

## CLIN™ Technologies Liquid nitrocarburizing treatments

CLIN™ technologies are the liquid nitrocarburizing treatments by HEF group. These treatments benefit from the circular economy thanks to ECO-CLIN™.

The CLIN™ family includes all ARCOR®, TENIFER®, SURSULF®, QPQ®, TUFFTRIDE®, NUTRIDE®, MELONITE® brands, all processes developed and patented by HEF.

### Characteristics

Liquid nitrocarburizing brings significant improvements in terms of **friction**, **corrosion** protection, **fatigue** resistance, **abrasive** and **adhesive wear** resistance (seizing).

*NB: The characteristics provided by nitriding/nitrocarburizing treatments depend on the substrates being treated.*

### CLIN™ treatment guidelines

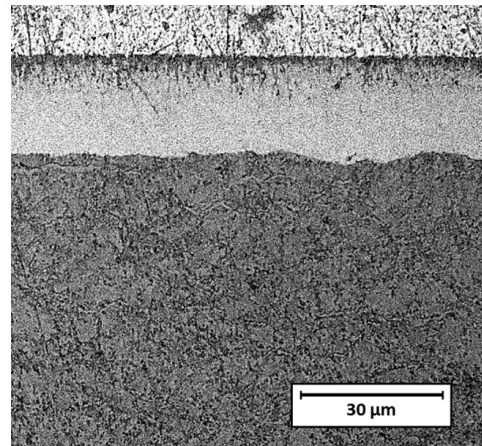
Nitrocarburizing treatments are thermochemical treatments enabling the diffusion of elements: nitrogen and carbon, into the substrate surface.

On a microstructural scale, this diffusion creates two layers:

- A **compound layer** on the extreme surface, composed mainly of **iron nitrides**;
- A deeper **diffusion layer** where the elements (N and C) are intercalated within the material, creating a **hardness gradient**.

### Materials

All types of ferrous materials, from cast iron to high-alloy steels.



CLIN™ processes combine this step with **post-oxidation** and **impregnation**:

- The oxidation stage creates a **layer of iron oxide (Fe<sub>3</sub>O<sub>4</sub>)** acting as a passive film, improving corrosion resistance.
- The impregnation step uses the **microporosities** created during treatment to retain organic compounds. This impregnation significantly improves corrosion resistance and friction behavior.

**The combination of these liquid nitrocarburizing steps results in multiple characteristics, making processes such as ARCOR® thorough and versatile treatments.**

### ARCOR®: a flexible range of industrial treatments.

Developed to meet customer constraints and issues (technical, economic and environmental). ARCOR® process parameters are adjustable in order to achieve the desired performance.

Combination layer thickness	Between 1 and 35 µm
Hardness	Up to 1200 HV
Salt spray corrosion resistance (ISO 9227)	Up to 1000h

*The property values obtained depend on the nature of the substrate treated.*

### Liquid environment advantages

A range of **robust and repeatable** processes:

- Rapid processing (less than 3 hours) and staged cooling to limit deformation.
- Possibility of processing parts with complex shapes.
- The homogeneity of the liquid environment ensures uniform treatment across the entire batch.
- Treated in the same environment, the characteristics given to parts are repeatable from one batch to the next.

## CLIN™: Versatile treatments for industries

Application examples	Examples of components	Examples of targeted characteristics
Hydraulic systems	Cylinder rod Pump body	<ul style="list-style-type: none"> <li>As a substitute for hard chrome</li> <li>Improved friction and corrosion resistance</li> </ul>
Brake systems	Brake disc Brake piston	<ul style="list-style-type: none"> <li>Wear resistance</li> <li>Improved corrosion resistance</li> </ul>
Drive systems	Drive shaft Differential shaft	<ul style="list-style-type: none"> <li>Improved friction and fatigue resistance</li> </ul>
Agricultural equipment Handling equipment	Articulation shaft	<ul style="list-style-type: none"> <li>Seizure resistance</li> <li>Improved friction and fatigue resistance</li> </ul>

### Custom technology

Nitrocarburizing processes are carried out on finished parts, and can benefit from custom finishes.

Examples:

- Mechanical treatment (tribofinishing, polishing, etc.) can be applied to optimize surface quality.
- Addition of a varnish to further improve the performance of parts subject to fretting-corrosion.

### Environmental impacts

CLIN™ processes release neither VOCs nor NOx, and use no PFAS substances.

HEF Group has developed and patented its **ECO-CLIN™ process**, an innovation that makes it possible to recycle plant waste and transform it into new consumables that can be used directly on the line.



CLIN™ technologies are part of a circular economy model:

- Reducing impact on natural resources
- Ensuring a secure supply of raw materials
- Maintaining and anticipating regulatory compliance



**CLIN™ technologies advantages, competitive process capable of substituting processes such as electroless nickel plating, hard chromium plating or even gas nitriding:**

	Wear resistance		Corrosion resistance	Ductility under bending	Friction properties	Flaking resistance
	Abrasive	Adhesive				
Hard chromium plating	++	++	+	-	++	-
Electroless nickel (low phosphorus)	+++	+	+	-	+	-
Electroless nickel (high phosphorus)	+	+	+++	-	+	-
Gas/plasma Nitriding	++	++	++	++	++	+++
CLIN™	++	+++	+++	++	+++	+++

### Contact

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