an operating failure, the pop-up headlights can also be operated manually.
- If a limit switch defect (limit of headlight unit travel) occurs, an automatic emergency program is activated to ensure that the headlights reach the normal position.
- Correct raising action is monitored by the Check Control, which displays any malfunction.
- An electronically actuated beam throw adjustment system (standard equipment) ensures the correct beam throw for all driving conditions.

Bulb changing

Two covers are provided in the headlight unit casing for bulb changing. The cover on the body must first be removed.

- Release the keeper on the snap fastener
- Open the fastener
- Raise the rear of the cover and push it forward
- To close, work in the reverse order

Venting

There are vent openings in the casing. Moisture condensate on the glass does not necessarily indicate leakage. The glass is replaceable after releasing 6 clips.

Masking off when driving on the other side of the road

The upwardly-angled section of the low (dipped) headlight beam can be masked off at the lever under the rubber sleeve above the low-beam headlight unit.

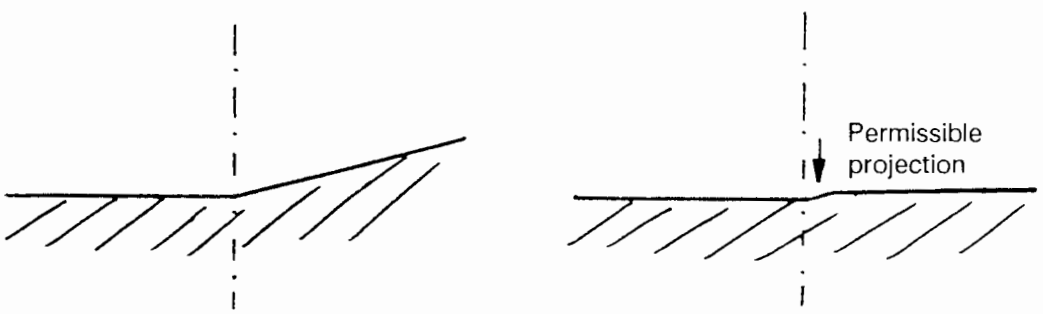


Fig. 7:
Masked-off angled section of low beam

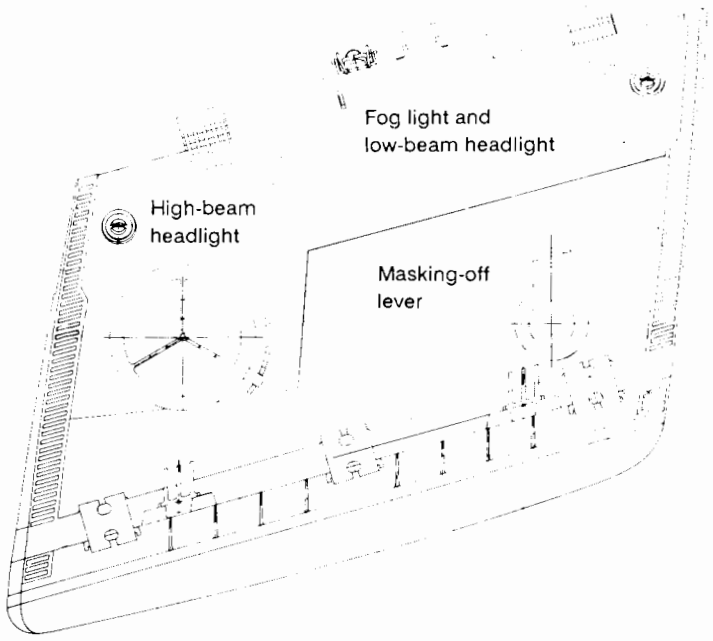


Fig. 8:
Masking off angled section of beam when driving on other side of road

Headlight cleaning system

The high-pressure washer system is used only for the pop-up headlights.

For the first time, four elevating jet assemblies controlled by fluid pressure have been installed. When the washer system is operated, the pressure forces them up and directs the high-pressure fluid jets against the headlight glasses.

The fluid for the cleaning system is divided between a reservoir holding approx. 2.5 litres in the engine compartment, and another holding 9 - 10 litres in the spare wheel well (in the luggage compartment). The connecting tubes run inside the car. Fluid from the engine compartment reservoir is used first. The Check Control display indicating low fluid level is not activated until the rear reservoir is also nearly empty.

Notes:

Bumper system

The bonded plastic bumper systems at front and rear are fully integrated into the body outlines, with impact dampers to ensure full self-regenerating capability up to an impact speed of 6 km/h.

In the event of impacts at speeds between 6 and 15 km/h, tubular deforming elements at front and rear provide the necessary additional energy absorption.

Notes:

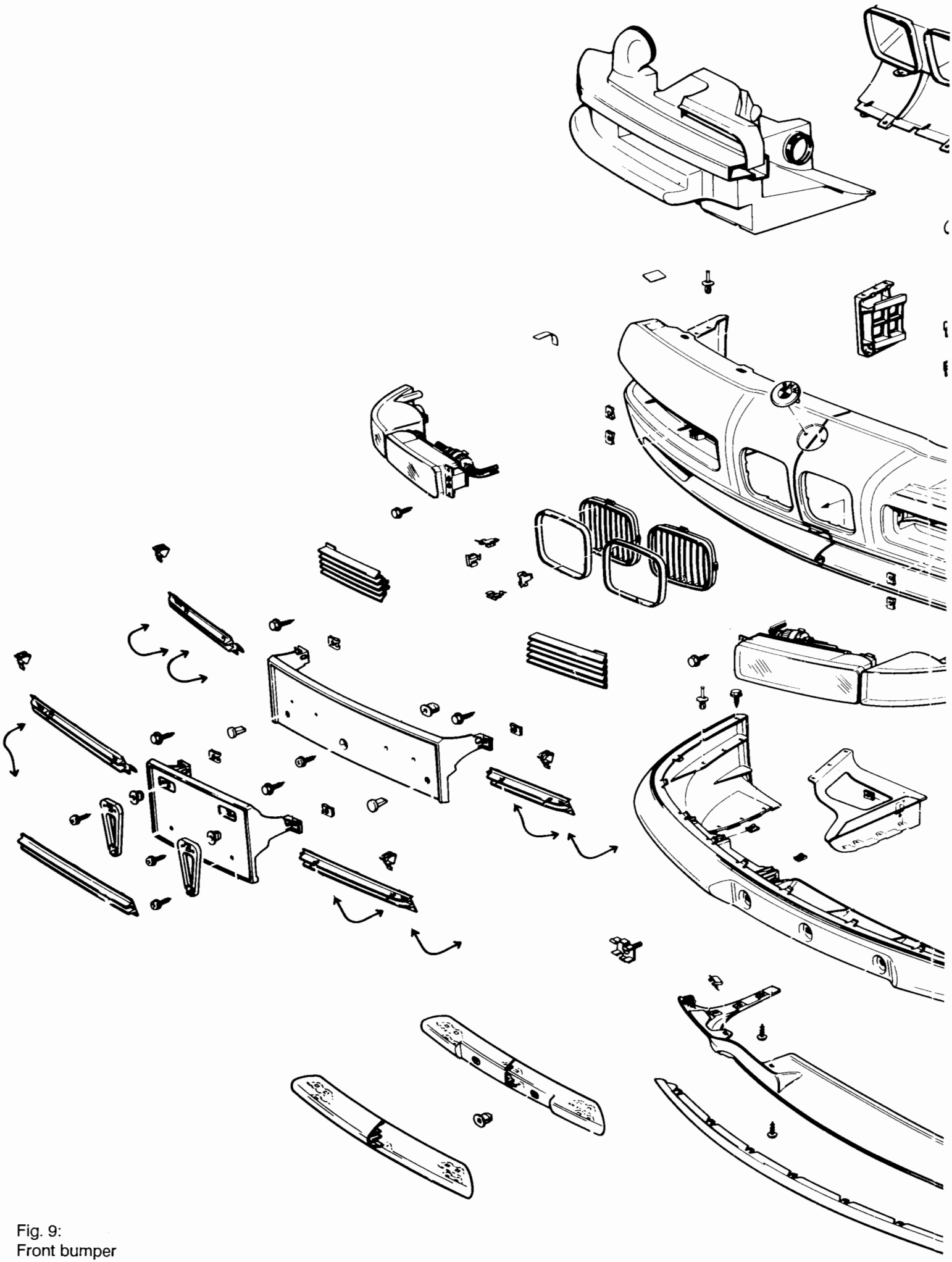
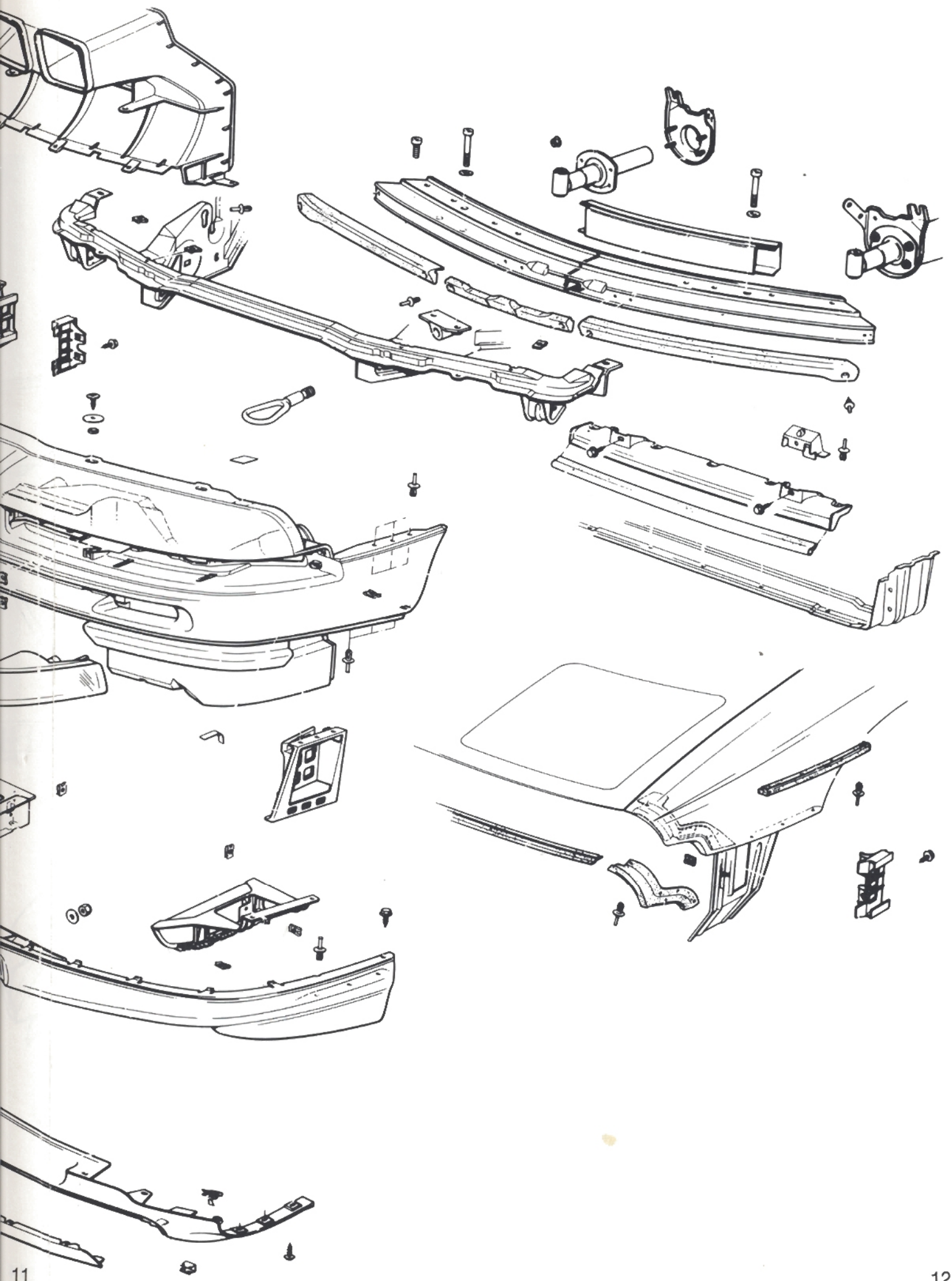


Fig. 9:
Front bumper



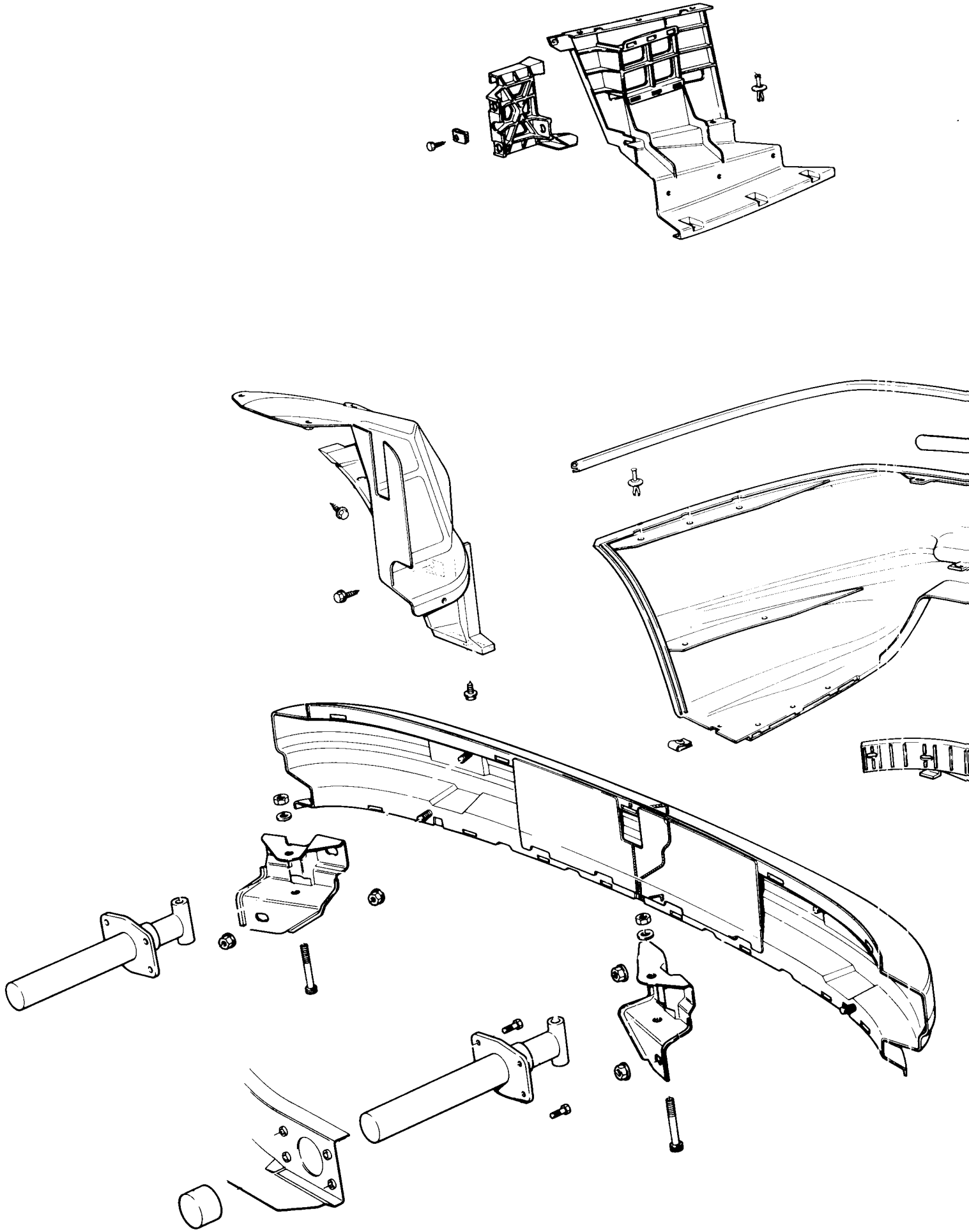
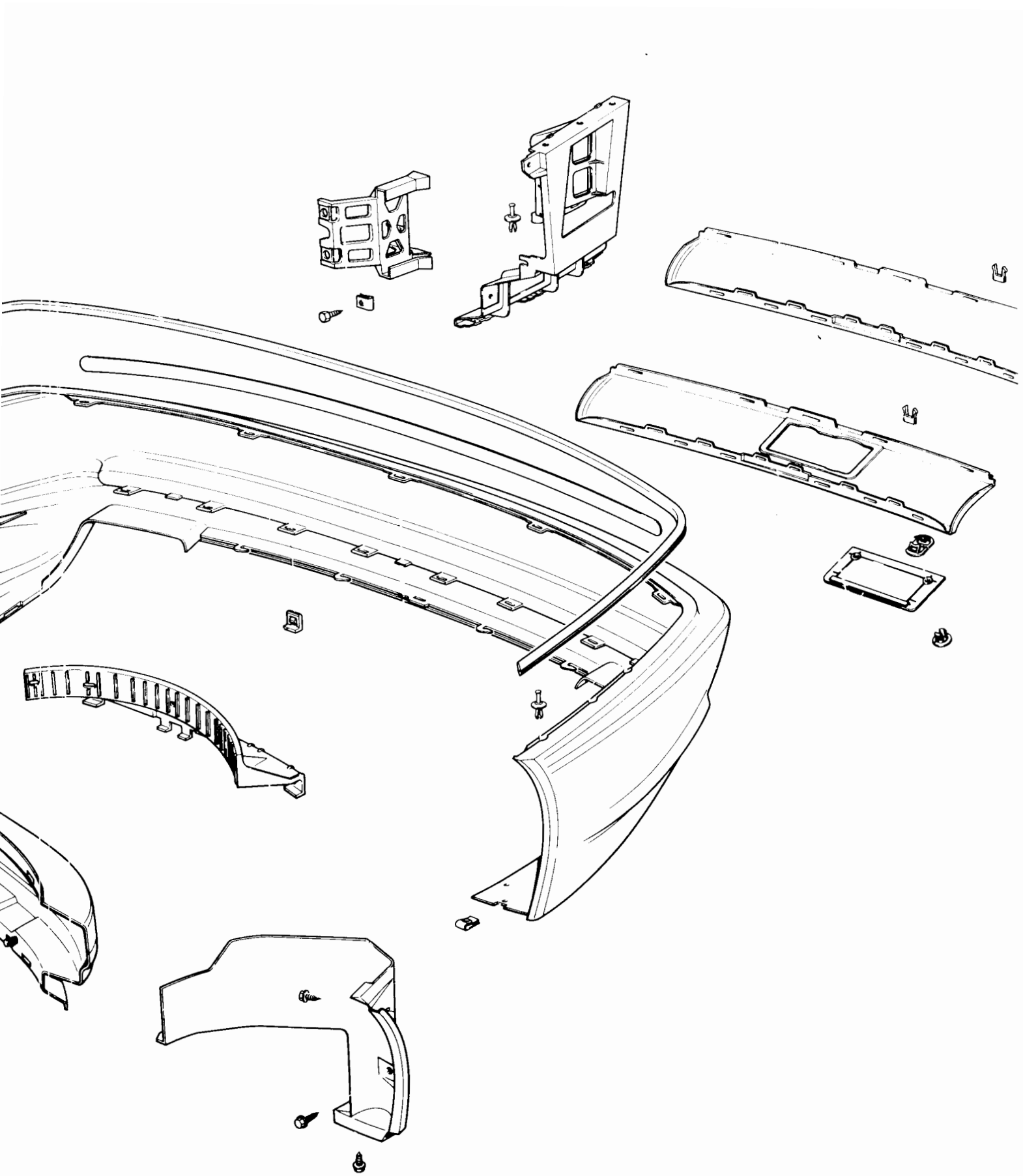


Fig. 10:
Rear bumper



Front seats
with seat-integrated belt system (SGS)

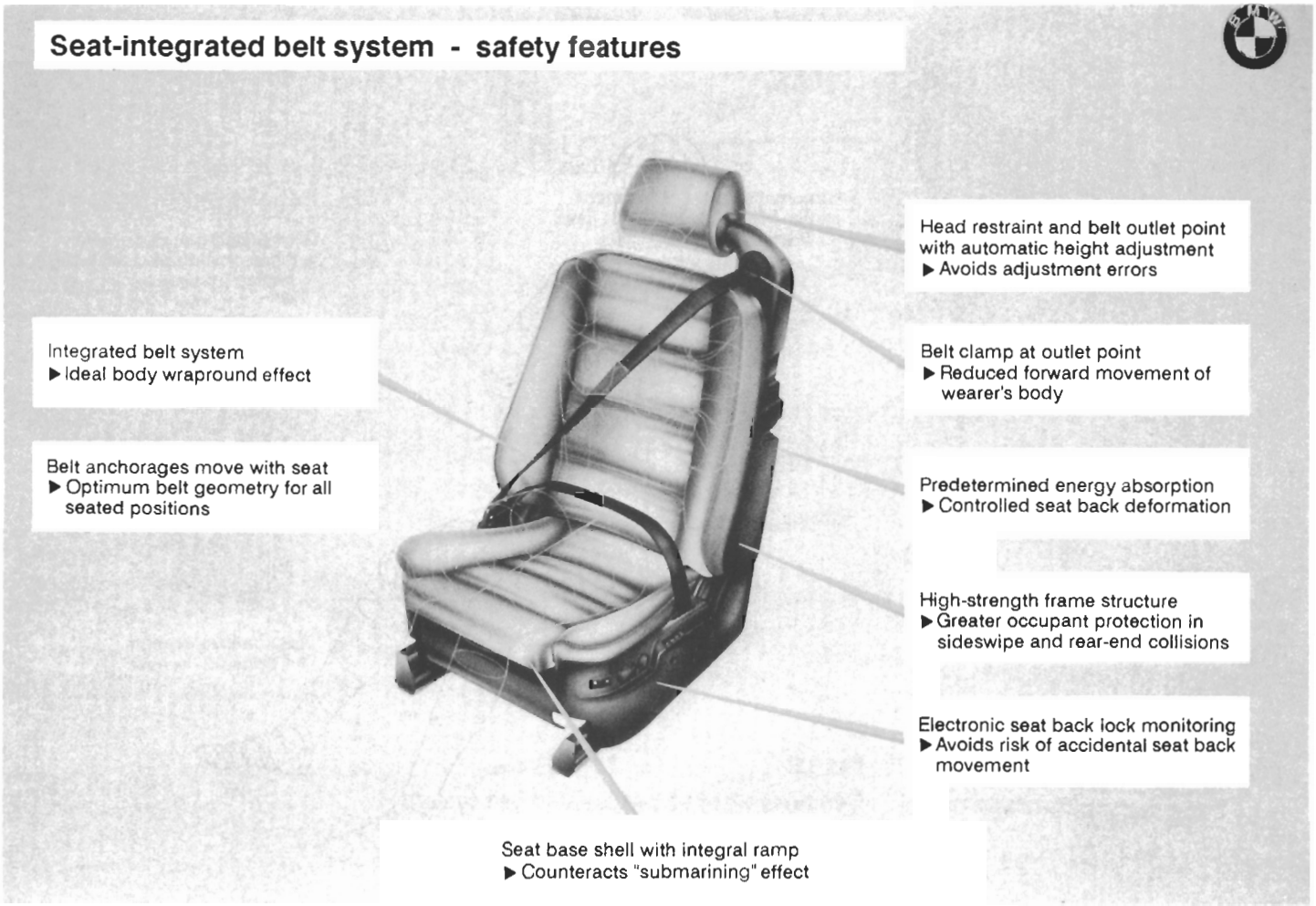


Fig. 11:
SGS safety features

Advantages:

- seat belt conveniently to hand
- lower belt anchorage does not obstruct access to rear seats
- excellent belt wraparound effect on wearer's body, despite absence of anchorage on upper B-post
- reduced belt slack
- belt height matched to size of wearer

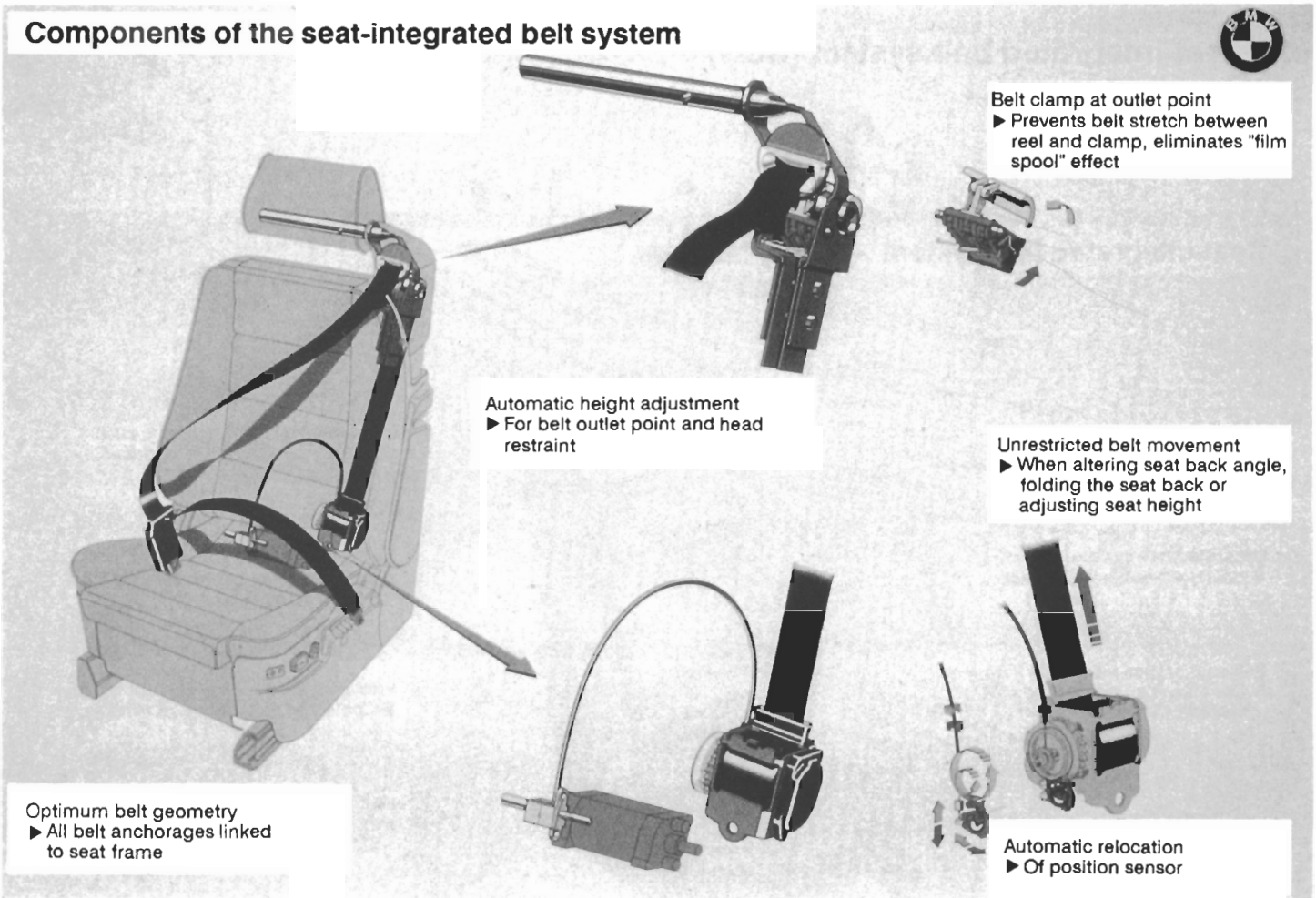


Fig. 12:
Components of seat-integrated belt system

Electric steel-panel sunroof

The vent position is a new feature of the sunroof.

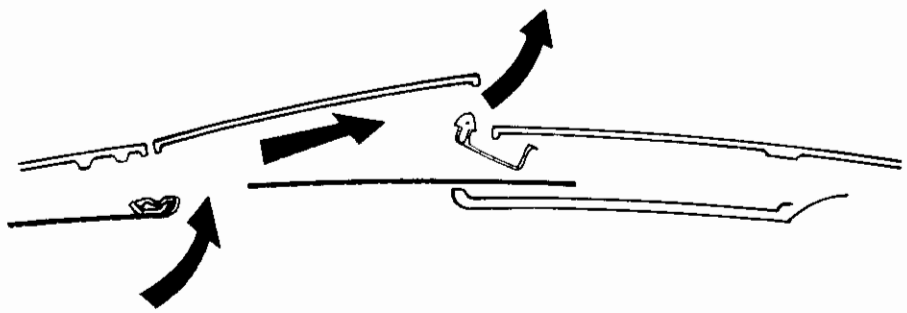
The roof lining moves back and the rear edge of the panel is raised in the usual way.

When the panel is raised, the rain trap channel automatically rises with it. This prevents water on the roof from entering the car when the brakes are applied.

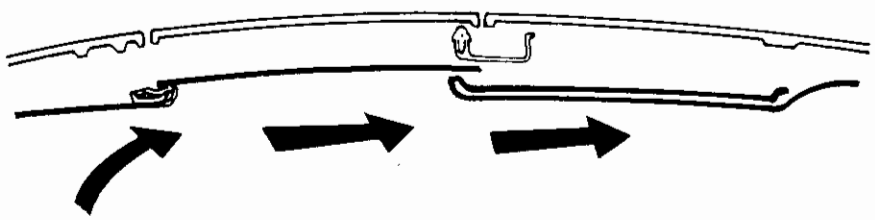
Notes:

Sunroof operating principle

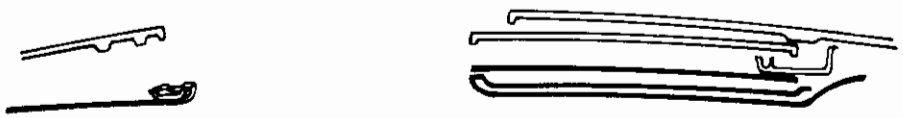
- with low-noise vent position and lift-up water trap channel



Raised at rear



Closed



Open

Fig. 13:
Sunroof operating principle

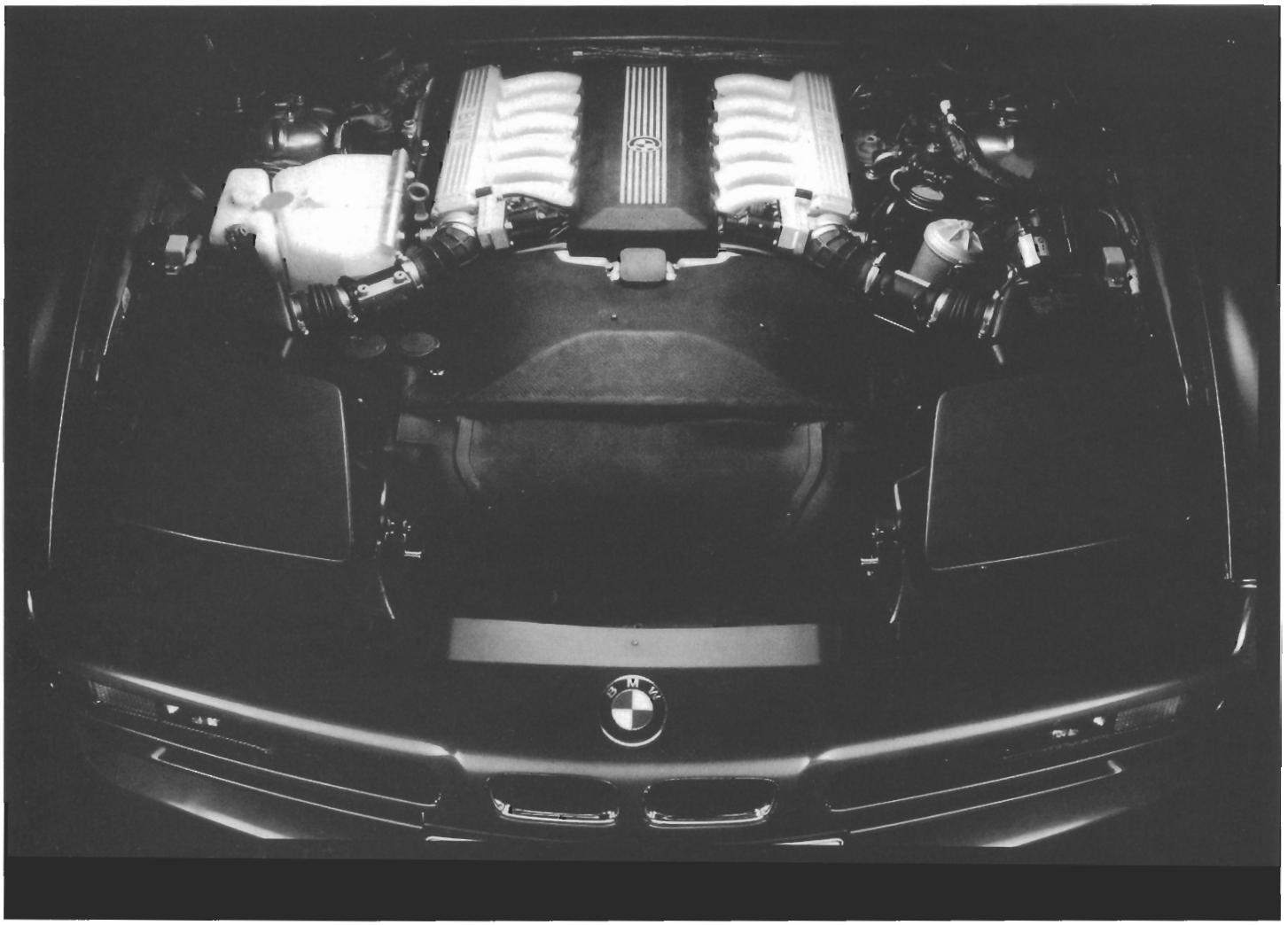


Fig. 14:
E 31 engine

Engine

The 850i's engine is the same unit as used in the 750i/750iL, with minor modifications.

These modifications are:

- oil filler pipe
- mounting flange eyes
- fuel lines
- connecting hose
- oil sump
- fresh air intake

The new M 1.7 is a developed version of DME 1.2 (for the basic functions of DME 1.2, see Trainer's Guide).

Changes and comparisons:

The casing used for the new M 1.7 is smaller, and therefore saves weight and requires less space.

It is:
20 mm narrower
13 mm lower
3 mm shorter.

The M 1.7 uses a single printed-circuit board only, so that the failure rate is lower.

The main plug has 88 pins (previously 55). This increases the scope for information processing.

The self-diagnosis facilities have been extended and improved. Signals at the interfaces with sensors and other control elements are continuously monitored and registered according to priority groups. Up to 30 faults can now be memorized instead of the previous total of 5.

Monitoring of the main ignition currents between coil and ignition leads now takes place by way of the DME. If the ignition current fails, the fuel supply to the affected bank of cylinders is interrupted. This makes it unnecessary to install the catalytic converter protection relay which previously performed this function.
The microprocessor has a 12 MHz (previously 10 MHz) operating rate. This raises the computing speed and achieves a corresponding increase in storage capacity.

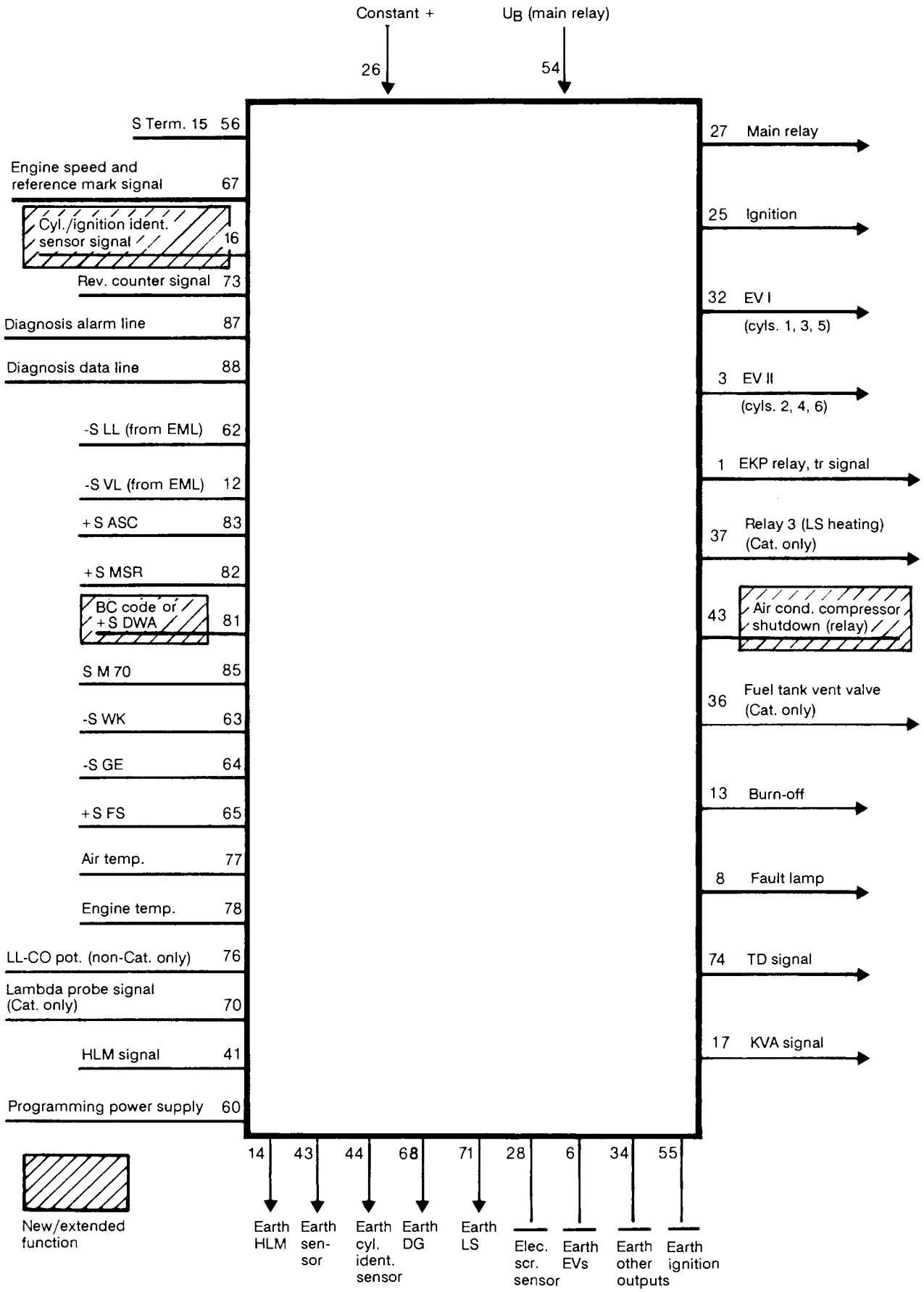


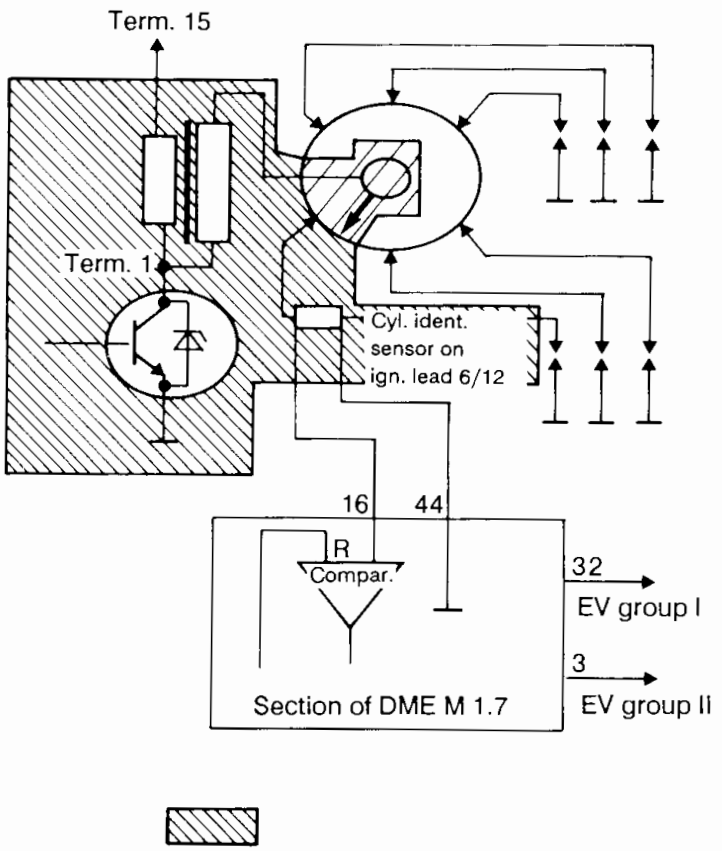
Fig. 15:
DME 1.7 inputs and outputs

S = Signal
- = negative
+ = positive
LS = lambda probe
GE = automatic transmission
FS = selector position
HLM = Hot wire airflow meter

Cylinder and ignition identification sensor

The cylinder and ignition identification signal (pin 16) has been changed, in order to extend the scope of catalytic converter protection.

New catalytic converter protection in conjunction with M 1.7.



Catalytic converter monitoring range

Fig. 16:
Schematic diagram of cylinder and ignition identification sensor

Compressor shutdown when accelerating

If certain operating conditions apply, the air conditioning compressor is shut down electronically (signal from DME control unit), in order not to affect acceleration from a standing start.

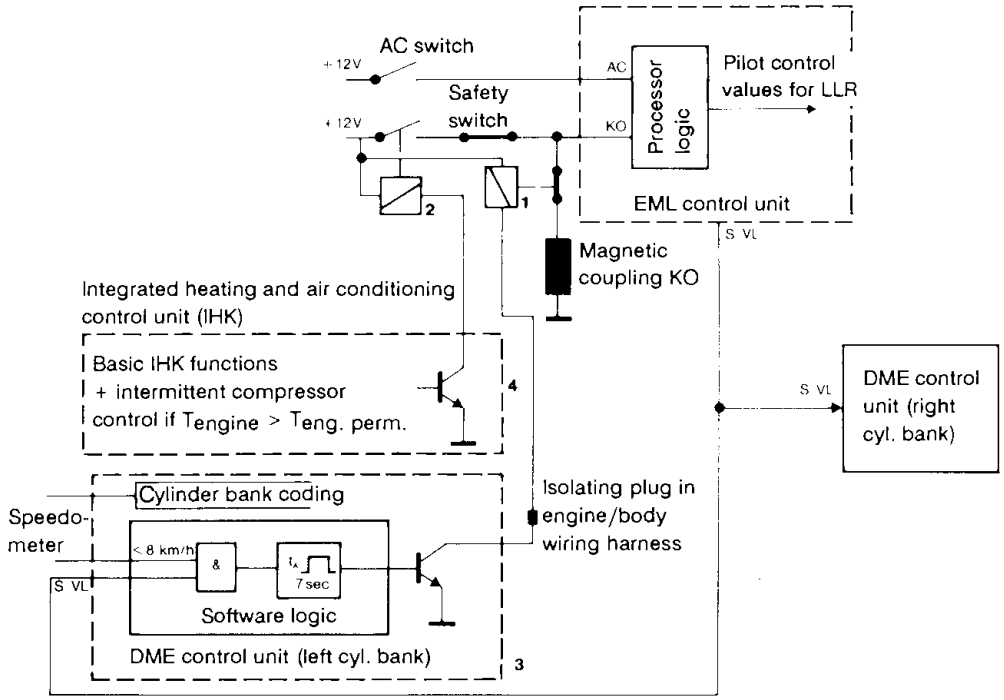


Fig. 17:
Schematic diagram of compressor switching circuit when accelerating

Starter interlock for DWA (pin 81)

In the DME 1.2 system, the ASC and DWA (thiefproofing system) starter interlock functions are coupled internally by way of pin 38.

Notes:

EML II

The functions of the EML (electronic engine output control) system have been extended.

Notes:

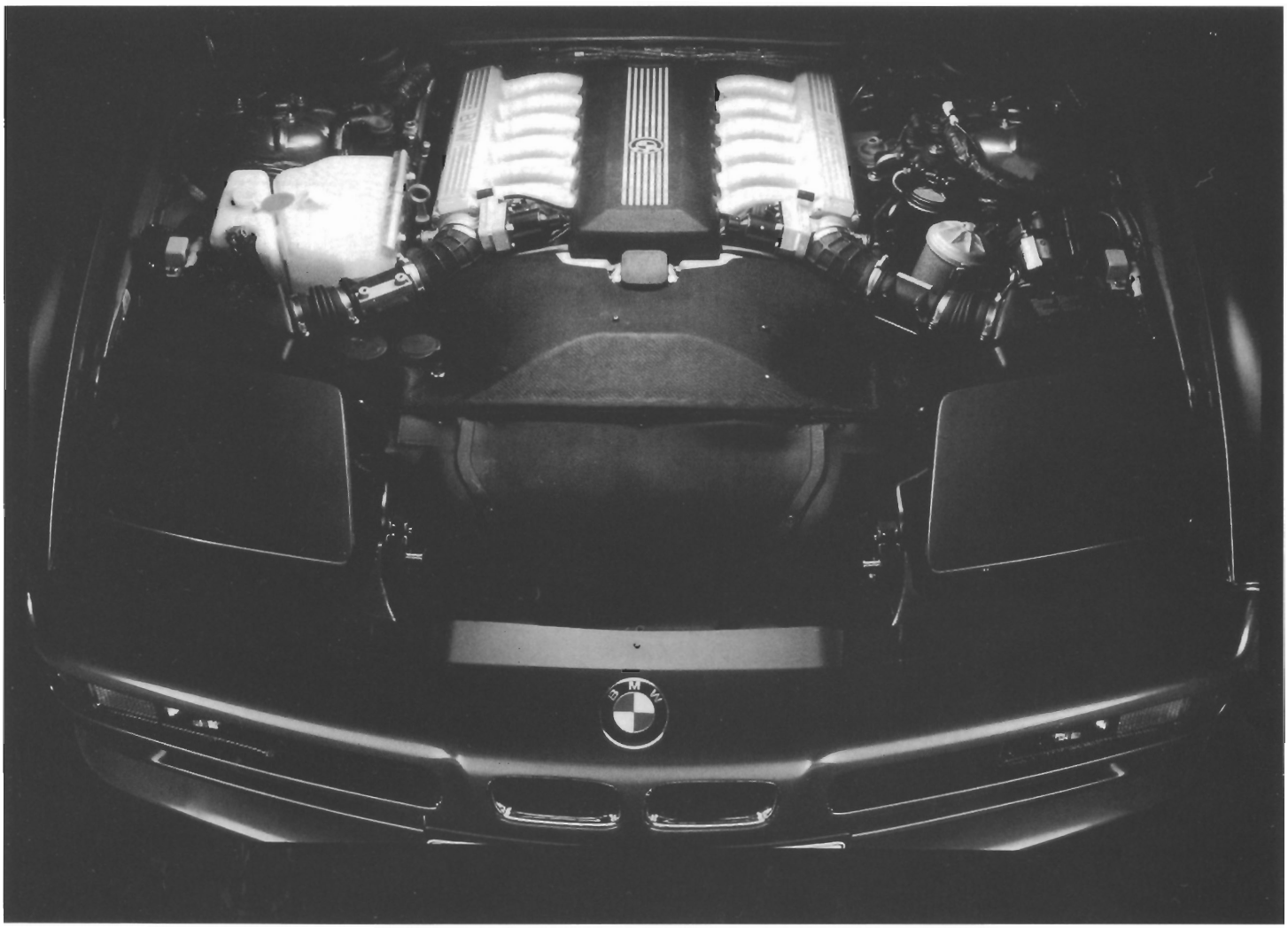


Fig. 18:
E 31 radiator

The cross-flow radiator is of aluminium construction.
The header tank is integrated into the fan shroud.
The lower area contains the vent system and the Check Control level sensor.
The header tank is made of polyamide plastic (to save weight).

Exhaust system/ catalytic converter

The E 32's catalytic converters have been adopted for the E 31.

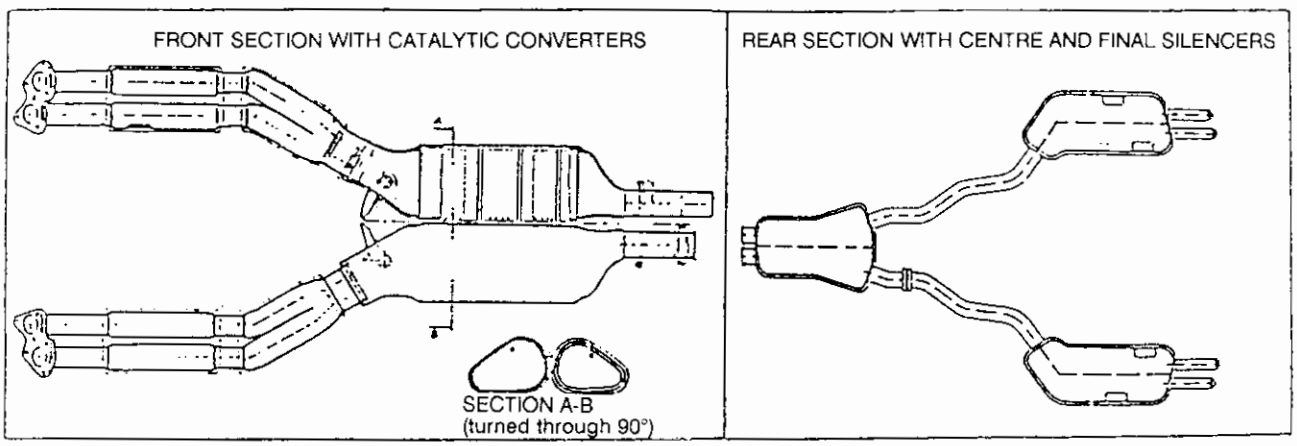


Fig. 19:
E 31 catalytic converter system

Notes:

Fuel system

A new type of 90-litre plastic fuel tank (made from high-density polyethylene [PE-HD]) is located under the rear seat.

Compared with the 70-l (USA: 63-l) steel fuel tank used on the E 24, the new tank is 30 % lighter. The hump-shaped link between the two halves of the tank acts as an equalizing section, so that a separate external catch tank (under the rear-window shelf in the E 24) is not needed. It also ensures reliable tank venting.

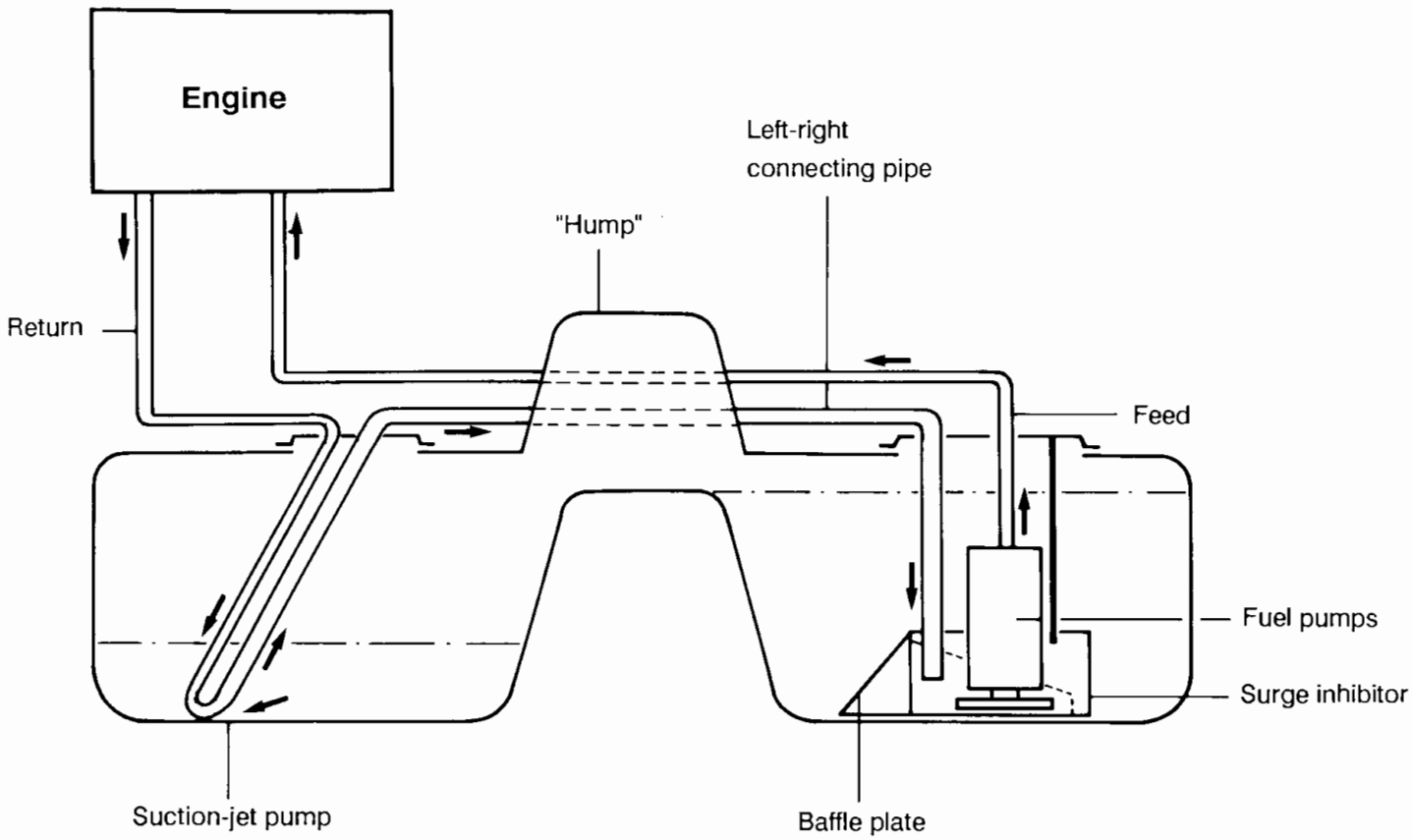


Fig. 20:
Fuel system

To provide an indication of the amount of fuel in the tank, each half has a lever-type level sensor (the immersed-tube type was previously used) with base support and electronic signal data transmission.

2 gear-type fuel delivery pumps in the right half of the tank.

Rubber damping blocks of a new type keep noise levels down.

A surge inhibitor with baffle plate in the right half of the tank ensures a supply of fuel to the pumps even when the tank is nearly empty, and in all driving situations.

A suction-jet pump in the left half of the tank automatically delivers fuel to the right half of the tank.

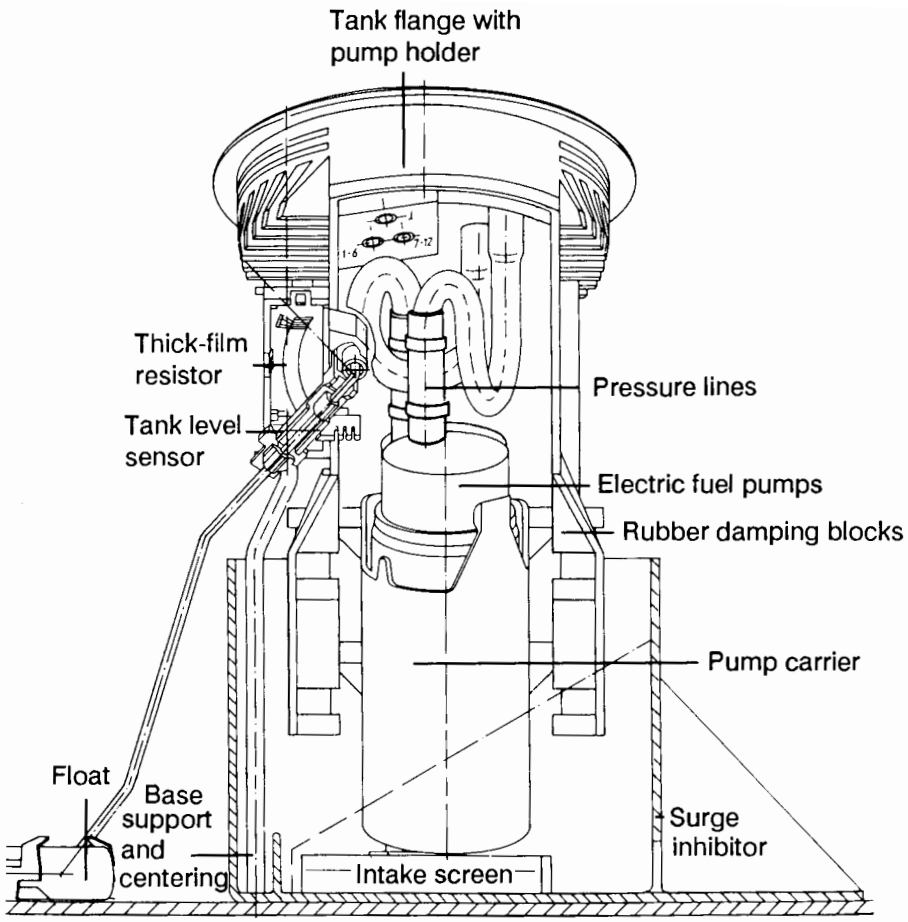


Fig. 21:
Right delivery unit and level sensor

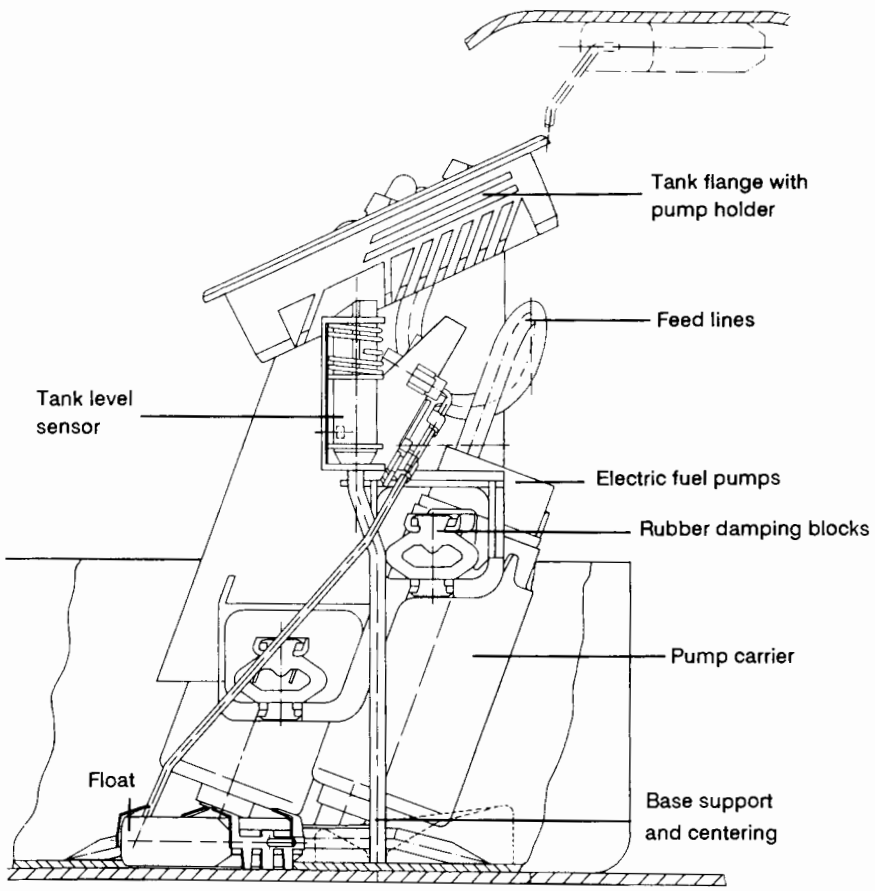


Fig. 22:
Right delivery unit and level sensor

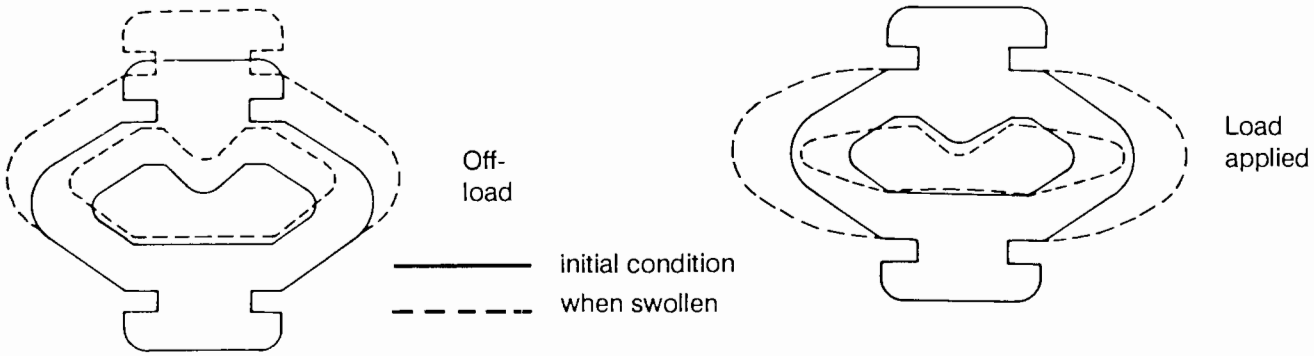


Fig. 23:
Rubber damping block for electric fuel pump mount

Function of surge inhibitor

The surge inhibitor contains a labyrinth in which fuel is always present, even if the tank is nearly empty. This device also ensures that the fuel pumps do not draw in air even in extreme driving conditions.

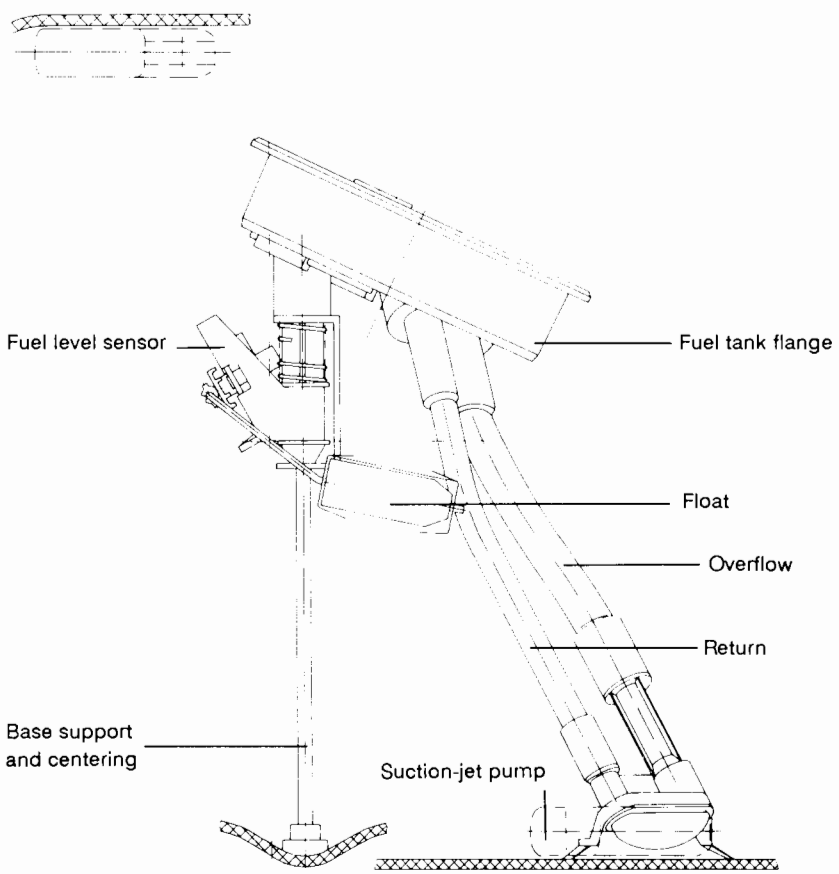


Fig. 24:
Left delivery unit and level sensor

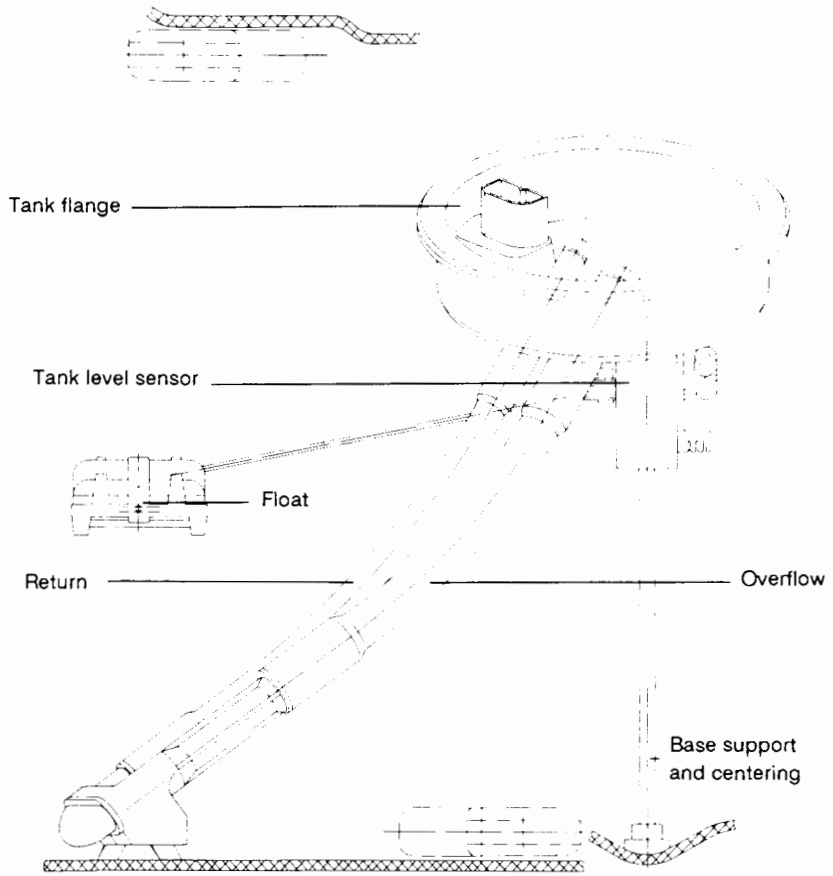


Fig. 25:
Left delivery unit and level sensor

Suction-jet pump

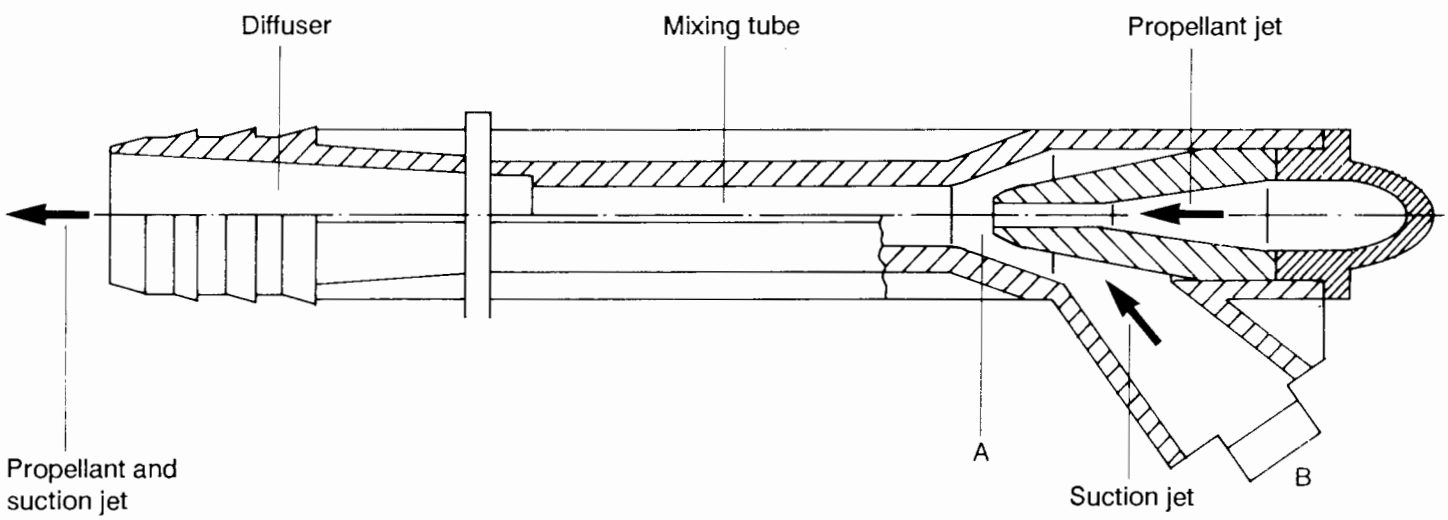


Fig. 26:
Longitudinal section through suction-jet pump

The suction-jet pump is installed in the left half of the fuel tank. It transfers fuel automatically to the right-hand half of the tank.

E 31 - fuel tank level sensor

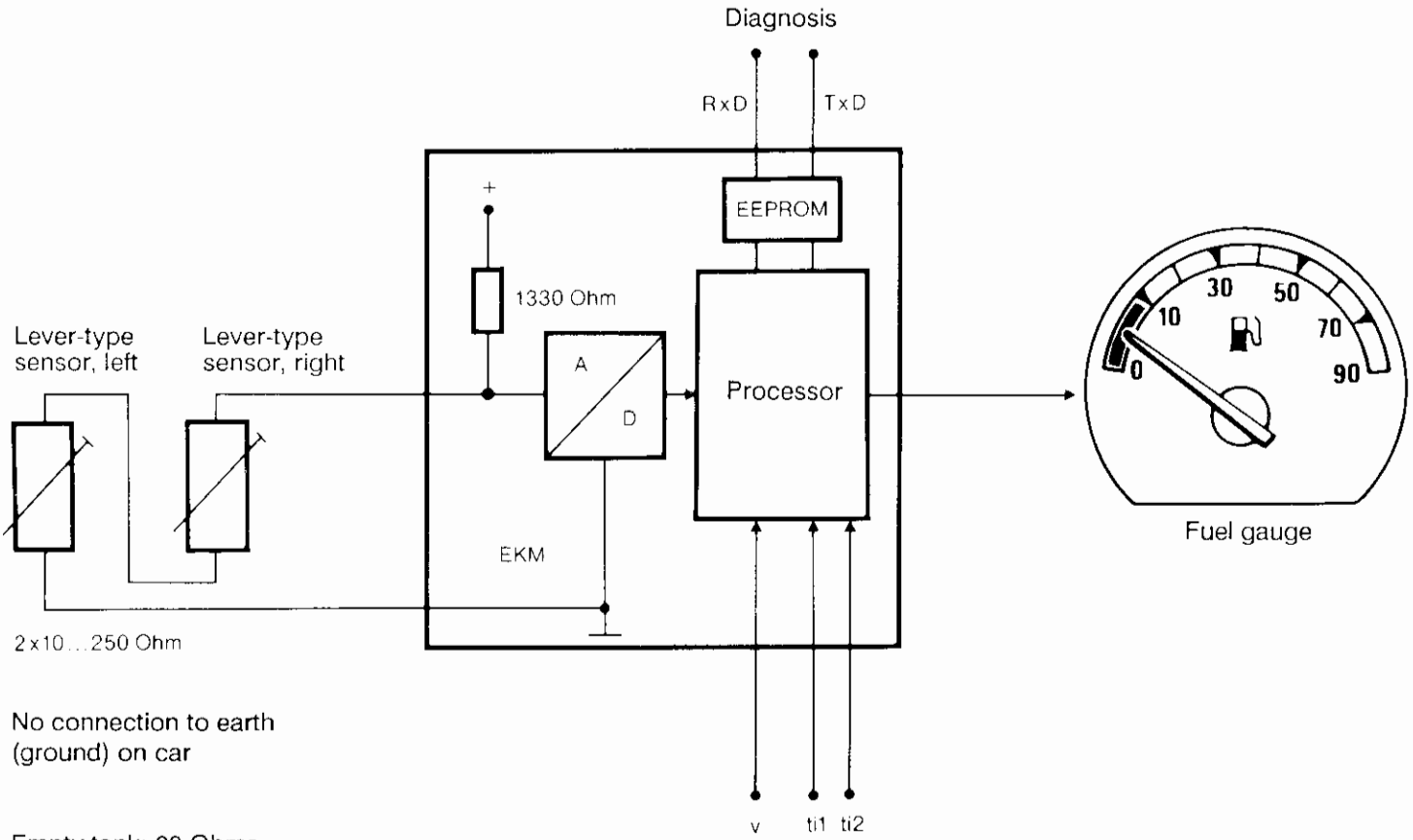


Fig. 27:
Schematic diagram of fuel level sensing system

6-speed manual-shift gearbox

The world première of a high-performance production car with V 12 engine and 6-speed gearbox.

The gearbox casing is an aluminium pressure casting, and is attached to the clutch housing to form a single rigid unit. The engine's sump acts as a stiffening web between the engine and the transmission assembly.

All these design features help to keep vibration and therefore noise to a minimum.

Cooling fins on the gearbox casing prevent overheating even in extreme operating conditions.

New design features of the synchromesh system

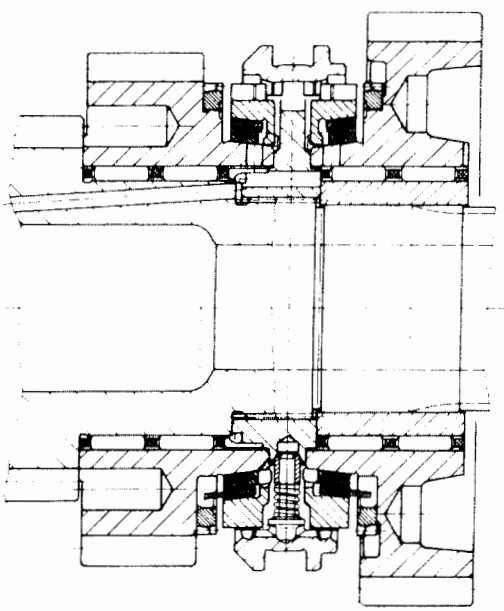


Fig. 28:
Triple-cone synchronizers

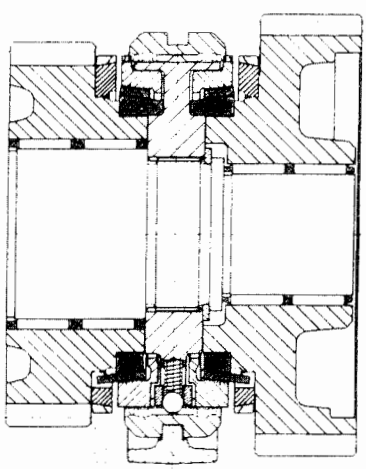


Fig. 29:
Double-cone synchronizers

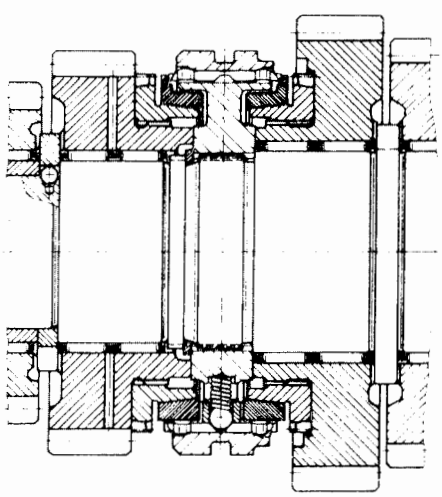


Fig. 30:
Single-cone synchronizers

Automatic transmission

The 4-speed automatic transmission of type 4 HP 24, with EH (electronic-hydraulic) control and a converter lock-up clutch, is almost completely identical with the unit used in the 750iA.

As in the E 32, the clutch linings contain no asbestos.
The three driving programs are also similar.

Program E is automatically selected each time the car's engine is restarted.

For the USA and Canada the sliding program switch has two positions (Automatic and Manual). If A is selected, a change takes place to the S shift program if the selector lever is moved back to 3 or beyond.

Features of the transmission:

- suitably modified shift program
- adaptive pressure control
- separate, compact transmission control unit
- emergency-run program

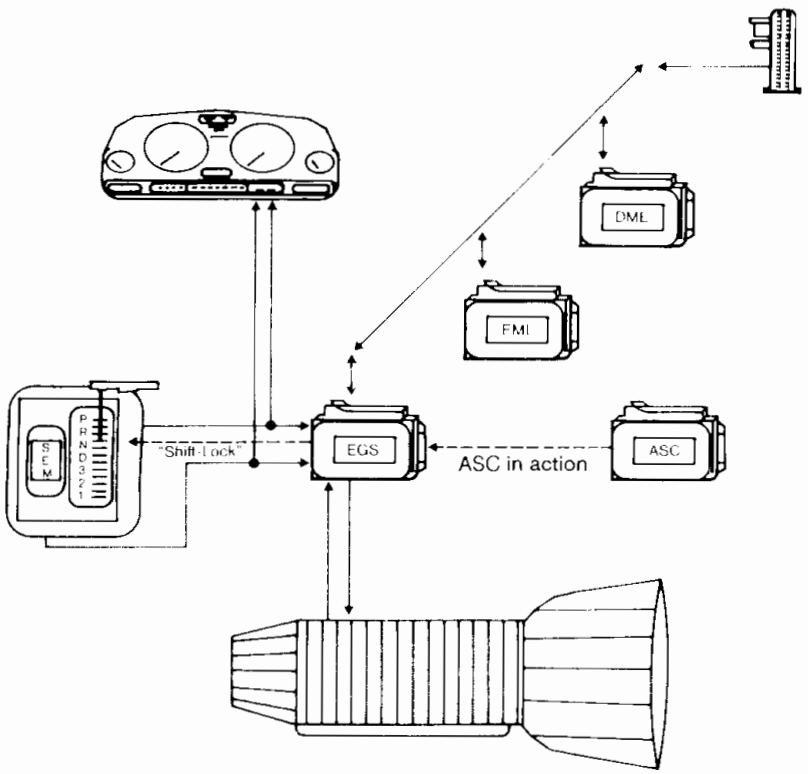


Fig. 31:
4-speed automatic transmission with electronic control unit (EGS) GS 1.2x

The chassis and suspension concept differs quite considerably from the E 24 and also from the E 32.

Front axle

The double-pivot spring-strut front suspension with lower lateral control arms and leading links, although basically the same as on the 750i/iL, has received the following basic modifications:

Modified kinematic data

		E 31	E 32 (750i)	E 24 (M 635 CSi)
Track	mm	1552	1528	1430
Toe-in	min.	18	18	18
Camber	min.	-12	-13	-28
Castor angle	deg.	8°14'	8°17'	8°42'
Castor distance	mm	17	16.4	15.1
Scrub radius	mm	+ 6	+ 8.4	+ 12
(All values measured in design [normal-load] position)				

Fig. 32:
Variations in front-axle kinematic data

"Integral" rear suspension

"Integral" rear suspension is a completely new development for use on the 850i; this suspension takes into account the exceptionally sporting and dynamic character of the car.

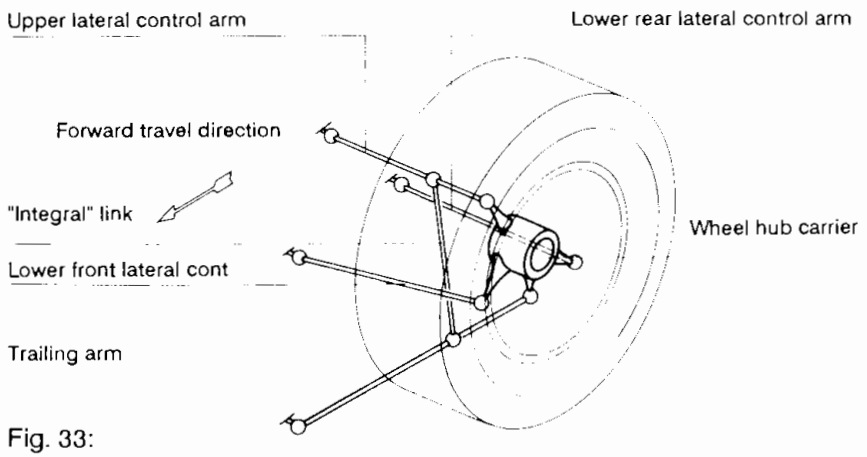


Fig. 33:
Schematic diagram of "integral" rear suspension

The "integral" rear suspension is a three-dimensional system with five locating arms on each side: three lateral control arms, one trailing arm and a new type of coupling link between one lateral control arm and the trailing arm, known as the "integral link".

The lateral control arms pivot on a rubber-mounted rear-axle subframe, whereas the trailing arms pivot on softer rubber bushings attached directly to the bodyshell. The final drive is double-insulated from the body to prevent noise transmission.

This form of suspension incorporates anti-squat and anti-dive geometry which takes effect when the car is started from a standstill briskly or braked hard. Each rear wheel has ample longitudinal compliance without any loads being transmitted to the subframe, so that one rear wheel cannot influence the other.

By distributing the control and trailing arm pivots between the rear-axle subframe and the main bodyshell, it has proved possible to achieve excellent road behaviour with a high degree of dynamic refinement and steering precision, without making the car sensitive to load reversals or longitudinal forces acting on one side only.

Driveline/ rear axle

Two-piece propeller shaft with Jurid joint disc at manual-shift gearbox output, for minimum noise transmission.

Universal joint on cars with automatic transmission.

Universal joint at centre bearing and homokinetic (constant-velocity) joint at input to final drive (as on E 32).

The half-shafts have been uprated to 33 mm diameter in conjunction with the 2.93:1 final drive ratio.

Notes:

Brakes

The brakes have been matched to the high demands and rapid rates of retardation called for on the E 31. A high-performance diagonally-split dual circuit system is used, similar to that on the E 24 or E 32.

Single-piston fist-type calipers (Type FN 60) are installed at the front, with internally ventilated brake discs. Disc diameter is 324 mm, compared with 300 mm on the M 635 CSi and 282 mm on the 635 CSi, and disc thickness is 30 mm instead of 25 mm (635 CSi).
324 mm diameter discs are also installed at the rear instead of the 284 mm dia. discs on the M 635 CSi; they are 12 mm thick instead of 10 mm (635 CSi).

The effective surface area of the brake pads is 28 % larger; together with 10 % greater disc area at the front, this ensures precise, consistent braking.

The improvements at the rear are even more striking: the pad area is about 100 % greater than on the E 24.

In view of the E 31's axle load distribution of 51.5 % (front) to 48.5 % (rear), the rear brakes play a greater part in overall braking.

The greater surface area of the pads reduces the rate of wear, making renewals less frequent and cutting maintenance costs.

As on the E 24/E 32, the brake pads contain no asbestos. The ABS 2 antilock braking system (Bosch) has 4 sensors and a 4-channel control system.