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.

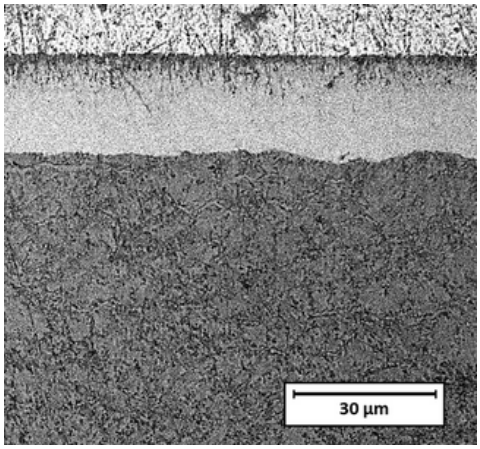
Materials

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

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**.



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

- The oxidation stage creates a **layer of iron oxide (Fe_3O_4)** 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.

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CLIN™: Versatile treatments for industries

Application examples	Examples of components	Examples of targeted characteristics
Hydraulic systems	Cylinder rod Pump body	• As a substitute for hard chrome • Improved friction and corrosion resistance
Brake systems	Brake disc Brake piston	• Wear resistance • Improved corrosion resistance
Drive systems	Drive shaft Differential shaft	• Improved friction and fatigue resistance
Agricultural equipment Handling equipment	Articulation shaft	• Seizure resistance • Improved friction and fatigue resistance

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™	++	+++	+++	++	+++	+++

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