Hot-Wall Retort Furnaces up to 1100 °C

Retort furnace NRA 25/06 with gas supply system

Retort furnace NRA 150/09 with automatic gas injection and process control H3700

Inside heating in retort furnaces NRA ../06

Bayonet quick-lock for the retort, also with electric drive as additional equipment

Parallel guided door to open the hot retort furnace as additional equipment

These gas tight retort furnaces are equipped with direct or indirect heating depending on temperature. They are perfectly suited for various heat treatment processes requiring a defined protective or a reaction gas atmosphere. These compact models can also be laid out for heat treatment under vacuum up to 600 °C. The furnace chamber consists of a gas tight retort with water cooling around the door to protect the special sealing. Equipped with the corresponding safety technology, retort furnaces are also suitable for applications under reaction gases, such as hydrogen or, in combination with the IDB package, for inert debinding or for pyrolysis processes.

Different model versions are available depending on the temperature range required for the process:

Models NRA ../06 with Tmax 650 °C

- Heating elements located inside the retort
- Temperature uniformity up to +/- 5 °C inside the worke space see page 71
- Retort made of 1.4571
- Gas circulation fan in the back of the retort provides for optimal temperature uniformity

Models NRA ../09 with Tmax 950 °C

- Outside heating with heating elements around the retort
- Temperature uniformity up to +/- 5 °C inside the worke space see page 71
- Retort made of 1.4841
- Fan in the back of the retort provides for optimal temperature uniformity

Models NR ../11 with Tmax 1100 °C

- Outside heating with heating elements around the retort
- Temperature uniformity up to +/- 5 °C inside the worke space see page 71
- Retort made of 1.4841

Retort furnace NRA 25/09

Retort furnace NRA 50/09 H_2

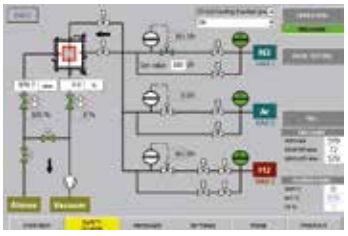
Basic version

- Compact housing in frame design with removable stainless steel sheets
- Controls and gas supply integrated in the furnace housing
- Welded charging supports in the retort or air-baffle box in the furnace with atmosphere circulation
- Swivel door hinged on right side with open cooling water system
- Depending on furnace volume for 950 °C- and 1100 °C-version the control system is divided in one or more heating zones
- Temperature control as furnace control with temperature measurement outside the retort
- Gas supply system for one non-flammable protective or reaction gas with flow meter and manual valve
- Port for vacuum pump for cold evacuation
- Operation under vacuum up to 600 °C with optional single-stage rotary vane pump
- Defined application within the constraints of the operating instructions
- NTLog Basic for Nabertherm controller: recording of process data with USB-flash drive
- Controls description see page 72

Vacuum pump for cold evacuation of the retort

Additional equipment

- Upgrade for other non-flammable gases
- Automatic gas injection, including MFC flow controller for alternating volume flow, controlled with process control H3700, H1700
- Vacuum pump for evacuating of the retort up to 600 °C, attainable vacuum up to 10^{-5} mbar subject to selected pump
- Cooling system for shortening process times
- Heat exchanger with closed-loop cooling water circuit for door cooling
- Measuring device for residual oxygen content
- Door heating
- Temperature control as charge control with temperature measurement inside and outside the retort
- Gas inlet with solenoid valve, controlled by the program
- Process control and documentation via VCD software package or Nabertherm Control Center (NCC) for monitoring, documentation and control see page 72



Process control H3700 for automatic version

Hot-Wall Retort Furnaces up to 1100 °C

Retort furnace NRA 300/09 H_2 for heat treatment under hydrogen

Charging of the retort furnace NRA 300/06 furnace with a pallet truck

H_2 Version for Operation with Flammable Process Gases

When a flammable process gas like hydrogen is used, the retort furnace is additionally equipped with the required safety technology. Only certified and industry proven safety sensors are used. The furnace is controlled by a fail-safe PLC control system (S7- 300F/safety controller).

- Supply of flammable process gas at controlled overpressure of 50 mbar relative
- Certified safety concept
- PLC controls with graphic touch panel H 3700 for data input
- Redundant gas inlet valves for hydrogen
- Monitored pre-pressures of all process gases
- Bypass for safe flushing of furnace chamber with inert gas
- Torch for thermal post combustion of exhaust gases
- Emergency flood container for purging the furnace in case of failore

Retort furnace NR 150/11 IDB with thermal post combustion

IDB Version for Debinding under Non-flammable Protective Gases or for Pyrolysis Processes

The retort furnaces of the NR and NRA product line are perfectly suited for debinding under non-flammable protective gases or for pyrolysis processes. The IDB version of the retort furnaces implements a safety concept by controlled purging the furnace chamber with a protective gas. Exhaust gases are burned in an exhaust torch. Both the purging and the torch function are monitored to ensure a safe operation.

- Process control under monitored and controlled overpressure of 50 mbar relative
- Process control H 1700 with PLC controls and graphic touch panel for data input
- Monitored gas pre-pressure of the process gas
- Bypass for safe flushing of furnace chamber with inert gas
- Torch for thermal post combustion of exhaust gases

Model	Tmax	Model	Tmax	Work space dimensions in mm			Work space	Electrical
	°C		°C	w	d	h	in l	connection*
NRA 17/..	650 or 950	NR 17/11	1100	225	350	225	17	3-phase
NRA 25/..	650 or 950	NR 25/11	1100	225	500	225	25	3-phase
NRA 50/..	650 or 950	NR 50/11	1100	325	475	325	50	3-phase
NRA 75/..	650 or 950	NR 75/11	1100	325	700	325	75	3-phase
NRA 150/..	650 or 950	NR 150/11	1100	450	750	450	150	3-phase
NRA 200/..	650 or 950	NR 200/11	1100	450	1000	450	200	3-phase
NRA 300/..	650 or 950	NR 300/11	1100	590	900	590	300	3-phase
NRA 400/..	650 or 950	NR 400/11	1100	590	1250	590	400	3-phase
NRA 500/..	650 or 950	NR 500/11	1100	720	1000	720	500	3-phase
NRA 700/..	650 or 950	NR 700/11	1100	720	1350	720	700	3-phase
NRA 1000/..	650 or 950	NR 1000/11	1100	870	1350	870	1000	3-phase

*Please see page 69 for more information about supply voltage

The retort furnaces SR and SRA (with gas circulation) are designed for operation with non-flammable or flammable protective or reaction gases. The furnace is loaded from above by crane or other lifting equipment provided by the customer. In this way, even large charge weights can be loaded into the furnace chamber.

Depending on the temperature range in which the furnace be used, the following models are available:

Models SR .../11 with Tmax 1100 °C
- Heating from all sides outside the retort
- Temperature uniformity up to +/- 5 °C inside the work space see page 71
- Retort made of 1.4841
- Top down multi-zone control of the furnace heating

Front made of textured stainless steel

Models SRA ../09 with Tmax 950 °C
Design like models SR.../11 with following differences:
- Atmosphere circulation with powerful fan in the furnace lid provides for temperature uniformity of up to +/- 5 °C inside the work space see page 71

Retort furnace SRA 300/06
with charging basket

Models SRA ../06 with Tmax 600 °C
Design like models SRA.../09 with following differences:
- Heating inside the retort
- Temperature uniformity up to +/- 5 °C inside the work space see page 71
- Single-zone control
- Retort made of 1.4841

Standard Equipment (all models)
Design like standard equipment of models NR and NRA with following differences:
- Charging from above with crane or other lifting equipment from customer
- Hinged lid with opening to the side
- Defined application within the constraints of the operating instructions
- NTLog Basic for Nabertherm controller: recording of process data with USB-flash drive

Retort furnace SR 170/1000/11
with changeable retort and cooling station

Additional equipment, H_2 version or IDB version see models NR and NRA

Model	Tmax	Inner dimensions of alloy retort		Volume	Outer dimensions in mm			Electrical	Weight
	°C	ø in mm	h in mm	in l	W	D	H	connection*	in kg
SR(A) 17/..		250	350	17	1300	1700	1800	3-phase	600
SR(A) 25/..		250	500	25	1300	1900	1800	3-phase	800
SR(A) 50/..		400	450	50	1400	2000	1800	3-phase	1300
SR(A) 100/..	600,	400	800	100	1400	2000	2100	3-phase	1500
SR(A) 200/..	950	600	700	200	1600	2200	2200	3-phase	2100
SR(A) 300/..	or	600	1000	300	1600	2200	2500	3-phase	2400
SR(A) 500/..	1100	800	1000	500	1800	2400	2700	3-phase	2800
SR(A) 600/..		800	1200	600	1800	2400	2900	3-phase	3000
SR(A) 800/..		1000	1000	800	2000	2600	2800	3-phase	3100
SR(A) 1000/..		1000	1300	1000	2000	2600	3100	3-phase	3300
SR(A) 1500/..		1200	1300	1500	2200	2800	3300	3-phase	3500

*Please see page 73 for more information about supply voltage

Retort furnace SRA 200/09

Cold-Wall Retort Furnaces up to 2400 °C

Retort furnace VHT 500/22-GR H_2 with CFC-process box and extension package for operation under hydrogen

Retort furnace VHT 100/15-KE H_2 with fiber insulation and extension package for operation under hydrogen, 1400 °C

Heat treatment of copper bars under hydrogen in retort furnace VHT 8/16-MO

The compact retort furnaces of the VHT product line are available as electrically heated chamber furnaces with graphite, molybdenum, tungsten or $MoSi_2$ heating. A wide variety of heating designs as well as a complete range of accessories provide for optimal retort furnace configurations even for sophisticated applications.

The vacuum-tight retort allows heat treatment processes either in protective and reaction gas atmospheres or in a vacuum, subject to the individual furnace specs to 10^{-5} mbar. The basic furnace is suited for operation with non-flammable protective or reactive gases or under vacuum. The H_2 version provides for operation under hydrogen or other flammable gases. Key of the specification up is a certified safety package providing for a safe operation at all times and triggers an appropriate emergency program in case of failure.

Alternative Heating Specifications

In general the following variants are available wit respect to the process requirements:

VHT ../..-GR with Graphite Insulation and Heating

- Suitable for processes under protective and reaction gases or under vacuum
- Tmax 1800 °C or 2200 °C (2400 °C as additional equipment)
- Max. vacuum up to 10^{-4} mbar depending on pump type used
- Graphite felt insulation

VHT ../..-MO or VHT ../..-W with Molybdenum or Tungsten Heating

- Suitable for high-purity processes under protective and reaction gases or under high vacuum
- Tmax 1200 °C, 1600 °C or 1800 °C (see table)
- Max. vacuum up to 10^{-5} mbar depending on pump type used
- Insulation made of molybdenum rsp. tungsten radiation sheets

VHT ../..-KE with Fiber Insulation and Heating through Molybdenum Disilicide Heating Elements

- Suitable for processes under protective and reaction gases, in air or under vacuum
- Tmax 1800 °C
- Max. vacuum up to 10^{-2} mbar (up to 1300 °C) depending on pump type
- Insulation made of high purity aluminum oxide fiber