



Outside hard

Inside smart



FRIESE

Our company was established in 1992 and

- employs 55 highly-qualified people, including 7 graduate engineers.
- produces 350 sets of corrugating rolls per year.
- is represented by partners or sales agents on all 5 continents.
- is certified according to ISO 9001: 2000.

This assures our customers that we manufacture products and services of consistently good quality.

FRIESE-developments:

<i>1995</i>	<i>CCS/THERMOGROOVES</i>
<i>1996</i>	<i>ROCKWELLE Tungsten-carbide coating</i>
<i>1999</i>	<i>Profile optimization ROCKPROFILE</i>
<i>2004</i>	<i>ROCKWELLE - polishing procedure</i>



FRIESE stands for innovation, quality and reliability regarding the production from corrugating rolls at all our partners and our customers. We are held in great esteem worldwide in this respect. In order to optimize corrugating board production by high quality rolls, our people do a great deal for the further development of innovative technologies with know-how and creativity.



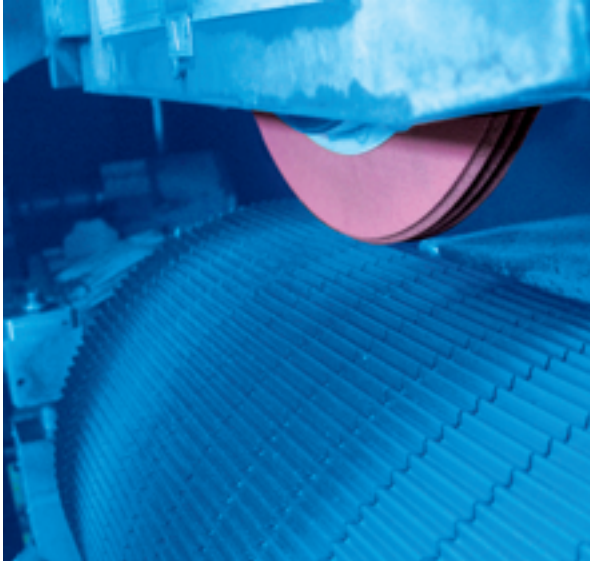
Since our company's establishment about 15 years ago we have definitely influenced the market for corrugating rolls with revolutionary technical developments, for example the introduction of tungsten-carbide coating for corrugating rolls in Europe.



In future we will continue to use our innovation power to expand our top position in the market.



corrugating rolls



Corrugating rolls grinding machine



Roll measuring station



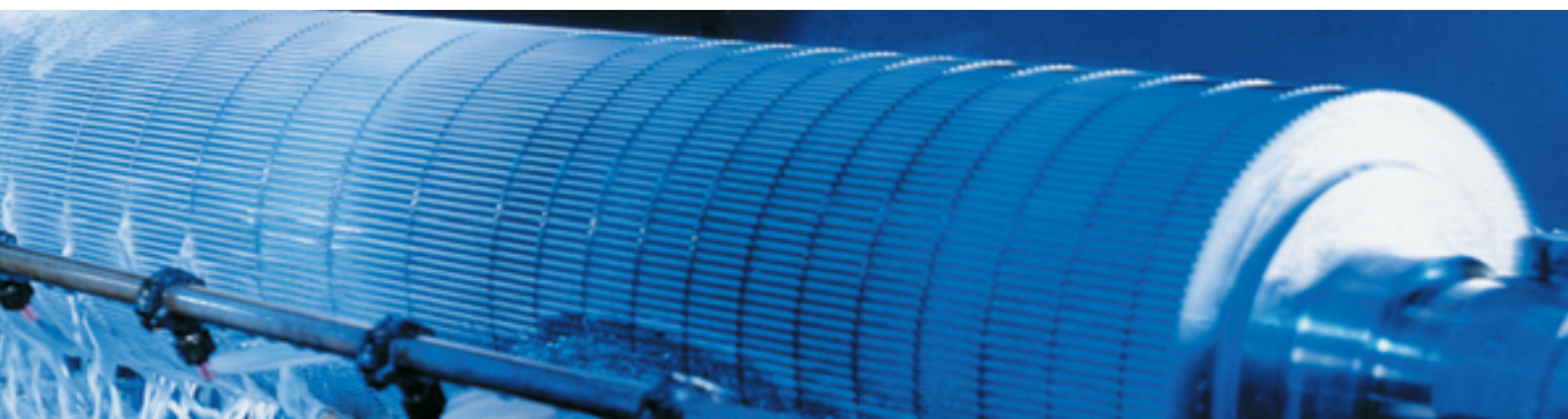
Induction hardening

FRIESE manufactures corrugating rolls for any type of single-facer. In addition we refurbish worn rolls and we use a totally integrated manufacturing procedure. That means the complete corrugating roll production - right to the application and special polishing of the tungsten carbide coating- is done at our workshop.

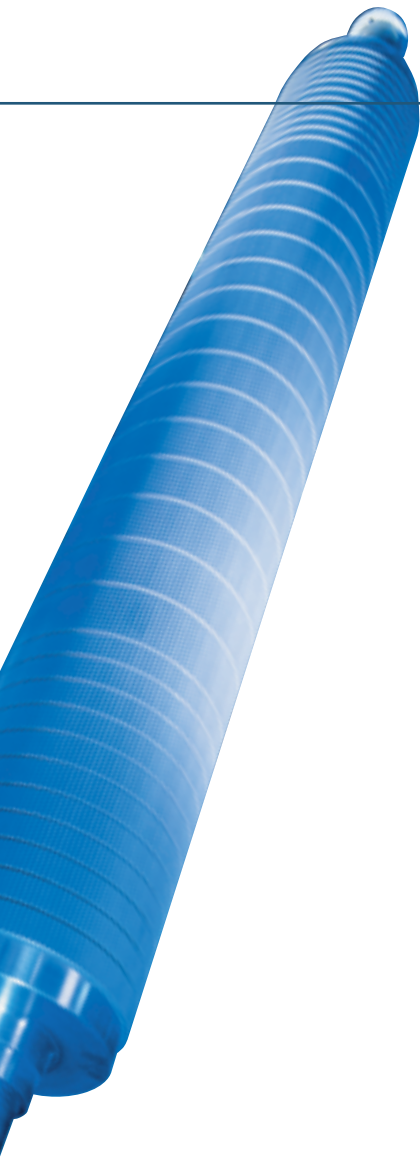
FRIESE corrugating rolls are ground on the most modern grinding machines available. Due to high precision of our CNC controlled corrugating rolls grinding machines the roundness tolerance is 20 μm . We use nitriding as well as induction hardening for the hardening procedure.

In addition to corrugating rolls we produce press rolls, glue applicator and glue doctor rolls as well as all customary cartridges. Furthermore we do singlefacer conversions from finger to vacuum system.

As additional services we offer roll installations as well as check-up measurements and all kind of analysis work concerning the singlefacer.



ROCKWELLE

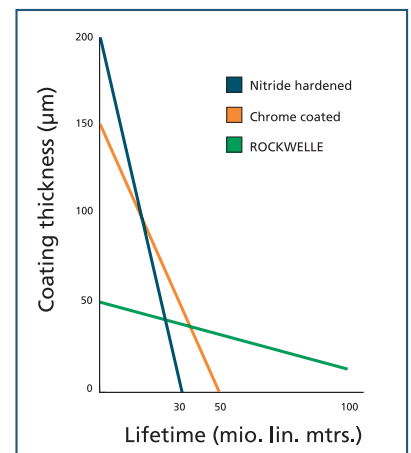


Our main product is the corrugating roll. In 1996 FRIESE has introduced the tungsten-carbide coating in Europe, since then we have called it ROCKWELLE. Experience showed that different qualities and surfaces are offered under 'tungsten-carbide coating'. Especially coating procedures, coating composition as well as quality assurance measures are extremely different. Our ROCKWELLE-coatings are known for an excellent adhesion and long life-time. Resulting from persistent further development of our ROCKWELLE coating we have developed a 3-stage polishing process that guarantees a surface smoothness comparable to chrome-coating (roughness $R_a < 0,2 \mu\text{m}$).

The ROCKWELLE coating has been modified in such a way that web widths between 50 % and 100 % of the working widths can be run without any negative effects on the coating.

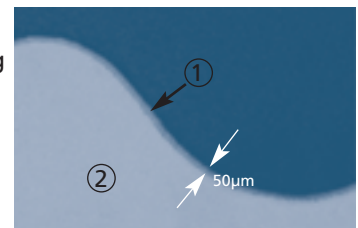
All in all, owing to our developments the cost of corrugating rolls per linear meter can be reduced by 75 % .

The graph shows coating thickness and life time of different roll surfaces. Compared to nitride hardened and chrome-coated rolls the ROCKWELLE shows a much longer lifetime. In addition nearly no wear is noticeable on the flute tips.



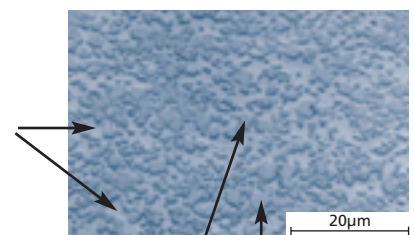
ROCKWELLE- corrugating roll

1. ROCKWELLE-coating
2. Basic roll material

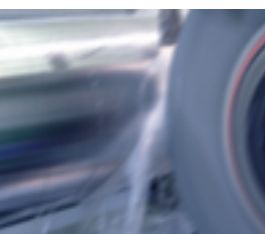


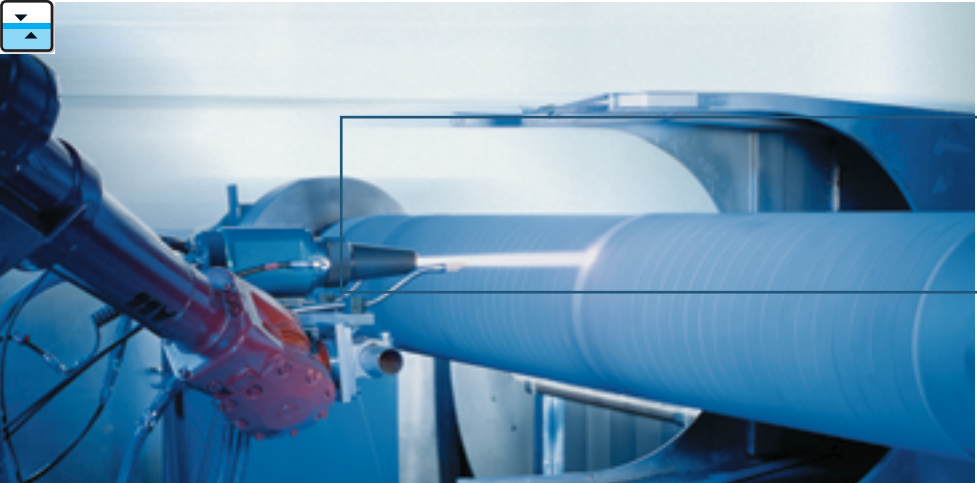
ROCKWELLE- microstructure

cobalt-matrix



tungsten-carbide particles

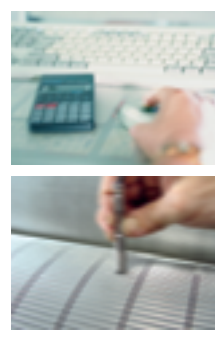




ROCKPROFILE

Spraying of the Rockwelle-coating

The fact that the flute profile of ROCKWELLE-coated rolls remains almost constant during their long life-time enabled us to optimize the flute profiles significantly. Our ROCKPROFILE is the result.



The optimized ROCKPROFILE

The starting point for the profile optimization was: The web tension of the fluting paper in the labyrinth between the corrugating rolls must be kept at a minimum. This way a constantly good corrugating board quality is reached.

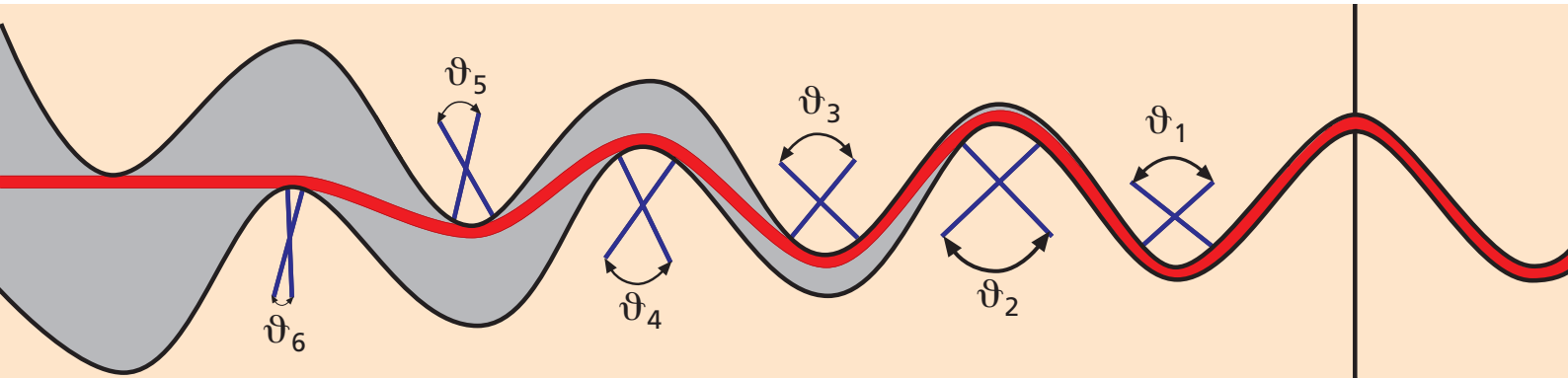
The ROCKPROFILE is designed individually for each application. Different parameters – for example type of single facer, paper grades used or production speeds – have to be considered. The take-up ratio can be reduced significantly while the same or even better corrugating board strength is achieved.

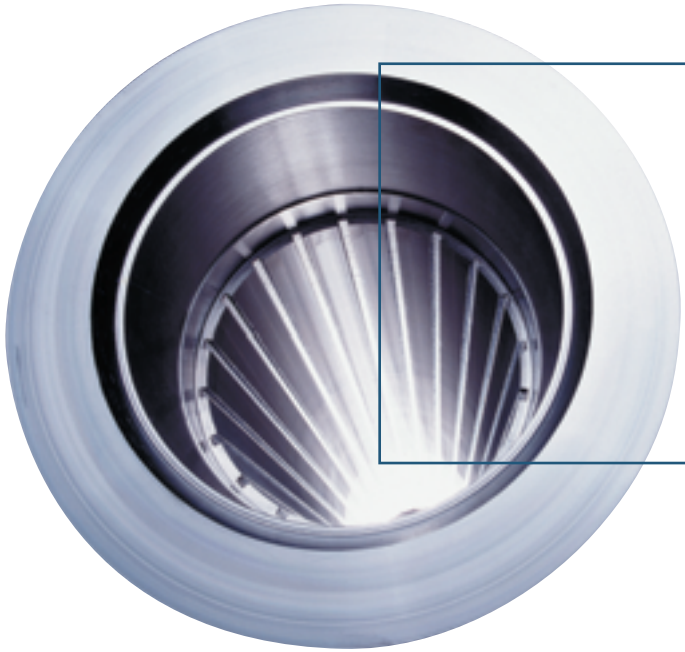
$$T = T_0 \cdot e^{\mu \vartheta}$$

- T = web tension in labyrinth
- T₀ = web tension at roll-stand
- μ = coefficient of friction of roll surface
- ϑ = sum of wrap angles in labyrinth

	Take-up ratio conv. profile	Take-up ratio ROCKPROFILE
C-flute	1,42	1,34 - 1,38
B-flute	1,31	1,27 - 1,30
E-flute	1,24	1,18 - 1,21

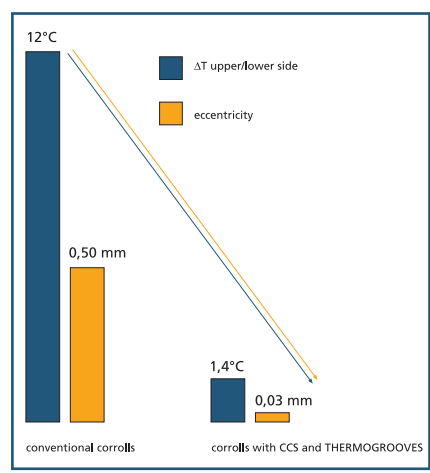
Corrugating rolls labyrinth





Controlled Condensate System CCS / THERMOGROOVES

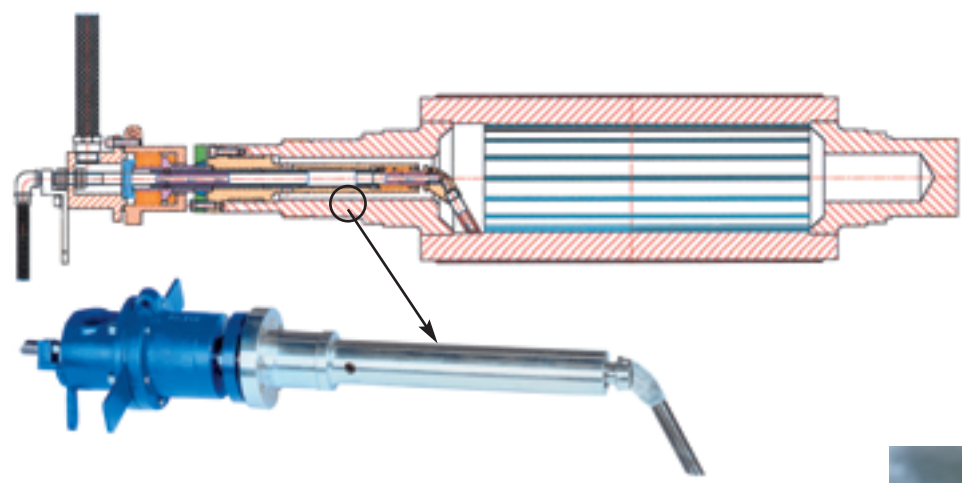
Our product CCS/THERMOGROOVES avoids the build-up of an insulating film of condensate inside the rolls during operation. There is no warping after stops.



Warping after stops
 Analysis by the University of
 Coburg (preheating to 180° C
 measurements 30 min. after stop)

Advantages of CCS/THERMOGROOVES

- better heat transfer enables higher production speeds and better glueing
- no waste because of 'banana effect' after production stops
- no readjustment and maintenance of steam head and condensate pipe





Our technology Your advantage

- long lifetime of rolls
- high profile stability
- 2-5 % less paper consumption
- increased corrugating board strength up to 5 %
- constant production conditions on high level:
 - no 'running in' of the rolls after roll changes
 - higher production speed
 - constant glue application
 - reduced vibrations
- low service and maintenance costs:
 - no regrinding of roll edges necessary
 - no maintenance and readjustment is required at CCS/THERMOGROOVES



A corrugating board plant using ROCKWELLE, ROCKPROFILE and CCS/THERMOGROOVES can realise **Savings of 500.000 Euro/year** at a production of 100 mio. m²/year - compared to using conventional corrugating rolls.