

Heat Treatment of Metals under Protective or Reactive Gases or in Vacuum

A large number of heat treatments of metals are usually carried under protective or reaction gases or in vacuum to prevent or minimize oxidation of the components.



Nabertherm offers an extensive range of graduated solutions for the heat treatment of metals. The catalog "Thermal Process Technology 2, furnaces and heat treatment plants for processes under protective or reactive gases or in vacuum", provides a description of the different furnace concepts and the accessories that are available for the different processes.



Forced convection chamber furnace
NA 120/65 I

Sealed Furnace

Sealed furnaces are standard furnaces with a protective gas connection in which the housing is sealed and the door design is adapted. These furnaces are suitable for processes without high requirements with respect to residual oxygen, or for heat treatment of components that are to be processed afterwards.

Furnaces with Protective Gas Boxes, Protective Gas Boxes with an Evacuation Lid, or Annealing Bags

Heat treatment furnaces with protective gas boxes or annealing bags offer a good price/performance ratio and can be used for many processes that have to be carried out in a non-flammable protective or reaction gas atmosphere.

By using a protective gas box with the corresponding process gas supply, a standard furnace can be upgraded to a protective gas furnace. Depending on the type of process gas, the preflushing rate, the process flushing rate, and the condition of the box, it is possible to achieve residual oxygen concentrations in the low ppm range.

Depending on the application, the protective gas boxes are removable, remain in the furnace, or are especially designed for heat treatment of bulk materials. Annealing bags are another gassing variant.

For charges with complex shapes or drilled holes, bulk materials, or sensitive materials, such as titanium, it is recommended to use a protective gas box with an additional evacuation lid for cold stage evacuation.

Protective gas boxes can be used in forced convection furnaces at temperatures up to 850 °C and in radiation heated furnaces for working temperatures up to 1100 °C.



Forced convection chamber furnace
N 250/85 HA with protective gas box

Hot-Wall Retort Furnaces

Retort furnaces are the perfect solution if the process requires a furnace chamber with a pure atmosphere. The retort is not water cooled and is therefore restricted in maximum temperature. Water cooling is used only for the door seal. Hot-wall retort furnaces can be used for maximum working temperatures of 1100 °C, and with special retort material, up to 1150 °C.

These gas tight retort furnaces are ideal for heat treatment processes that require a defined protective or reaction gas atmosphere. The compact models can also be designed for heat treatment in vacuum up to 600 °C. Equipped with corresponding safety technology, retort furnaces are also suitable for applications under reaction gases such as hydrogen.



Retort furnace NR 80/11



Cold-Wall Retort Furnaces

Cold-wall retort furnaces can be used for heat treatment processes in defined protective or reaction gas atmospheres or high temperature processes under vacuum. The VHT retort furnaces are designed as electrically heated chamber furnaces with graphite, molybdenum, tungsten, or MoSi₂ heating.

The vacuum-tight retort is completely water-cooled and allows for heat treatment processes either in protective or reaction gas atmospheres or under vacuum up to 5×10^{-6} mbar.

This furnace series can also be equipped with suitable safety packages for flammable gases.



Retort furnace VHT 100/16-MO

Furnaces for Continuous Processes

Nabertherm also has compact furnaces for continuous processes that require a protective or reaction gas atmosphere.



Hydrogen continuous furnace
D 150/1600/20/10 H₂

Martempering and Salt-Bath Furnaces

Martempering and salt-bath furnaces have excellent temperature uniformity and ensure very good heat transfer to the work piece. Generally, heat treatment can be carried out with shorter dwell times than in chamber furnaces. Since the charge is heat treated with the exclusion of oxygen, scale and discoloration on the surface of the parts are reduced considerably.

Martempering furnaces with a maximum working temperature of 550 °C are suitable for processes such as tempering or bainite hardening (intermediate stage hardening). For annealing processes carried out at higher temperatures, salt bath furnaces are used.



Salt-bath furnace TS 30/18 with preheating chamber above the salt bath and charging aid for immersion of the charge