

# Cryogenic Treatment

## We deliver:

- Process consistency
- Reliability and traceability
- Uncompromised safety
- Full industry compliance



## The Industry Challenge

Cryo treatment of metal parts is a transverse application commonly used in a variety of industries, from automotive and aeronautics to machinery and metal fabrication.

With the development of new materials and ever-increasing requirements for mechanical properties by end-users, new heat treatment applications are rapidly expanding, such as cryogenic treatment followed by tempering.

To ensure a truly reliable and efficient process, safety and reproducibility are essential.

## Your Solution

With more than 50 years of experience in heat treatment applications, Air Liquide has developed solid expertise in providing gas solutions adapted to your needs.

**Nexelia™ for Cryogenic Treatment** technology uses liquid nitrogen to reach low temperature (typically lower than  $-80^{\circ}\text{C}$ ) during the hardening of metal parts.

It reduces residual austenite by transforming it into martensite while increasing precipitation and distribution of finer carbides in the microstructure during tempering steps.

As with all solutions under the Nexelia™ label, we work closely with you to define your needs and targets, and we commit to delivering them.

## Your Advantages

### ▪ Increased hardness & wear resistance

Retained austenite is transformed into hard martensite. A hard structure of carbides is created while microscopic cracks are reduced.

### ▪ Improved dimensional stability

Because retained austenite is unstable and slowly decomposes over time, the uncontrolled transformation of retained austenite into martensite involves volume expansion.

### ▪ Less residual micro-stress

### ▪ Compliance with industry requirements

Equipment complies with Air Liquide stringent internal safety rules and supports you to comply with NADCAP requirements.

### ▪ Custom-made design

- Up to 2700L internal volume and 1.4t load
- From  $-150^{\circ}\text{C}$  to  $+300^{\circ}\text{C}$  with homogenous temperature inside the chamber, optimized liquid nitrogen consumption
- Fine control of temperature ramps

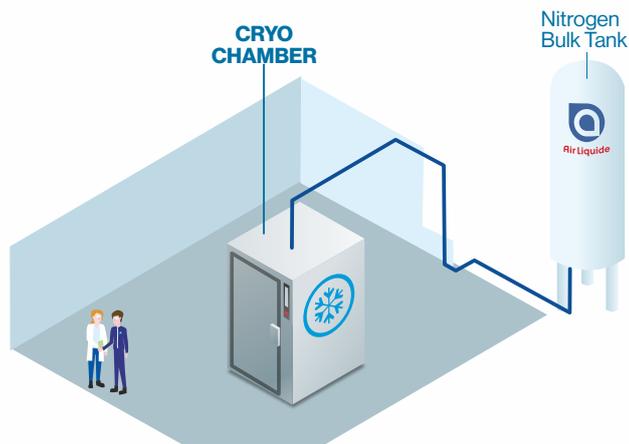
# Core Features

**Nexelia™ for Cryogenic Treatment** is a turnkey packaged solution, which includes the equipment and fluid needed.

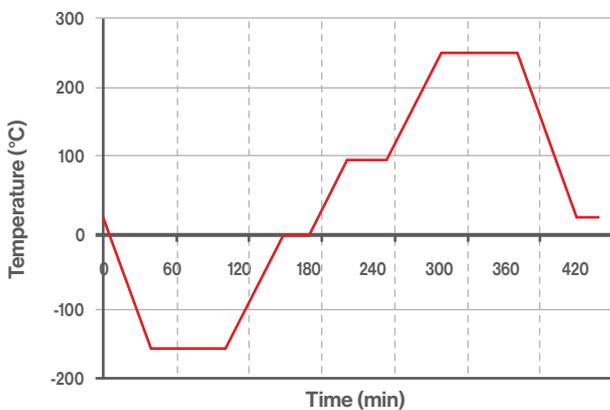
Nitrogen is a neutral gas for many metal alloys. Pure nitrogen serves as an excellent protection atmosphere against oxidation and brings the cold needed to perform cryogenic treatment.

## Application Technology:

**CRYO CHAMBER:** Air Liquide's team of experts has designed a cryo-cabinet range to efficiently perform cryogenic treatment and tempering in line with aerospace specifications. Fluid installation ensures the proper gas characteristics at point of use. Liquid nitrogen is injected into the chamber to reach down to -150°C, followed by tempering up to 300°C.



**PROFILE EXAMPLE**  
(Sub-zero Quenching & Tempering)

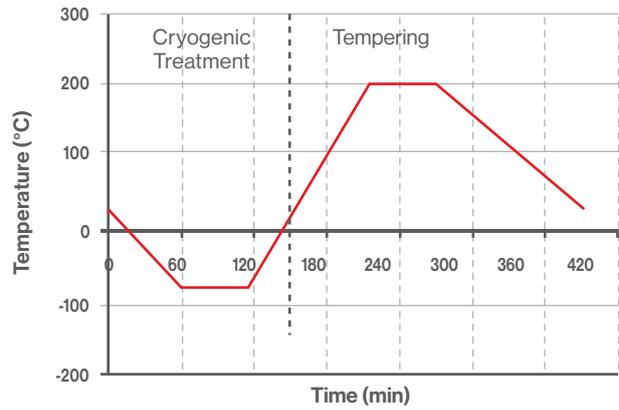


## Process Expertise & Service:

Our worldwide network of heat treatment experts will help you:

- Design your installation according to your needs
- Audit your process and train your operators
- Define the most consistent process methods for you

# Case Study



Solutions	Cryogenic treatment	Cryogenic treatment + tempering
Cycle time (h)	2:30	6:30
Liquid nitrogen consumption	0.5 L/kg	0.8 L/kg (with nitrogen cooling)
Energy consumption	0.02 kWh/kg	0.06 kWh/kg

## Contact Us

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