

# Densit® wear protection in **The steel industry**

- ensures continuous operation of critical components



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**Continuous operation is essential to maximise return on investment in the steel industry. To run economically, maintenance costs must be minimised throughout the production line, requiring engineering skill and reliable components so that shutdowns can be scheduled.**

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In particular the heart of the process, the blast furnace, must always run as first priority. Unscheduled shutdowns must be avoided, primarily to avoid production loss but also to minimise maintenance costs. Keeping energy consumption low is also an important factor in running an economical plant, affecting many aspects of process flow and component selection. Compliance with environmental performance legislation is an increasing and vital priority.

Densit® wear protection systems is a useful tool in the ongoing battle for continuous improvement and constant minimisation of operating costs. Reliable wear linings are essential for effective maintenance planning, and a Densit® solution offers both reliability and long life: less frequent planned maintenance, no unscheduled maintenance and no unexpected leaks. Densit® wear protection systems can be designed to minimise heat loss in components, ducts and pipes.

## DENSIT® ECONOMY WITH SEAMLESS AND FLEXIBLE LININGS

The intrinsic nature of Densit® wear lining systems means that they are completely jointless, and can be formed into any geometry. This flexibility provides the capability for installing seamlessly graduated eccentric linings of variable thickness. In this way the most economical lining solution is achieved, thicker protection being applied where wear is most extreme, and thinner protection where less wear occurs, with smooth graduation in between. This feature is particularly recommended for lining components such as pipes, ducts and cyclones, where wear exposure varies within the component. For the same reason, eccentric linings are especially recommended for pipe bends.

### IN-SITU INSTALLATION

Densit® wear protection is applied by casting, trowelling or spraying, depending upon the component size and geometry. Densulate insulated linings are suitable for high-temperature applications where minimising heat loss is critical.

### DENSIT® COMPONENTS

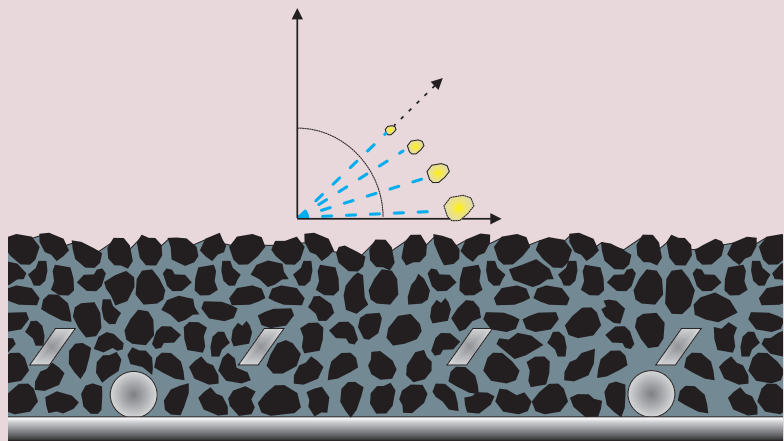
Pre-lined Densit® components in any geometry are also available, for situations where in-situ lining is impractical or uneconomical.

## General Technical Guidelines

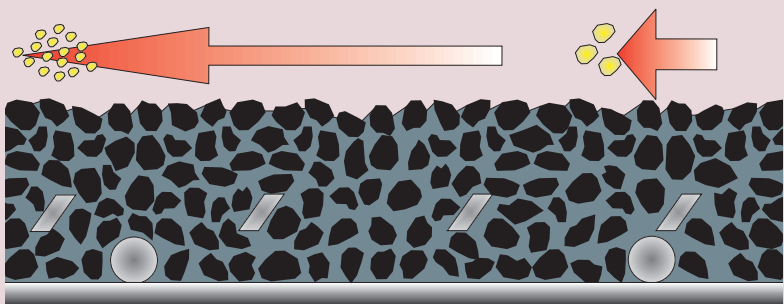
The lifetime of Densit® wear protection increases with reduction in particle size, slower particle velocity, and a smaller angle of particle impact.

Wear rates increase exponentially with particle velocity.

Wear rates increase with hardness and angularity of particles, determined by media mineralogy and physical form.



Relation of particle size to angle of incidence

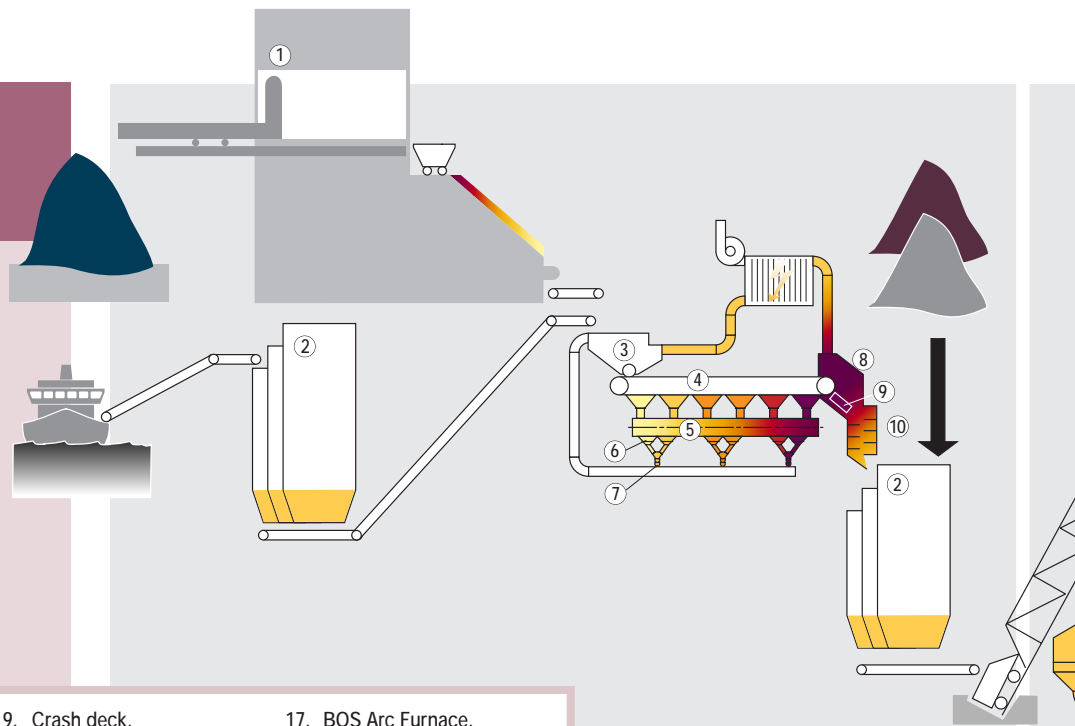


Relation of particle size to air velocity

**Densit** 

# FLOW SHEET

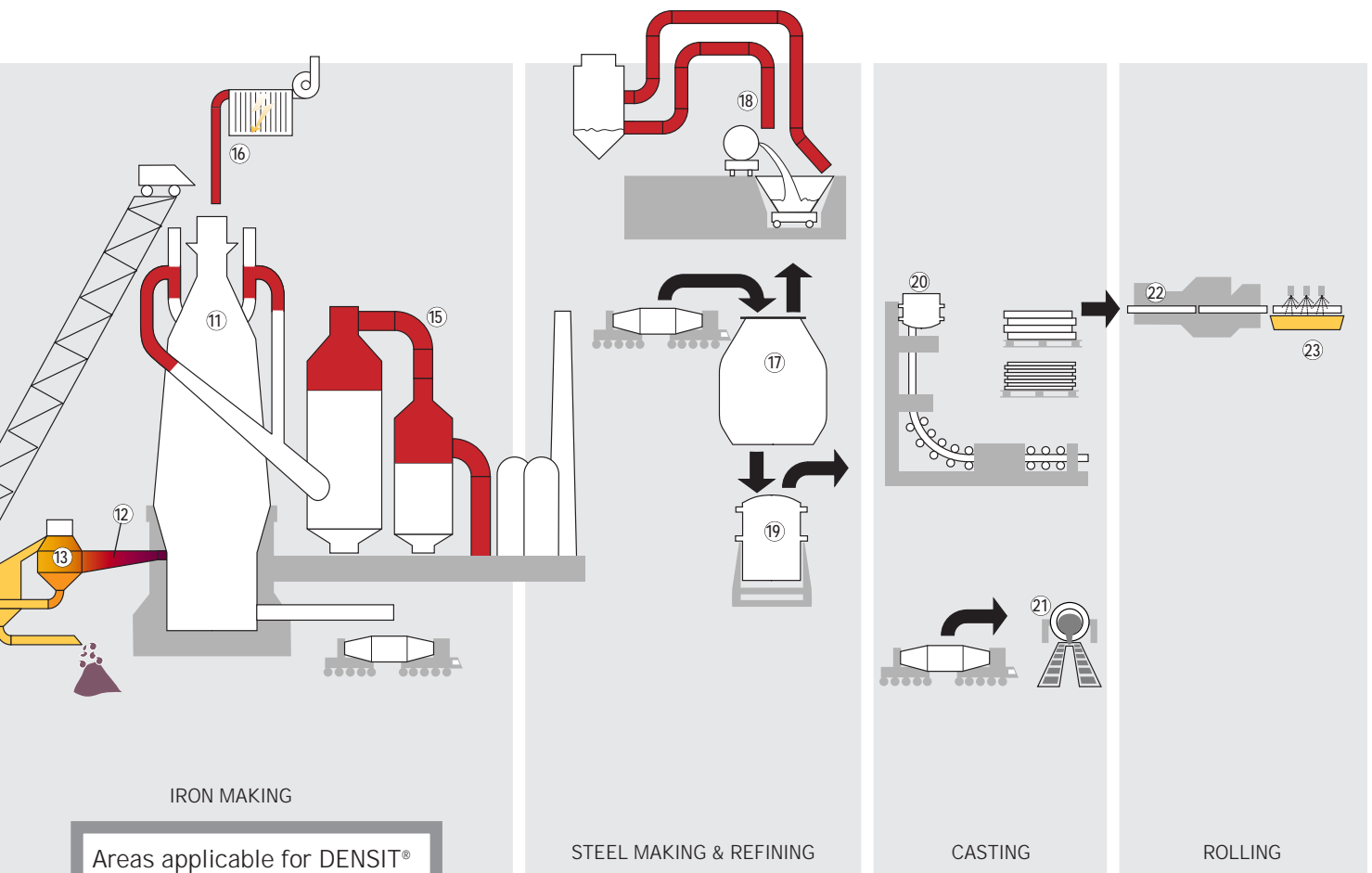
Typical process flow in the steel industry, showing components where Densit® wear-resistant linings are installed.



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|------------------------|-------------------------------|-------------------------|
| 1. Coke battery.       | 9. Crash deck.                | 17. BOS Arc Furnace.    |
| 2. Blending bunkers.   | 10. Spider chute.             | 18. Flue gas scrubbing. |
| 3. Mixer drum.         | 11. Blast furnace.            | 19. Steel refining.     |
| 4. Sinter strand.      | 12. Cold runner.              | 20. Continuous casting. |
| 5. Wind main.          | 13. Slag granulation system.  | 21. Pig iron casting.   |
| 6. Down comers.        | 14. Dewatering drum.          | 22. Cold rolling.       |
| 7. Double cone valves. | 15. Dust catchers.            | 23. Sluiceways.         |
| 8. Crash deck hood.    | 16. Blast furnace de-dusting. |                         |

BURDEN PREPARATION

COMPONENT	PROCESS PARAMETERS	MEDIA TYPE	TYPICAL SERVICE TEMP.	RECOMMENDED DENSIT® SOLUTION
<b>Bunkers, blending bunkers, hoppers</b>	Storage and blending of raw materials.	Iron ore, coal coke, various minerals.	Ambient.	WearFlex/Cast 500 or WearFlex/Cast 2000 depending on media type.
<b>Pipes, ducts and bends, chutes</b>	Transport of process air, groundmedia, flue gases, containing dust in variable concentrations.	Water, coal, coke, iron ore, dolomite, various minerals, steel.	Up to 1000°C (1830°F)	WearFlex/Cast 500 or WearFlex/Cast 2000 depending on media type. WearFlex/Cast 2000 HT for T>400°C. Densit® components cater for all geometries. Above Ø600 mm, in-situ trowelled solutions are an option. Eccentric lining recommended to provide longer wear resistance in most exposed sections.
<b>Electrostatic filters</b>	Transport of sinter dust and blast furnace burden dust.	Coal, coke, iron ore, dolomite, various other minerals, steel.	Up to 150°C (300°F)	WearFlex/Cast 500 or WearFlex/Cast 2000 depending on media type.
<b>Coke plant Coke ramp, coke apron.</b>	Cooling and transport of coke to bunkers.	Coke.	400°C (750°F) or above.	WearFlex/Cast 2000 and WearFlex/Cast 2000 HT depending on the process.
<b>Sinter strand Crash deck and hood, wind main, mains de-dusting.</b>	Critical continuous operation. Sintering and transport of feed to blast furnace.	Iron ore, coke, dolomite, various minerals.	Up to 1200°C (2190°F)	WearFlex/Cast 2000 and WearFlex/Cast 2000 HT depending on the section of the process.
<b>Blast furnace hood and de-dusting</b>	Critical continuous operation. Iron making.	Iron ore, coke, dolomite, various other minerals.	Up to 800°C (1470°F)	WearFlex/Cast 2000 and WearFlex/Cast 2000 HT.
<b>Blast furnace slag granulation system</b>	Critical continuous operation.	Water, iron ore, coke, various minerals, slag, molten iron.	Up to 1200°C (2190°F)	WearFlex/Cast 2000 and WearFlex/Cast 2000 HT.
<b>BOS arc furnace hood</b>	Steel making.	Steel, slag, dust.	Up to 1200°C (2190°F)	WearFlex/Cast 2000 HT.
<b>Cold rolling mills Sluiceways.</b>	Steel rolling.	Steel, water.	150°C (300°F) or above.	WearFlex/Cast 500 or WearFlex/Cast 2000 depending on media type.



IRON MAKING

STEEL MAKING & REFINING

CASTING

ROLLING

Areas applicable for DENSIT®

Shade matches  
operating  
temperature:

0 – 400°C (32-750°F)
400 – 1200°C (750-2190°F)

### HARBOUR

**General process parameters relevant for wear:**

Wear by iron ore, coal, dolomite, various other minerals.  
Low temperatures.

#### COMPONENTS

Bunkers.

Chutes.

### BURDEN PREPARATION Burden preparation - Coke Plant

**General process parameters relevant for wear:**

Wear by coal and coke.  
High temperatures.

#### COMPONENTS

Coke ramp.

Coke apron.

Cooling tower.

### BURDEN PREPARATION

Burden preparation - Sinter plant

Continuous operation critical.

**General process parameters relevant for wear:**

Processing of iron ore, coke, dolomite, various other minerals.  
Low and high temperatures.

#### COMPONENTS

**The wind main:**

Wind main boxes, selected areas of the wind main, downcomers, double cone valves, mains de-dusting.

**Crash deck:**

Crash deck hood, duct from crash deck hood to sinter roller, crash deck, spider chute.

### STEEL MAKING & REFINING

BOS arc furnace

**General process parameters relevant for wear:**

Processing of molten steel.  
High temperatures.

#### COMPONENTS

Flue gas scrubbers.

Furnace hood.

### IRON MAKING - Blast furnace

Continuous operation critical.

**General process parameters relevant for wear:**

Processing of iron ore, coke, various minerals, molten iron and slag.  
High temperatures.

#### COMPONENTS

**Burden preparation:**

Blending bunkers.

**Blast furnace top:**

Burden dedusting, blast furnace down comers from candle sticks, dust catchers.

**Slag granulation system:**

Cold runner, slow down box walls, slow down box hood, granulation basin, distributor.  
In wet environment.

**Fuel injection:**

Coal injection pipes.

### ROLLING

**General process parameters relevant for wear:**

Wear by steel, mill scale.  
In wet environment.

#### COMPONENTS

Sluiceways.