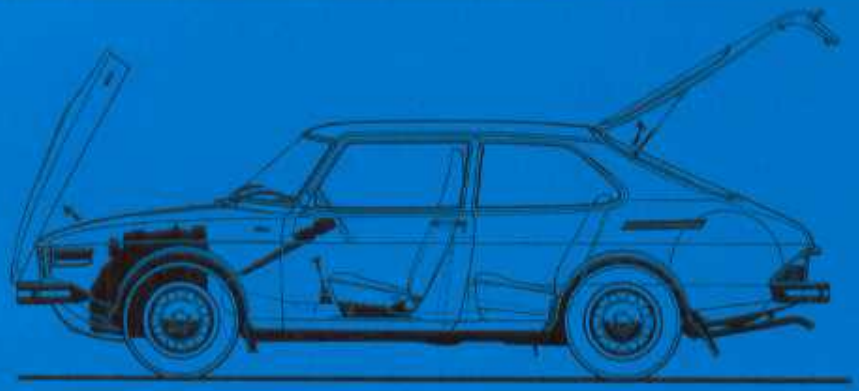
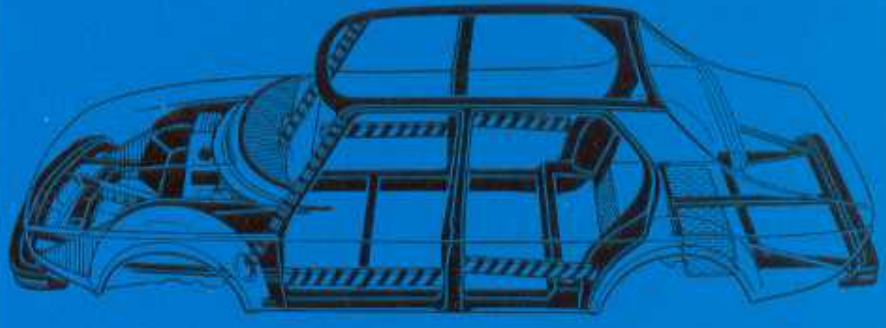
Engineering features

The Saab 99 models





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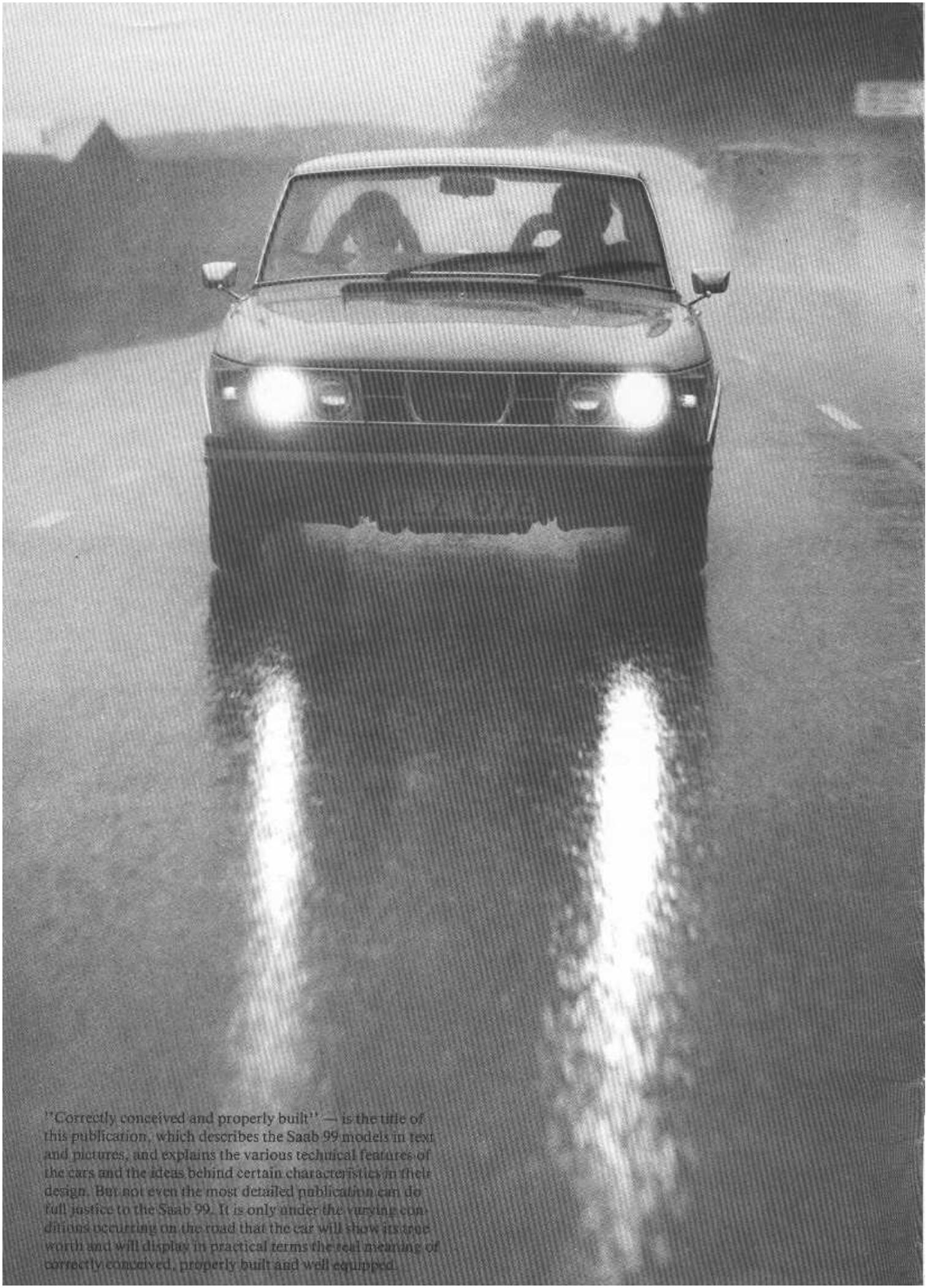


"Correctly conceived and properly built" — is the title of this publication, which describes the Saab 99 models in text and pictures, and explains the various technical features of the cars and the ideas behind certain characteristics in their design. But not even the most detailed publication can do full justice to the Saab 99. It is only under the varying conditions occurring on the road that the car will show its true worth and will display in practical terms the real meaning of correctly conceived, properly built and well equipped.

Saab 99LE Sedan

2 door model, 2.0 liter fuel injected engine, 4 speed manual or 3 speed automatic transmission, power steering option with 4 door automatic transmission.

Saab 99LE Sedan

4 door model, 2.0 liter fuel injected engine, 4 speed manual or 3 speed automatic transmission, power steering option with 4 door automatic transmission.

Saab 99LE WagonBack

3 door Sedan/hatchback combination, 2.0 liter fuel injected engine, 4 speed manual or 3 speed automatic transmission, power steering option with automatic transmission.

Saab 99 EMS

2 door sports Sedan, 2.0 liter fuel injected engine, 4 speed manual transmission, delux interior, performance wheels and tires, sun roof option.

Correctly conceived and properly built

When the guidelines were drawn up for the Saab 99 project, or Gudmund, as its code name was then, the Saab design team was faced wih a diffcult task. But it was also an inspiring task. Their desire was to create a compact and robust, although roomy and comfortable car, which was to have good roadholding characteristics. They wanted it to be versatile and easy to service, and have good cold starting characteristics, good heating, an attractive appearance and good performance. Moreover, the whole car was to reflect a very serious attitude towards safety.

The decision to mount the engine in the front and use the front wheels to drive the car was the first step in achieving these often conflicting goals. This was entirely in line with the fundamental Saab design philosophy, and provided the prerequisites for the car being roomy, without having to be long and heavy. An additional advantage was that the tractive effort was applied by the pair of wheels which basically had the best grip, i.e. those which generally carried the heaviest load. Directional stability also favored the front wheels being driven.

The laws of nature and common sense also dictated the styling of the car. It was obviously desirable to make the car aesthetically attractive, although a functional design was considered more important than stylishness. Low air resistance and insensitivity to cross-winds were considered to be vital design factors. The car was to offer good visibility, and the driver's seat was to be designed for comfort and safety.

About 400,000 hours of engineering design time had already been devoted to the "Gudmund" project when the car was presented to the public in November 1967, when it was christened the Saab 99. By this time, the styling of the car had been all but finalized, although full-scale production was still about one year away. It was considered vital to make certain that the new car was thoroughly tested and equal to the original design concept. The road-testing was given depth by allowing a number of people in various parts of Sweden to have a pre-production Saab 99 at their disposal for about six months, on condition that they advised the factory in Trollhättan of their likes and dislikes about this newest Saab. Information was thus received from motorists with different driving habits and requirements. At the same time the test department gathered information from arduous road and laboratory tests.

When the Saab 99 made its first appearance on the market — after ten years of development — a great deal was naturally expected of it by the motoring public and the motoring press. Much had already been written about the new, larger Saab model and journalists were eager to test it on the road, to see whether the newcomer really was worth all the acclaim it had already received.

The articles in the daily papers and the motoring press were very favorable. The Saab 99 really was correctly conceived and properly built. The roominess of the car, its good roadholding, the seating comfort and the well-developed heating system received special praise. The brakes, suspension, controls, directional stability in strong cross winds, low wind noise at high speeds and the modern engine design were also highly praised. And all agreed that the Saab 99 must surely be one of the world's most advanced cars from the safety point of view.

1 The Saab 99 has an aerodynamically tested body. It is designed and styled to ensure directional stability under all road conditions, even in a blustery cross-wind. The overall road stability is good, due to the shape of the car and its favorable weight distribution. The deeply curved windshield and the absence of corners which create turbulence are features which contribute to the low interior noise level.

2 The Saab 99 has front wheel drive. Since the engine and gearbox are mounted at the front, more than half of the total weight of the car is supported by the front wheels, and these wheels are therefore more firmly in contact with the road surface than are the rear wheels. The car's center of gravity is closer to the front axle than the rear axle, and this is an important factor from a safety and comfort point of view. The larger proportion of the weight on the front wheels assures directional stability and insensitivity to cross-winds. And since the amount of extra weight carried by the front wheels is moderate, it has been fairly simple to make the car understeer slightly. A further advantage of front wheel drive is that the front wheels have a greater capacity for transmitting tractive force at the road surface without skidding, hence the driving wheels are assured a firm grip. This is a vital factor in maintaining control on slippery or poor road conditions. In spite of its compact outside dimensions, the Saab 99 provides space for five adults and their luggage. The front wheel drive eliminates the need for a drive shaft. This saves space and ensures that even three people will be comfortably seated in the back seat.

3 The Saab 99 has been acclaimed as one of the world's safest cars. The windshield pillars of a Saab consist of exceptionally strong steel sections which, together with sturdy sill-beams, protective beams in the doors and other structural members of the body, form a protective cage around the passengers.

4 The Saab 99 is designed to make its occupants comfortable even at extremely low outdoor temperatures. Even experienced drivers know that the Saab 99 can withstand arctic winters. It will start easily and quickly attain a comfortable interior temperature. In 1972, Saab was the first car to introduce the automatic electrically heated driver's seat as standard equipment — a comfort feature which reflects Saab basic motoring philosophy — a comfortable driver is a safe driver.

The many excellent test results by the press and others, prove that Saab engineers indeed achieved their goal, with no small measure of success. The sub-heading to a Saab 99 test report in the April 1970 issue of the American **Car and Driver** read as follows: "Saab doesn't build automobiles — Saab builds Saabs, which are a highly original and highly logical answer to at least one facet of the human transportation problem."

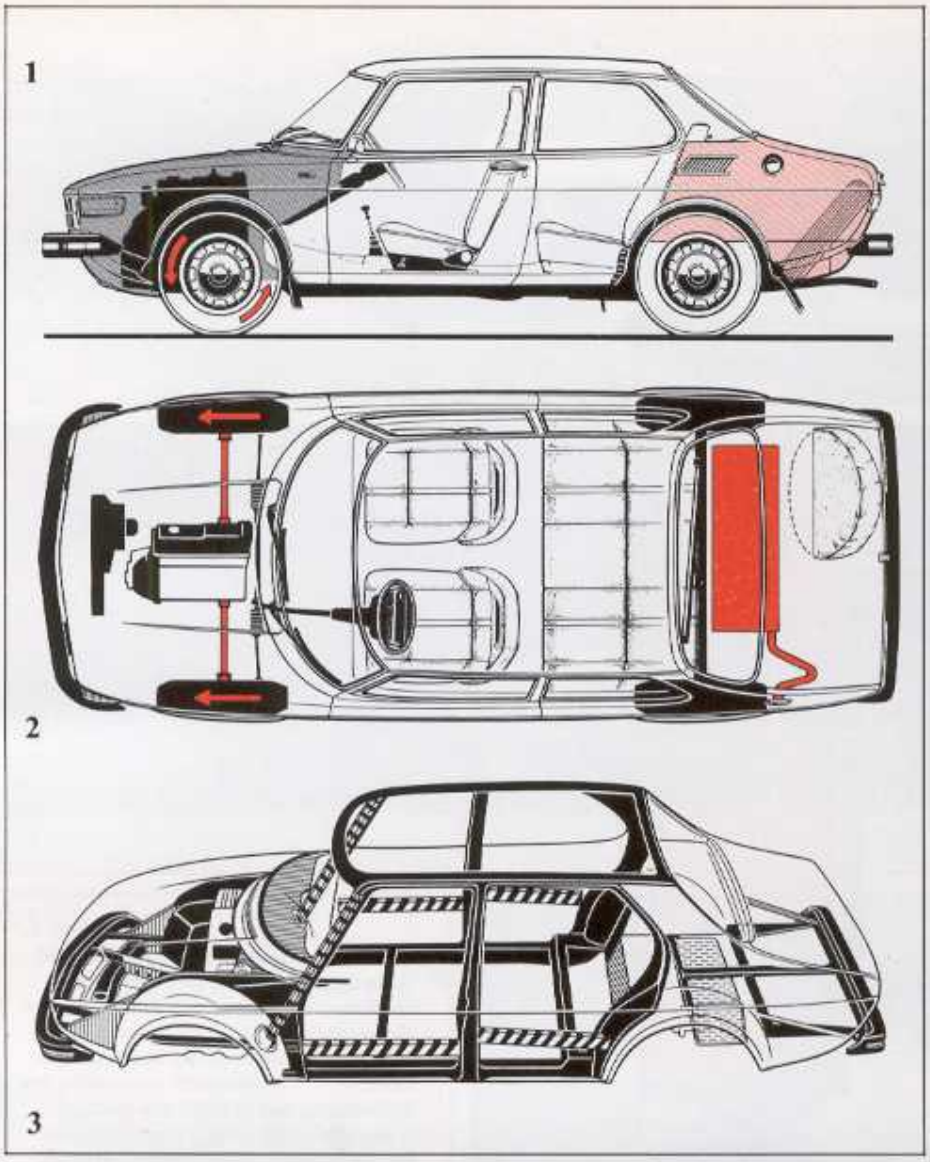
In 1972, **Popular Science Magazine** awarded the Saab 99 and four other cars the title of "cars of the future". In justifying the choice, the magazine stated that "each and every one of the chosen cars boasts features which can be expected to become standard equipment on the cars of the future."

Two years in succession (1972 and 1973), the Saab 99 won the longterm test organized by the Swedish magazine **Vi Biläagare**, in competition with cars such as the Volvo 142, Volkswagen K70, Opel Rekord II, Ford Consul, Peugoet 504 and Audi 100 LS. In 1973, the final comments of the magazine on the Saab 99 read as follows: "Those who followed the test could not fail to notice that, round after round, Saab was best in nearly every instance, and that there is actually very little to criticize."

5 In 1972, the Don Safety Trophy, the most coveted British prize for safety was awarded for the seventh time. For the first time in the history of the award, a non-British automobile took the honor. It was, of course, the Saab 99.

6 **Teknikens Värld**, Sweden's largest popular technical magazine awarded its 1972 "Car of the year" prize to the Saab 99. In justifying its choice, the panel wrote: "The selection of the Saab 99 as the 1972 "Car of the year" is a tribute to the features which place this car in a special class on the world market. An already good Swedish car has become even better, and illustrates the proof of the saying: "where there's a will, there's a way."

7 The German magazine **Hobby** awarded its 1972 "Oscar" for car safety (in the 1.5 — 2 litre class) to the Saab 99.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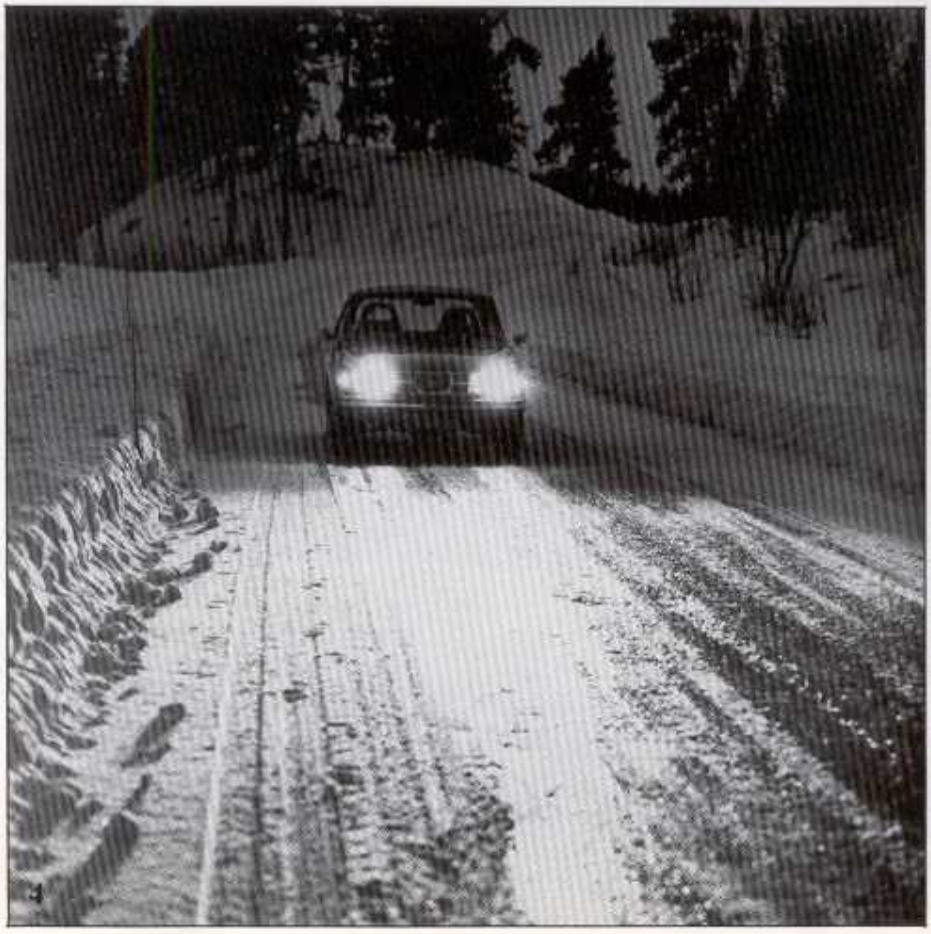
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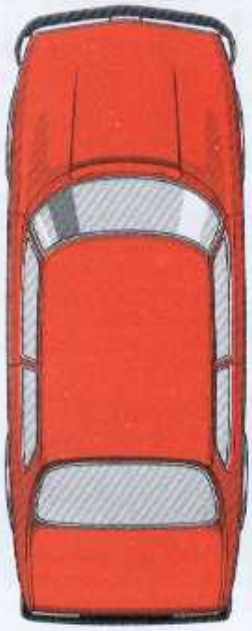
Aerodynamics must not be neglected

When a car is driven at a steady speed on a level road, the tractive effort at the driving wheels is equal to the sum of the rolling resistance (friction) plus air resistance.

As long as the speed is moderate and the weather is not windy, the power required to drive the car is fairly low. At 43 mph, for instance, the air resistance of a medium-sized car may be of the order of 30—40 ft/lb of torque, and the power required to overcome this resistance will be about 5 hp. But at 62 mph the engine must deliver an additional 10 hp to the driving wheels to overcome the air resistance. If the speed is increased to 93 mph, the air resistance will absorb at least 50 hp (i.e. 27 times as much as at one-third of the speed, or 8 times the power required at half the speed).
The laws of physics state that the coefficient of drag increases as the square of road speed increases. In other words, if a certain speed is doubled, the drag will be 2^2 or 4 times higher than the original value, if the speed is tripled, the drag will be 3^2 or 9 times higher, etc. The power demand will increase even more steeply — as the cube of the speed, i.e. $2^3 = 8$, $3^3 = 27$, $4^3 = 64$, etc. Thus, if 0.6 hp is required at 10 m/s (36 km or 22 mph), $0.6 \cdot 4 = 38.4$ hp will be required at 40 m/s (114 km or 71 mph). Side winds and to an even greater extent, head winds, naturally increase the power demand and the fuel consumption. Experimental results show that an additional 15 — 20 hp and an extra 1.7 gallons of fuel per 100 miles may be required in a headwind at a highway speed of 68 mph. A very high proportion of engine horsepower is needed to overcome air resistance, especially at high road speeds. Hence, it is desireable to keep air resistance to a minimum. Saab accomplished this with an exterior design that produces very little aerodynamic drag, as compared to other cars of similar size and weight.



Automobile designers can alter three variables to modify the drag of a car: the shape of the body, its size, and weight. Saab engineers wanted to build a car with a roomy interior, but a compact, aerodynamic exterior which would produce a low drag coefficent. They were suprisingly successful.

1 The drag alone, unaffected by crosswinds and headwinds, is not the only factor which should be made as low as possible to achieve a car with an aerodynamically favorable shape. Numerous other factors must also be taken into account to ensure safety, comfort and economy. The car must not alter its course when exposed to strong wind gusts from the side. Neither must the speed of the car and crosswinds create lifting forces of such magnitude at one or several wheels that roadholding and stability are jeopardized. Unfortunately, many cars perform poorly in these two important areas because of a lack of attention to aerodynamics in design.

2 The yardstick used for specifying the air resistance of a certain shape is the "drag coefficient". This coefficient is reasonably independent of the size of the car, and is between 0.32 and 0.50 for most modern cars. The lower the coefficient, the more favorable the shape. Values below 0.35 are unusual. Knowledge of the drag coefficient of a car, its cross-sectional area and the density of air, and tangential force, relate to the total drag of the car. The tangential force, to be calculated for any speed, provides that there are no wind forces to be considered.

3 The first aerodynamic tests on the Saab 99, in the autumn of 1964, indicated a drag coefficient of no more than 0.36. The curve defines the variation in the drag coefficient (CT) as the speed of the car and headwinds increase. A 1:5 scale model was used for the experiments, and its shape was practically identical to the present-day production car. Certain modifications were obviously made before production prototypes were manufactured, although the changes had no significant influence on the value of drag. Before the shape of the body was finalized, some important factors were analyzed. The most suitable locations of the ventilation air outlets were also investigated. The 99 was then modified year by year, although the changes to the exterior only affected such items as bumpers, direction indicators and rear view mirrors. The basic shape still remains unaltered.

4 The Saab 99 is designed and styled to ensure directional stability under all conditions. Because of its aerodynamic design, yaw susceptibility is low. The shape of the rear window and the trunk lid, as well as the transition between the side surfaces and the rear section are also important factors in the unusually good directional stability in windy weather. The deeply-curved windshield and absence of sharp corners, which often cause turbulence, contribute to reduce wind noise in the Saab 99.

5 The latest model of the Saab 99 — the WagonBack — has an even lower drag coefficient than the sedan types. One of the goals in designing the rear section was to ensure that the rear window was self-cleaning. Tests under the worst conceivable road conditions showed that the results achieved were better than expected. The air flows across the window with no turbulence thus keeping the window clear of dirt.

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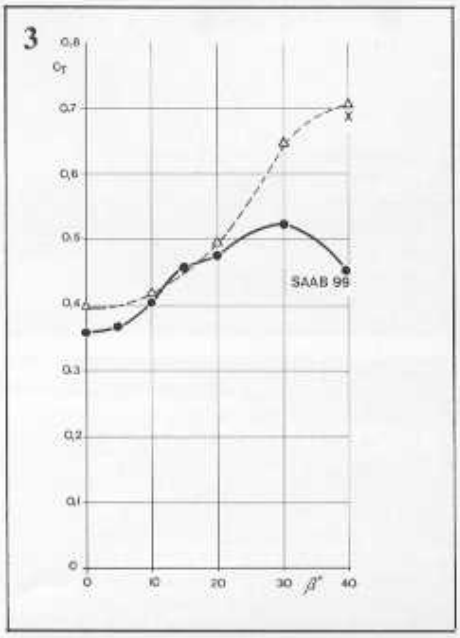

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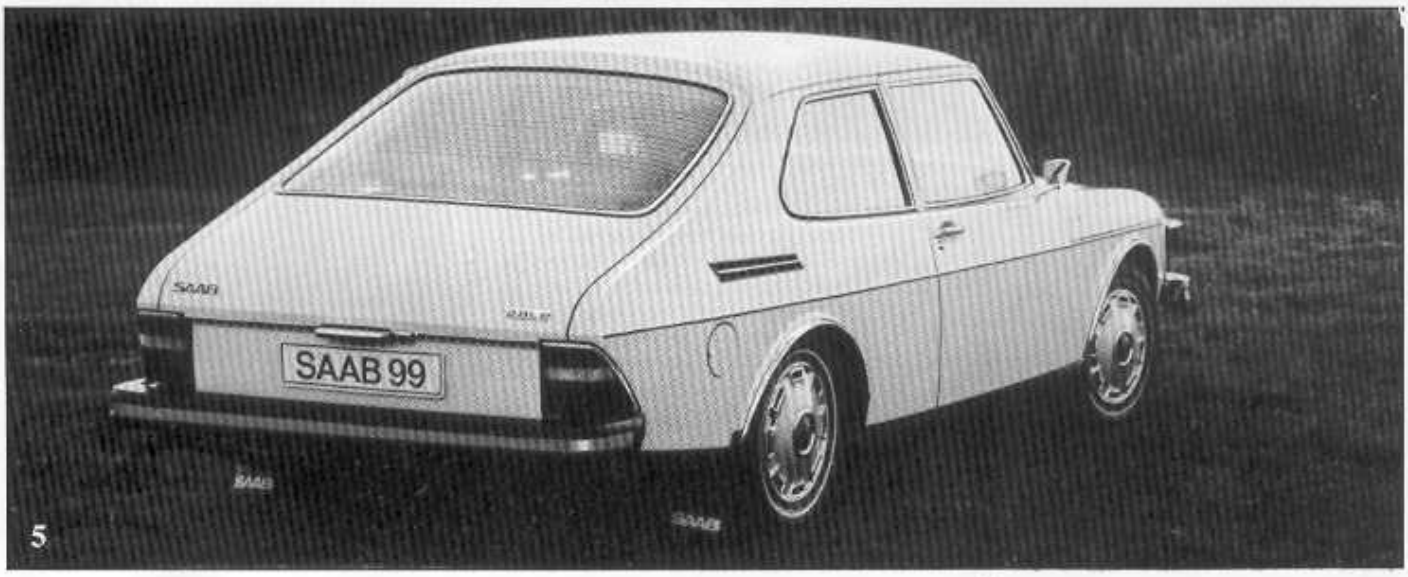

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The exterior design

The ambition of every car designer is obviously to create aesthetically pleasing cars, although he must first master the art of achieving harmony and distinctive styling. Numerous, often conflicting factors must then be taken into account. The beauty of the final product is largely dependent on the functionality of the shape and the "feeling" of the stylist. And the fact that the car is a compromise must not be immediately apparent.

Since the car is such an integral part of our environment and since its appearance affects us emotionally, its aesthetic qualities are very important, but the shape is also important from a functional point of view. Factors such as maneuverability in traffic, the available space, the ease of entering and exiting the car, and the convenience of storing luggage are largely dependent on the styling of the car. The same applies to the accessibility of the engine and the intensity of the wind noise at a certain speed. The designer and stylist must use the dimensions wisely, so that interior space will be as large as possible in relation to the length, width and height of the car. An economical and efficient approach must also be adopted regarding the use of various types of materials and components. At Saab, these considerations are guided by a time-honored motoring philosophy.

1 The exteriors of the Saab 99 models reflect a functional design with certain distinctive characteristics. The 99 models are compact. The body has no sharp, projecting corners, no "empty inches" in length to give an impressive appearance or to provide space or fashionable styling. The smooth and sparsely decorated surfaces simplify the care of the car and ensure a minimum of points at which dirt can collect or corrosion can start.

As an example, take a look at the rear pillars. They are integral with the side panels, without a distinctive waistline at the top of the fenders. The design provides exceptionally generous interior dimensions, particularly in the width of the back seat. The rear track is 4 ft 7.5 in. — a self-evident advantage as far as roadholding is concerned.

The radiator grille and headlight frames are a one-piece moulding of durable plastic, with silver-colored trim. The material will not corrode or rattle and is insensitive to the elements. All bright exterior parts — trim, wheel covers, etc. are also made of non-corrosive material. The windshield is made of tough laminated glass and is deeply curved to meet safety and aerodynamic criteria. The windshield pillars are relatively far back, and the narrowest side faces the driver, thus ensuring excellent visibility forward and to the sides. The short hood slopes down at the front to provide good visibility forward.

2 The WagonBack has a profile which distinguishes it from the other 99 models. The roof line between the windshield and the rear window is the same as on the sedan models. The body is of a new design from the center pillar to the rear of the car. This section has been designed and styled to suit the semi-station wagon features of the car. The Wagonback is 4 in. longer than other models, although the wheel base is the same as other 99 models. The rear door extends from the roof to the floor, and the rear window has an area of almost 0.807 m². The tail light and directional signal assembly has also been newly designed.

3 The engine compartment is completely accessible for service and inspection because of the unique hood design. This design incorporates the fenders with the hood as one integral unit. It eliminates the usual scratches and dents caused by service personnel as they service the car.

4 The rear lights are grouped in a large cluster which incorporates the direction indicator light, the rear light and reflector, the brake light, the reversing light, and the parking light. The arrangement on the WagonBack differs slightly.

5 Climbing in and out of a Saab 99 is easy and convenient. The sill beams are low, and indented from the outer edge of the body. Since the beams are protected from dirt thrown up from the road, there is no risk of getting dirt on your clothes when entering the car. The door hinges are designed so that the bottom of the door swings outside the fender when the door is opened. This provides a very large door opening to make entry and exit exceptionally convenient. A safety feature — the door edges are fitted with reflectors, so when opened, they will be visible in the dark by approaching motorists.

6 An example illustrating the amount of thought devoted to the design of the car is the rear mudflaps. They are located so that they will not be torn off by being caught between the wheel and the curb when the car is being driven in reverse.

7 On examining the exterior of the Saab 99, the careful observer cannot avoid noticing the sturdy bumpers. The bumpers are well clear of the body to allow access for cleaning.

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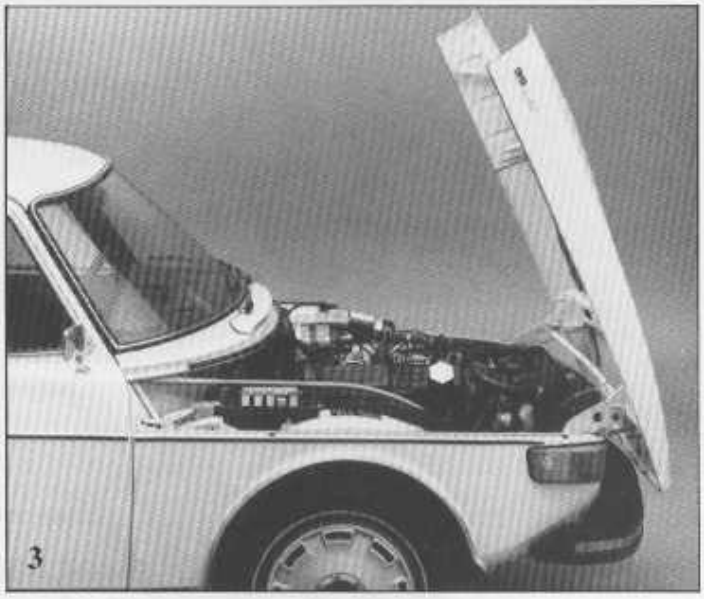

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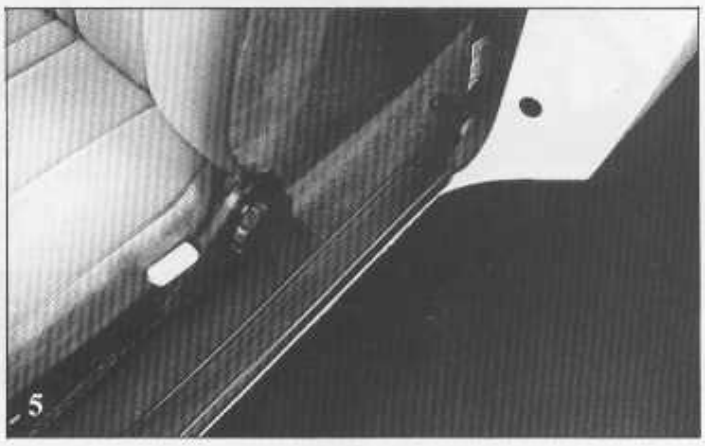

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A body with built-in safety

The Saab 99 has unit body construction. Its all-welded steel body is considerably thicker than that normally employed in the automotive industry. Despite the steel body thickness and the large interior dimensions, the overall weight of the car is low.

1 The windshield pillars consist of 39 inch long, exceptionally strong steel sections made of .080 inch thick material. The bottom of the steel sections are welded to the wheel housings. The sill beams and side pillars are also exceptionally strong, and a reinforcing steel rail is welded around the edge of the roof.

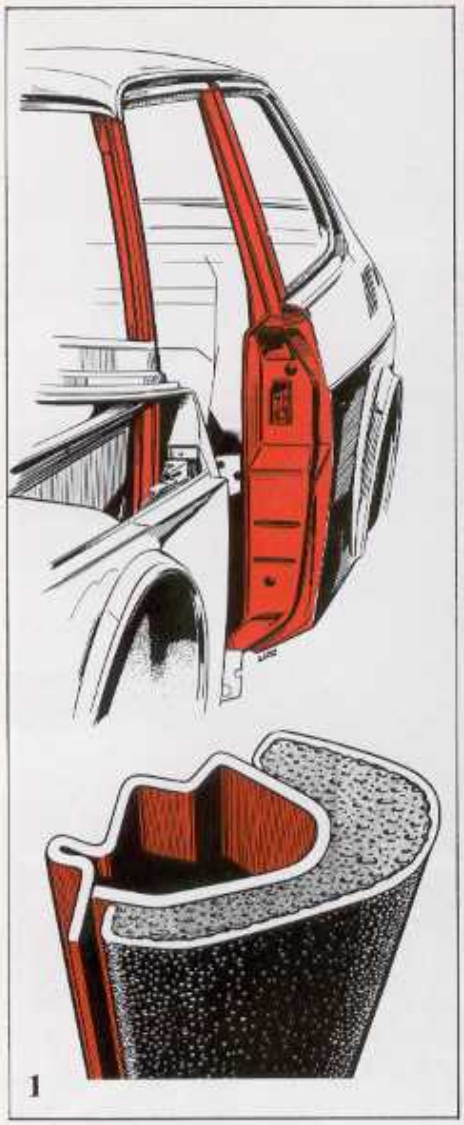
2 The front and rear sections of the car are designed as energy-absorbing deformation zones. Development work is continuously in progress to improve and refine the design.

3 The "cage" around the passenger compartment has given ample proof of its immense strength in many tests and after actual accidents. As an example, a Saab 99 has been dropped upside down onto a concrete floor from a height of 7 feet without the windshield or center pillars being deformed.

4 Even a stable steel structure is subject to corrosion attack. The anti-corrosion treatment carried out at the factory is, therefore, an important part of safety. All Saab 99 cars are subjected to extensive treatment in several stages during the manufacturing process. Priming is done by the electrophoresis process. After the body has been phosphated, it is immersed in a bath of anti-corrosion primer, where the particles are induced by a strong electric current to adhere securely to all steel surfaces, even along edges and in cavities.

5 Before the fully-assembled car leaves the factory, it is subjected to additional unique anti-corrosion treatment. All cavities, such as doors, sill beams and brackets, are sprayed internally with anti-corrosion oil. The joints between the wheel housings and fenders are also treated with anti-corrosion agent, as well as the space between the outer panel and framework of the trunk lid and hood. This oil treatment is applied to 30 points on the body. The whole engine compartment is protected with a special clear substance and the outside of the car is coated with a wax which protects the paintwork while the car is being transported to the sales outlet. As a final measure, the whole underside of the body is sprayed automatically with an anti-corrosion agent.

6 Before the body receives its final coat of paint, it is given a protective and sound-absorbing layer of underseal compound on the underside of the body and in the wheel housings. The compound is applied by means of an airless high-pressure spraying process, to eliminate the risk of air bubbles in the final coating.



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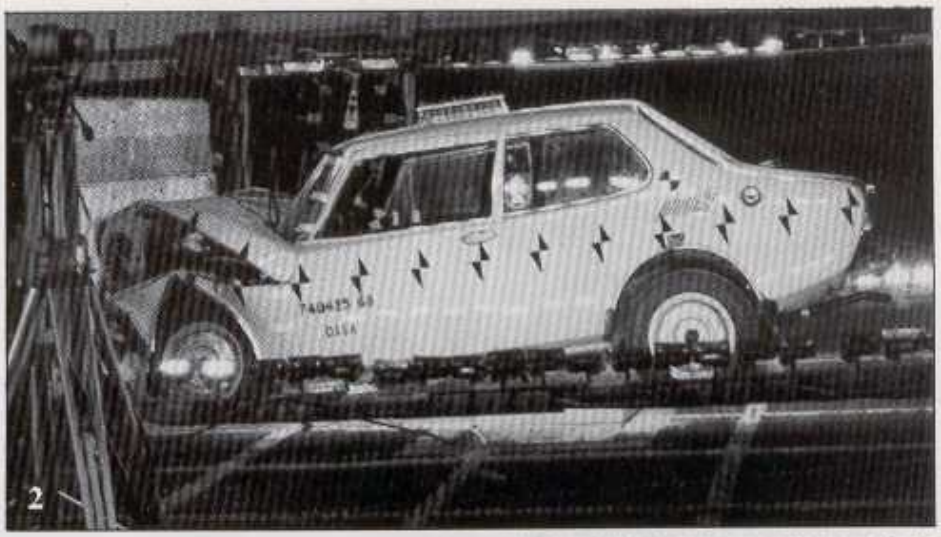

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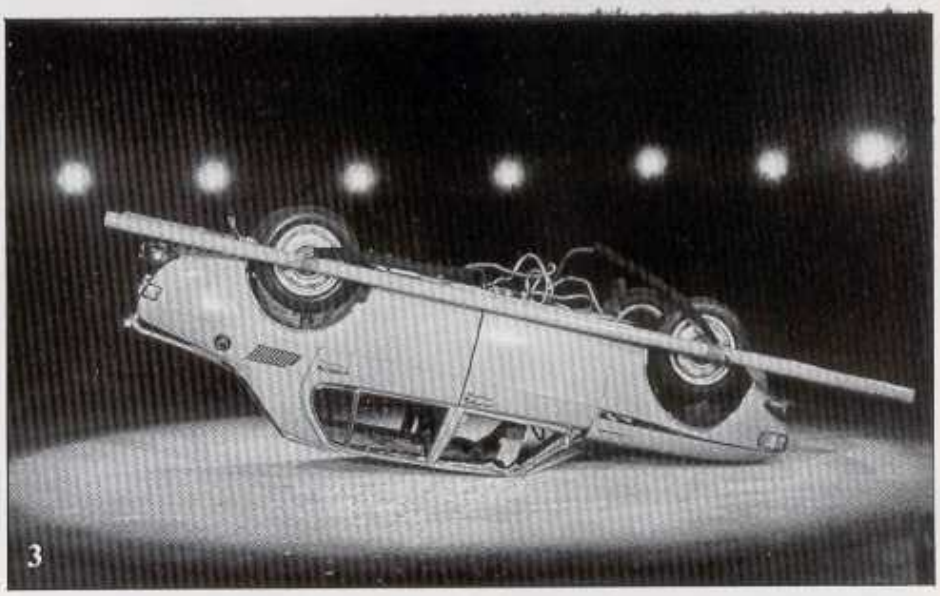

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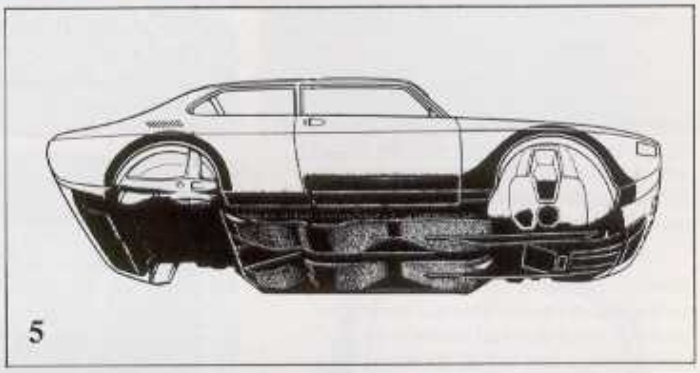

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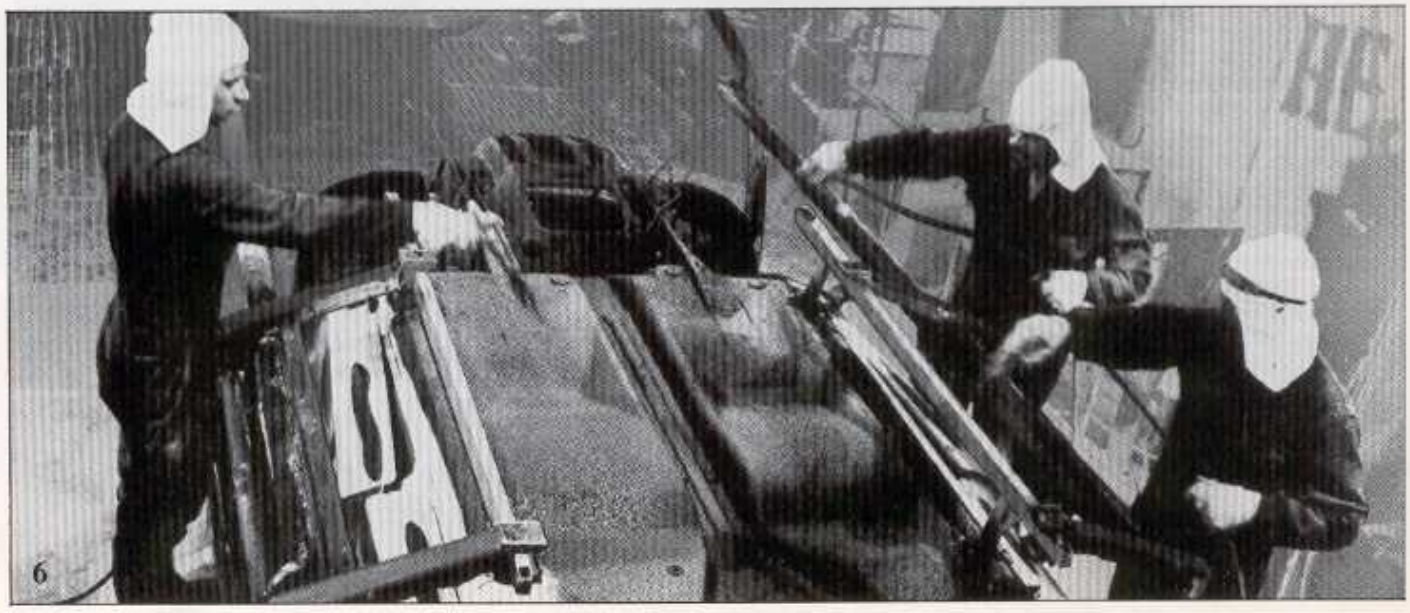

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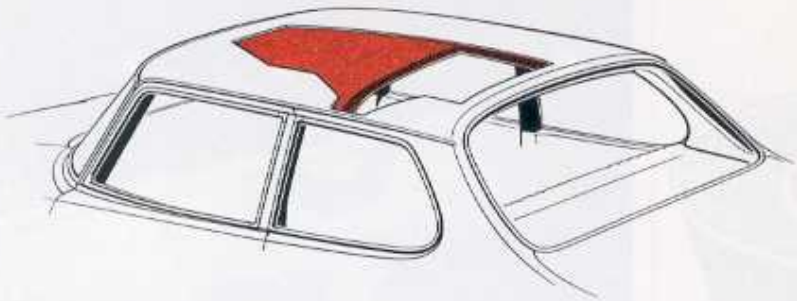


Interior — Safety

The interior of a Saab 99 has a well-developed safety design. Improvements and detail modifications are continuously introduced as a result of laboratory tests and accident investigations. Since 1971, a group of specialists — physicians and engineers — have been engaged in road accident research. Saab cars which have been involved in serious accidents are investigated, with the primary aim of obtaining the information necessary for further development of an already well-proven safety design.

1 Simulated collision tests against a barrier are carried out at regular intervals in order to establish the strength of the body and interior fittings, and to find the means for improvements, particularly as regards the prevention of injuries.

The dashboard is designed with the safety of the occupants in mind. If subjected to a heavy impact, it will absorb energy by deforming. The dash panel is polyurethane foam with a .039 inch thick surface layer and incorporates reinforcing plates of such design that they will absorb energy by deforming upon impact. The plates are perforated at strategic points for energy absorption considerations. The panel, in its entirety, is mounted on four bulkheads running in the longitudinal directions of the car, and these bulkheads will fracture if exposed to an abnormally high load. The integral material provides the panel with the necessary softness, and can also assist in distributing the load over a wide area. The shape and location of the windshield in relation to the heads of the front seat occupants minimizes the risk of contact with the windshield in the event of a collision, provided that their seat belts are fastened. The stable corner pillars are covered with abundant engery-absorbent padding.

2 The head restraints of the front seats are designed to take into account the passengers in the back seat. This is illustrated by the absence of sharp corners and edges, and the seat back's impact-absorbent padding. The bottom edges of the seats are provided with extra soft padding to protect the ankles of the back seat passengers.

3 The location of the ignition key on a special console between the front seats has been chosen for safety reasons. Many serious knee injuries have been caused by the key in an ingition lock fitted on the steering column at knee height. The handbrake lever is fitted where it can also be operated by the passenger in an emergency situation.

4 The steering wheel allows for a firm grip, and is provided with substantial, energy-absorbent padding. The padding is located on the steering wheel center section. This padding, though ample, does not block vision to the instruments.

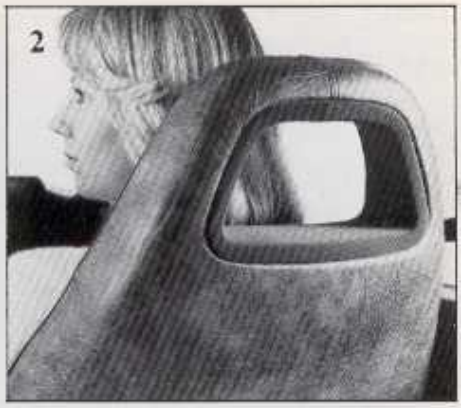
5 All Saab 99 models are equipped with inertia reel belts for both the front and back seat occupants. Front seat belts are connected across a switch which lights up a red warning light with the text "Fasten belts" if the driver or passenger has not fastened his seat belt when the ignition is switched on and the handbrake has been released. The seat belt has no metal buckle, and is passed around a special flap lock on an upright location between the front seats. This design allows for a lighter inertia reel mechanism and reduces the seat belt pressure, an advantage on a long drive.

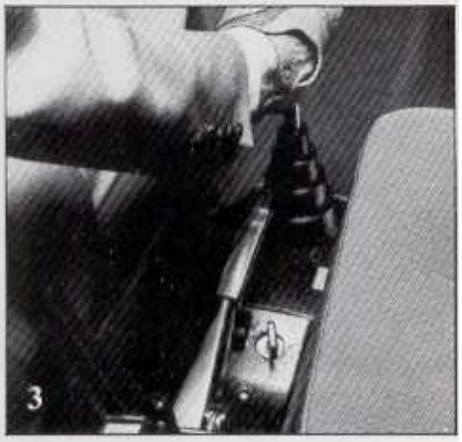
6 The defroster duct is also designed to provide a head restraint for the back seat passengers. The duct can be fitted with comfortable cushions available as optional extras.

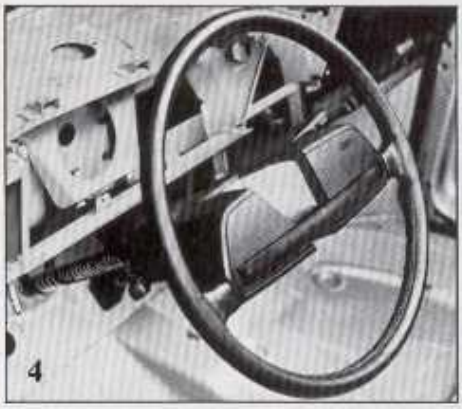
7 The roof lining acts as a large, impact-absorbent shield extending down over the roof beams and around the edges.

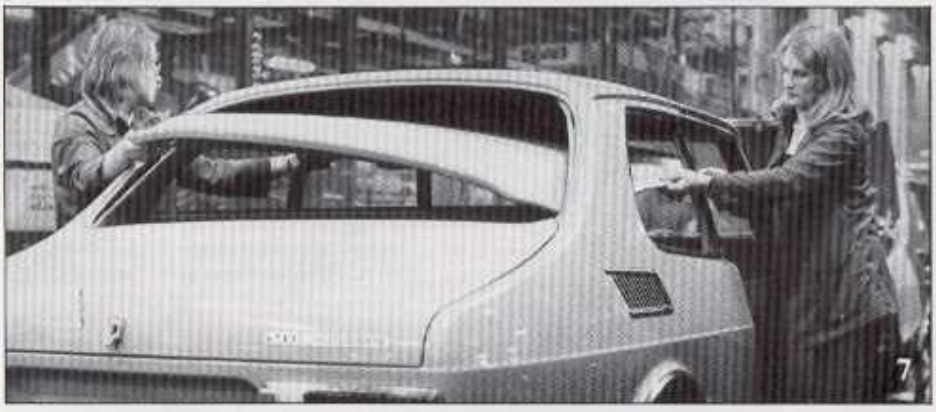
8 In order to reduce the risk of knee injuries to the front seat occupants in the event of an accident, a three-piece shield is fitted in front of the footwell and extends up to the bottom edge of the dashboard of all new Saab 99 models. The three parts of the shield are hooked to each other and the outer parts are secured to brackets at the wheel arches. Thus, they form a sort of hammock with a chain action. Experience has shown that this shield provides excellent protection. The material (ABS plastic) is highly flexible and has a rounded pattern of fracture, even at low temperature.

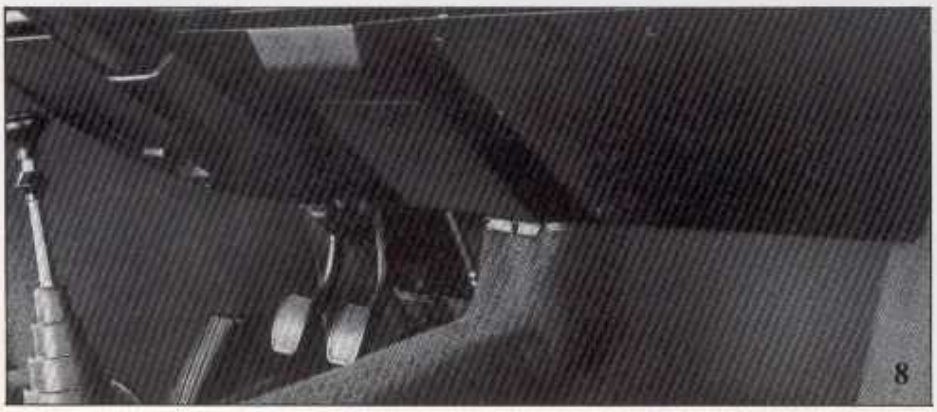
9 All models are fitted with sturdy longitudinal beams welded into the sides of the doors to protect the passengers in the event of a collision from the side. In addition, the inner door panel of the WagonBack and EMS is designed to form an energy-absorbent hip protector. The one-piece door lining is covered with strong vinyl. The panel is designed so that it will progressively fracture and collapse at predetermined points if exposed to a very heavy blow. All four-door models are equipped with childproof locks in the rear doors.

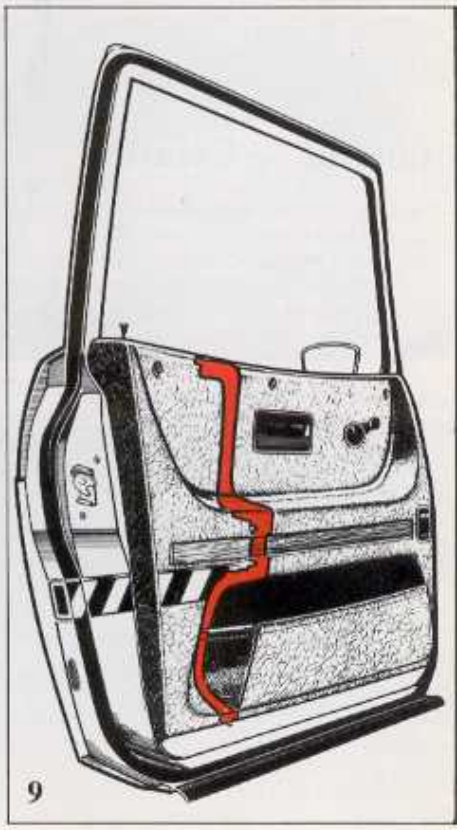


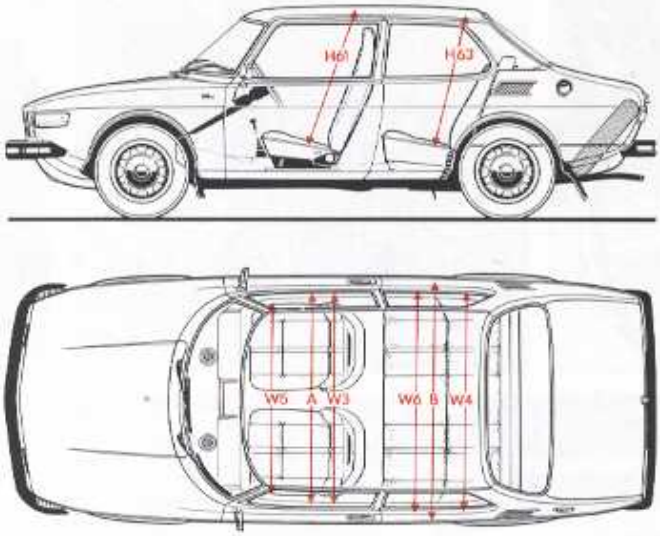












Interior — Comfort

The Saab 99 offers a comfortable ride. The interior is remarkably roomy. Since there is no drive shaft tunnel under the back seat, passengers are comfortably seated and ample space is available even for five persons.

1 The interior of the Saab 99 LE is elegant and comfortable. The seats are upholstered with a plush nylon velour material. Nylon velour "breathes" and is not cold in the winter or hot in the summer. The door and side trim are in a matching shade. The color coordinated all-nylon carpeting is of excellent quality and is easy to keep clean.

2 The seats provide good lateral support, and the springs and padding are nicely balanced so that the seat feels neither too hard nor to "spongy". The front seatbacks are totally adjustable for excellent seating comfort. Comfort can be improved further by fitting soft, specially designed, headrest cushions in the seat back.

3 The EMS model has special upholstery with vinyl trim on the seats. The folding center armrest improves the comfort further when two passengers travel in the back seat. Soft and comfortable headrest cushions for the driver and passengers round off the comfort of the interior. These cushions are available as accessories for all 99 models. In the back seat, the cusions can be simply secured to the defroster duct by means of two-sided tape. In the two-door models, the sides at the back seat conform to the shape of the body, thus offering extra space where it is best needed — at elbow level. This is a further contribution towards comfort when three passengers travel in the back seat.

4 The rear door opening on the 4-door model follows the contour of the rear backrest. Comfortably. There are no sharp or awkward corners to restrict entry and exit.

5 The roofliner is made of moulded fiberglass for impact protection and is covered with nylon velour. The fiberglass and nylon velour combination offers superior insulation against heat, cold and noise. The roofliner is yet another Saab safety and comfort feature found in all Saab 99's as standard equipment.

6 The luggage compartment of the WagonBack is of functional but elegant design. The flat floor is covered with a fitted, tufted carpet with a plastic backing. The front interior door trim is made of an impact-absorbent material covered with durable vinyl.

Dimensions according to the above drawings (2-door sedan).

H61	Height seat/roof, front	37.7 in.
H63	Height seat/roof, rear	37.4 in.
A	Width at elbow height, front	54.3 in.
B	Width at elbow height, rear	59.7 in.
W3	Shoulder room, front	52.8 in.
W4	Shoulder room, rear	54.5 in.
W5	Hip room, front	50.0 in.
W6	Hip room, rear	50.9 in.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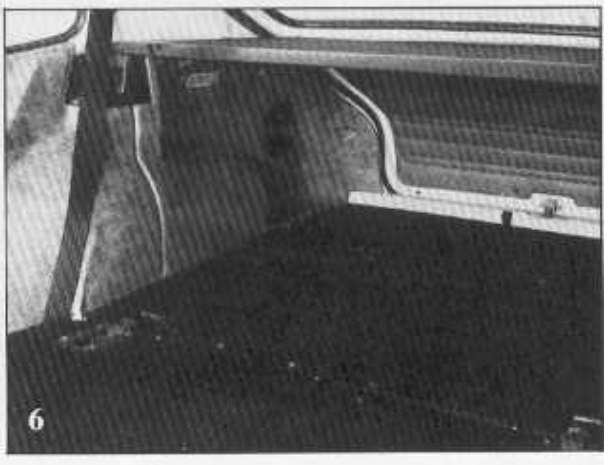
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Driver's Seat

The driver of a car must always be in a position to carry out all driving operations conveniently, safely, sometimes quickly and often for long periods and under varying conditions. Strong light, darkness, bad weather, varying road conditions, dense traffic and tight situations are factors which make heavy demands on the driver. And the driver's "workplace" must also be designed to suit a wide variety of individuals. Saab engineers, in collaboration with physicians, have therefore designed a seat which is anatomically as correct as is reasonably possible, i.e. a seat which offers the correct seating to any driver. Characteristic features of the Saab seat are:

- Total adjustability.
- Built-in injury-preventive safety.
- Comfort.

Scope for adjustment

1 The Saab 99 has separate front seats. The fore-and-aft adjustment is stepless, and can easily be carried out even from the outside, in order to facilitate entry into the rear of the car. The distance to the pedals can be varied by 6.3 inches. The angle of the backrest on all U.S. models can be steplessly altered to the horizontal position.

2 A truly exclusive feature is that the driver's seat can be raised and lowered, and that the driver can set the slope of the seat bottom to suit his individual requirements — high or low at the front edge, high or low at the rear edge. Resetting is simple to carry out by means of a handle at the front of the seat.

Built-in safety

3 **A.** Mounting is stable. It can withstand a load which is almost four times as great as that specified in U.S. safety codes.

B. The seat is built around a stable steel structure.

C. The head restraint is integral with the backrest, and the openings are designed for maximum visibility. The head restraint can be fitted with a comfortable cushion.

D. A special lumbar support is provided between the backrest and the head restraint.

E. In the event of a heavy collision from the rear, a safety mechanism will be released and the front seats are allowed to move backwards to prevent injury.

F. The rear section of the front seats is not provided with a transverse stay. Soft padding is provided instead to protect the legs of the back seat passengers.

G. The backrest contains no sharp metal which can cause injuries to the back seat passengers. The backrest is smoothly shaped and is well padded in the rear.

H. The seat is equipped with a load-sensing contact which lights up a warning lamp and activates a buzzer on the dashboard to indicate that one of the front seat occupants has not fastened his seat belt.

Comfort

The anatomic design of the seat allows the driver to be comfortable and relaxed even after a long trip.

I. The backrest and the seats are contoured to fit the small of the back.

J. Due to the length and depth of the seat, body weight is distributed from the base of the spine to the knee joint.

K. The flexible lumbar support inside the backrest adjusts itself to suit different shapes of backs.

L. The seat is upholstered with nylon velour which is comfortable in both the summer and winter.

M. The driver's seat is equipped with an automatic heating element.

N. Latch for folding the backrest forward to protect the passengers in the back seat of two-door models.

O. Lever for adjusting the slope of the seat.

P. Release catch for fore and aft seat adjustment.

Q. Wheel for adjusting the rake of the backrest.

R. Quick-release catch for folding the backrest forward.

S. Quick-release lever for folding the backrest forward from the back seat.

4 For many people, winter is a season of uncomfortably cold weather. Aching backs ache more, bladders become inflamed and rheumatic pains become irritated. Medical experts regard chilling of the lower parts of the body as often being directly responsible for these ailments. The cold also creates stress. A cold driver is not a safe driver. In a car which is thoroughly cold on a winter day, it may take more than 15 minutes before the seat has ceased to feel uncomfortably cold. The picture illustrates the skin temperature during a winter start. Two cars have been parked for 12 hours at an outdoor temperature of 5 degrees F. The black curve represents a car without a heated seat, and the red curve represents a Saab with a heated seat.

5 Electric heating wires run underneath the upholstery of the driver's seat, both in the seat cushion and the backrest. When the ignition is switched on, power will be supplied to the heating wires if the temperature of the seat cushion is lower than +57 degrees F. But the engine will usually have started and the alternator will have begun to generate before any appreciable power is used for heating the seat. This saves the battery. When the seat temperature has reached +82 degrees F, the heating element will automatically be switched off. A bi-metal thermostat, which is sensitive to heat, ensures that the system operates automatically.

6 The heating wires are placed in net pockets underneath the upholstery and rest on aluminium foil which reflects the heat upwards.

7 The picture shows the seat impression made by a man weighing 154 lbs. The rectangle indicates the area of the heating element.

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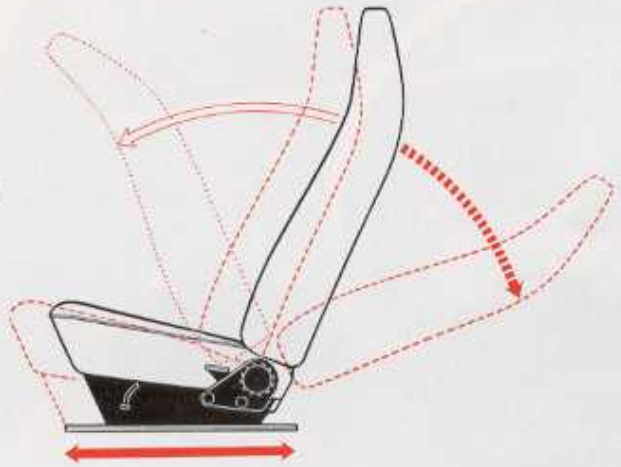

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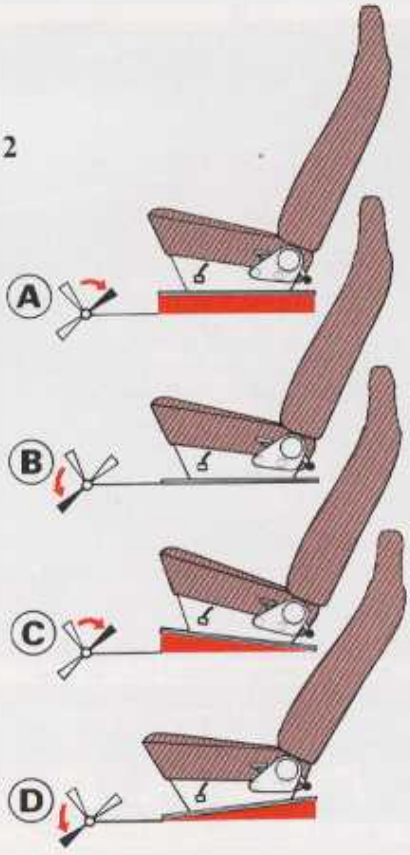
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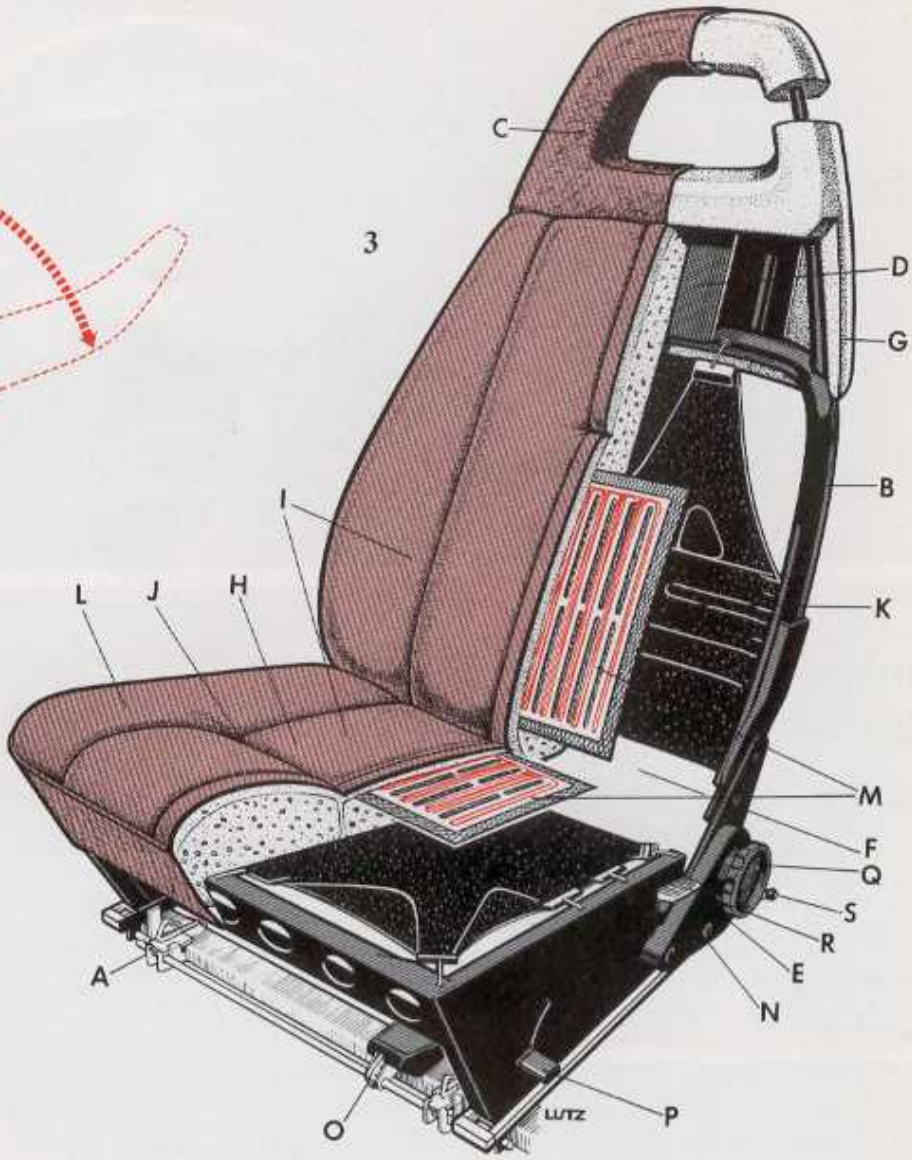
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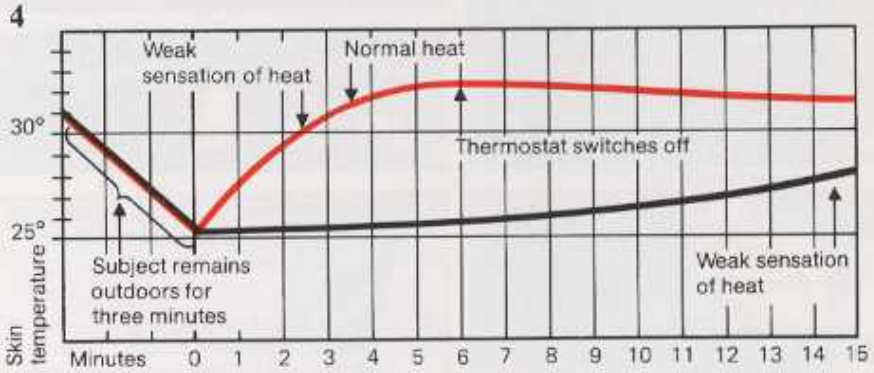
Weak sensation of heat
Normal heat
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Thermostat switches off
25°
Subject remains outdoors for three minutes
Weak sensation of heat
Skin temperature
Minutes
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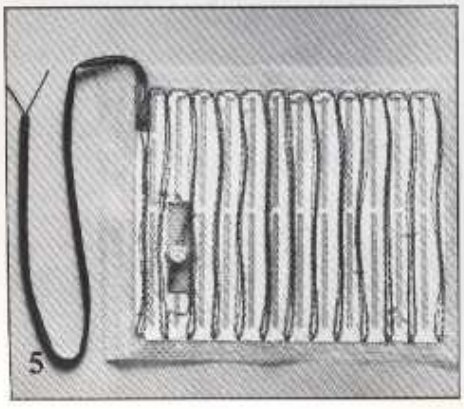

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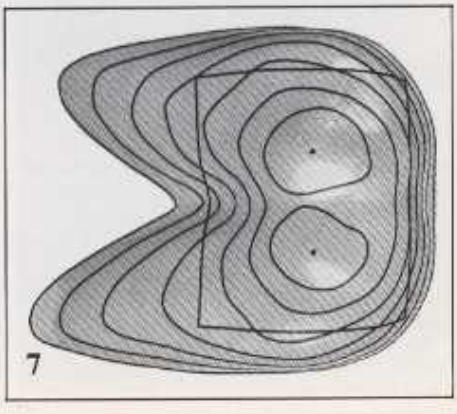
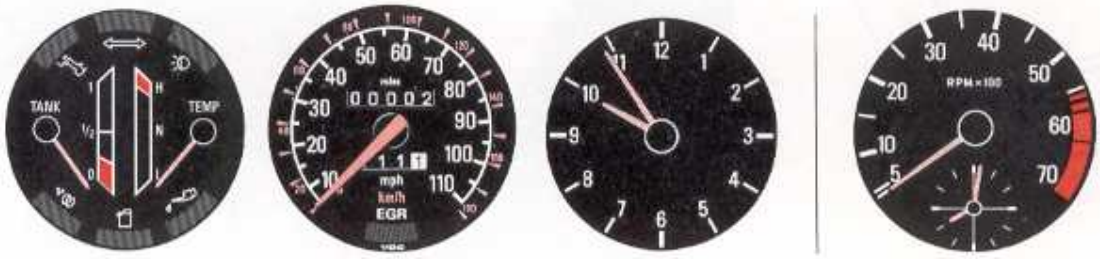




A B C D

Instruments and controls

Every Saab is easy to drive and is safe on the road. A good view of the road and the surroundings, clearly visible instruments, and controls and levers within easy reach are factors which contribute to a feeling of confidence. Time and again, the motoring press throughout the world has lavished praise on the safety and design of the instrumentation and location of controls in the Saab 99.

The indicating instruments are circular, non-reflecting and easy to read. Above, from the left:

A. Combined instrument which includes gauges for the fuel level and cooling water temperature, and warning or indicating lights for oil pressure, alternator, direction indicators, high beam and handbrake. The fuel gauge is combined with a warning light which lights up when the contents of the tank have fallen to about 1.5 gallons. The brake warning light will light up if the brake pedal is depressed too far during braking, e.g. if one of the brake circuits fails.

B. Speedometer, odometer, and trip meter.

C. Large, easy-to-read clock.

D. Revolution counter combined with a clock (exclusive to the EMS).

1 The instruments are large and recessed well back into the frames, to avoid reflections in the glass. The figures and symbols are light against a black matt background. The pointers are yellow-orange, a color which has been found to be most clearly visible under varying light conditions. The instruments have no bright areas to cause dazzling reflections. The brightness of the instrument illumination is continuously variable by means of a rheostat located to the left of the steering wheel. In the 99LE, the speedometer and odometer are located in the center of the group of instruments. The combined instrument with warning and indicating lamps is located to the left. To the right is a large, easy-to-read clock.

2 The EMS has a smaller clock than that in the LE series. Instead of the clock, an engine revolution counter is located to the right of the speedometer, and the revolution counter includes the clock. A trip meter is standard equipment on all Saabs.

3 In cars fitted with automatic transmissions, the gear lever is located on the center console. The lever can be set to six positions:

P = Parking position. The lever must be set in this position to allow the ignition key to be turned to the locked position and removed. The lever and gearbox will then be locked.

R = Reversing position.

N = Neutral position. No power is transmitted to the driving wheels, and the car is free to roll.

D = Drive position. The lever should be set to this position for all normal driving forward. The transmission will change gears automatically through all ratios.

2 = Drive position with third gear rendered inoperative.

1 = Drive position in bottom gear only. Can be used on very steep hills and when heavy engine braking is required.

4 Switches and controls are designed so that inadvertent operation is avoided. They are grouped on a wood-grained panel below the dashboard. To the left of the steering wheel is the main switch for the lights and the switch for the warning flashers.

To the right of the steering wheel is the switch for the two-speed ventilation fan, the cigarette lighter and the seat belt warning light. In the WagonBack model, the switch for controlling the electrically heated rear window defroster is fitted at the center of the panel. A green light is activated when the heating element is switched on.

All switches and controls are indirectly illuminated in an ingenious manner. Light is transmitted through a perspex tube and through prisms to each point which is to be illuminated.

5 The ignition lock is located behind the gear lever on the console between the seats. It is combined with a lock for the gear lever. On standard transmission Saabs, before the key can be turned to the lock position, the gear lever must be set in reverse. The gear lever is then locked by withdrawing the key. This is an excellent anti-theft precaution.

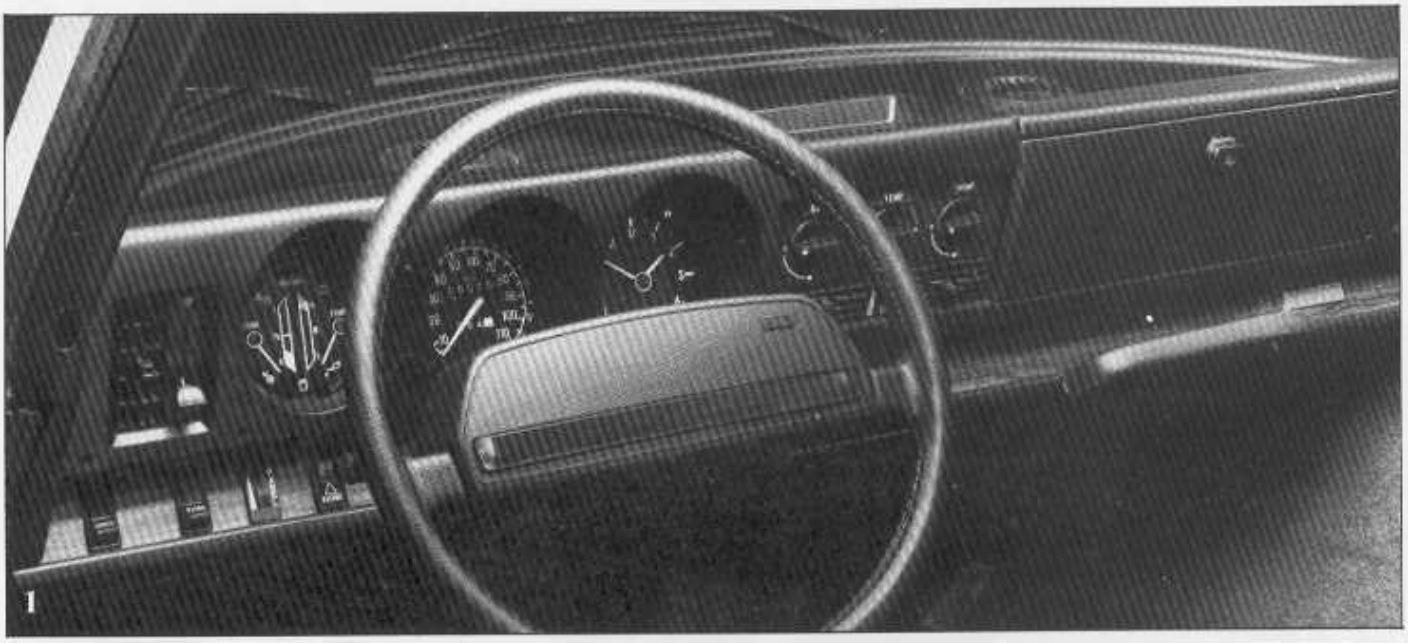
A further refinement in connection with the ignition lock system is the headlight interlock. When the headlights are on, they will be automatically switched off when the ignition key is turned to the locked position. This eliminates the risk of discharging the battery by having forgotten to switch off the lights. The parking lights are unaffected by the headlights being switched off. The headlights will light up again automatically when the ignition is switched on, if the headlight switched is still in the "ON" position.

6 A critical situation may require the instant use of the windshield wipers and washer. This also applies to the headlight flasher and the direction indicator. The levers controlling these various functions are therefore located within fingertip reach below the steering wheel rim. The light control is fitted on the left-hand side and the wiper and washer control on the right-hand side. The pattern of operation of both levers is based on simple logic.

As an example, when the right-hand control is moved down, all wiper and washer functions will start immediately.

The horn is actuated by depressing the strip on the pad in the center of the steering wheel.

7 The handbrake should be easy to reach, and located in a position where it cannot cause injury in the event of an accident. The front seat passenger should also be able to use it in an emergency. This is why the handbrake lever is located on a console between the front seats.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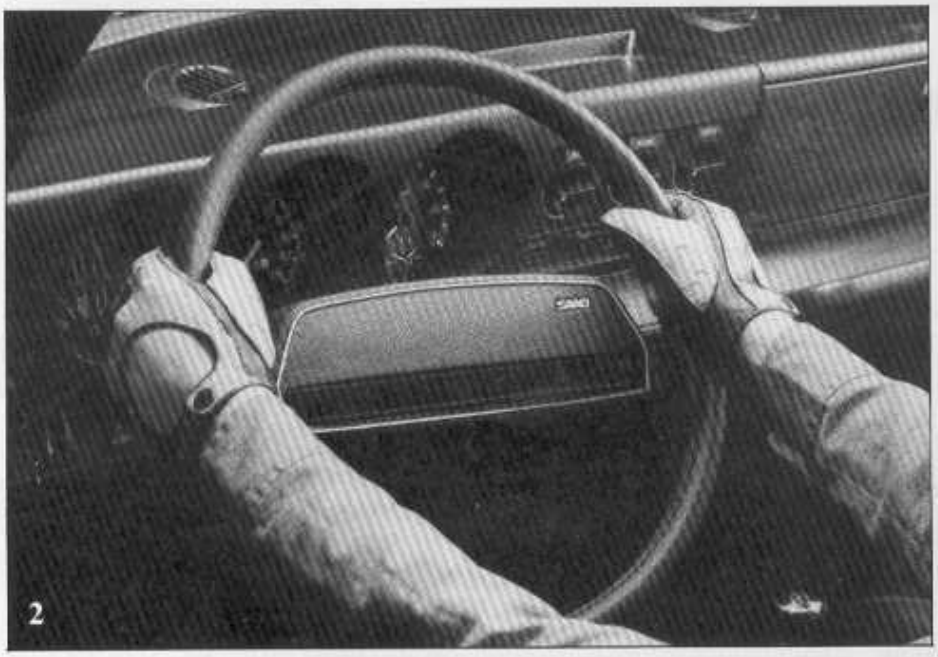
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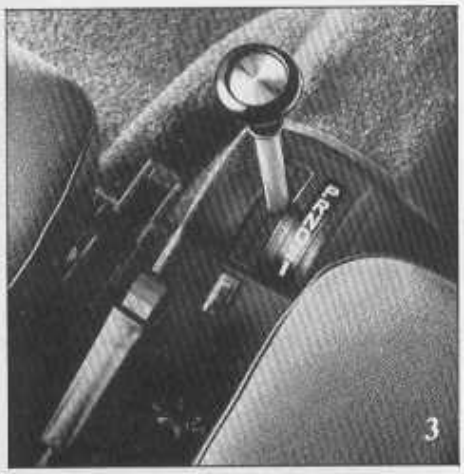
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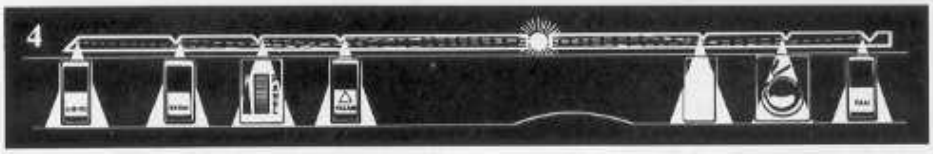
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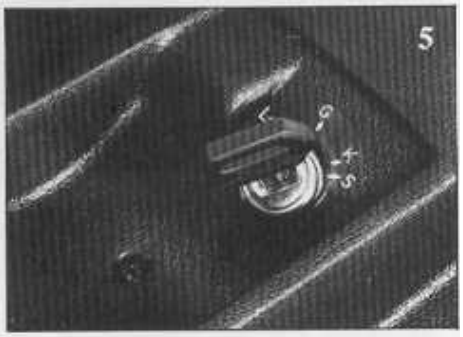
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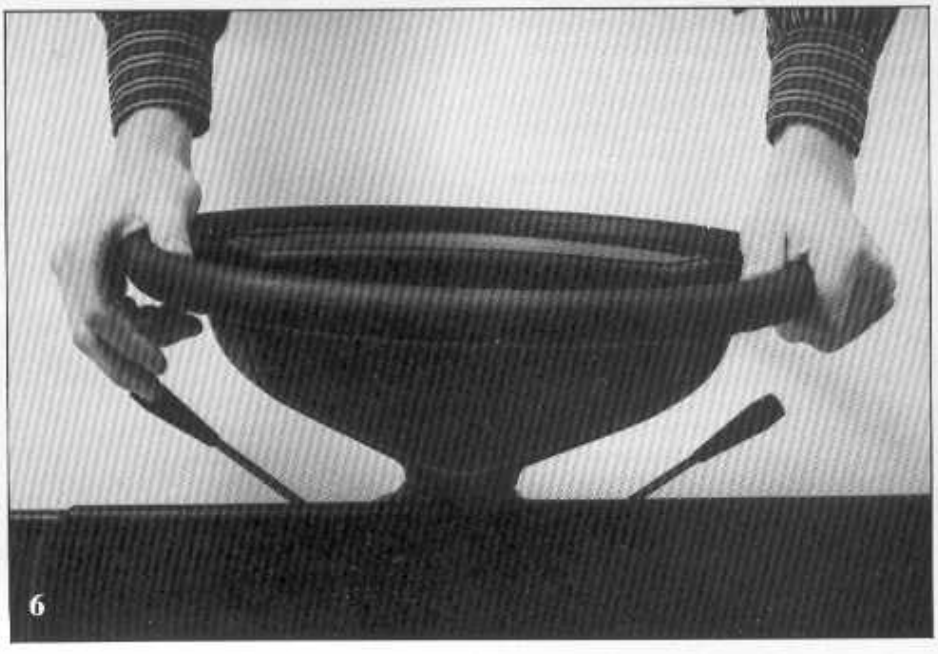
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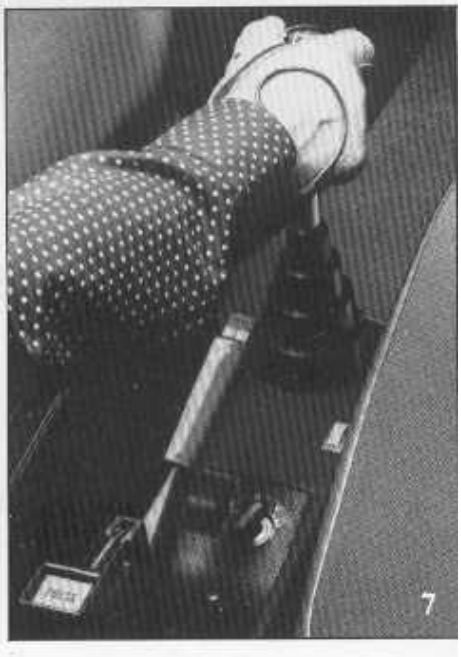
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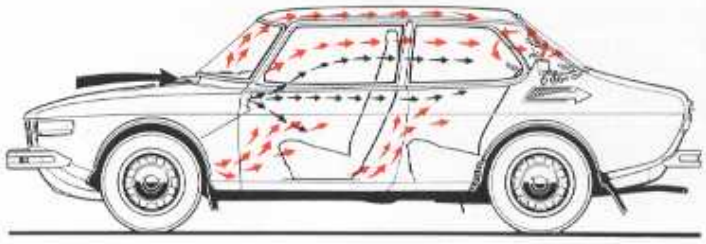


Heating and ventilation

As already mentioned, one of the fundamental directives to the designers of the Saab 99 was that the car should be equipped with a heating and ventilation system suitable for Scandinavian winter conditions. And this is exactly what it has, although several significant improvements have been made over the years. Even in extremely cold weather, the engine is easy to start, and requires a surprisingly short time to reach normal working temperature. So it does not take very long, after a cold start, before the heating system begins to distribute warm air to the interior.

Whenever required, the fresh air system delivers a welcome flow of cool air to the interior. The air supply — be it cold or warm — can be intensified by means of a fan with two speed ranges. The rate of air flow through the interior is very high. Under normal driving conditions, the air in the interior is changed about twice a minute, at a road speed of 25 miles per hour. When the fan is switched on, the capacity increases to double the speed.

1 When the car is travelling, the interior air is changed continuously and without drafts. At low speeds, the air flow can be increased by means of a fan. Cold or heated air is admitted to the interior through 16 vent openings. Fresh air vents are fitted at each extremity of the dashboard. These vents admit cold air into the interior, air which has not passed through the heat exchanger. The vents are provided with adjustable grilles which can be used to direct the air in the required direction. The flow of incoming air can also be controlled separately. Openings are provided at the extreme rear of the passenger compartment adjacent to the rear window, and air is discharged through these openings to the outlets on the sides of the body. The locations of the outlets have been derived from wind tunnel tests. Maximum suction, without the risk of drawing in exhaust gases, has thus been attained.

2 Air is admitted through a grille located at the rear of the hood. The air is then routed either through the heat exchanger or directly into the fresh air vents.

3 Controls for setting the temperature and the air flow into the interior are provided at the center of the dashboard. The knob which controls the temperature of the air supplied from the heat exchanger is market TEMP. The selected temperature level is basically maintained constant, regardless of fluctuations in the air speed and cooling water temperature. A thermostat actuates the water valve in the heat exchanger, thus controlling the heat supplies.

The front and rear areas of the interior are provided with warm air outlets at floor level. Both outlets are split, so that one air stream is directed towards the right-hand side and the other towards the left-hand side. The VENT knob to the right of the dashboard center controls the air flow to the floor at the front. The left-hand control on the console between the seats determines the intensity of the warm air stream to the rear footwell.

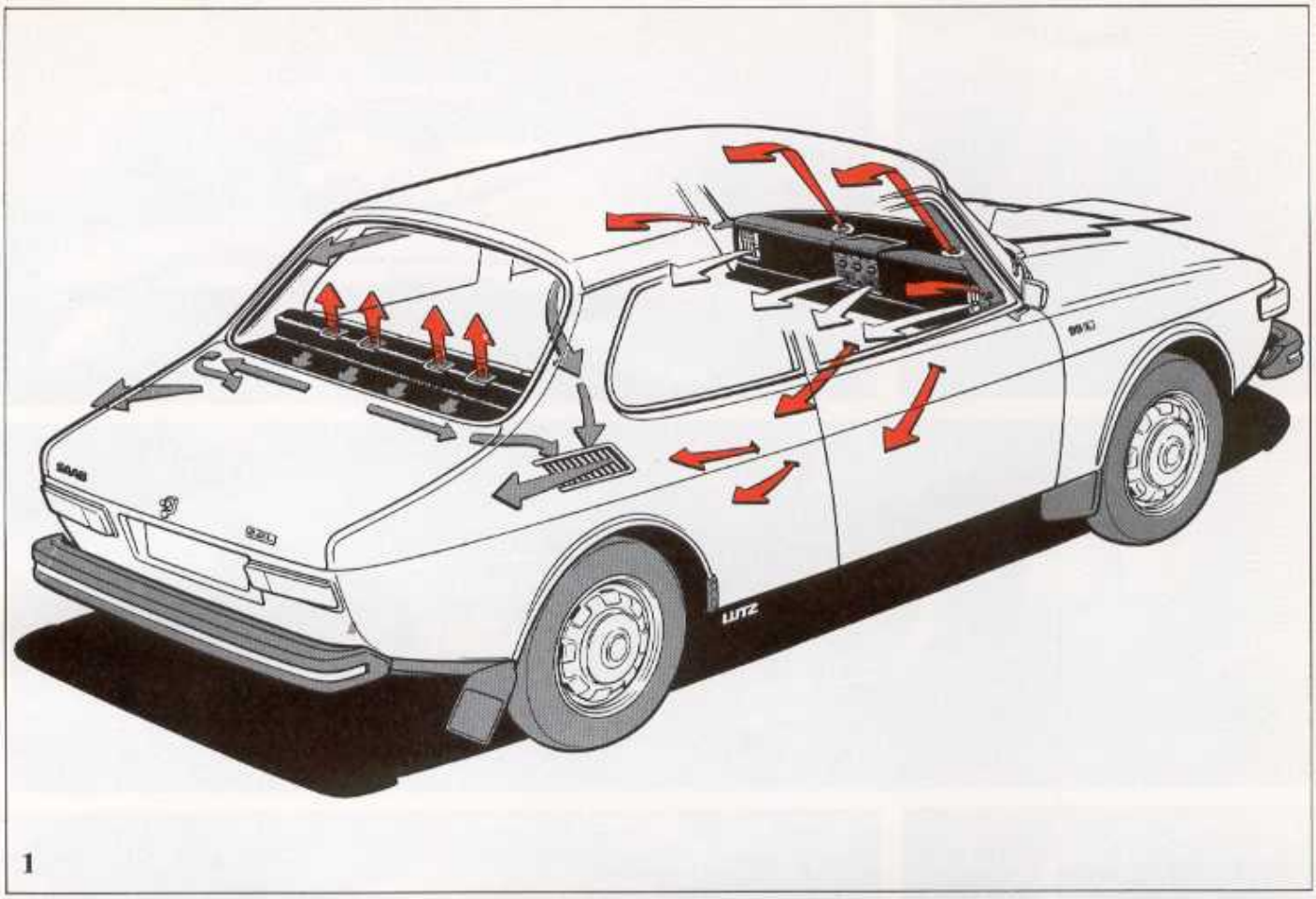
The DEFR knob to the left controls the warm air flow towards the windshield. If it is required to concentrate the defroster action for maximum effect on the windshield and side windows, the air supply to the footwells and rear window can be shut off, and the fan can be set to full speed. The warm air flow to other inlets in the interior can obviously also be increased by resetting the knobs and controls. However, the capacity of the heating system is so large that this will only be required in exceptional cases.

4 Two large defroster nozzles at the top of the dashboard direct jets of air onto the windshield, to ensure that it will always be defogged. The knob also controls the air flow onto the side windows at the front — from holes in the windshield pillars.

5 The console between the front seats includes controls for adjusting the air flow to the footwells at the rear and to the rear window. The location of the controls allows the back seat passengers to adjust the "climate" in their area of the car.

6 The efficient rear defroster clears the rear window very quickly. Warm air is discharged through four nozzles directly onto the rear window at exactly the right height to ensure unimpaired rear vision.

7 The Saab 99 WagonBack has a double defroster device for the rear window. Warm air is blown onto the rear window from nozzles located on each side. Wires in the rear window are provided for electric defrosting. The electric heating is controlled by means of a switch at the center of the dashboard. A green warning light indicates when the rear window is electrically heated. On the WagonBack, the ventilation air is discharged through openings in the side panels of the luggage compartment.



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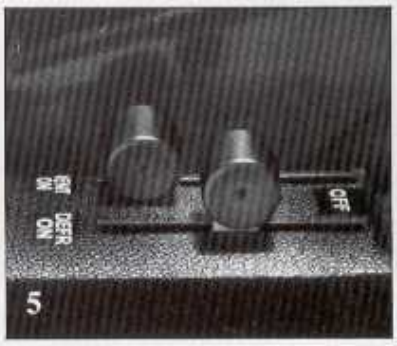

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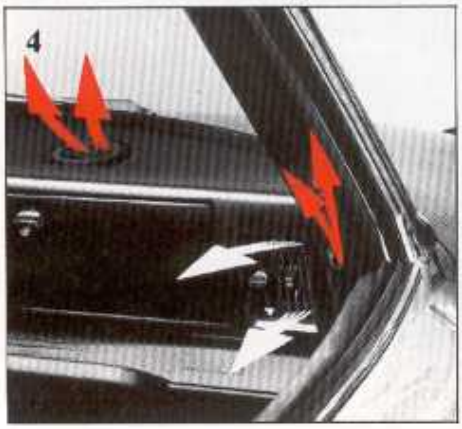

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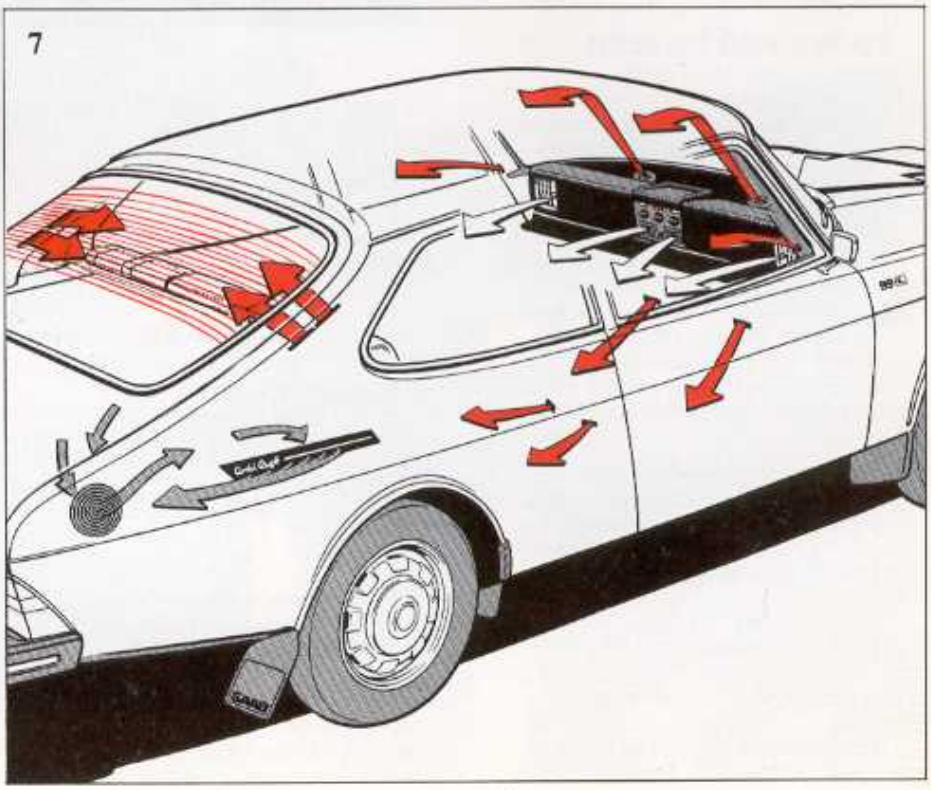

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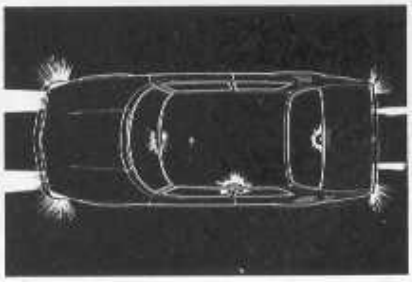

To see and be seen

When driving on dirty roads, it will soon become obvious that vision through the windshield rapidly becomes reduced by dirt.

1 The windshield wipers work quickly and efficiently. The wipers are cable-driven, and the slope of the driving shafts is such that the wiper blades are in perfect contact with the windshield. When assisted by water sprayed by the washers, the wipers will keep the windshield clean even when driving the car under very difficult conditions. The wipers are matt-black for anti-glare reasons.

2 The windshield wipers and washers are actuated by means of a common lever at fingertip level on the right-hand side below the steering wheel. The control positions of the lever are in the same plane as the steering wheel.

1. Windshield wipers at low speed

2. Windshield wipers at high speed

3. Windshield wipers at high speed with washers

4. In addition, by moving the stalk against the spring towards the steering wheel rim, the windshield will be washed. Provision for washing the windshield before the wipers are started protects the windshield from scratching and reduces the wear on the wiper blades, especially when the dirt on the windshield is dry.

3 Few cars can match the Saab 99 as regards the rear window remaining clear on the inside and outside. The fact that the rear window does not tend to pick up dirt is due to the favorable aerodynamic shape of the car. The aerodynamic design of the Saab 99 WagonBack prevents dirt from collecting on the rear window even under difficult road conditions.

4 The rear lights on the Saab 99 WagonBack are designed so that all functions will be clearly visible to other road users, even diagonally from the side. The rear light is directed to the rear and diagonally to the side, to facilitate reversing maneuvers in the dark. The rear license plate illumination is built into the handle of the rear door fields.

5 The direction indicator lights at the front are large and are located so that they will be clearly visible from the front and sides. The headlights interlock is connected to the ignition lock. The headlight will be switched on and off as the ignition is switched on and off, provided that the light switch is in the "on" position. For safety reasons, many drivers prefer to drive with the headlights switched on even during the day, particularly since the interlock eliminates the risk of forgetting to switch off the headlights after parking the car.

The drawing above illustrates interior lighting: There are two overhead lamps provided for interior lighting — one on the left-hand side of the roof, and another above the windshield behind the rear view mirror. The latter is directed onto the passenger seat, to allow the passenger to read a map, for instance, without the light irritating the driver. Both lamps, as well as the indirect illumination of the ignition lock, light up automatically when a door is opened. A conveniently located switch for the interior lighting is provided on the console between the front seats. When the trunk lid is opened, a light in the trunk will automatically go on.

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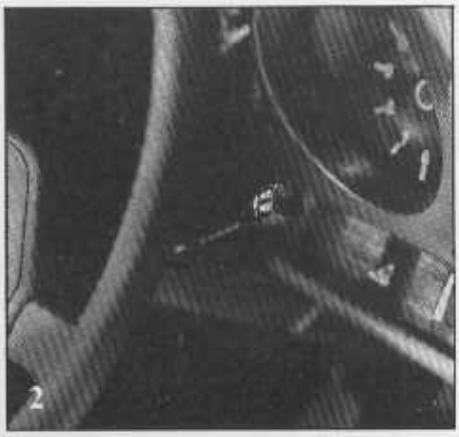

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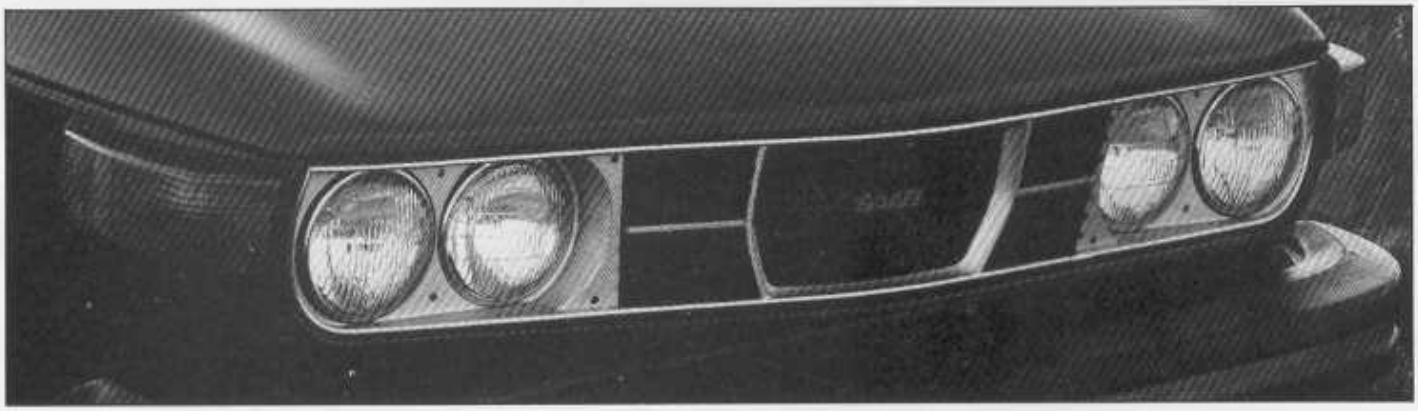

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Bumpers

However carefully and considerately you drive, you may still be hit by another car in rush-hour traffic, skid against another car on a slippery road or bump against a post while parking. Slight collisions of this kind may occur in many ways, and they often result in costly and irritating damage.

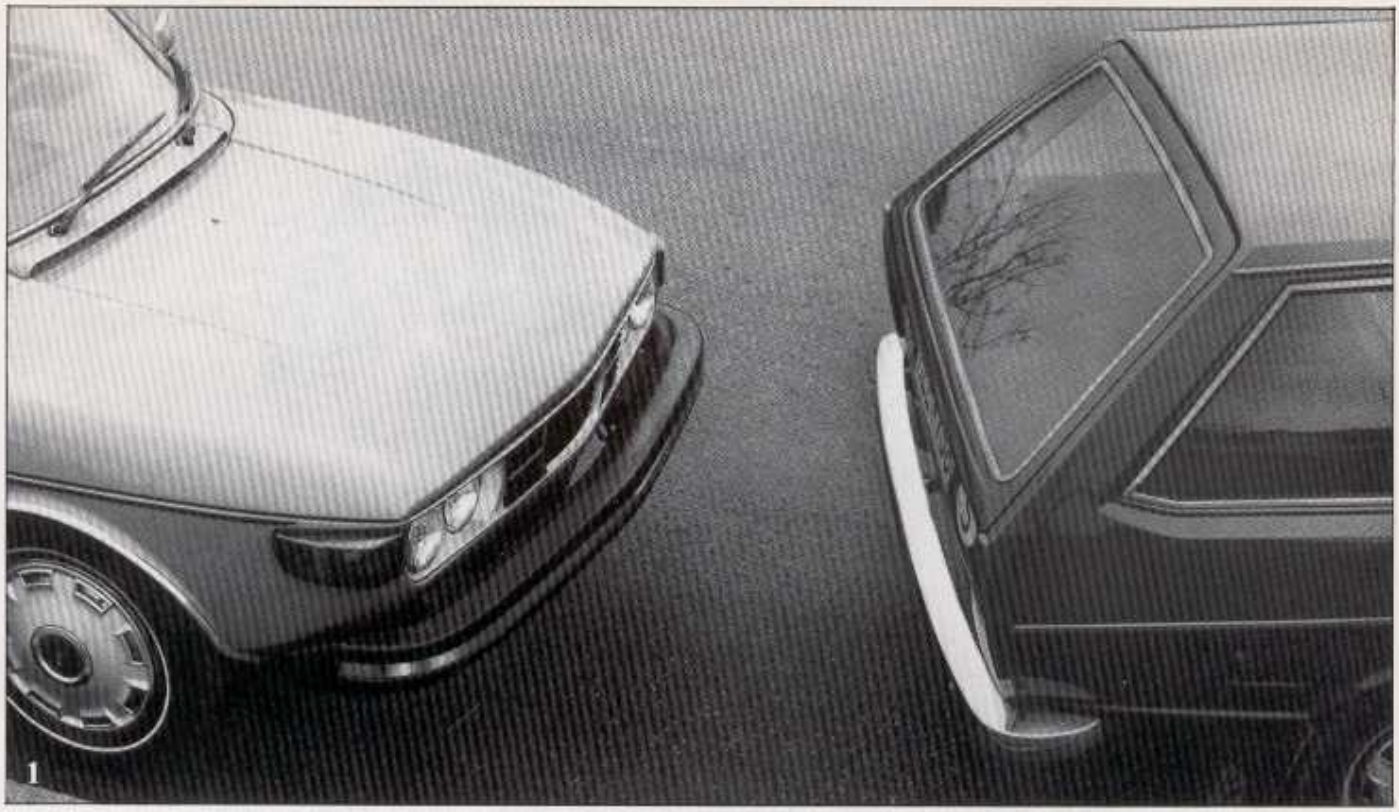
In the United States, where the federal authorities and insurance companies have long demanded better car bumpers, an official directive specified that all cars sold in the United States, beginning with the 1973 models, should be capable of being driven against a fixed barrier at a speed of 5 miles per hour, without sustaining any damage to controls, headlights, direction indicators, etc. The car must also be capable of rear collision into the barrier at the same speed, without sustaining corresponding damage. These speeds may seem somewhat low, but a pre-1973 car which collides at that speed without being fitted with special bumpers will sustain damage which may cost more than $250 to repair.

1 The bumpers protect the car in collisions at speeds up to 5 miles per hour. After being compressed, the bumper will revert to its original shape.

2 The picture shows the construction of the bumper. Compressible cellular plastic blocks are fitted in front of a sturdy aluminium section. In the event of a collision, the cellular blocks absorb energy by undergoing temporary deformation. When the external pressure is relieved, the blocks will revert to their original shape. Strong support members and reinforcements in the body-work ensure that the impact will not damage the car. A plastic rail is fitted between the black rubber casing and the cellular blocks, and a stainless steel strip is fitted on the outside.

3 All models of the Saab 99 can withstand collisions from the front or from the rear at a speed of 5 miles per hour without the car sustaining damage. The bumpers are "self repairing", and will resume their original shape after being depressed. If all traces of the mishap are to be removed, only the stainless steel strip may have to be replaced, and possibly one of the cellular blocks. But this is simple and inexpensive.

The pictures show a test in which a Saab 99 was driven straight into a post at a speed of 5 miles per hour. The pictures illustrate clearly how the bumper has been compressed at the point of impact, and how it has resumed its original shape after a few minutes, without the body being damaged in any way. The mark on the strip is the only visible sign of the impact.



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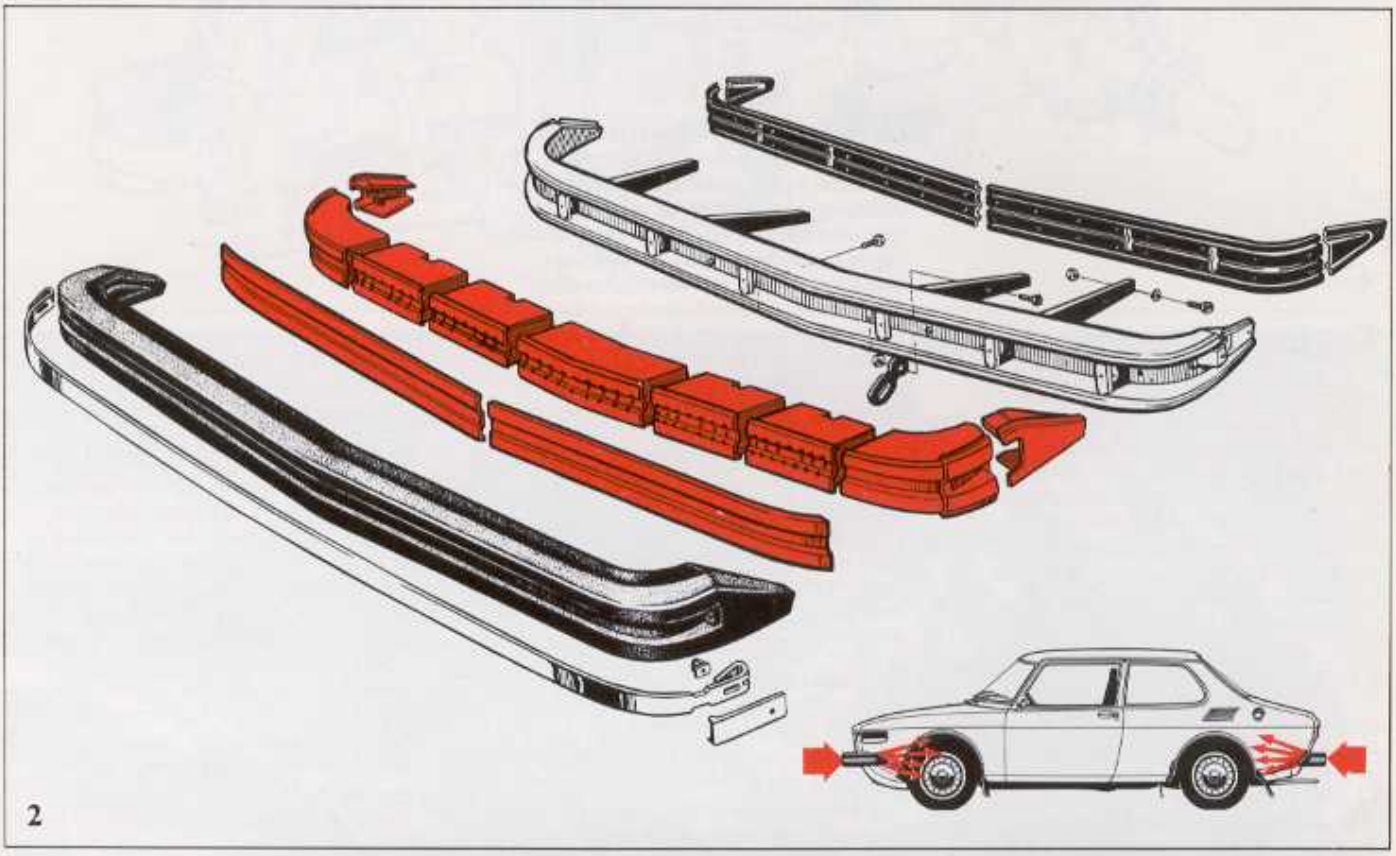

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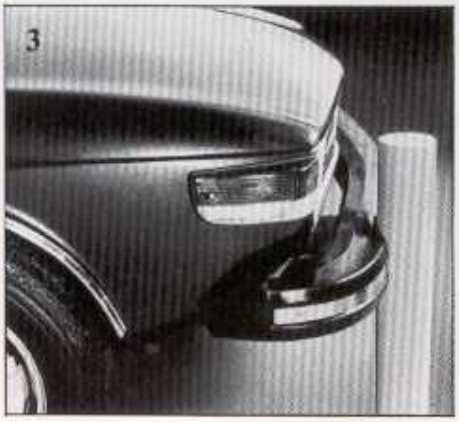

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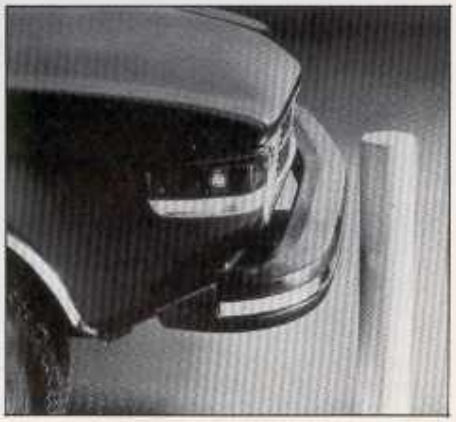
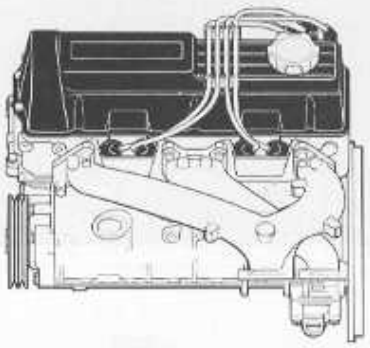




Engine

All models of the Saab 99 are equipped with a water-cooled four-cylinder in-line engine with an overhead camshaft. The engine block is made of special cast iron and the cylinder head is an aluminium alloy casting. The crankshaft and camshaft are both mounted in five bearings. The engine is manufactured in three versions, with one or two carburetors, or with mechanical fuel injection, for the U.S.

The cylinders are inclined at an angle of 45° to the right, and the engine is located so that its clutch end is at the front and the camshaft drive is nearest the bulkhead. The cylinders are numbered from the rear forward. The cylinder head is of the cross-flow type, and closed circuit crankcase ventilation is employed. The water pump, oil pump and distributor are driven by a special shaft within the engine. The intake and exhaust manifolds are located on opposites sides of the cylinder block. Hence, it was possible to design them for optimum low-speed performance of the engine, and the optimum "breathing" at high speeds. The piston stroke is 3.07 inches and the engine can thus withstand high speeds, without unnecessarily high average piston speed or inertia forces. However, the stroke is not so short that the low-speed torque is affected.

The crankshaft is a high-grade steel forging with ground journals. It is dynamically balanced and is kept within close dimensional tolerances. The diameters of the big-end bearings and the five main bearings are so large that they overlap each other to a significant extent, and this renders the crankshaft exceptionally stiff and vibration-free. The valve mechanism also illustrates that the engine is designed to work smoothly and without vibrations. Since the engine is provided with an overhead camshaft, i.e. since it is located in the cylinder head, it acts directly on the tappets, without the need for push-rods, which only serve to increase the mass of the moving parts, which gives rise to noise.

The camshaft is supported by a carrier which can be removed from the cylinder head. In out the valve clearance being affected. In order to simplify service work, the cylinder head bolts are readily accessible without the need for dismantling the camshaft and valve mechanism. The camshaft is driven by a double chain.

To ensure reliable lubrication even under difficult operating conditions, the engine is provided with separate oil passages from the main bearings to each big-end bearing. The engine is integral with the clutch, gearbox and differential, and forms a complete power package which saves weight and space. (It does not encroach on the passenger compartment because there is no conventional propeller shaft, and no heavy power transmission components at the rear). Power is transmitted from the clutch through a primary gear train to the gearbox and differential located below the engine.

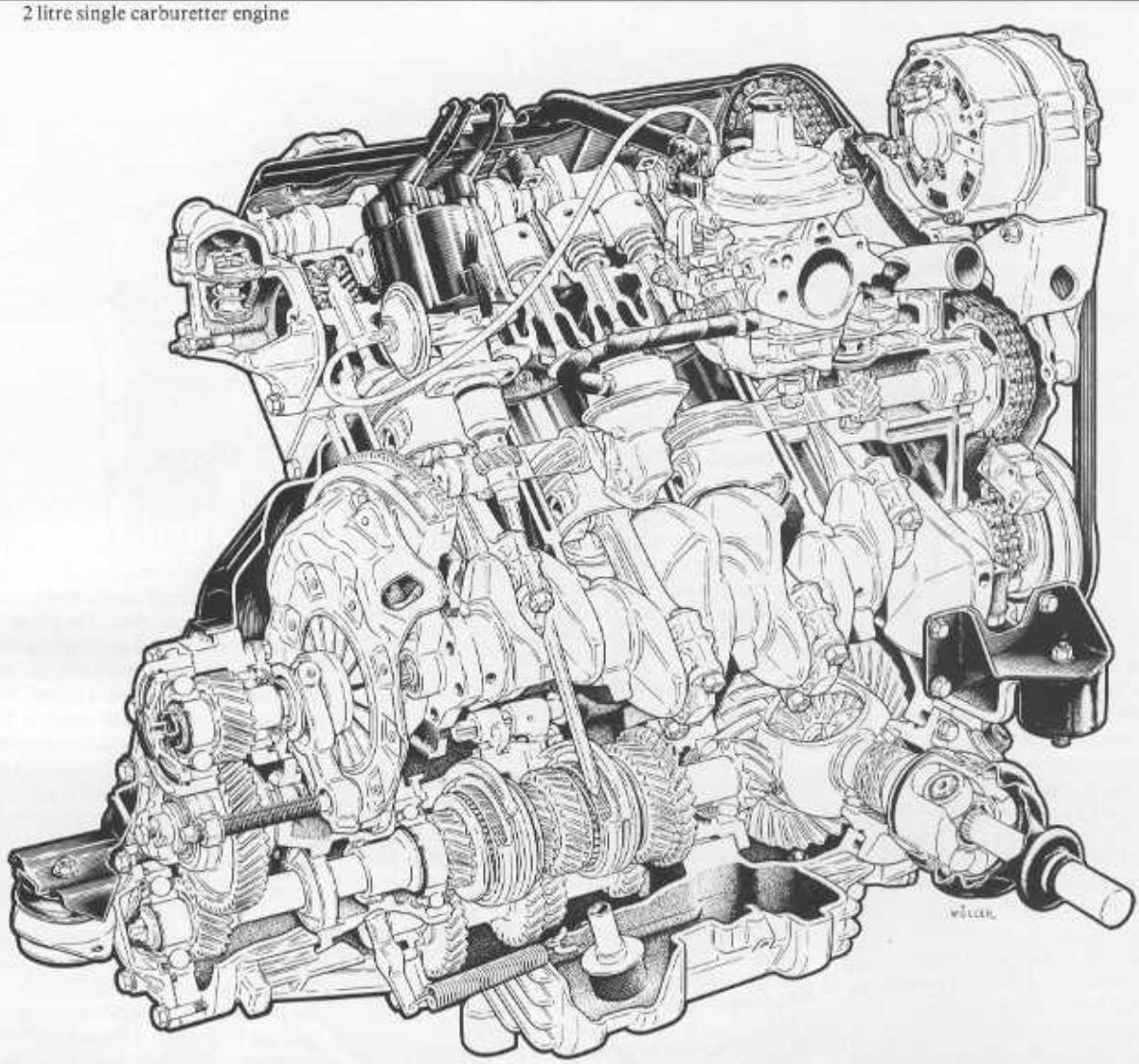
Cars with manual gearboxes are equipped with hydraulically operated, single dry plate Borg & Beck clutches. The primary gear train consists of toothed gears. The clutch is effectively cooled by being located at the front of the engine, and this contributes to a long service life of the lining. Moreover, this location simplifies service work on the clutch.

The gearbox is very sturdy. It has full synchromesh in four forward speeds. It's separated from the engine crankcase by a partition, but is integral with the final drive and differential, to form a unit with its own lubricating system. The drive shafts have double universal joints, the outer being of the Rzeppa type, which ensure smoother steering and less vibration in the steering wheel during heavy cornering. The inner and outer universal joints are both permanently lubricated. Splash lubrication and oil circulation are employed for the power transmission. The final drive crown wheel pumps oil through a passage to the gearbox and primary gear. Oil runs back to the final drive through other passages. Cooling fins are provided on the inside and outside of the gearcase, and heat is dissipated through these fins to keep the oil cool.

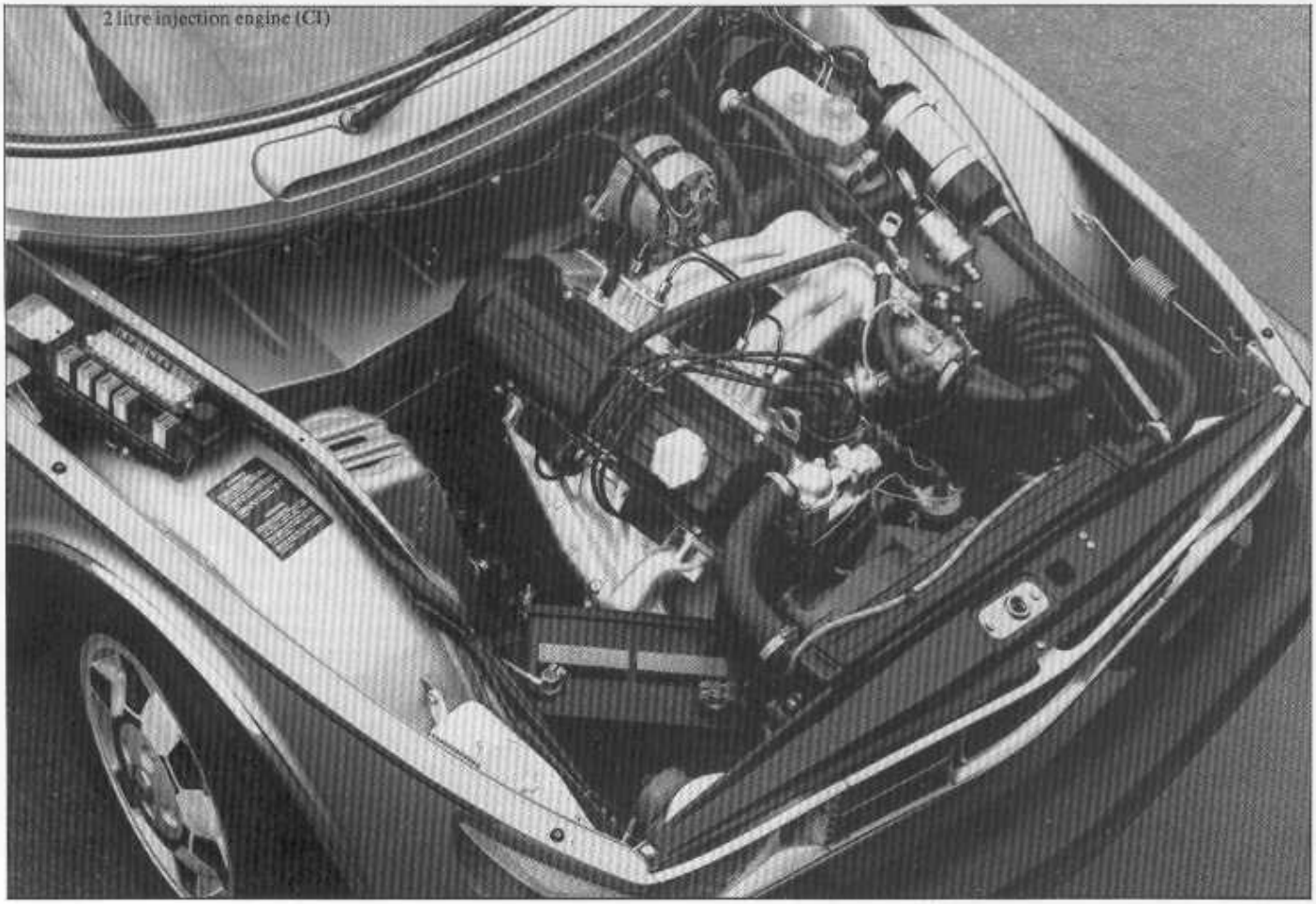
The air cleaner has a paper element and, apart from cleaning the intake air, also acts as an intake silencer.

The exhaust system is run in a tunnel under the floor of the passenger compartment and is thus completely protected from damage on rough roads. The system consists basically of the front exhaust pipe, transverse silencer and rear exhaust pipe. The aluminized sheet steel in the end walls of the silencer have a thickness of .070 inches. The end walls are of an expanding design to provide high strength at the most exposed points. This method has been employed to reduce the temperature stresses which would otherwise occur in the welded joints.

2 litre single carburetter engine



2 litre injection engine (CI)



The radiator is of the cross flow type with a two-row core. The cooling capacity of the radiator is sufficient even when the car is driven in hilly country towing a trailer. A separate expansion tank is provided to avoid loss of coolant by accepting a temporary excess and topping-up the system as it cools. The cooling water pump has a very large capacity and induces the coolant to flow at high velocity across the hottest parts of the cylinder head. The cooling water also circulates through passages between the cylinders. The parts of the engine which require most cooling are thus provided with the best cooling. The cooling is thermostatically controlled by means of a reliable wax thermostat. Due to the efficiency of the cooling system, a relatively small amount of coolant is required, and this ensures rapid heating of the engine after a cold start. The engine is **not** equipped with a belt-driven cooling fan. This allows for faster warm-up of the engine. The cooling fan is driven by an electric motor and is switched on by means of a temperature switch whenever required, e.g. when operating at very low stop and go speeds.

Mechanical fuel injection

The CI injection system on the two-litre engine supersedes the earlier electronic system. The letters "CI" stand for Continuous Injection, i.e. injection takes place continuously. The CI system contains appreciably fewer electronic components than the earlier system, and is other wise significantly simple. In addition, the CI system gives cleaner exhaust gases.

This is how the system works:
The fuel pump (3) pumps the fuel from the tank (2) to a pressure accumulator (4). The fuel then flows through a filter (5) to a fuel distributor (15). A constant pressure valve (13) maintains constant fuel pressure. The system also includes an air metering unit consisting of a metering disc (6) mounted in the tapered opening into which the air is drawn. The air flows through the cone from below. The metering disc assumes a certain position in relations to the intake air flow, and this is determined by the speed of the engine and the position of the air butterfly valve (1). The larger the amount of air flowing through the tapered opening, the higher will the metering disc (6) be raised. A lever (7) connected to the metering disc actuates a control plunger (8). The higher the metering disc is raised, the higher the control plunger will be lifted, and the fuel flow increases in direct proportion to the air flow.

It is thus the air flow which actuates the metering disc, and the latter moves the control plunger upwards. The space above the control plunger is occupied by fuel under pressure. A vertical slot is provided for each engine cylinder. As the plunger is lifted, the slots are gradually exposed, thus supplying the correct amount of fuel to the cylinders. To ensure that all cylinders are supplied with exactly the right amount of fuel, the metering system is equipped with a differential pressure valve (9) for each slot. This valve maintains a constant pressure drop across the plunger.

From the fuel flow distributor, the fuel is delivered to the injection valve (10) of each cylinder. The valve is spring-loaded and opens at a pressure of 43 p.s.i., and injection then takes place continuously. When the engine is stopped, the pressure in the system is reduced to 28 p.s.i. and injection ceases. This pressure is maintained by the pressure accumulator for a long period, thus preventing vaporization of the fuel and facilitating starting when the engine is hot.

During cold starting, extra fuel is injected through the cold starting valve (11) at the instant of starting. This valve is controlled by a thermostatic transducer (12). In addition, a control pressure valve (14) is provided to reduce the pressure above the control plunger, thus raising the plunger and providing a richer mixture. The control pressure valve is actuated by the engine temperature, thus eliminating the need for a choke.

Automatic transmission

The Saab automatic transmission is the Borg-Warner type 35. The integration with the engine is special to Saab. The torque converter, chain, gearcase and differential are integrated into one unit, and the automatic control is incorporated at the front end of the gearcase, for ease of access through a cover in the front floor.

The drive is transmitted from the engine to a hydrodynamic torque converter, from which it is transmitted by a chain to the automatic gearbox. The torque converter is oil-filled and has three main components, i.e. the pump impeller, turbine and stator. The pump impeller is connected to the engine crankshaft, whereas the turbine drives the input shaft of the gearbox. The stator is mounted on a free wheel coupling with a fixed hub. The oil delivered by the pump impeller causes the turbine to rotate. When the driving and driven blades rotate at different speeds, the stator returns the oil to the pump impeller in such a direction that the torque on the pump impeller is increased. The torque amplification can vary from a maximum of about 1.9:1 down to 1:1 and amplification will cease when the turbine rotates at about 90% of the pump impeller speed.

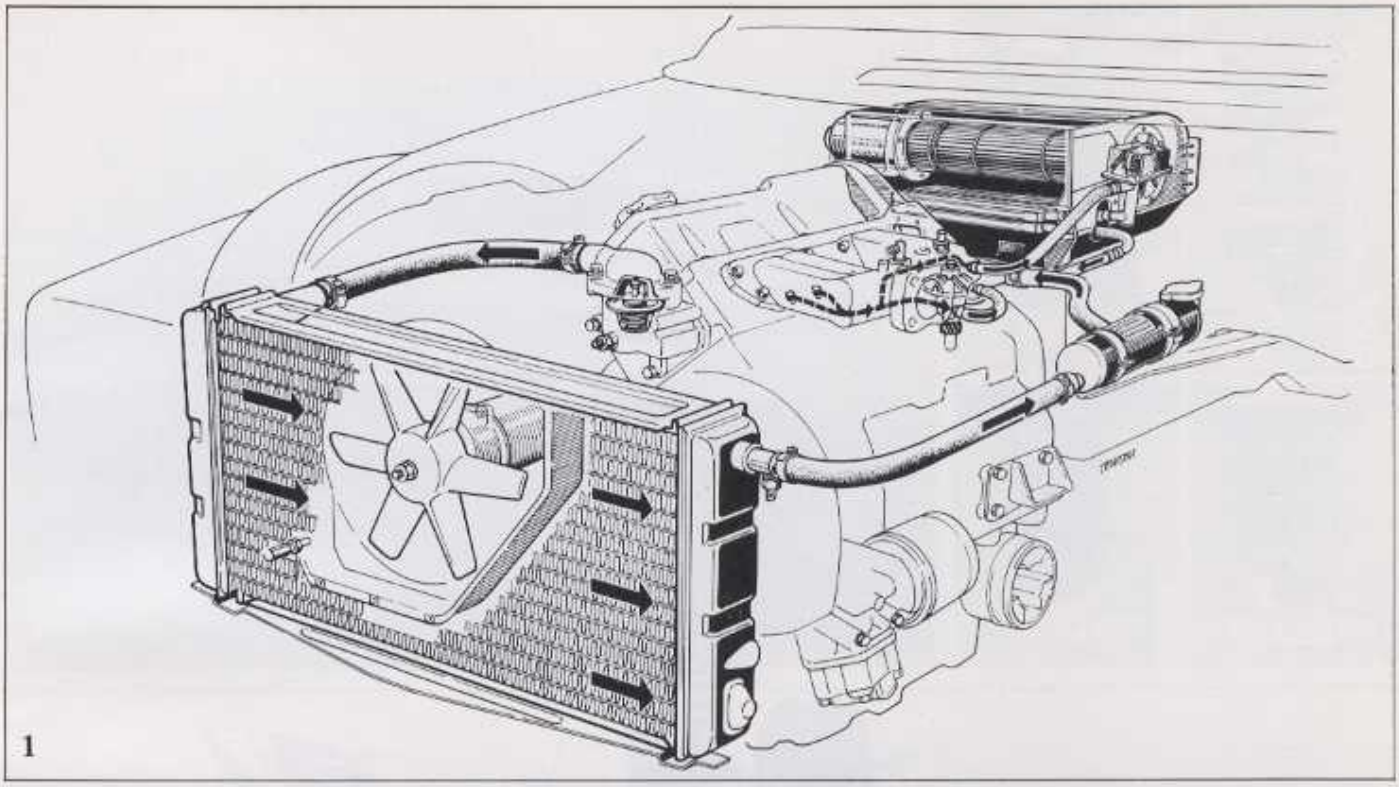
The torque convertor's ability to increase engine torque helps to provide the car with good acceleration from low speeds. The Saab automatic transmission thus has a large amount of overlap. This eliminates the constant changing up and down between 12 and 28 miles per hour. Gear changing takes place automatically by a hydraulic system, incorporating a pump, regulator, valves and servo pistons, actuating the various units in the gearbox, taking into account the position of the gear lever and other operating conditions. The kickdown gear is available at speeds below 53 miles per hour by depressing the accelerator to the floor.

The Saab automatic gearbox provides the average motorist with appreciably simplified and safer driving. In addition, the automatic operation of the gearbox allows the driver to employ the maximum performance of the car for safer passing.

Driving will be more convenient, especially in city traffic and when parking, starting uphill or towing a trailer. The automatic transmission also reduces the wear on the tires and transmission components.

Although the fuel comsumption of a car with an automatic transmission is normally higher, that on Saab 99 models equipped with automatic transmission is very close to the consumption of the models equipped with a manual gearbox. Practical tests have also shown that, other than in city driving, the engine with an automatic transmission is equivalent to that with a manual gearbox in terms of fuel consumption.

Note that a special oil cooler is required when towing a trailer. Moreover, a car with an automatic transmission cannot be started by towing, since the oil pump of the gearbox is driven by the engine.



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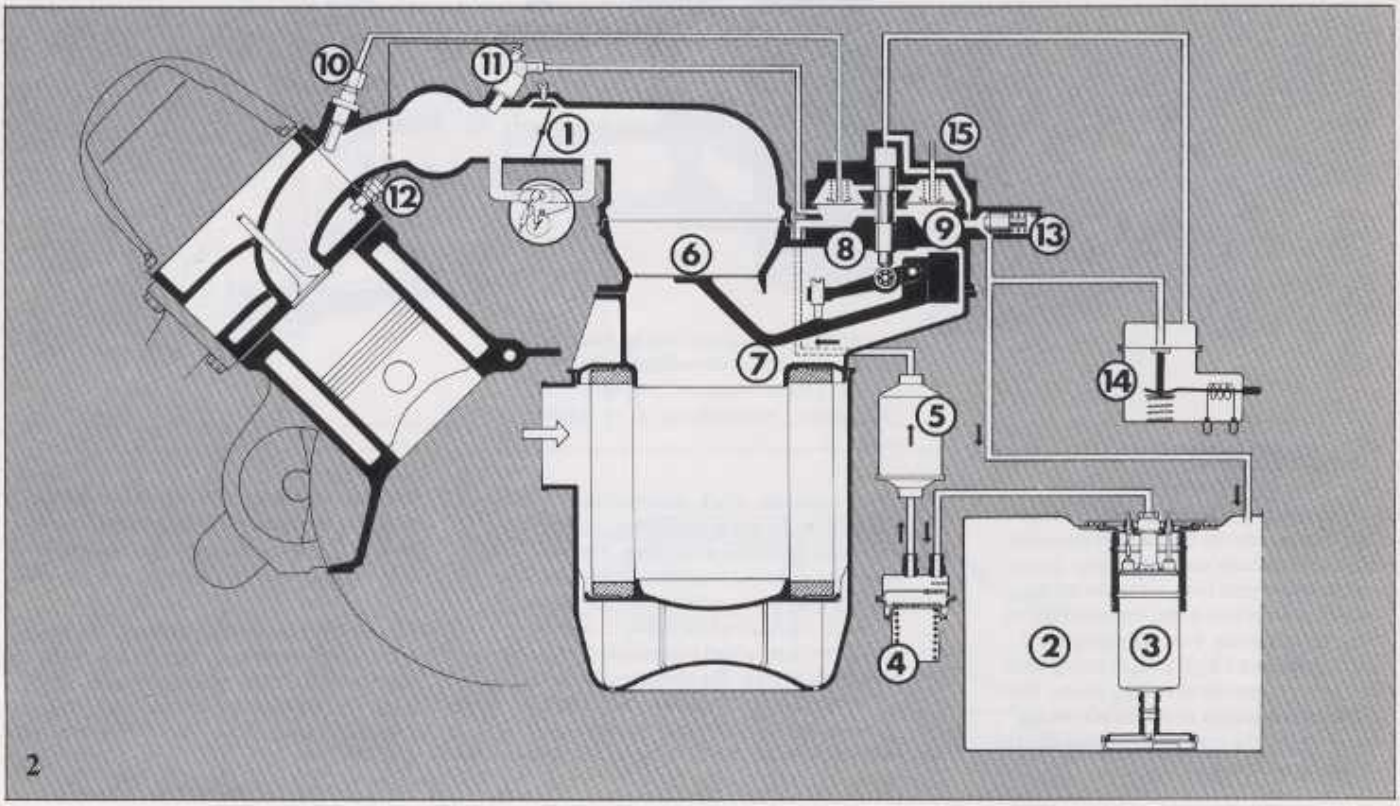

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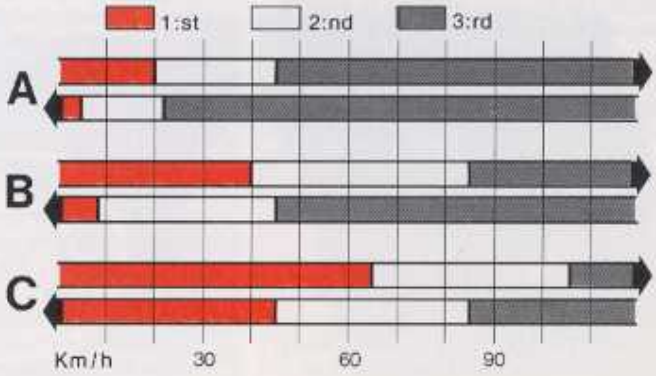
A = gear-changing chart for normal driving
B = gear-changing chart at full throttle
C = gear-changing chart on kick-down

The upper bars indicate when gear-changing will occur when accelerating, whereas the lower bars indicate changing-down during retardation (braking).



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Suspension

Since the weight of the engine rests on the front driving wheels, the Saab 99 has good directional stability and a firm grip. Long-term practical tests have led to the springs and shock absorbers being well-matched to the needs of the car, thus providing good roadholding and a high level of riding comfort, be it on smooth or bumpy roads. The low unsprung weight of the car allows the wheels to grip the road firmly even when the surface is not smooth.

1 The unusually wide track, 54.7 inches, at the front and 55.5 inches at the rear and on the EMS, 55.1 inches, at the front and 55.9 inches at the rear, the widely spaced springs and shock absorbers, and the wheel suspension geometry in general contribute to the negligible tendency of the Saab 99 to roll when exposed to lateral forces. The distance between the roll axis of the car and its center of gravity is comparatively small, and the moment arm of the lateral forces is thus short when taking corners.

2 The front wheels are suspended on double V-shaped wishbones and have pivot-mounted coil springs. The springs, therefore, always operate linearly (cylindrically) and absorb bumpy and uneven road surfaces smoothly but firmly. The coil springs have very good progressive action by being provided with substantial buffers inside the springs. This arrangement prevents "bottoming" when driving on very poor roads.

3 At the front, the shock absorbers are actuated by the lower wishbones, and the springs by the upper wishbones. The wishbones are mounted in rubber bushing and the steering gear is secured by means of permanently lubricated ball joints, thus rendering the front wheel suspension completely maintenance-free. The absence of an anti-roll bar makes the suspension softer and reduces the risk of wheel spin when taking sharp corners at speed.

4 The rear axle is entirely free from bulky and heavy transmission components, and is designed as a light, rigid tube, which will always maintain the wheels parallel and prevents any changes in track width. The rear axle is secured to the body by means of rubber-bushed arms. The two forward-facing arms take up the springing forces. A coil spring is located between the arm and a seat in the body, as is the double-acting telescopic shock absorber. Two upper rearward arms and the lower arms absorb longitudinal forces and the braking moment. Finally, the transverse forces are absorbed by a Panhard rod. The rear axle is well guided, to say the least. In addition, it is designed and suspended so that the good roadholding properties of the car will not be affected by changes in load. The pattern of movement of the arms and the hardness of the rubber bushings are adjusted so that the resistance to rolling of the rear axle is decreased somewhat as the rear springs are compressed, i.e. as the load is increased.

5 Lines joining the bearing points of the wishbones converge close to the rear axle, even slightly behind. This geomentry is one of the reasons responsible for the car displaying negligible "diving" tendencies when braking.

6 All models of the Saab 99 LE are fitted with 15 inch wheels of pressed design. The wheel and tire dimensions have been selected so that the car will not feel bumpy on an uneven road and will not display a "yawing" tendency. The large wheels ensure better mobility in snow, sand and on other loose surfaces, and contribute to the good ground clearance of the car. The springing of the car is calibrated for steel belted radial tires. 165SR15 (steel-belted) tubeless tires are fitted as standard equipment.

7 The EMS and WagonBack have 5 in. wide, cast aluminium wheels.

8 The tires are provided with a "tread depth indicator". When the tire has become so worn that it should be replaced, wide stripes will become visible across the tire tread.

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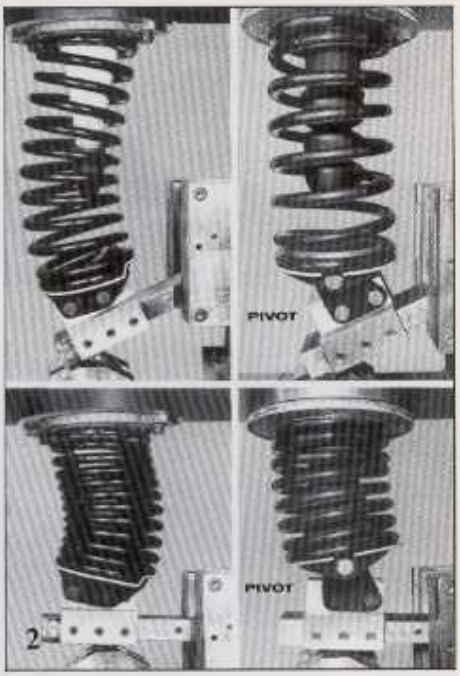

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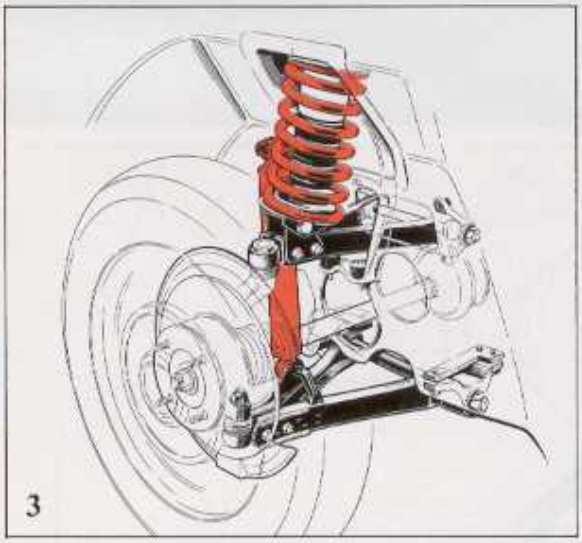
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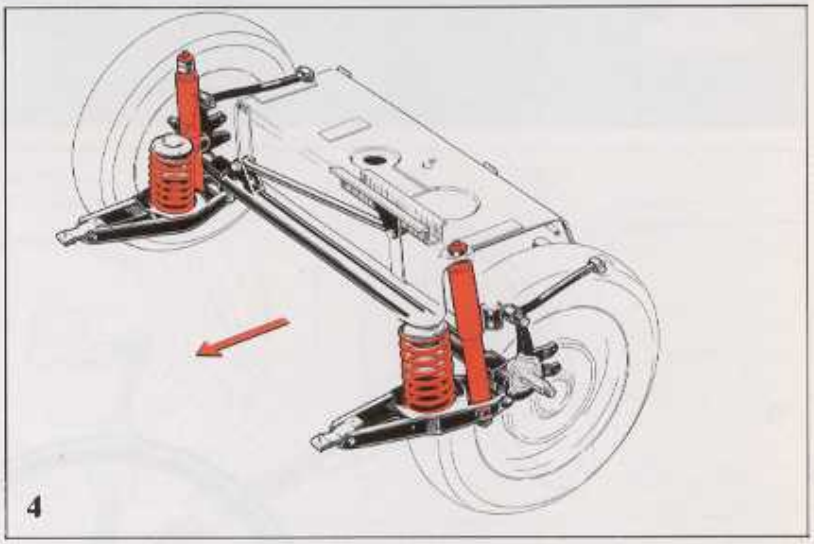
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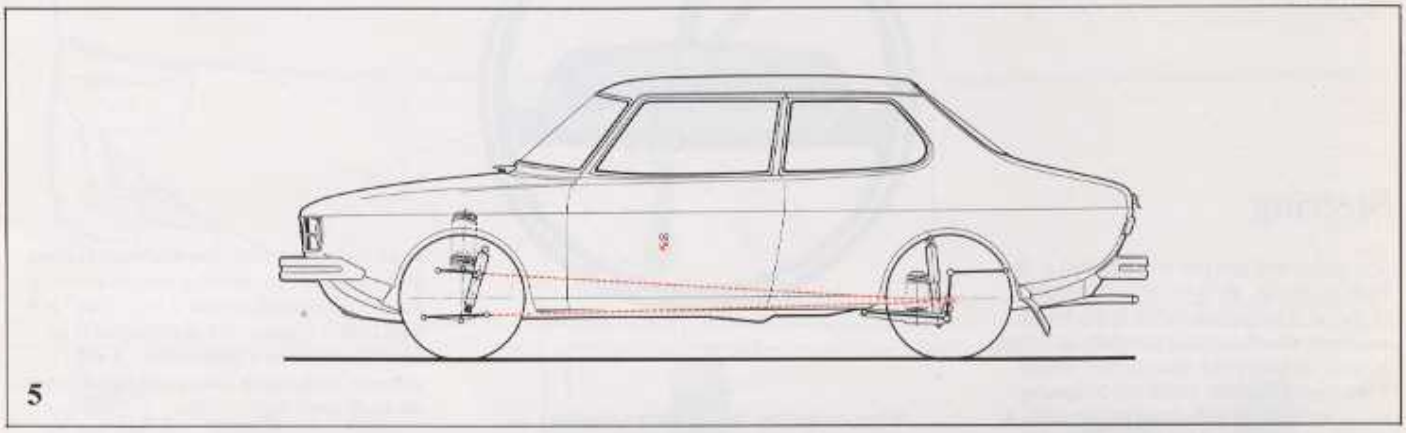
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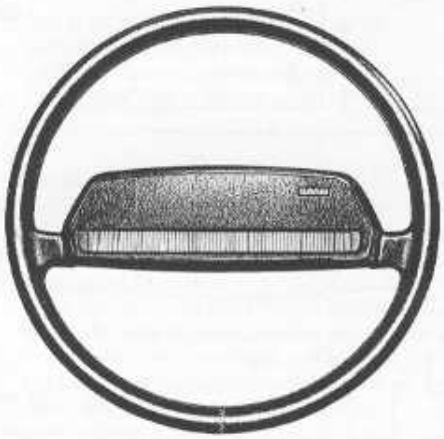
Steering



The engine and gearbox are mounted at the front of the car. 60 % of the total weight of the car is supported by the front wheels, and these wheels are thus generally in firmer contact with the road than the rear wheels. The center of gravity of the car is therefore closer to the front axle than the rear axle. A greater proportion of the weight on the front wheels is one of the prerequisites for directional stability and insensitivity to cross-winds, two characterisitics for which the Saab is renowned. The greater weight on the front wheels has enabled us to design the car with just the correct amount of understeer.

1 The steering geometry at the wheels is designed so that changes in the power transmitted to the wheels will not have a noticeable effect on the steering. The steering ratio has been selected to make the car easy to maneuver. This is an important characteristic when parking. The turning radius is 17.2 feet and the number of steering wheel turns lock-to-lock is 4.1.

When cornering, the car takes a slightly wider line than that exactly corresponding to the movement of the steering wheel. The turning radius increases with the speed, unless the driver compensates by turning the steering wheel. This characteristic is due the weight distribution, and provides good directional stability, as well as reducing the risk of rear-end break-away. Moreover, this feature reduces the steering wheel effort under practically all driving conditions.

2 The oil-filled steering rack is located at the rear of the engine compartment and is well protected by the engine. Significant collision forces would first have to displace the engine before contacting the steering rack and column assembly.

In addition, to protect the driver in the event of an accident, the steering column is telescopic and jointed, so that it will "fold" if a high load is applied. If it is subjected to an axial load beyond a certain limit, it will collapse, at the same time as the mounting at the body gives way.

3 Steering design is rack and pinion. It has inherent resilience and a minimum of lost motion. The location of the tie rod and the angle of the front wheels are practically unaffected by the wheels moving up and down in the suspension. As a result, the driver need not constantly correct with the wheel when the car is being driven on a bumpy road.

4 Power-assisted steering is available on both the Saab 99LE and the WagonBack in conjunction with automatic transmission. Power assistance reduces more than 50 % of the steering wheel effort necessary to maneuver the car at low road speeds and during parking.

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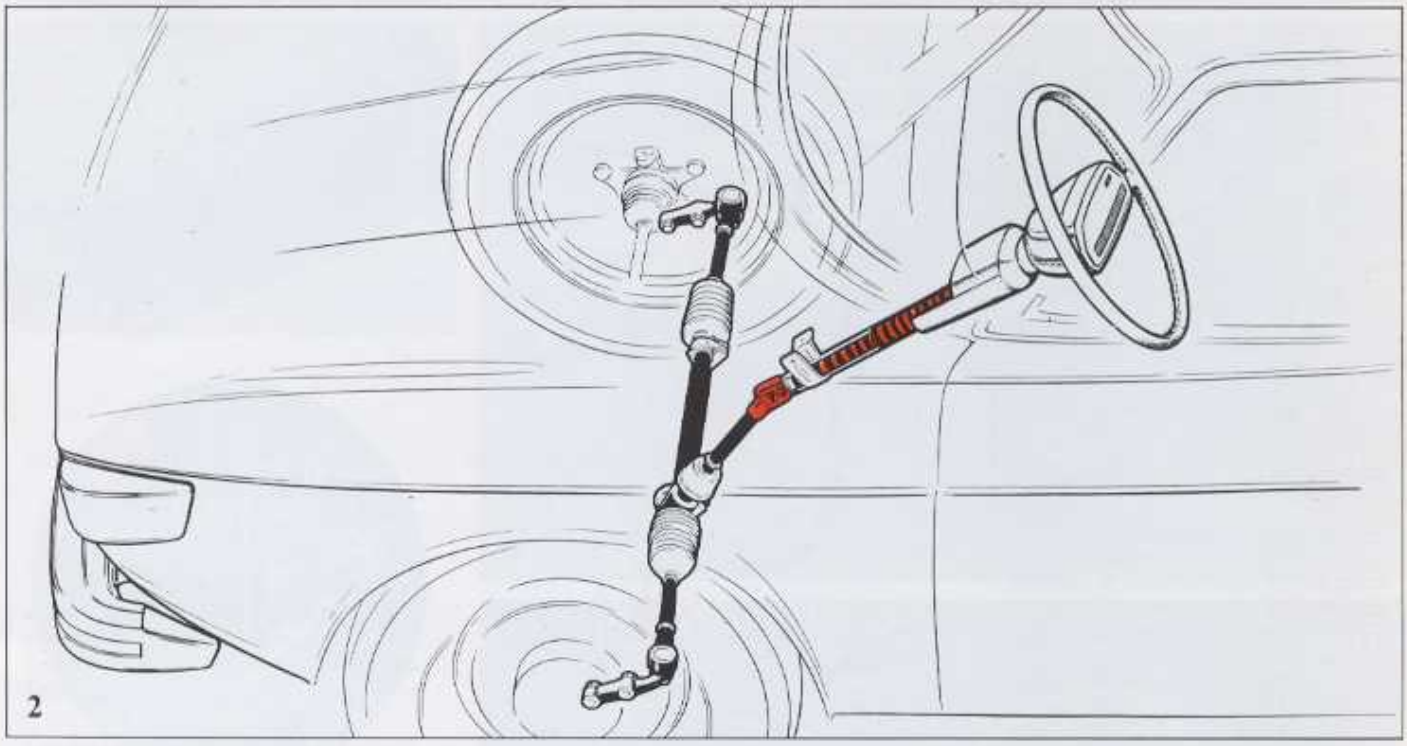

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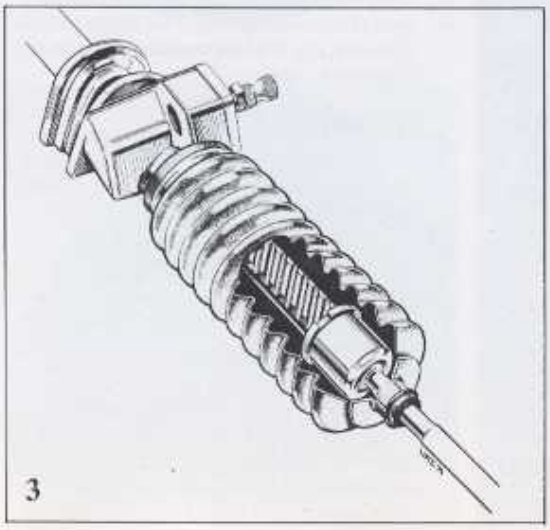

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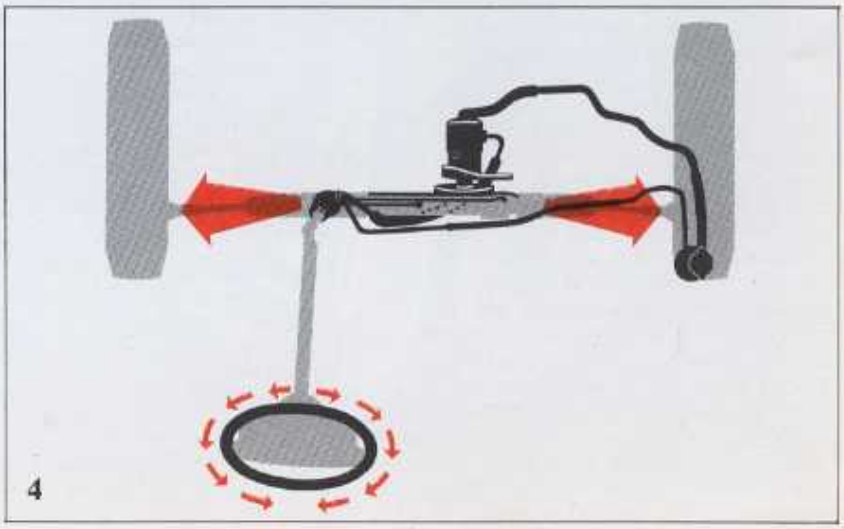

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Brakes

The front and rear wheels are both fitted with disc brakes. Braking is smooth and the braking effort is proportional to the pedal pressure. The four disc brakes are self-adjusting and are fitted with highly heat-resistant pads, which are practically fade-free, even after repeated heavy braking.

The Saab brake system features split, independent hydraulic circuits. Saab first introduced the dual-circuit system in early 1963 and is thus one of the pioneers of this safety feature which is now fairly common and required by U.S. law. But the Saab system is still unique. Contrary to usual practice, it is not divided so that one circuit serves the front brakes and the other circuit serves the rear brakes. Instead, the brake circuits of the Saab are arranged so that the front wheel on one side of the car and the rear wheel on the other side are actuated by one circuit, and the other pair of wheels by the other circuit. In the event of failure of one circuit, no less than 50% of the normal braking effort will still always be available. If two-wheel braking is employed on slippery roads, it is advantageous to have one front wheel and one rear wheel which cannot be locked by the brakes, and will thus help to keep the car on course.

1 The master cylinder actuates both circuits simultaneously, although independently of each other. The brake cylinders of the front wheels are of a larger diameter than those of the rear wheels. As a result, the front wheels exert more than 80% of the braking effort, and the rear wheels — which carry a lower load — will not tend to lock too early in the event of heavy braking.

The risk of a fault occurring in the braking lines is negligible. The brake lines are protected from physical damage and corrosion by being located inside the car, on the left-hand sill beam.

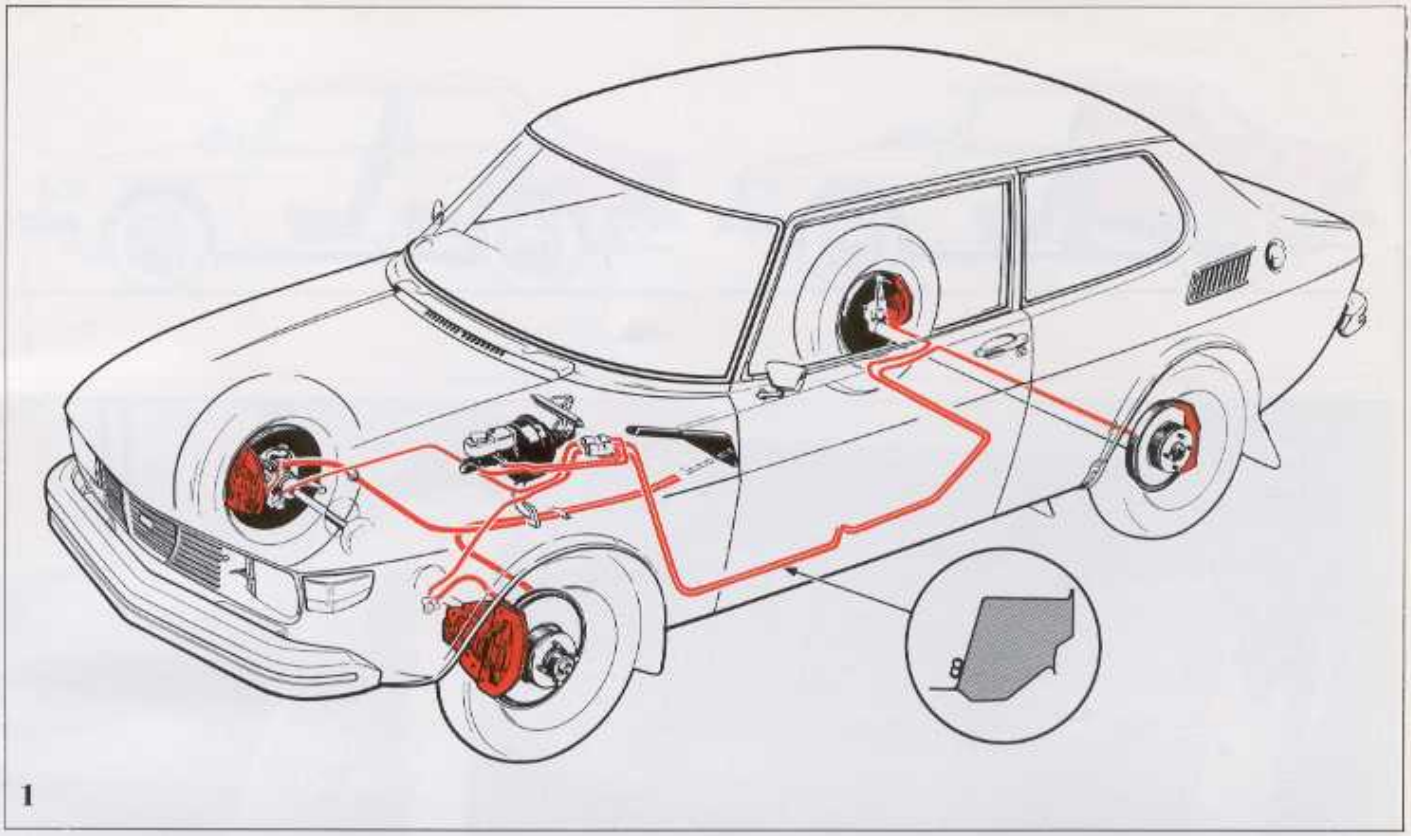
2 The handbrake acts on the front brake discs. In practice, this will therefore provide a third brake circuit. This braking effort is about 50% of that exerted by the foot brake. The hand brake is applied to the front wheels so the car will remain on course even if only the handbrake is used. The handbrake system is designed so that it is automatically adjusted every time the foot brake system is actuated.

3 A red warning light in the left-hand instrument cluster will light up if the brake pedal is excessive, e.g. if a leak should develop in any of the brake lines.

4 In order to protect the brake discs from road dirt, the wheels are provided with radial ventilation holes. These holes also contribute to better cooling of the brake discs.

5 The foot brake system is equipped with a 9-inch vacuum servo which significantly reduces the pedal effort necessary to achieve a certain braking effort.

6 When the brakes have become worn to such an extent that they must be replaced, the driver's attention is drawn by a higher pedal effort being required. This advance warning is designed to avoid damage to the discs.



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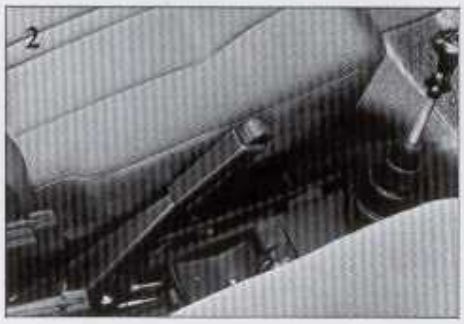

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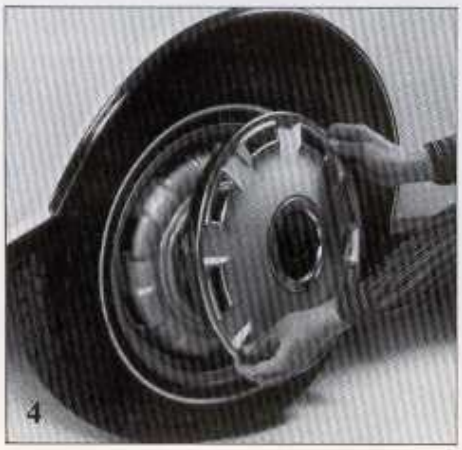

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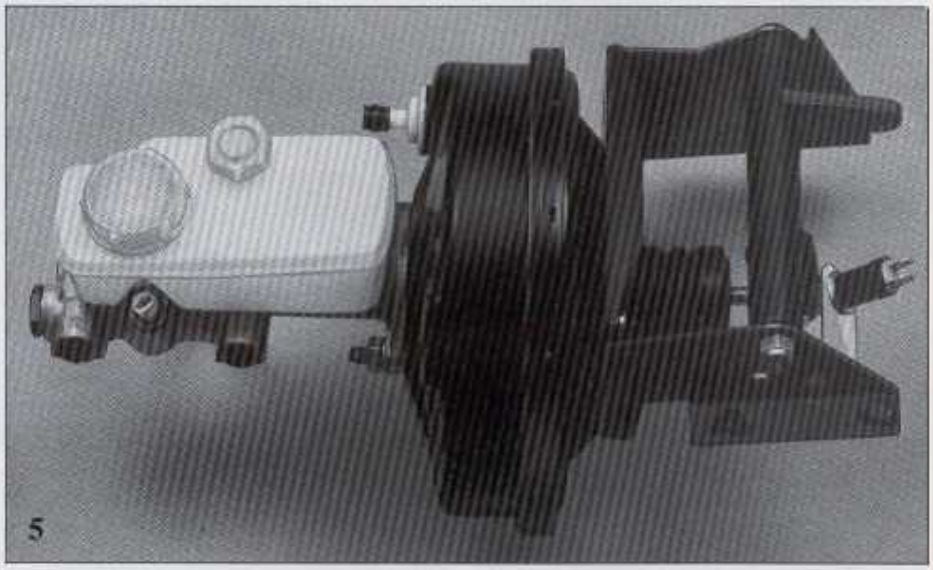

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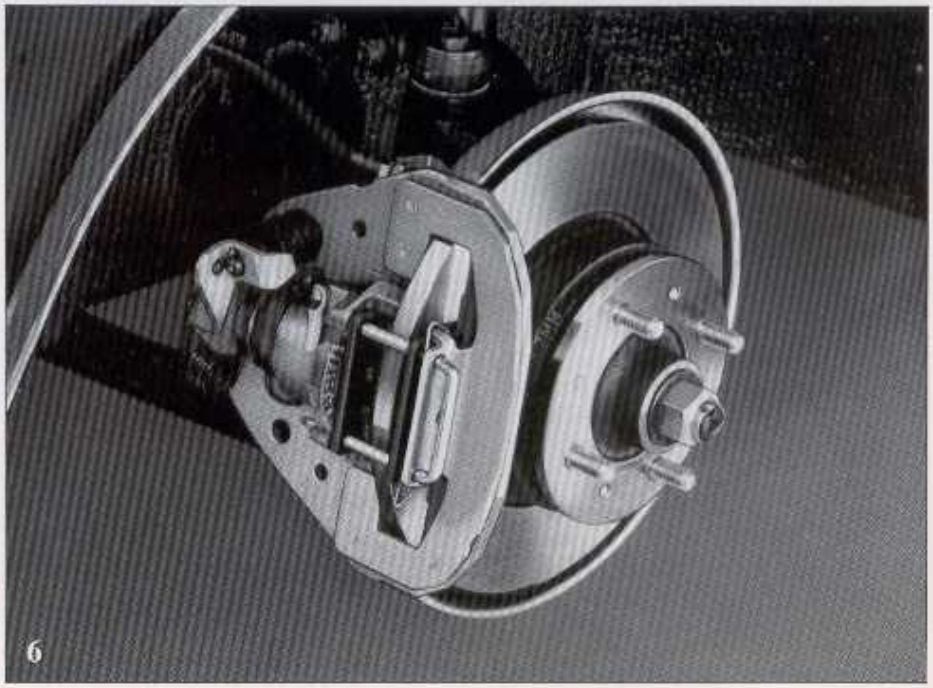

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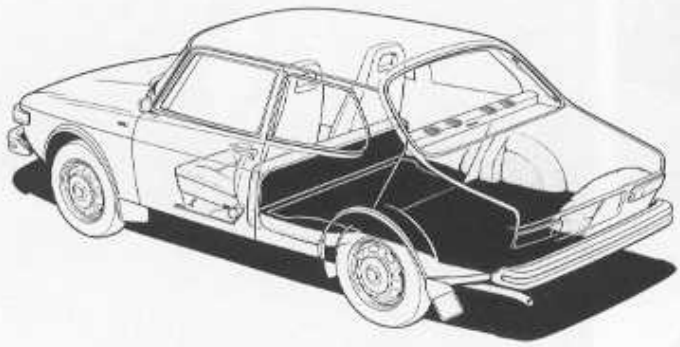


Luggage and storage space —Sedan models

1 The Saab 99 LE and EMS have an "expanding" luggage compartment. The conventional trunk can be simply converted to a semi-station wagon design which allows the area behind the front seat to be used for transporting bulky items by folding down the rear seat. In the Saab 99 WagonBack, the luggage compartment can be used in three different versions, the station wagon version in fact provides a flat floor of over six feet in length and a maximum capacity of 53 cubic feet.

2 Ordinary trunk space in the sedan models can accommodate 12.3 cubic feet of luggage according to the SAE standard which employs a set of items of luggage of stipulated size. The actual total volume is just over 23.3 cubic feet. The maximum load-carrying capacity of a 2-door or 4-door sedan, with manual gearbox, is 815 pounds, with only the driver in the car. The spare tire is located at the extreme rear for easy removal even when the trunk is full.

The luggage compartment has a flat, wide floor. The floor is covered with a wear-resistant plastic covering. The channel around the trunk lid will effectively drain rain water, even during the heaviest downpour. The spring-loaded lid will open automatically when the opening button is depressed. A light will automatically illuminate the luggage compartment when the lid is opened. The trunk sill is only 20.9 inches from the ground in the WagonBack model. The Saab 99 LE-sedan can be converted to a semi-station wagon in about half a minute by folding the back seat forward, and then folding the backrest foreward and downwards. The continuous flat floor will then be 67.7 inches long (A) and 51.5 inches at its widest (B) and 84.7 inches long diagonally (C). The car can be converted back to a conventional 5-seater in a few seconds. For safety reasons, the seat back is secured in an upright position by sturdy catches.

3 The doors are provided with spacious packets for maps, newspapers, and eight track cassette tapes.

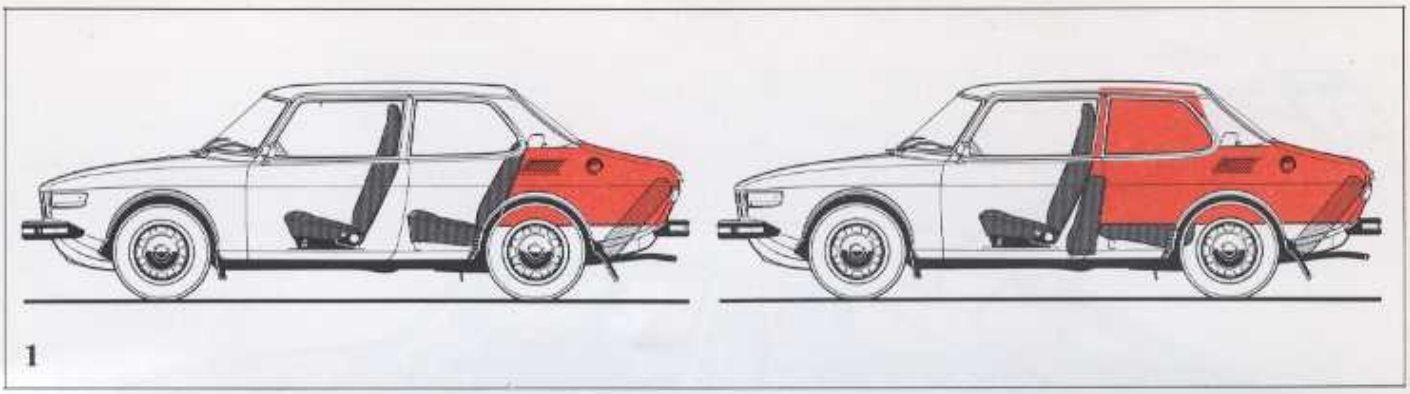
4 The door trim design of the Saab 99 EMS and WagonBack allows for even greater door pocket storage.

5 The lid of the glove compartment will remain in the horizontal position when open, and has a number of circular recesses which can be used as holders for cups during a break on a long trip.

6 A tray-like surface, on top of the dashboard, is provided for sunglasses or other items. The surface has a slight forward slope, to prevent small items from rolling off.

7 The ashtray is of ample size, and tucks in neatly under the dashboard. Ashtrays are also incorporated in the two armrests at the back seat.

8 Provision is made on the Saab 99 for fitting a trailer hitch. The highest permissible trailer weight is 2000 pounds.



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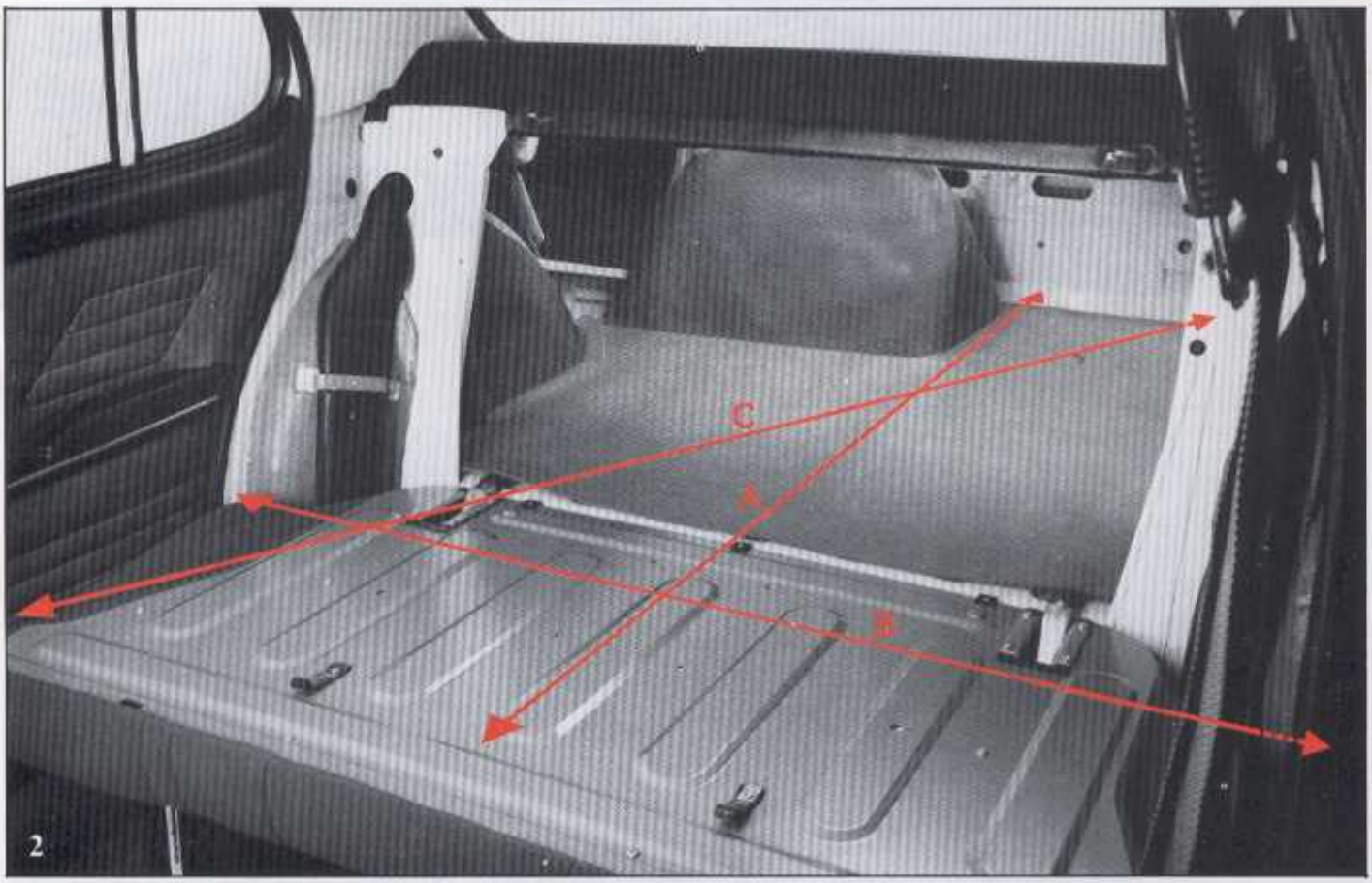

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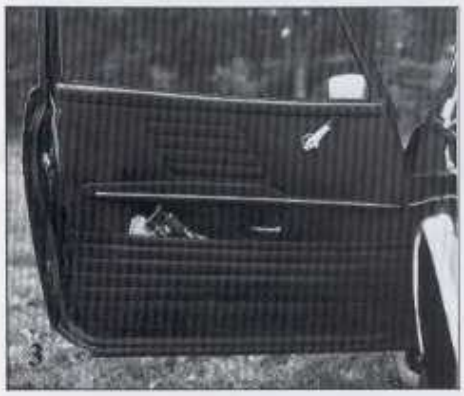

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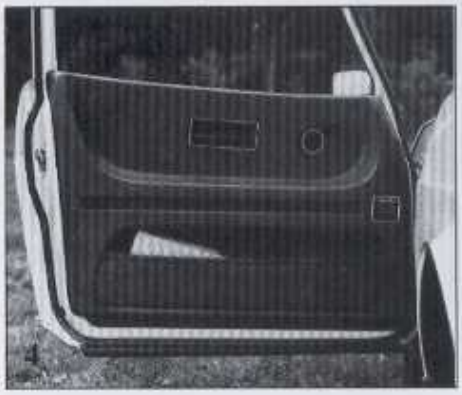

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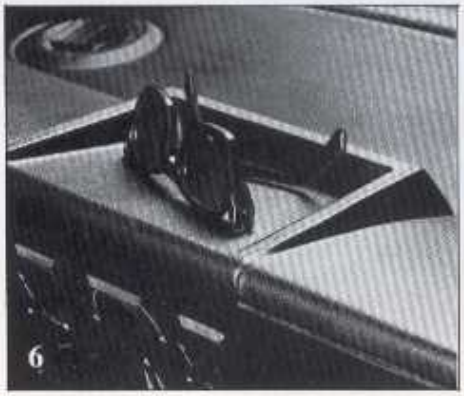

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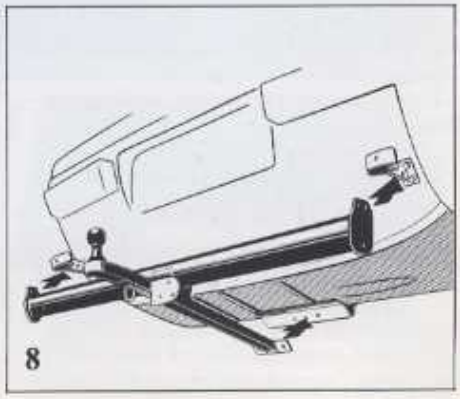

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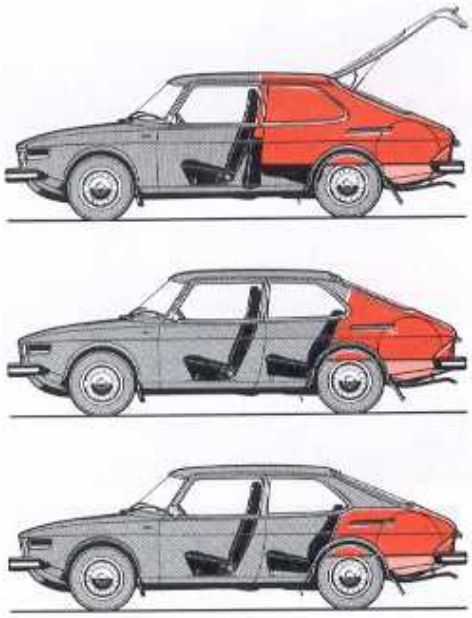


Luggage and storage space WagonBack

The Saab 99 WagonBack is an unconventional car which incorporates the best features of the conventional sedan and station wagon.

- large passenger compartment with first-rate comfort
- sporty appearance and aerodynamic design
- large and easily convertible load-carrying area

The luggage compartment can be converted to three different versions:

- conventional trunk with parcel shelf and room for five occupants
- conventional trunk without parcel shelf and room for five occupants
- station wagon capacity and room for two occupants.

1 The large rear door allows for convenient loading, even of very bulky items. There is no sill whatsoever, and the height of lift is thus only 20.9 inches. The rubber covered bumper can be used as a support when loading heavy and long items. The rear door is hinged at the edge of the roof and the height of the rear door opening is 32 inches. The width of the door opening is 46 inches at the widest point.

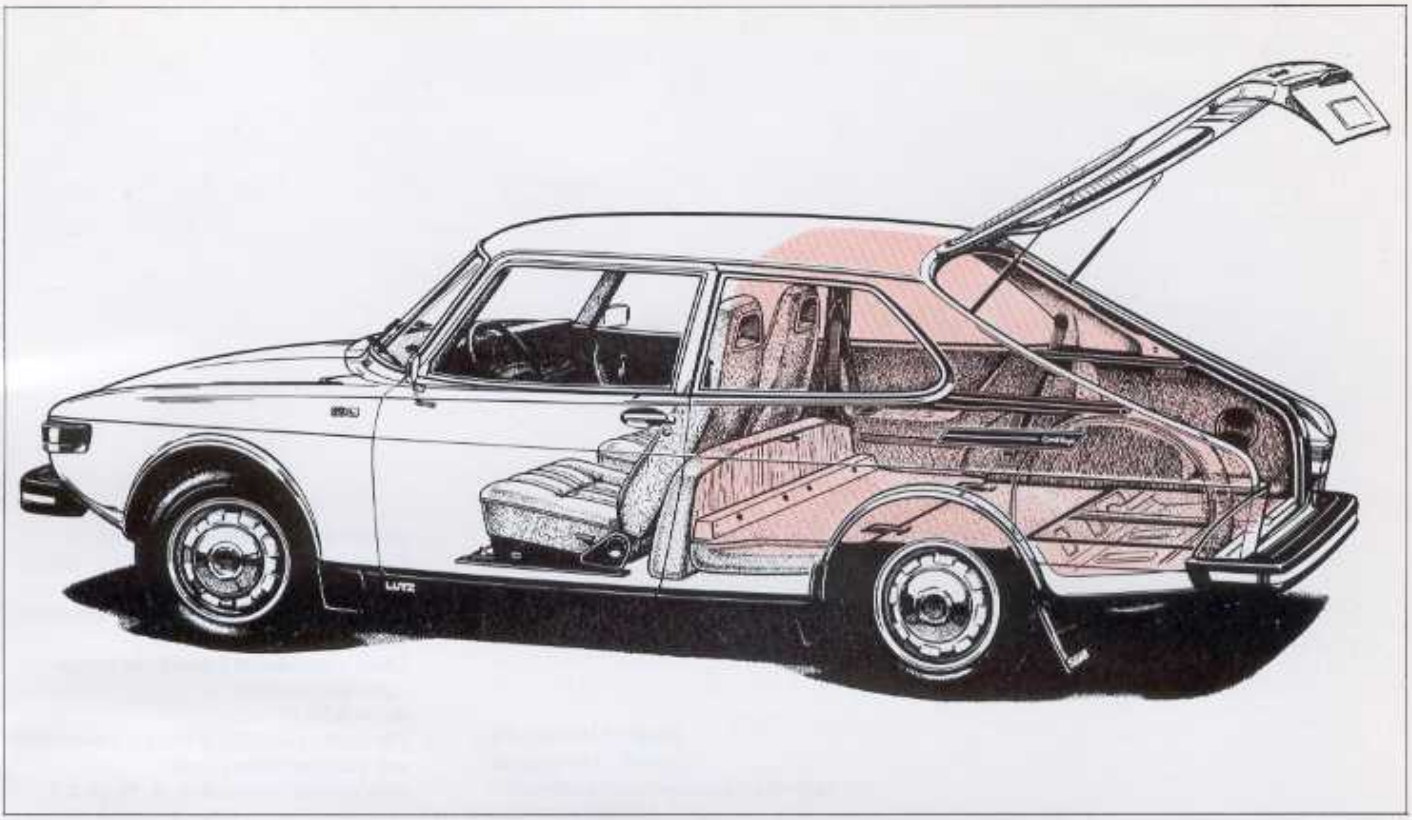
2 The trunk (with seat up) is 46.8 inches long and can accommodate 13.4 cubic feet according to SAE standards. If the parcel shelf is removed, the rear of the car can be loaded up to the roof.

3 The WagonBack configuration can be obtained by folding down the back seat and its backrest forward. This can be done in less than half a minute. No tools are required.

4 The floor is completely flat and is covered with a plastic-backed nylon carpet. The spare wheel is located to the left, and is easily accessible even if the luggage compartment is loaded. With the back seat folded, the length of the floor is 72.4 inches. The total volume is 53 cubic feet.

5 A well-protected light is activated automatically when the rear door is opened.

6 A compartment with the maximum volume of 3.2 cubic feet is available under the trunk floor. The floor in this compartment is covered with a nylon carpet. This compartment is practical for the storage of a spare fuel can, warning triangle, tow-rope, jack. The wheel housings and side walls are lined with moulded panels of 3/8 inch thick foam material, covered with a .080 inch thick layer of touch vinyl. The material is impact-absorbent, sound and heat insulating, and fire resistant. It is oil-resistant and easy to keep clean. The rear door is also lined with the same material.

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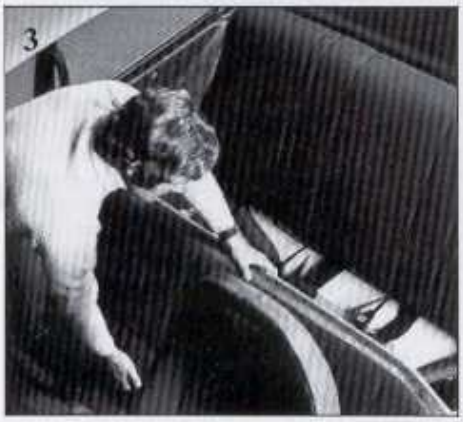
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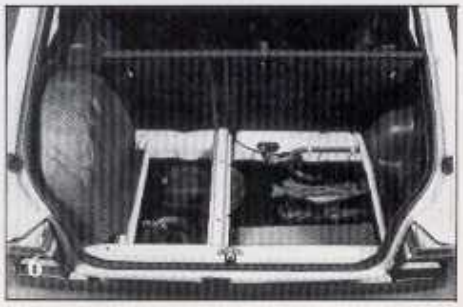
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Technical data

Engine

ALL VERSIONS

Straight, four-stroke, water-cooled, four cycle engine with overhead camshaft.
Number of cylinders: 4.
The engine is located with the clutch facing forward.
The cylinder slope is angled 45° to the right.
The cylinder block is of special alloy cast iron, and is a one-piece casting. The cylinder head is a light alloy casting.
Forged, hardened crankshaft with drilled oil passages and replaceable bearing shells.
The camshaft is chain-driven and is of a special grade of forged steel.
The pistons are made of light alloy, and each is equipped with two compression rings and one oil scraper ring.
Number of main bearings: 5.
Number of camshaft bearings: 5.
The crankshaft drives a separate idler shaft which drives the oil pump, water pump, distributor, and on the carburetor engines, also the fuel pump.
Idling speed: 825—875 rev/min.
Average piston speed at 5 000 rev/min: 2 560 ft/min. (13.9 m/s).
Pressurized lubricating oil system and full-flow oil filter.
Oil capacity, including filter: 3.7 U.S. quarts.

FUEL INJECTION ENGINE: 2.0 LITRE

Cylinder bore: 3.54 in (90 mm).
Piston stroke: 3.07 in (78 mm).
Displacement: 121 cu. in. (1 985 cm³).
Compression ratio: 8.7:1.
Max. horsepower, DIN: 115 hp, 87 kW (110 hp, 81 kW, for West Coast cars) at 92 rev/s (5 500 rev/min.).
Max. torque: 123 lb ft, 167 Nm (118 lb ft, 161 Nm for West Coast cars) at 62 rev/s (3 500 rev/min.).

Fuel system

FUEL INJECTION ENGINE

Mechanically controlled Bosch CI (Continuous Injection) fuel injection.
Recommended fuel: 91 RON (Regular).
Fuel tank capacity: 14.2 U.S. gal.

Cooling system

The cooling system is of the pressurized type.
Cross-flow radiator, separate expansion tank.
The thermostat opens at +88°C.
Coolant capacity, including heating system: 2.1 U.S. gal.
Electrically driven cooling fan. Thermostatically controlled 150 W motor.

Power transmission

The gearbox, with the final drive and differential, is located under the engine and forms an integral part of the engine. The power is transmitted from the clutch to the gearbox by means of primary gears.
The front wheels are driven. The drive shaft universal joints — the outer are of the Rzeppa constant-velocity type — are permanently lubricated.

MANUAL GEARBOX

Single dry-plate clutch with flexible hub, of Borg & Beck manufacture.
The clutch is hydraulically actuated. The primary drive is in the form of a gear train.
Primary drive ratio: 1.00:1.
The gearbox is fully synchromesh and has four forward speeds.
Reduction ratios, engine to driving wheels:

First gear	13.40:1
Second gear	8.06:1
Third gear	5.41:1
Fourth gear	3.89:1
Reverse	14.70:1
Ratio of final drive:	3.89:1

The theoretical speed in fourth gear at 1 000 engine rev/min: 18.6 mph (30.0 km/h) (with 165-SR 15 tires).
Oil capacity of gearbox: 3 U.S. quarts.

AUTOMATIC TRANSMISSION

Coupling in the form of a hydraulic torque converter.
The reduction ratio of the torque converter varies between 1.91:1 and 1:1.
Chain transmission between the torque converter and gearbox.
Ratio: 0.97:1.
The gearbox is of Borg-Warner manufacture and has three forward gears.
Gear selector positions: P, R, N, D, 2, 1.

Ratios in the automatic transmission:

First gear	2.39:1
Second gear	1.45:1
Third gear	1:1
Reverse	2.09:1
Final drive reduction:	3.89:1

Torque ratio from engine to driving wheels:
D 17.29—3.79
2 17.29—5.49
1 17.29—9.04
R 15.13—7.92

Oil capacity of automatic transmission: 2.1 U.S. gal.

Changing-up speeds, mph:

	first 2nd	2nd third
Full gas	approx. 28	approx. 46.6
Kick-down	approx. 37.2	approx. 65.2

Changing-down speeds, mph:

	third 2nd	2nd first
Full gas	—	—
Kick-down	approx. 56	approx. 24.8

Brakes

Dual-circuit hydraulic foot brake system with Girling vacuum servo. The servo unit reduces the necessary pedal pressure by an average of about 40%. The left front wheel and right rear wheel brakes are actuated by one brake circuit, and the diagonally opposed pair of wheels are actuated by the other.
Self-adjusting disc brakes all round.

The handbrake and foot brake have common brake pads at the front.
The handbrake is mechanical.
Brake disc diameters: 11 in. front and 10.6 in. rear.

Braking area:

Front wheels	222 sq.in.
Rear wheels	157 sq.in.
Total	379 sq.in.

Brake servo diameter: 9 in.
Braking power distribution: approx. 80% on the front wheels.

Wheels suspension, springing

Transverse wishbones at the front. Helical springs and hydraulic telescoping shock absorbers front and rear.
The front springs are pivot-mounted and are located between the upper wishbones and the seating in the wheel housings.
The front shock absorbers are actuated by the lower wishbones.
All shock absorbers are double-acting.
Light, rigid rear axle guided by two forward-facing longitudinal arms and two backward-facing links, and a Panhard rod.
The springs and shock absorbers at the rear are actuated by the forward-facing links.
Total spring deflection: 6.3 in. front and 7.1 in. rear.
Maximum stroke of the shock absorbers (fitted): 3.6 in. front, 6.2 in. rear.

Steering

Steering of the rack and pinion type.
Normal reduction: 20.1.
4.1 steering wheel turns lock to lock (3.6 turns with power assistance).
Turning circle: 34.1 ft (10.5 m.).

Wheels and tires

All models of the Saab 99 have disc wheels with radial ventilation holes.
The EMS model has cast aluminium wheels of special design.
Rim sizes:

Saab 99 and 99LE	4½ J FHAx15"
EMS	5 J FHAx15"

All models are equipped with 165 SR 15 steel-belted radial-ply tires.
Tire pressures: 27 psi (1.9 kg/cm²) with a light load and 30 psi (2.1 kg/cm²) with a full load.

Electrical system

Battery: 12 V, 60 Ah.
Maximum alternator charging current/voltage: 55 A/14 V.
Starter motor: 1.1 hp (0.8 kW).
Distributor contact gap: 0.016 in. (0.4 mm).
Firing order: 1—3—4—2.
Spark plugs with 0.71 in. (18 mm) thread length, M 14 thread and 0.024—0.028 in. (0.6—0.7 mm) electrode gap.
Fuses:
2 (25 mm) 5 A
7 (23 mm) 8 A
3 (25 mm) 16 A

General specification of the Saab 99LE and EMS

Overall length across bumpers	174 in. (4 420 mm)
Overall width	66.5 in. (1 690 mm)
Overall height (unladen)	56.7 in. (1 440 mm)
Ground clearance (curb weight)	6.9 in. (175 mm)
Track, front, Saab 99LE	54.7 in. (1 390 mm)
Track, front, Saab 99 EMS	55.1 in. (1 400 mm)
Track, rear, Saab 99LE	55.5 in. (1 410 mm)
Track, rear, Saab 99 EMS	55.9 in. (1 420 mm)
Wheelbase	97.4 in. (2 473 mm)
Turning circle	34.1 ft. (10.5 m)
Curb weight (car with fuel, coolant, tools, spare wheel and driver weighing 154 lb.	2 660—2 770 lb. (1 210—1 260 kg)
Max. weight (curb weight and four passengers of 154 lb. (70 kg) each and 154—220 lb. (70—100 kg) of luggage	3 500—3 560 lb. (1 590—1 620 kg)
Weight distribution:	
Curb weight	61% on front
Max. weight	52% on front
Number of seats (including driver)	5
Trunk capacity according to SAE	12.2 cu. ft. (0.347 m³)
Maximum permissible load on the roof	220 lb. (100 kg)
Maximum permissible trailer weight	2 000 lb. (907 kg)

General specification of the Saab 99LE WagonBack

Overall length across bumpers	178.3 in. (4 530 mm)
Overall width	66.5 in. (1 690 mm)
Overall height (unladen)	56.7 in. (1 440 mm)
Ground clearance (curb weight)	6.9 in. (175 mm)
Track, front	54.7 in. (1 390 mm)
Track, rear	55.5 in. (1 410 mm)
Wheelbase	97.4 in. (2 473 mm)
Turning circle	34.1 ft. (10.5 m)
Curb weight (car with fuel, coolant, tools, spare wheel and driver weighing 154 lb.)	2 750—2 820 lb. (1 250—1 280 kg)
Max. weight (curb weight and four passengers of 154 lb. (70 kg) each and 198—264 lb. (90—120 kg) of luggage	3 630 lb. (1 650 kg)
Weight distribution:	
Curb weight	59% on front
Max. weight	49% on front
Number of seats (including driver)	5
Luggage capacity according to SAE	13.5 cu. ft. (0.381 m³)
Maximum permissible load on the roof	220 lb. (100 kg)
Maximum permissible trailer weight	2 000 lb. (907 kg)