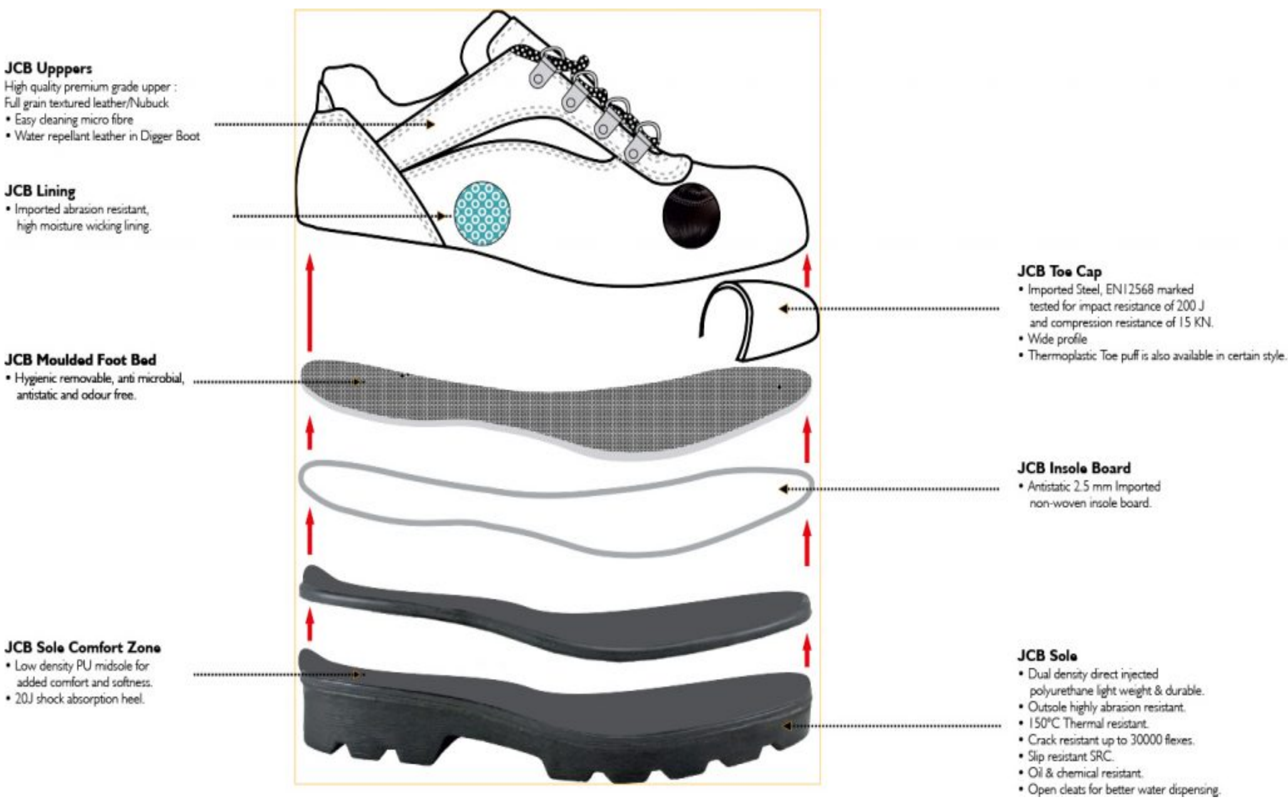
Penetration Resistance Insert

Puncture wounds are bad because spikes, glass, sharp scrap metal or the nail puncturing the foot, can deposit bacteria & chemicals deep into the body, leading to **dangerous infections** /or **permanent foot damage**. This can be serious in diabetics.

The protective midsoles are embedded during the manufacturing process, between the insole-outsole of the puncture resistant boots. The standard specifies that the protective midsole of puncture resistant boots **cannot be removed** without damaging or destroying the boot.

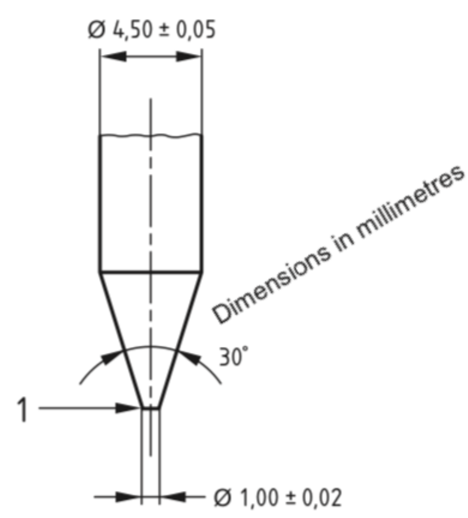


When puncture resistant boots have a woven fabrics midsole, they are most likely to have a composite toe cap too to create a metal-free, **work** boot. A crucial element on sites where metal detectors are used as employees enter & leave, for example high-security environments, such as airports, governmental buildings military bases, where the scanning aims to prevent weapons from making their way in.

Here is a broad comparison between Steel & Fabric Insert:

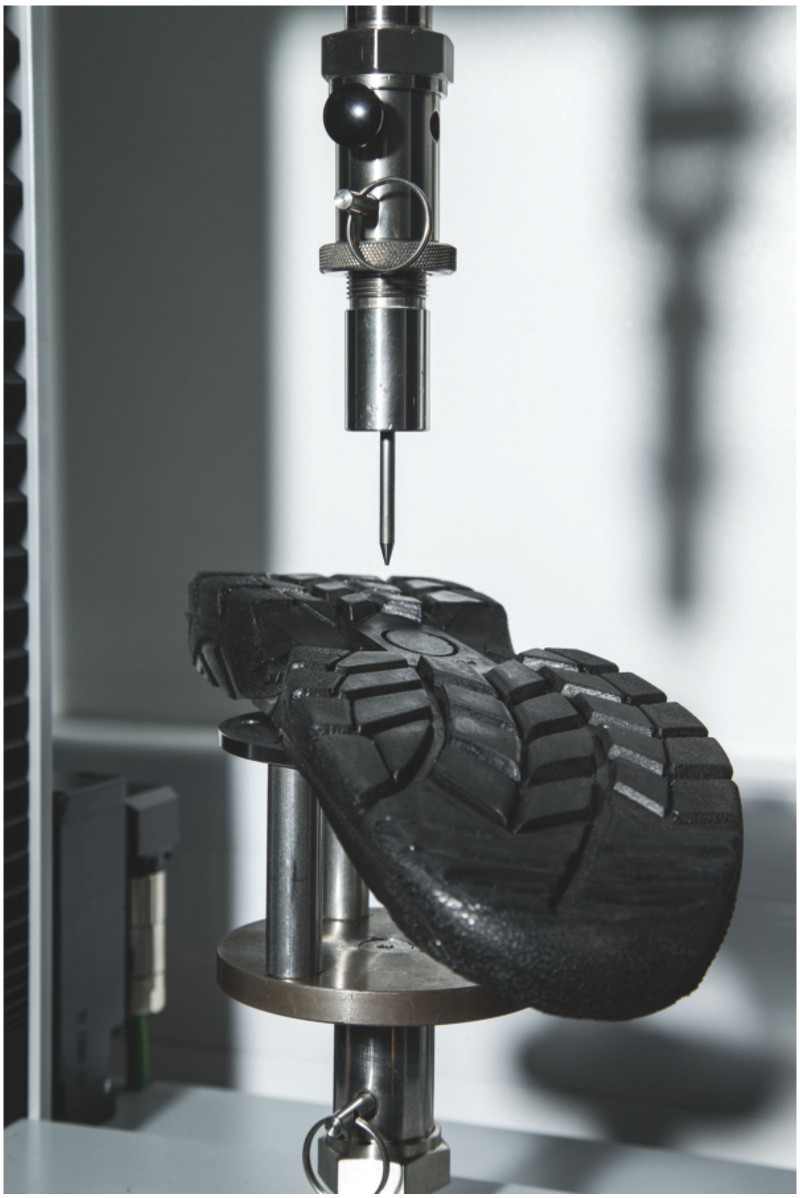
STEEL	FABRIC
Made from steel	**Made from** Synthetic /Aramid (Kevlar)
More economic compared to textile/Aramid	**More flexible** than steel midsoles
Thinner than textile/Aramid midsoles	**Less heavy** than steel
Embedded in the outsole construction, not visible when taking out the comfort insole	**Sewn to** upper visible inside footwear
Conducting cold, heat electricity	**Not conducting** cold, heat electricity
Less flexible than textile midsoles, due to the characteristics of metal	**More comfort** due to technical evolution towards thinner, more lightweight materials.
Not protecting the full bottom surface few mm stay unprotected at the sides	**Protecting** the full bottom surface of the shoe
May corrode, when made of carbon steel	No Corrosion

Please note that the penetration resistance is measured in the laboratory using a truncated nail of diameter 4.5 mm a force of 1,100 N, which is equivalent to the force generated by an 80 kg person walking placing their foot on a nail with a blunt tip of 1 mm in diameter.



The shoe bottom is removed from the footwear upper. The complete bottom unit is then placed on a support plate mounted in the tensile testing machine. The support plate contains a 25mm diameter hole with its center aligned with the specified nail. This allows the nail to be pushed through the specimen during the test without coming into contact with the support plate. The specimen is positioned so the nail is applied from the underside of the sole.

Run the testing machine at a speed of (10 ± 3) mm/minute up to the required force of 1100 N, then stop machine & carry out either the visual inspection within 10 s at an angle of (90 ± 15)° to the nail axis or an electrical or cinematographic detection. ***If the opposite surface of the test piece has been penetrated, the test piece has failed the test. If separation between the layers of the test piece occurs ("tent effect") the test piece has failed the test.***



Credit: SATRA

Two types of penetration resistant insert are currently available. These are of metal & non-metal materials & they meet the minimum requirements for the standard marked on this footwear but each has different additional advantages or disadvantages including the following:

Metal: Is less affected by the shape of the sharp object/hazard but due to shoemaking limitations does not cover the entire lower area of the shoe.

Non-metal/Textile/Composite: Lighter, more flexible & provide greater coverage area (almost 100%- see below) when compared with metal but the penetration resistance may vary more depending on the shape of the sharp object/hazard (i. e. diameter, geometry, sharpness). This material does not conduct heat & cold.

STEEL MID SOLE

TEXTILE/ FABRIC