EQUIPMENT PROFILE

MINI SINTERING PLANT
SKP® PROCESS

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THE MINI SINTERING PLANT - SKP® PROCESS

The Mini Sintering Plant - SKP® Process was developed by MINITEC MINITECNOLGIAS aiming low capital investment as well as low operating and maintenance costs, high flexibility and easy operation and maintenance. Its flexibility allows agglomerating all kinds of ore fines, like iron ore, manganese ore, nickel ore, cassiterite and others, obtaining a good quality sinter. Even very fine materials (below 100 meshes) can be sintered. Due to its characteristics, many plant wastes - such as scales, dusts, slags, powders etc - may be recycled in this process. Hazardous wastes are recycled under environmentally safe conditions. Special treatment of the flue gas can be added, to eliminate hazardous substances like NOx, SOx, dioxin, etc.

Conventional sintering is done on a moving grate, as a continuous process. Historically, the sintering process started as a batch process, in stationary pans. The new process developed by MINITEC MINITECNOLGIAS is a semi-continuous one, consisting of a number of pans in a carrousel arrangement, which are successively fed, ignited, processed and discharged, turning in a circle. All steps are fully controlled by a supervisory station making the operation fully automatic.

This is the MINITEC MINITECNOLGIAS Mini Sintering Plant - SKP® Process.

1. DESCRIPTION OF THE SKP® Process:

The equipment described below corresponds to the standard configuration. This configuration can be adapted to match clients’ or raw materials requirements. Burden preparation, mixing station, sinter cooling and sinter screening (with an eventual secondary crushing) can be adapted.

The sintering process starts with the preparation of the raw mix, consisting of ore fines, fluxes, in-plant waste material, fuel and return fines. These materials are mixed in a revolving drum and water is added in order to reach proper micropelletizing of the raw mix and obtaining adequate permeability. The raw mix is carefully conveyed to the sintering machine to ensure that permeability is maintained. A layer of controlled size sinter (bedding) is fed to the pans bottom for protection of the grate. After this the raw mix is fed and leveled.

Thereafter the surface of the raw mix is ignited using gas or oil burners. Air is sucked through the ignited layer from the pan bottom and sintering proceeds downward in the material bed. Gas circuit is fully leakproof, not allowing false air to be sucked by the system. This saves power in the waste gas circuit.

Subsequently, the sinter cake is discharged into the crushing station. After the sinter cake is crushed to a pre-determined maximum particle size it is discharged onto a metallic conveyor, which transfers the hot sinter from crusher to sinter cooling bin.
The screening station, where product sinter, bedding and return fines are separated, is located under the sinter cooling bin. Return fines, not suitable for downstream processing, are conveyed to a bin for recycling in the sintering process.

The product obtained from the sintering process presents good quality characteristics for downstream process, such as:

- Chemical analysis
- Grain size distribution
- Reducibility
- Sinter strength

A supervisory station controls all steps of the sintering process. From the control room the operator has full control of the entire plant through the PC terminals.

**MINITEC MINITECNOLOGIAS Mini Sintering Plant** is designed to fulfill all aspects of environmental protection. Appropriate dedusting units are provided for cleaning the waste gas generated during the sintering/cooling processes as well as for burden preparation. If required, DeSOx, DeNOx and dioxin treatment systems can be provided to meet environmental requirements, and even more complex flue gas treatments may be applied in case of agglomeration of hazardous wastes.

MINITEC MINITECNOLOGIAS approach to the sintering technology is oriented to match the downstream process requirements, like Mini Blast Furnaces, Electric Arc Furnaces (metallurgical industries) etc. Emphasis in the design of plant and equipment is given towards fulfilling the requirements of the sintering process, in terms of quality and quantity.
2. ADVANTAGES

The advantages of the MINITEC MINITECNOLIGIAS Mini Sintering Plant are:

- Low specific investment
- Waste gas leak proof system
- Excellent sinter quality
- Full process automation
- Low production cost
- High operational flexibility
- Maintenance-friendly design
- Compact plant
- Short erection schedule

3. PLANT DESIGN AND CONSUMPTION FIGURES:

Mini Sintering Plants - SKP® Process are designed to cater the fluctuating demands on production requirements. It is even possible to operate the carousel type MSP for one or two shifts per day only.

MINITEC MINITECNOLIGIAS Mini Sintering Plants are available in the following sizes and capacities:

<table>
<thead>
<tr>
<th>Model</th>
<th>Sintering Area</th>
<th>Rated production</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKP 50</td>
<td>6 m²</td>
<td>150 tpd</td>
</tr>
<tr>
<td>SKP 100</td>
<td>12 m²</td>
<td>300 tpd</td>
</tr>
<tr>
<td>SKP 150</td>
<td>18 m²</td>
<td>450 tpd</td>
</tr>
<tr>
<td>SKP 200</td>
<td>24 m²</td>
<td>600 tpd</td>
</tr>
<tr>
<td>SKP 250</td>
<td>30 m²</td>
<td>750 tpd</td>
</tr>
<tr>
<td>SKP 300</td>
<td>36 m²</td>
<td>900 tpd</td>
</tr>
</tbody>
</table>

Production capacity shown above is based on sintering of iron ore. For other materials the production rate may change due to their specific characteristics.

Standard availability: 330 days per year
Basicity CaO/SiO2: from 0,5 to 2,5
Bed height: 400 to 600 mm
Suction: 1600 mmWG
Return fines rate: 25 - 35%
Rate of return fines will depend upon the material characteristics.

**Typical data for iron ore sintering:**

Consumption (per ton of product sinter):
- Fuel consumption (LPG): 0,8 Nm³/t
- Electrical power: 40 kWh/t
- Process water: 0,1 m³/t
- Labor for operation and maintenance (4 shift basis): 16 total (maximum)
- Specific output: 20 - 30 t/m² 24 h

Raw material requirement per ton of product sinter:
- Iron ore fines (- 8 mm): 930 kg
- Limestone (- 3 mm): 100 kg
- Coke breeze (- 4 mm): 50 to 60 kg
- Charcoal fines (alternative) (- 4 mm): 70 to 90 kg
- Flue dust: > 30 kg
- Return fines (- 6 mm): 420 kg

Sinter Quality:

<table>
<thead>
<tr>
<th>Index</th>
<th>Coke</th>
<th>Charcoal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shatter (JIS) (+ 9,52)</td>
<td>%</td>
<td>75 - 85</td>
</tr>
<tr>
<td>RDI (- 2,83 mm)</td>
<td>%</td>
<td>28 - 30</td>
</tr>
<tr>
<td>FeO</td>
<td>%</td>
<td>5 - 8</td>
</tr>
</tbody>
</table>

Note: All above data are indicative and may change from case to case.

4. **DESCRIPTION OF THE MINITEC MINITECNOLOGIAS MINI SINTERING PLANT FEATURES**

The main areas in the Mini Sintering Plant are:
- Burden preparation
- Mixing and nodulizing drum
- Sinter machine, carousel type
- Sinter cooling system
- Sinter plant automation
- Environmental pollution control
4.1. **Burden Preparation**

The number of day bins installed is related to the number of raw materials to be used. Typically, for iron ore the day bin area has the following configuration:

- Iron ore fines 1
- Iron ore fines 2
- Iron ore fines 3
- Coke breeze
- Limestone
- Return fines
- Flue dust

There are two possible configurations for the burden preparation system:

- Continuous feeding system: an extracting and dosing belt conveyor is installed below each day bin. The mixing drum feeding belt conveyor is fed continuously. In this case the mixing drum is of the continuous type.

- Batching feeding system: a vibrating feeder and a weighing bin are installed below each day bin. The mixing drum feeding belt conveyor is fed in batches. In this case the mixing drum is of the batching type.

In any case the system is automatically controlled by means of the supervisory station.

4.2. **Mixing and Nodulizing Drum:**

![Batching type Mixing and Nodulizing Drum](image)
Mixing and nodulizing of the raw mix is performed in a drum specially developed for this purpose. Nodulizing of the raw mix is achieved by special lifters. Filling degree and retention time of the raw mix in the drum ensure an optimum mixing and nodulizing effect. According to the plant configuration required the mixing drum can be of the continuous or batching type.

The supervisory station automatically controls water addition in the Mixing and Nodulizing Drum.

4.3. The Sintering Machine

The MINITEC MINITECNOLOGIAS Carrousel Type Mini Sintering Plant consists of a circular machine, with a series of pans installed side by side. The pans are the rotating part of the machine.

In the first phase of the process the bedding is fed into the pan, covering uniformly the grate bars.

In the second step, the raw mix is also fed uniformly over the bedding, assuring the correct layer thickness and proper leveling.

In a third and optional step a thin layer of coke breeze or charcoal fines is fed covering the entire raw mix surface. This last layer will make the raw mix ignition faster and save solid and gas fuel.

The pan is then positioned under the ignition hood, where ignition of the raw mix takes place. During further rotation of the machine the sintering process is completed.

Finally the pan is tilted and the sinter cake is fed to the crushing station, where it is crushed and then conveyed to the cooling bin.

The cooled sinter is unloaded on screening station, in order to separate the product sinter, bedding and return fines.

The suction system consists of a set of ducts, individually connected to the bottom of each pan, and rotates with the carrousel. At the center there is a collector, connected to a fixed pipe by means of a rotating leakproof joint. From this collector the exhaust gas passes through the gas cleaning system, the suction blower and is discharged to the atmosphere. Each individual duct is outfitted with a control valve, allowing presetting any desired suction profile.

The supervisory station automatically controls all steps in the Sintering Machine.
4.4. Feeding Station

- **Bedding:**
  The hearth layer is discharged via conical roller with a height-adjusting gate. The gate opening determines the height of the hearth layer on the pallet.

- **Raw Mix:**
  The hopper outlet is equipped with an adjustable gate for raw mix flow control. The material is discharged by means of a conical roller. The design is in accordance with the flow characteristics of each raw mix in order to control segregation.

- **Coke Breeze/Charcoal Fines for ignition (optional):**
  A conical roller feeds anthracite or charcoal fines Coke breeze, over the raw mix surface, in a thin layer. The aperture of the gate opening controls the layer thickness.

4.5. The Ignition Hood

Proper burners, installed at the refractory lined ignition hood achieve ignition. Basically all kind of gaseous and liquid fuels can be used for ignition. The ignition hood warrants a uniform ignition across the pans surface.
4.6. Sintering Machine Discharge Station

The pans are automatically discharged, once they reach the discharge station, by means of a special hydraulic device. The sintering pans discharge the sinter onto a crushing deck from where a spiked roll crushes the sinter to the desired maximum size. The Discharge Station consists on:

- Crushing deck, specially designed and equipped with wear resistant material for long service life
- Spiked roll crusher fitted with crushing arms
- Crusher drive with AC motor, safety coupling and special gear box
- Hydraulic tilting system

4.7. Sinter Cooling System

Cooling of hot sinter is accomplished into a Cooling Bin, of special design, by blowing up air through the bed of crushed sinter to be cooled down. The necessary cooling air is delivered by the blower system connected to the metallic bin.

An alternative for the Cooling Bin is a Metallic Cooling Conveyor, which cools down the crushed sinter while conveying same to the screening station.

4.8. Sintering Plant Automation

Operation of the sintering plant is remotely controlled and monitored from a central control room. This concept allows:

- A continuous observation and assessment of the process and the operational status of the machines and equipment.
- A correction or adjustment, if necessary, of the actual conditions to set point or other required values.
- Plant operation with a minimum of personnel.

The automation system is based on micro-processor equipment.

4.9. Environmental Pollution Control

MINITEC MINITECNOLOGIAS Mini Sintering Plants are adequately designed and equipped with all required devices in order to meet environmental regulations. For the dedusting of the flue gas generated during the sintering process a wet scrubber system is installed. Water used in this system is fully recirculated through a water treatment system.

For dust collecting from raw material handling, screening station and sinter cooling bin, a bag filter system is installed in order to achieve high dust collection efficiencies. Processes for limiting the SOx, NOx and dioxin emissions are available, as well as more elaborate flue treatment processes whenever required.
5. IMPLEMENTATION SCHEDULE

Due to the equipment simplicity of the SKP Sintering Process, the total implementation time, including engineering and designing phases, is relatively short.

6. ANNEXURE

Typical MINITEC MINITECNOLOGIAS Mini Sintering Plant flow sheet.

SKP® PROCESS THE MOST FLEXIBLE AND CHEAPEST SOLUTION FOR SINTERING ANY KIND OF ORE FINES AND WASTE MATERIAL.

MINITEC MINITECNOLOGIAS SCOPE OF SUPPLY IN MINI STEEL PLANT AND METALLURGY FIELDS

- Feasibility Studies
- Supply in full or partial turn key
- Coordination and management for implantation
- Training
- Complete technical support

OTHER EQUIPMENT PROFILES

- Mini Sinter Plants with capacity ranging from 50,000 to 300,000 tpy
- Mini Blast Furnaces of 125,135,175, 215, 250 and 350 m3 working volume
- Pulverized Coal Injection (PCI) for MBF
- Stock level indicator for MBF
- Air dehumidifying system for MBF blast
- Mud Gun and Tap Hole Drill
- HMLR – Hot Metal Ladle Refining

For more detailed information please contact:

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