Fact sheet
Indirectly heated Rotary Kilns

Sixteen different rotary kilns are available for your project trials and production needs.

- 12 indirect heated rotary kilns
- Temperature range: 100 – 1,200°C
- Residence time: 15 – 180 minutes
- Reaction modes: continuous, co-current, counter-current, batch
- Typical Processes: pyrolysis, calcination, reduction, surface treatment of catalyst supports

<table>
<thead>
<tr>
<th>Kiln name</th>
<th>Heated kiln length [m]</th>
<th>Inner diameter [m]</th>
<th>Heating type</th>
<th>Temperature range [°C]</th>
<th>Raw material throughput [kg/h]</th>
<th>Mode of operation</th>
<th>Special features</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDO 10</td>
<td>7</td>
<td>1 natural gas</td>
<td>300 – 1,150</td>
<td>100 – 1,000</td>
<td>counter-current</td>
<td>5 heating zones, afterburner</td>
<td></td>
</tr>
<tr>
<td>IDO 9</td>
<td>7</td>
<td>1 natural gas</td>
<td>300 – 1,100</td>
<td>100 – 1,100</td>
<td>counter-current</td>
<td>defined gas atmosphere, 5 heating zones, afterburner</td>
<td></td>
</tr>
<tr>
<td>IDO 11</td>
<td>4.7</td>
<td>0.6 electrical</td>
<td>100 – 1,150</td>
<td>40 – 400</td>
<td>counter-current</td>
<td>inert and reducing, hydrogen-atmosphere, thermal oxidizer</td>
<td></td>
</tr>
<tr>
<td>IDO 3</td>
<td>4</td>
<td>0.5 natural gas</td>
<td>300 – 1,150</td>
<td>25 – 250</td>
<td>counter-current or co-current, batch operation possible</td>
<td>6 heating zones, afterburner</td>
<td></td>
</tr>
<tr>
<td>IDO 6</td>
<td>3.75</td>
<td>0.45 electrical</td>
<td>100 – 900</td>
<td>15 – 150</td>
<td>counter-current</td>
<td>3 heating zones, thermal oxidizer, DeNOx</td>
<td></td>
</tr>
<tr>
<td>IDO 5</td>
<td>3.5</td>
<td>0.4 natural gas</td>
<td>300 – 1,100</td>
<td>10 – 100</td>
<td>counter-current or co-current</td>
<td>defined gas atmosphere, 3 heating zones, afterburner</td>
<td></td>
</tr>
<tr>
<td>IDO 1</td>
<td>3</td>
<td>0.4 electrical</td>
<td>50 – 1,150</td>
<td>10 – 100</td>
<td>counter-current or co-current, batch operation possible</td>
<td>3 heating zones, afterburner</td>
<td></td>
</tr>
<tr>
<td>IDO 2</td>
<td>2.5</td>
<td>0.35 electrical</td>
<td>50 – 1,200</td>
<td>10 – 75</td>
<td>counter-current or co-current, batch operation possible</td>
<td>4 heating zones</td>
<td></td>
</tr>
<tr>
<td>IDO 7</td>
<td>2.3</td>
<td>0.254 electrical</td>
<td>100 – 1,000</td>
<td>3 – 30</td>
<td>counter-current</td>
<td>inert and reducing, thermal oxidizer</td>
<td></td>
</tr>
<tr>
<td>IDO 4</td>
<td>1</td>
<td>0.1 electrical</td>
<td>50 – 1,100</td>
<td>0.1 – 2</td>
<td>counter-current or co-current, batch operation possible</td>
<td>defined gas atmosphere, afterburner</td>
<td></td>
</tr>
<tr>
<td>IDO 8</td>
<td>1</td>
<td>0.1 electrical</td>
<td>100 – 1,400</td>
<td>0.1 – 2</td>
<td>counter-current or co-current, batch operation possible</td>
<td>ceramic &amp; metal tube, defined gas atmosphere, afterburner</td>
<td></td>
</tr>
<tr>
<td>IDO 12</td>
<td>0.9</td>
<td>0.4 electrical</td>
<td>50 – 1,100</td>
<td>ca. 30 l/batch</td>
<td>batch operation only</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Pre- & Post-Processing Equipment

#### Conveying and Dosing Equipment
- Screw conveyors
- Conveyor belts
- Disc conveyors
- Pneumatic conveyors
- Gravimetric dosing unit with screw feed
- Volumetric dosing screws
- Vibration chutes (Vibration conveyors, Gravimetric feeders)
- Dosing belt scale
- Membrane pumps
- Spraying lances
- Rotary feeders
- Displacement and peristaltic pumps

#### Exhaust Gas Treatment
- Thermal afterburners and exhaust gas cleaning
- DeNOx systems to denitrogenize the exhaust gas
- Filter systems to remove dust from the exhaust gas
- Gas scrubbers, venture-scrubbers (wet gas scrubbers) for the removal of particulates and absorbable gases [acidic and alkaline washes]
- Dust analysis in the treated gas, final police filter
- Use of adsorbents to remove acidic components

### Mixing and Granulation Units

<table>
<thead>
<tr>
<th>Type</th>
<th>Number on site</th>
<th>Typical size</th>
<th>Attainable throughput</th>
<th>Material type</th>
<th>Specifications / special characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIRICH Intensive mixer R2</td>
<td>1</td>
<td>Useable vol.: 3.5 l</td>
<td>N/A</td>
<td>Stainless steel</td>
<td>Laboratory mixer</td>
</tr>
<tr>
<td>EIRICH Intensive mixer R09</td>
<td>1</td>
<td>Useable vol.: 150 l</td>
<td>up to 300 kg/h</td>
<td>Stainless steel</td>
<td>Batch mixer, suitable for tests or production</td>
</tr>
<tr>
<td>EIRICH Intensive mixer R11</td>
<td>1</td>
<td>Useable vol.: 250 l</td>
<td>up to 1,000 kg/h</td>
<td>Carbon steel</td>
<td>Batch mixer, suitable for tests or production, automated</td>
</tr>
<tr>
<td>Cone mixer</td>
<td>2</td>
<td>1 x à 1,500 l</td>
<td>up to 480 kg/h</td>
<td>Stainless steel</td>
<td>Batch mixer, suitable for tests or production</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 x à 2,500 l</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lödige ploughshare mixer</td>
<td>5</td>
<td>3 x à 600 l</td>
<td>up to 600 kg/h</td>
<td>Stainless steel</td>
<td>Batch mixer, suitable for tests or production</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 x à 300 l</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 x à 1,400 l</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Screening and Sorting

<table>
<thead>
<tr>
<th>Type</th>
<th>Number on site</th>
<th>Attainable throughput</th>
<th>Mesh dimensions</th>
<th>Specifications / special characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-deck screening machine</td>
<td>1</td>
<td>up to 1,000 kg/h</td>
<td>0.1 mm to 7 mm</td>
<td>7 decks</td>
</tr>
<tr>
<td>Vibration-screening machine</td>
<td>1</td>
<td>up to 590 kg/h</td>
<td>40 µm - 1,000 µm</td>
<td>2 decks / ultrasound cleaning</td>
</tr>
<tr>
<td>Vibration-screening machine</td>
<td>1</td>
<td>up to 350 kg/h</td>
<td>40 µm - 1,000 µm</td>
<td>2 decks / ball cleaning</td>
</tr>
<tr>
<td>Round-vibration sieve</td>
<td>1</td>
<td>up to 350 kg/h</td>
<td>40 µm - 1,000 µm</td>
<td>2 decks / ultrasound cleaning</td>
</tr>
<tr>
<td>Single deck sieve</td>
<td>2</td>
<td>up to 100 kg/h</td>
<td>0.2 mm to 5 mm</td>
<td>1 deck / only for removal of oversized and undersized particles</td>
</tr>
</tbody>
</table>

### Laboratory Facilities

#### Experimental Kilns
- A gradient kiln of our own design is used to simulate processing conditions in industrial direct kilns (dynamic laboratory kiln, max. 1,500 °C)
- Pivot kiln (Carbolite) with a modifiable atmosphere, simulating sample movement (max. 1,100 °C)
- High-temperature microscope with automatic image analysis (HTM) for the determination of melting and expansion behavior (max. 1,600 °C)
- A large number of muffle furnaces (max. 1,600 °C)

#### Mineralogical Analysis
- Phase analysis using X-ray diffraction / XRD (Bruker D2 Phaser), including Rietveld analysis

#### Chemical Analysis
- Digestion (among others: fusion, microwave, acidic)
- Optical emissions spectroscopy [ICP-OES / ICP-iCAP]
- Atomic absorption spectrometer (F-AAS)
- Complexometric titration
- Colorimetry
- Photometry
- Potentiometry
- Gravimetric analysis
- Elemental analysis

#### Processing Technology
- 2 agitator bead mills (Netzsch Zeta RS & LabStar)
- Spray drying (GEA Niro Minor)
- Cryomilling
- Homogenization
- Dispersing
- Stirring
- Drying
- Centrifugation

#### Fuel Analysis
- Elemental analysis (CHS & CHNS)
- Proximate analysis
- Ash analysis
- Calorific value measurement
- Ash melting characteristics (HTM)

#### Physical Analysis
- Specific surface area (Brunauer-Emmett-Teller, BET) by N2 adsorption
- Pore size distribution and pore radius distribution
- Dynamic and static laser granulometry with a laser diffractometer, in situ [particle size analysis / PSD]
- Sieving analysis
- Determination of particle size, particle shape, particle distribution and strength
- Color value measurement
- Density analysis
- Light microscopy with digital image analysis