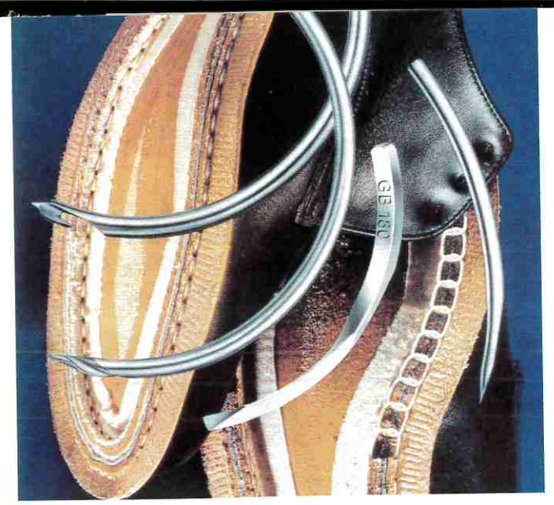


Diag. 1: Needles and awls for a welt-sewn shoe

In shoe production, the right choice of needle for the sewing process in use is of critical importance for the final outcome, both in terms of the quality of the construction and the optical appearance of the finished shoe. It also has a signal effect on sewing machine productivity.

Needle supplier Groz-Beckert

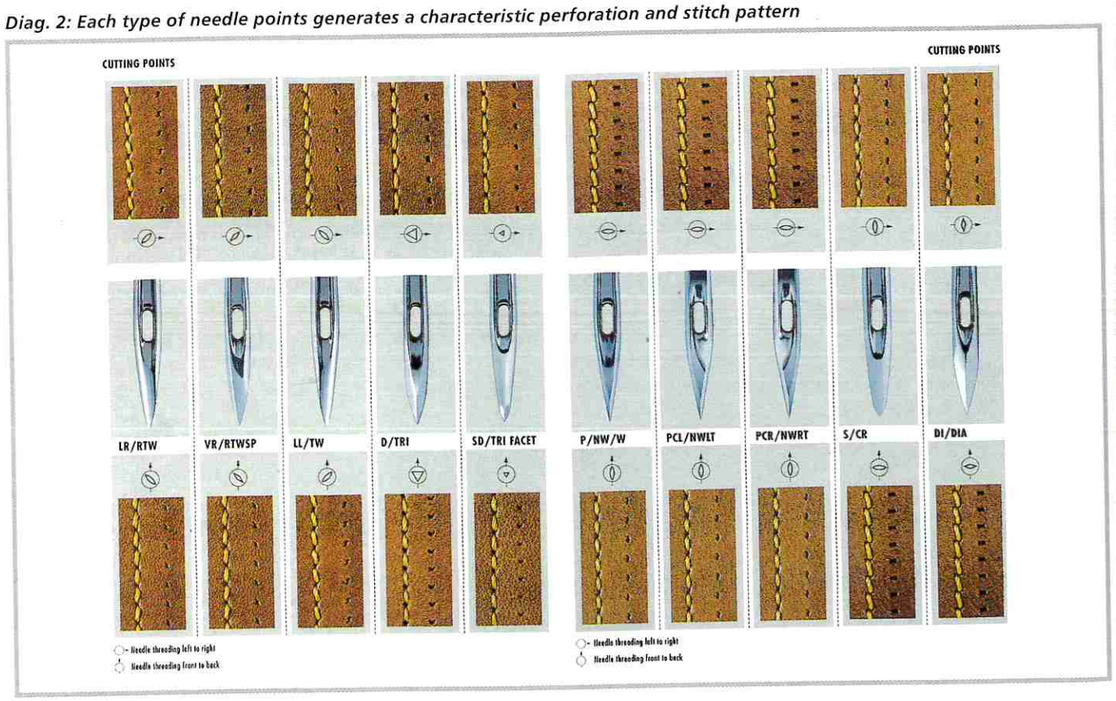
A stitch in time...

Upper and bottom seams

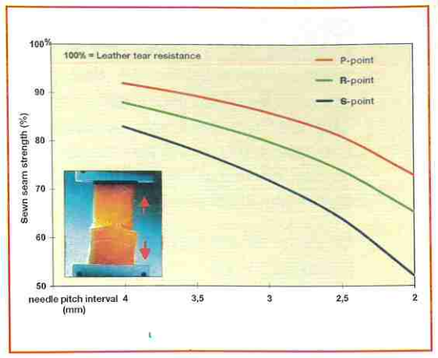
Welt-sewn footwear represents a peak achievement of industrial production and skill for the shoe industry. In terms of their wearing characteristics and durability, their qualities are only approached by hand-made shoes. Diag. 1 shows a welt-sewn shoe together with the relevant needles and awls. Unfortunately, this manufacturing technique is usually reserved for niche products, while lower-cost processes are used for mass production.

Sewing is a process with a multitude of applications and characteristics. For example, the fashion aspect of work boots have virtually given them with cult status; there are now extreme demands with respect to durability, reliability and load-bearing properties of welt-sewn boots; the flexibility and lightness of moccasins or

Diag. 2: Each type of needle points generates a characteristic perforation and stitch pattern



Diag. 3: The Groz-Beckert mechanical test sewing workshop



Diag. 4: Sewn seam strength in relation to needle pitch interval and the needle cutting point design

through-stitched low shoes; or the timeless elegance and wearing-comfort of the welt-stitched shoes mentioned above. These are all applications in which not only the uppers but also the bottoms are sewn.

There are roughly 500 different types of sewing machine needles in use for sewing uppers in the shoe industry. This large number is necessary to meet the requirements raised by different types of sewing machine, leathers, threads and customer requirements.

Approximately 250 different types of needles are needed for sewing attractive and durable bottoms, using the new and old machinery still in operation. New needle designs are constantly added to the range in production, and shoe manufacturers are aided in their search for the right product by user-friendly catalogues.

The design of the needle point affects the both the appearance and load-bearing characteristics of the seam, and Diag. 2 shows the range of possible stitching for uppers as affected by the needle point. To avoid any later misunderstandings or complaints, it is important that the shoe manufacturer establishes the exact requirements with respect to appearance and load-bearing before selecting the needle.

Diag. 4 shows the relative strength of a seam stitched in leather, in relation to the pitch and with different needle points. The leather used was selected by the customer, and served to help in the choice of the stitching design for a sports shoe.

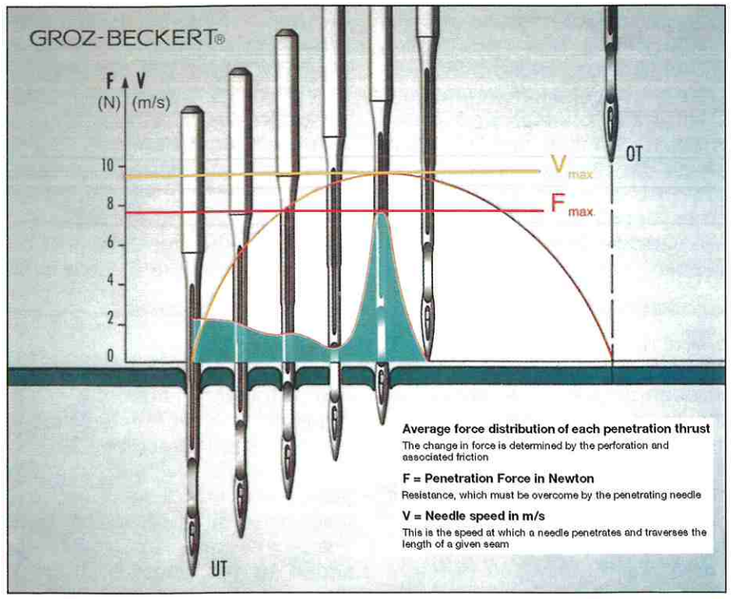
Choice of needle and productivity

In addition to the issues of appearance and quality of the final product, the needle manufacturer must concern himself with the matter of productivity. The key aspects here are the sewing speed, the maximum available length of seam, and the needle service life.

The limiting factor on speed is the needle temperature. If this rises beyond an acceptable level, the possible consequences include the transfer of colour from one leather to another, unwanted sticking of the needle to the material, melting of the thread, or in an extreme case loss of needle elasticity. Diag. 5 shows the force exerted by a penetrating needle. The area under the curve indicates the energy required to achieve penetration, some of which is transferred to the needle as heat. The amount of energy liberated depends upon the materials in use, the needle design and strength, and the needle surface finish. Groz-Beckert uses this diagram to aid visitors to its mechanical engineering laboratory in the selection of the most suitable and coolest-working needle for their purposes. The uninterrupted availability of a sewing machine line is also affected by the need to change needles, and thread breakage.

In manufacture, the company uses polishing thread and paste to finish all needle eyelets. Experience has shown that this produces eyelet faces which minimise friction on the thread, possible thread wear and breakage.

Depending upon the load which is anticipated during operation, a thread rated at 100 g and a throw of 100 mm is pulled through the eyelet under test conditions. A high-quality cotton sewing thread is used for the measurements. The dimension measured is the doubling of the throw until the thread breaks. The number of throws varies with the chosen thread and the load. However, the relationship between the different eyelets remains unchanged. The reason for this difference is revealed by photographs of a thread-polished eyelet face and a chemically-treated eyelet face, taken through an electron-microscope (Diag. 6).



Diag. 5: Needle penetration force

Gebedur needles

German needle manufacturer Groz-Becker AG of Albstadt has developed a new type of sewing machine needle which is finished with a coating of titanium-nitride on a core of needle steel.

In terms of pure appearance, the Gebedur needle differs from conventional needles by its gold-coloured finish. But it is the technical characteristics which are the key: in spite of having a surface hardness of 2300 Vickers, the needle is highly elastic. The needle can withstand the highest loads without developing symptoms of fatigue. In use, the point is highly resistant to loads, breakage, deformation and wear. When overloaded, the Gebedur needle shows no tendency to brittleness. The advantage is that the needle will not break and leave metal residues in the seam, with the subsequent customer complaints.

The new needle develops much less surface-friction, resulting in lower heating than in conventional needles. Further, the needle is much less adhesive and less inclined to collect surface particles or stick to other materials. The transfer of unwanted coloured substances from one product to another is greatly minimised.

These characteristics minimise damage in use both to the leather or textile in use and the needle itself, while combining high needle service-life with good productivity.

Diag. 6: These photos taken through an electron-microscope show the difference: at left, a chrome-plated needle eyelet; right, a Gebedur titanium-nitride coated eyelet

Groz-Beckert developed the Gebedur process in order to achieve extended needle service-life. Previously, needles were surface-finished using an electrolytic hard-chroming process; Gebedur needles are plasma-coated with titanium nitride.

The company says that the new coating significantly extends needle service life, though the amount of the increase is strictly dependent on the individual sewing process employed, the mechanical load and needle wear. The increment may range from just a few percentage points, right up to a life extension which is several times that of chromium-plated needles. Under ideal process conditions, the needle easily pays for itself by minimising sewing machine interruptions due to thread breakage.

The company

Groz-Beckert was founded in 1852 at Ebingen, which is now known as Albstadt, then a focal point of the German knitwear industry in the Swabian region of South Germany. Another factory was set up in Chemnitz, Saxony, in the Eastern Part of the country. In 1980 the company decided to rationalise its output for international markets by classifying its products anew into different groups. Since then, sewing machine needles have been brought together in a group which serves the leather working and shoe manufacturing industries, plus all other industries employing sewing machines, for the knitwear industry, and needles used for the production of non-woven fabrics. The company lays great emphasis on high standards of quality, innovation and world-wide service. Groz-Beckert employs more than 5,000 people at factories and outlets in Germany and other countries, and exports more than 90 per cent of the needles it manufactures for the sewing and shoe manufacturing industries. It has a transferred some parts of its manufacturing capacity to other countries in order to achieve the right blend of uncompromising quality with attractive prices. Nevertheless, the importance that the company accords to continued manufacture in Germany can be inferred from the number of apprentices and trainees. The company believes that the fashion drive which continues evident in Europe will trigger the next generation of technical requirements which will lead to new sewing machinery and the associated needles. The company also says that nowhere else can it find a better combination of a well-qualified work force, excellent infrastructure, plus first-class communications and transport links. These are the main reasons why the company continues to develop and improve its products in Germany, with the result that the standards for manufacture and quality assurance are generated in that country. Several hundred persons are employed in the development and construction of the necessary machinery, and it is here that the processes and equipment are created for needle manufacture.

Groz-Beckert in brief:

Number of employees:	*approx. 5,000*
of which at Albstadt HQ:	*2,100*
Commercial trainees:	*25*
Technical trainees:	*120*
1995 turnover:	
Groz-Beckert KG:	*408 million DM*
1995 Group turnover:	*482 million DM*