Noritake technology, focusing on the future

Over a century of our business in the production of tablewares, Noritake has developed, expanded, and applied its technology and know-how in various business fields and industries. We make the technology for the next generation.

1904  Established Nippon Toki Gomei Kaisha (today’s NORITAKE CO., LIMITED)
1917  Sanitary Ware Division spun off to become Toyo Toki Co., Ltd. (today’s TOTO Ltd.)
1919  The electric insulator division spun off to become NGK Insulators Ltd.
1939  Began full-scale production of industrial grinding wheels
1975  Launched the Noritake Roller Hearth Kiln
1983  Developed Far-infrared ceramic heaters
2003  Acquired shares in Toshiba Ceramic Furnace and established Noritake TCF Co., Ltd.
2010  Development of coating/drying systems for LIB
2014  Launched Ceramic Tube Rotary Kiln
With the heating technology obtained through the production of porcelain products, we offer the most suitable solution for various heating processes.
# Noritake Heat Technology

## Always one step ahead.

### Applications

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<th>Semiconductor</th>
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<td>ITO powder (1000°C)</td>
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<td>Li-ion battery cathode material (1000°C)</td>
<td>Li-ion battery anode material (800°C)</td>
<td>Neodymium (1200°C)</td>
<td>Phosphor (1300°C)</td>
<td>Wafer (1200°C)</td>
<td></td>
</tr>
<tr>
<td>Solar cell electrode firing (800°C)</td>
<td>Barium titanate (1100°C)</td>
<td>Sintered alloy (1100°C)</td>
<td>ITO sintering (1600°C)</td>
<td>Process material (1400°C)</td>
<td></td>
</tr>
<tr>
<td>Activated carbon (1100°C)</td>
<td>Ferrite (1300°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O2 sensor (1500°C)</td>
<td>PZT (1250°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spark plug (1600°C)</td>
<td>MLCC (1250°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED (1500°C)</td>
<td>High-purity alumina for separator (1600°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitride based ceramics (1800°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-purity alumina for separator (1600°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Li-ion battery anode material (2800°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Energy
- **Heat Technology Revolution**
- **Temperature**
  - 250°C
  - 500°C
  - 750°C
  - 1000°C
  - 1250°C
  - 1500°C
  - 1750°C
  - 2000°C
  - 2250°C
  - 2500°C

## Applications
- **Energy**
  - LiB electrode (130°C)
  - EVA film annealing (100°C)
  - MEA for fuel cell (80°C)
  - GDL for fuel cell (360°C)
  - Li-ion battery cathode material (1000°C)
  - Solvent drying (300°C)
  - Electric double layer capacitor (750°C)
  - Solar cell electrode firing (800°C)
  - Activated carbon (1100°C)
  - Si fusion for solar cell (1500°C)
  - SOFC (1500°C)
  - Carbon nanotube (1300°C)
  - High-purity alumina for separator (1600°C)
  - Li-ion battery anode material (2800°C)

- **Electronics**
  - Substrate drying (160°C)
  - FCCL (350°C)
  - De-binder (600°C)
  - Electrode firing (800°C)
  - Li-ion battery anode material (1300°C)
  - Varistor (1100°C)
  - Barium titanate (1100°C)
  - Ferrite (1300°C)
  - PZT (1250°C)
  - MLCC (1250°C)
  - Alumina substrate (1600°C)
  - HTCC (1650°C)
  - Nitride based ceramics (1800°C)

- **Automotives**
  - Plastics component annealing (120°C)
  - Resin curing (100°C)
  - CFRP (300°C)
  - Cylinder gasket (200°C)
  - Metal parts (1000°C)
  - Inorganic pigment (1000°C)
  - Neodymium (1200°C)
  - Sintered alloy (1100°C)
  - Catalyzer (1500°C)
  - O2 sensor (1500°C)
  - Spark plug (1600°C)

- **Display**
  - LCD (200°C)
  - ITO film (120°C)
  - Optical film (140°C)
  - Glass anneal (700°C)
  - PDP (550°C)
  - ITO powder (1000°C)
  - Phosphor (1300°C)
  - LED (1500°C)

- **Semiconductor**
  - IC tray (170°C)
  - HDD parts (180°C)
  - Wafer (1200°C)
  - Process material (1400°C)
  - Barium titanate (1100°C)
  - Inorganic pigment (1000°C)

- **Other**
  - Medical instrument annealing (120°C)
  - Cosmetics pigment (900°C)
  - Porcelain (1300°C)
  - Tile (1200°C)
  - Calcium powder for medical use (1300°C)
  - Carbon fiber (2500°C)
Roller Hearth Kiln (RHK) is a continuous firing kiln which transports products using ceramic rollers. RHK provides outstanding temperature uniformity, cleanliness, and heat efficiency. We offer in a wide range of scale; from small lab types to mass-production systems.

### Fast and Uniform Firing

Homogeneous and high-speed firing can be achieved by placing the green materials on the roller conveyor without stacking.

- The roller conveyor facilitates radiant heating from all directions and reduces the temperature deviation to ±2°C.
- Conveyor rollers are driven by Spring Drive. This allows for high speed transfer without meandering.

### Uniform Gas Flow

Partitioned kiln zones with respective ventilation ports provides optimum gas flow for chemical reactions.

### Gas Supply

- Optimized flow rate for effective flow around the products.
- Optimized flow volume to achieve the target gas concentration around products.

### Exhaust System

- Quickly eliminates the vapor/volatiles generated from the products.
- Effectively divided zones prevent volatiles from spreading through the kiln.
Contamination-Free

Kiln materials can be composed of ceramics which provides contamination-free environment and great resistance to chemical attacks. External handling system/conveyor is also protected with ceramic and plastic materials.

High Gas Tightness

Sealing options are available for efficient firing environment with special gases.

<Airtight Grade Comparison>

<table>
<thead>
<tr>
<th>Standard type</th>
<th>Airtight Type</th>
<th>Super Airtight Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen : 200ppm</td>
<td>Oxygen : 50ppm</td>
<td>Oxygen : 10ppm</td>
</tr>
</tbody>
</table>

End portions of rollers and heaters are enclosed to prevent gas leakage. Flange seals

High Efficiency / Energy Saving / Space-saving

The combination of uniform heating, high speed calcination and ceramics-only internal materials achieves significantly high production and energy efficiencies.

Roller Hearth Kiln is the best solution for the continuous calcination of advanced products!
## 3.6m Pilot Roller Hearth Kiln

### Air type
- **Maximum temperature**: 1200°C
- **Atmosphere**: Air
- **Sagger size**: 330 x 330 x 100H (mm)
- **Sagger conveyor**: 1 lane, 1 stack, 7kg/sagger (typical)
- **Zone**: 300 mm x 12 zones (Heating zone: 1-9)

### Atmosphere type
- **Maximum temperature**: 1200°C
- **Atmosphere**: Air, N2, Ar, O2, N2 + H2
- **Sagger size**: 330 x 330 x 100H (mm)
- **Sagger conveyor**: 1 lane, 1 stack, 7kg/sagger (typical)
- **Zone**: 300 mm x 12 zones (Heating zone: 1-9) (Cooling jacket: 11-12)

## 7.2m Pilot Roller Hearth Kiln

### Air type
- **Maximum temperature**: 1400°C
- **Atmosphere**: Air
- **Sagger size**: 330 x 330 x 100H (mm)
- **Sagger conveyor**: 1 lane, 1 stack, 7kg/sagger (typical)
- **Zone**: 450 mm x 16 zones (Heating zone: 1-13)

### Atmosphere type
- **Maximum temperature**: 1400°C
- **Atmosphere**: Air, N2, Ar, O2, N2 + H2
- **Sagger size**: 330 x 330 x 100H (mm)
- **Sagger conveyor**: 1 lane, 1 stack, 7kg/sagger (typical)
- **Zone**: 450 mm x 16 zones (Heating zone: 1-13) (Cooling jacket: 15-16)
Roller Hearth Kiln offers the options for calcination at highest temperature ranges.

### High Temperature Roller Hearth Kiln

- Conveyor rollers capable of high speed transportation at 1620°C
- Various energy-saving systems/options available.

<table>
<thead>
<tr>
<th>Maximum temperature</th>
<th>1620°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmosphere</td>
<td>Air</td>
</tr>
<tr>
<td>Heat sources</td>
<td>Electricity, Gas</td>
</tr>
</tbody>
</table>

Optional Equipment

### Off-gas Combustion System

For the combustion of flue gas from kilns.

- Can be installed on various types of kilns e.g. batch kilns or continuous systems.
- Makes a gas flow inside the kiln to establish the efficient and compact off-gas treatment.

<table>
<thead>
<tr>
<th>Maximum temperature</th>
<th>800°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat source</td>
<td>Electricity, Gas</td>
</tr>
<tr>
<td>Substances to burn</td>
<td>Tar, binder, etc.</td>
</tr>
</tbody>
</table>

### Microwave Kiln for Preheating

Installing a microwave kiln at pre-heating / temperature ramp sections of continuous system e.g. RHK will reduce the ramp-up time.

- Shorter heating time
- Uniform heating
- High efficiency

<table>
<thead>
<tr>
<th>Maximum temperature</th>
<th>500°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmosphere</td>
<td>Air, N₂, O₂</td>
</tr>
<tr>
<td>Usable dimensions</td>
<td>330 x 330 x 100H (mm)</td>
</tr>
</tbody>
</table>
Compact Design
Designed for smaller products while utilizing the benefits of Roller Hearth Kilns. 1400°C soak profile is possible with this 1200 mm klin.

Suited for Scale-up
Using this small kiln for R&D or pilot productions will make it quite easy to scale up to larger mass-production system with roller hearth kiln.

A Solution for Flexible Production
Provides smooth changeover between products and high production efficiency. Ideal for high-mix, low volume production.

Atmosphere
With its small configuration and good sealing, calcination in highly precise atmosphere conditions is possible.

Basic specification

<table>
<thead>
<tr>
<th>Air type</th>
<th>Atmosphere type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Models</td>
<td>DTK-NA</td>
</tr>
<tr>
<td>Max. temperature</td>
<td>1400°C</td>
</tr>
<tr>
<td>Temperature precision</td>
<td>±2°C</td>
</tr>
<tr>
<td>Zone length</td>
<td>150 mm</td>
</tr>
<tr>
<td>Zones</td>
<td>12</td>
</tr>
<tr>
<td>Usable dimensions</td>
<td>150W x 50H (mm)</td>
</tr>
<tr>
<td>Kiln length</td>
<td>1200 mm</td>
</tr>
<tr>
<td>Roller materials</td>
<td>Mullite / Alumina</td>
</tr>
<tr>
<td>Heater material</td>
<td>SiC</td>
</tr>
</tbody>
</table>
RHK Simulator

RHK Simulator is a batch kiln which represents the internal structure of Roller Hearth Kiln.

● Easy to Scale-up
You can simulate the settings for continuous kilns i.e. Roller Hearth Kiln with identical parameters on this Simulator. Helps you to design larger, mass-production systems easily by applying such settings.

● Expansion to Continuous Kiln System
Heating parameters established on this simulator can be applied directly to Special-Atmosphere Roller Hearth Kilns for mass production.

● Atmosphere control
Capable of special atmospheres such as nitrogen, oxygen, and so on. Various tests and production conditions can be established.

● Ideal size for laboratories.

● Clean heating
Components inside the chamber can be entirely of ceramics which is ideal for products that are sensitive to metal contamination e.g. battery materials.

<table>
<thead>
<tr>
<th>Basic specification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Model</td>
</tr>
<tr>
<td>Max. temperature</td>
</tr>
<tr>
<td>Atmosphere</td>
</tr>
<tr>
<td>Usable dimensions</td>
</tr>
<tr>
<td>Sagger quantity</td>
</tr>
</tbody>
</table>
Continuous kiln for the heat treatment of green materials while agitating in a rotating kiln shell.

High Temperature / Cleanliness
Our special kiln core drum restrains oxidation and abrasion under high temperature conditions. This maintains a clean atmosphere and prevents product contamination.

Special Atmospheres
Noritake’s original sealing system keeps the kiln airtight, which allows the use of special atmosphere gases for heating.

Clean-Processing Rotary Kiln for Mass Productions

Mass-Production Kiln for Clean Calcination of LIB Materials

- **Perfect for Battery Materials**
  Shell tube made of special ceramics inhibits the reaction of lithium materials during heat treatment.

- **Clean Calcination**
  Chromeless metal shell tubes and ceramic shell tubes achieve a clean thermal treatment without metal contaminations.

- **High Efficiency**
  No need of containers e.g. saggers. High efficiency with less cost.

- **Atmosphere Control**
  Noritake’s original sealing system allows the heat treatment in various atmospheres.

- **Adhesion Preventing Mechanism**
  Double-shell structure allows the use of Knockers to prevent powder from adhering inside the shell.

- **Double-Shell Tube**
  The double shell structure with segregated ceramic inner tubes enables to make larger shells.

Maximum temperature : 1100°C
Heat source : Electricity or Gas
Heating method : Indirect heating
Operation time : 30 min to 4 hr (Variable)
Throughput : 30 to 70 kg/hr
Dimensions : 8300L x 2200W x 1830H (mm)
Tube size : I.D. ø500 x 7000 (mm)
Atmosphere : Air, O₂ (95% or more), N₂, N₂ + H₂ (Oxygen : 50 ppm or less), Ar (Oxygen : 50 ppm or less)
### Desktop Rotary Kiln

- Ideal for labs and R&D and/or high-mix, low volume productions.

### Shell Materials and Maximum Temperatures

<table>
<thead>
<tr>
<th>Material</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat-resistant steel</td>
<td>Max. 1000°C</td>
</tr>
<tr>
<td>Heat-resistant steel + Alumina</td>
<td></td>
</tr>
<tr>
<td>Heat-resistant steel + Carbon</td>
<td></td>
</tr>
<tr>
<td>Heat-resistant steel + Nickel alloys</td>
<td></td>
</tr>
<tr>
<td>Quartz</td>
<td></td>
</tr>
<tr>
<td>SiC</td>
<td>Max. 1200°C</td>
</tr>
<tr>
<td>Alumina</td>
<td>Max. 1300°C</td>
</tr>
</tbody>
</table>

- Atmosphere: Air, N₂, N₂ + H₂
- Heat source: Electricity
- Heating method: Indirect heating

### Pilot-size Ceramic Rotary Kiln

- Clean Calcination
  The ceramic shell tube provides a clean, metal contamination-free calcination.

- For High Temperature
  The ceramic shell enables the calcination at 1000°C or higher.
  - Maximum temperature: 1250°C
  - Heat source: Electricity or Gas
  - Heating method: Indirect heating
  - Operation time: 30 min to 180 min (Variable)
  - Throughput: 2 to 6 kg/hr
  - Dimensions: 5500L x 800W x 2700H (mm)
  - Tube size: I.D. ø200 x 2800 (mm)
  - Tube materials: SUS310S, Heat-resistant cast steel, Inconel 601, SiC, Alumina, Carbon
  - Atmosphere: Air, O₂ (95% or more), N₂, N₂ + H₂ (Oxygen: 50ppm or less), Ar (Oxygen: 50ppm or less)

### Indirect / Direct-Heating Rotary Kiln

- Suitable for the mass production of single product.

### Optional Equipment: Rotary Cooler

- Cooling water
Batch Kiln

We offer various types of Batch Kilns depending on temperature and atmosphere conditions. Available in various sizes, operation methods and heat sources.

### Cylindrical Bell Kiln

- **High Airtight Atmosphere Control**
  The multiplex seal structure provides superior air-tightness. This also allows for ultra low oxygen concentration with limited supply of gas.

- **Shorter Air/Gas Purge Time**
  Our original double gas-supply system (direct and penetration) with aid of a vacuum pump reduces the atmosphere-changing time, improving the overall production efficiency.

- **Space Saving**
  Automatic control system for multiple kilns and their car-handling system improves the production efficiency while reducing the installation space.

- **Uniform Temperature Distribution**
  Heaters are installed inside and outside the setter piles, arranged along the circular vessel, to heat the products from three directions.

<table>
<thead>
<tr>
<th>Maximum temperature : 1400°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmosphere : Air, Special atmosphere gas</td>
</tr>
<tr>
<td>Heat source : Electricity</td>
</tr>
<tr>
<td>Usable dimensions : Model A-AF-500 (4 piles) ø500W x 400H (mm)</td>
</tr>
<tr>
<td>: Model A-AF-850 (8 piles) ø750W x 400H (mm)</td>
</tr>
</tbody>
</table>

### Rectangular Elevator Kiln with Cars

- **Batch Kiln with multiple capabilities and high productivity suitable for medium-scale production of electric components and materials.**

<table>
<thead>
<tr>
<th>Maximum temperature : 1400°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmosphere : Air, N₂, N₂ + H₂, O₂</td>
</tr>
<tr>
<td>Heat source : Electricity</td>
</tr>
<tr>
<td>Usable dimensions : Model A-EV-H/M4P (4 piles) 760W x 760L x 400H (mm)</td>
</tr>
<tr>
<td>: Model A-EV-H/M8P (8 piles) 760W x 1970L x 400H (mm)</td>
</tr>
<tr>
<td>: Model A-EV-H/L4P (4 piles) 900W x 900L x 1100H (mm)</td>
</tr>
<tr>
<td>: Model A-EV-H/L8P (8 piles) 760W x 1970L x 1100H (mm)</td>
</tr>
</tbody>
</table>
**High Temperature Multi-atmosphere Batch Kiln**

- Capable of 100% hydrogen and oxygen.
- Compact design, fast heating/cooling.
- Useful for various firing tests and production condition setups.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>A (V)-B-UH16</td>
</tr>
<tr>
<td>Maximum temperature</td>
<td>1600°C</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Air, N2, O2, H2, Ar, CO2</td>
</tr>
<tr>
<td>Vacuum range</td>
<td>&lt;20 Pa</td>
</tr>
<tr>
<td>Heat source</td>
<td>Electricity</td>
</tr>
<tr>
<td>Dimension</td>
<td>1000W x 1040L x 1655H (mm)</td>
</tr>
<tr>
<td>Effective dimension</td>
<td>150W x 150L x 100H (mm)</td>
</tr>
<tr>
<td>Heating speed</td>
<td>60 min to 1600°C</td>
</tr>
</tbody>
</table>

**Carbon Batch Kiln**

- For the heating of ceramics and new materials
- Contamination Free
  Chamber materials with very low impurities promise the heat treatment in high purity atmosphere.
- Rapid Temperature Control
  800°C/h temperature rising is possible. (2 hours to reach 1600°C)
- Automatic Temperature Control Switching
  Precise temperature control in a wide range is possible as the measurement uses type R thermocouples for low-temperature zones (<1000°C) and infrared thermometers for higher temperature zones.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>A (V)-B-UH/C</td>
</tr>
<tr>
<td>Maximum temperature</td>
<td>2400°C</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>N2, Ar</td>
</tr>
<tr>
<td>Usable dimensions</td>
<td>300W x 300H x 300L (mm)</td>
</tr>
<tr>
<td>Kiln material</td>
<td>Carbon, Carbon fiber</td>
</tr>
<tr>
<td>Heater</td>
<td>Carbon</td>
</tr>
</tbody>
</table>
Pusher Kiln

A continuous baking kiln which conveys the products on kiln cars/base plates using hydraulic pushers. Pusher kilns are ideal for mass-production of one product, or productions which require good stability at higher temperatures.

Homogeneous Atmosphere

Noritake’s original design of the gas supply & exhaust holes allow for high precision atmosphere control.

Gas is supplied from both sides and the center. This enables respective controls of supply volumes, and improves the uniformity of the atmosphere inside kiln.

Carbon Pusher Kiln

- **Capability for Higher Temperatures**
  Carbon materials are used to correspond to higher temperatures than conventional pusher kilns.

- **Contamination-free**
  Reduces impurities from kiln materials and makes further purification treatment possible.

- **For Continuous Production at High Temperatures!**
  High productivity with continuous production is available with the pusher system.

<table>
<thead>
<tr>
<th>Model</th>
<th>A-CPK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum temperature</td>
<td>2000°C</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>N₂, Ar</td>
</tr>
<tr>
<td>Kiln material</td>
<td>Carbon, Carbon fiber</td>
</tr>
<tr>
<td>Heater</td>
<td>Carbon</td>
</tr>
<tr>
<td>Kiln dimensions</td>
<td>1800W x 2700H x 6000L (mm)</td>
</tr>
<tr>
<td>Product</td>
<td>Ceramics, New material</td>
</tr>
<tr>
<td>Optional equipment</td>
<td>Degreasing furnace</td>
</tr>
</tbody>
</table>
Heat Technology Revolution

**High-temperature Continuous Firing**
A wide range of heat treatment is available from 400°C for binder burn-out and higher than 1600°C for sintering.

**Layout example**

![Diagram of layout example]

**Stable Transportation**
- **Main Pusher**
  Manages precise control of transfer speed.
  Speed precision: Time difference ±1% (Standard: ±2%)

![Diagram of main pusher]

**Uniform Internal Atmosphere**
Individual tuning of gas supplies as well as uniform supplies from right/middle/left inlets at the bottom are available.

**Reduction in Nitrogen Consumption**
- **Vacuum Purging System**
  Exchanges the atmosphere quickly. Optimum for production with short firing cycles. Nitrogen is supplied after the chamber is vacuumed, which reduces the consumption up to 75% (compared to our conventional models).

![Diagram of vacuum purging system]

**Atmosphere Pusher Kiln**

**Reduction in Nitrogen Consumption**
Exchanging gases with vacuum pumps reduces the ventilation time and nitrogen consumption.

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**Model**
- A-SAP (1 lane)
- A-SAP (2 lanes)

**Maximum temperature**
1650°C

**Atmosphere**
- Air, N₂, N₂ + H₂, H₂, O₂, Ar, CO₂

**Heat source**
- Electricity, Gas
**Mesh Belt Kiln**

Mesh Belt Kiln is a continuous firing kiln, conveying products by a metal mesh-belt conveyer. It has excellent productivity for lower temperature processes.

- **Clean**
  Gas flow is controlled from kiln firing zone to burnout zone and binder is exhausted outside of kiln the at an optimum temperature. This allows for maintaining of a clean atmosphere.

- **Highly Precise Temperature Distribution**
  Heater alignment based on past experience and separation control provide precise temperature distribution for any temperature range.

- **Energy-Saving**
  Kiln body, except muffle, is built with molded ceramic fiber and an energy saving structure, it can significantly reduce power consumption.

---

**Operating temperature**: R.T. - 1000°C  
**Temperature precision**: ±2°C (at 1000°C)  
**Oxygen concentration**: < 10ppm  
**Atmosphere**: Air, N₂, H₂, O₂, Ar

---

**Furnace internal structure**

[Diagram of furnace internal structure]

---

**Muffle type**

<table>
<thead>
<tr>
<th>Structure</th>
<th>Muffle type</th>
<th>Non-Muffle type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating method</td>
<td>Infrared secondary heating (Metal muffle)</td>
<td>Ceramic tube far-infrared direct heating</td>
</tr>
<tr>
<td>Power consumption</td>
<td>Large</td>
<td>Small (Energy-saving type)</td>
</tr>
<tr>
<td>Dust</td>
<td>Little</td>
<td>None</td>
</tr>
<tr>
<td>Temperature Uniformity</td>
<td>Good</td>
<td>Moderate (Good in Width)</td>
</tr>
<tr>
<td>Temperature response</td>
<td>Slow</td>
<td>Good</td>
</tr>
<tr>
<td>Temperature control</td>
<td>SSR, SCR</td>
<td>SSR, SCR</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Air, N₂, H₂, O₂, Ar</td>
<td>Air</td>
</tr>
</tbody>
</table>
Kiln for Special Use

We also design special kilns for various customer requirements such as vacuum, pressurization, high temperature firing, and other requirement.

**Carbon Kiln**
- Stable heating even at high temperature zones
- Compact and space saving

| Maximum temperature : 2800°C |
| Atmosphere : N₂, Ar |
| Heat source : Electricity |

**Atmosphere Vacuum Kiln**
- Atmosphere and Vacuum firing are available.
- Maximum 1 Pa vacuum level.

| Maximum temperature : 1700°C |
| Vacuum range : 1 Pa |
| Atmosphere : Vacuum, Ar, N₂ |
| Heat source : Electricity |

**Pressure Kiln**
- Max pressure 0.96 MPa
- Compact and space saving

| Maximum temperature : 1600°C |
| Atmosphere : Air, N₂ |
| Heat source : Electricity |
Batch Kiln with Chlorine Atmosphere

Capable of corrosive gases e.g. chlorine. Our newly-developed technology protects the structure from corrosions. Withstands high vacuum and high temperature (max. 1,450°C). Effectively removes metal impurities from ceramic powders e.g. carbon, silica, SiC.

- Removes impurities effectively by the chemical reactions with chlorine gas.
- Fully automated and easy to use; All you have to do is to place the item and push a button.
- Vaporized impurities will be discharged out of furnace by our original system.
- Maintenance-friendly chamber.
- Hydrogen, nitrogen and argon gases are also usable as well as chlorine. (Interlocks are provided for the safe use of those gases.)

<table>
<thead>
<tr>
<th>Model: 470</th>
<th>Model: 800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>390W x 390L x 250Hmm</td>
</tr>
<tr>
<td>Effective dimension</td>
<td>470W x 470L x 600Hmm</td>
</tr>
<tr>
<td>Maximum temperature</td>
<td>1450°C</td>
</tr>
<tr>
<td>Vacuum level</td>
<td>&lt;10 Pa</td>
</tr>
<tr>
<td>Heat source</td>
<td>Carbon heater</td>
</tr>
</tbody>
</table>

Removal of Metal by Chlorine (Example)
Long Tammann Furnace

Capable of continuous heating at ultra-high temperature (2800°C)

- Continuous high-temperature heating at < 2,800°C in Ar or N₂
- High productivity & energy saving. Heat-up/cooling processes not required unlike Batch Furnaces.
- Precise temperature uniformity with new heating technology. Enhances the product quality.
- The square type can be zone-divided to provide stepped heating, which offers optimum thermal profiles for your products.

Applications
- Sintering of SiC products (roller, heater, tube etc.)
- Sintering of C/C composite, Graphitizing of carbon fiber
- Various heat treatment such as graphitizing or carbonization
- Heat treatment of SOFC
- Graphitizing and carbonization of graphite sheets

Operating temperature : Max. 2800°C  Min. 100°C
Atmosphere : Ar, N₂
Conveyor : Pusher, Roll to Roll (sheet or film)
Discharge : Roller conveyor
Furnace length : 2000 - 8000mm (customizable)
Usable Width : [Tube] - ø300 mm [Square type] <1100mm
Utility : Electricity, gas, coolant water, exhaust line

Example Layout
Noritake also provides customized material-handling systems for the firing of powder/granule products. We offer contaminant-free equipments and systems such as feeders, collectors, mills, conveyors and others which meet the specific characteristics of the granular material. This packaged system will furnish your facility with efficiency, stability and ensured quality control.

Containers are inspected by sensors to find cracks and prevent future troubles.

The powder recovery machine overturns a sagger in a sealed enclosure to collect the powder material.

Caked powders are crushed into proper particle sizes using roll crushers, jaw crushers, etc.

Powders remaining inside the container will be vacuum-cleaned with a brush nozzle.

New powder is poured into containers using vibration feeder, screw feeder or other methods that are suitable for the properties of the powder.

The surface of piled-up powder is flattened quickly at Leveling Station after it was poured into a container.
Noritake ceramic roller provides excellent dimensional precision, sufficient strength in high temperature range, and excellent corrosion resistance. Being used in a wide range of applications such as conveyor rollers in roller hearth kiln, shell tubes in rotary kilns, heat-resistant tubes, gas sampling tubes, gas supply tubes, and acid resistant components.

<table>
<thead>
<tr>
<th>Roller</th>
<th>Alumina Content (%)</th>
<th>Recommended Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>55</td>
<td>- 1200°C</td>
</tr>
<tr>
<td>TA</td>
<td>60</td>
<td>1100 - 1300°C</td>
</tr>
<tr>
<td>TA-A</td>
<td>65</td>
<td>1150 - 1350°C</td>
</tr>
<tr>
<td>TA-N</td>
<td>69</td>
<td>1200 - 1400°C</td>
</tr>
<tr>
<td>NM</td>
<td>72</td>
<td>1300 - 1500°C</td>
</tr>
<tr>
<td>NM-S</td>
<td>75</td>
<td>1400 - 1650°C</td>
</tr>
<tr>
<td>TA-S</td>
<td>99</td>
<td>- 1400°C</td>
</tr>
<tr>
<td>KE</td>
<td>87</td>
<td>- 1650°C</td>
</tr>
<tr>
<td>SiC</td>
<td>-</td>
<td>- 1400°C</td>
</tr>
</tbody>
</table>

Great thermal resistance, suitable for applications at higher temperatures. Its excellent flexural strength is ideal for stacking. Available with flexible line-up to be used under various conditions.

Resistant to thermal shock, suitable for high ramp/cooling rates. High purity or high porosity types available, capable of special shapes.

Best thermal resistance. Excellent resistance to the chemical reactions with alkaline materials guarantees long service life.

Extremely conductive therefore suitable for quick heat-up/cooling of product, shape can be flexibly customized as it is made by cutting instead of mold.
## Properties

<table>
<thead>
<tr>
<th>Chemical Components (%)</th>
<th>Al2O3</th>
<th>SiO2</th>
<th>MgO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cordierite-Mullite</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KR-4A Sagger, Plate</td>
<td>29</td>
<td>2.1</td>
<td>0.30</td>
</tr>
<tr>
<td>ANC Sagger, Plate</td>
<td>35</td>
<td>1.9</td>
<td>0.32</td>
</tr>
<tr>
<td>MT-70 Plate</td>
<td>30</td>
<td>2.1</td>
<td>0.32</td>
</tr>
<tr>
<td>Mullite</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NR-H Sagger, Plate</td>
<td>24</td>
<td>2.3</td>
<td>0.36</td>
</tr>
<tr>
<td>P1 Plate</td>
<td>71</td>
<td>1.1</td>
<td>0.77</td>
</tr>
<tr>
<td>Alumina</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MY-99X Sagger, Plate</td>
<td>&lt;0.1</td>
<td>3.9</td>
<td>300</td>
</tr>
<tr>
<td>MM-8 Sagger, Plate</td>
<td>20</td>
<td>3.2</td>
<td>25</td>
</tr>
<tr>
<td>MM-3 Plate</td>
<td>25</td>
<td>2.8</td>
<td>20</td>
</tr>
<tr>
<td>Spinel-Cordierite</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MK-3AM Sagger, Plate</td>
<td>35</td>
<td>2.0</td>
<td>8</td>
</tr>
<tr>
<td>MK-7-3 Sagger, Plate</td>
<td>25</td>
<td>2.6</td>
<td>6</td>
</tr>
<tr>
<td>Magnesia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MY-PS Sagger, Plate</td>
<td>&lt;0.1</td>
<td>3.2</td>
<td>100</td>
</tr>
<tr>
<td>MY-M99 Sagger, Plate</td>
<td>17</td>
<td>3.0</td>
<td>13</td>
</tr>
<tr>
<td>Zirconia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TZ-Y Plate</td>
<td>&lt;0.1</td>
<td>5.6</td>
<td>200</td>
</tr>
<tr>
<td>MY-Z42 Sagger, Plate</td>
<td>20</td>
<td>4.5</td>
<td>15</td>
</tr>
<tr>
<td>Silicon Carbide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HE-902 Plate</td>
<td>&lt;0.1</td>
<td>3.1</td>
<td>450</td>
</tr>
<tr>
<td>KM-8 Sagger, Plate</td>
<td>23</td>
<td>2.4</td>
<td>79</td>
</tr>
<tr>
<td>Carbon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MY-C1 Sagger, Plate</td>
<td>15</td>
<td>1.7</td>
<td>14</td>
</tr>
</tbody>
</table>

*1) Thermal expansion: Linear coefficient for heating from room temperature to 1,000°C.
*2) Maximum working temperature depends on the processing objects and conditions.
(Other specifications not listed above are also available.)
Kiln Heater

**SiC Heater**

- **Working temperature**: 400 - 1400°C
- Non-metal element consisting primarily of silicon carbide.
- Keeps clean environment inside the kiln.
- Simple to use and easy to maintain.
- Suitable for various unique atmospheres.

**Coated Type**

- Special coating e.g. CVD, alumina, or glass is applied to protect the heater from rapid degradation in severe atmospheres.

**Homogeneity Type**

- The center section of the heating element does not heat up. Therefore, uniform heating in the horizontal direction is possible. This type is effective for wide continuous kilns.

**Protection Tube**

- Protects the heater from chemical attacks due to acidic or alkaline off-gases generated from heated products. Available with alumina, mullite, SiC, etc.

**Insulated Metal Heater**

- **Working temperature**: <1000°C
- A heater module consisting of thermal insulation and metal heating element.
- For smaller structure and efficient heating.
- A surface covered with heating elements provides uniform heating.

**MoSi2 Heater**

- **Working temperature**: 1000 - 1800°C
- Molybdenum disilicide-based heater for high temperature.
- High purity material is used for this heater. It will extend the life time of glass protection film which is formed at the surface of heating element.
- It is high efficiency against creep property features and has a high mechanical tolerance.
Thermocouple

Thermocouple with Protecting Tube
The ceramic protective tube prevents atmosphere gas from damaging the thermocouple and its accuracy. Tube material will be selected to meet your heating conditions.

Thermocouple with Protective Jacket
A light and flexible thermocouple whose conductors are protected with electric-insulation jackets e.g. plastics, glass, ceramics. Ideal for real-time temperature measurement of products while conveying through a kiln.

Sheath Thermocouple
Thermocouple protected by metal sheath such as SUS provides flexibility for mounting in narrow spaces.

Wide Variation
We offer the most suitable products for customers' demand.

<table>
<thead>
<tr>
<th>Type</th>
<th>Materials</th>
<th>Working temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive Wire</td>
<td>Negative Wire</td>
</tr>
<tr>
<td>K</td>
<td>Chromel</td>
<td>Alumel</td>
</tr>
<tr>
<td>J</td>
<td>Iron</td>
<td>Constantan</td>
</tr>
<tr>
<td>R</td>
<td>Platinum rhodium</td>
<td>Platinum</td>
</tr>
<tr>
<td>B</td>
<td>Platinum rhodium</td>
<td>Platinum rhodium</td>
</tr>
<tr>
<td>PR40-20</td>
<td>Platinum rhodium</td>
<td>Platinum rhodium</td>
</tr>
</tbody>
</table>

Note) The working temperatures are of JIS (Japan Industrial Standard) recommended.

After-sales Service

Temperature calibration
Thermocouples require periodical calibration as they deteriorate with time. Noritake therefore provides temperature calibration programs according to the operating conditions to ensure the users’ quality controls.

Wire recast
Products using precious metals such as platinum can be very expensive. Noritake recasts and recycles used wire.

Partial repair
Depending on the circumstances, protection tubes and terminals may be damaged earlier than thermocouple. Noritake can make partial repairs and suggestions on improvement methods.
Far Infrared Conveyor Furnace

Excellent high-speed/uniform heating by the combination of far-infrared and hot-air. With the belt type continuous conveyance, automatization is available by combining customer’s equipment.

- **High-speed/high-precision heating**
  The hybrid of far-infrared heating and hot-air can uniformly heat at high speed.

- **Energy-saving**
  With radiant heating, there is minimal heat loss and the combination of an energy-saving heater therefore, running cost is reduced.

- **Clean heating**
  This furnace uses Noritake far-infrared heater and a teflon-coated mesh belt which reduces the amount of dust formation.

- **Automation**
  With the belt type continuous conveyance, automatization is achieved through integration customer’s equipment.

### Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>R.T. &lt;230°C (Product temperature standard)</td>
</tr>
<tr>
<td>Temperature precision</td>
<td>±5°C at 230°C (Product temperature standard)</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Air, N₂ (Optional)</td>
</tr>
<tr>
<td>Heat source</td>
<td>Electricity</td>
</tr>
<tr>
<td>Clean level</td>
<td>Class 10000</td>
</tr>
<tr>
<td></td>
<td>* Capable of Class 1000 depending on conveying system</td>
</tr>
<tr>
<td>Heating method</td>
<td>Far infrared heater + Hot air</td>
</tr>
</tbody>
</table>

### Applications

- Plastic molded goods annealing
- Epoxy/Phenol resin heat hardening
- Drying/Hardening printed substrate
- Drying paint
- Drying moisture etc.
High-speed/High-precision Heating
By using both far-infrared heating and hot-air assist uniformly heat at high speed.

Clean Atmosphere Heating
Special processing on the surface of a heater maintains the inside of a furnace at pure atmosphere.

Capability for Multi-Stack Systems:
Can be used for mass-production by stacking 2 - 3 tiers of furnaces and adding auxiliary elevators.

Applications
- LCD, PDP, OLED, FED glass substrate:
  Moisture drying after cleaning, various paste drying
- Drying/firing of printed ceramic substrates

Far-infrared Clean Conveyer Furnace

Operating temperature: R.T. - 400°C
Temperature precision: ± 5°C
Atmosphere: Air, N₂
Heat source: Electricity
Clean level: Class 100
Heating method: Far infrared heater + Hot air

Far-infrared Heater

Electric Plate Heater <PLC>
The hollow structure inhibits the heater's back side form heat-up / radiation and reduces power consumption.

Surface temperature: Max. 650°C
Sizes: 120 x 120 mm
Capacity: 100 - 800W

Electric Plate Heater <PLR>
Best suited for heating wide area uniformly.

Surface temperature: Max. 400°C
Sizes: 400 x 300 mm, 300 x 200 mm
Capacity: 500 - 2000W

Electric Pipe Heater <SCH>
Low cost & Lightweight. Most suitable for simple continuous furnace.

Surface temperature: Max. 550°C
Size: 425 - 1575 mm
Capacity: 400 - 2000W
Other: Optional reflective board
Roll to Roll Far-infrared Heating Furnace

Infiltration of far-infrared ray reduces treating time significantly by heating the inside and outside of film simultaneously.

NORITAKE provides the optimum Roll to Roll conveyance system to meet the property of each different film.

Roll to Roll Special Atmosphere Furnace

Cross section model of heat transferring (early stages of heating)

<table>
<thead>
<tr>
<th>Hot-air heating method</th>
<th>Far-infrared heating method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating surface hardens first.</td>
<td>Entire coating is dried efficiently and uniformly.</td>
</tr>
<tr>
<td>Internal solvent does not fall out.</td>
<td>Shortening of processing time</td>
</tr>
<tr>
<td>Foaming and migration</td>
<td>Improvement in physical properties of a product</td>
</tr>
</tbody>
</table>

Uniform Heating
Our unique heaters were developed exclusively for this equipment and the structure of its furnace can stabilize far-infrared heaters as well as atmosphere temperature, which enable precise temperature profiles.

Measures for curls and wrinkles during conveyance
Equipment design solves the problems such as curls and wrinkles of products caused by heat.

Maintenance improvement for heating space
The top of the furnace opens wide for easy feeding of film prior to operation and periodical maintenance.

Applications
- 2-Phase FCCL polyimide drying - heat cure processes
- Polyimide water drying process
- Annealing process for various transparent heat-resistant film

Specifications

- Operating temperature: R.T. - 400°C
- Temperature precision: ±5°C
- Atmosphere: Air, N₂ (Option)
- Clean level: Class 1000
- Film width: 600 - 1200 mm
- Conveyance tension: 10 - 100N
## Roll to Roll Furnace for High Temperature

By integrating the thermal treatment and Roll-to-Roll conveyance technologies of Noritake, we can offer a tailored high temperature R2R furnace that fulfills all of your requirements.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>R.T. - 240°C</td>
</tr>
<tr>
<td>Temperature precision</td>
<td>±3°C</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Air, N₂ (Option)</td>
</tr>
<tr>
<td>Film width</td>
<td>600 - 1700 mm</td>
</tr>
<tr>
<td>Conveyance tension</td>
<td>30 - 150N</td>
</tr>
</tbody>
</table>

- **High Efficiency / Energy Saving / Space-saving**
  The combination of uniform heating, high speed calcination and ceramics-only internal materials achieves high production and energy efficiencies.

- **Applications**
  - Heat treatment of CNT materials
  - Heat treatment of fiber materials
  - Heat treatment of metal foils

## Roll to Roll Far-infrared Film Anneal Furnace for Optical Film

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>R.T. - 240°C</td>
</tr>
<tr>
<td>Temperature precision</td>
<td>±3°C</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Air, N₂ (Option)</td>
</tr>
<tr>
<td>Clean level</td>
<td>Class 1000</td>
</tr>
<tr>
<td>Film width</td>
<td>500 - 1700 mm</td>
</tr>
<tr>
<td>Conveyance tension</td>
<td>None (inside Heating Furnace)</td>
</tr>
</tbody>
</table>

- **Uniform Heating**
  Heater zone arrangement of far infrared heaters for wide-width film provides a high-accuracy temperature profile.

- **Roll to Roll conveyance system for Optical film**
  We propose conveyance system to reduce load during heating and not to cause distortion and damage caused by conveyance on products.

- **Applications**
  - ITO film crystallization anneal process
  - Anneal process for various types of function membrane film
  - Individual annealing treatment process for Optical film (PI, PEN, PET, PMMA etc.)

[Test equipment: Roll to Roll far-infrared heating furnace for films]
Production-level test furnace is available at our facility. (Capable of 600 mm-width product, overall length 10 m, furnace 5 m)
Automated Drying System with Material Handling Conveyor

Labor Saving
Processes without human operators prevent contamination of materials and dry rooms.

Safety Improvement
Reduces safety risks by replacing operators in heavy-lifting/transporting tasks.

Processes Integration
Establishes automated transfer line with preceding and subsequent processes.

Vacuum Drying Oven

Shorter Processing Time
The use of heat transfer mediums (nitrogen, CDA, argon) for heat-up and cool-down along with our original convection system reduces the total processing time.

Uniform Heating
Homogeneous heating between the inside and outside of materials improves the product quality.

Establishing Optimum Recipes
Flexible control system for developing temperature settings.

Example of temperature profile

Reduces processing time significantly (1/2 of standard vacuum oven)

Operating temperature : R.T. - 250°C
Temperature precision : ±5°C
Atmosphere : Vacuum N₂, CDA, Ar
Vacuum level : 10 Pa (7.5×10⁻² Torr)
Heat source : Electricity

Optional : Doors on both side, barcode management
Test Equipment

We offer various test kilns to meet customer requirements. Please feel free to ask us about in-house firing and sample manufacturing.

### Roller Hearth Kiln

<table>
<thead>
<tr>
<th>Atmosphere RHK</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum temperature</td>
<td>1400°C</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Air, N₂, N₂ + H₂, Ar, O₂</td>
</tr>
<tr>
<td>Effective dimension</td>
<td>330W x 100H (mm)</td>
</tr>
</tbody>
</table>

### High Temperature Atmosphere Roller Hearth Kiln

<table>
<thead>
<tr>
<th>High Temperature Atmosphere Roller Hearth Kiln</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum temperature</td>
<td>1500°C *1400°C for N₂ or N₂ + H₂ atmosphere</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Air, N₂, N₂ + H₂, Ar, O₂</td>
</tr>
<tr>
<td>Effective dimension</td>
<td>300W x 100H (mm)</td>
</tr>
</tbody>
</table>

### Desk Top Kiln

<table>
<thead>
<tr>
<th>Desk Top Kiln</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum temperature</td>
<td>1400°C</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Air</td>
</tr>
<tr>
<td>Effective dimension</td>
<td>150W x 25H (mm)</td>
</tr>
</tbody>
</table>

### Atmosphere Desk Top Kiln

<table>
<thead>
<tr>
<th>Atmosphere Desk Top Kiln</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum temperature</td>
<td>1400°C</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Air, N₂, N₂ + H₂, Ar, O₂</td>
</tr>
<tr>
<td>Effective dimension</td>
<td>520W x 70H (mm)</td>
</tr>
</tbody>
</table>

### RHK Simulator

<table>
<thead>
<tr>
<th>RHK Simulator</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum temperature</td>
<td>1400°C</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Air, N₂, Ar, O₂, CO₂</td>
</tr>
<tr>
<td>Effective dimension</td>
<td>330L x 330W x 100H (mm)</td>
</tr>
</tbody>
</table>
Batch Kiln

Elevator Type Atmosphere Batch Kiln
- Maximum temperature: 1400°C
- Atmosphere: Air, N₂, N₂ + H₂, O₂
- Effective dimension: ø750 x 400H (mm)

Batch Kiln for De-binder
- Maximum temperature: 600°C
- Atmosphere: Air, N₂
- Effective dimension: 450W x 450L x 450H (mm)

Multi Atmosphere Batch Kiln
- Maximum temperature: 1600°C
- Atmosphere: Air, N₂, H₂, O₂
- Effective dimension: 150W x 150L x 100H (mm)

Carbon Heater High Temperature Batch Kiln
- Maximum temperature: 2900°C
- Atmosphere: N₂ (-2400°C), Ar
- Effective dimension: ø100 x 120H (mm)

Rotary Kiln

Desk Top Rotary Kiln
- Maximum temperature: 1300°C
- Atmosphere: Air, O₂, N₂, N₂ + H₂
- Tube size: ø108 x 1100L (mm)

Ceramic Reactor Core Rotary Kiln
- Maximum temperature: 1250°C
- Atmosphere: Air, N₂, N₂ + H₂
- Tube size: ø240 x 2800L (mm)
- Tube materials: Alumina, Carbon, Quartz, SiC

Atmosphere Continuous Rotary Kiln
- Maximum temperature: 1000°C
- Atmosphere: Air, N₂, N₂ + H₂
- Tube size: ø300 x 4100L (mm)

Indirect Continuous Rotary Kiln
- Maximum temperature: 1050°C
- Atmosphere: Air
- Tube size: ø300 x 1500L (mm)
Test Equipment

Optional Equipment

Microwave Kiln for Preheating
- Maximum temperature: 500°C
- Atmosphere: Air, O₂, N₂
- Effective dimension: 330W x 330D x 100H (mm)

Exhaust Gas Kiln
- Maximum temperature: 800°C
  - For the heat treatment of off-gas from kiln.

Recuperator
- Exhaust intake temperature: 300°C - 1000°C
- Pre-heated discharge temperature: ≤ 700°C
- Pre-heated substances: Air, COG, Mix, N₂
  - Heat exchanger to recover the hot waste gas from industrial kilns and improve the thermal efficiency.

Fully Automatic Powder Processing System

Auger Feeder
- Less dust and high speed

Rotary Feeder
- Stable feeding of low-fluidity powder

Vibration Feeder
- Low abrasion and high feeding accuracy

Powder Levelling Machine (Vibration/Sway)
- Makes the powder height uniform after supplied into container.
### Drying Furnace

<table>
<thead>
<tr>
<th>Model Description</th>
<th>Temperature</th>
<th>Heating furnace length</th>
<th>Belt effective width</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conveyor type far-infrared heating furnace</td>
<td>Max. 240°C</td>
<td>2150 mm</td>
<td>450 mm</td>
<td>Air blow system combined with hot-air</td>
</tr>
<tr>
<td>Batch type far-infrared heating furnace</td>
<td>Max. 360°C</td>
<td></td>
<td></td>
<td>Side blow system combined with hot-air</td>
</tr>
<tr>
<td>Conveyor type far-infrared heating furnace for N₂</td>
<td>Max. 400°C</td>
<td>1860 mm</td>
<td>450 mm</td>
<td>For Nitrogen, Roll to Roll test is possible.</td>
</tr>
<tr>
<td>R to R type far-infrared heating furnace for N₂</td>
<td>Max. 400°C</td>
<td>4650 mm</td>
<td>600 mm</td>
<td>For Nitrogen, Tension control 10 - 100N</td>
</tr>
<tr>
<td>Batch type vacuum drying furnace</td>
<td>Max. 150°C</td>
<td></td>
<td></td>
<td>Uniform heating, Cooling system (shortening of processing time)</td>
</tr>
<tr>
<td>Multi-atmosphere Drying Furnace</td>
<td>Max. 600°C</td>
<td>2630 mm</td>
<td>800 mm</td>
<td>Capable of heating by quick-heating heater and in wet atmosphere</td>
</tr>
</tbody>
</table>

* Dew point in Dry Room: -30°C

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**Heat Technology Revolution**
Locations

Head Office
3-1-36, Noritake-shinmachi, Nishi-ku, Nagoya, Aichi 451-8501 Japan
- 15 min. walk from Nagoya Station
- 5 min. walk from the No. 2 exit of Kamejima Station
(Subway Higashiyama line)

Tokyo Office
1-13-8, Toranomon, Minato-ku, Tokyo 105-8502 Japan
- 3 min. walk from the No.4 or 1 exit of Toramonon Station
(Subway Ginza line)

Heat Technology Test Center
Komaki Factory
1780 Oaza-mitsubuchi, Komaki, Aichi 485-0075 Japan
- 15 min. by car from Iwakura Station (Meitetsu Inuyama Line)
- 10 min. by car from Meishin Expressway Komaki Interchange
- 10 min. by car from Nagoya Expressway Komaki-kita Interchange
Noritake TCF Co., Ltd. (Head office)
7-7 Shimofuji, Ogakie-cho, Kariya, Aichi 448-0813, Japan
- 10 min. by car from Kariya Station (JR Tokaido main Line)

Miyoshi Office
300 Higashiyama, Miyoshi-cho, Miyoshi, Aichi 470-0293 Japan
- 12 min. by car from Miyoshi Interchange

Engineering Group
Various other machines and devices are also available with us along with the heat-treatment products.

Fluid Technology
(Chemical equipment, Filtration system)
Static mixer and mixing / heating / cooling / reaction systems using the mixer, and filtration system such as filtration equipment, magnet separator, etc.

Machine Technology
Cutting solutions such as sawing machine (Thin Cut Master).

Static Mixer
Magnet Separator
Carbide Tipped Circular Sawing Machine
Safety Precautions

- Consult our agencies or head office to confirm appropriate usage (selection) according to your planned use purposes.
- The specification and appearance are subject to change without advance notice for improvement reasons.
- This catalog lists the standard specification. The shape, dimensions, and materials of the machines may be changed depending on the requested specification by customers.
- The charts and equations used in this catalog are adopted as a reference, and they by no means represent guaranteed figures.
- The color and shape of the machines in the photos in this catalog may differ from those of the real machines. This catalog carries only the photos of selected machines from each series, not all machines.
- For more details, please contact our agencies or head office.