

Product Engineering

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New package of auto safety sets the pace for Detroit

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Sweden's new Volvo incorporates nearly all the proposed standards that are baffling American makers.

And it does this without penalty in size or cost

The deceptively simple-looking Volvo 144S, imported from Sweden, is rolling proof on the highway of what can be accomplished in auto safety within present standards of size and cost. In its wealth of engineering features for safety, economy, and performance, it includes virtually all the safety standards that are giving U.S. manufacturers sleepless nights.

The surprising thing is that Volvo finalized the design of the 144S two years prior to the Congressional hearings on auto safety. Based on Swedish and European safety standards, design of the brakes, for example, was frozen in 1964.

Meeting a deadline. Though most European producers and all American auto manufacturers have serious misgivings about incorporating the safety requirements ordered for next Jan. 1, Volvo sees no immediate problem. Though there are minor fixes to be made—the turn indicators, for example, must be enlarged—the company expects to incorporate all the final safety requirements by the deadline date.

From front turn indicators that are visible from nearly behind the car to a practically fail-proof hydraulic brake system, the Volvo guards against road hazards. And if a collision should occur, it protects occupants against whiplash injury or contact with interior fixtures.

Specifications. In the compact-size range, 102 in. wheel base and 183 in. overall, the Volvo is powered by a 4-cylinder water-cooled engine with five main bearings and a displacement of 109 cu. in. Engine features include twin side-draft carburetors, separate intake and exhaust ports, fully machined combustion chambers, and a 10:1 compression ratio.

Maximum output of the engine is



Front seats have infinitely variable backrest angle, fore and aft positioning, plus adjustable stiffness in the critical lumbar region.

115 brake horsepower SAE at 6000 rpm, or 1.06 bhp SAE per cu. in. One key to the engine's durability is the fact that the bearing area is greater than that of conventional American engines with more than twice the displacement.

Engine maintenance is reduced by using a sealed cooling system with an expansion tank to handle overflow during temperature extremes. Coolant level can be checked visually by looking at a transparent expansion tank next to the radiator.

Body design. Though the exterior of the vehicle can be described as contemporary conservative, it has several noteworthy details. Visibility is enhanced by the large glass area.

A full-width rear window enables the driver to see all four corners easily. The simple wrap-around bumpers are anodized aluminum, faced with hard rubber strips that absorb minor impacts to prevent bumper damage.

Front turn signals that curve

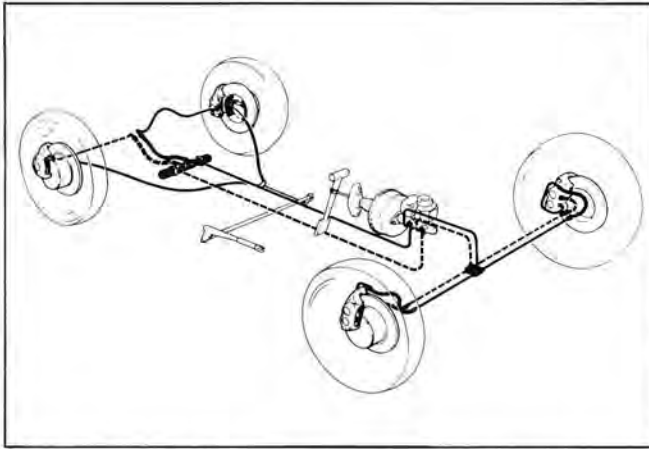
around the corner of the fender are visible through an arc of nearly 270 deg. Tail-lighting is simplified by incorporating the turn signal, parking lights, stop light, and back-up lights in a pair of single-lens units.

Unitized body construction is strengthened by boxing the six main body pillars and tying them together with transverse and longitudinal members. The rigid skeleton formed by these members is capable of supporting a dead weight of 15 tons. The lighter sheet-metal structure of the front fenders and trunk are designed to deform and absorb energy during serious collisions. In tests, the passenger compartment remained undeformed after a 30-mph crash into a concrete block.

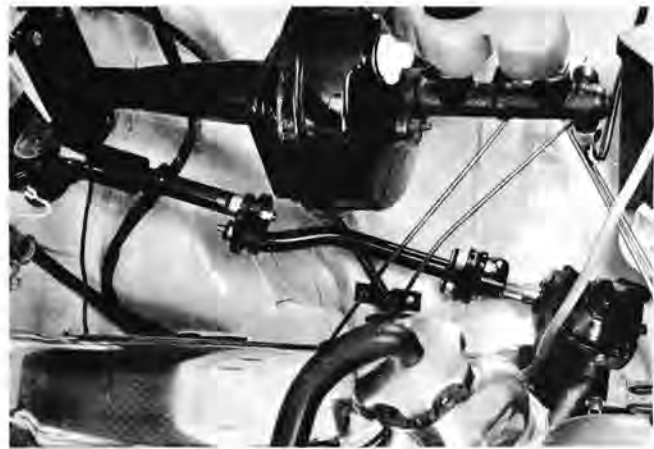
Padded interior. Designed for maximum protection, Volvo's interior has padding on the doors, roof liner, sun visors, and instrument panel. Passengers in front are protected from leg injury by a vinyl-covered energy absorbing plastic foam pad that covers the underside of the dashboard.

Whiplash injuries are minimized by incorporating a friction clutch in the control for the back of the front seat. The force needed to cause severe neck injury is calculated at approximately 10 g. The friction catch that holds the back of the 144S seat is designed to slip enough to allow the seat back to move at 8 g, about the force produced by a 10-mph rear-end collision.

The heating system, designed for Sweden's rugged winters, should be more than adequate for U.S. conditions. A duct along the transmission tunnel directs warm air to the passengers in the rear. Ducts along the door sills carry warm air to



Disk brakes on all four wheels provide straight-line stops from high speeds without wheel lock-up.



Safety steering column breaks away during a crash preventing passenger compartment penetration.

defrosters on the rear windows. The door-sill ducts also help keep the floor and rocker panels dry, minimizing corrosion in boxed sections of the body.

Breakaway joint. The steering column contains a simple breakaway joint that saves the driver from being impaled in a severe collision. Two sections of the column are coupled by two steel pins mounted on the upper shaft and fitting through hard-rubber bushings on the lower shaft. Normally, the column performs as a solid unit, but the joint separates under severe impact. The front end

of the car can be extensively deformed without affecting the position of the steering wheel.

Fail-proof brakes. One of the car's most interesting design details is the three-wheel twin-hydraulic brake circuit, with dual master cylinders.

The basic brake system consists of a power-assisted dual master cylinder, 4-wheel disks, rear-wheel relief valves, and a mechanically activated hand brake. Separate hydraulic lines connect each master cylinder with both front wheels and one rear wheel. If either circuit fails, braking still takes place on

three wheels at 80% of normal braking force.

With both systems operating, a stop from 60 mph takes 180 ft. With one system out, the stopping distance increases only to 210 ft. A noticeable increase in brake-pedal pressure and pedal travel, plus a dashboard warning light, warns the driver if a circuit fails.

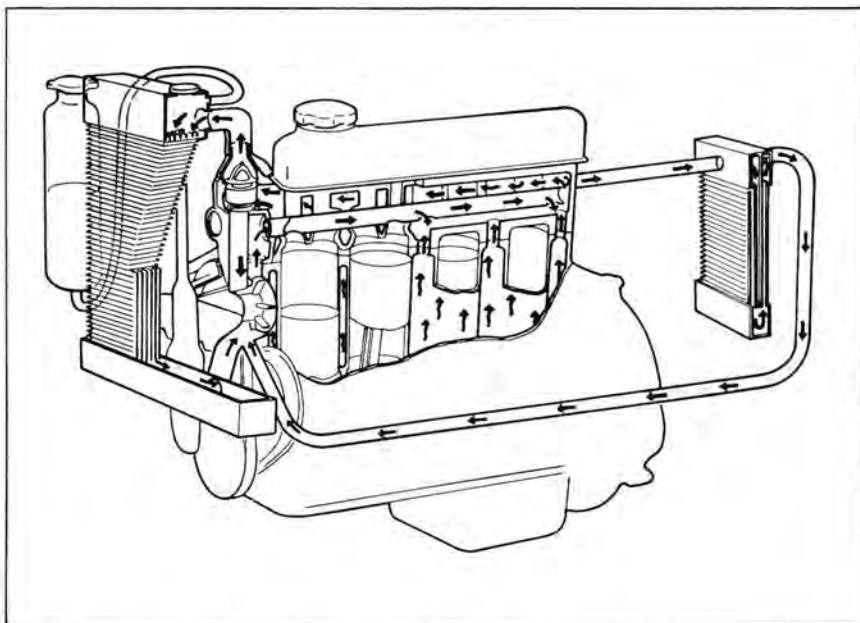
The relief valves on rear brake lines restrict pressure to the rear disks, preventing the locking of wheels and loss of steering in hard braking. The mechanical parking brake consists of a conventional drum brake in the crown of the hat-shaped rear-wheel disks.

Steady ride. The car handles exceptionally well on either smooth surfaces or rough dirt roads, thanks to its 50/50 weight distribution, low roll centers, and the positive location of the rear axle. Long control arms above and below the rear axle transmit torque directly to the body, preventing rear-axle windup and wheel hop.

Another factor contributing to good road-holding qualities are the low-profile, wide-base, tubeless tires. Mounted on 15-in. pressed steel wheels the tires are rated at 110-mph continuous duty. The combination of tires and suspension result in precise control and low steering effort at all speeds.

The suspension system is easy to maintain, because all joints are lubricated and sealed for life.

—Joseph J. Kelleher



Sealed coolant system features an oversize heater core plus a transparent expansion tank for a visual checking of fluid level.

