



Use reliable Danfoss drives Lower costs, greater efficiency

Complete VFD range,
meeting metallurgical
industry needs

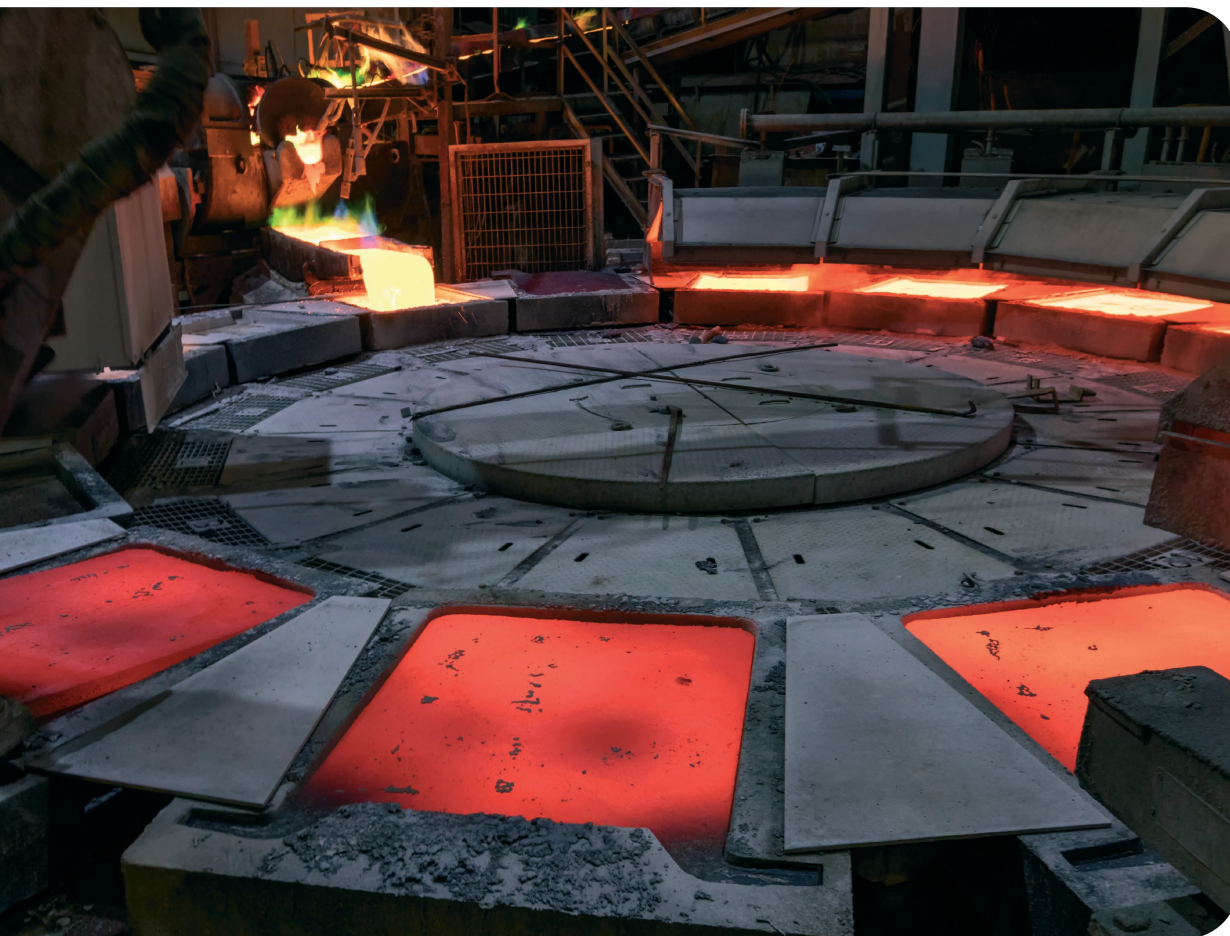


Reduce costs with drives from Danfoss

No matter how well you've optimized your plant design, there's always a way to **drive down costs even more.**

Variable frequency drives (VFDs) ensure efficient operation, delivering energy savings to reduce operating costs. At the same time, they extend equipment lifetime, optimize processes, and reduce maintenance requirements.

The VFD sits between the electrical supply and the motor. It controls the electrical motor speed by changing the frequency and voltage of power supplied to the motor. Power from the electrical supply goes into the VFD which then regulates the power that is fed to the motor. The result? Instant energy savings



Did you know...

there are variable frequency drives (VFDs) designed specifically to meet the needs of the metals sector.

These drives are designed to cope with extreme conditions, heavy loads and controllers that are installed a long distance away. By using iC7, VLT® and VACON® drives from Danfoss, you can often reduce the cost of other equipment.

Expertise – the benefit of an experienced partner

Want a partner who understands your issues in depth?
And who can give you the winning edge?

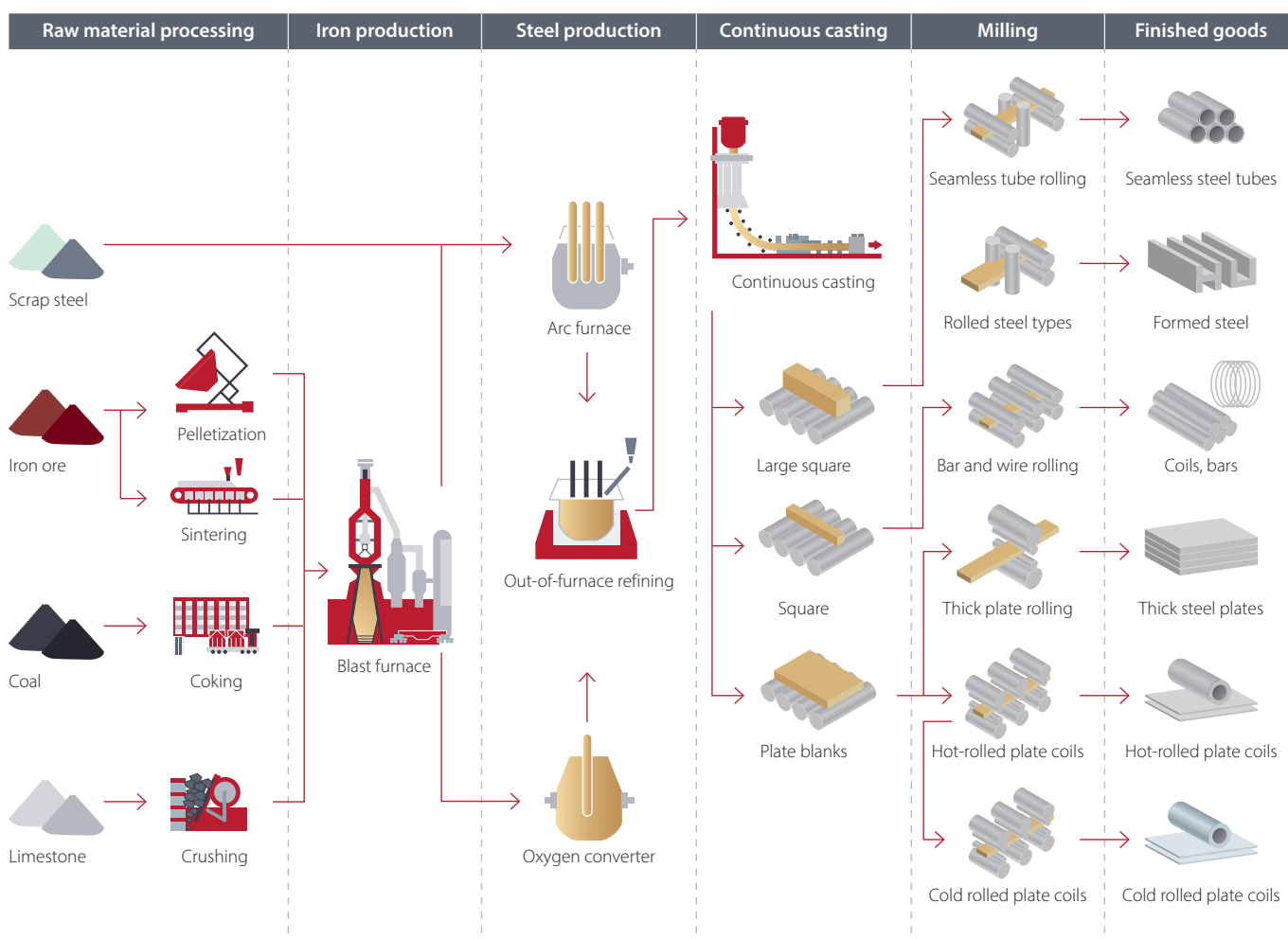
With the most specialized drive solutions and expertise in the metallurgical industry, Danfoss Drives can be your most valuable partner in developing competitive solutions.

Optimized product applications ensure that Danfoss drives meet the application requirements of metallurgical drive equipment, while optimized solutions save on equipment costs and operational maintenance costs.

Whatever low voltage drive you require, we can deliver it, on time, no matter where you are located. Danfoss drives operate reliably over decades of use in harsh environments, thereby saving maintenance costs, ensuring better asset availability and providing you with the lowest cost of ownership.

All our drives integrate seamlessly into all common PLC fieldbus networks.

Drives from Danfoss are fully compatible with all typical motor makes and types.





Enhance ESG with drives from Danfoss

In metal industries, where energy-intensive processes are the norm, integrating Danfoss drives offers a strategic advantage in advancing environmental, social, and governance (ESG) goals.

Variable frequency drives (VFD) enable precise motor control and energy optimization, significantly reducing electricity consumption and associated CO₂ emissions – directly supporting environmental objectives.

By improving operational efficiency and reducing maintenance needs, VFDs also contribute to safer working conditions and long-term cost savings, aligning with social and governance priorities. For metallurgical plants aiming to decarbonize and future-proof their operations, VFDs from Danfoss are a key enabler of a more sustainable and responsible industrial footprint.

How do VFDs reduce energy consumption – and the electricity bill?

Variable frequency drives (VFD) sit between the electrical supply and the motor. These VFDs control the speed of an electrical motor by changing the frequency and voltage of power supplied to the motor.

Power from the electrical supply enters the drive. The drive then regulates the power that is fed to the motor. This means the motor no longer runs at continuous full speed. Instead, average motor speed is lower, because the motor follows fluctuating demand, continuously adjusting to run at the right speed to match the load. As a result, the motor consumes much less energy – which also cuts the power bill.

Powering performance in steel: Danfoss drives for metallurgical excellence

In the demanding world of steel production, Danfoss drives deliver unmatched reliability, efficiency, and control. Engineered for the toughest environments, our variable frequency drives (VFDs) are the smart choice for every stage of metallurgical operations – from rolling mills to arc furnaces.

Smart fault diagnostics

Quickly identify and resolve VFD faults in rolling mill motors with intuitive interfaces and advanced troubleshooting tools.

Precision motor control

Optimize induction motor performance with flexible parameter settings tailored for the high demands of steel plants.

High-torque, heavy-duty

Built for power, Danfoss drives excel in high-torque applications like arc furnaces and conveyor systems – ensuring smooth, reliable operation.

Clean power, fewer harmonics

Integrated harmonic mitigation keeps your power system stable and compliant, even in large-scale industrial setups.

Built for earsh Environments

With a comprehensive preventive maintenance checklist and rugged design, Danfoss drives thrive in extreme conditions.

Seamless SCADA integration

Real-time monitoring and control made easy – connect effortlessly with your SCADA systems for smarter plant management.

Energy efficiency that pays off

Cut energy costs in blower and variable load systems with intelligent drive control that adapts to your process needs.



Grow your green steel business – with Danfoss

Green steel is a revolutionary approach to steel production that aims to significantly reduce or eliminate carbon emissions compared to traditional methods.

At Danfoss, we are committed to playing a crucial role in the transition to sustainable steel production. Which technologies are you using? Hydrogen-based steelmaking, direct reduced iron (DRI) production using natural gas or hydrogen, integration of electric arc furnaces (EAFs) with renewable energy sources, or implementing carbon capture, utilization, and storage (CCUS) solutions?

With our expertise and cutting-edge technologies, we offer solutions to support them all. Apply Danfoss drives and power converters to ensure

efficient and environmentally friendly steel production, paving the way for a greener future.

- **Hydrogen-based steelmaking:**

Danfoss power converters ensure efficient electrolysis

- **Direct reduced iron (DRI) production using natural gas or hydrogen:**

Robust Danfoss drives are equipped with 3C3 coated boards to ensure longer life of the drive in a dusty and corrosive gaseous environment

- **Integration of electric arc furnaces (EAFs) with renewable energy sources:**

Highly efficient Danfoss drives reduce operational cost and strain on the grid

- **Implementing carbon capture, utilization, and storage (CCUS) solutions:**

Danfoss can optimize motor performance of compressors and pumps to typically reduce energy consumption by up to 50%



Robust, reliable VFDs for the metals industry

Flexible applications

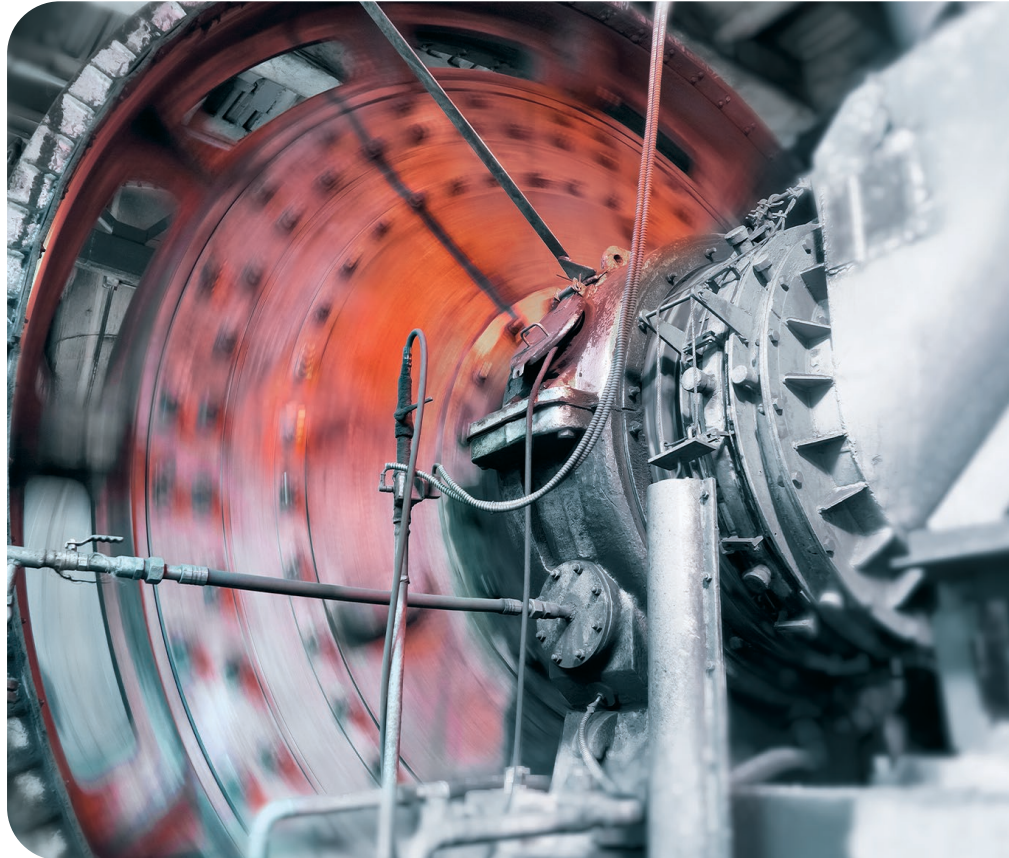
Danfoss drives meet the demands of all stages of metallurgical production.

Easy installation

They are available as standard in a wide range of wall-mounted and floor-standing, IP and NEMA/UL-type-rated chassis to meet your specific installation needs, and air-cooled and liquid-cooled modules for integrating into your metallurgical equipment.

Extremely flexible

Drives for regenerative applications and a wide range of harmonic mitigation products provide you with optimum solutions to meet your requirements.



iC7 series

- Air-cooled and liquid-cooled drives (0.37-2700 kW)
- Power converters (170-6400 A)
- Frequency converter and enclosed drives
- Active front-end drives
- Grid converter
- DC/DC converter
- Hybridization and energy storage
- Electrolysis for Power-to-X
- Power options
- Software tools

VLT®

- Frequency converters (0.18-1400 kW)
- Decentral drives
- Integrated Servo Drive
- Soft starters
- Power Options (filters)
- Software tools

VACON®

- Air-cooled and liquid-cooled drives (0.75-6000 kW)
- Decentral drives
- Active front-end drives
- Industrial system drives
- Grid converter
- DC/DC converter
- Hybridization and energy storage solutions
- Customer-specific drives
- Software tools

Product portfolio

Communications functionality

This legend indicates the communication interface and fieldbus protocol functionality which is specific to each product. For details, please refer to the individual product brochures.



Integrated

(Fieldbus or communication protocols)

BAC	BACnet (MSTP)
ASi	AS interface
META	Metasys N2
MOD	Modbus RTU
TCP	Modbus TCP
BIP	BACnet/IP
N2	N2 Metasys
FLN	FLN Apogee
FC	FC Protocol

Optional

PB	PROFIBUS DP V1
PN	PROFINET
PL	POWERLINK
DN	DeviceNet
CAN	CANopen
AKD	LONworks for AKD
LON	LONworks
BAC	BACnet (MSTP)
TCP	Modbus TCP
EIP	EtherNet/IP
ECAT	EtherCAT
DCP	DCP 3/4
DSP	CANopen DSP 417
BIP	BACnet/IP with MQTT UDMI
ASi	AS interface
OPC	OPC UA

iC7-Automation

Whatever the environment, the iC7-Automation delivers the reliability and performance you need. With connectivity, security and intelligence, this premium drive lets you take advantage of the latest in Industrial IoT.

Efficient and future-proof

iC7-Automation gives you a whole new way to optimize your system with selectable communication protocols and Safe Torque Off (STO) SIL3 as standard. The modular control platform allows you to expand functionality to meet your needs.

More precise than ever

Get superior shaft performance even at low speed, in open or closed loop. Commission fast with Automatic Motor Adaptation at standstill. Depending on your requirements, use the relevant application software: *Industry or Motion*.

Power range

Frequency converters:
 3 x 380-500 V AC 0.37-710 kW
 Air-cooled system modules:
 3 x 380-500 V AC 200-2700 kW
 Enclosed drives 6-pulse, LHD and regen:
 3 x 380-500 V AC 110-1400 kW

Fieldbus

PN	EIP	ECAT	TCP	OPC
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Enclosure

IP00	IP20	IP21/Type 1
■	■	■ ¹⁾
IP54	IP55/Type 12	IP66/Type 4X
■ ¹⁾		

¹⁾ Dependent upon enclosure size

iC7-Hybrid

This intelligent power converter helps you tap into energy savings with hybrid and pure electric solutions.

Power conversion specialist

Enhance smart grid applications such as energy storage, shore supply, charging and electrolysis. Choose application software: Grid Converter or DC/DC Converter.

World's most compact

High power density reduces installation footprint to 50% of alternative modules while still giving the same power output. Now you can reduce the size of your electrical room and lower your cooling needs too.

Liquid-cooled system modules

Robust and ultra-compact power converters for system integration. Filters are contained in the pre-wired integration unit. Highly expandable option concept.

Power range

Liquid-cooled system modules:
 Voltage rating:
 3 x 380-500 VAC, 460-800 V DC
 3 x 525-690 VAC, 640-1100 V DC
 Current rating: 236-5750 A
 Power range: 0.25-6.8 MVA & beyond
 Enclosed drives:
 3x525-690 V 200 kW-6 MW

Fieldbus

PN	EIP	TCP
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Enclosure

IP00	IP20	IP21/Type 1
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IP54	IP55/Type 12	IP66/Type 4X
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VLT® AutomationDrive FC 302

This modular drive complies with all modern automation application requirements: easy configuration and a broad power range.

Safety where it matters

The VLT® AutomationDrive FC 302 features Safe Torque Off as standard. Easily configurable options are available: SS1, SLS, SMS and PROFIsafe over PROFINET.

Integrated Motion Controller

The Integrated Motion Controller software enables the VLT® AutomationDrive FC 302 to run induction and PM motors in positioning and synchronization applications, both with and without encoders.

Harmonic mitigation

Advanced active filter variants reduce harmonics to below 3% at best, and 12-pulse drives provide robust cost-effective harmonics reduction in supply applications.

Power range

3 x 200-240 V	0.25-37 kW
3 x 380-500 V	0.37-500 kW
3 x 525-600 V	0.75-75 kW
3 x 525-690 V	1.1-710 kW

Fieldbus

MOD					
DN	CAN	PB	TCP	EIP	
ECAT	PN	PL			

Enclosure

IP00	IP20	IP21/Type 1
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IP54	IP55/Type 12	IP66/Type 4X
■	■	■



VLT® AQUA Drive FC 202

The VLT® AQUA Drive FC 202 drives and controls all types of pumps. In addition to the widely used centrifugal pumps (quadratic load torque), the VLT® AQUA Drive FC 202 is ideal for displacement pumps or eccentric screw pumps (constant load torque).

Focusing on water and pumps

Dedicated functions such as burst pipe monitoring, dry-running protection and flow compensation secure and empower your pumping application independent of the motor technology.

Cascade controller as standard

The cascade controller connects or disconnects pumps as necessary and according to specified limits. It also enables master/follower operation. Extended functionality is available via an option.

Power range

1 x 200-240 V	1.1-22 kW
1 x 380-480 V	7.5-37 kW
3 x 200-240 V	0.25-45 kW
3 x 380-480 V	0.37-1000 kW
3 x 525-600 V	0.75-90 kW
3 x 525-690 V	1.1-1400 kW

Fieldbus

MOD					
PN	DN	PB	TCP	EIP	
BIP					

Enclosure

IP00	IP20	IP21/Type 1
■	■	■
IP54	IP55/Type 12	IP66/Type 4X
■	■	■



VLT® HVAC Drive FC 102

This intelligent drive improves indoor climate with low energy usage, in applications ranging from air handling and rooftop units to simple fan and pump applications. Simple to commission and operate, it drives down OPEX and total cost of ownership.

HVAC Inside

The VLT® HVAC Drive FC 102 delivers smart control for building automation, with abilities like reliable -25 °C operability and remote control from outside the AHU.

Optimal EMC protection

Standard integrated chokes and high-quality RFI filters ensure interference-free operation at all times.

EC+

The intelligent VVC+ control principle enables the use of permanent magnet motors or synchronous reluctance motors with efficiency equal to or better than EC technology.

Power range

1 x 200-240 V	1.1-22 kW
1 x 380-480 V	7.5-37 kW
3 x 200-240 V	1.1-45 kW
3 x 380-480 V	1.1-160 kW
3 x 525-600 V	1.1-90 kW
3 x 525-690 V	1.1-1400 kW

Fieldbus

MOD ¹⁾	META	BAC			
DN	LON	BAC	TCP	EIP	
PB	PN	BIP			

¹⁾ MODBUS includes master and follower versions

Enclosure

IP00	IP20	IP21/Type 1
■	■	■
IP54	IP55/Type 12	IP66/Type 4X
■	■	■



VACON® NXP Air Cooled

The VACON® NXP Air Cooled drive is designed for a broad range of demanding industrial applications, focusing on higher power sizes and system drives.

Top performance

VACON® NXP control flexibility delivers maximum motor control performance and dynamics, in both single-shaft machines and drive systems.

Configurable on all levels

Fully configurable I/O and fieldbuses cater for any connectivity need. Fast optical drive-to-drive communication gives you the flexibility of load sharing and paralleling of power units.

Extremely flexible

Adapt the drive using VACON application software. Built-in PLC functionality according to IEC61131-1 enables you to create new functionality in the drive to obtain cost savings and deeper machine integration.

Power range

3 x 208-240 V	0.55-90 kW
3 x 380-500 V	1.5-1200 kW
with DriveSynch	1.5-4000 kW
3 x 525-690 V	2.0-2000 kW
with DriveSynch	2.0-4500 kW

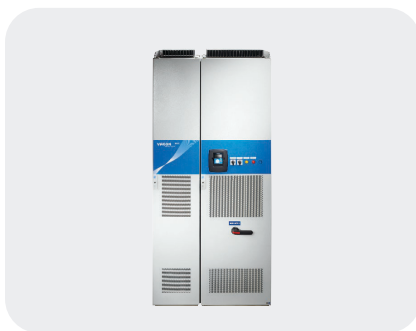
Fieldbus

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TCP	EIP	PN	MOD	META
ECAT				

Enclosure

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IP54	IP55/Type 12	IP66/Type 4X
■ ¹⁾		

¹⁾ Dependent upon enclosure size



VACON® NXC Air Cooled Enclosed Drives

The VACON® NXC combines the VACON® NXP product range with a wide range of options in a single enclosed drive format.

Reliable operation

Based on a Rittal enclosure, the VACON® NXC enclosed drive is fully pre-designed and factory tested in order to ensure reliable and trouble-free operation.

Easy to work with

Access to the control equipment is easy and safe, due to the dedicated control compartment. It is also internally protected against unintentional touch to increase user safety.

Easy to configure

Choose from a wide range of cabinet-installed options; and 6 or 12 pulse rectifiers or Active Front End (AFE).

Power range

3 x 380-500 V	132-1200 kW
3 x 525-690 V	110-2000 kW

Power range – AFE supply

3 x 380-500 V	132-1500 kW
3 x 525-690 V	110-2000 kW

Power range – Low harmonic, Active Filter supplies

400 V	132-560 kW
500 V ¹⁾	132-560 kW
690 V	110-800 kW

¹⁾ requires 690 V active filter

Fieldbus

PB	DN	CAN	BAC	LON
TCP	EIP	PN	MOD	META
ECAT				

Enclosure

IP00	IP20	IP21/Type 1
		■
IP54	IP55/Type 12	IP66/Type 4X
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VACON® NXP Liquid Cooled

This dedicated liquid-cooled drive is well-suited to applications where air quality is critical, space is limited, and efficient heat transfer is required.

Compact

No need for air ducts or large fans, combined with a more compact size, means you achieve a high power density in your installation - and virtually silent operation.

Uptime and cost savings

Save on both investment and operating costs when removing heat using the liquid medium. Achieve maximum uptime, with robust operation even in demanding conditions and with only minimal air filtering in dusty conditions.

Highest control flexibility

The drive utilizes the full VACON® NXP family control functionality to achieve modularity and scalability in a wide range of drive applications.

Power range

3 x 400-500 V	132-4100 kW
3 x 525-690 V	110-5300 kW

Fieldbus

PB	DN	CAN	BAC	LON
TCP	EIP	PN	MOD	META
ECAT				

Enclosure

IP00	IP20	IP21/Type 1
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IP54	IP55/Type 12	IP66/Type 4X



VACON® NXP Liquid Cooled Enclosed Drive

The VACON® NXP Liquid Cooled Enclosed Drive offers all the benefits of VACON® NXP Liquid Cooled drives for high power applications in a compact IP54 rated enclosed drive package.

Predesigned is easy

Being predesigned and engineered, these drives are ready to go as soon as you receive them. Simply connect to the cooling system and the power and motor supplies.

Active Front End for clean supply

Drives with active front end minimize harmonic disturbance to the grid, enable regenerative braking and reduce the scale of infrastructure required, such as transformers and generators.

Fast serviceability

Fast access to the modules using pull-out rails saves time and money in service and maintenance situations.

Power range

400-500 V90-5150 kW
525-690 V 110-5300 kW

Fieldbus

PB	DN	CAN	BAC	LON
TCP	EIP	PN	MOD	META
ECAT				

Enclosure

IP00	IP20	IP21/Type 1
IP54	IP55/Type 12	IP66/Type 4X
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VACON® NXP System Drive

By combining common DC bus components the VACON® NXP System Drive provides you a drive configured and assembled to meet your needs.

Simplicity in projects

Using pre-designed enclosed drive sections for all main system parts, it enables a short engineering and configuration time for any drive system. Every project design is fully documented for the specific configuration.

Reliability is key

The drive and its components are tested, for verified reliability.

Easy serviceability

A pullout system allows quick replacement of drives modules in service situations. Safety is a priority with internal touch protection and high power busbar sections in separate compartments.

Current ratings (main busbars)

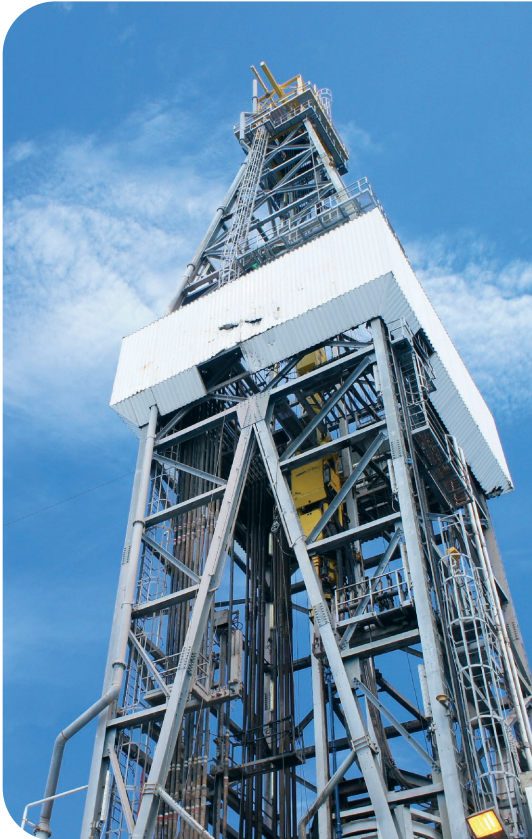
3 x 380-500 V630-5000 A
3 x 525-690 V630-5000 A

Fieldbus

PB	DN	CAN	BAC	LON
TCP	EIP	PN	MOD	META
ECAT				

Enclosure

IP00	IP20	IP21/Type 1
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IP54	IP55/Type 12	IP66/Type 4X





VACON® NXP Common DC Bus

VACON® NXP Common DC Bus components are designed to enable systems integrators, machine builders, and OEMs to design and build efficient industrial drives systems.

Comprehensive range

Build almost any kind of system imaginable, with this fully complete range of components, including inverter units (INUs), active front-end units (AFEs), non-regenerative front-end units (NFEs), and brake chopper units (BCUs).

Maximum uptime

Designed for absolutely reliable operation, the common DC bus range supports full availability with a minimum of operational interruptions.

Minimal installation width

Reduce installation cost and space requirements, with slim INU components optimized for minimal width of the complete drive line-up.

Power range

3 x 380-500 V 1.5-1850 kW
3 x 525-690 V 3-2000 kW

Fieldbus

PB	DN	CAN	BAC	LON
TCP	EIP	PN	MOD	META
ECAT				

Enclosure

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IP54	IP55/Type 12	IP66/Type 4X



VACON® NXP Liquid Cooled Common DC Bus

This range of liquid-cooled common DC bus components brings the benefits of liquid cooling into common DC bus systems.

For demanding systems

Liquid cooling offers strong benefits in applications where cooling air supply or quality is limited, enabling creation of solutions that work even in demanding situations.

Minimum amount of spare parts

Built on a unified product platform reduces costs and increases availability of spare parts and service units, since there is a common hardware platform for all variants used.

Reliable and cost-saving

Enjoy economical installation cost, maximum uptime and full VACON® NXP control functionality.

Power range

400-500 V 90-5150 kW
525-690 V 110-5300 kW

Fieldbus

PB	DN	CAN	BAC	LON
TCP	EIP	PN	MOD	META
ECAT				

Enclosure

IP00	IP20	IP21/Type 1
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IP54	IP55/Type 12	IP66/Type 4X



VACON® NXP Grid Converter

This range of air and liquid-cooled drives is specifically designed for energy storage and marine energy management applications.

Reliable grid

VACON® NXP Grid Converter assures a reliable grid in applications for energy storage and energy management.

Save on fuel and emissions

In marine applications fuel savings and reduced emissions are immediate benefits of grid converters in shaft generator applications.

Power range

Air-cooled
3 x 380-500 V 180-1100 kW
3 x 525-690 V 200-1200 kW

Liquid-cooled
3 x 400-500 V 160-1800 kW
3 x 525-690 V 210-1800 kW

To achieve even higher power capacity, combine multiple VACON® NXP Grid Converter units.

Fieldbus

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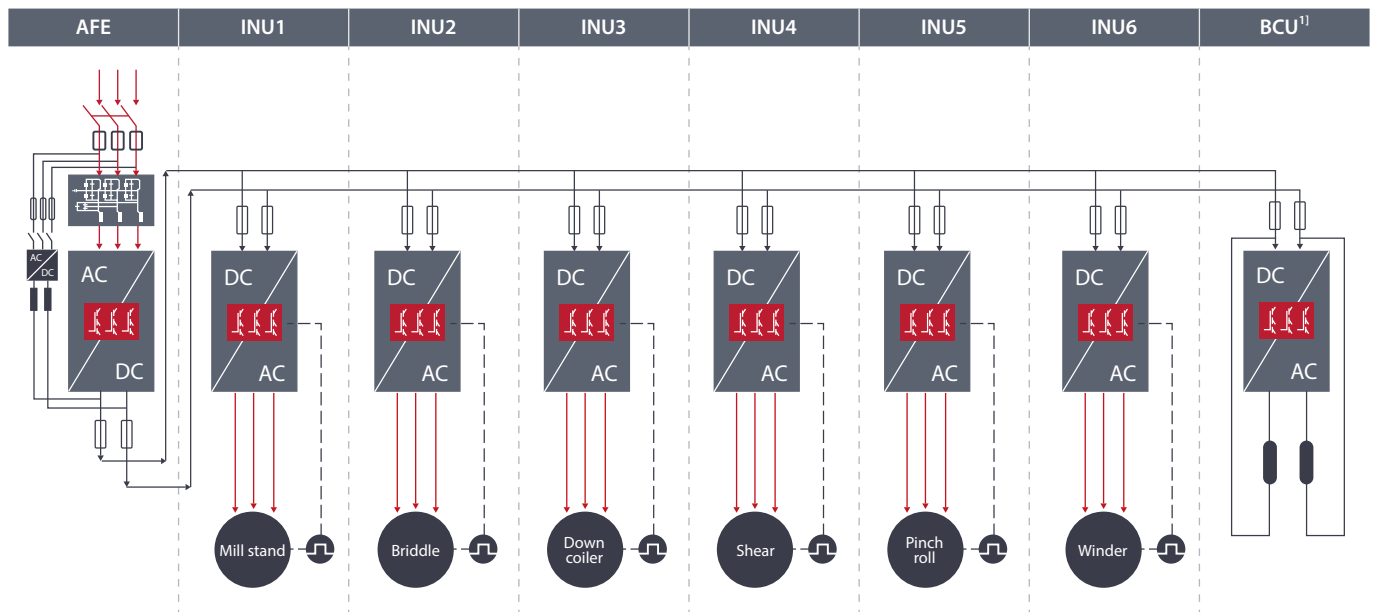
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Common DC Bus System Drives

For high-power drive systems, common DC bus products (380-500 V, 690 V) can be used to optimize the energy structure of the system and save installation space.

Typical common DC system arrangement diagram



¹⁾ Typically used in non-regenerative front-end applications



Iron production



Steel production



Continuous casting



Hot-rolled long products



Hot-rolled flat products



Cold rolling



Non-ferrous metal rolling



Post-treatment



Continuous casting rolling



iC2-Micro

Here is the compact drive that's reliable and exible, ready to power your pumps, fans, conveyors and mixers, textile machinery, palletizers, and packaging machines.

Compact and easy retrofit

User-friendly, with condensed functionality and easy commissioning, this drive comes in a compact package.iC2-Micro is designed as an easy replacement for VLT® Micro Drive FC 51.

Built to last

This reliable and durable drive is even easier to use and install. You can reduce system complexity and cost whilst maintaining full performance.

Power range

1 x 200-240 V	0.37-2.2 kW
3 x 380-480 V	0.37-22 kW
1 x 100-120 V	0.37-1.1 kW
3 x 200-240 V	0.37-11 kW

Fieldbus

MOD

Enclosure

IP00	IP20	IP21/Type 1
	■	■
IP54	IP55/Type 12	IP66/Type 4X



VLT® Soft Starter MCD 600

The VLT® Soft Starter MCD 600 delivers superior performance in fixed-speed applications.

Fast and flexible installation

The MCD 600 is more flexible than ever to install, thanks to a wide variety of Ethernet and serial-based communication option cards, application-dedicated smart cards and support for eight languages.

Pump Clean / reverse function

The pump clean function uses reverse operation. Motor control is simple, with soft ramps in both directions.

More uptime

More extensive motor and starter protections ensure more uptime.

Technical data

Input	3 x 200-690 V
Control voltage	24 V DC or 110-240 V AC
Current range IP20	20-129 A
Current range IP00	144-579 A

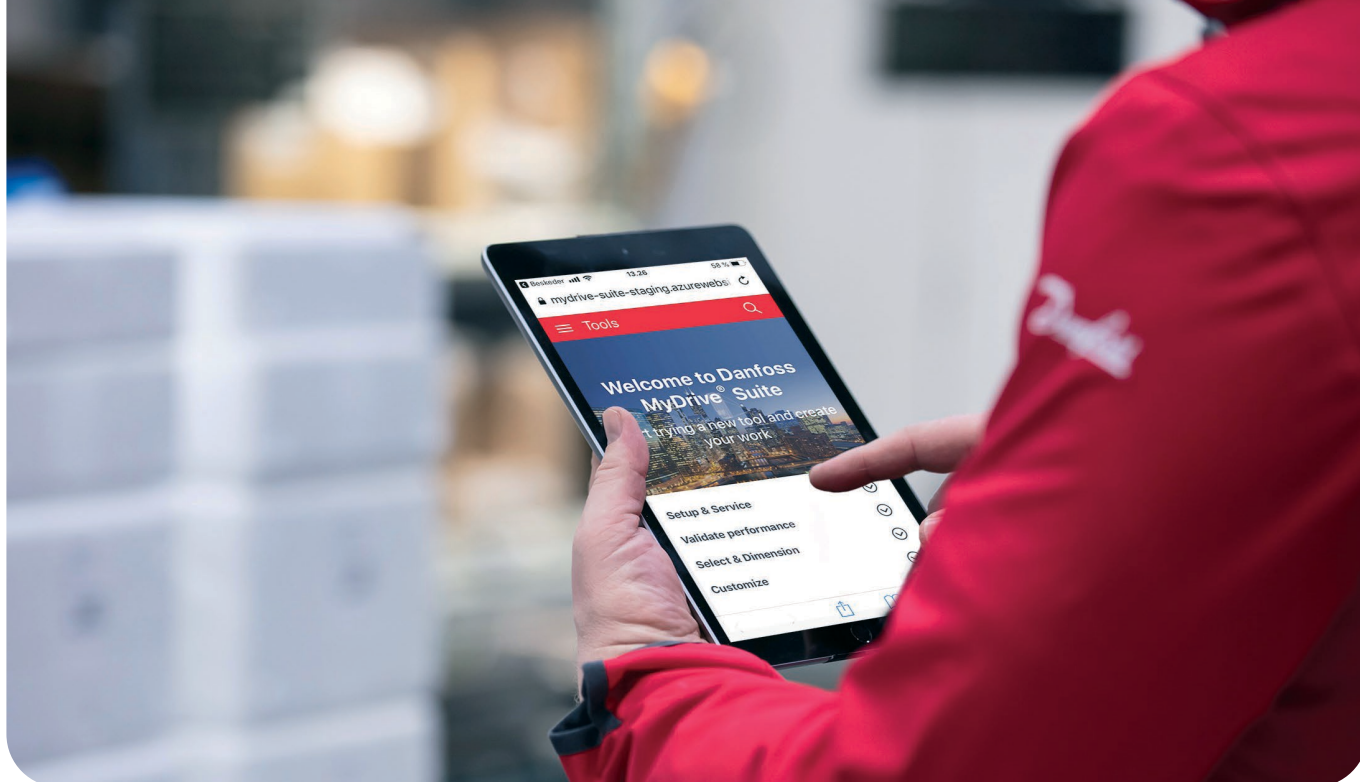
Fieldbus

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Enclosure

IP00	IP20	IP21/Type 1
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IP54	IP55/Type 12	IP66/Type 4X





MyDrive® Suite ensures your digital tools are only one click away

MyDrive® Suite brings all your tools together to support you during engineering, operation and service. What is MyDrive® Suite? It's a tool providing a single point of access for the other digital tools supporting you during engineering, operation and service, thereby covering the whole life cycle of the drive.

Based on your needs, the tools are accessible via different platforms. They can be integrated into your system and business processes to enable a world-class end-to-end experience with full flexibility. Your data is synchronized between the tools, and by sharing the same data backend, information is always correct and up to date.

Our suite of software tools is designed to ensure you easy operation and the highest level of customization of your AC drives. Whether you're a

beginner or a pro, you have everything you need to go from selecting to programmability of a drive.

Try MyDrive® Suite today:

<https://suite.mydrive.danfoss.com/content/tools>

Easy to use

- One tool suite
- One common look and feel
- Single login to all tools
- Seamless usage across devices and touchpoints
- Platform enables coherent workflows
- Data synchronization between tools. There is no need to enter information twice, which means your information is always correct and up to date
- Search and smart filtering
- Tutorials and documentation

Keeps your data safe

- Data security through user levels and authentication
- End-to-end secure communication

Fits your needs

- Data integration into your tools and systems
- APIs and open interfaces facilitate third-party applications or branded versions
- The tools are available as web app, desktop application, dedicated tablet and smartphone app, all with offline functionality. No internet connection is required once the tool is installed to your device



Discover MyDrive® Suite digital tools here:

Digital tools

Digital tools ensure easy operation and great flexibility in customization of your drives. In our Downloads area you can also download application software, configuration files, PLC libraries and firmware updates.

Select and dimension

Select the right AC drive based on motor and load characteristics. Find general product, segment and application information

- **MyDrive® Select**

Validate performance

Monitor the performance of your drives, analyze harmonics content, calculate the energy savings achievable, and validate compliance to norms and standards.

- **MyDrive® Insight**
- **MyDrive® ecoSmart™**
- **MyDrive® Harmonics**
- **MyDrive® Energy**

Set-up and service

Set up a drive or power converter to operate according to your requirements. Monitor drive performance throughout the entire lifecycle of your drive or power converter

- **MyDrive® Connect**
- **VLT® Motion Control Tool MCT 10**
- **Danfoss AAF 007 Setup Tool**
- **VLT® Servo Toolbox**
- **VACON® NCDriver**
- **VACON® Live**
- **DrivePro® 360Live**

Customize

Freely customize the interface and operation of your drive. Modify or create unique splash screens, initial values, and start-up wizards

- **VLT® Software Customizer**
- **VACON® Customizer**

Simulate

Simulate your drive or power converter environment to benefit from fast response time and flexibility in product development. This approach helps you go to market faster and gain competitive advantage.

MyDrive® simulation tools put the best predictive simulation software and hardware tools in your hands, equipping you with the tools and expertise necessary to achieve your design goals.

- **MyDrive® Simulation**

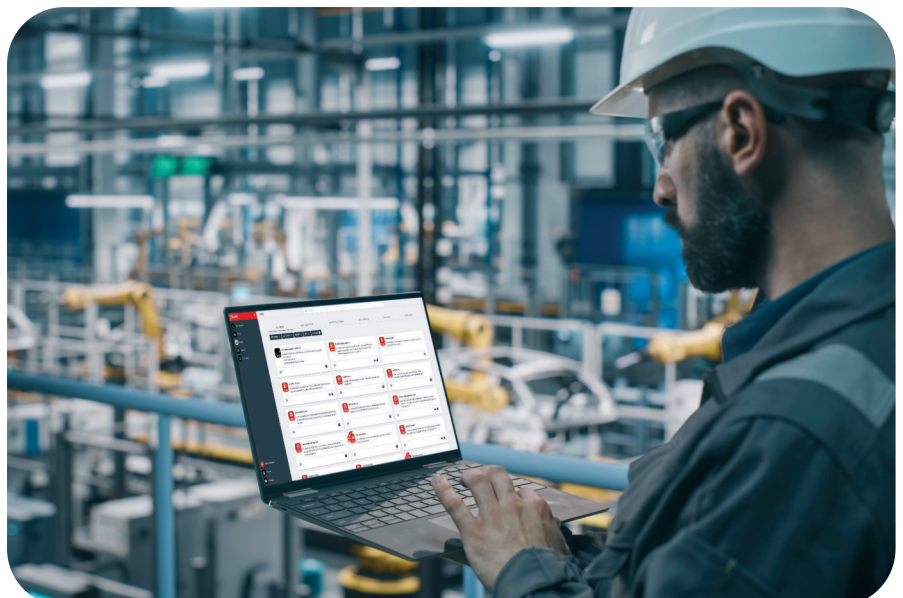
High-fidelity drive models that are compatible with over 150 simulation tools worldwide.

- **MyDrive® HIL**

Real-time hardware in the loop simulation. This tool combines actual Danfoss control components with virtual applications, offering unmatched fidelity and cost savings.

- **MyDrive® Virtual**

Cloud-based simulation platform for enhanced collaboration between colleagues, for high efficiency.







DrivePro® Services

Delivering a customized service experience

Every AC drive application is different. DrivePro® Services is a collection of tailor-made products designed around your needs. From optimized spare part packages to condition-monitoring solutions, we deliver customized service offerings to support your business through the different lifecycle stages of your AC drive.



Learn more about
DrivePro® Services here

You are covered with DrivePro® Services



DrivePro® 360Live **Achieve excellence with precision of maintenance**

An installed base management solution to register and effectively optimize drives maintenance.



DrivePro® Site Assessment **Get a complete on-site survey of your AC drives**

Optimize your maintenance strategy with a complete onsite survey and risk analysis of all your AC drives, collected in one detailed report.



DrivePro® Start-up **Take the complexity out of commissioning**

DrivePro® Start-up includes a full range of operating health checks and parameter adjustments. Based on a manufacturer's commissioning checklist, our experts will inspect and test your AC drive and its motor performance to ensure the best configuration of each drive.



DrivePro® Extended Warranty **The industry's longest warranty coverage**

Even the best performing AC drives need protection. DrivePro® Extended Warranty offers a wide range of warranty options and provides the longest coverage in the industry – up to 6 years.



DrivePro® Spare Part **Original Danfoss spare parts at your fingertips**

Maximize uptime and maintain peak performance throughout the lifetime of your AC drives. DrivePro® Spare Parts makes sure you are equipped with the original spare parts from Danfoss Drives.



DrivePro® Preventive Maintenance

Take the guesswork out of your maintenance plan

With a structured maintenance program tailored to your needs, you can boost operational efficiency. Reduce the effects of wear and tear with DrivePro® Preventive Maintenance.



DrivePro® Exchange **Reduce costly downtime with a fast replacement**

Maintain uptime with a fast alternative to repair in time-critical situations. If an AC drive fails, the DrivePro® Exchange service ensures quick exchange to a new unit of the same type, for shortest possible production delay.



DrivePro® Retrofit **Be prepared for the end of a drive service life**

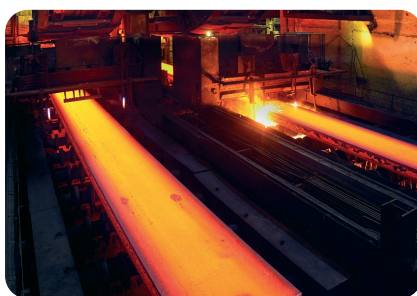
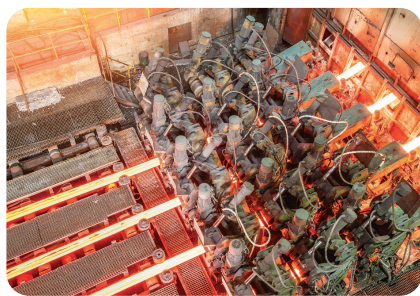
The DrivePro® Retrofit service prepares you for end of the drive service life. Replace outdated drives with optimal successor products and recommended conversion plan – while minimizing unscheduled downtime.



DrivePro® Remote Monitoring **Minimize unexpected downtime and increase your efficiency with faster response**

DrivePro® Remote Monitoring is a digital service that provides real-time remote monitoring by collecting drives performance parameter and fault values, storing them in the cloud, and representing analytics in an easily accessible and simplified way.

Danfoss drives every process in metallurgy



Metallurgical production processes and main equipment



Raw material field

- Unloader
- Belt conveyor
- Rollover
- Reclaimers
- Vibrating screens
- Crushers
- Fan or pump type



Coking

- Vibrating screens
- Mills
- Belt conveyor
- Fan or pump type
- Lubrication station oil pump
- Push car
- Stop car
- Dry quenching hoist
- Rollover



Sintering

- Vibrating screens
- Crushers
- Belt conveyor
- Fan or pump type
- Mixer
- Ring cooler
- Lubrication station oil pump



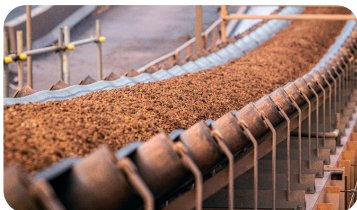
Pellets

- Vibrating screens
- Crushers
- Belt conveyor
- Fan or pump type
- Mixer
- Lubrication station oil pump
- Chain grate
- Rotary kiln



Lime kiln

- Rotary kiln
- Furnace blower
- Hoist
- Conveyor belt
- Fabricator



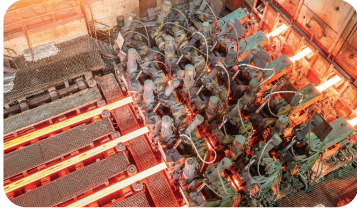
Iron production

- Vibrating screens
- Belt conveyor
- Fan or pump type
- Dedusting device
- Hot air furnace
- Loading equipment
- Slag handling equipment
- Fabricator



Steel production

- Pretreatment of cast iron
- Converter tilting
- Oxygen gun hoist
- Secondary gun hoist
- Out-of-furnace refining
- hoist
- AOD furnace
- Casting crane
- Vibrating feeder
- Deslagging machine
- Dust extraction fan
- Exhaust fan



Continuous casting

- Dummy bar
- Ladel turret
- Straightener
- First cooling zone
- Roller table
- Continuous casting electromagnetic stirring
- Billet transfer car



Hot rolled-plate strip

- Heating furnace
- Vertical roller
- Roughing mill
- Finishing mill
- Electric press down
- Hot coil box
- Flying shears
- Roughing mill roller table
- Extraction mill roller table
- Laminar flow cooling
- Winding aid
- Winder
- Pinch roller
- Descaling pump
- Transfer car



Hot rolled-type steel

- Heating furnace
- Opener
- Finishing mill
- Flying shears
- Spacing
- Phosphorus removal
- Roughing mill roller table
- Extraction mill roller table
- Cooling bed
- Transfer car



Hot rolled medium-thick plates

- Two-roller mill
- Roller table
- Flying shears
- Cross-section
- Longitudinal cut
- Straightener
- Cooling bed
- Transfer car



Hot-rolled bar and wire

- Roughing mill
- Intermediate rolling mill
- Pre-finishing mill
- Flying shears
- Finishing mill
- Sizing equipment
- Push-pull pickling line
- Roller table
- Laying head
- Feeding roller
- Cooling bed



Cold rolling and processing lines

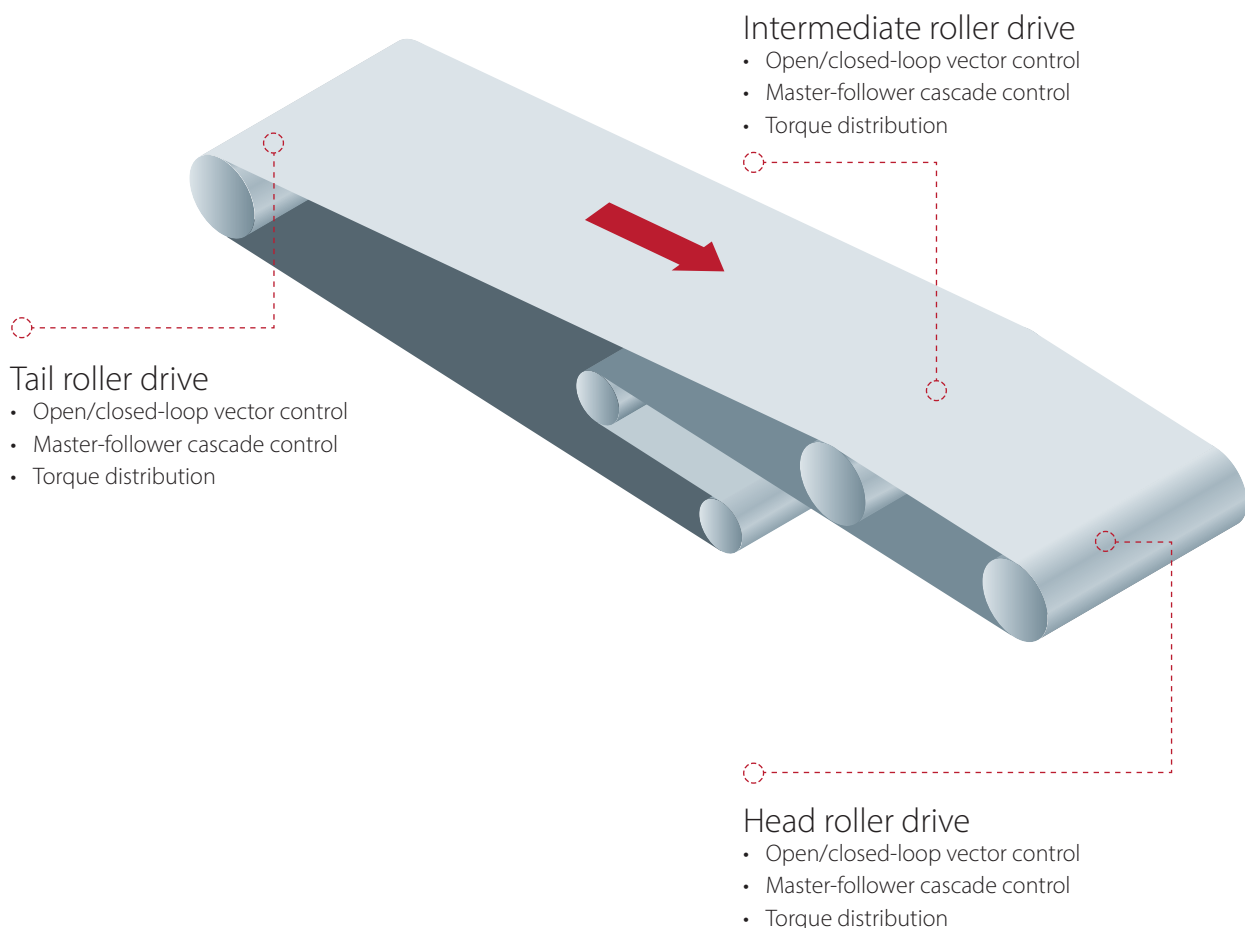
- Twenty-roll reversible mill
- Double-frame reversible rolling machine
- Pickling mill line
- Continuous annealing line
- Pickling line.
- Galvanizing line
- Recoiling line, slitting line
- Leveling line, color coating line
- Stainless steel, electro-galvanized.
- Electroplated tin
- Unwinder, tension roller
- Straightener, looper
- Furnace roller, winder
- Leveler, skin pass mill



Basic unit – belt conveyor

Belt conveyors are highly efficient continuous conveying devices that have the advantages of **long conveying distances, high throughput, wide material handling, easy loading and unloading, continuous transport and low freight costs.**

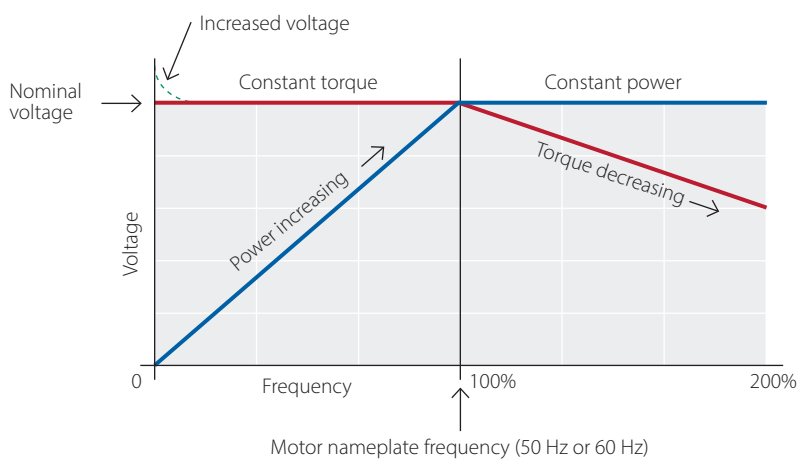
Its ease of automation and the ability to perform several process operations during conveying make it widely used for raw material conveying in a wide range of material processing and metallurgical plants.



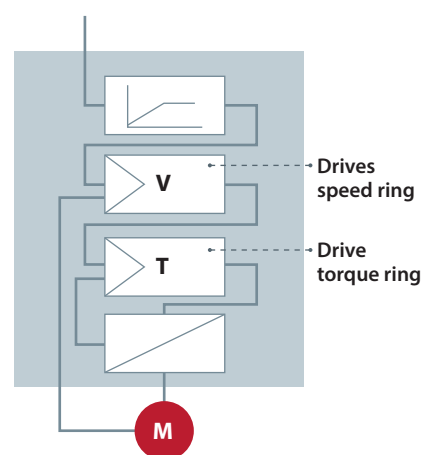
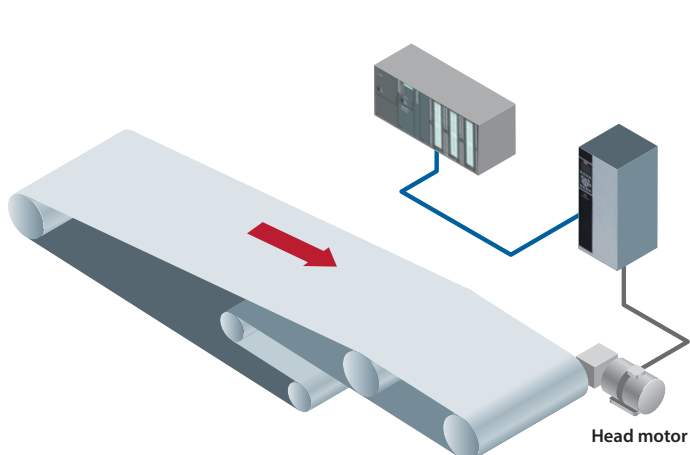
Units	Drive model	Application features
Head roller drive	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NXP series	Single-drive or master-follower control
Intermediate roller drive	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NXP series	Single-drive or master-follower control
Tail roller drive	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NXP series	Single-drive or master-follower control



Basic unit – belt conveyor



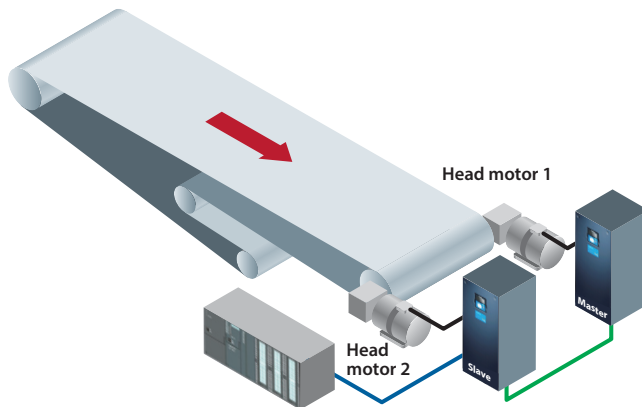
← The type of conveyor drive depends on the length and width of the conveyor belt, the angle of inclination, etc., and we offer a variety of drive types to meet these needs.



↑ A single-drive configuration utilizing standard vector control, where the motor's speed loop and torque loop are applied specifically to control a single motor.

Single-motor single-roller drive

Open-loop/closed-loop speed control



Dual-motor single-roller drive (head drive)

Open-loop/closed-loop speed control

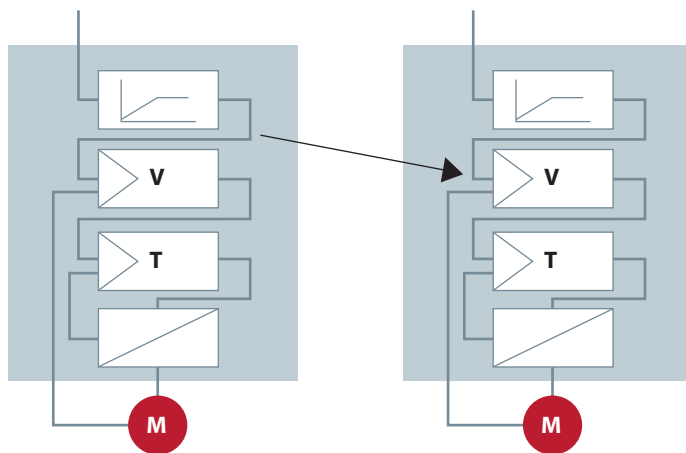
Master-follower cascade control mode
(fiber optic communication)

Load share function

Torque tracking

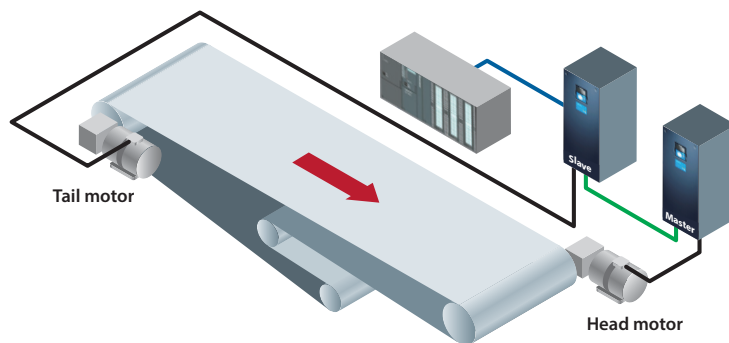
Common DC drive

Configurable 4-quadrant energy feedback



← A drive configuration for coaxial twin motors utilizing standard vector control with master-follower controls.

- Master-follower torque tracking mode
The follower and master start simultaneously, and the torque information from the master is sent to the follower for tracking and correction



Dual-motor dual-roller drive (head and end drive)

Open-loop/closed-loop speed control

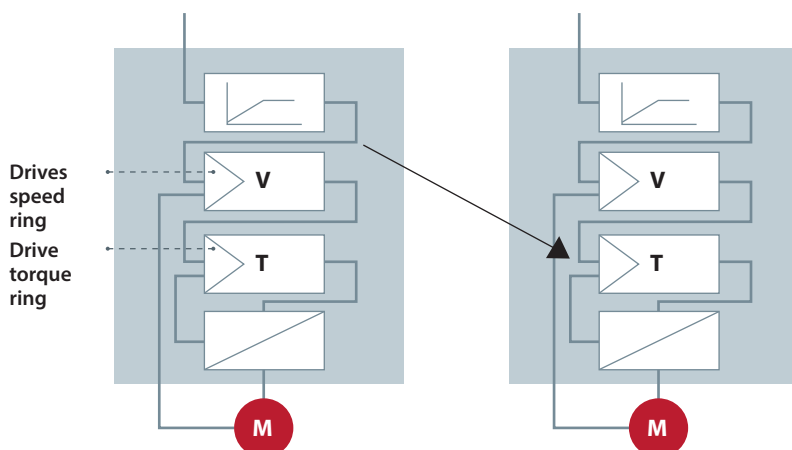
Master-follower cascade control mode
(fiber optic communication)

Load share function

Speed tracking

Common DC drive

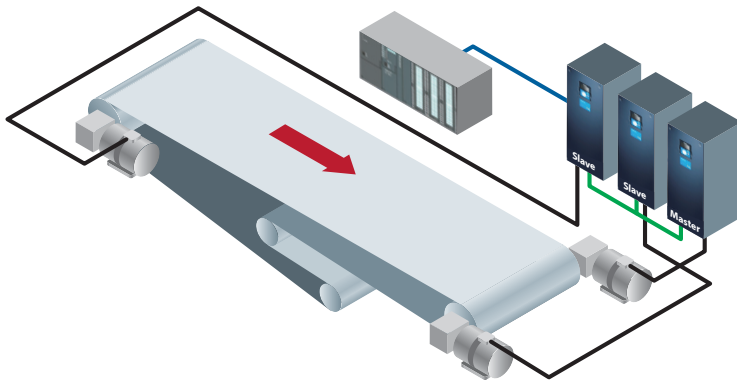
Configurable 4-quadrant energy feedback



← A drive concept for axial dual motors utilizing standard vector control with master-follower control.

- Master-follower speed tracking
The follower and master start simultaneously, and the speed information from the master is sent to the follower as a tracking correction

Basic unit – belt conveyer



Triple-motor dual-roller drive (head and end drive)

Speed control open loop

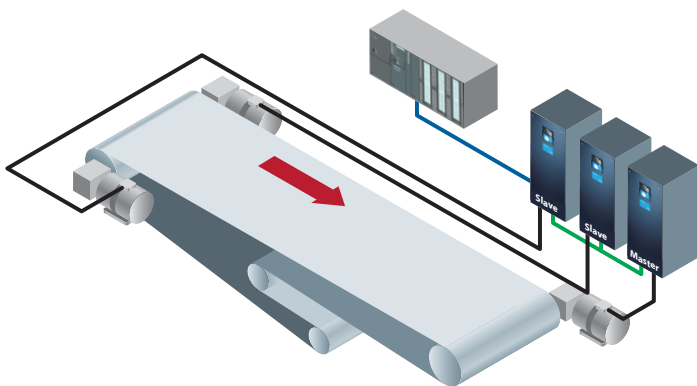
Master-follower cascade control mode
(fiber optic communication)

Load share function

Speed tracking

Common DC drive

Configurable 4-quadrant energy feedback



Triple-motor dual-roller drive (head and end drive)

Speed control open loop

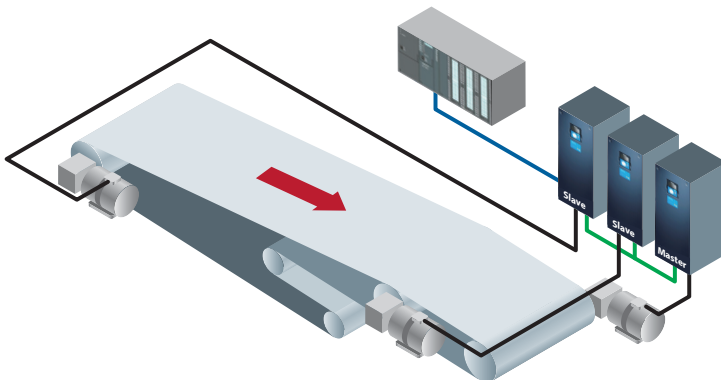
Master-follower cascade control mode
(fiber optic communication)

Load share function

Speed tracking

Common DC drive

Configurable 4-quadrant energy feedback



Triple-motor triple-roller drive (head-center-end drive)

Open-loop/closed-loop speed control

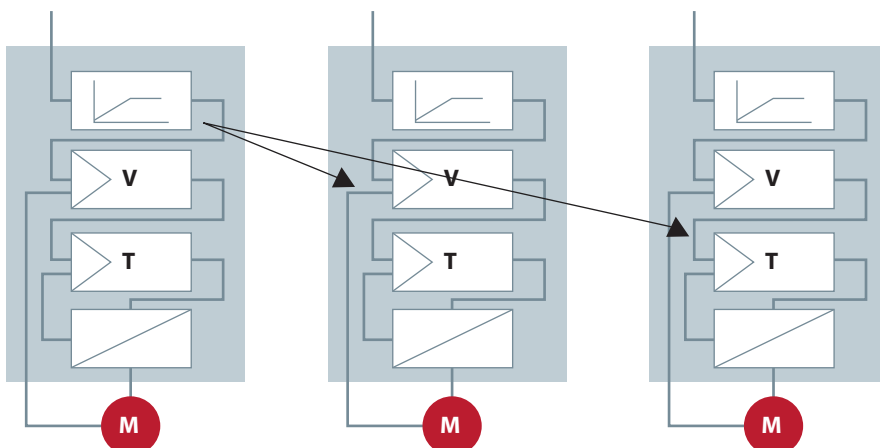
Master-follower cascade control mode
(fiber optic communication)

Load share function

Speed tracking

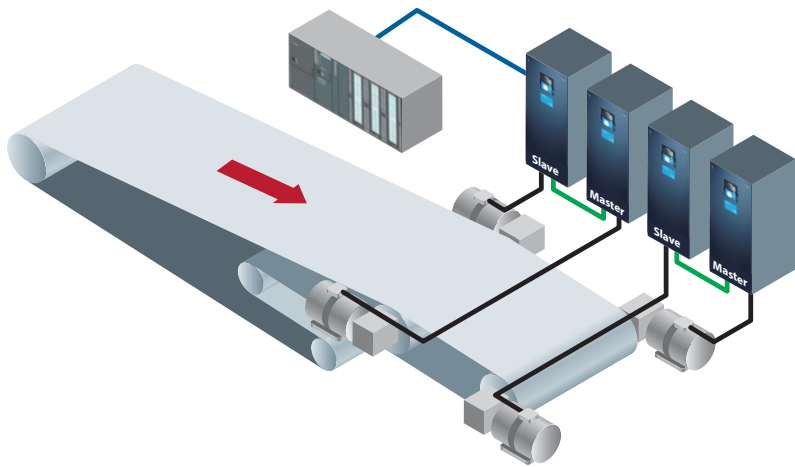
Common DC drive

Configurable 4-quadrant energy feedback

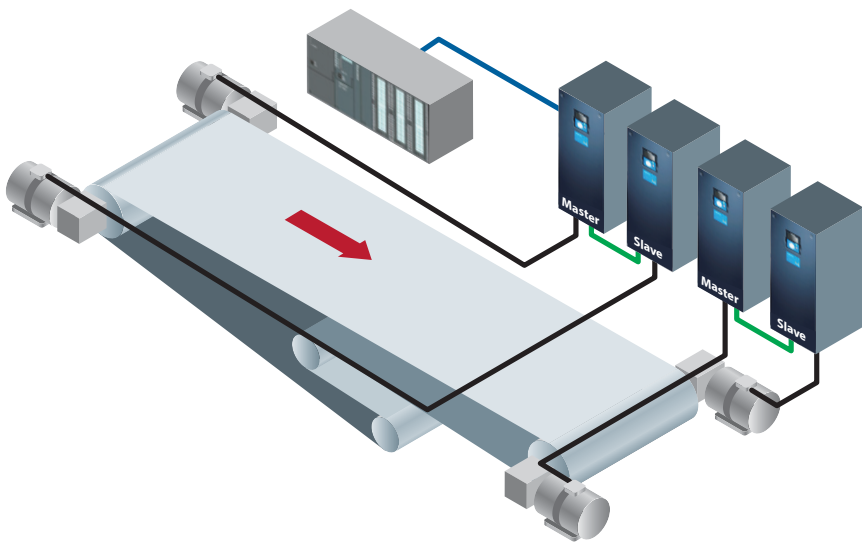


← A multi-axis multi-motor drive concept with rigid or flexible connections depending on how the master and follower are connected.

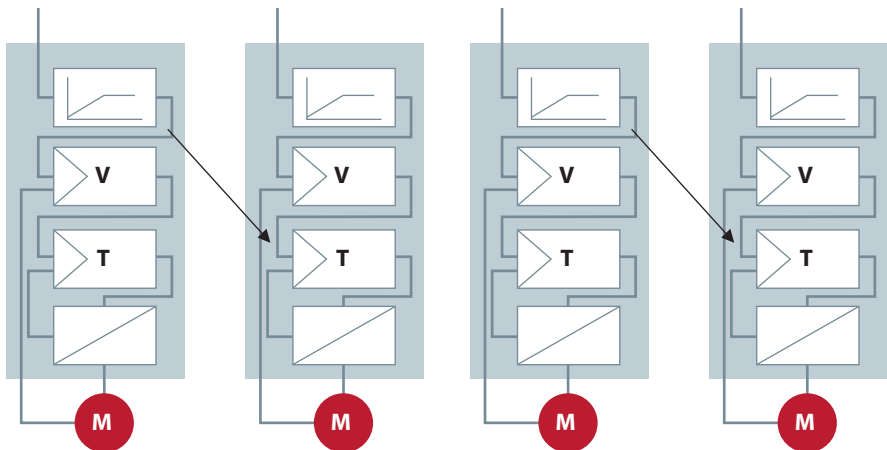
- Reliability: Torque tracking
- Flexibility: Speed tracking



- Quad-motor quad-roller drive (head and center drive)
- Speed control open loop
- Master-follower cascade control mode (fiber optic communication)
- Load share function
- Speed tracking
- Common DC drive



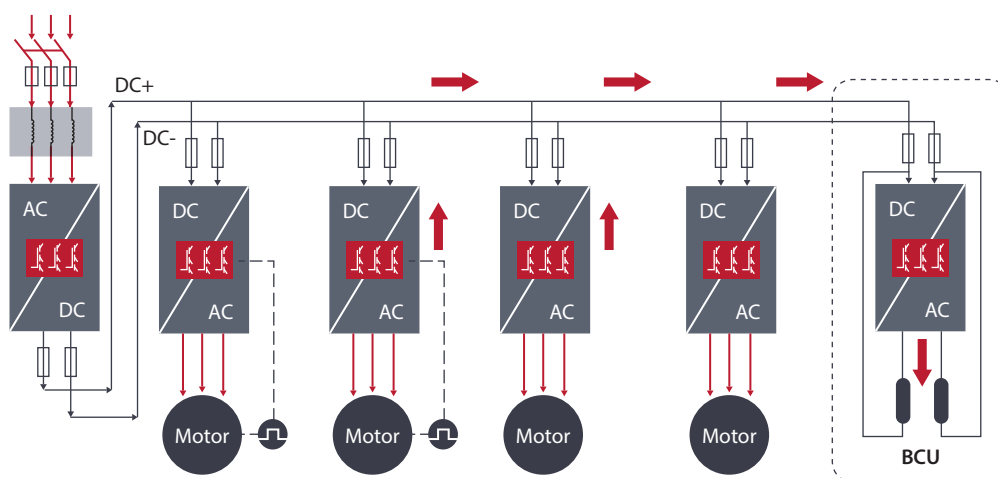
- Quad motor dual roller drive (head and end drive)
- Speed control open loop
- Master-follower cascade control mode (fiber optic communication)
- Load share function
- Speed tracking



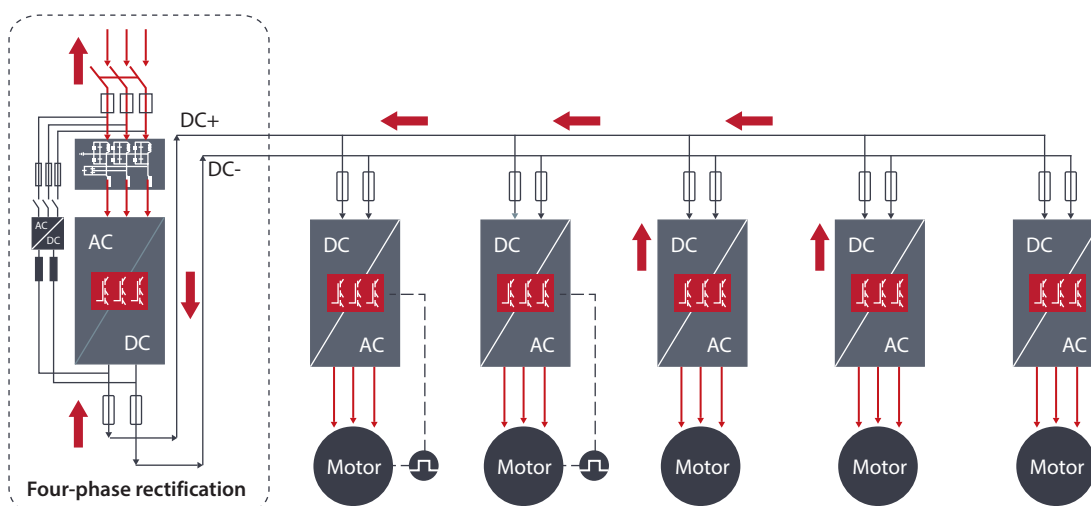
More motors are used to support multi-roller drives, with a one-to-one master-follower control setup. Torque distribution and control between the rollers are handled by the upper-level control system.

Basic unit – belt conveyor

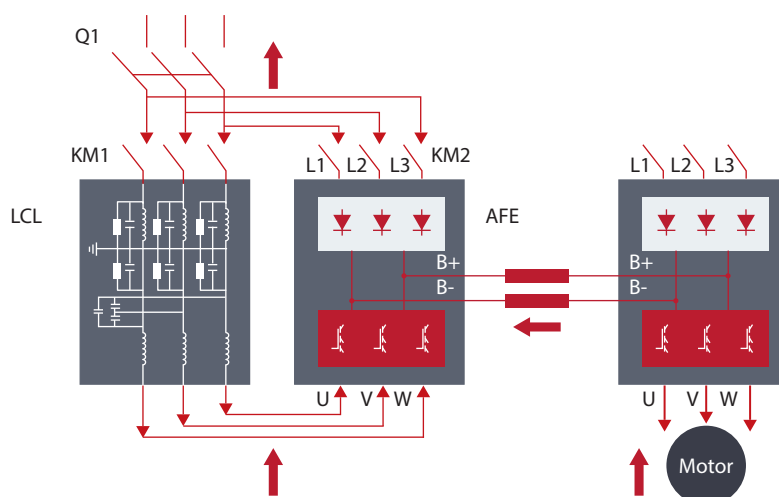
Handling of braking energy



Typical Common DC System Arrangement Diagram



An AFE (Active Front End) energy recovery system that meets grid feedback standards.

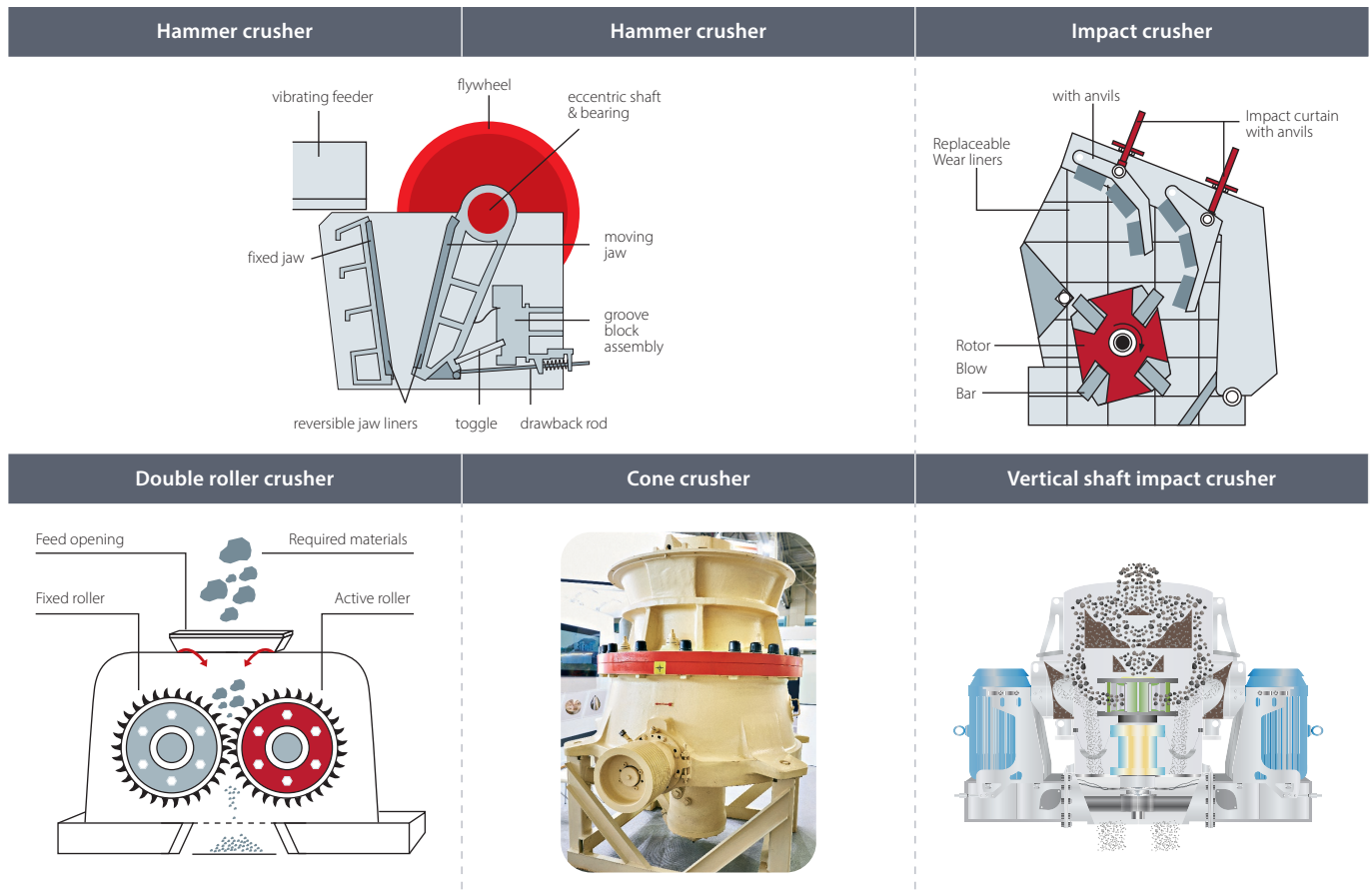


Parallel energy recovery unit for low-power single drive units

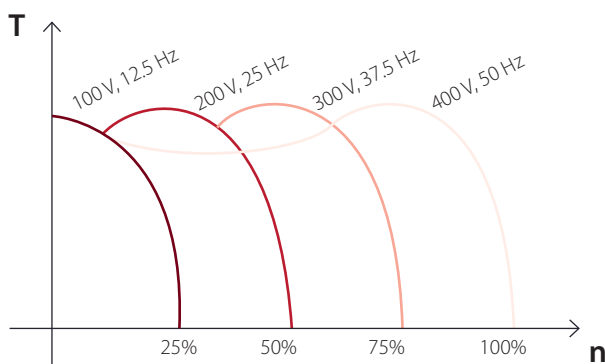


Basic equipment – crushers

Crushers are important equipment for breaking down ore feedstock into controlled sizes that meet process requirements, which are mainly divided into the following:



Crusher drive features and requirements



- ← • 150% overload capacity
- Constant torque control
- Mechanical load protection
- Torque limit or control torque
- Reduced wear plate breakage
- Motor stall protection

Units	Drive model	Application introduction
Crusher drive	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Open-loop control
		Heavy duty selection



Basic equipment – Vibrating screen

A vibrating screen is a device for screen-grading crushed material. The motion trajectory can be divided into circular motion and linear motion vibration screens. When the vibrating screen is working, the synchronous reverse rotation of the two motors causes the vibrator to

generate a reverse oscillation force, forcing the screen to move longitudinally, so that the material on it receives the oscillation force and periodically throws a shot forward, thus completing the material screening operation.

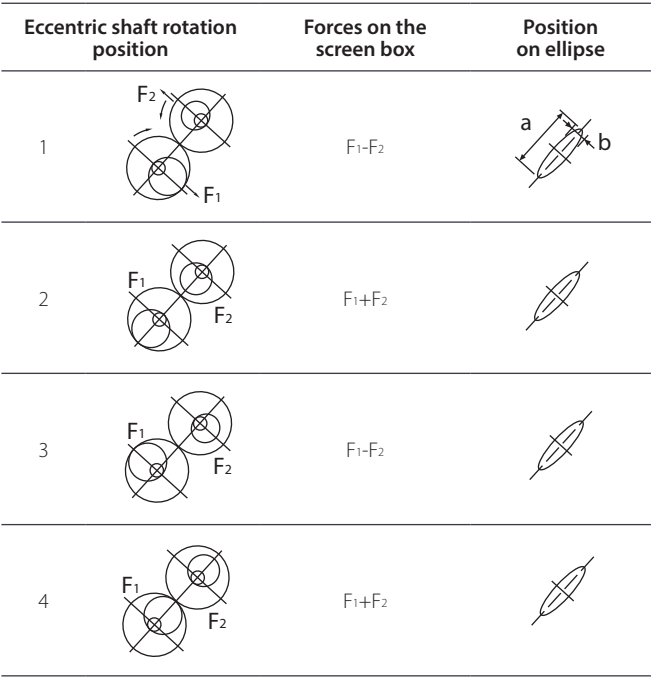
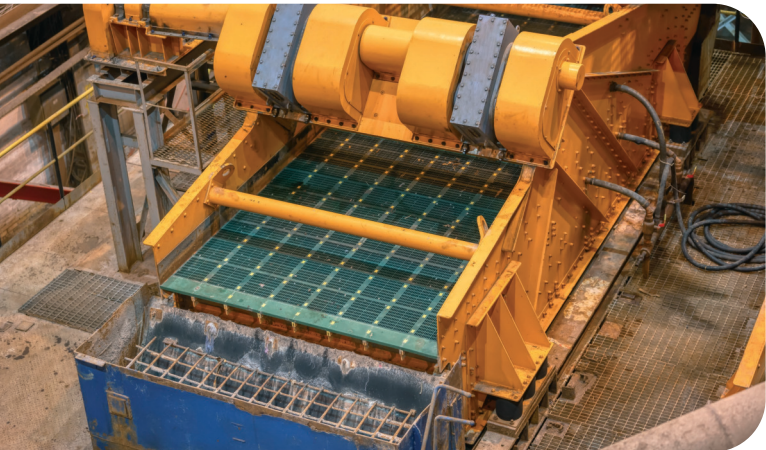


Fig. 1 Working principle of the double excitation oval vibrating screen

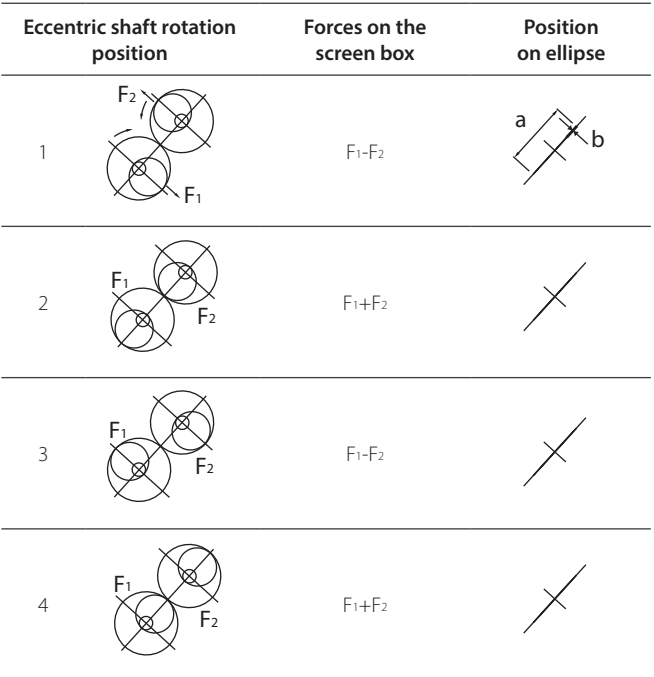
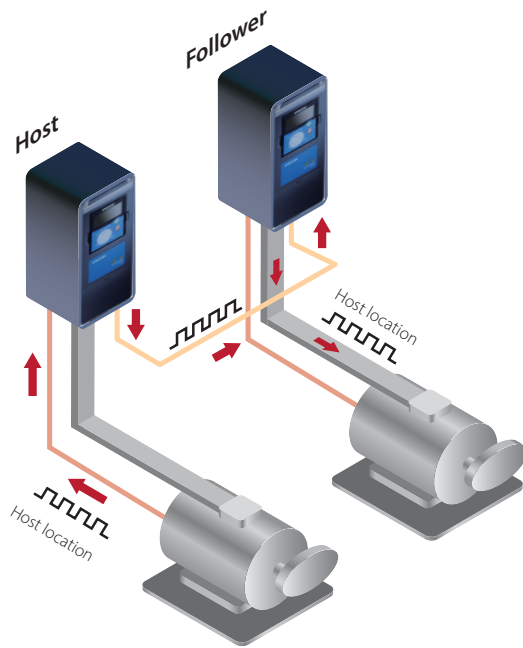


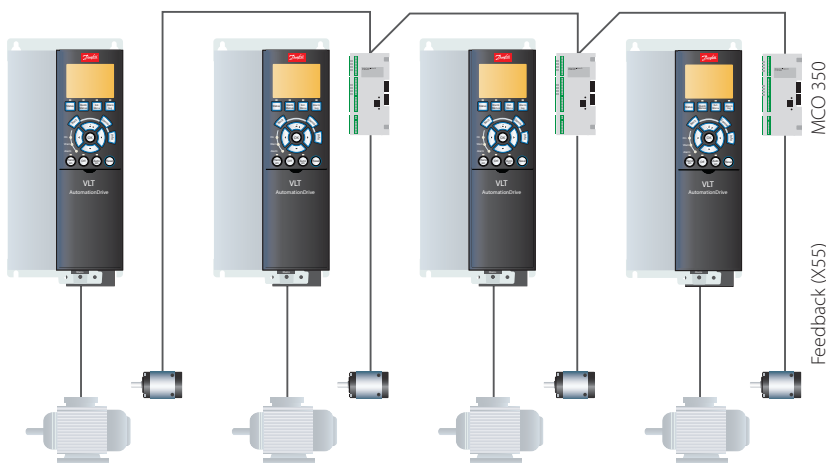
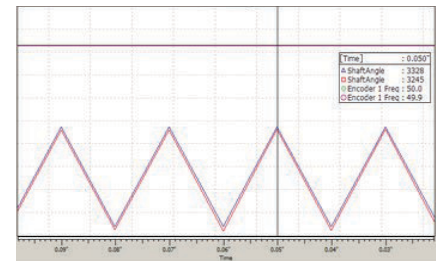
Fig. 2 Working principle of the dual excitation inline vibrating screen

Units	Drive model	Application introduction
Vibrating screen drive	iC2-Micro	Open-loop control
	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Position synchronization

Introduction to vibrating screen application solutions



The axis synchronization application of VACON NX series drives transmits the master position information via fiber optics to the follower, which compares it to its own encoder signal, calibrating the synchronization output and maintaining the same axis position as the master.



VLT® AutomationDrive FC 302 series drives enable synchronous position control of multiple drives by adding a synchronous position control card.

For vibrating screens, several motors are guaranteed to be in the same position during operation to achieve synchronization.

Basic equipment – Disc feeder

The quantitative disc feeder is a volumetric device for continuous feeding of materials, and is widely used in industries such as steel, metallurgy, building materials, chemical, energy, etc.

It plays a particularly important role in the sintering process in the metallurgical industry. As a key piece of process equipment, it helps ensure the quality and grade of sintered ore and maintains stable production output. Its reliable operation directly impacts both the yield and quality of steel production. It is the main process equipment for improving and

guaranteeing the quality of sintered ore, stable output, and the yield and quality of steel produced are directly affected by its normal operation.

It is typically installed at the discharge point of storage units such as silos, bins, or hoppers. Utilizing both the force of gravity and the mechanical action of the feeder, it discharges material from the storage unit and delivers it in a continuous and uniform flow to the next stage in the process. It also acts as a storage lock when it stops working.



Units	Drive model	Application introduction
Disc feed drive	iC2-Micro	Open-loop control
	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Open-loop control

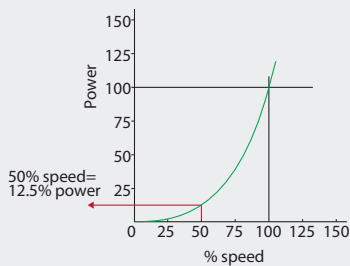
Basic equipment – Fans and pumps

According to many surveys, motors powering centrifugal pumps and fans account for more than half of industrial electricity consumption. Worldwide, this can consume billions of euros worth of electricity per year.

The air replenishment rate required for a ventilation system depends on many factors, including the number

of people, the machinery in operation, the amount of heat produced by the equipment, direct sunlight on floors, etc. These factors determine how much ventilation work needs to be done to make the working environment comfortable, especially in terms of the distribution of work done by the fan, and the extraction of air.

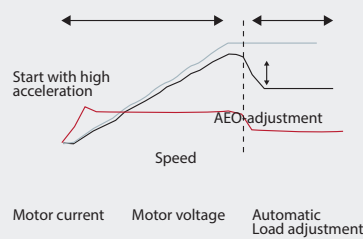
In many systems, fans operate either at full speed or are completely shut off, with airflow also being toggled on or off. However, where possible, flow can be regulated using inlet guide vanes at the fan's air intake, or dampers installed in ducts and exhaust outlets.



Energy savings

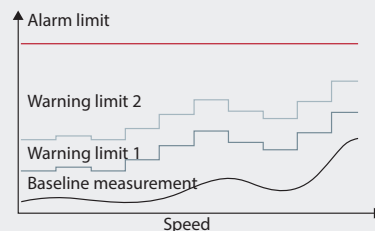
Even a small reduction in the speed of pumps and fans leads to a significant decrease in power consumption. Centrifugal pumps and fans consume relatively less energy at low speeds compared to running at high speeds. This is an important fact to consider when operating any pump or fan.

So why operate a fan or pump at full capacity when it is not necessary instead of simply turning on one unit at full speed? It's more energy-efficient to run the unit at optimal speed matched to system demand. For example, as shown in the accompanying chart, when a fan or pump operates at 50% of its rated speed, it consumes only 12.5% of the power used at full speed. Matching fan and pump speeds to the actual load – especially during continuous operation – results in significant energy savings.



AEO Automatic Energy Optimization

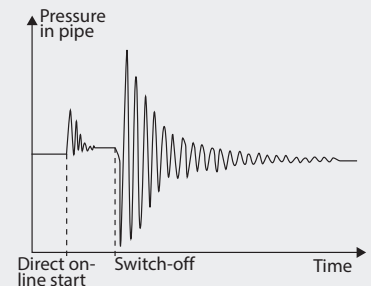
- Automatic Motor Adaptation AMA can be used to obtain model parameters for motor control
- For square torque loads, better energy savings can be achieved by setting the parameters related to the AEO function correctly
- 3-5% higher average savings compared to when the AEO function is not activated



CBM functionality

CBM condition-based monitoring features:

- Motor stator insulation monitoring
- Motor vibration monitoring
- Load envelope



Repeated pressure spikes reduce the overall life of a system

Suppression of water hammer

Pressure peaks in piping systems, sometimes referred to as water hammer, are caused by a sudden stop in the water flow. This is particularly true with long or under-sized pipes and high fluid flow rates.

Water is incompressible and has a relatively low viscosity. When water moves, such as in long pipes, a considerable amount of kinetic energy accumulates. When the water outlet suddenly closes, the kinetic energy of the flowing water must dissipate. This causes pressure peaks in the pipelines, which can cause noise and vibrations. Repeated pressure peaks ultimately lead to weakening of pipes and equipment.

The water is usually circulated by the pump, and when the pump stops suddenly, the water on the suction side of the pump can strike with considerable force. Eventually, repeated shocks from pressure peaks come to gradually damage the pump (and any other equipment affected by the pressure peaks).

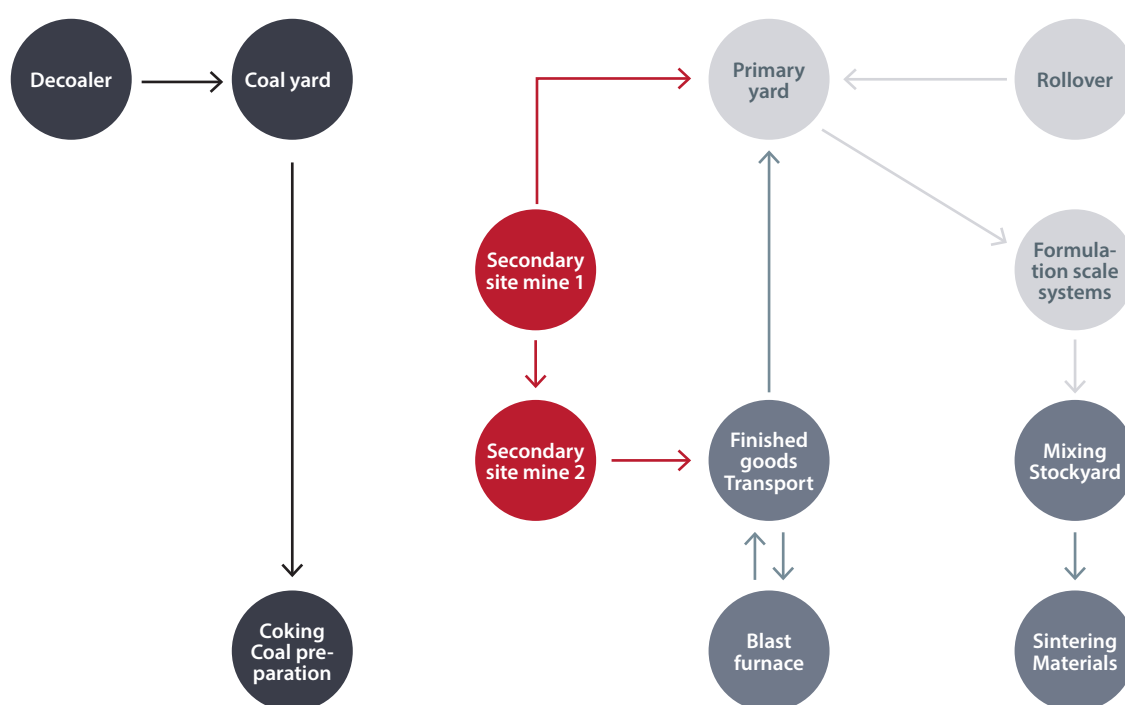
If the pump is controlled by a drive instead of relying on a direct start/stop control, pressure peaks caused by sudden stops of the pump and the resulting damage are eliminated.



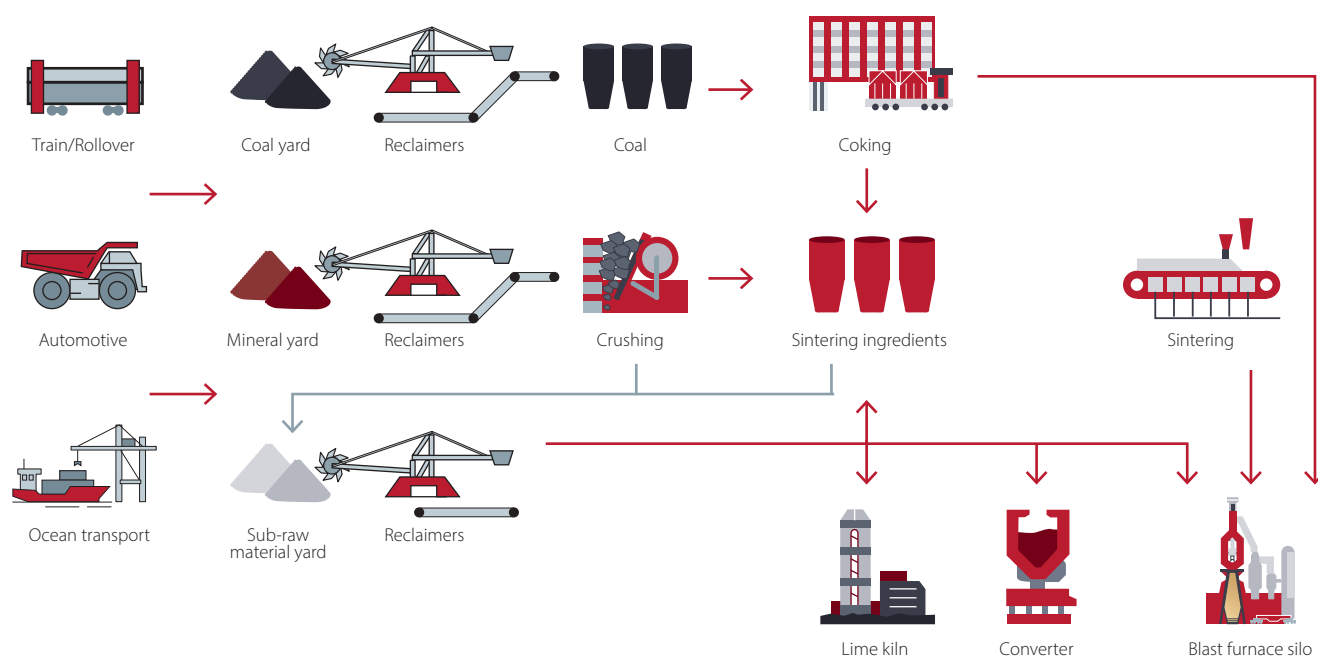
Raw material yard

Raw material facilities must be provided for the supply and stockpiling of melting equipment such as blast furnaces, sintering furnaces (or ball furnaces), coke ovens and transfer furnaces. The raw material plant is mainly responsible for the input, storage, crushing, homogenization, and supply of

the main secondary raw materials such as iron ore, coke and power coal to the various production plants. It is an essential workshop for obtaining uniform components. The plant is essential for maintaining high technical and economic indicators for iron refineries.



Raw material yard process
flow diagram



Common stacker drives

Units	Drive model	Application introduction
Receiving section	Feeding section feeding systems, railway feeding systems, and feeding systems for crushed sieve products; iC7-Automation, VLT® AutomationDrive FC 302, or VACON® NX series	• Rollover • Unloader • Vibrating screens • Crushers • Belt conveyor
Mixing section	The mixing section includes mobile equipment such as various stacker loaders; iC7-Automation, VLT® AutomationDrive FC 302, or VACON® NX series	• Reclaimers
Supply section	The supply section includes the supply, transport and storage equipment to and from the individual workshops; e.g. tape conveyor iC7-Automation, VLT® AutomationDrive FC 302, or VACON® NX series	• Belt conveyor
Crush and screening section	Crushing of raw ore, whole ore crushing, fine ore crushing, limestone crushing, coal primary crushing and bulk screening, re-screening equipment iC7-Automation, VLT® AutomationDrive FC 302, or VACON® NX series	• Crushers • Vibrating screens
Sampling section	The sampling section includes waterway feed sampling, coke feed sampling, mix feed and crushing screen facility sampling; iC7-Automation, VLT® AutomationDrive FC 302, or VACON® NX series	
Auxiliary section	The auxiliary section includes various vehicles, garages, oil depots, etc; iC7-Automation, VLT® AutomationDrive FC 302, or VACON® NX series	• Fan or pump type

Raw material yard – stack picker yard

The picker is a large combined unit of electromechanical and hydraulic control. It is an important piece of equipment for stockpile picking in large and medium-sized steel companies.



Travel drive

- Open-loop/closed-loop vector control
- Torque distribution

Belt conveyor

- Open-loop vector control
- Master-follower cascade control
- Torque distribution

Slewing mechanism

- Closed-loop vector control
- High overload capability

Boom mechanism

- Closed-loop vector control
- High overload capability

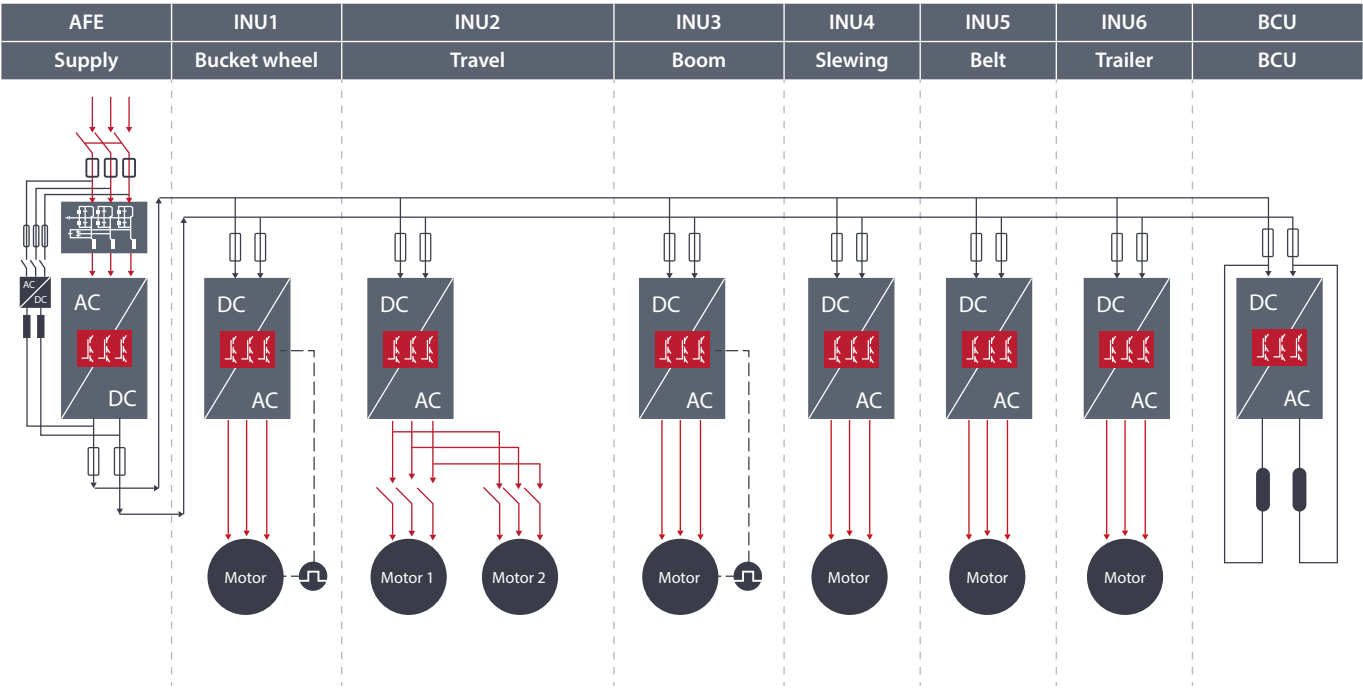
Bucket wheel drive

- Closed-loop vector control
- High overload capability

Common stacker drives

Units	Drive model	Application introduction
Bucket wheel drive	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Closed-loop vector control
Boom mechanism	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Closed-loop vector control
Slewing mechanism	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Closed-loop vector control
Conveyor belt mechanism	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Closed-loop vector control
Actuator	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Open-loop/closed-loop vector control
Auxiliary equipment	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Trailers, fan pumps, etc.

For centralized drive systems, a common DC bus system concept can be used for centralized power supply control and efficient energy distribution. Rectifier units can be configured as IGBT quadruphasic rectifiers, and economical diode rectifiers.



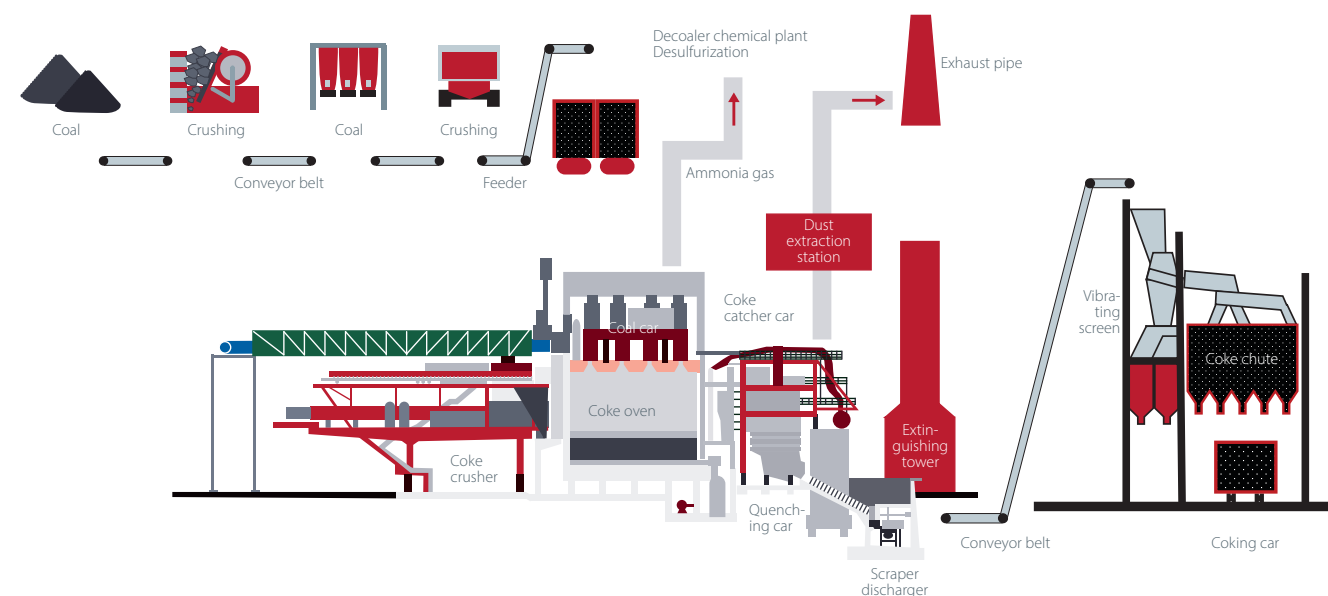
Rectifier unit	AFE	NFE
Technology	IGBT	Thyristor
Type	Can be returned	Non-returnable
Switching frequency	3.6 kHz	
DC voltage	1.35x1.1xUs	1.35xUs
THDi	< 5%	~ 30%
In-line filter	LCL	L
Charge circuit	External	Internal



Coking

The coke plant produces the fuel feedstock for the production of refined iron.
The main process is the carbonization of raw coal.

The production process is: Coal mixing, compaction, coking, wet and dry quenching of coke, waste heat generation, recovery, coal chemicalization.



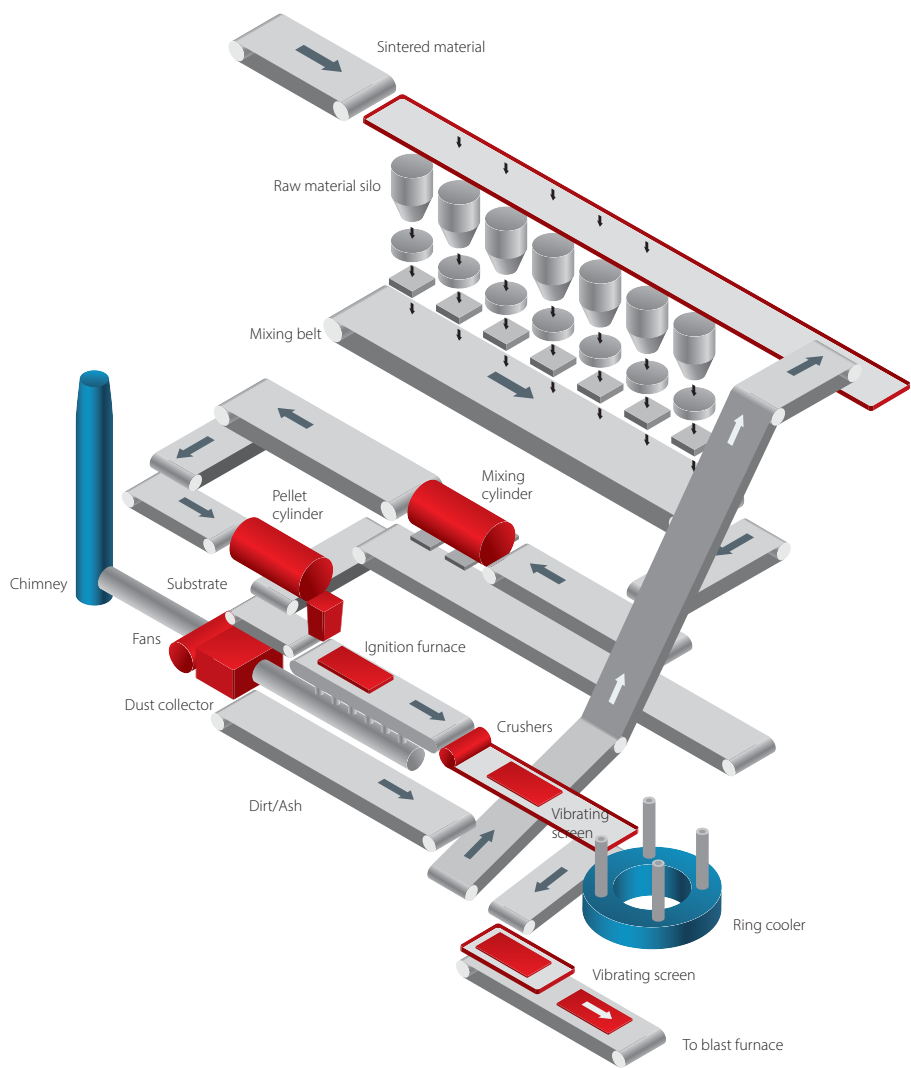
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Coking process flow diagram

Units				
Mills	Disc feeder	Dust extraction system fan	Pusher	Charging car
Crushers	Conveyor transport	Exhaust fan	Quenching car	Scraper discharger
Vibrating screens	Bucket lifter	Cooling fan	Stop car	Coke transfer car

Sintering

The function of sintering is to sinter the iron ore powder at high temperatures into blocks, initially removing impurities from the iron ore for further sintering in the blast furnace.

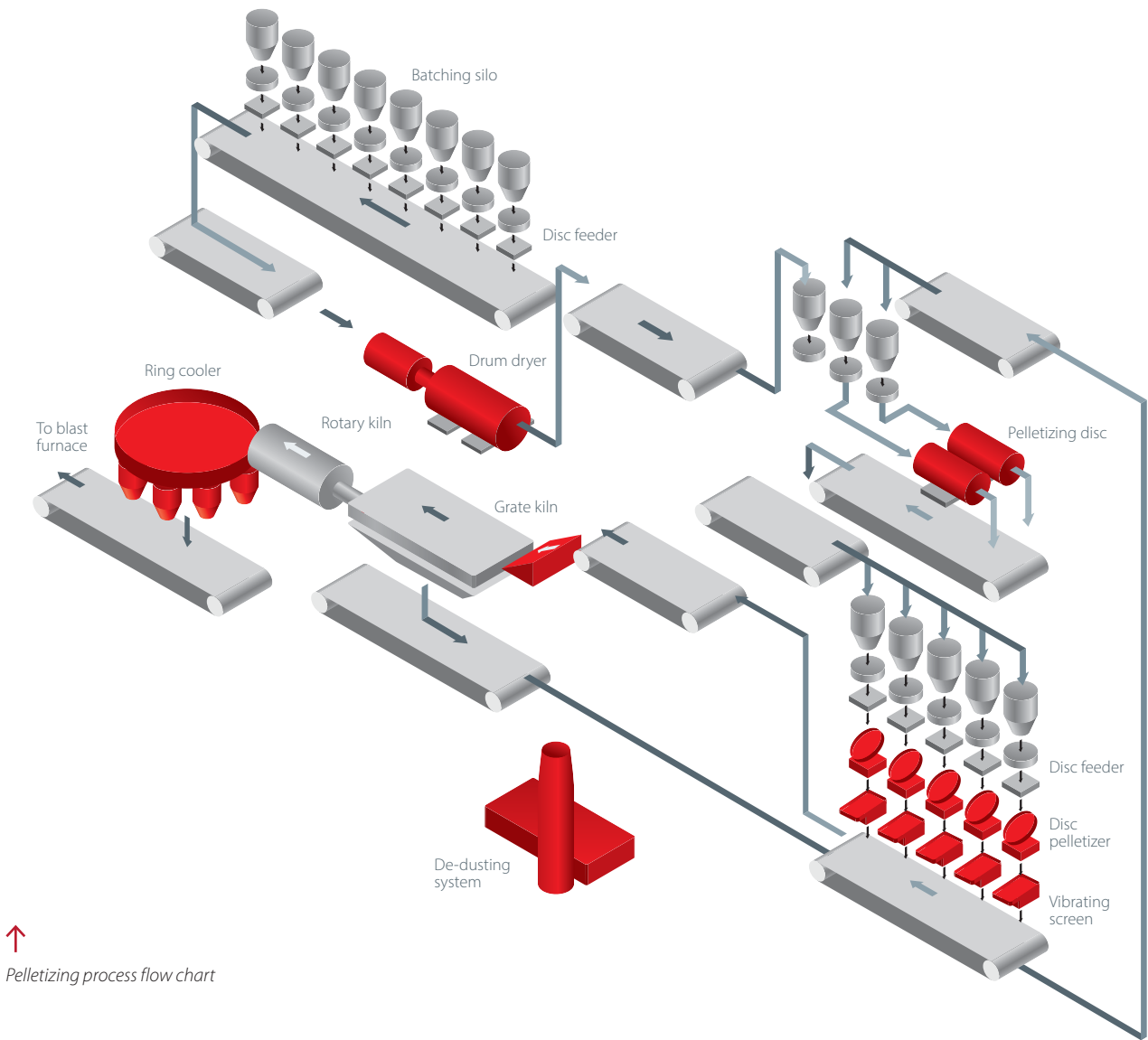
The sintering process is relatively simple, mainly using sequential controls with a small number of conveyor belts. However, mines with a high level of contaminants use more high-powered dust extraction fans.



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Sintering process flow diagram

Units				Drive model
Conveyor transport	Disc feeder	Dust extraction system fan	Pelletizing drum	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series
Crushers	Conveyor transport	Exhaust fan	Water treatment	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series
Vibrating screens	Lubrication station oil pump	Cooling fan		iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series

Pelletization

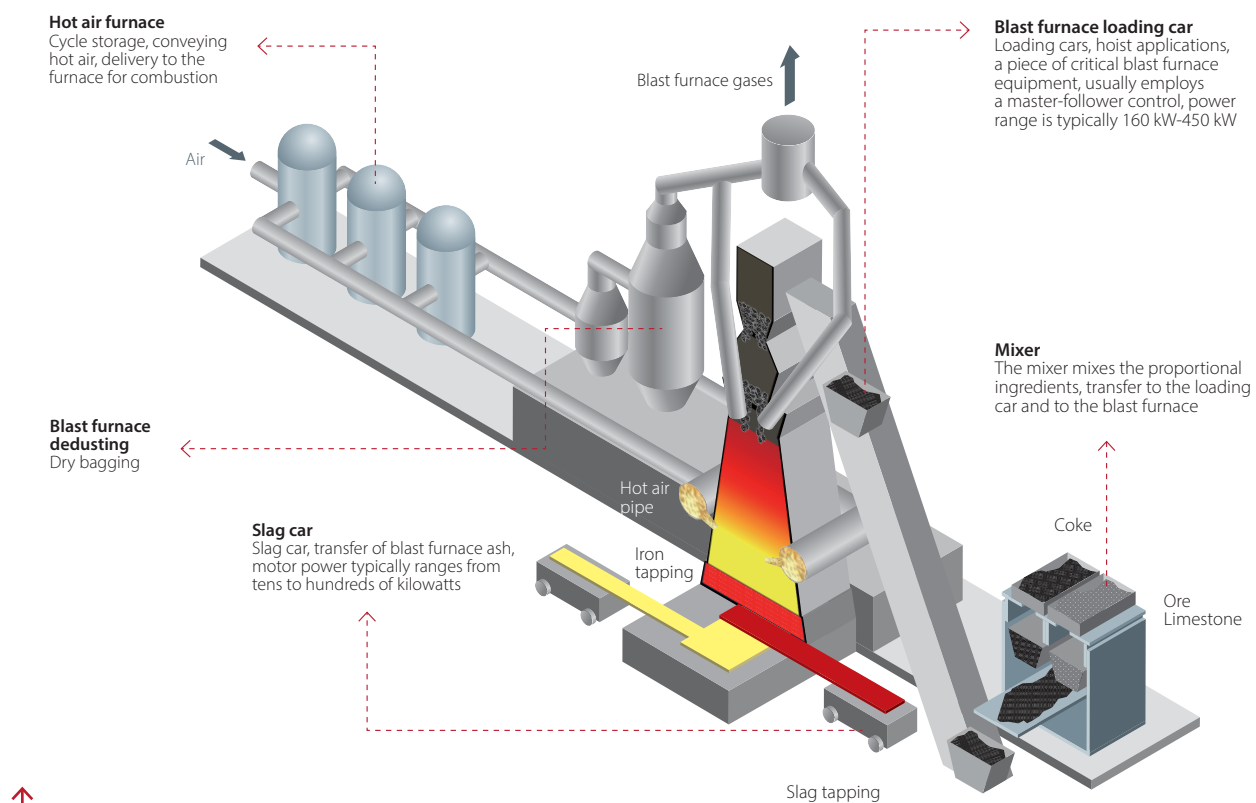


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Pelletizing process flow chart

Units				Drive model
Conveyor transport	Disc feeder	Dust extraction system fan	Pelletizing drum	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series
Crushers	Conveyor transport	Exhaust fan	Water treatment	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series
Vibrating screens	Lubrication station oil pump	Cooling fan		iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series

Iron production

The blast furnace iron-making process involves loading raw materials from the top while injecting heated air through tuyeres. Combustion of coke produces rising hot gases that reduce the descending iron ore, exchanging heat to form molten iron and slag. Iron and slag accumulated in the furnace cylinders are discharged through respective iron outlets.



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Iron production process flow chart

Units	Drive model	Application introduction
Conveyor transport	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Single or master-follower control, load sharing
Crushers	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	High overload, resistant to shock load changes
Disc feeder	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Single control, open-loop vector control
Mills	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	High overload, resistant to shock load changes
Cooling fan	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	
Exhaust fan	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	High power, high demands on operational stability. Medium or low voltage 690 scheme
Vibrating screens	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Single or multiple simultaneous position control
Roller mixer	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Single or multi-master-follower control
Dust extraction system fan	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	High power, high demands on operational stability. Medium or low voltage 690 scheme
Lubrication station oil pump	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	

Steel production

Furnace tilt

- The converter is used as the main equipment for steel-making, and the steel is transferred by pouring
- Tilt is usually controlled by several motors in tandem, requiring load balancing between motors
- Conversion furnaces place high demands on the operational safety of the equipment

Oxygen gun hoist

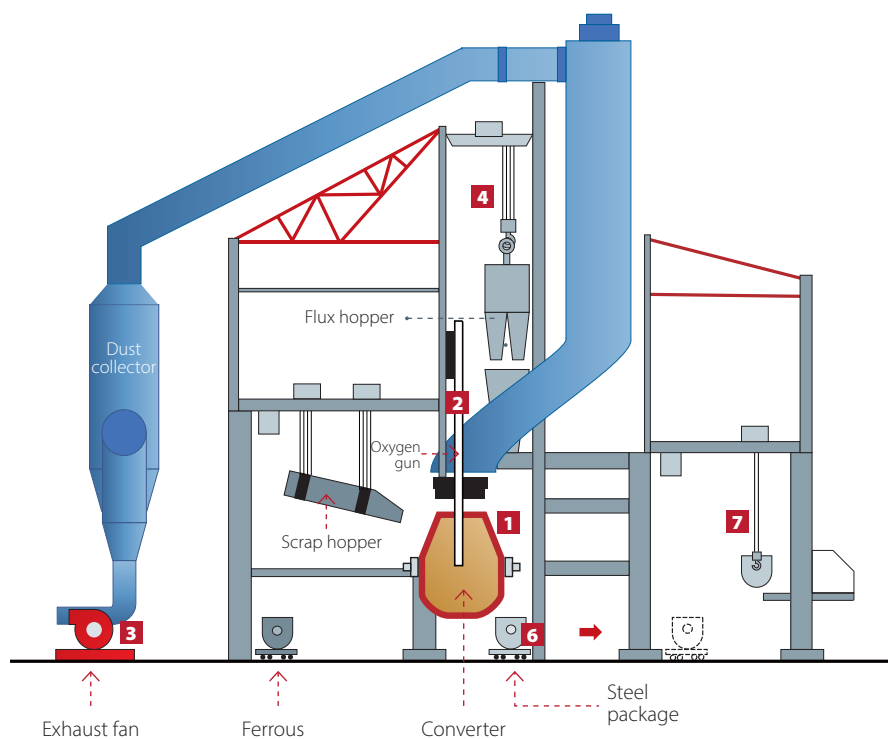
- Enhanced control, requires fast acceleration of equipment, timely dynamic torque response

Out-of-furnace refined steel ladle hoist

- Hoist control lifts the barrels onto the transport car to be transferred after refinement
- Requires the equipment to be extremely safe while operating in poor environments, high temperatures and dust

Out-of-furnace refining

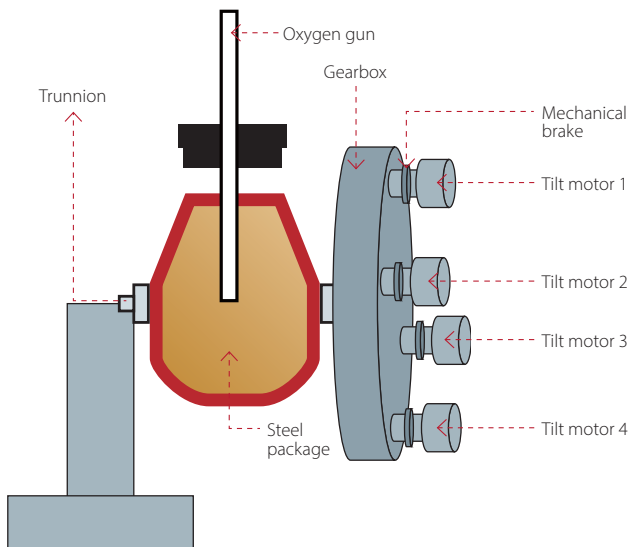
- Out-of-furnace refining is a secondary steel-making process that transfers the steel water from the turner to the refinery for refining
- Common out-of-furnace refining includes RH vacuum cycle fume extraction and AOD out-of-furnace refining



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Steel production process flowchart

Units	Drive model	Application introduction
1 Converter tilting	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Master-follower cascade control mode, load sharing, very high stability requirements
2 Oxygen gun hoist	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Single closed-loop, short acceleration time, high acceleration torque; Drive selection accounts for the high overload factor
3 Exhaust fan	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	
4 Grab bucket crane	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Hoist, tramping control, gripper control
5 Out-of-furnace refining hoist	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Refinery hoist, mechanical brake control Requires extremely high operating stability
6 Transfer car	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Vector control, requires equipment to accelerate and decelerate smoothly
7 Casting crane	iC7 series, VLT® AutomationDrive FC 302, or VACON® NX series	Barrel hoist, mechanical brake control, poor environment High temperatures, humidity, and extreme stability requirements for electrical equipment

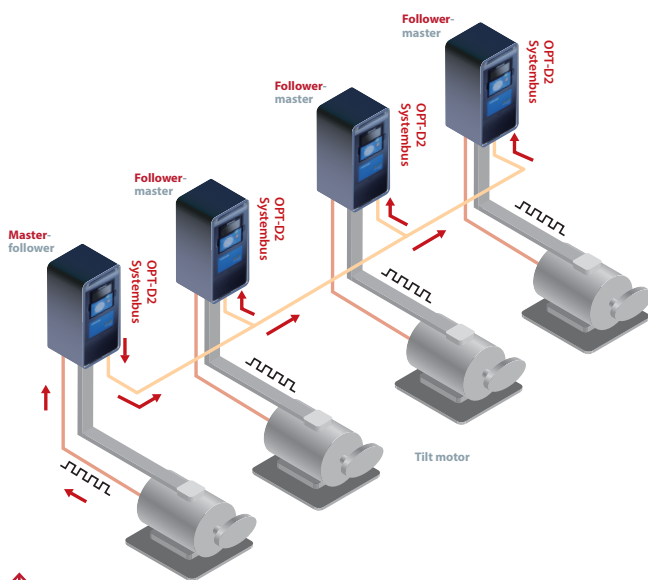
Steel-making – Converter tilting



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Steel-making – Converter tilting

Furnace requirements

- Tilt requirements, large tilt rotation
- Parking brake requirements, capable of stopping at any specified position during rotation
- Speed regulation requirements, which require the tilting speed to be continuously adjustable during production
- Load change, during which the converter output torque is subjected to the load change caused by the change in the inclination angle of the transformer
- Reliability requirements, the converter is a critical device, and tilting demands a high level of safety and reliability for the drive



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Steel-making – Tilting solutions

Hardware configuration

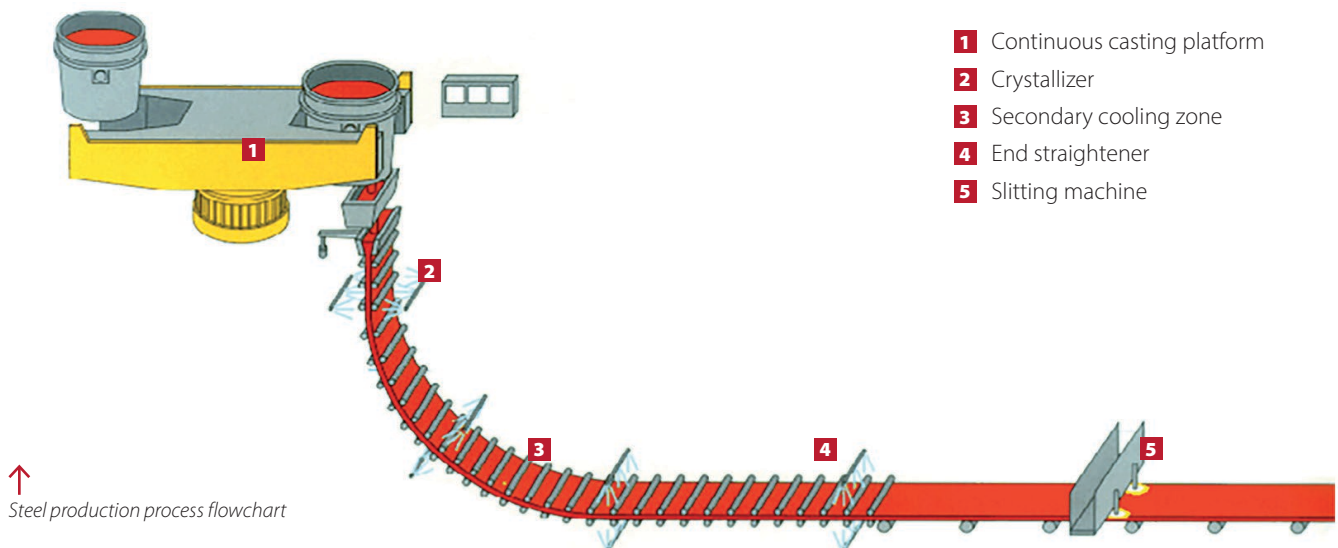
- Danfoss NXP drives
- Based on the System Bus communication protocol option board OPT-D1 or OPT-D2
- Motor encoder option board OPT-A4/A5, etc.
- Communication cards for various communication protocols

Scheme summary

- During normal operation, either one is designated as the master, the other as follower, and the communication between master and follower is performed via the System Bus, ensuring load balancing during operation
- The drive features master-follower online switching functionality. When the primary master unit fails and drops out, the PLC designates any remaining unit as the new master to maintain continuous operation
- The drive integrates built-in external mechanical brake control logic. Follower units can either synchronize with the master unit's brake logic or utilize their own internal brake logic

Continuous casting

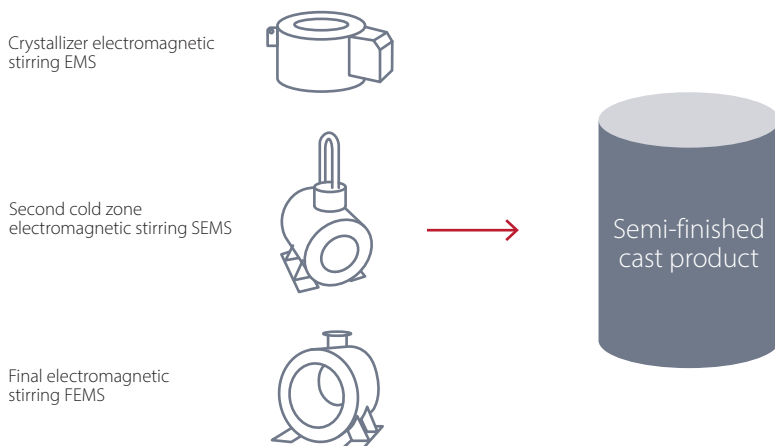
In continuous casting, the ladle containing molten steel from the refining furnace is transported to the turret. After the turret rotates to the pouring position, the molten steel is poured into the tundish, which then distributes the steel to individual crystallizers through nozzles. The crystallizer is one of the core components of the continuous caster, where the steel is formed into shape and rapidly solidifies. Working in tandem with the crystallizer oscillation system, the withdrawal straightener extracts the molten steel from the crystallizer. After cooling and electromagnetic stirring, it is cut into billets of specified lengths.



Units	Drive model	Application introduction
Ladel turret	iC7-Automation or VACON® NX series	Start-stop, smooth ramp control, reduced shock; vector control
Pilot rod hoist	iC7-Automation or VACON® NX series	Controls the lifting and lowering of the rod, vector control
Electromagnetic stirring with low-frequency power supply	VACON NX Series Single Drive or Common DC Bus	Low-frequency high-current output; output current and frequency are individually adjustable The loads are mostly three-phase unbalanced loads or two-phase loads
Withdrawal and straightening machine	iC7-Automation or VACON® NX series	Single-point or multi-point straighteners, drive rollers controlled by a drive
Straightening roller	iC7-Automation or VACON® NX series	Straightening roller control, open-loop control
Thin plate blank shears	iC7-Automation or VACON® NX series	Shock load with high overload factor
Weighing roller track	iC7-Automation or VACON® NX series	Open-loop control, one-drives-one or one-drives-multiple
Transfer car	iC7-Automation or VACON® NX series	Open-loop control

Continuous casting – electromagnetic stirring

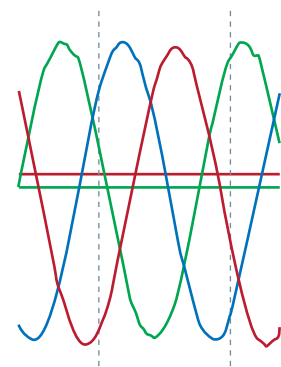
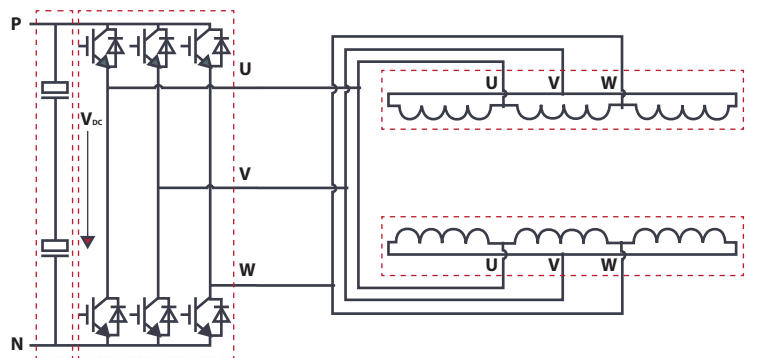
Electromagnetic stirring (EMS for short) refers to a process in continuous casting where the strand passes through a rotating magnetic field generated by drive-controlled crystallizer coils. This induces controlled rotational motion in the uncrystallized molten steel within the strand through electromagnetic forces, creating stirring flows. The resulting fluid dynamics improve steel solidification and enhance final strand quality.



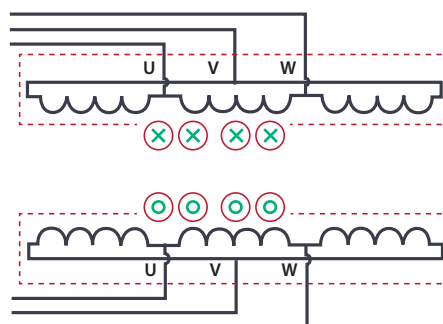
Electromagnetic stirrer body classification

Electromagnetic stirring

- Improved distribution of inclusions in castings
- Improved casting surface quality
- Enlarging casting and other axial bands
- Eliminate casting shrinkage to improve centerline loss
- Changes the dendritic crystalline structure in the electromagnetically stirred region of the continuously cast steel product
- Reduced centerline segregation in continuously cast steel products

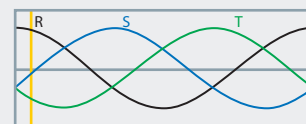
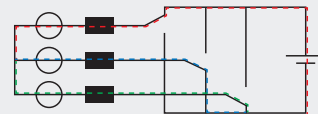
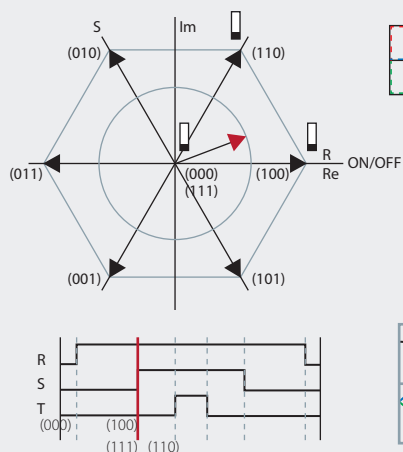
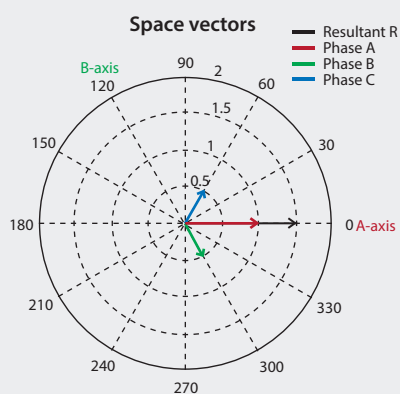


Special software for electromagnetic stirring low-frequency power supply



Supported load types

- Three-phase balanced load
- Three-phase imbalanced load
- Two-phase load



Electromagnetic stirring low-frequency power supply

Continuous casting – electromagnetic stirring

Low-frequency power supply software functions



Programmable stirring current and frequency



Adaptive adjustment of imbalanced loads



Alternating mixing modes



Multi-mixer master-follower control



Cycle time mixing mode



Supports 2-phase loads



Automatic adjustment of internal PID parameters to adapt to different bodies



Supports multiple communication protocols



Three-phase balanced load



Safety function to detect leakage currents

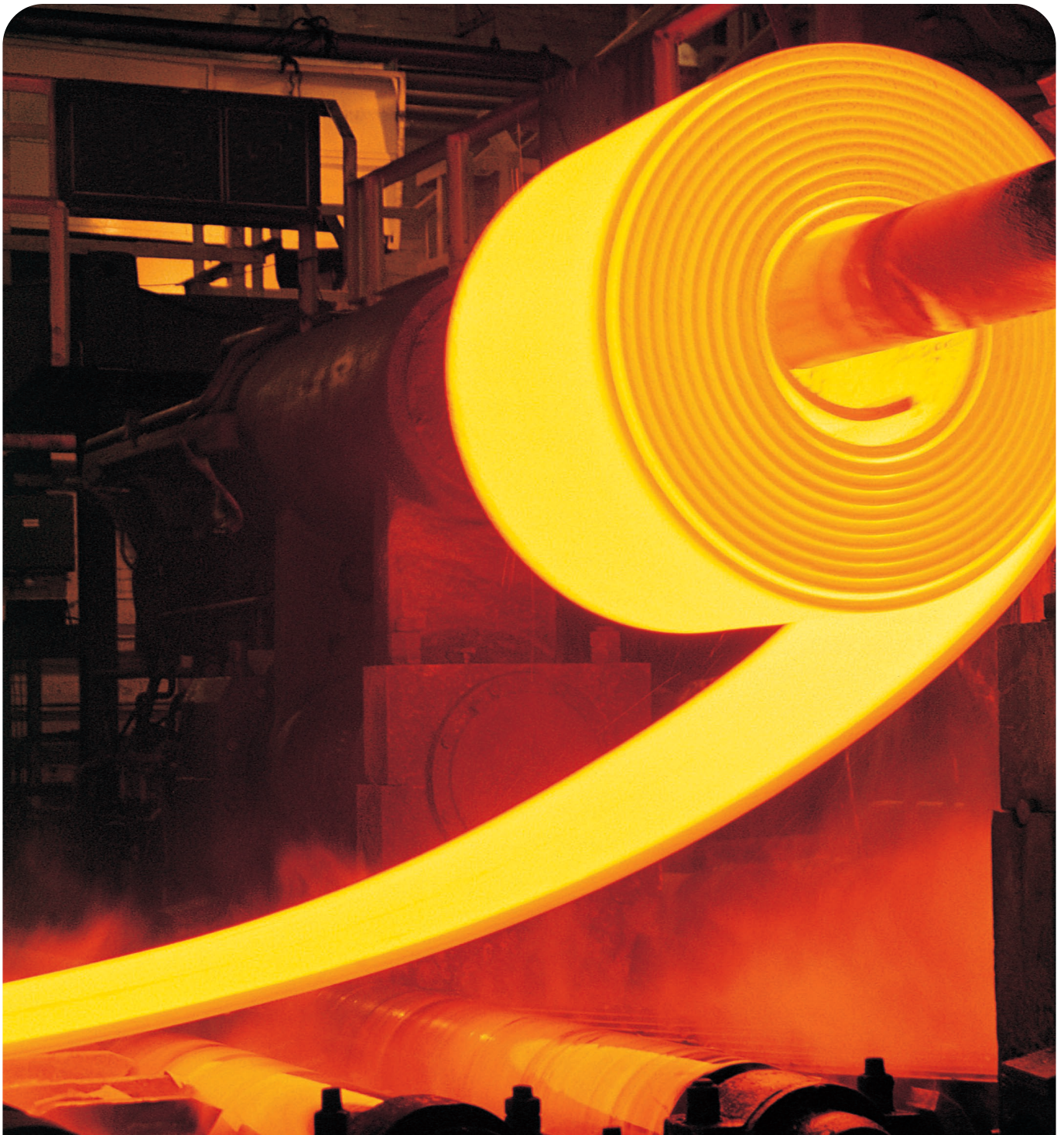


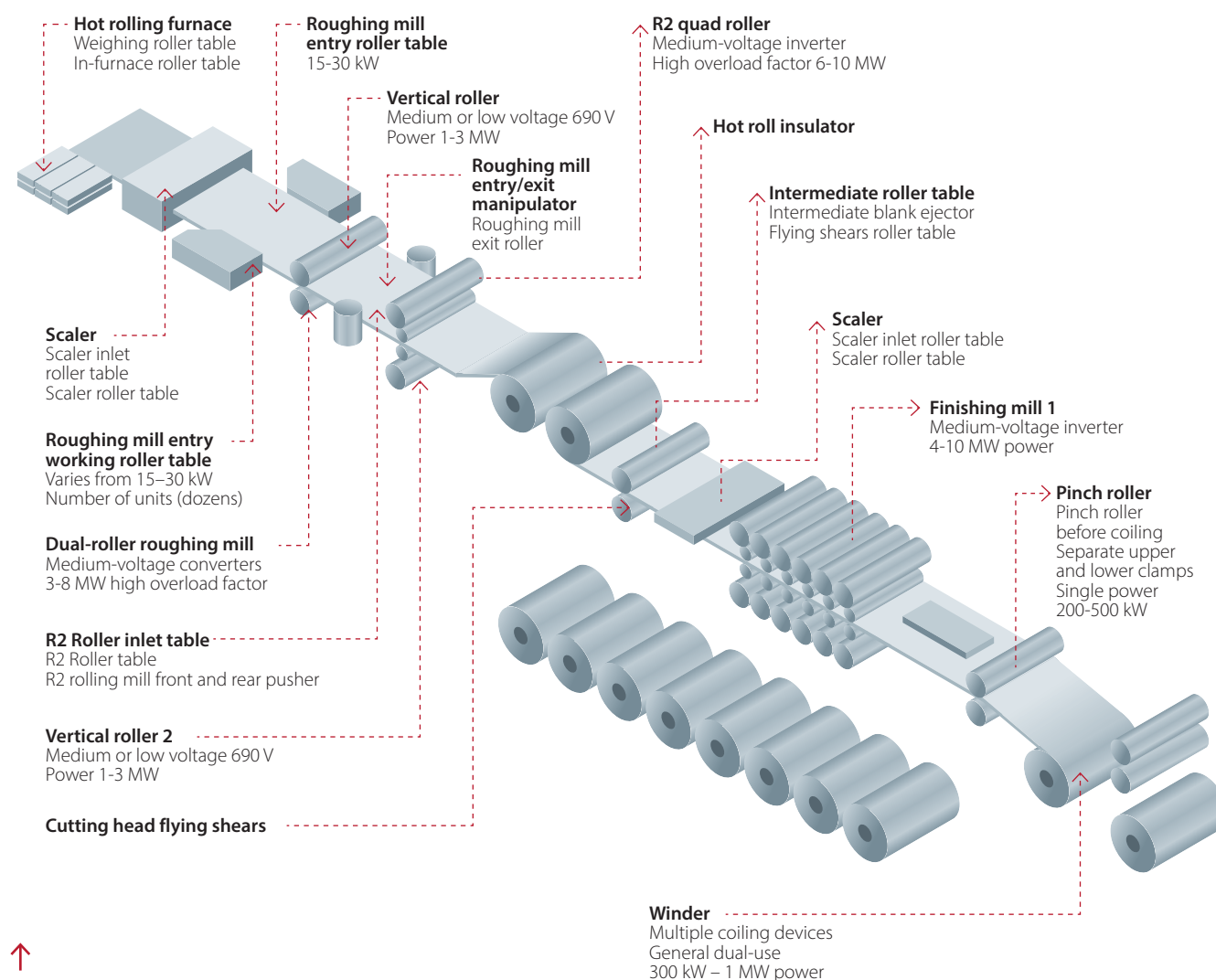
Three-phase imbalanced load

Hot-rolled plate and strip

The billets from the steel mill are still only semi-finished products and need to be rolled in the mill to become a product meeting specifications.

First, it enters the furnace where it is descaled, then it passes through a rough mill, a finishing mill, and finally the finished product is a hot-rolled steel coil.

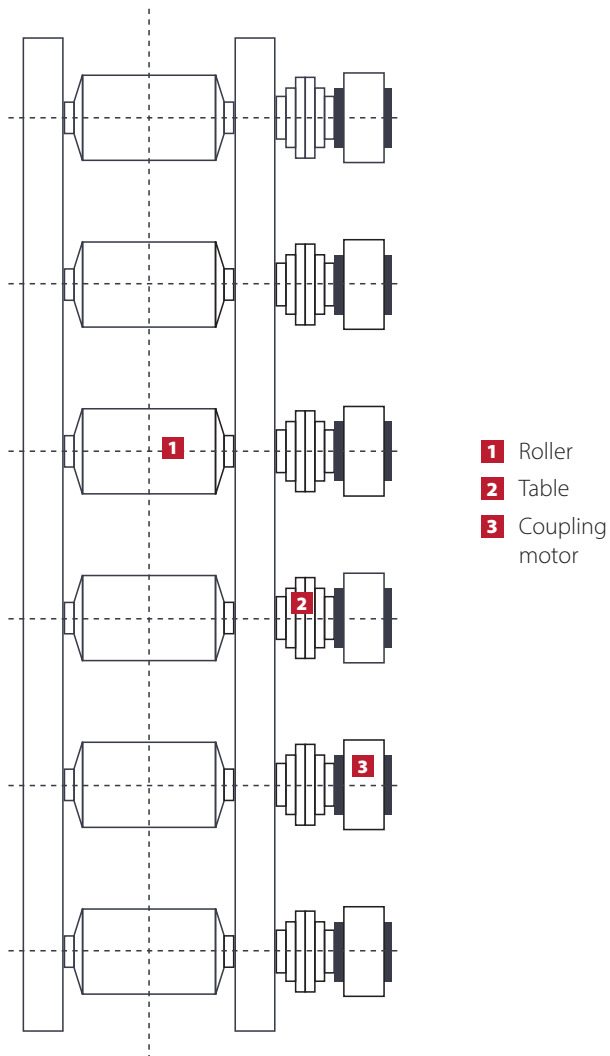




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Hot rolling process flow diagram

Units	Drive model	Application introduction
Heating furnace	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Roller table. Open-loop vector control
Scaler	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Roller table, water pump. Open-loop vector control
Rough rolling conveyor	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple
Vertical roller	VACON® NXP Common DC Bus	Upper and lower support rollers at the rolling mill, closed-loop control, high overload factor
Rough rolling front and rear pusher, Front and rear working rollers	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Vector control, open/closed-loop control
Hot coil box	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Roller table. Open-loop vector control
Flying shears	VACON® NX single drive or VACON® NXP Common DC Bus	Closed-loop position, velocity, current control
Laminar flow cooling	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Roller table, water pump. Open-loop vector control
Winder	VACON® NX single drive or VACON® NXP Common DC Bus	Closed-loop position, vector control

Roller table applications

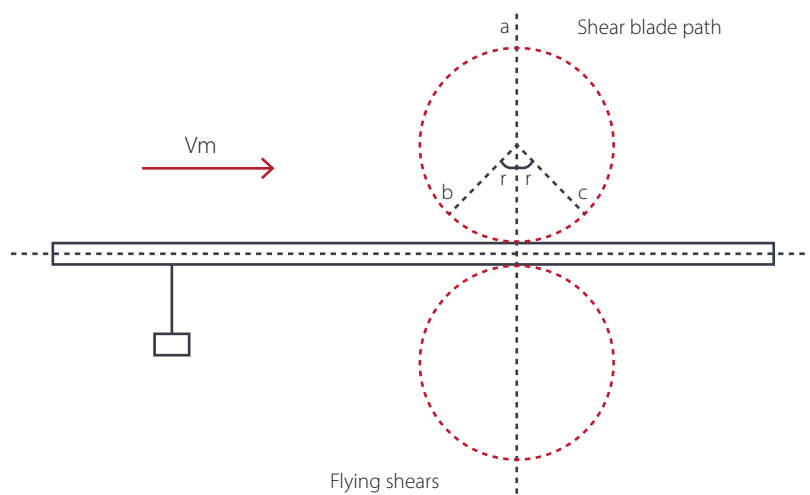
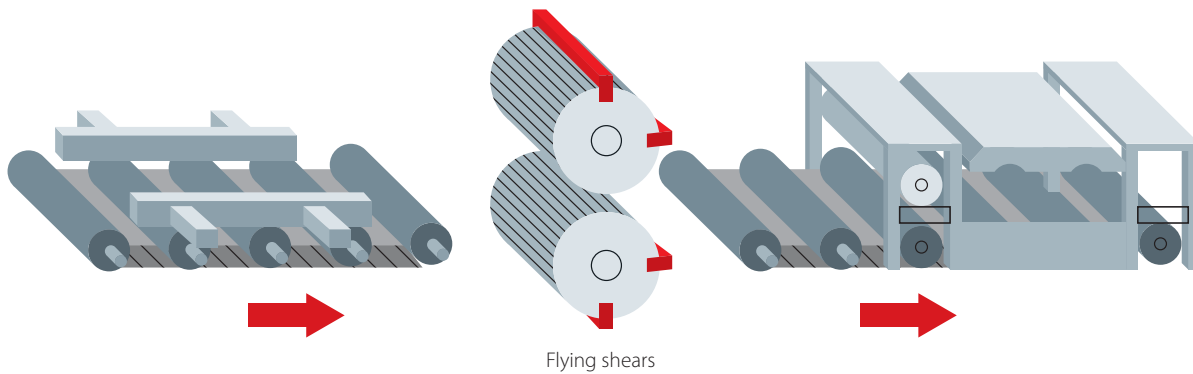


Roller table drive features

- Single multi-motor or single-motor converters adapt to process needs and offer strong carrying capacity
- Long motor cables effectively compensate for leakage currents from parasitic capacitors
- Billets exhibit rapid impact-load adaptation throughout the entry, intermediate, and exit rolling phases
- Requires electrical braking capabilities
- Satisfies four-quadrant motor operation
- Open-loop vector control for fast response and fewer failures.



Flying shears application



Flying shear drive characteristics

- Closed-loop control; absolute encoder or incremental encoder plus proximity switch
- Speed rings, current rings, and position rings work in tandem
- High speed accuracy
- Fast dynamic response
- High overload factor

Hot rolled – Medium-thick plates

Thick metal plates are widely used in various industrial applications, such as **shipbuilding, marine platform construction, bridge construction, pressurized tanks**, etc.

Thick plate production features

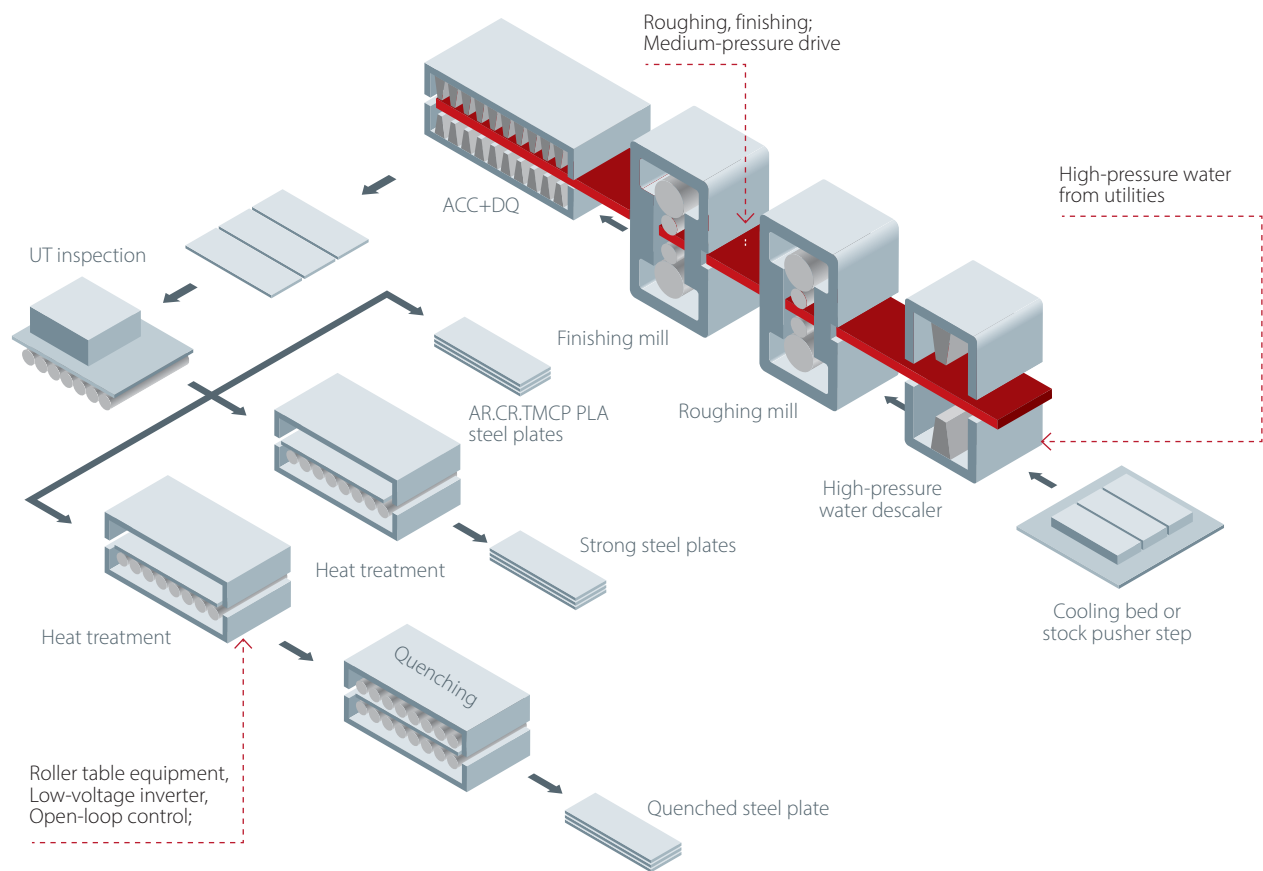
- Thick plates are basic raw materials for industrial production, and they cover a wide variety of applications, with production continuity varying according to market use;
- The production of special steels is of critical importance to society

Hot rolled – Medium-thick plates

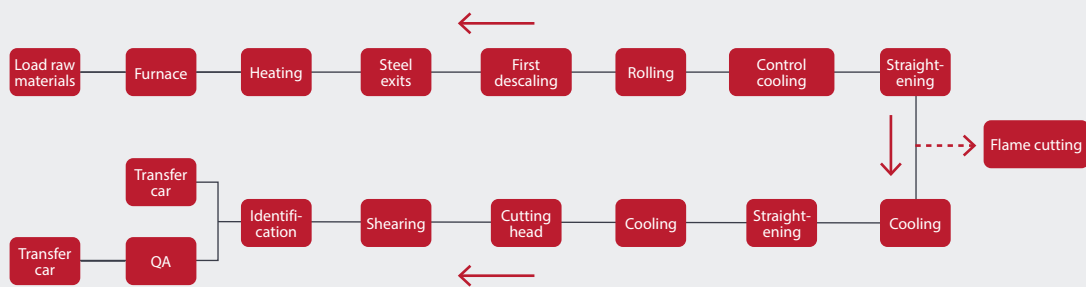
Roller table
Disc shears
Cross-section
Longitudinal cut

Straightener
Two-roller mill
Four-roller mill
Descaling

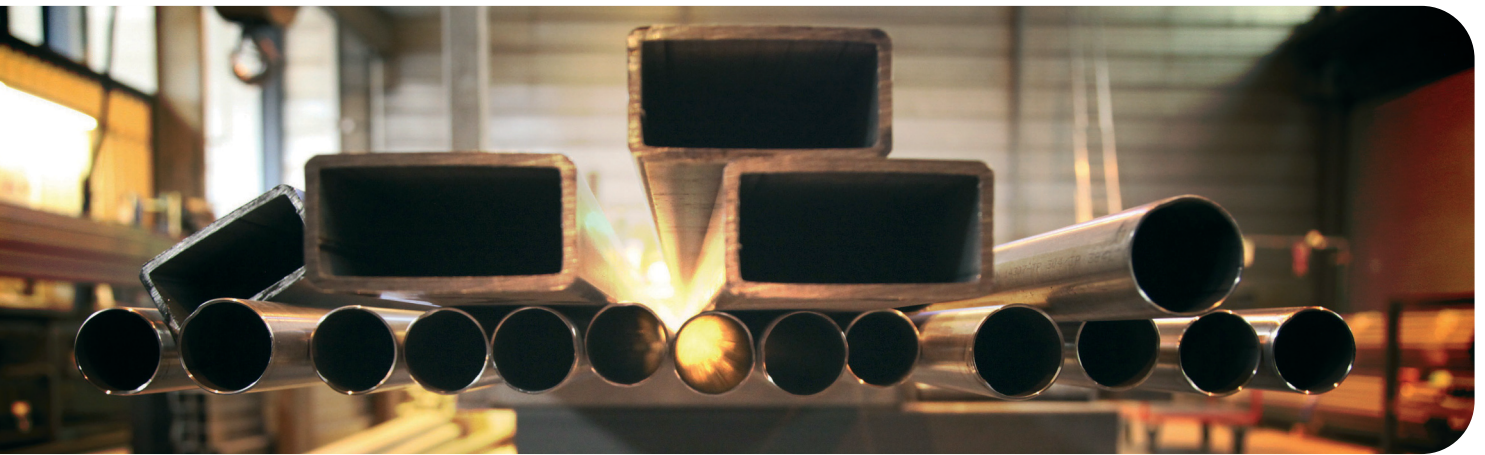
Hot-rolled – thick plates



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Thick-plate process



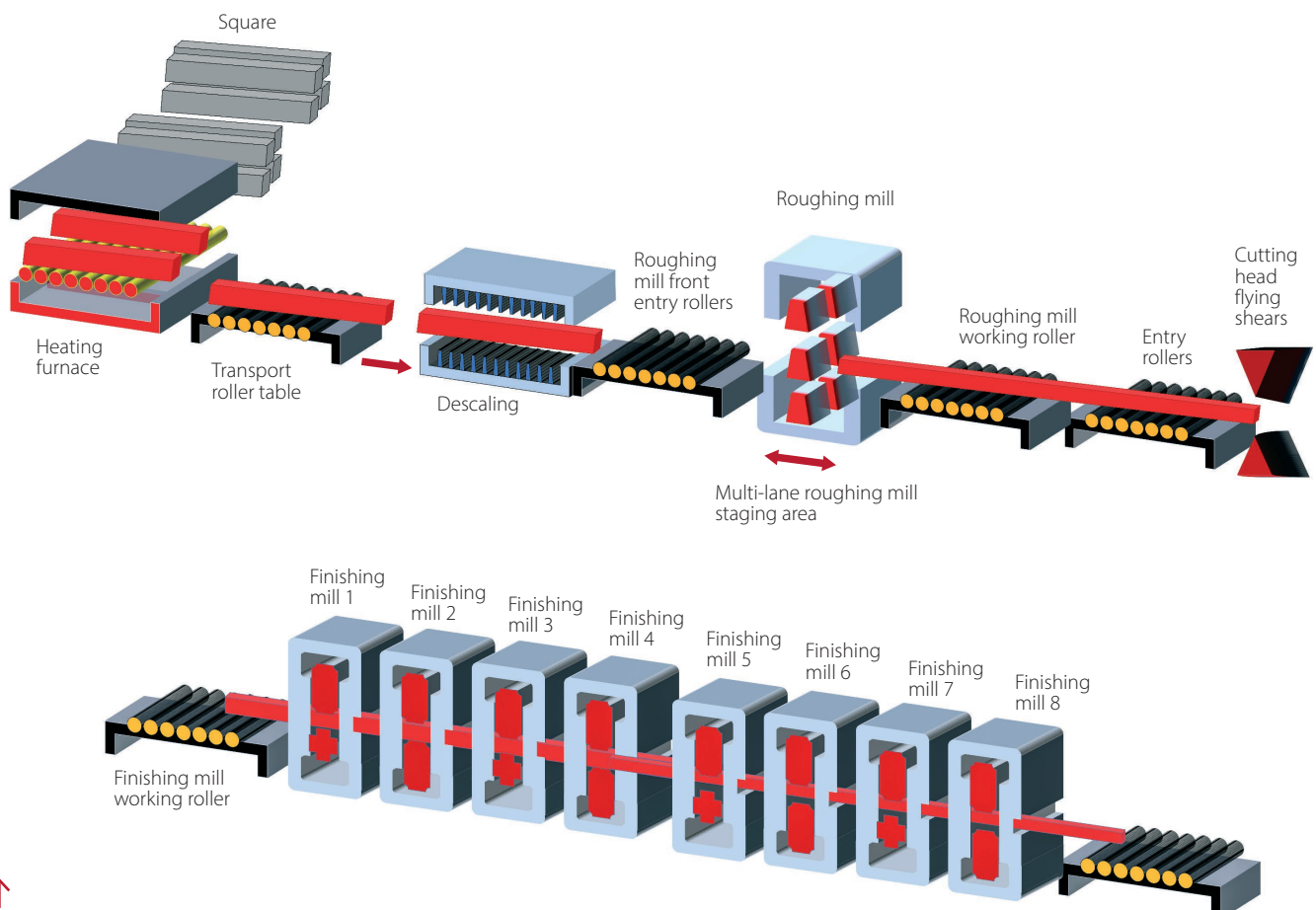
Units	Drive model	Application introduction
Heating furnace roller table	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple
Descaling	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Descaling pump
Roller entry, exit roller table	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple
Finishing – Straightening	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Open-loop, closed-loop control
Cooling bed	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Open-loop, closed-loop control



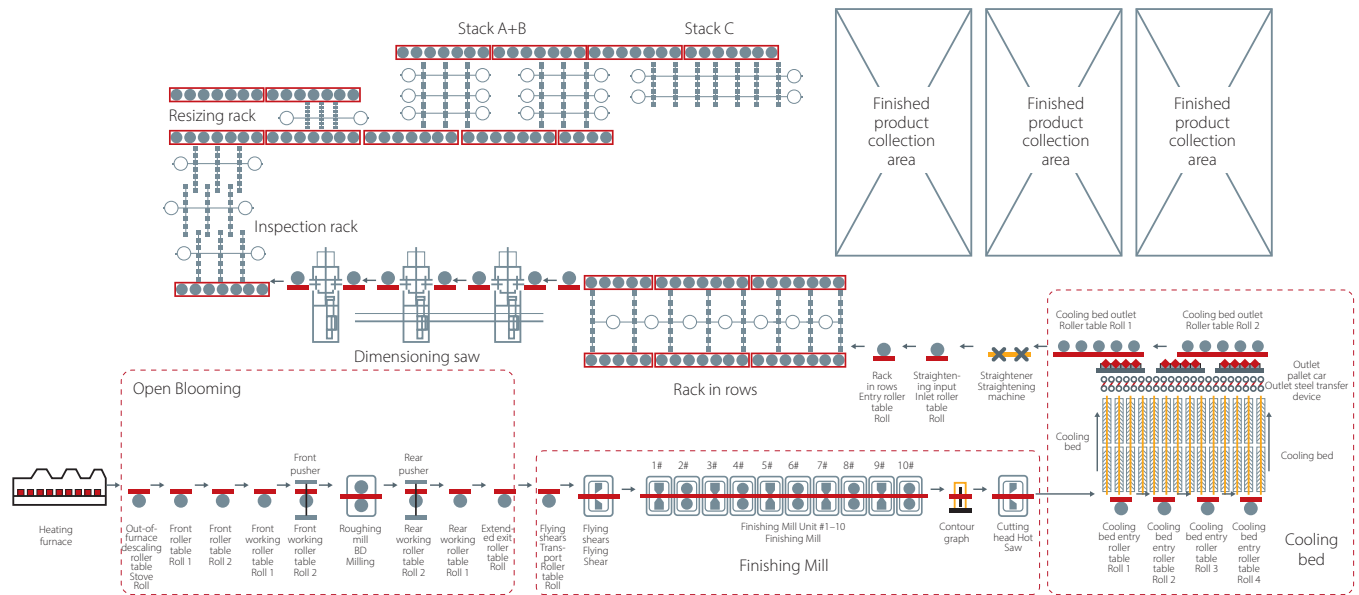
Hot rolled-type steel

Formed steel uses

Formed steel is a category of solid, straight-bar steel products formed through plastic deformation, characterized by defined cross-sectional shapes and dimensions. Also known as steel sections or long products. Widely used in industrial production and civil construction, the most common forms are H-steel, T-steel, channel steel, and angle steel.



Steel production process example diagram



Blanking

- Scaling roller table
- Roughing front transport rollers
- Roughing mill front working rollers
- Roughing mill
- Roughing mill front and rear pushers
- Roughing mill working roller
- Roughing mill rear transport roller

Finishing

- Cutting head flying shears;
- Finishing mill 1; finishing mill 6
- Finishing mill 2; finishing mill 7
- Finishing mill 3; finishing mill 8
- Finishing mill 4; finishing mill 9
- Finishing mill 5; finishing mill 10

Cooling bed

- Cooling bed entry roller table
- Dimensioning saw
- Spreader car
- Chain cooling bed
- Cooling bed exit roller table
- Straightening bench
- Straightener roller table

Units	Drive model	Application introduction
Scaling roller table	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple
Roughing mill entry transport roller table	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple
Roughing mill front working roller	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Closed-loop vector control, one-drives-one; fast roller table response
Roughing mill front and rear pushers	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple
Roughing mill rear working roller	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Closed-loop vector control, one-drives-one; fast roller table response
Roughing mill rear transport roller	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple
Cutting head flying shears	690 V VACON® NXP Common DC Bus	Closed-loop control, high overload factor; fast dynamic response
Finishing mill	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Closed-loop control, high overload factor; multi-frame continuous rolling; unidirectional rolling
Straightener	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Closed-loop control
Cooling bed inlet rollers	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple
Cooling bed exit roller table	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple
Straightener	iC7-Automation, VACON® NX single drive, or VACON® NXP Common DC Bus	Closed-loop control



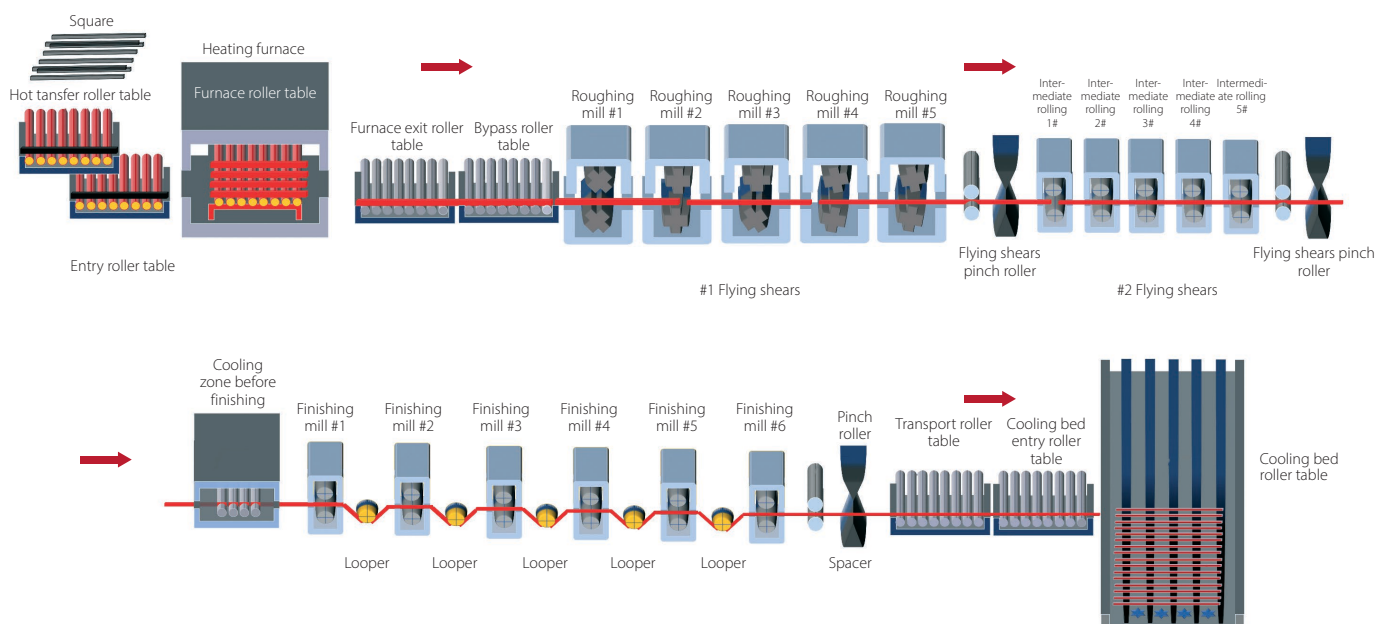
Hot-rolled bars

Bar steel uses

Bars are simple sectional profiles that are classified by sectional shape. These usually include round, square, or diamond sections. Common types of bars are rebar, angle steel, threaded steel, etc., and they are widely used in the construction, machinery, automotive, marine and other industrial fields.

Bar production process

The production process generally consists of heating, rough rolling, intermediate rolling, finishing, shearing, packing, etc. VFDs are a key piece of equipment for driving motors and play a key role in the production of bars.



Heating furnace

- Hoist exit roller table
- Hot transfer roller table
- Square blank hoist
- Entry roller table

Roughing mill

- Exit roller table
- Overhead conveyor roller table
- Roughing mill #1
- Roughing mill #2
- Roughing mill #3
- Roughing mill #4
- Roughing mill #5
- #1 Flying shears pinch roller
- Flying shears #1

Intermediate rolling

- Overhead conveyor roller table
- Intermediate rolling mill 1#
- Intermediate rolling mill 2#
- Intermediate rolling mill 3#
- Intermediate rolling mill 4#
- Intermediate rolling mill 5#
- 2# Flying shears pinch roller
- Flying shear #2

Cooling bed

- Cooling bed entry roller table
- Steel chain
- Raw materials unloading car
- Cooling bed magnetic chain
- Alignment roller table
- Cooling bed exit roller table

Finishing

- Intermediate mill bypass roller table
- Intermediate mill cooling zone roller table
- Roughing mill entry liquid cooling zone roller table
- Finishing mill #1
- Finishing mill looper #1
- Finishing mill #2
- Finishing mill looper #2
- Finishing mill #3
- Finishing roll looper #3
- Finishing mill #4#
- Finishing roll looper #4
- Finishing mill #5
- Finishing roll looper #5
- Finishing mill #6
- Pinch roller
- Measure

Packaging

- Chain conveyor
- Raw materials unloading car
- Scrap collection car
- Finished product stacking roller table
- Packing roller table
- Collection rack hoist
- Collection rack leveler

Units	Drive model	Application introduction
Square blank hoist	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Closed-loop control, hoist applications;
Hoist exit roller table	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple;
Entry roller table	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Open-loop control, one-drives-one;
Hot transfer roller table	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Open-loop control, one-drives-one;
Exit roller table	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Open-loop control, one-drives-one;
Overhead conveyor roller table	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple
Roughing mill	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Closed-loop control, high overload factor, fast torque response;
Flying shears #1 Entry pinch roller	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Closed-loop control, master-follower cascade control mode;
Flying shears #1	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Closed-loop control, high overload factor; fast dynamic response;
Intermediate rolling mill	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Closed-loop control, high overload factor, fast torque response;
Flying shears #2 Front pinch roller	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Closed-loop control, master-follower cascade control mode;
Flying shears #2	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Closed-loop control, high overload factor; fast dynamic response;
Intermediate mill colling zone roller table	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple;
Roughing mill entry liquid cooling zone roller table	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple;
Finishing mill	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Closed-loop control, high overload factor; fast dynamic response;
Looper	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Closed-loop control, tension control, fast dynamic response;
Dimensioning shears	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Closed-loop control, high overload factor; fast dynamic response;
Cooling bed inlet rollers	iC7-Automation, VACON® NX single drive or VACON® Common DC Bus	Open-loop control, one-drives-one or one-drives-multiple;

Cold-rolled plate strips

Cold rolling mill

The type of cold rolling mill is primarily defined by the material properties and dimensional specifications of the product: Four-high and six-high mills are typically used for low-carbon steels and low-alloy steels of standard thicknesses, while multi-high mills are required for alloy steels, stainless steels, thin gauges, and specialty steels like silicon steel. Specialty steels such as silicon steel require multi-high rolling mills like the Sendzimir 20-high mill to achieve proper rolling results.

Low rolling temperature

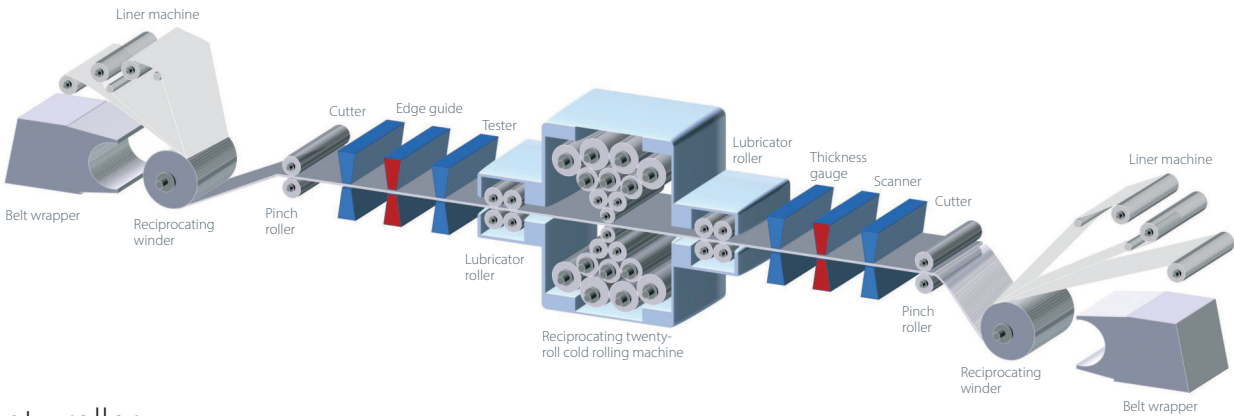
To avoid machining hardening, multiple rolling passes are required.

High-tension rolling

In order to prevent the strip from slipping, it is necessary to apply a great amount of tension to the strip during the rolling process. At the same time, high tension can also ensure that the strip remains straight during the rolling process, and offers better control of the plate.

Process lubrication

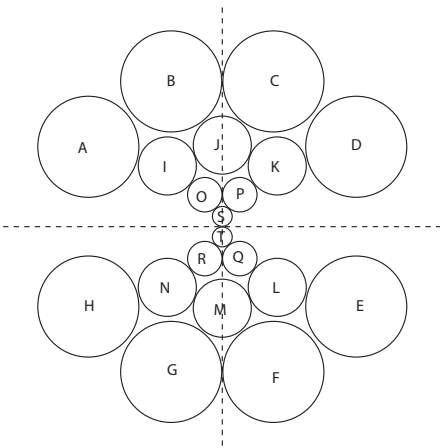
Process lubrication is also essential to ensure that the strip steel keeps its shape during milling. Process lubrication is primarily achieved by using a lubricant to reduce the deformation stresses generated by the metal during deformation, while also improving the heat conduction of the rolled part.



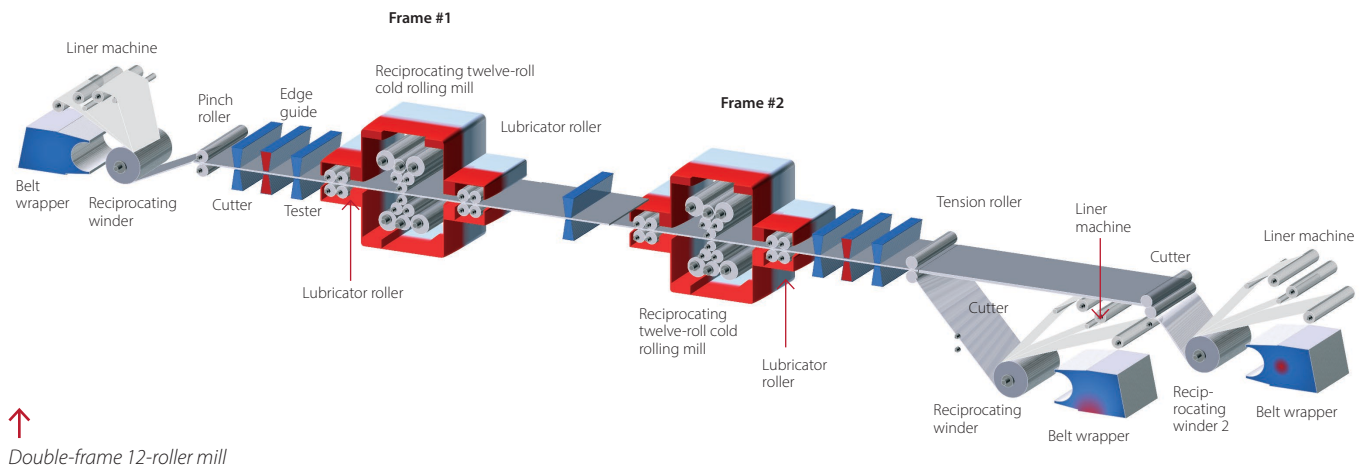
Twenty-roller

A twenty-roll rolling mill can be used for a reciprocating rolling process, where the steel is rolled in multiple lanes by switching the forward and backward directions of movement until the ideal specification is reached. This type of rolling mill is typically used to produce high-strength materials or thin sheets, such as silicon steel, compared to other types of rolling mills. Its main features are:

- Small roller diameter, high rolling pressure ratio, suitable for high-tension, thin-format rolling
- Stable rolling system with high mill stiffness, including lateral and longitudinal stiffness
- Good roll seam and plate type control adjustment system



Units	Drive model	Application introduction
Reciprocating winder	VACON® NXP Common DC Bus	Closed-loop vector control
Pinch roller wrapper	VACON® NXP Common DC Bus	Open-loop control
Tension roller/speed roller	VACON® NXP Common DC Bus	Closed-loop control
Smoke and oil extraction	VACON® NX Single Drive	Open-loop control
Lubricator roller	VACON® NXP Common DC Bus	Open-loop control

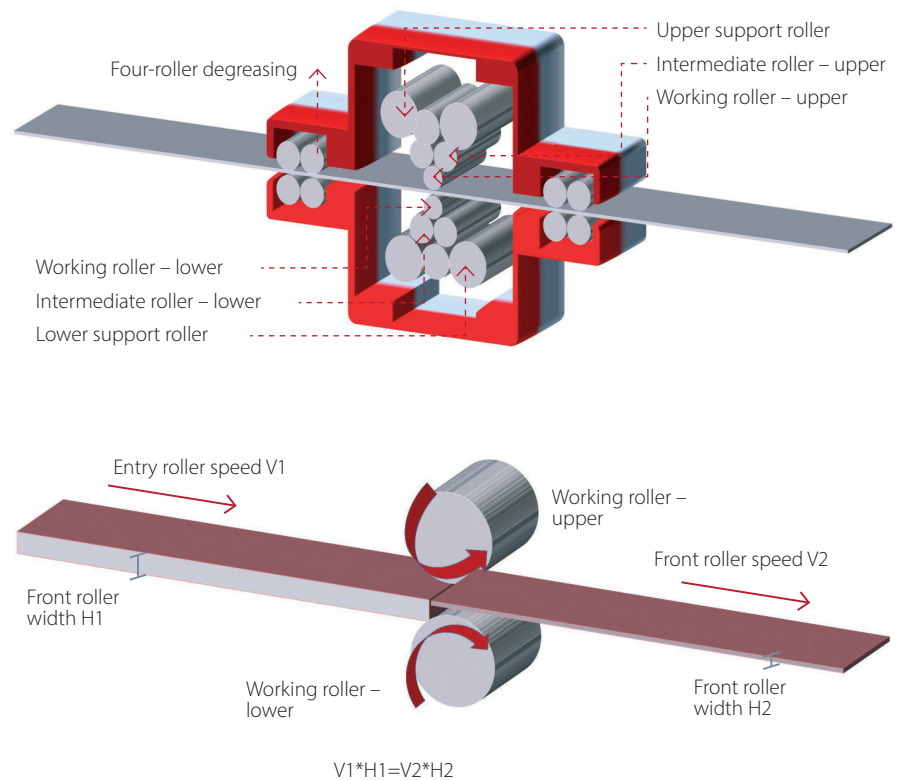


Double-frame twelve-roller

The rolling section consists of two twelve-roller mills, which allow the rolling process to be carried out in two lanes in one direction compared to a single-frame rolling mill.

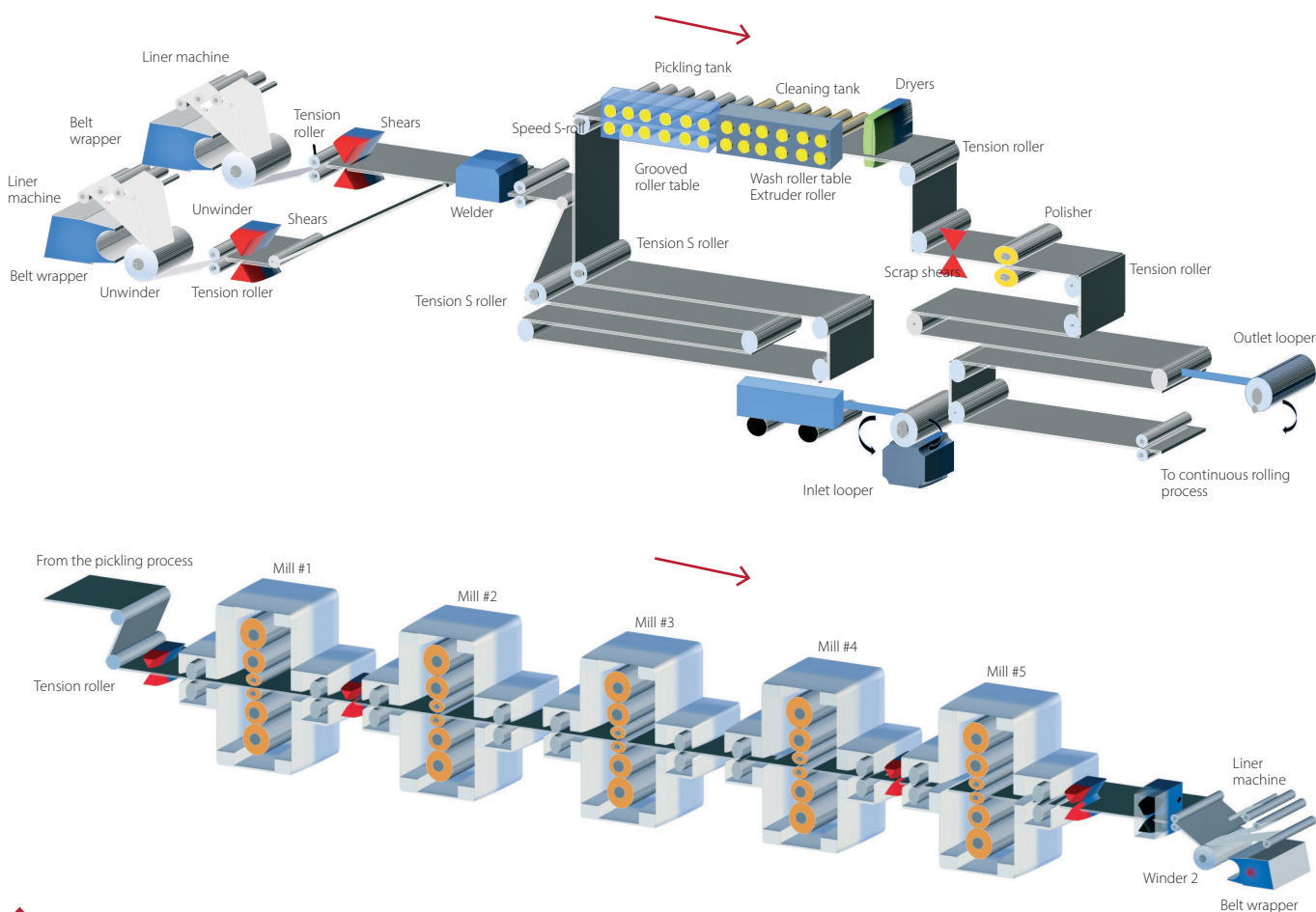
Reciprocating rolling:

Two-way reciprocating rolling process with unwinding on both inlet and outlet sides.



Units	Drive model	Application introduction
Reciprocating winder	VACON® NXP Common DC Bus	Closed-loop vector control
Pinch roller wrapper	VACON® NXP Common DC Bus	Open-loop control
Tension roller	VACON® NXP Common DC Bus	Closed-loop control, velocity/torque control
Smoke and oil extraction	VACON® NX Single Drive	Open-loop control
#1 Mill	VACON® NXP Common DC Bus	Low-voltage 690 V drive or medium-voltage drive, high overload factor, fast torque response
#2 Mill	VACON® NX Common DC Bus	Low-voltage 690 V drive or medium-voltage drive, high overload factor, fast torque response
Lubricator roller	VACON® NXP Common DC Bus	Open-loop control
Coiling car/uncoiling car	VACON® NX Single Drive or VLT® AutomationDrive FC 302	Open-loop control

Cold rolling – Pickling



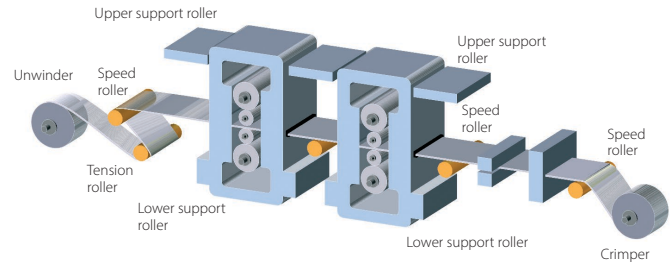
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Pickling line flow diagram

Units	Drive model	Application introduction
Unwinder	VACON® NXP Common DC Bus	Closed-loop vector control, tension control, roll size calculation
Speed roller	VACON® NXP Common DC Bus	Closed-loop vector control for roller tables; multi-speed zone synchronization with master-follower control and load sharing
Inlet sleeve	VACON® NXP Common DC Bus	Closed-loop control speed, tension control
Tension roller	VACON® NXP Common DC Bus	Closed-loop speed control, tension control, tension closed-loop regulation
Pickling tank inner roller	VACON® NXP Common DC Bus	Open-loop speed control; one-drives-one
Extruder roller	VACON® NXP Common DC Bus	Open-loop speed control; one-drives-one
Scrap cutter	VACON® NXP Common DC Bus	Closed-loop speed control
Outlet sleeve	VACON® NXP Common DC Bus	Closed-loop control speed, tension control
Shears	VACON® NXP Common DC Bus	Open/closed-loop speed control
Continuous roller	VACON® NX Common DC Bus	Continuous rolling mill, closed-loop control, high torque response requirement, high overload factor
Flying shears	VACON® NXP Common DC Bus	Closed-loop position, velocity, current control, high overload factor
Pinch roller	VACON® NXP Common DC Bus	Closed-loop speed control
Coiling	VACON® NXP Common DC Bus	Closed-loop vector control, tension control, roll size calculation

Cold rolling

Screed drive characteristics

- Common DC bus concept that returns energy to the grid when braking
- Inertia, friction force compensation functions
- Enhanced dynamic performance with feed-forward control
- Master-follower cascade control mode, upper and lower support roller control
- Load sharing
- Tension control
- Elongation control



Looper control drive characteristics

- Closed-loop control, set calculation
- Master-follower cascade control mode, synergistic inlet and outlet speed control
- Tension control to maintain the set belt tension
- Steel oscillation compensation control inside the looper

Unwinding, winding machine drive characteristics

- Common DC bus concept that returns energy to the grid when braking
- Closed-loop control with photoelectric encoder
- Inertia, frictional force compensation; uses feed-forward control to improve dynamic performance
- Load sharing
- Tension control
- Special macro applications; process operations such as coil size calculations, tension control, and acceleration compensation can be completed by the drive

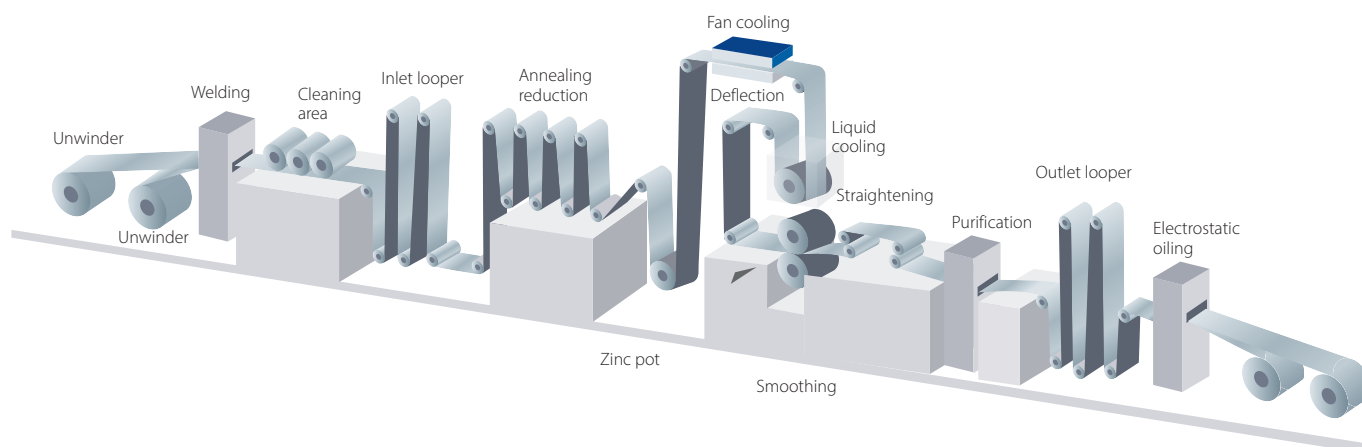




Process line

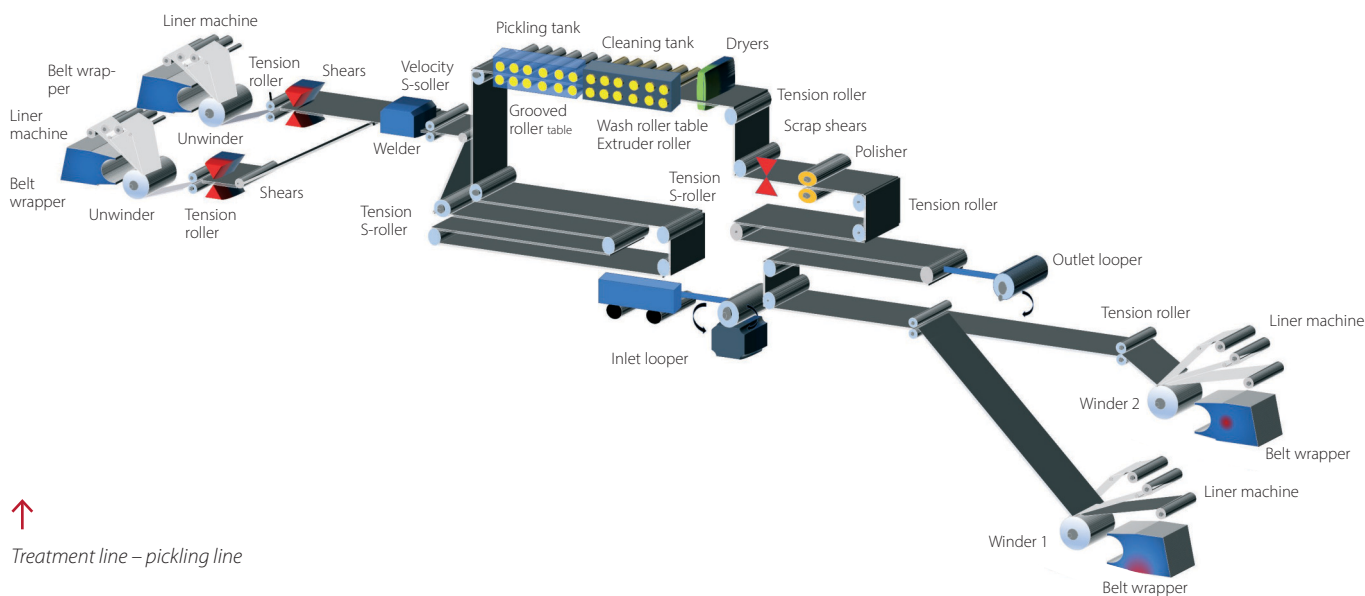
Rewinding, tearing, laminating, and other physical processes of plate strip processing.
 Surface treatment of plate strip-finished products to form intermediate finished products.
 Reprocessing of finished strip products to form final products for industrial and civil production.
 The strips are treated with a special production process to obtain a finished strip with specific properties.

Process line types	Process line description	Product use
Slitting line	Separation of multiple sheet metal strips into single-layer strips by mechanical force, winding of single-layer strips by a coiler	Single-layer rolls, metallurgical intermediate products; processed in other ways to produce final products
Rewinding line	Hot-rolled or cold-rolled products with large spools are cut into small spools of various diameters to meet end-user production needs, after passing through a heavy-roll line	Various small roll sizes; metallurgical intermediates
Galvanizing line	Zinc coating is applied to either hot-rolled or cold-rolled steel after cleaning and annealing, significantly improving the metal's corrosion and oxidation resistance	Galvanized sheeting is an important raw material in industrial and civil production and is widely used in automotive production, food storage tank production, etc.
Silicon steel line	Grain-oriented and non-grain-oriented silicon steels, special metal production processes	Silicon steel is mainly used in the production of industrial products such as motors, transformers and inductors
Other common treatment lines are annealing lines, color coating lines, electro-galvanizing lines, etc.		



Treatment line – continuous annealing, galvanizing

Units	Drive model	Application introduction
Unwinder	VACON® NXP Common DC Bus	Closed-loop vector control, tension control, roll size calculation
Straightener	VACON® NXP Common DC Bus	Open-loop/closed-loop vector control
S-roller tension roller	VACON® NXP Common DC Bus	Closed-loop speed control, tension control
Cleaning section roller table	VACON® NXP Common DC Bus	Open-loop speed control
Inlet sleeve	VACON® NXP Common DC Bus	Closed-loop speed/torque control, tension control
S-roller tension roller	VACON® NXP Common DC Bus	Closed-loop speed control, tension control, load sharing
Furnace roller	VACON® NXP Common DC Bus	Open-loop/closed-loop speed control, extension control, staged master-follower control
S-roller speed roller	VACON® NXP Common DC Bus	Closed-loop speed control, load sharing
Fan	VACON® NXP Common DC Bus	Fan load, precise airflow control
Outlet sleeve	VACON® NXP Common DC Bus	Closed-loop speed/torque control, tension control
Coiling	VACON® NXP Common DC Bus	Closed-loop speed/torque control, tension control
Rectifier unit	VACON® NX Common DC Bus AFE/NFE	Active front-end rectification with feedback, or diode rectification
Brake	VACON® NXP Common DC Bus	



Units	Drive model	Application introduction
Unwinder	VACON® NXP Common DC Bus	Closed-loop vector control, tension control, roll size calculation;
Straightener	VACON® NXP Common DC Bus	Open-loop/closed-loop vector control;
S-roller tension roller	VACON® NXP Common DC Bus	Closed-loop speed control, tension control;
Cleaning section roller table	VACON® NXP Common DC Bus	Open-loop speed control;
Inlet sleeve	VACON® NXP Common DC Bus	Closed-loop speed/torque control, tension control;
S-roller tension roller	VACON® NXP Common DC Bus	Closed-loop speed control, tension control, load sharing;
Furnace roller	VACON® NXP Common DC Bus	Open-loop/closed-loop speed control, extension control, staged master-follower control;
S-roller speed roller	VACON® NXP Common DC Bus	Closed-loop speed control, load sharing;
Fan	VACON® NXP Common DC Bus	Fan load, precise airflow control;
Outlet sleeve	VACON® NXP Common DC Bus	Closed-loop speed/torque control, tension control;
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Brake	VACON® NXP Common DC Bus	

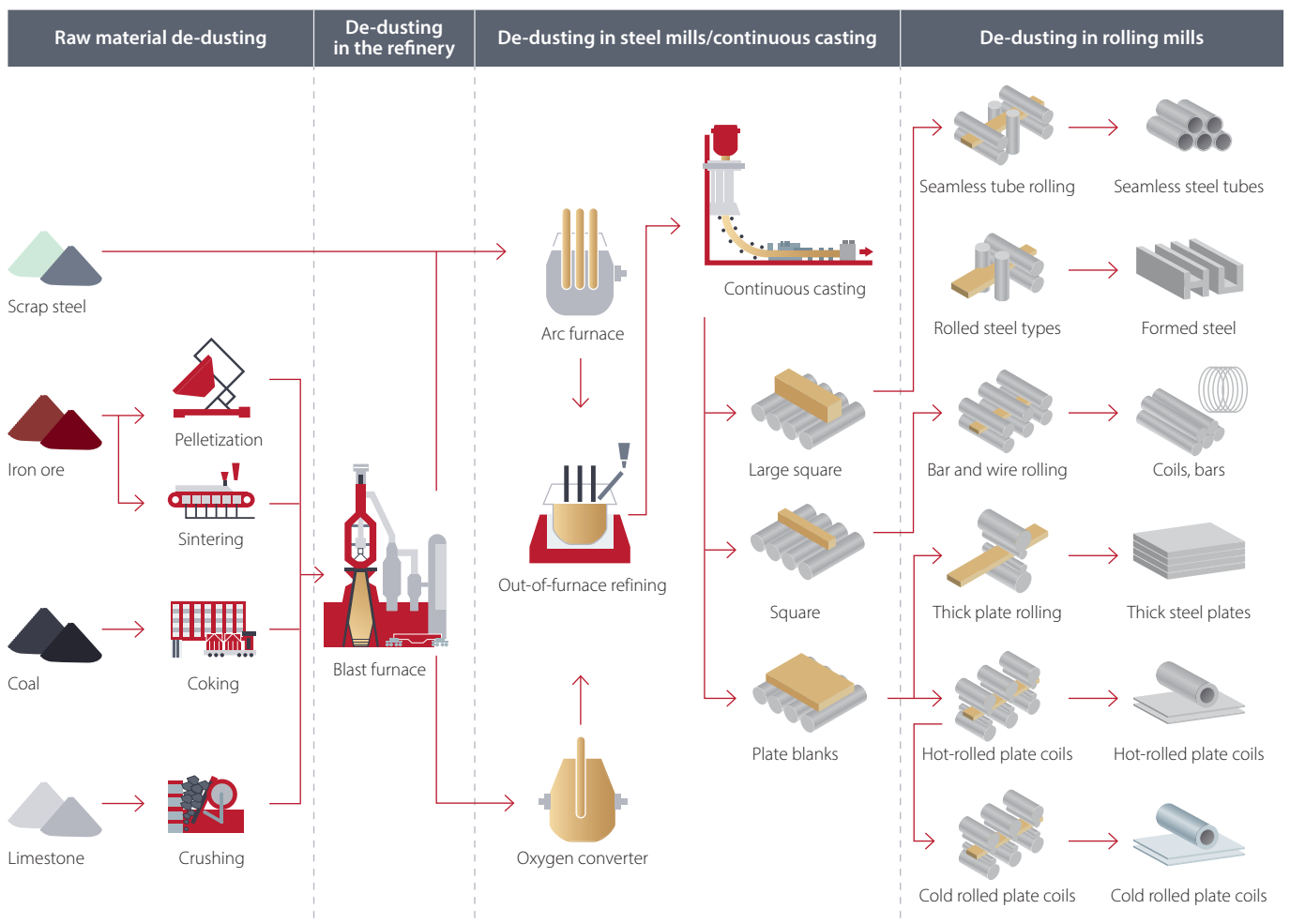


De-dusting

In metallurgy, de-dusting mainly takes place during raw material production, and dust is removed from blast furnaces, turnover furnaces, electric furnaces, hot rolling mills. De-dusting systems are configured according to their size and can be divided into several categories, such as on-site, decentralized, or centralized; and either dry or wet. Dry de-dusting methods include cloth bags, electrical de-dusting

and plastic plate de-dusting, while wet methods include wet electrical de-dusting, venturi de-dusting, and impact de-dusting.

In general, a de-dusting system consists of mechanical equipment such as extraction hoods, air ducts, dust collectors, ash collectors, lime dust collectors, ventilators, silencers, exhausts, etc.



Raw material de-dusting

Raw material plant de-dusting mainly includes: removing dust from ore, limestone, magnesium oxide, coal raw material crushing and screening.

De-dusting in the refinery

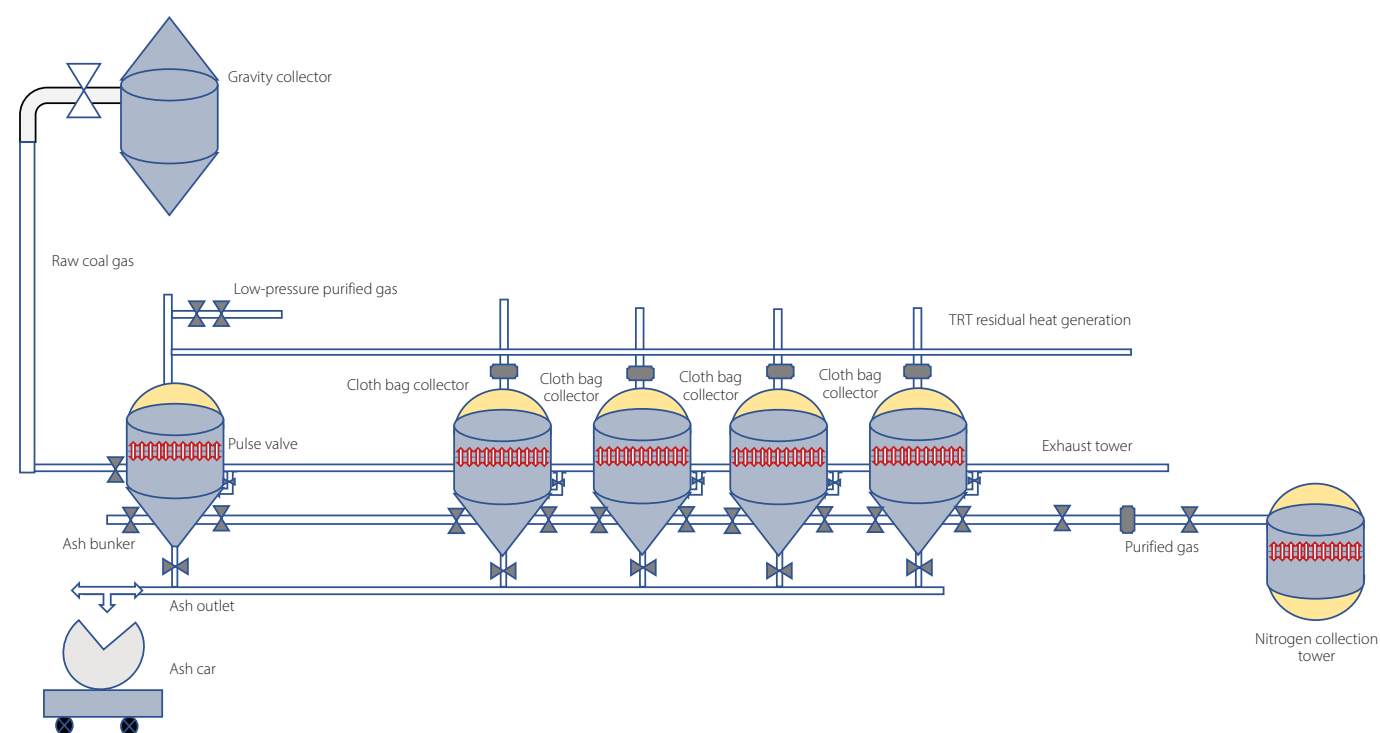
Refinery de-dusting mainly consists of: roof-top gas cleaners for coke bunkers and blast furnaces, de-dusting in iron production, pig iron mills, crushers.

De-dusting in steel mills

Steel mill de-dusting mainly consists of: conversion furnace primary de-dusting, secondary de-dusting, electric furnace de-dusting, refining furnace de-dusting, continuous casting workshop de-dusting, mixing furnace and desulfurization slag de-dusting.

De-dusting in rolling mills

De-dusting in steel mills mainly consists of: de-dusting in roughing and finishing mills.



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Cloth bagging system

Units		Drive model	Application introduction
Sintering, coke de-dusting	Dust extraction fan	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series	Sinter dust extraction fan, power 800-2000 kW, open-loop control
	Electric cooler de-dusting	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series	75-110 kW, usually with several electric cooling fans, open-loop control
	Coke guide car, coke de-dusting	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series	Power up to 2000 kW, open-loop control
Refinery de-dusting	Mine dust extraction fans	iC7-Automation or VACON® NX series	Fan type loads up to 2000 kW, open-loop control
	Blast furnace gas de-dusting	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series	Fan type loads up to 4000 kW, open-loop control
	De-dusting in front of the furnace	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series	Fan type loads up to 3000 kW, open-loop control
Steel-making, continuous casting de-dusting	Smoke/dust extraction fan	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series	Fan type loads up to 3000 kW, open-loop control
	Secondary dust extraction fan	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series	Fan type loads up to 1000 kW, open-loop control
	De-dusting heated casting ovens	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series	Fan type loads up to 2000 kW, open-loop control
Hot rolling de-dusting	Roughing, finishing de-dusting	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series	Fan type loads up to 2000 kW, open-loop control

Desulfurisation/Denitrification

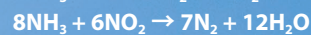
Desulfurization can be divided into three categories: Desulfurization can occur at three stages: Pre-combustion, during combustion, and post-combustion, i.e. flue gas treatment. Flue gas desulfurization technology can be divided into the following according to its desulfurization method and the morphology of the desulfurization reaction product: Wet, dry and semi-dry.

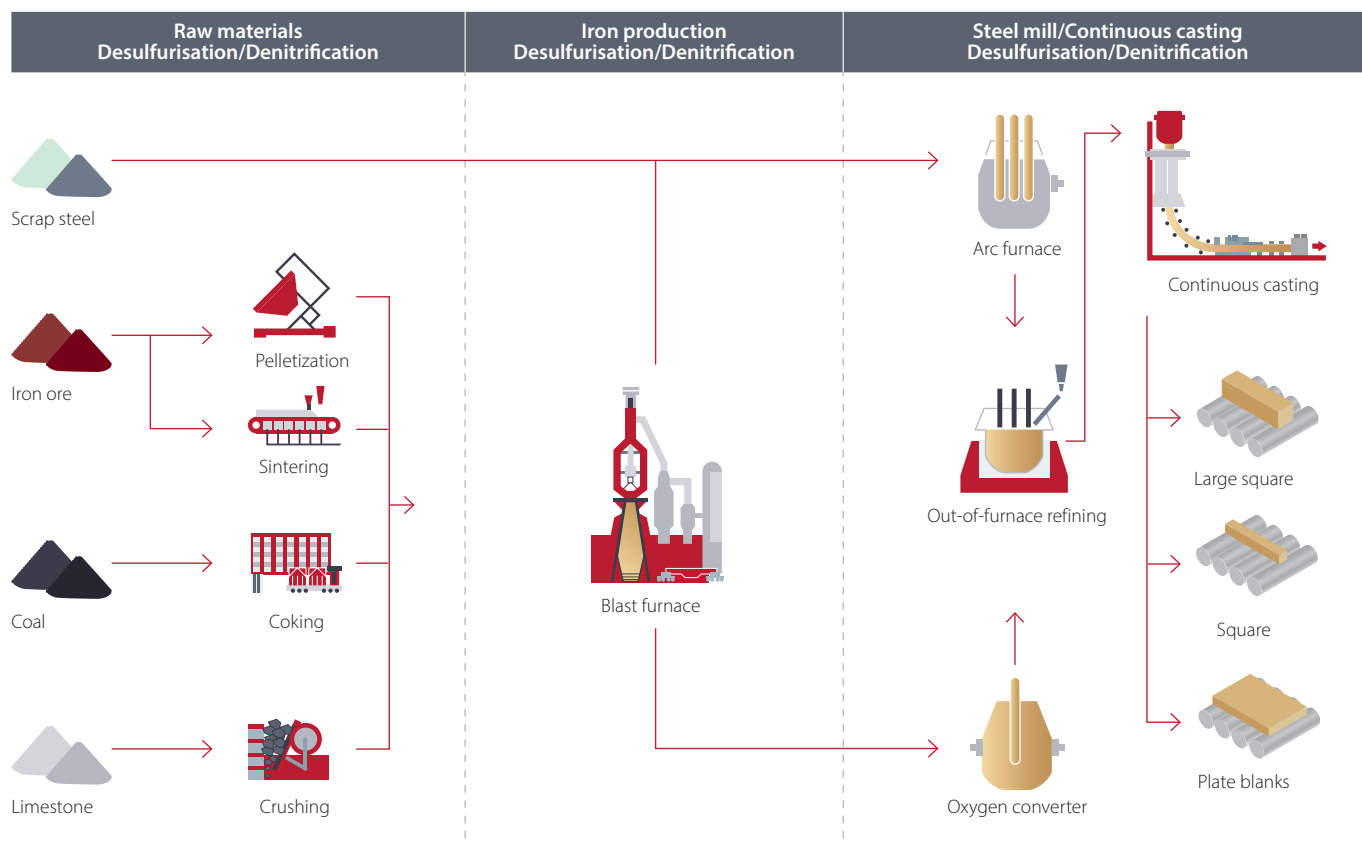
- When an aqueous solution or slurry is used as a desulfurizing agent and the resulting desulfurization product is an aqueous solution or slurry, this is referred to as a wet process
- An aqueous solution or slurry is a desulfurizing agent, and the process that produces a desulfurization product in a dry state is referred to as a semi-dry process
- A desulfurization process in which both the added desulfurizing agent and the desulfurization product remain dry is called a dry process.

The nitrogen removal process is divided into: The two main types are dry and wet flue gas denitrogenation. There are two main methods of dry flue gas denitrogenation:

- Selective Catalytic Reduction (SCR)
- Selective Non-Catalytic Reduction (SNCR)

The Selective Catalytic Reduction (SCR) method is the most widely used flue gas nitrogen removal process today due to its outstanding advantage of high NO_x removal rates. However, its investment and operating costs are high, as it is the only method of nitrogen removal that meets stringent emission requirements at the current level of technology.





Desulfurisation/denitrification includes:

- Desulfurization and nitrogen removal during raw material treatment
- High furnace desulfurization and nitrogen removal in iron refining

- Steel production converter desulfurization
- Desulfurization and nitrogen removal during continuous casting

VFDs are widely used in this process to drive various types of fans, circulation pumps, lubrication systems and equipment in conveying systems.

System	Units	Drive model	Application introduction
Flue gas system	Priming fan	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series	Wind turbine type load, open-loop control
	Booster fans	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series	Wind turbine type load, open-loop control
	Oil pump	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series; VLT® Soft Starter MCD 600	Wind turbine type load, open-loop control
	Intake Drum Seal Fan	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series; VLT® Soft Starter MCD 600	Wind turbine type load, open-loop control
	Diffuser cartridge sealing fan	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series; VLT® Soft Starter MCD 600	Wind turbine type load, open-loop control
Absorption tower system	Agitators, slurry circulation pumps, absorption tower circulation pumps, oxidation fans, process water pumps, agitation pumps;	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series; VLT® Soft Starter MCD 600	Fan, pump load, open-loop control
Limestone unloading and slurry system	Elevators, conveyors, feeders, pellet mills, slurry circulation pumps, limestone slurry pumps, agitation pumps, agitators, oil pumps, etc;	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series; VLT® Soft Starter MCD 600	Fan, pump load, open-loop control
Wastewater treatment system	Wastewater pumps, outlet pumps, slurry peristaltic pumps, sludge circulation pumps, acid removal pumps, mixers, acidification pumps, sludge pumps, etc.	iC7-Automation, VLT® AutomationDrive FC 302 or VACON® NX series; VLT® Soft Starter MCD 600	Fan, pump load, open-loop control



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Some functionalities listed in this fact sheet are for future implementation

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