



OUTOTEC TRAVELING GRATE SINTERING

Outotec Traveling Grate Sintering is based on our extensive experience and continuous R&D in fine-ore preparation and agglomeration. The process is suitable for sintering a wide range of raw materials, including iron, manganese, and nickel ores. Our innovative technologies, including industry-leading process automation solutions, ensure high performance and quality, low investment and operating costs, and reduced energy consumption and emissions.

BENEFITS

- Flexible process suitable for a wide range of fine-grained materials
- Highly efficient gas cleaning reduces atmospheric emissions
- State-of-the art process automation ensures continuous stable production
- Effective heat recovery allows waste heat to be reused in other processes
- Optimal performance and ROI ensured with our lifecycle services



SINTERING INNOVATIONS BASED ON DECADES OF EXPERIENCE AND CONTINUOUS R&D

We have extensive experience in developing innovative technologies for the agglomeration of fine-grained iron ores. Our track record includes over 400 sintering plant projects with daily capacities of up to 20,000 tons. A significant proportion of the world's sinter capacity is produced using Outotec Traveling Grate Sintering. In recent years the Outotec process technology has been responsible for more than three-quarters of the global sinter capacity.

Our innovations focus on improving plant performance and reliability, while reducing capital investment and lifetime operating costs. We have carried out extensive research and testing with a wide range of raw materials and process parameters, and are continuously developing and improving the mechanical design and process automation of our technologies.

At our research facility in Germany we have the capabilities to perform in-depth testing programs to support the continuous improvement of the sintering process – including small-scale pot grate tests and cold agglomeration tests – to improve and optimize existing plant equipment. The small-scale test parameters form the basis of sinter plant design. Sinter parameters are rigorously tested to ensure compliance with international standards such as ISO, ASTM, JIS, and DIN.

Our R&D activities have led to several key advances in sinter production design. One of the most significant is the use of ultra-fine iron ore, pellet feed, or concentrate ($100\% < 50\mu\text{m}$) in sinter plants with minimum productivity loss.

A LIFETIME OF SUPPORT

Outotec is committed to supporting your operations throughout the plant life cycle, helping you achieve and maintain peak performance levels and guaranteeing the best long-term return on your investment. Our global network of service centers covers more than 25 countries and provides lifecycle services for everything from spare parts, maintenance, and technical services to modernizations, operations and maintenance agreements, training, and consultancy.

1. Spares

Our spare parts solutions are designed to maximize production availability throughout the entire lifecycle of your plant. Our solutions range from high-quality OEM spare parts to complete service agreements, and are tailored to your exact needs.

2. Training

We offer an extensive training portfolio for both new plants and existing operations, with tailored training plans that can be followed up with refresher courses after a few years. Professional training supports knowledge transfer and long-term competence build-up for both operations and maintenance. Training plans combine classroom and hands-on teaching.

3. Operation and maintenance

During the operation phase you want to achieve the highest possible production rates. We support this goal in several ways – from basic inspections and maintenance support to continuous site presence and operational responsibility for the entire plant. The various production challenges you face can be systematically targeted through process and metallurgical expertise, as well as maintenance excellence.

4. Modernization

Operating conditions tend to change over time, so the production process and equipment may need to be fine-tuned or modernized to meet new requirements. We maintain a wide portfolio of modernization solutions for sintering technology to ensure you continuously achieve the highest production and quality levels. Whether your challenge concerns the ignition furnace, optimization of mixing or granulation, raw material classification, sinter cooling, gas treatment, or similar issues, we are able to help.

Developing a more sustainable future for sintering

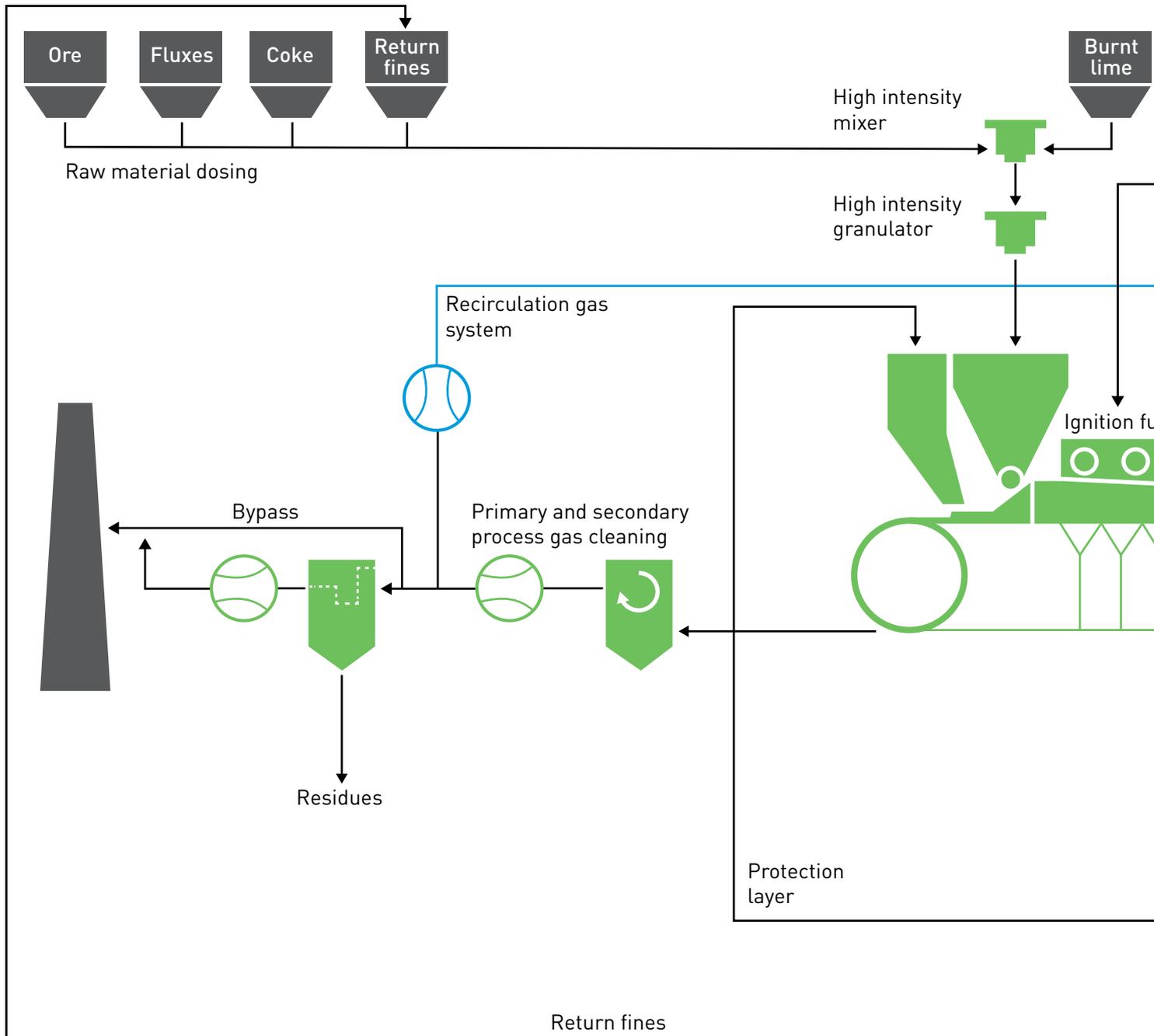
As environmental regulations become increasingly strict, producers around the world are under pressure to reduce the impact of their sintering activities. The Outotec Emission and Energy Optimized Sintering (EOS) process features complete recirculation of the sinter off-gases, which significantly reduces the off-gas volume and therefore the investment costs for secondary gas cleaning. In this process the sinter machine is completely covered with a hood, which significantly reduces pollution by enabling waste gas to be recycled.

The key benefits of an EOS-system are:

- Reduced SO_x and NO_x emissions after primary gas cleaning
- Off-gas volume is reduced by up to 50%, which in turn reduces the CAPEX required for secondary gas cleaning equipment (DeSO_x, DeNO_x)
- The use of post-combusted carbon monoxide from the recirculated off-gas reduces the consumption of solid fuel
- Can be retrofitted at existing sinter plants to ensure compliance with plant operation requirements

The EOS process also helps to reduce operational costs by enabling a substantial reduction in coke consumption. For greenfield projects, the capital investment required is comparable to that of a conventional sintering process, while for retrofit projects the investment required to adapt the existing sintering process is offset by the significant reduction in fuel costs.

THE OUTOTEC TRAVELING GRATE SINTERING PROCESS WITH EOS TECHNOLOGY

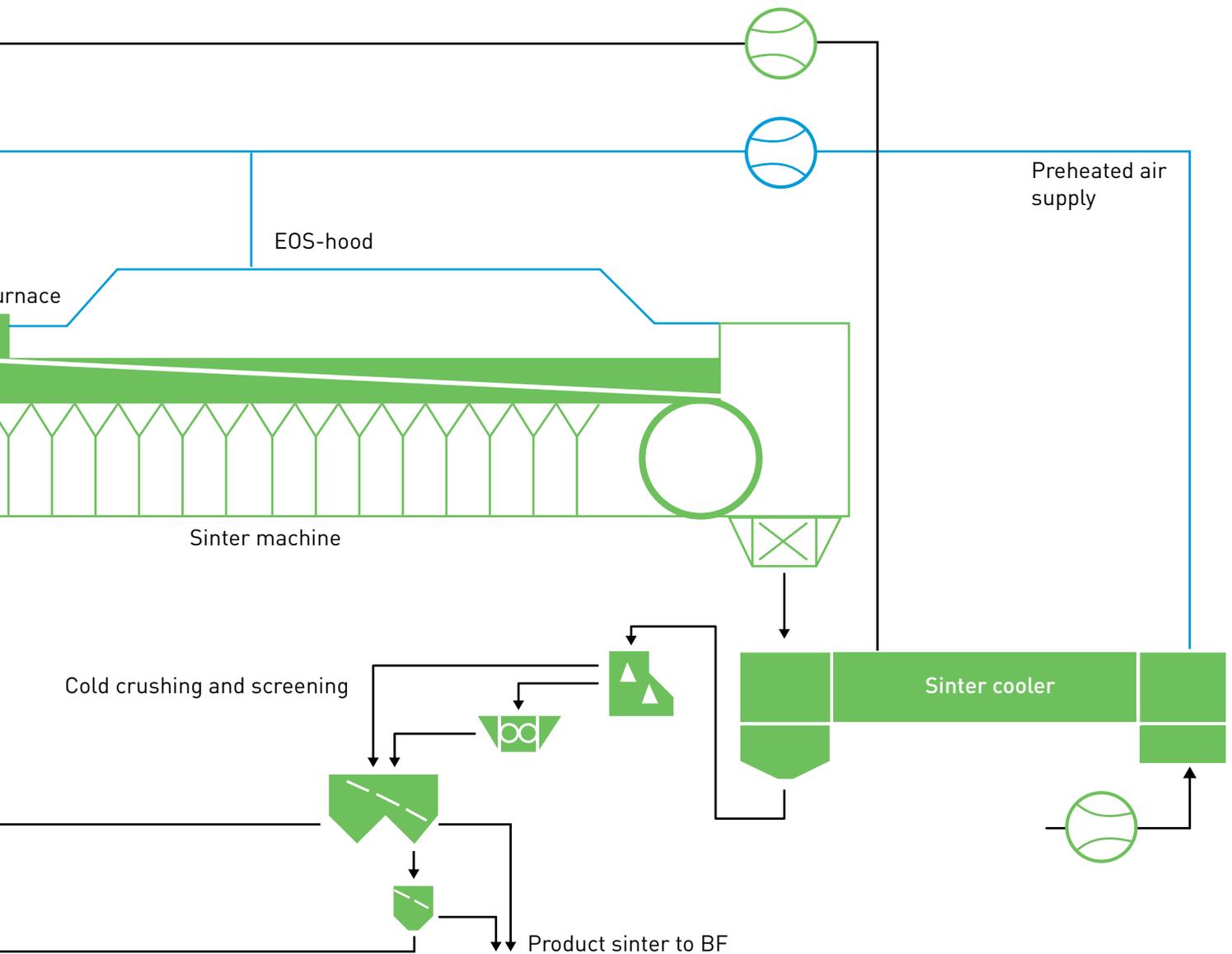


Automated material dosing and feeding

All raw materials are dosed automatically based on the required composition of the overall mix. Water and additional binders are added to achieve the optimal bed permeability. The hearth layer bin is equipped with an adjustable gate that ensures the correct height of the hearth layer. The feed hopper outlet has adjustable gates and variable-roll feeder speed. Ultrasonic sensors control the bed height for optimum productivity.

High-intensity mixing and granulation

Mixing and granulation is performed in two stages by high-intensity bowl-type equipment. These cost-effective and compact machines are extremely effective, especially when processing fine-grained ores. The bowl-type design also helps to prevent any build-up of material inside the mixing chamber. Process water is added in predetermined ratios to achieve the optimum moisture and permeability for the feed mix.



High-performance, easy-to-maintain ignition furnace

The Outotec ignition furnace consists of standardized segments with straight, refractory-lined vertical side walls and a laterally arranged special combustion chamber on each side. The furnace design ensures even temperature distribution and uniform ignition. The large burners are insensitive to dust-laden fuel gases, and the pipe and valve equipment comply with all relevant international safety standards.

Proven, durable pallet car design

Our pallet car design has proven itself in hundreds of plant operations around the world for decades, and we are continuously working to improve it even further.

The pallet cars are designed to suffer minimum wear, giving them a long operational lifespan. The grate bars can be easily removed for maintenance purposes.



OPTIMAL ENERGY EFFICIENCY AND HEAT RECOVERY FOR SINTER COOLING

Outotec Traveling Grate Sintering features a number of innovations designed to maximize the energy efficiency of sintering operations and reduce emissions. The sinter cooler has a circular design with forced draft air-cooling, and features a hood that minimizes dust emissions to the surrounding environment. The feed chute design both supports the cooler efficiency and contributes to reduced power consumption. The primary benefits of Outotec sinter cooling are:

- Optimum permeability of the sinter layer on the cooler through segregation
- High cooling efficiency due to high specific volume flow and effective sealing
- Low dust emissions due to improved material handling and de-dusting hoods
- Efficient friction drives with low power consumption

The waste heat generated during sinter cooling can be reused in a variety of different applications, including:

- To provide preheated combustion air for the burners
- To provide hot air for the annealing hood
- To generate hot water and steam for process and heating purposes
- For power generation up to 6 MW



ADVANCED PROCESS CONTROL AND AUTOMATION FOR STABLE, CONTINUOUS PRODUCTION

Our state-of-the-art process control and automation solutions help to ensure stable and continuous production, high availability and reliability, and excellent end-product quality with minimum intervention from operators. Our advanced process control technologies for sinter plants cover the following areas:

- Automatic raw material dosing and water addition to ensure optimal and consistent product quality
- Automatic product basicity calculation for fast and easy product chemistry adjustments
- Automatic ignition furnace control for optimal ignition with minimized gas consumption
- Automatic sinter machine speed control for maximized throughput
- Automatic return fines balance control for optimizing solid fuel consumption while fulfilling the product quality requirements
- Automatic sinter cooler control for optimal product cooling with minimized power consumption
- Advanced IR technology for maximum process control and comprehensive operator support
- Optional level 2 advisory tools integrated with the distributed control system provide maximum operator support while reducing the plant energy consumption and increasing the overall plant efficiency



Outotec provides leading technologies and services for the sustainable use of Earth's natural resources. As the global leader in minerals and metals processing technology, we have developed many breakthrough technologies over the decades for our customers in metals and mining industry. We also provide innovative solutions for industrial water treatment, the utilization of alternative energy sources and the chemical industry. Outotec shares are listed on NASDAQ OMX Helsinki. www.outotec.com