When the going gets tough, the tough get going...

Drive technology for the cement industry
Manufacturing cement, one of the world’s oldest building materials, is a complex and energy-intensive process. In continuous operation, the demanding procedures need to run reliably and economically. Standstills of rotary kilns or mills are things of the past. Competition, environmental protection regulations and energy prices put pressure on the cement manufacturers.

Having the right drive technology plays a key role. The better it is tailored to match the specific characteristics of the process, the more economical and reliable the procedure can be set up. Possessing years of industry know-how and having an extended portfolio, we offer customized drive systems for all applications of the cement production – whatever the power requirements: few kilowatts or megawatts in the two-digit range.

In close cooperation with customers of the cement industry, we develop complete drive solutions for maximum performance, operational reliability and high energy utilization.

Innovative technologies, application and engineering knowledge as well as precisely matched components can be combined to form solutions that are perfectly tailored to fulfill all requirements needed. This applies not only to power, torque and dynamics but also to availability, diagnostics and operating efficiency.

Siemens not only supplies solutions for the entire drive train, but also supports you during the entire life cycle. Prompt service and support due to global presence, proactive maintenance methods or economic modernization.
Drive systems for every processing step

**Quarry**
- Primary crusher
- Quarry
- Stockpiles

**Raw material handling**
- Pre-blending hall
- Vertical roller mill
- Raw material silos
- Homogenization silo

**Clinker production**
- Electrostatic precipitator
- Preheater tower
- ALTERNATIVE FUELS
  - Waste fuels/Solvents
  - Tires
- Coal mill
- COAL MILL
- Coal silo
- Stack
- Roller press
- Separator
- Finished cement silos

**Clinker storage**
- Additives silo
- Gypsum silo

**Finished cement silos**
- Finished cement
- Load-out/Packaging

**Finished products**
- Finished cement silos
- Finished products
The entire cement manufacturing process producing up to 12,500 tons of clinker a day, requires superior performance and efficiency. The drive technology in use runs non-stop over more than 300 days a year, it also withstands the toughest environmental conditions. Siemens offers for all processing steps of the cement manufacturing customized and highly reliable drive systems.

<table>
<thead>
<tr>
<th>Process</th>
<th>Motor Types</th>
<th>Gear Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crusher</strong></td>
<td>• High-voltage slip ring motors</td>
<td>• FLENDER couplings</td>
</tr>
<tr>
<td><strong>Roller press</strong></td>
<td>• High-voltage slip ring motors</td>
<td>• FLENDER planetary gear unit</td>
</tr>
<tr>
<td></td>
<td>• Low-voltage asynchronous motors</td>
<td>• FLENDER gear unit</td>
</tr>
<tr>
<td><strong>Vertical mills</strong></td>
<td>• High-voltage slip ring motors</td>
<td>• FLENDER planetary gear unit</td>
</tr>
<tr>
<td></td>
<td>• High-voltage asynchronous motors</td>
<td>• Vertical mill gear unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(in the KMP, KMPS, EMPP and MultiDrive versions)</td>
</tr>
<tr>
<td><strong>Tube mills, horizontal</strong></td>
<td>• High-voltage slip ring motors</td>
<td>• Toothed gearing</td>
</tr>
<tr>
<td></td>
<td>• Ring motor with AC converters</td>
<td>• HCPP planetary gear units for central drive</td>
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<tr>
<td><strong>Rotary kiln</strong></td>
<td>• Low-voltage asynchronous motors</td>
<td>• FLENDER gear units</td>
</tr>
<tr>
<td></td>
<td>• High-voltage asynchronous motors</td>
<td>• Duored® gear unit with power split</td>
</tr>
<tr>
<td><strong>Separators</strong></td>
<td>• Low-voltage asynchronous motors</td>
<td>• Single-stage FLENDER gear unit (MDSS)</td>
</tr>
<tr>
<td><strong>Bucket elevator</strong></td>
<td>• Low-voltage asynchronous motors</td>
<td>• FLENDER gear unit</td>
</tr>
<tr>
<td><strong>Conveyor belt</strong></td>
<td>• Low-voltage asynchronous motors</td>
<td>• MOTOX geared motors</td>
</tr>
<tr>
<td></td>
<td>• High-voltage asynchronous motors</td>
<td>• Planetary gear unit</td>
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<tr>
<td><strong>Fan</strong></td>
<td>• High-voltage slip ring motors</td>
<td>• FLENDER gear unit</td>
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<tr>
<td></td>
<td>• Low-voltage asynchronous motors</td>
<td>• FLENDER gear unit</td>
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<tr>
<td></td>
<td>• High-voltage asynchronous motors</td>
<td>• FLENDER belt transmission</td>
</tr>
</tbody>
</table>

Perfectly matched motors, converters, couplings and gear units transfer high level of power and force not only completely reliable, but also extremely energy-efficient.
Cement is made of limestone, clay, sand and iron ore. Before grinding the raw material, fixed or mobile crushers consuming a considerable amount of power and energy reduce the material to the required size. During start-up, the drive systems used do not only have to handle the significant mass moment of inertia of the crusher rotor, but also be able to withstand the continuously high torque peaks. The use of slipping resistances makes the motor’s torque curve softer.

Entire drive trains for crushers
Siemens offers the perfect drive for all types of crushers: reliable high-voltage slip ring motors, application-specific FLENDER gear units and planetary gear units as well as durable and low-maintenance couplings that have been well-proven in multiple jaw, conical and roll crusher applications.
Mills grinding raw materials to very fine grain are used at various stages in cement production. Due to their low energy consumption in comparison with conventional horizontal mills, it is preferable to use vertical mills that employ enormous drives. Its energy efficiency and its performance depend to a large extent on the drive system. Siemens offers robust, high-performance drive components and systems which have been well proven in the building materials industry. Even for limited space we can supply compact solutions from a single source.

### Drive solutions that are energy-efficient

Aside from common drive versions having asynchronous slip ring motors and liquid starters, we offer innovative systems that ensure greater energy efficiency for your system. Due to a higher level of efficiency, the motors reduce energy consumption.

This effect can be increased by also using our medium-voltage converters such as ROBICON Perfect Harmony or SINAMICS GM150, which ensure efficient and reliable operation using the latest IGBT technology.

### Compact and reliable gear units

Siemens also supplies the core element of a drive: The compact and reliable FLENDER vertical mill gear units KMP, KMPS, KMPP as well as the EMPP which cover a power range up to 9,000 kW. These bevel planetary gear units come with special built-in bearings and special housing to direct the high axial forces right into the plinth.
The quality provided by raw and finished material mills influences the following process steps. Therefore, after the grinding process, a separator is often installed to sort the milled material. If necessary, the material is fed back for further milling. In general, separators are equipped with a controlled drive.

For each separator, a unique solution
Our portfolio is designed specifically for the cement industry offering the right solution for any separator: durable, compact and economic motors, energy-efficient high-performance frequency converters such as the reliable and low-loss SINAMICS G150 complemented with the time-tested FLENDER gear units.

Your requirements set the benchmark
For applications requiring brake resistors we offer the right solution, either as standardized module or customized for your specific needs.
Keeping kilns turning

The raw mix is heated up to sintering temperature of up to 1,450 °C in the rotary kiln. Then cement clinkers can be formed. The precious centrepiece of the clinker manufacturing runs non-stop throughout the year.

Only for maintenance the kiln stops. Since an abrupt standstill would cause permanent deformation and damage due to the high temperature, the kiln needs to turn continuously at an appropriate lower temperature. In general, the auxiliary drive takes over the “cooling down procedure”.

For all these performance requirements, Siemens provides a full range of solutions.

Perfect drive trains

Depending on the size, individual or twin drive systems with load-equalizing regulation are used. Siemens offers reliable low- and high-voltage asynchronous motors, converters of the SINAMICS and ROBICON Perfect Harmony series, as well as gear units and planetary gear units including auxiliary drives.

A drive portfolio optimized by durable gear couplings perfectly suited for rough operating environment.

Prepared for all eventualities

In order to avoid deformation following an abrupt standstill, the drive system is often equipped with an emergency device in the event of a power failure, which can be provided by Siemens.
The required emergency properties along with high start-up torques, large speed ranges and extreme ambient temperatures place great demands on the drive technology. Accordingly, we produce powerful and robust devices for every type of kiln.
To increase the throughput of the downstream mills, roller presses are often used. Cement clinker, ore or limestone is ground between two-counter-rotating rollers under high pressure. The drive usually consists of electric motors with accompanying control devices and gear units that are placed directly onto the rollers.

**Profitable drive solutions for roller presses**

For optimum electric driving of roller presses, our portfolio offers two options:

The simplest solution is an asynchronous slip ring motor as a fixed-speed drive with accompanying starter. A more convenient option is supplied through combining asynchronous and squirrel-cage motors and converters. Siemens offers you economic motors for these applications which offer efficiency, high power density and compact design.

Our motors can be combined with the SINAMICS G150 converters, SINAMICS S120 inverters and corresponding load distribution control. The advantages of the converter solution include controlled, material-saving start-up and the ability to adjust the speed to match the process requirements. For gear units with multiple motors, central supply connection and common DC busbar, our portfolio includes a finely scalable solution in the form of the modular SINAMICS S120 Cabinet Modules.

Planetary gear units with higher power density and a low noise level as well as durable and low-maintenance FLENDER gear units and FLENDER gear couplings cover the entire drive spectrum for roller presses.
In order to drive tube mills reliably and efficiently, our large portfolio of motors and converters comprises also compact and efficient FLENDER gear units using innovative power splitting to offer perfect load distribution. FLENDER gear and planetary gear units are perfectly suited for the drive of a tube mill. The HCCP version was specifically designed for centrally driven mills. All gear units are perfectly supplemented by the ZAPEX FLENDER gear couplings which are suited for horizontal or vertical mounting. All drives can be supplied with auxiliary drives.

Keeping tube mills working

With up to 30 MW, tube mills are amongst the largest machines in primary industry. They use impact and friction to grind cement clinker into extremely fine powder.

Reliable drive solutions for tube mills

The standard version drives tube mills with asynchronous slip ring motors, liquid starters and gear units. At around 10 MW, using drives with ring motors and direct AC converters from the SINAMICS SL150 series, well-established in the field of ore processing, are well suited.
Materials handling all across the board

Bucket elevators and conveyor belts are used at many sites in the cement production to transport large amounts of bulk materials over complex routes, sometimes horizontally, sometimes vertically, often outdoors or to bridge height differences. The drive systems have to be able to handle these tough conditions and still provide maximum performance and operating efficiency.

Start-up and reliability

Siemens provides all components necessary for reliable drives in the material handling sector. Ideal solutions for a soft start-up of the conveyor belt systems are the FLENDER couplings (FLUDEX) or soft starters such as SIRIUS 3RW44. The innovative torque control of the high-feature soft starter ensures optimum start-up for drives up to 710 kW output with standard switching or 1,200 kW with inside-delta circuit. PROFIBUS allows the SIRIUS 3RW44 to be integrated in higher-level control systems.

For special or complex transport tasks, our well-proven converter systems MICROMASTER 440, SINAMICS G150/S120/GM150 and SINAMICS G120 are available.

Tested worldwide, the FLENDER belt transmission series having an extreme large gear unit surface and perfect heat dissipation along with the MOTOX geared motors complete the entire spectrum.

No matter what your conveyor needs: The Siemens solutions cover the entire drive train. They can be easily adjusted to the most diversified requirements and they ensure availability and cost-effectiveness.
Making sure fans don’t run out of breath

Fans of various designs are used in many locations throughout the cement production. From about 100 kW right up to units with several MW and quadratic characteristic curves. Siemens offers economical solutions for any fan drive system. With a comprehensive range of low- and high-voltage motors, the powerful SIRIUS 3RW44 soft starter, converters from the SINAMICS and ROBICON Perfect Harmony series, the well-proven FLENDER gear unit program including accessories such as the hydro dynamic and virtually wear-free FLUDEX couplings for soft and shock proof start-ups, we offer an economic solution.

Energy-efficient drives for fans

Our converters have a particularly positive effect on energy consumption at high output. They allow variable speed operation of the fan drives. This allows energy to be saved – depending on the system characteristic curve, up to 70% savings can be realized. In contrast to traditional control processes, in which the motor always runs at maximum speed assuming maximum conveyance mass, the excess material is “throttled away” using mechanical actuators.

Drive systems with converters adjust the speed and therefore the energy consumption. In other words: The motor only draws as much power as actually required. The overall result is significantly lower energy consumption than with fixed drives of similar performance using mechanical control principles in partial load operation. The energy-saving effect is high with pumps and fans as here, the power consumption is proportional to the cube of the speed. Even low speeds offer a major energy-saving effect. Conversion of a fixed speed drive in the MW range can be amortized in less than 24 months, often in as few as nine months.

Large saving potentials can also be realized through converter operation in the clinker cooling process, as this cooling involves 10 to 20 controlled drives to achieve 75 to 200 kW output requirement. The more efficient path: individual motor converter units on a common DC busbar with redundant supply.
Energy efficiency throughout the entire line

A shortage of resources and the effects of climate change are causing companies to rethink their strategies. Especially energy-intensive industries are concerned with this problematic nature. The main power consumers are the drive systems. The solution: targeted use of energy-saving motors and frequency converters allows valuable kilowatt hours to be saved.

The key factors for energy efficiency are optimum design and dimensioning of the installations as well as targeted selection of the drive components. With comprehensive process know-how in cement production and a corresponding portfolio of energy-saving motors and frequency converters, we can help the design of energy-efficient systems for the cement industry.

And we approach this from all angles. We do not only work consistently to increase the efficiency and performance of our drive components, we also place great emphasis on their perfect interplay. The use of energy-efficient drive components always pays for itself. Investments in the right technology can generally be amortized after just a few months and then ensure lasting savings throughout the entire life cycle. Exactly when the use of energy-saving motors or frequency converters pays for itself and the level of future monthly savings can easily be calculated with the SinaSave software tool using system-specific data.

Energy-saving motors for every application

We are one of the few motor suppliers worldwide that offers you a whole range of high-performance motors IE2 and IE3 class efficiency for virtually any application, all of which are safe for use with converters up to 500 V. Alongside an excellent price-performance ratio and a high degree of operational reliability, our energy-saving motors ensure significant reductions in operating costs, up to 10% higher efficiency compared to standard motors for a significant reduction of operating costs and a longer service life.

Our motors not only fulfil the minimum level of electrical efficiency according to EU regulations 640/2009, but are also certified to guidelines according to efficiency policies such as EISA and CSA.

Due to lower motor temperatures, they have a lower service life and a lower consumption of lubricants. In continuous operation, our energy-saving motors also incorporate high levels of overload reserves (SF1, 15 for LA9/1LG6).
MOTOX geared motors

With the new, extremely compact MOTOX geared motor series we have completed our drive portfolio for the 0.12 to 200 kW power range. In comparison with conventional geared motors, the MOTOX range is characterized by greater drive torques up to 32,000 Nm and greater rated gear units torques. In summary: MOTOX provides concentrated power in the smallest place.

Lots of power, small room

With all common gear unit types from helical through flat-type, helical bevel and helical worm right up to worm geared motors – MOTOX covers all drive tasks and fulfils all of the relevant international regulations.

Our new range of geared motors is characterized by excellent technical performance, in particular when used in materials handling, crane or lifting technology. Drive torques up to 32,000 Nm and a significantly higher rated torque than competitors’ products ensure consistently efficient operating, increased system availability and operational reliability. Thanks to the special design principle, which allows a higher gear ratio, 4-pin MOTOX standard motors are, for example, an economical alternative to 6- or 8-pin motors.

Extremely flexible due to modular systems

Due to the modular system, our geared motors can not only be combined in a flexible way but also be customized for the respective drive task. All standard market designs and fittings are possible. Even subsequent expansions can be carried out quickly: functional units such as brakes, external fans or encoders can be attached to the modular base motors with additional shafts.

MOTOX geared motors are an integral part of Totally Integrated Automation, our comprehensive range of products and systems for company-wide automation in all industries. They can easily be combined with other components from our extensive drive spectrum, e.g. converters of the SINAMICS or SINAMICS G120 family. The results are system solutions that permanently increase system productivity.

The MOTOX geared motors series comprises:
- Standard motors according to IEC/EN
- NAFTA motors with specification in accordance with NEMA, UL, CSA
- CCC-certified motors for export to China along with GOST-R-certified motors and gear units for the Russian market
- Highly efficient geared motors (EFF1 motors) in accordance with CEMEP and EPAct for increased energy efficiency
- Explosion-protected geared motors for zone 1 and 2 (gas) as well as 21 and 22 (dust) in accordance with the EU directive 94/9/EUG
Customized drive solutions

Being a reliable partner of the cement industry, Siemens possesses an extensive industry knowledge as well as specific drive solutions for the entire product life cycle. Of course this comprises retrofitting. When modernizing you can take advantage of customized drive solutions which are tailored to your requirements. On request we provide the entire drive train and fit it in your automation environment.

For over 100 years, the Loher GmbH has been supplying customized solutions for drives of all types no matter how very specialized. All around the globe, Loher is renowned for its know-how in regards to drive trains and its extraordinary performance in regards to customer-specific solutions. Loher’s drive components can be tailored to the current project in a flexible and precise manner on the basis of tried and tested standard platforms in respect of design and electrical layout along with special monitoring equipment and cooling methods.

DYNAVERT®I:
Retrofit for existing SIMOVERT A converters

One of the Loher’s highlights is the DYNAVERT® I current source DC-link converter. The frequency-controlled 4-quadrant operation with a power rating of 15–6.00 kW is ideal for large fans.

Fully digitized, it provides low-loss speed control and minimum system perturbations due to a 24-pulse mains supply.

Integrated drive solutions

When required, Siemens can supply integrated solutions for the complete drive train. You profit from the highest degree of reliability, productivity and efficiency for your cement plant. This is because all of the specific components – gearboxes, couplings, motors, frequency converters and drive controls – are optimally coordinated and harmonized with one another and can be seamlessly integrated into the existing automation environment.
Service and support

Service and support are important to us. Regardless of time and place, our drive experts will be there for you whenever you need support: with professional advice and service in over 130 countries around the globe.

Our experts provide support quickly, simply and competently in all areas of drive technology. From customized design, delivery, assembly and installation right up to maintenance and servicing.

For fast and immediate support for technical questions at any time via Internet:

Service & Support site: http://support.automation.siemens.com
Phone: Technical support hotline: 0180 / 50 50 222

We will assist you quickly and simply in the search for a sales representative.

Internet search for sales representative: http://automation.siemens.com/partner
Phone: Sales hotline: 0180 / 50 50 1111
# Overview: Motor types for the cement industry

## Applications in the cement industry
- Low-voltage asynchronous motors: materials handling, fans etc.
- High-voltage asynchronous motors: roller presses, mills, rotary kilns, separators, materials handling, fans

## Performance spectrum
- Low-voltage: 0.75...4,000 kW
- High-voltage: 200...15,000 kW

## Voltage classes
- Low-voltage: 230...690 V
- High-voltage: 2...13.8 kV

## Axis heights
- Low-voltage: 100...630 mm
- High-voltage: 315...1,000 mm

## Number of poles
- Low-voltage: 2...8
- High-voltage: 4...8

## Rotation speed
- Low-voltage: up to 5,000 U/min
- High-voltage: up to 4,800 U/min

## Degree of protection
- Low-voltage: IP55, IP65
- High-voltage: IP55, IP56 optional

## Technology
- Low-voltage: asynchronous
- High-voltage: asynchronous

## Cooling concept
- Low-voltage: self-cooling, forced ventilation, water cooling jacket
- High-voltage: self-cooling, forced ventilation, water jacket cooling, air-air cooler, air-water cooler, open-circuit cooling

## Standards
- Low-voltage: IEC, ATEX, NEMA
- High-voltage: IEC, ATEX, NEMA

## Key features
- Low-voltage: • robust design with cast-iron enclosure
  • large selection of motors for varied applications, e.g. explosion prevention
- High-voltage: • high degree of efficiency at maximum power density
  • robust design
  • low noise and low maintenance
  • large selection of motors for versatile applications

## System partners for converter-related issues
- Low-voltage: SINAMICS G120, G150, S120
- High-voltage: ROBICON Perfect Harmony, SINAMICS GM150
From a comprehensive range of low-voltage motors through reliable and well-proven high-voltage motors right up to energy-saving and geared motors: Siemens provides you with the ideal motor for every drive task in the cement industry, in every speed range, whether for low power ratings or several megawatts.

### Gearless ring motors for tube presses

Our ring motors fulfil all these requirements convincing with a reliability of 99%! They work reliably even in extreme conditions. The reason for their high reliability lies in their robust design and the concept of the direct drive, the best concept in the application. Siemens offers gearless ring motors with a power rating of up to 30 MW. Pedestal diameter is up to 44 ft. The typical rotation speed is 10 rpm.

<table>
<thead>
<tr>
<th>High-voltage slip ring motors</th>
<th>MOTOX geared motors</th>
</tr>
</thead>
<tbody>
<tr>
<td>applications in the cement industry</td>
<td>conveyor belts, bucket elevators, mixers</td>
</tr>
<tr>
<td>rating</td>
<td>0.12 ... 200 kW</td>
</tr>
<tr>
<td>torque</td>
<td>100 ... 20,000 Nm</td>
</tr>
<tr>
<td>ratio</td>
<td>1 ... 60,000</td>
</tr>
</tbody>
</table>
| key features | • modular system  
• tightly spaced gear ratio  
• modular motor blocks  
• operational reliability |
| accessories | • backstop  
• torque arms  
• output flange  
• status monitoring  
• ATEX design  
• energy-efficient motors  
• adapter for IEC and NEMA motors  
• breaking motors  
• complete motor range |

<table>
<thead>
<tr>
<th>High-voltage slip ring motors</th>
</tr>
</thead>
<tbody>
<tr>
<td>crushers, roller presses, mills, fans</td>
</tr>
<tr>
<td>300 ... 7,000 kW</td>
</tr>
<tr>
<td>3.3 ... 11 kV</td>
</tr>
<tr>
<td>450 ... 900 mm</td>
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<tr>
<td>4 ... 10</td>
</tr>
<tr>
<td>up to 1,500 U/min</td>
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<tr>
<td>IP65</td>
</tr>
<tr>
<td>asynchronous</td>
</tr>
<tr>
<td>air-air cooler, air-water cooler</td>
</tr>
<tr>
<td>IEC, EN, DIN, VDE</td>
</tr>
</tbody>
</table>
| • reliable  
• low maintenance  
• internal slip ring with IP55 protection  
• with and without brush lifting device |
| ROBICON Perfect Harmony for modernization |
### Overview: converters for the cement industry

<table>
<thead>
<tr>
<th>SINAMICS G120</th>
<th>SINAMICS G130/G150</th>
<th>SINAMICS S120</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applications in the cement industry</strong></td>
<td>conveyor belts, fans, centrifuges</td>
<td>roller presses, rotary kilns, separators, conveyor belts, fans</td>
</tr>
<tr>
<td><strong>Performance spectrum</strong></td>
<td>0.37...250 kW</td>
<td>75...2,700 kW</td>
</tr>
<tr>
<td><strong>Voltage classes</strong></td>
<td>380...690 V</td>
<td>380...690 V</td>
</tr>
<tr>
<td><strong>Technical concept</strong></td>
<td>modular frequency converter with safety and efficient infeed technology (energy recuperation)</td>
<td>voltage source DC link converter with vector control or V/f control</td>
</tr>
<tr>
<td><strong>Semiconductors used</strong></td>
<td>IGBT</td>
<td>IGBT</td>
</tr>
<tr>
<td><strong>Cooling method</strong></td>
<td>air</td>
<td>air</td>
</tr>
<tr>
<td><strong>Key features</strong></td>
<td>IP20</td>
<td>IP20, optional IP21, IP23, IP54</td>
</tr>
<tr>
<td></td>
<td>• modular and expandable</td>
<td>• solid and ready for connection cabinet unit</td>
</tr>
<tr>
<td></td>
<td>• simple and fast commissioning</td>
<td>• modular and expandable</td>
</tr>
<tr>
<td></td>
<td>• recovery</td>
<td>• reliable power supply through the unique process of pulse-edged modulation with optimized pulse patterns</td>
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<tr>
<td></td>
<td>• SINAMICS safety integrated</td>
<td>• low noise</td>
</tr>
<tr>
<td></td>
<td>• innovative cooling concept</td>
<td>• simple and fast start-up</td>
</tr>
<tr>
<td><strong>System partners for motor-related issues</strong></td>
<td>Low-voltage asynchronous motors: e.g. 1LE/1LG4/1LG6</td>
<td>Low-voltage asynchronous motors: e.g. 1LE1/1LG6/1LA8/1PQ8</td>
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### Siemens Range of Converters

The Siemens range of converters is as extensive as the motor portfolio.

With SINAMICS, MICROMASTER and ROBICON Perfect Harmony we offer a complete and end-to-end drive family which covers all performance levels.

Industry-specific converters are available for the individual process steps in the cement industry, which can be adjusted for specific drive tasks. All our converters feature extreme flexibility, functionality and engineering efficiency.

### Applications in the Cement Industry

- Conveyor belts, fans, centrifuges
- Roller presses, rotary kilns, separators, conveyor belts, fans, vertical mills

### Performance Spectrum

- **SINAMICS G120 / SINAMICS G130 / SINAMICS G150**
  - Vertical mills, rotary kilns
  - 150...13,500 kW
  - 2.3...17.2 kV
  - Multi-cell DC link converter
- **SINAMICS GM150**
  - Vertical mills, rotary kilns
  - 820...17,000 kW
  - 2.3...4.16 kV
  - 3-point NPC DC converter

### Voltage Classes

- **380...690 V**
- **2.3...17.2 kV**
- **2.3...4.16 kV**

### Technical Concept

- **Modular frequency converter**
  - Safety and efficient infeed technology (energy recuperation)
  - Voltage source DC link converter with vector control or V/f control
  - Multi-cell DC link converter: 3-point NPC DC converter

### Key Features

- **IP20, optional IP21, IP23, IP54**
  - IP22, optional IP42, liquid-cooled IP54

### Additional Features

- **Universal usage, esp. in multi-motor applications**
- **Available as type-tested cabinet unit systems**
- **Modular and flexible**
- **Scalable in power, function, number of axes, performance**
- **Simple and fast commissioning, Autoconfiguration**
- **Future-proof system’s architecture**
- **Graded feed/recuperation system with possibility of energy transfer via shared DC link**
- **Broad motor spectrum**
- **SINAMICS Safety Integrated**

### System Partners for Motor-Related Issues

- **Low-voltage asynchronous motors:** e.g. 1LE / 1LG4 / 1LG6
- **High-voltage asynchronous motors:**
  - e.g. 1LA4 / 1PQ4 / 1RQ4 / 1RN4
  - High-voltage slip ring motors can still be used following modernization

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<table>
<thead>
<tr>
<th>ROBICON Perfect Harmony</th>
<th>SINAMICS GM150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical mills, rotary kilns, fans</td>
<td>Vertical mills, rotary kilns</td>
</tr>
<tr>
<td>150...13,500 kW</td>
<td>820...17,000 kW</td>
</tr>
<tr>
<td>2.3...17.2 kV</td>
<td>2.3...4.16 kV</td>
</tr>
<tr>
<td>Multi-cell DC link converter</td>
<td>3-point NPC DC converter</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>LV-IGBT</th>
<th>HV-IGBT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air- and liquid-cooled</td>
<td>Air- and liquid-cooled</td>
</tr>
</tbody>
</table>

**Key Features:***

- The most solid medium-voltage converter
- Integrated input transformer
- Highest voltage quality
- Simple operation
- Highest availability due to cell bypass and ProToPs®

**High-voltage asynchronous motors:**

- e.g. 1LA4 / 1PQ4 / 1RQ4 / 1RN4
- High-voltage slip ring motors can still be used following modernization
## FLENDER gear units and couplings for the cement industry and oil supply systems

<table>
<thead>
<tr>
<th>Gear units</th>
<th>Planetary gear units</th>
<th>Vertical mill gear units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applications for the cement industry</strong></td>
<td>crushers, roller presses, rotary kilns, separators, bucket elevators</td>
<td>crushers, rotary kilns, roller presses, tube mills</td>
</tr>
<tr>
<td><strong>Power rating</strong></td>
<td>6 ... 4,500 kW</td>
<td>30 ... 13,000 kW</td>
</tr>
<tr>
<td><strong>Torque</strong></td>
<td>2,300 - 1.4 Mio. Nm</td>
<td>22,000 ... 2,600,000 Nm</td>
</tr>
<tr>
<td><strong>Ratio</strong></td>
<td>1 ... 450</td>
<td>25 ... 4,000</td>
</tr>
</tbody>
</table>
| **Key features** | • modular system  
• degressive scaling for a larger selection of sizes  
• low noise rating due to smooth bevel gear tooth system and housing is anti-noise-optimized | • modular system  
(versatile use of the housing and inner parts)  
• light weight and solid space-saving design due to power split  
• combination with other gear units can be realized easily  
• optimized load distribution on the planet wheels due to high production accuracy and finite element calculation (FEM calculation) on the planet carrier | • very solid  
• optimal design and high production quality combined with bearing selection, tooth geometry and housing rigidity  
• higher power by using innovative drive concepts |
| **Accessories** | • motor rocker arm, seat console, bell case  
• backstop  
• heating rods  
• water-oil-air oil coolers  
• speed monitoring  
• torque arms  
• loose flanges  
• loose flanges  
• gear unit rocker arms  
• oil level gauge  
• oil level limit switch  
• integrated overrunning clutches  
• auxiliary drive | • housing with and without mounting foot  
• torque arm  
• bell case  
• motor console  
• oil cooling systems  
• shrink disks (oil level indicators)  
• auxiliary drive  
• backstop | • oil supply  
• auxiliary drive |

**Notes:**
- Power rating includes both, input and output power.
- Torque includes both, input and output torque.
- Ratio refers to the overall ratio of the gear unit.
- Key features highlight the advantages of the gear units, including design, noise reduction, load distribution, and compatibility.
- Accessories list the available options for customization and functionality.
Siemens is offering a comprehensive range of gearboxes and gearbox components for all drive tasks. Whether helical, helical bevel, bevel gear or planetary gearboxes with the standardized module or highly specialized, industry-specific solutions, FLENDER portfolio covers all tasks.

<table>
<thead>
<tr>
<th>Toothed gearing</th>
<th>Belt transmission</th>
<th>Central drive</th>
<th>Couplings</th>
<th>Oil supply systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>developed in particular for ball tube mill drives</td>
<td>conveyor belts</td>
<td>central drive for ball tube mills</td>
<td>crushers, rotary kilns, cement mills, fans</td>
<td>all drives</td>
</tr>
<tr>
<td>1,500 ... 18,000 kW</td>
<td>5 ... 2,500 kW</td>
<td>3,200 ... 12,000 kW</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>mill torque up to 12,000,000 Nm</td>
<td>up to 600,000 Nm</td>
<td>up to 9,000 Nm</td>
<td>15 ... 10,000,000 Nm</td>
<td>---</td>
</tr>
<tr>
<td>4 ... 11,65</td>
<td>10 ... 50</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

- significantly more solid and economical than conventional pinion ring gearing variants
- internal power split in accordance with tried and tested principles
- high tooth quality (as per DIN 3990 > 6)
- optimum contact patterns of the drive pinion to the gearing even in the case of mill movement or gearing deviations
- optimum housing
- improved heat dissipation due to enlarged surface area
- available with built-on auxiliary drive
- very solid due to high power density
- perfect quality of calculation, construction and manufacturing
- perfect load distribution of planetary wheels due to high production accuracy and finite element calculation and FEM calculation of carrier
- low maintenance
- high reliability
- long operating life
- fast availability
- perfect for all drives and all environmental conditions
- available with “stand-by” circuit
- high-pressure circuit for sliding bearings available
- complete oil supply system for gear units and gearing (no lubrication necessary)
- oil supply system
- auxiliary drive
- backstop
- liquid coupling
- self-aligning system
- passageway possible
- oil supply
- for hazardous area types in accordance with ATEX can be provided
- oil supply
- auxiliary drive
- backstop
- liquid coupling
- self-aligning system
- passageway possible
- oil supply
- for hazardous area types in accordance with ATEX can be provided

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