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3-Point Safety Belt From Volvo - The Most Effective Lifesaver In Traffic For Fifty Years

Few people have saved as many lives as Nils Bohlin - the Volvo engineer who in 1959 invented the V-type three-point safety belt. A design as obvious as it was intelligent, perfectly suited to the seat occupant's body. To this very day, the safety belt still provides the most effective protection in the event of an accident.

Since the 1960s, Bohlin's belt has saved many hundreds of thousands of lives and prevented or reduced the severity of injuries among many millions. This makes the three-point safety belt the single most important safety device in the car's 120-year history. And that's not just Volvo's claim. As confirmation of its effectiveness, Bohlin's invention has been identified by German patent registrars as one of the eight patents to have the greatest significance for humanity during the hundred years from 1885 to 1985. Bohlin shares this honour with patent-holders such as Benz, Edison and Diesel.

From catapult seats to Volvo cars
Engineer Nils Bohlin was born in 1920 in Härnösand, Sweden. He started his career in 1942 at Svenska Aeroplan Aktiebolaget (SAAB) as an aircraft engineer. In 1955 he was made responsible for the development of catapult seats and for the pilots' other safety equipment. Paradoxically, Bohlin was actually also interested in the exact opposite phenomenon - keeping the body as safe as possible during extreme retardation.

He soon got the opportunity to develop his ideas. In 1958 Nils Bohlin was recruited to Volvo as a safety engineer by the then-president of the company, Gunnar Engellau.

Two-point belt not safe enough
During the latter half of the 1950s, Volvo developed a number of related solutions, all intended to prevent the occupant's impact with the car's interior components or to lessen the severity of the consequences of such impacts in a collision: collapsible steering column, padded dashboard and attachment points for diagonal two-point belts in the front seats.

Volvo had already been equipping its cars with standard-fit anchorages for two-point front safety belts back in 1957, but the so-called "diagonal belt" did not have the required potential for developing into the safe solution for which Volvo was aiming. The reason was that the belt buckle was positioned at the height of the occupant's ribcage. This positioning meant that the buckle damaged the body's soft organs instead of protecting them.

Volvo president Engellau also had family experience of traffic fatalities. A relative had died in a road accident owing among other things to shortcomings in the two-point belt. He therefore gave Bohlin the brief to develop a better alternative.

Bohlin's solution: simple perfection
Bohlin soon realised that both the upper and lower body had to be properly secured in place, with one belt across the chest and another across the hips. His biggest challenge was to create a solution that was both simple to use and effective since the belt had to be able to be put on using just one hand.

In 1958 his work resulted in a patent application for Nils Bohlin's three-point belt. What Bohlin integrated into his design, and which he regarded as most important for a car safety belt, were four golden rules: the belt consisted of both a hip or lap belt and also a diagonal belt across the
upper body, which was positioned correctly from the physiological viewpoint. That is to say across the pelvis and the ribcage, and attached at a low anchorage point beside the seat. The belt geometry formed a "V" with the peak pointing down towards the floor. In addition, the belt stayed in position and did not move when it was under load.

This is the crucial difference between the effective V-shaped belt according to Bohlin's design and the previous three-point design of Y-type (Griswold). Bohlin's belt was in fact an effective demonstration of geometrical perfection rather than a cutting-edge innovation. The solution and the benefits of the three-point design soon spread throughout the world since Volvo immediately made Bohlin's patent available to all car makers.

**Volvo first with 3-point belt as standard**

In 1959, the patented three-point safety belt was introduced in the Volvo Amazon (120) and PV 544 on the Nordic markets. Volvo thus became the first car maker in the world to equip its cars with safety belts as standard. Owing to the two-point belt's relatively poor protective ability and the fact that it was perceived as awkward, customers initially also resisted Volvo's three-point safety belt. Although it was easy to use and both comfortable and effective from the protection viewpoint, it was met with a certain degree of scepticism.

Ahead of the launch of the three-point belt in Volvo's cars on markets worldwide, a series of sled tests and trial impacts were first carried out on all the safety belt models available at the time. The results were crystal-clear: Volvo's three-point belt provided by far the best level of protection for the car’s occupants. Backed by these results, in 1963 Volvo introduced the three-point safety belt in the USA and on other markets where it was not yet fitted. This meant that all Volvo cars leaving the factory were now fitted as standard with the three-point safety belt in the front seats.

**The belt is equally important in the rear seat**

Volvo soon realised the importance of ensuring that all the car's occupants were held securely in their seats, and work on equipping even the rear seat with belts was conducted in parallel with other safety-related developments. Volvo's cars were fitted with attachment points for rear seat belts as early as 1958, but it was not until 1967 that Volvo succeeded in convincing the car-buying public that the rear seat's occupants should also use the belts.

People previously held the peculiar belief that just sitting in the rear seat provided protection in a collision - after all, it was in the front that the occupants were in danger. The fact that the occupants of the rear seat are hurled forward with a force of 3000-5000 kg and thus risk seriously injuring both themselves and the occupants of the front seats was suppressed, or perhaps there was simply no awareness of this danger. Today the wearing of seat belts in the rear is required by law and is quite simply a matter of course in many countries.

**Safety expert throughout his lifetime**

During his time at Volvo, Bohlin came to lead the company's safety drive towards ever-safer occupant protection in Volvo cars. He was quick to realise the need for side-impact protection, so back in the 1970s he started working on various technical solutions that eventually resulted in what is now the well-known and patented SIPS - Side Impact Protection System - which Volvo was among the world's first car makers to introduce.

After retiring in 1985, Nils Bohlin was consulted by Volvo on a number of occasions regarding particularly complicated safety issues. In 2002, Nils Bohlin succumbed at the age of 82 to the after-effects of a stroke.

**One of the car industry's most important inventors**

Nils Bohlin has received many international honours for his work and his development of the three-point safety belt. Many people took the initiative to personally get in touch with Nils Bohlin to thank him when they realised their lives had been saved by his invention. Here is a summary of the awards that the three-point safety belt and Nils Bohlin received over the years:

- **1956** Grant for continued studies in aviation medicine in the USA, The Swedish Union of Clerical and Technical Employees in Industry

- **1965** Award for the best sales-enhancing attribute in 1964 (the Volvo seat), Volvo Dealership Association
Nils Bohlin's pioneering work in car safety at Volvo, International Association of Accident and Traffic Medicine (6th Int. Conference)

1979 Safety award for particularly excellent engineering work, NHTSA, USA (ESV conference in Paris)

1985 Bohlin's safety belt patent listed as one of the eight patents of greatest significance to humanity in the past century (Benz, Edison, Diesel), Germany patent registry, West Germany

1985 Award for special achievements, NHTSA, USA, (ESV conference in Oxford)

1989 Nils Bohlin is inducted into the International Safety and Health Hall of Fame, USA


1995 Royal Swedish Academy of Engineering Sciences (IVA) gold medal

1999 Nils Bohlin is inducted into the Automotive Hall of Fame

2002 Nils Bohlin is inducted into the National Inventors Hall of Fame

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Descriptions and facts in this press material relate to Volvo Cars' International car range. Described features might be optional. Vehicle specifications may vary from one country to another and may be altered without prior notification.

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Related Images
Nils Bohlin has received many international honours for his work and his development of the three-point safety belt. Many people took the initiative to personally get in touch with Nils Bohlin to thank him for his contribution to road safety. Bohlin’s most frequent answer was: “I had nothing to do with the fact that people are now safe when they are in a car.”

Bohlin’s solution: simple perfection

Bohlin soon realised that both the upper and lower body had to be properly secured in place, with the belt’s lower edge held firmly against the body, at the waist, and the belt’s shoulder part passed over the shoulder. The three-point design was demonstrated to feature excellent positioning and control of the occupant’s body. To this very day, the safety belt still provides the most effective protection in the event of an accident owing among other things to shortcomings in the two-point belt. He therefore gave Bohlin four golden rules: the belt consisted of both a hip or lap belt and also a diagonal belt across the shoulder. The diagonal belt had to fit tightly against the body and form an unbroken line from the shoulder to the hip. The geometry formed a “V” with the peak pointing down towards the floor. In addition, the belt stayed in place during a collision, without sliding out from under the occupant’s body. This is the crucial difference between the effective V-shaped belt according to Bohlin’s design and an ineffective belt that detaches from the occupant’s body and drags the occupant across the seat in the course of a collision. For Bohlin, the belt was simply a “demonstration of geometrical perfection rather than a cutting-edge innovation. The solution and geometry were verified in tests.”

Two-point belt not safe enough

In 1957, Volvo had already been equipping its cars with standard-fit anchorages for two-point front safety belts. During the latter half of the 1950s, Volvo developed a number of related solutions, all intended to improve occupant protection in Volvos. During this period, the company was already aware of the problems associated with rear seat occupants, but incentives were lagging behind. People previously held the peculiar belief that just sitting in the rear seat provided protection in a collision. During the latter half of the 1950s, Volvo developed a number of related solutions, all intended to improve occupant protection in Volvos. During this period, the company was already aware of the problems associated with rear seat occupants, but incentives were lagging behind. People previously held the peculiar belief that just sitting in the rear seat provided protection in a collision.

Volvo soon realised the importance of ensuring that all the car’s occupants were held securely in their seats, and work on equipping even the rear seat with belts was conducted in parallel with other safety-related developments. Volvo’s cars were fitted with attachment points for rear seat belts. In 1958, Volvo began testing the use of diagonal two-point belts in the front seats. In 1963, Volvo also began testing diagonal two-point belts in both the front and rear seats. During the 1970s, the company continued to develop its safety systems, testing diagonal two-point belts in various combinations in the front and rear seats. In 1992, Volvo was among the first to offer a three-point safety belt in the rear seat as standard.

Owing to the two-point belt’s relatively poor protective ability and the fact that it was perceived as a “fashionable accessory” rather than an important component of road safety, the wearing of seat belts in the rear was not made mandatory by law in Sweden until 1992.

Ahead of the launch of the three-point belt in Volvo’s cars on markets worldwide, a series of sled tests were undertaken. The results of the 1963 tests showed that rear seat occupants were at risk of being ejected from a car during a collision if they were not correctly restrained. Volvo therefore decided to equip its cars with three-point safety belts in the rear seats as standard. In 1967, the three-point belt was introduced in the front seats of Volvo cars on the Nordic markets. Volvo thus became the first car maker in the world to equip its cars with three-point safety belts as standard.

In 1959, the patented three-point safety belt was introduced in the Volvo Amazon (120) and PV 544. The belt’s attachment points in the front seats were detachable. A year later, the belts were also fitted in the rear seats. In 1963, the belts became fixed, resulting in the Volvo Amazon and PV 544 being the first cars on the market to be equipped with fixed three-point safety belts.

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