

# CRYOFLEX<sup>®</sup> CC – Cooling cutting blade strips with liquid nitrogen.

For increased productivity and quality.



# 1. Your challenges today.

Cutting blade manufacturers are under growing pressure to increase both productivity and quality.

In particular, conventional compressor systems are often incapable of generating the low temperatures required to achieve this.



## 2. Our solution to your challenges.

CRYOFLEX® Contact Cooling (CC) is an effective way to address these challenges. It uses cryogenic liquid nitrogen (LIN) to cool down blade strips more effectively following tempering, thus eliminating the downsides of mechanical freezers while boosting quality and productivity.

CRYOFLEX CC achieves temperatures as low as minus 160°C. Unlike conventional cooling systems, it thus ensures continuous and reliable cooling of the blade strip regardless of the surrounding conditions or temperature. In addition, this is a climate-friendly solution as it eliminates the need for refrigerants with ozone-depletion potential.

A high-performance heat exchanger extracts maximum cooling power from the cryogenic nitrogen. The liquid nitrogen evaporates within a hermetically sealed heat exchanger without leaving any residue on the product. It can then be fed back into the gas supply scheme and support other steps in the production flow.

In addition, some of the evaporated nitrogen is used to dispel atmospheric moisture and thus minimise the formation of ice particles.

### Replacement of mechanical freezers → Cost savings

- By cooling blades with liquid nitrogen instead of conventional freezers that work with compressors, operators can realise significant energy and cost savings.
- Re-use of evaporated nitrogen increases energy efficiency overall (ISO 50001).

### Fast cooling → Greater productivity

- Liquid nitrogen rapidly cools blade strips down to temperatures as low as minus 100°C.
- Rapid cooling increases productivity without compromising on blade quality.
- Increased productivity means manufacturers can shorten the cooling line or increase throughput.
- CRYOFLEX CC meets the need for lower temperatures by outperforming conventional freezers (compressors).

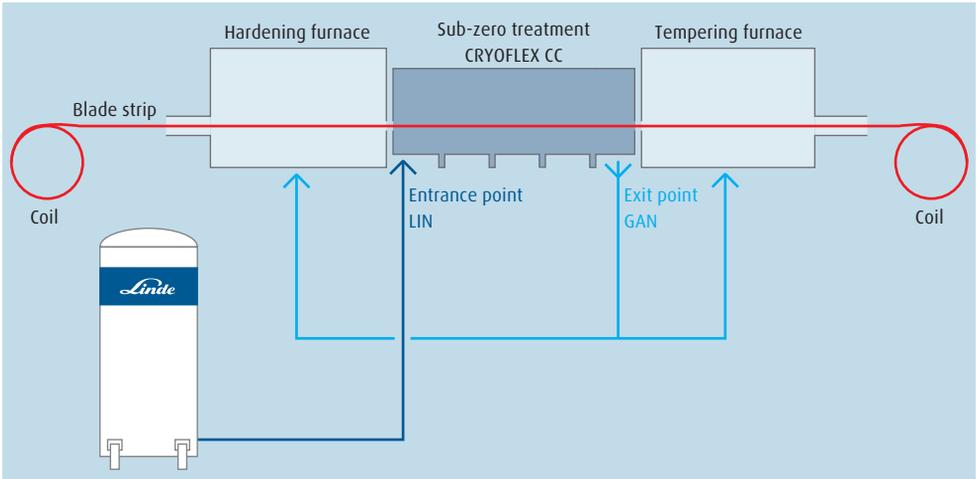
### Reliable technology → Ease of maintenance

- Featuring only a few moving parts, CRYOFLEX CC offers a robust, low-maintenance design subject to minimal wear and tear.
- Innovative purge concept and dual seal system minimises build-up of ice.
- Low-maintenance system – cooling power is generated by nitrogen, eliminating the need for a compressor and refrigerant refills.
- Rapid start-up after downtime due to effective cooling concept.

CRYOFLEX CC is suited to a wide range of strip materials including razor blade strips and craft knives (see Fig. 2).

# 3. Scope of the solution.

Fig. 1: Solution overview



## Nitrogen supply solution

A vacuum-insulated pipe runs from the liquid nitrogen tank to the CRYOFLEX CC system (see Fig. 1). The blade strip runs over a copper plate which is cooled by nitrogen. The recycling concept uses a closed-cycle heat exchanger to recapture up to 100% of the nitrogen instead of venting it. This recycled gas can then be fed into the gas supply scheme and used for other application steps such as inerting in downstream heat treatment furnaces.

## We ensure

### 1. Flexibility

Up to eight strips can be cooled in parallel. The freezer is designed for efficiency and flexibility, enabling easy integration into existing heat treatment systems. The length of the cooling line is variable from 1 to 2 metres.

### 2. Reliability

CRYOFLEX CC comes with a state-of-the-art, robust digital instrumentation panel with all necessary security and monitoring functions. The nitrogen feed can be continuously adjusted, enabling the operator to minimise pressure fluctuations in the downstream gas network.

### 3. Climate protection

CRYOFLEX CC does not use refrigerants that contribute to climate change – it is a future-ready, climate-friendly solution.

We are committed to helping our customers maximise their investment in liquid nitrogen for reliable and efficient blade strip cooling. In addition to complete nitrogen supply schemes, we also offer consultation, installation and commissioning support. The first customer reference projects underscore our expertise in this area, illustrating the concrete productivity and efficiency gains of CRYOFLEX CC in live production environments.

Fig. 2: Examples of different cutting blades



# 4. Reference case for razor blades.

*“CRYOFLEX® CC from Linde has enabled us to increase both productivity and quality while also reducing maintenance effort and contributing to climate protection by avoiding ozone-depleting substances. We are very happy with our decision to go with CRYOFLEX CC and plan to roll out more of these systems moving forward.”*

Simon Artschwager, Production Engineering at Feintechnik GmbH Eisfeld, a Harry's Inc. company

## Customer

Based in Eisfeld, Germany, Feintechnik ([www.feintechnik.com](http://www.feintechnik.com)) is one of Europe's leading manufacturers of quality razors and razor blades, specialising in private label shaving systems and disposable razors. With its “made in Germany” seal of quality, the company is constantly refining its product technology, always with a view to producing precision products of the highest standards. To produce these razor blades, Feintechnik operates four heat treatment systems for stainless steel.

## Challenge

After the hardening step, the razor blades are cooled down to 25°C. Subsequently, a sub-zero treatment transforms retained austenite into martensite. Feintechnik operated compressor-based systems for this step. However, these offer limited performance as they can only cool parts down to minus 80°C. In addition, these systems are subject to strong fluctuations in efficiency, depending on the surrounding temperature. Consequently, many of these systems do not reach their maximum performance if the surrounding temperature is elevated. In addition, compressor systems can be prone to heavy icing inside

the cooler. This further compromises overall operational efficiency. Maintenance was also an issue for Feintechnik. Typically, the company had to call in a service technician three or four times a year to top up refrigerant and replace frozen valves and compressors.

Feintechnik was keen to overcome these challenges. On the one hand, it wanted to increase productivity and efficiency. It was therefore looking for an innovative technology that would enable it to cool razor blades faster to a lower temperature. There are two ways to increase throughput – either extend the cooling line or switch to a cooling line that offers faster results.

And, on the other, Feintechnik wanted to put reliable, low-maintenance technology in place that would reduce high refrigerant losses and the number of visits from service technicians.

Feintechnik decided that the best way to meet all of these demands was to invest in a new heat treatment system and equip this with Linde's cryogenic cooling technology. It would increase cooling speed by quickly reducing the temperature of hardened parts to below minus 100°C while also reducing maintenance effort and cost.

## Solution

In September 2015, the company deployed CRYOFLEX CC, cooling eight strips in parallel with four cooling zones. The cooling line is 2 metres long.

This new cooling line runs at twice the speed of the existing systems. Feintechnik has thus achieved its productivity and capacity goals. This increase in throughput would not have been possible with compressor technology.

In addition, the new system is a lot more reliable than the compressors in use – reducing downtime and maintenance effort considerably. This is partly due to the fact that CRYOFLEX CC has very few moving parts. By way of comparison, the system was up and running for two years before Feintechnik had to call in a maintenance technician.

In addition, CRYOFLEX CC helps Feintechnik to contribute to climate mitigation as it does not require refrigerants like R404A, which contribute to ozone depletion. It also means that the company does not have to contend with refrigerant sourcing problems as stricter phase-out regulations come into play.

Furthermore, CRYOFLEX CC reduces operating expenses as Feintechnik no longer has to invest in coolant. The nitrogen is simply recycled and consumption does not rise over time. Liquid nitrogen is supplied from a tank and fed into the gas network once it has evaporated.

A further advantage of Linde's cryogenic solution is the fact that a small amount of the employed nitrogen is used to provide a dry and inert atmosphere inside the treatment chamber. This further contributes to ease of maintenance by significantly reducing icing within the treatment chamber.

Feintechnik is so impressed with the performance of CRYOFLEX CC that it plans to gradually switch its other heat treatment systems over to Linde's innovative cryogenic technology.

## Benefits at a glance

- Productivity and capacity gains
- Less maintenance
- Reduced energy costs
- Higher and more consistent product quality
- Easy integration into existing production system
- Climate friendly

# Getting ahead through innovation.

With its innovative concepts, Linde is playing a pioneering role in the global market. As a technology leader, it is our task to constantly raise the bar. Traditionally driven by entrepreneurship, we are working steadily on new high-quality products and innovative processes.

Linde offers more. We create added value, clearly discernible competitive advantages, and greater profitability. Each concept is tailored specifically to meet our customers' requirements – offering standardised as well as customised solutions. This applies to all industries and all companies regardless of their size.

If you want to keep pace with tomorrow's competition, you need a partner by your side for whom top quality, process optimisation, and enhanced productivity are part of daily business. However, we define partnership not merely as being there for you but being with you. After all, joint activities form the core of commercial success.

**Linde – ideas become solutions.**

## **Linde AG**

Gases Division, Carl-von-Linde-Strasse 25, 85716 Unterschleissheim

Phone +49 89 31001-0, [www.linde-gas.com/metals](http://www.linde-gas.com/metals)