

## PNR solves a cooling problem thanks to CFD

A car component manufacturer optimizes the cooling of metal parts with a custom made solution



### SCENARIO FOR THE SECTOR

Components for the automotive industry

The automotive components sector is of considerable importance in the European mechanical industry, supplying not only the automotive production of the continent but also the main American car manufacturers.

Although the component sector may appear to be of secondary importance because of its lower visibility than car manufacturers, it is a **very important industry from an economic and employment point of view**.

In March 2021 the European car market was growing strongly compared to the same month of 2020: + 62.7% and 1,387,924 registrations.

However, this considerable increase in registrations, however, only partially succeeded in compensating for the strong loss of the market recorded in March 2020: -52%. Compared to March 2019, however, there is a decrease of 21.6%\*.

\* anfia.it ANFIA - National Association of the Automotive Industry

### THE PROBLEM OF OUR CLIENT

The customer who has applied to PNR belongs to the automotive components sector and operates in **Germany**.

The customer needed to cool an aluminium pipe with water from the inside after the quenching phase. Specifically, the need was to cool the tube by 250 ° in 2 seconds.

Cooling was therefore to be:

**FAST:** to **obtain the desired mechanical properties** with tempering;

**TARGETED:** to **avoid geometric deformations** of the pipe with consequent ovalization, the cooling water had to be sprayed uniformly in the axial direction to the pipe.

#### INDUSTRY

Automotive industry



#### APPLICATION OF PNR PRODUCTS

Cooling of a post quenching pipe



#### PROBLEM

Controlled lowering of high temperatures without deformation



#### PNR SOLUTION

Fluid dynamic analysis and design of a custom made cooling head



## PNR SOLUTION

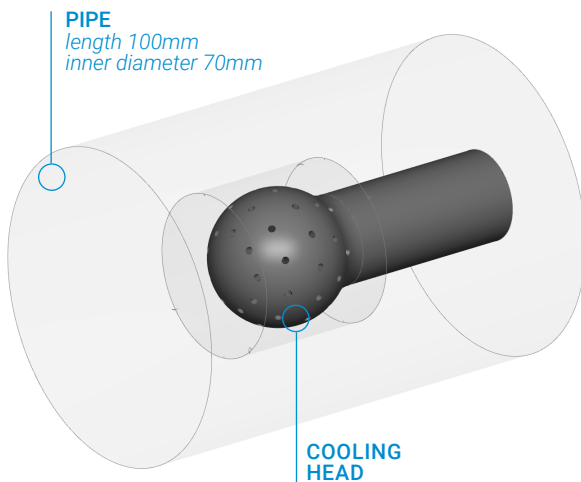
The PNR Technical Department addressed the client's problem with **computational fluid dynamics software**.

The pipe to be cooled was first modeled, 100mm long and with an internal diameter of 70mm. Subsequently, a custom made cooling head was developed, able to lower the temperature of the tube by 250 ° in 2 seconds.

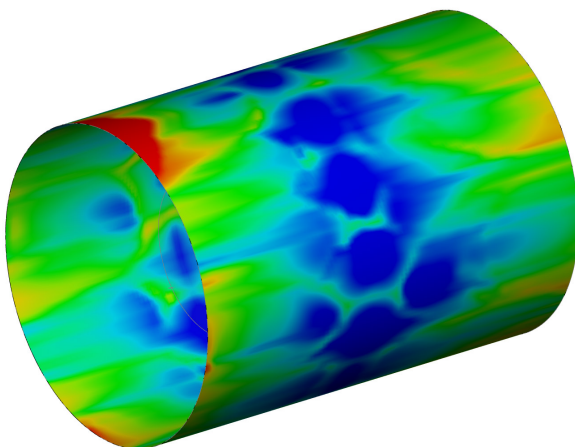
**Our engineering team started with our fixed UAC washing head to obtain a product designed specifically for the application in question.**

## ADVANTAGES FOR OUR CLIENT

Thanks to the solution proposed by PNR, **the customer has managed to obtain the right level of cooling at the indicated times**, avoiding the geometric deformation of the pipe.



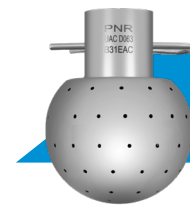
**COOLING HEAD INSERTED IN THE PIPE**  
INLET WATER PRESSURE = 3 BAR  
FLOW RATE = 100 LPM



**TEMPERATURE DISTRIBUTION**  
TEMPERATURE EVENLY DISTRIBUTED ALONG THE AXIAL DIRECTION OF THE PIPE AND THEREFORE MINIMAL RISK OF OVALIZATION

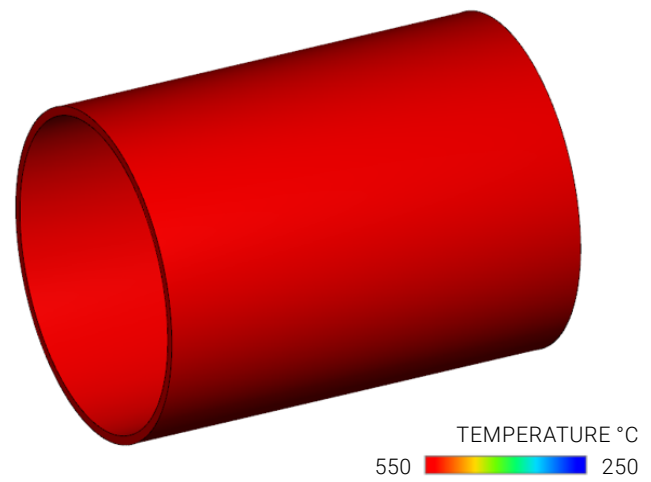
## FOCUS ON THE PRODUCT

The solution developed for the customer includes a custom made cooling head, based on our UAC head, present in the catalog.



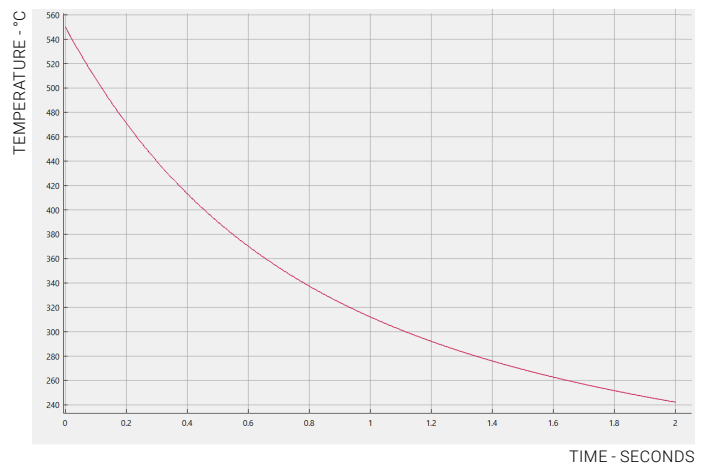
FIXED WASHING HEAD  
UAC

They are simple, fast and efficient devices for cleaning small tanks where a rinsing action is sufficient. The required water flow rate recommends its use with low supply pressures.



## SETTING THE THERMAL SIMULATION

INITIAL TEMPERATURE = 550 ° C | DENSITY = 2700 KG / M<sup>3</sup>  
SPECIFIC HEAT = 962 J / KG K  
CALCULATED AVERAGE HTC = 9831.85 W / M<sup>2</sup> K.  
INLET WATER TEMPERATURE = 25 ° C



## THERMAL DYNAMICS OF THE COOLING PROCESS

COOLING HEAD SUPPLY PRESSURE = 3 BAR  
FLOW RATE = 100.44 LPM

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