

## Rotary Tube Furnaces for Continuous Processes and/or Batch Operation



RSR 120/1000/13 for continuous operation



RSR-B 120/750/11 as tabletop version for batch operation

### RSR 80-500/11 - RSR 120-1000/13, RSR-B 80-500/11 - RSR-B 120-1000/11

If, for example, the focus lies on maintaining the individual grain characteristics of the material such as in drying or calcination, rotary tube furnaces of the RSR product line are the optimal solution. The permanently rotating working tube allows for the continuous movement of the charge.

In general, these models can be used for continuous processing and/or batch operation. While during a continuous process the charge is transported uniformly from one end to the other of the working tube, during batch operation, it can be heated-treated over a longer period in the furnace chamber thanks to the special shape of the quartz glass reactor (tapered tube ends).

The compact furnaces of the RSR-B product line are perfectly suited for batch operation. The versatile RSR furnaces can be equipped both with working tubes for continuous operation as well as with reactors for batch operation.

Depending on the process, charge and the required maximum temperature, various working tubes made of quartz glass, ceramic or metal can be used (see page 42). Depending on the application these models can be upgraded by adding suitable accessories such as filling funnels, electric feed screw for feeding material or gas supply systems for small production furnaces. Operation can take place in air, in non-flammable protective or reactive gases, or in a vacuum. The necessary equipment is available as additional equipment.

#### Standard design of all models

- Housing made of sheets of textured stainless steel
- Beltless drive and hinged furnace housing provide for very easy removal of working tube or reactor
- Adjustable drive of approx. 2-45 rpm
- Controls description see page 60



Adapters for alternative operation with working tube or process reactor



Connection set for vacuum operation



RSR 80/750/11 with charging funnel and collection bottle at the outlet

#### Additional equipment for all models

- Different tube diameters or heated lengths
- Manual or automatic gas supply systems
- Gas tight rotary device for the connection to gas supply systems
- Check valve at gas outlet avoids intrusion of false air
- Three-zone control for the optimization of temperature uniformity
- Temperature display unit in the working tube with measurement by means of an additional thermocouple
- Charge control by means of an additional thermocouple in the working tube

#### Standard design for batch operation

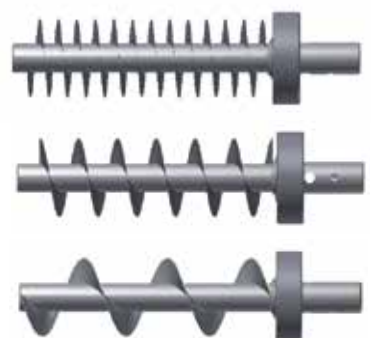
- Tmax 1100 °C
- Thermocouple type K
- Furnace designed as table-top model with quartz glass reactor which opens on both sides, tapered ends
- Reactor is removed from the furnace for discharging
- Switchgear and control unit separate from furnace in own wall or standing cabinet

#### Additional equipment for batch operation

- Different gas supply systems
- Vacuum design, up to  $10^{-2}$  mbar depending on the applied pump
- Reactor made of quartz glass, open at both sides, with burling for better conveyance of the charge in the tube
- Information on the different working tubes see page 42
- Package for improved charging and discharging of the working tube in the following design:
  - Single-side closed mixing reactor made of quartz glass with an integrated blade for improved blending of the charge
  - Tilting mechanism to the left/to the right. For charging and heat treatment, the furnace is tilted towards the right side until the stop so that the load is charged into the furnace. For discharge, the furnace is tilted towards the other side to discharge the powder from the reactor. It is no longer necessary to remove the reactor.
  - Furnace assembled on base with integrated switchgear and controller, incl. transport casters
- Digital display for the tilting angle of the furnace



Screw-conveyor with adjustable speed



Screw-conveyors with different pitches for the adaption to the charge



Vibration generator at the charging funnel for improved powder supply



RSR 120/750/11 S with electrically adjustable tilting angle for continuous processes or batch operation

#### Standard design for continuous processes

- Tmax 1100 °C
  - Thermocouple type K
  - Working tube made of quartz glass open at both sides
- Tmax 1300 °C
  - Thermocouple type S
  - Working tube made of C530 ceramics, open at both sides, not gas tight
- Compact design with switchgear and controller, mounted in the base, including transport casters
- Furnace mounted on base, including manual spindle drive with crank for pre-adjustment of the tilting angle

#### Additional equipment for continuous processes

- Working tube made of quartz glass with burling for optimized mixing of the charge up to Tmax 1100 °C
- Gas tight working tube made of C610 ceramics up to Tmax 1300 °C
- Information on the different working tubes see page 42
- Higher temperatures up to 1600 °C available on request
- Different gas supply systems with good process gas circulation around the charge thanks to an inlet on one tube side and outlet on the other side (only together with the charging system, see below)
- Charging system for continuous material transport, consisting of:
  - Charging funnel made of stainless steel with lockable powder outlet
  - Electric vibration generator at the charging funnel for the optimization of material supply into the working tube as additional option
  - Electrically driven screw-conveyor at the inlet of the working tube with 10, 20 or 40 mm pitch and adjustable speed between 0.28 and 6 revolutions per minute, different gear transmissions for other speeds on request
  - Collecting bottle made of laboratory glass at the outlet of the working tube
  - Suitable for operation in a gas atmosphere or in a vacuum
- Digital display unit for the tilting angle of the furnace
- Electric linear drive for the adjustment of the tilting angle
- Alternating design for continuous processes or batch operation. The furnace can be tilted on the frame towards both sides. The customer can mount a working tube open at both sides for flow processes as well as a process reactor (Tmax 1100 °C) closed at one side for batch operation.
- PLC controls for temperature control and the control of connected aggregates such as gearshift and speed of the screw-conveyor, speed of the working tube, switching of the vibration generator, etc.



RSR 120/500/11 S with reactor closed at one side for batch operation



Gas tight closing plug for tubes made of silica glass closed at one side

Model Rotary tube furnace	Tmax °C <sup>3</sup>	Outer dimensions in mm			Length constant Temperature ΔT 10 K in mm	Total length	Tube dimensions in mm			Connected load kW	Electrical connection*	Weight in kg
		W	D	H			Length working zone <sup>5</sup>	Ø Outer	Ø Terminal end <sup>5</sup>			
<b>Batch operation</b>												
RSR-B 80-500/11	1100	1145 <sup>4</sup>	475	390	170	1140	500	76	34	3.7	1-phase	555
RSR-B 80-750/11	1100	1395 <sup>4</sup>	475	390	250	1390	750	76	34	4.9	3-phase <sup>2</sup>	570
RSR-B 120-500/11	1100	1145 <sup>4</sup>	525	440	170	1140	500	106	34	5.1	3-phase <sup>2</sup>	585
RSR-B 120-750/11	1100	1395 <sup>4</sup>	525	440	250	1390	750	106	34	6.6	3-phase <sup>1</sup>	600
RSR-B 120-1000/11	1100	1645 <sup>4</sup>	525	440	330	1640	1000	106	34	9.3	3-phase <sup>1</sup>	605
<b>Continuous operation</b>												
RSR 80-500/11	1100	2505	1045	1655	170	1540	500	76	34	3.7	1-phase	555
RSR 80-750/11	1100	2755	1045	1655	250	1790	750	76	34	4.9	3-phase <sup>2</sup>	570
RSR 120-500/11	1100	2505	1045	1715	170	1540	500	106	34	5.1	3-phase <sup>2</sup>	585
RSR 120-750/11	1100	2755	1045	1715	250	1790	750	106	34	6.6	3-phase <sup>1</sup>	600
RSR 120-1000/11	1100	3005	1045	1715	330	2040	1000	106	34	9.3	3-phase <sup>1</sup>	605
RSR 80-500/13	1300	2505	1045	1655	170	1540	500	76	34	6.3	3-phase <sup>1</sup>	555
RSR 80-750/13	1300	2755	1045	1655	250	1790	750	76	34	9.6	3-phase <sup>1</sup>	570
RSR 120-500/13	1300	2505	1045	1715	170	1540	500	106	34	8.1	3-phase <sup>1</sup>	585
RSR 120-750/13	1300	2755	1045	1715	250	1790	750	106	34	12.9	3-phase <sup>1</sup>	600
RSR 120-1000/13	1300	3005	1045	1715	330	2040	1000	106	34	12.9	3-phase <sup>1</sup>	605

<sup>1</sup>Heating only between two phases

<sup>2</sup>Heating only between phase 1 and neutral

<sup>3</sup>Tmax is reached outside the tube. Realistic working temperature inside the tube is approx. 50 °C lower.

\*Please see page 60 for more information about supply voltage

<sup>4</sup>Without tube

<sup>5</sup>Only for reactors

## Tube Furnaces for Integration into Customized Systems



RS 120/1000/11S in divided version. Both half furnaces are manufactured identically and will be integrated in an existing gas-heating system with space-saving design

With their high level of flexibility and innovation, Nabertherm offers the optimal solution for customer-specific applications.

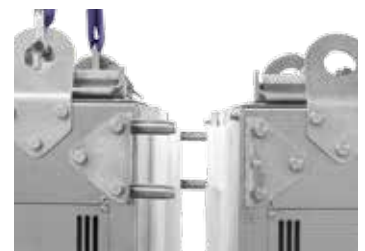
Based on our standard models, we develop individual solutions for integration in overriding process systems. The solutions shown on this page are just a few examples of what is feasible. From working under vacuum or protective gas via innovative control and automation technology for a wide selection of temperatures, sizes, lengths and other properties of tube furnace systems – we will find the appropriate solution for a suitable process optimization.



RS 100/250/11S in split-type design for integration into a test stand



Tube furnace with five-zone control for optimal temperature uniformity



Bolts for connection of two separated half furnaces