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INVENTION MEETS RELIABILITY

**ZeroFlow**

Gas nitriding technology



# ZeroFlow

It is a modern, energy-saving and ecological gas nitriding technology used in HRN/VRN type furnaces, allowing for the precise development of the preset composition of the nitrided layer, composed only of alpha, alpha + gamma' or alpha + gamma' + epsilon phase, while maintaining minimum ammonia consumption, and thus, the minimum emission of post-process gases.



## PROCESSES

- / Nitriding
- / Nitrocarburizing (FNC)
- / Post-oxidation
- / Tempering
- / Annealing
- / Others

## ZeroFlow IS A UNIQUE TECHNOLOGY THAT ENSURES:

- / Full control of the nitriding processes with the use of ammonia as the only process gas (a dissociator is not needed).
- / Continuous visualization and automatic control of changes in the nitrogen potential in the furnace.
- / Possibility of precise control of the white layer thickness.
- / Continuous control of hydrogen level in the furnace.
- / The innovative nature of ZeroFlow technology enables a significant saving of process gases, in particular in the case of long-term nitriding processes.

ZeroFlow technology allows for maintaining full versatility of conventional gas nitriding while optimising process gas consumption, i.e. a significant reduction thereof in relation to competitive technologies.

Depending on the type of processed details, steel grade and final requirements, this method allows for saving gas consumption, including ammonia, by up to several dozen percent as compared to traditional methods.

HRN and VRN furnaces equipped with ZeroFlow technology are retort nitriding furnaces with a horizontal or vertical feeding and vacuum flushing. These furnaces are characterised by their compact design and are equipped with an internal convection gas fan and a cooling gas blower to accelerate the feed cooling in the retort. The special design of the retort and heating elements ensure the long-term and reliable operation of the equipment in the conditions of industrial operation. The nitriding process is automated in HRN and VRN furnaces. The furnace may be equipped with nitrocarburizing and post-oxidation systems. In addition, these furnaces may be used for conducting a broad range of tempering processes, which further enhances their versatility.



## BENEFITS

Advantages of HRN and VRN furnaces equipped with ZeroFlow technology:

- / High quality of parts after thermal treatment according to customer specifications.
- / Reliable furnace operation in automatic mode.
- / Very high level of repeatability of the process.
- / Distribution of temperature in working space at a level of  $\pm 5^{\circ}\text{C}$  or better.
- / Optimised process gas consumption, i.e. significant reduction thereof in relation to competitive technologies (by up to several dozen percent).
- / ZeroFlow gas nitriding technology:
  - / Continuous visualization and automatic control of changes in the nitrogen potential in the furnace.
  - / Full control of the nitriding processes with the use of ammonia as the only process gas (a dissociator is not needed).
  - / Possibility of precise control of the white layer thickness
  - / Continuous control of hydrogen level in the furnace.
  - / The innovative nature of ZeroFlow technology enables a significant saving of process gases, in particular in the case of long-term nitriding processes.
  - / Full automation and visualization of heat treatment.
  - / Industrial computer equipped with the SCADA system based on the Siemens WinCC software with a 19" touch screen resistant to industrial conditions.
  - / Easy and intuitive operation of the furnace and preparation of the process recipe.
  - / System for data archiving and reporting.
  - / Remote diagnostics.
  - / Compact design.
  - / Features of the ZeroFlow gas nitriding process:
    - / During ZeroFlow nitriding, the temperature and nitriding potential KN are controlled based on the measurement of  $\text{H}_2$  content in the nitriding atmosphere. The current nitriding potential value (Kn) is compared with the preset value (according to the recipe) and automatically adjusted by the PLC system by the periodic dosing of ammonia, e.g. using a mass valve according to the PID parameter algorithm.
    - / ZeroFlow technology allows for the reduction of nitriding potential by the partial or complete closing of ammonia inflow to the retort and increase in the nitriding temperature.
    - / Only when the preset value of the nitriding potential Kn is exceeded, it is adjusted by opening and closing the ammonia inflow to the nitriding atmosphere.
    - / Nitriding takes place in a tightly closed retort with forced atmosphere circulation through the atmosphere agitator.
    - / The nitriding atmosphere pressure is continuously adjusted.
    - / The nitriding atmosphere leaving the furnace is combusted in a small utilization burner.

## SECO/WARWICK

### Invention Meets Reliability

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