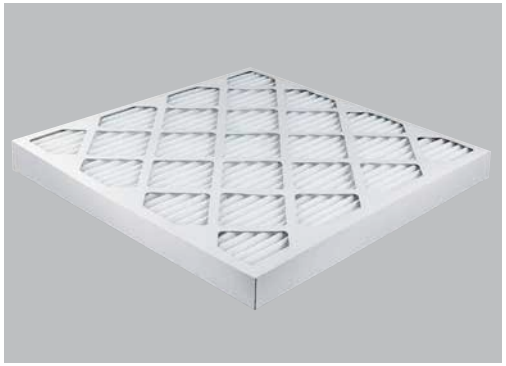
GROZ-BECKERT

# Felting

Felting and structuring needles for the nonwovens industry

# The technology: Needling and structuring

**Groz-Beckert develops, produces and sells machine needles, precision parts, precision tools and systems for different textile production and joining techniques. The product portfolio services the fields of Knitting and Warp Knitting, Weaving, Tufting, Carding, Sewing and the manufacture of Nonwovens. Specifically for the nonwovens industry, Groz-Beckert offers more than 2,000 high-performance needles for flat needling or structuring. Typical uses include geotextiles (for instance nonwovens for drainage) and other technical textiles for filtration (air and fluid filters) and automotive applications (trunk lining).**



Cassette filter

Parcel shelf

Wheel arch liner

The bonding of nonwoven fabrics can be performed thermally, chemically or mechanically – including also the use of felting needles. When using the mechanical bonding method, the fibers are transported and integrated into the fabric by barbed felting needles. This increases the friction forces between the fibers, which serves to increase the bond of the nonwoven fabric. The needle board of a needling machine accommodates a large number of felting needles which are guided through the nonwoven fabric.

The task of structuring needles, conversely, is to structure already bonded nonwoven fabric in special machines. The surfaces are produced with a velvety or grainy character, or feature geometric or linear patterns.

# Contents

# Felting needles

**Felting needles are used for the mechanical bonding of fiber nonwovens in needling machines. Depending on the fiber materials and required properties of the end product, different needle types are appropriate which differ in terms of their length, the shape of the working part and the distribution or properties of the barbs. In order to allow the stringent demands imposed on wide-ranging different applications – in terms of surface properties, tear resistance, uniformity, minimal damage to the fiber and substrate material as well as service life – felting needles with wide-ranging working part shapes are available, whose characteristics are described in the following.**

## Standard triangular

**Features:**
- The working part cross-section is an equilateral triangle
- Working part parallel from the point to the tapered transition
- Between 1 and 3 barbs along each edge as standard
- Barb dimensions are identical across all edges

**Benefits:**
- Uniform deflection in every direction of load
- Universal application
- Improved surface of the finished product

**Fields of application:**
Suitable for all applications

**Availability:**
- Gauges: 12–46 gauge
- Needle lengths: 2.5", 3", 3.5", 4", 4.5", 5"
- Barb styles: KV, RF, FB, HL

Other gauges and needle lengths on request

**Standard triangular working part cross-section**

## Vario barb needle

**Features:**

- The working part cross-section is an equilateral triangle
- Working part parallel from the point to the tapered transition
- Between 1 and 3 barbs along each edge as standard
- Graduated barb size per edge: The closer to the point, the smaller the barb

**Benefits:**

- Uniform deflection in every direction of load
- Improvement of the surface aspect (smaller funnel-shaped recesses in the end product) compared to conical felting needles
- Reduction of machine load
- Less soiling during waste fiber needling (of felting needles, needle board, base plates and stripper plates) compared to conical needles
- Reduced penetration force at the start, resulting in improved needle guidance, lower deflection and less needle breakage

**Fields of application:**

Pre-needling, needling of natural and regenerated fibers, high-tenacity fibers such as para-aramid fibers

**Availability:**

- Gauges: 16–36 gauge
- Needle lengths: 3", 3.5", 4"
- Barb styles: KV, RF, FB, HL

Other gauges and needle lengths on request

**Standard triangular working part cross-section**

## Conical needle

**Features:**

- The working part cross-section is an equilateral triangle
- Markedly rising taper angle from the point to the end of the working part
- Reduced number of barbs (smaller than 9 barbs)
- Graduated barb size per edge: The closer to the point, the smaller the barb

**Benefits:**

- Uniform bending strength coupled with maximum stability in all directions of load
- Generally lower needle breakage
- Reduced penetration force at the start due to downward graduation of barb size towards the point

**Fields of application:**

Particularly suitable in the pre-needling infeed area, and for needling of natural and regenerated fibers, high-tenacity fibers such as para-aramid fibers

**Availability:**

- Gauges: 18–43 gauge
- Needle lengths: 2.5", 3", 3.5", 4", 4.5", 5"
- Barb styles: KV, RF, FB

Other gauges, barb styles and needle lengths on request

**Conical working part cross-section**

## GEBECON®

For more information, see
the datasheet „GEBECON®“

GEBECON® working part cross-section

**Features:**

- Conical working part and continuously tapered working part as far as the shank
- Graduated barb size per edge: The closer to the point, the smaller the barb
- Reduced number of barbs (smaller than 9 barbs)
- Lower working part and taper angle compared to the standard conical needle

**Benefits:**

- Uniform bending strength coupled with high flexibility, ensuring improved stability (less needle breakage) compared to standard needles and higher production speed coupled with reduced web draft compared to conical needles
- Reduced penetration force at the start, resulting in improved needle guidance, lower deflection and less needle breakage
- No overloading due to the high number of barbs, resulting in improved bending properties and less needle breakage in the rear working part area of the needle
- Improvement of the surface aspect (smaller funnel-shaped recesses in the end product) compared to conical felting needles
- Reduction of machine load
- Less soiling during waste fiber needling – of felting needles, needle board, base plates and stripper plates

**Fields of application:**

- Pre-needling in all segments where high demands are placed on product quality (surface) and needle quality (breakage/bending), for instance automotive sector, synthetic leathers, geotextiles, filter felts and any type of technical felt
- Needling of fine, ultra-fine, micro and special fibers

**Availability:**

- Gauges: 25–43 gauge
- Needle lengths: 3”, 3.5”
- Barb styles: RF, HL

Other gauges, barb styles and needle lengths on request

**The special features of GEBECON®**

With GEBECON®, a unique, patented needle group with a conical needle geometry has been created. The outstanding benefit of GEBECON® needles is their ability to rise to even the toughest challenges due to a high level of needle elasticity and special surface quality demands on the end product.

## Cross STAR®

**Features:**

- Working part similar to an equilateral four-edged star
- Working part parallel from the point to the tapered transition
- Barb dimensions are identical across all edges
- Most common number of barbs: Either 1 or 2 barbs per edge

**Benefits:**

- Greater needling efficiency due to distribution of the barbs over 4 edges
- More uniform MD:CD rear resistance ratio (machine direction/cross direction)

**Fields of application:**

Geotextiles (heavyweight fabrics) and where high isotropic properties are required

**Availability:**

- Gauges: 32–40 gauge
- Needle lengths: 3", 3.5"
- Barb styles: RF, FB

Other gauges, barb styles and needle lengths on request

**Cross STAR® working part cross-section**

## Tri STAR®

**Features:**

- Equilateral triangular working part
- Working part parallel from the point to the tapered transition
- Barb dimensions are identical across all edges
- Most common number of barbs: 2 barbs per edge
- Working part side concave in shape, creating more acutely angled edges
- 8 % lower working part cross-section compared to the standard needle

**Benefits:**

- Higher needling efficiency due to improved fiber entanglement in the barb area
- Suitable productivity increase

**Fields of application:**

Geotextiles (lower product weights) with stringent demands on tear resistance

**Availability:**

- Gauges: 32–38 gauge
- Needle lengths: 3", 3.5"
- Barb shape: RF

Other gauges, barb styles and needle lengths on request

**Tri STAR® working part cross-section**

## Teardrop working part

**Features:**

- Teardrop shaped working part cross section
- Working part parallel from the point to the tapered transition
- Barb dimensions are identical across the edge
- Most common number of barbs: 4, 6 or 8 barbs

**Benefits:**

- Higher needling efficiency due to improved fiber entanglement in the barb area
- Extremely gentle effect on the warp and weft thread networks of the base material

**Fields of application:**

Generally where base materials are used, for instance paper machine and filtration felts, or for needling furniture upholstery fabrics

**Availability**:

- Gauges: 30–40 gauge
- Needle lengths: 3", 3.5"
- Barb styles: RF, HL

Other gauges, barb styles and needle lengths on request

**Teardrop working part cross-section**

## EcoStar®

For more information, see the datasheet „EcoStar®“

**Features:**

- Equilateral triangular working part
- Working part parallel from the point to the tapered transition
- Barb dimensions are identical across all edges
- Most common number of barbs: 2 barbs per edge
- Rectangular shaped edge surfaces
- 13 % lower working part cross-section compared to the standard needle

**Benefits:**

- Improved surface of the finished product
- Lower penetration force without compromising efficiency
- Reduced energy requirement

**Fields of application:**

Generally for all applications involving extreme demands on the product surface

**Availability:**

- Gauges: 32–42 gauge
- Needle lengths: 3”, 3.5”
- Barb shape: RF

Other gauges, barb styles and needle lengths on request

EcoStar® working part cross-section

## Twisted

For more information, see the datasheet „Twisted“

**Features:**

- Equilaterally formed triangular working part with a defined twist
- Barb dimensions are identical across the egde
- Most common number of barbs: 2 barbs per edge
- Modifies barb arrangement on the working part compared to the standard felting needle

**Benefits:**

- More efficient needling due to higher fiber transportation
- Improved tensile strength and better isotropic properties (MD:CD ratio) of the end product due to modified barb arrangement
- Optimized surface quality of the end product
- Higher production speeds possible due to reduced penetration density
- Good compaction of the non-woven fabric
- Compared to standard felting needles, the twisted working part does not cause any detrimental bending strength properties
- Higher degree of splitting when using microfibers

**Availability:**

- Gauges: 36-42 gauge
- Needle lengths: 3“, 3.5“
- Barb styles: RF
- Other gauges, barb styles and needle lengths on request

**Fields of application:**

- Automotive sector (visible)
- Filtration

Twisted working part cross-section

# Structuring needles

**The task of structuring needles is to structure already bonded nonwoven fabric in special machines. These surfaces are produced with a velvety or grainy character, and may also feature geometric or linear patterns. A distinction is drawn between fork and crown needles on the basis of their geometry. While crown needles generate a particularly uniform structure, fork needles are used to create a grainy structure. Both needle types are combined to produce very dense velour fabrics with an uniform surface quality. For processing ultra-fine fibers, fine gauge fork needles are also available.**

**Fork needle**


**Features:**
- Shank with single or multiple reduction and cylindrical working part
- Three-dimensionally rounded fork geometry
- Fork setting V or D

**Benefits:**
- Gentle fiber take-up – coupled with long service life of the needle
- No needle breakage or bending due to optimum needle straightness
- Fabric appearance is influenced by the fork setting V and D

**Gauges:**
17–43 gauge

**Fields of application:**
- Automotive interiors
- Home textiles: Floor coverings, decorative nonwovens
- Toy industry: Teddy bears

**Needle lengths:**
62.30; 65.30; 68.30; 75.80; 77.80 mm

Other gauges and needle lengths on request

**Benefits of fine gauge fork needle:**
- High level of uniformity during the structuring process
- Pronounced loops (grainy structure)
- Very dense surface quality due to efficient fiber processing capacity
- Optimum product quality due to high process reliability
- Maximum surface quality due to ultra-fine working part cross-sections (smaller funnel-shaped recesses)

## Crown needle

**Features:**
- High dimensional accuracy of barbs
- Minimal, precisely maintained barb spacing
- Structure similar to felting needles, only difference lies in barb arrangement: Precisely one barb on each edge of the working part
- Short distance from the point to the barbs

**Benefits:**
- Particularly uniform, velvety surface structure
- Simultaneous fiber pick-up during structuring due to high dimensional stability of barbs and very low, precisely maintained barb spacing

**Fields of application:**
- Automotive interiors
- Home textiles: Floor coverings

**Gauges:**
25–46 gauge

**Needle lengths:**
65.30; 68.50; 78 mm

**Barb styles:**
RF, HL

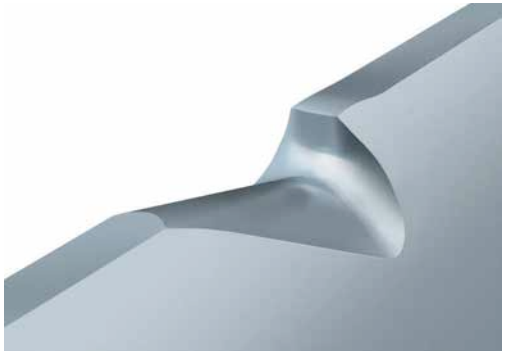
Other gauges, barb styles and needle lengths on request

# Barb styles

**Groz-Beckert offers four different barb styles. The dimensions and shape of the barbs are highly significant in determining the efficiency of the needling process, as they are used in transporting and bonding the fibers within the nonwoven. By forming fiber loops, the nonwoven becomes increasingly compressed. This results in higher friction forces from fiber to fiber, which determine the final strength and volume as well as all other mechanical properties of the nonwoven fabric.**

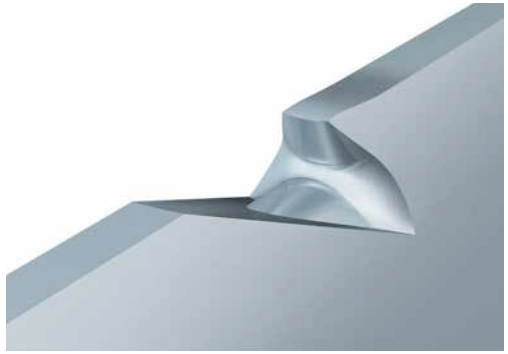
**KV barb**

**Features:**
The traditionally cut barb with its pronounced edges remains in widespread use in a range of application fields. This can also represent an economical alternative to other barb styles.



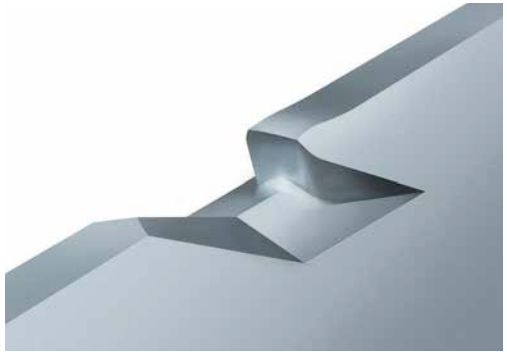
**HL barb**

**Features:**
The HL barb stands for maximum care of the fibers. The three-dimensionally rounded shape is achieved using precision tools. The fibers adhere to the rounded barb area and are therefore gently needled.



**RF barb**

**Features:**
The accentuated base of the barb and the rounded edges in the undercut area have a positive impact on the wear characteristics and so guarantee a long service life of the needle.



**FB barb**

**Features:**
The FB barb also has a three-dimensionally shaped contour. The efficient transport of fibers takes place over the defined surfaces in the undercut area. These two characteristics result in a uniform needling effect plus a long needle service life.

# Point configurations

**Depending on the structure and gauge of the base material used, for instance filtration felts and technical felts, needle points are used with differently pronounced radii (SS, LS, S, S1 and S2 points). The chisel point is a cutting point, which is used for instance for needling open a fiber nonwoven fabric used to cover foam.**

**SS-point**

**Feature:**
The standard defines a sharp point (SS) for felting needles over the entire gauge range

**LS-point**

**Feature:**
Very slightly rounded point

**S-point**

**Feature:**
Slightly rounded point

**S1-point**

**Feature:**
Rounded point

**S2-point**

**Feature:**
Very rounded point

**M-point**

**Feature:**
Chisel point

# Materials and coatings

**With time, standard needles show clear signs of wear caused by fibers. The barb style changes and there is a risk of the needling becoming uneven and the required product properties no longer being achieved. Groz-Beckert therefore offers coated and treated needles with a higher wear-resistance. Groz-Beckert GEBEDUR® needles achieve a constant and economical needling over a longer period in constant industrial use. A chrome surface coating protects from premature corrosion. Groz-Beckert dur® combines the benefits of longer service life and increased resistance to corrosion, thanks to a new base material in conjunction with a patented manufacturing process.**

GEBEDUR® I
surface coating

For more information, see the datasheet „Groz-Beckert® dur“

**GEBEDUR® I**

**Feature:** Surface coating with titanium nitride

**GEBEDUR® II**

**Feature:** Special metallurgical treatment

**Groz-Beckert dur**

**Feature:** Patented manufacturing process and new base material

**Partially chrome-plated**

**Feature:** Partial chrome-plated surface coating

**Benefits:**

- Increased service life
- Improved wear properties
- Consistent, economical needling over extended periods
- Minimized machine set-up and downtimes
- High level of process reliability

**Fields of application:**

- Synthetic leather manufacture
- Needling of materials for the automotive industry, for instance headliners, parcel shelves, door panels and floor coverings
- Production of technical felts such as geotextiles, filter felts and press felts
- Needling of all kinds of abrasive fibers such as glass, ceramic and carbon fibers
- Manufacture of products from natural fibers such as jute, coir, sisal, hemp and flax

# Needle packaging methods

**Groz-Beckert pays attention to greater user convenience – even when it comes to packaging its products. The needles are protected in the box by corrosion protection oil and paper for simple, rapid removal in units of 250 or 125 pieces. Groz-Beckert felting and structuring needles are available in three packaging variants.**

### Standard packaging

The standard packaging size contains 500 felting needles (with coarse needle types, 250 needles). 250 or 125 needles in each case are laid opposite each other for maximum space savings and are wrapped separately in corrosion protection paper. The needles can be removed individually, several at a time or as a complete package.

### Packaging in truncated pyramid-shaped protectors

The truncated pyramid packaging is suitable for fine fork needles and all crown needles. The needles are removed as a whole packet at a time (250 pcs).

**Benefits:**
Special point protection

### Packaging in boxes with diagonal divider

In the medium term, the diagonal divider boxes will take over from the standard packaging. The needles can be removed individually, several at a time, as a complete diagonal package.

**Benefits:**
Special point protection

### Accessories

Alongside felting and structuring needles, Groz-Beckert also offers application aids: Needle removal tools, needle board inserts, crank positioning disks and needle inspection boards as well as a slide rule to determine penetration depth and stitch density. Specially designed needle packaging concepts round off the range.

# Other products

**Needle removal tools**

Using what are known as needle removal tools, felting and structuring needles can be knocked out of the needle board.


**Standard needle removal tools**

Groz-Beckert offers several different tool versions for removing felting and fork needles with cylindrical working parts:

- FN 19–25 gauge: for felting needles with a working part gauge of 19–25
- GA 17–20 gauge: for fork needles with a gauge of 17–20
- FN 30–43 gauge: for felting needles with a working part gauge of 30–43
- GA 25–43 gauge: for fork needles with a gauge of 25–43

Needle removal tools are useful in day-to-day work with felting and structuring needles, as they allow needles to be reused following non-destructive removal. These are specially designed for felting needles with a triangular working part or non-standard working parts such as Tri STAR®, Cross STAR®, Teardrop and fork needles.


**FN CON needle removal tool**

Groz-Beckert supplies the FN CON needle removal tool for removing felting needles with a tapered working part. This tool prevents tapered felting needles from becoming jammed, enabling a trouble-free work process when removing needles from the needle board.

Using Groz-Beckert needle removal tools, the needles can be simply and directly removed from the needle boards. It is of no consequence whether individual needles, whole segments or the entire needle board have to be knocked out.

# Needle board inserts

**Needle board inserts are used predominantly to identify different needle groups in the needle boards. These may be different needle types or the same type of needle but in groups that have been in use for different working periods (needle rotation system).**

Needle board inserts serve to stabilize the needles in the board. As the needle board ages, the hole diameter changes, which can compromise straight needle guidance in the board. Under certain circumstances, this can lead to greater needle deflection when penetrating the nonwoven fabric, possibly impacting the stripper or base plate, and breaking.

| Article no. | Designation | | | Color |
|---|---|---|---|---|
| 643641 | 15gg | 9/16 | G1 | Blue |
| 643931 | | | | Yellow |
| 644071 | | | | Green |
| 643651 | | | | Red |
| 643631 | | | | White |
| | | | | |
| 643741 | 15gg | 9/16 | G2 | Blue |
| 643731 | | | | Yellow |
| 643751 | | | | Red |
| 643711 | | | | White |
| | | | | |
| 644091 | 15gg | 9/16 | G5 | Blue |
| 644111 | | | | Yellow |
| 644081 | | | | Red |
| 644101 | | | | White |
| | | | | |
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| 643991 | 15gg | 15/16 | G1 | Blue |
| 644051 | | | | Yellow |
| 644061 | | | | Green |
| 643661 | | | | Red |
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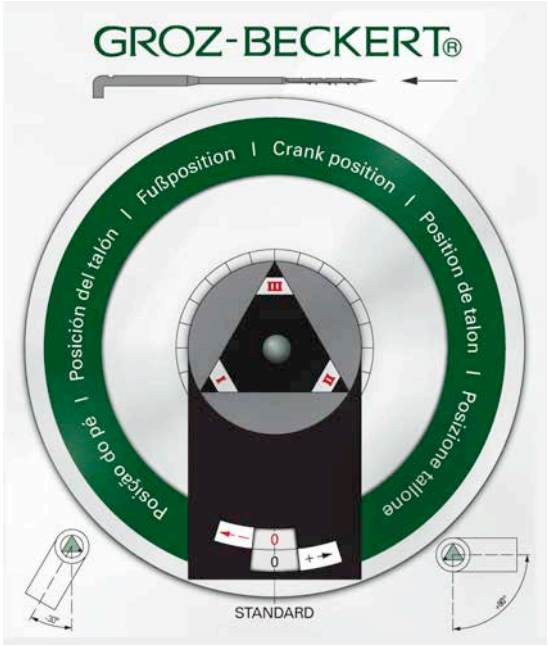
| 643811 | Nisert | 192 | | - |

**Crank positioning disc and needle inspection board**

To achieve the optimum punching result, the right machine parameters are just as important as correct positioning of a suitable felting needle, by means of the crank, as this has a direct impact on the alignment of the working part. It is practically impossible to locate individual damaged needles in the board. A suitable aid for more quickly locating and exchanging broken and bent needles in the board is the Groz-Beckert needle inspection board.




When it comes to crank positioning, Groz-Beckert refers to the needle perspective looking at the needle point with the crank aligned downwards. With the aid of this disk, all possible scenarios can be depicted and clearly indicated for users. This allows users to simulate the relative rotary position between the crank and working part while looking at the needle crank/at the rear of the disk, and to then take a reading of the number of degrees at the front of the disk.


In order to locate broken needles among the large number of needles in the board, the needle inspection board from Groz-Beckert is guided row-by-row through the needles, by the user crosswise to the machine direction. Every needle can thus be checked and broken or damaged needles located and replaced if necessary. Equipped needle boards can also be checked using the needle inspection board to ensure that all needles are aligned correctly.

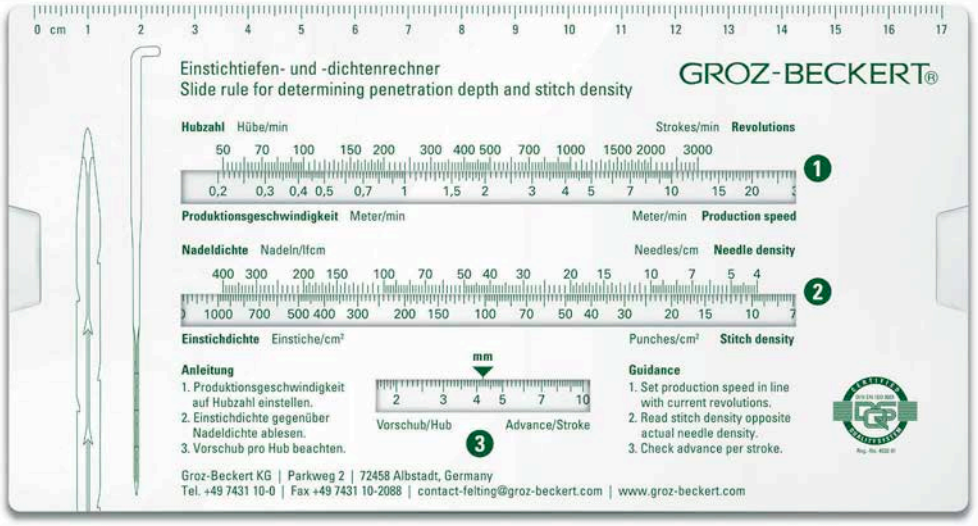
This check can be carried out easily and effectively row-by-row.

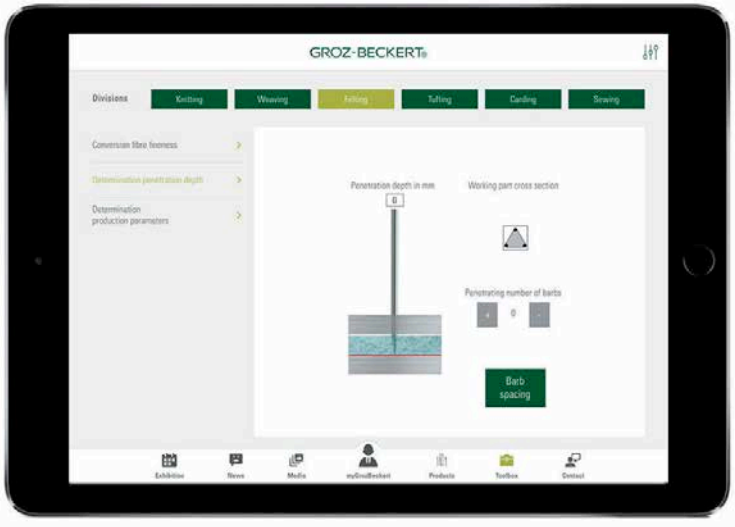
The cleaning of the needle boards and other interruptions in production can be used to inspect the needle boards for broken, damaged and bent needles using the needle inspection board.

More information on the myGrozBeckert app

## Slide rule for determining stitch density and penetration depth

The stitch density and penetration depth are key machine parameters when manufacturing needle punched nonwovens, as the correct machine setting determines the final optical and physical results in the fabric. Groz-Beckert therefore recommends the use of its combined calculator for stitch density and penetration depth or the the use of the myGroz-Beckert App.




### Stitch density

The stitch density is a product of the factors stroke frequency, needle density and production speed. The current stroke frequency and production speed can generally be taken as a reading at the machine control desk. The relevant needle density in the needle board is specified by the machine manufacturer. Using the calculator, the penetration density can be conveniently and rapidly calculated. In addition, theoretical scenarios can easily be simulated in respect to the required machine parameters at given stitch densities.

### Penetration depth

The penetration depth describes the distance from the needle point to the upper edge of the base plate when the needle board is located at the bottom machine dead center. When a felting needle penetrates a nonwoven fabric, the first barb on the first edge picks up one or more fibers. This causes the fiber density in the immediate vicinity of the needle to be reduced, making fewer fibers available for the subsequent barbs. Wear analyses have shown that the first barb performs around half of the total work carried out by the needle, and that in most cases hardly any more than three to five barbs are actually in use. As a result, the penetration depth of a felting needle should be selected so that around three to five barbs are effectively located underneath the upper edge of the base plate.

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GROZ-BECKERT

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