FLENDER GEAR UNITS

8,000,000 KILOWATTS OF INSTALLED EXPERTISE

The innovative Flender vertical mill drives for grinding raw meal, clinker and slag.

flender.com

FLENDER

8,000,000 KILOWATTS

That's more than the gross power output of the most important natural gas power plants in Germany.

8,000,000 kW – that's the capacity of Flender vertical mill gear units installed internationally. You can build on our experience. Choose from our extensive portfolio of reliable, quality solutions.

Flender vertical mill drives are indispensable for those who want the right solution for every vertical mill requirement, those who value sustainable, energy-efficient, optimized processes and those for whom drive availability and safety have top priority – in short, all those who want to rely 100% on their drive technology.

In addition to first-class product quality and consultation based on decades of experience and in-depth industry expertise, we offer by far the most comprehensive portfolio of highly advanced, mature and proven drive solutions. What's more, we produce them ourselves from start to finish.

With our global availability with thousands of references in all capacity classes and partnerships with the world's most significant OEMs, in addition to customer service based on trust, we are the right partner for all kinds of drives. We maintain good customer relationships, treating both plant engineers and end-users as peers and developing new solutions with them, always with a view to the perfect result. This can only be achieved with the outstanding technical expertise of a leading innovator.

As the only system provider with expertise related to the entire drive train, we offer you investment security on one hand and rapid response times on the other. Our global setup and virtually seamless international service network, our great supply capacity and short delivery times, our guarantee for complete systems and, last but not least, our extraordinary price/performance ratio are unrivalled the world over.

COSTS ARE CRUCIAL NOT ONLY IN THE PROCUREMENT OF THE GEAR UNIT …

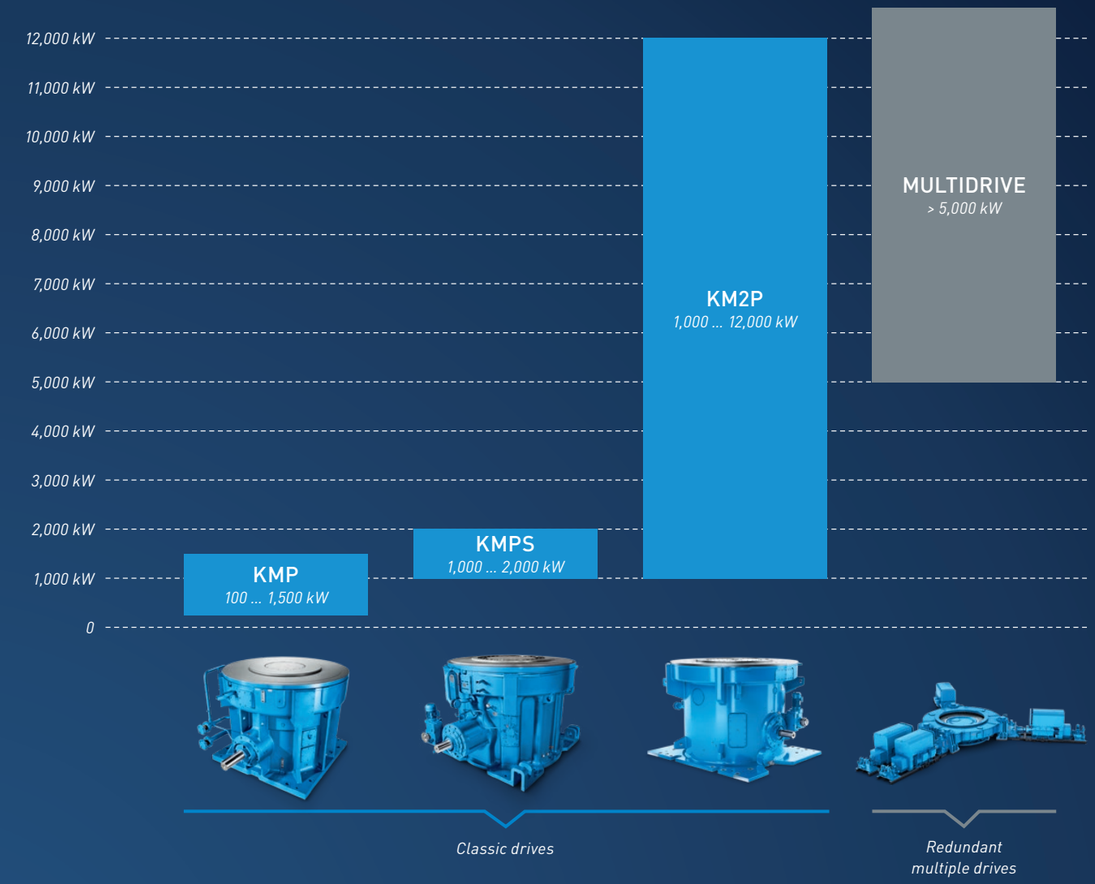
… but also throughout the entire process and in the availability of your plant. Because in the end, what counts most are output and – above all – process and life cycle costs.

EXTENSIVE PRODUCT PORTFOLIO

The grinding of raw meal, clinker and slag is among the applications that our solutions specifically address.
The foundation is our extensive modular system. Its platform concept is consistently in line with this principle: standardized as often as possible; specialized only when necessary. In this way, we can offer perfectly designed and cost-efficient solutions that you can always rely on – for every application.

To meet our customers' requests for larger mills with very high availability, the Flender portfolio in the area of classic vertical mill drives has continually expanded upward in recent years, to the extent that in the meantime, up to 12 MW can be realized here. Those who want to increase process reliability even more at this capacity level can also rely on Flender's redundant multiple drives. This results in the portfolio shown here:

CAPACITY RANGES FOR VERTICAL MILLS



Sliding bearing technology for accommodating process forces

For all vertical mill gear units, tilting pad bearings accommodate the axial loads from the grinding process determined by material hardness, mechanical process influences, and mill technology and design. In the process, a cushioning oil film between the bearing and the rotating gear unit adjusts to changing conditions. This creates a frictionless bearing that is not subject to wear and has outstanding attenuation properties which have positive effects on mill operation.

Oil supply systems

A continuous supply of fresh oil upstream of every single bearing ensures bearing cooling and dissipates the heat from the mill. Extremely high-quality oil supply systems are used here. These were developed specially by Flender, are produced at our own plant and are available in standard versions. Built-in sensors monitor the temperature.

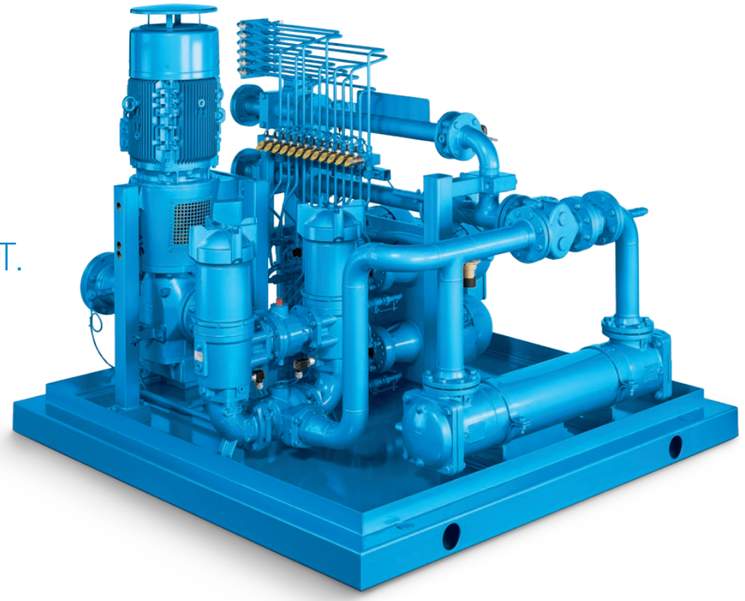
All other customer requirements can be met – even above and beyond standards – through the use of larger coolers, finer filters or replacement pumps. Of course, we provide the appropriate oil supply system for drives supported by both sliding bearings and rolling bearings. We incorporated our entire expertise gained in recent decades into our newest series of oil supply systems, which were developed for the KM2P. All Flender systems provide increased reliability and ensure the trouble-free functioning of your systems to guarantee smooth operation.

Hydrodynamic and hydrostatic solutions

Hydrodynamic bearings rely on the formation of a lubricant bearing film generated by the rotation of the gear unit flange – the lubricant is supplied to the bearing on the inlet side. This technology is standard for the KMP gear units used for grinding because these mills are operated with axial forces and average process dynamics.

Our hydrostatic bearings are used if the gear units have to accommodate higher process forces with greater dynamics, such as those for cement mills. In this case, each individual bearing is supplied with filtered, cooled high-pressure lubricant at a constant flow volume, regardless of load. In addition to the hydrodynamic effect, the lubricant film thickness achieved in this way is two to three times thicker. This degree of thickness not only serves as a starting aid no matter which working point is involved, but also increases the attenuation characteristics of the lubricant film, which allows the hardest materials to be processed under high loads that fluctuate considerably. By request, gear units with standard hydrodynamic lubrication can also be supplied with both hydrostatic bearings and hydrostatic starting aids as an option.

OIL SUPPLY IS A KEY COMPONENT IN THE LONG SERVICE LIFE OF A GEAR UNIT.



Better than standard

The Flender material specification includes special steels. Our requirements have been developed in thousands of reference projects and demand even more specific characteristics than the international norm. This increases service life and reduces life cycle costs.

The high-quality design and manufacture, the wear-resistant bearings, the precise gear tooth geometry and the extraordinary stiffness of the housing made with the least material possible ensure top values for our gear units with respect to vibrations and noise emissions.

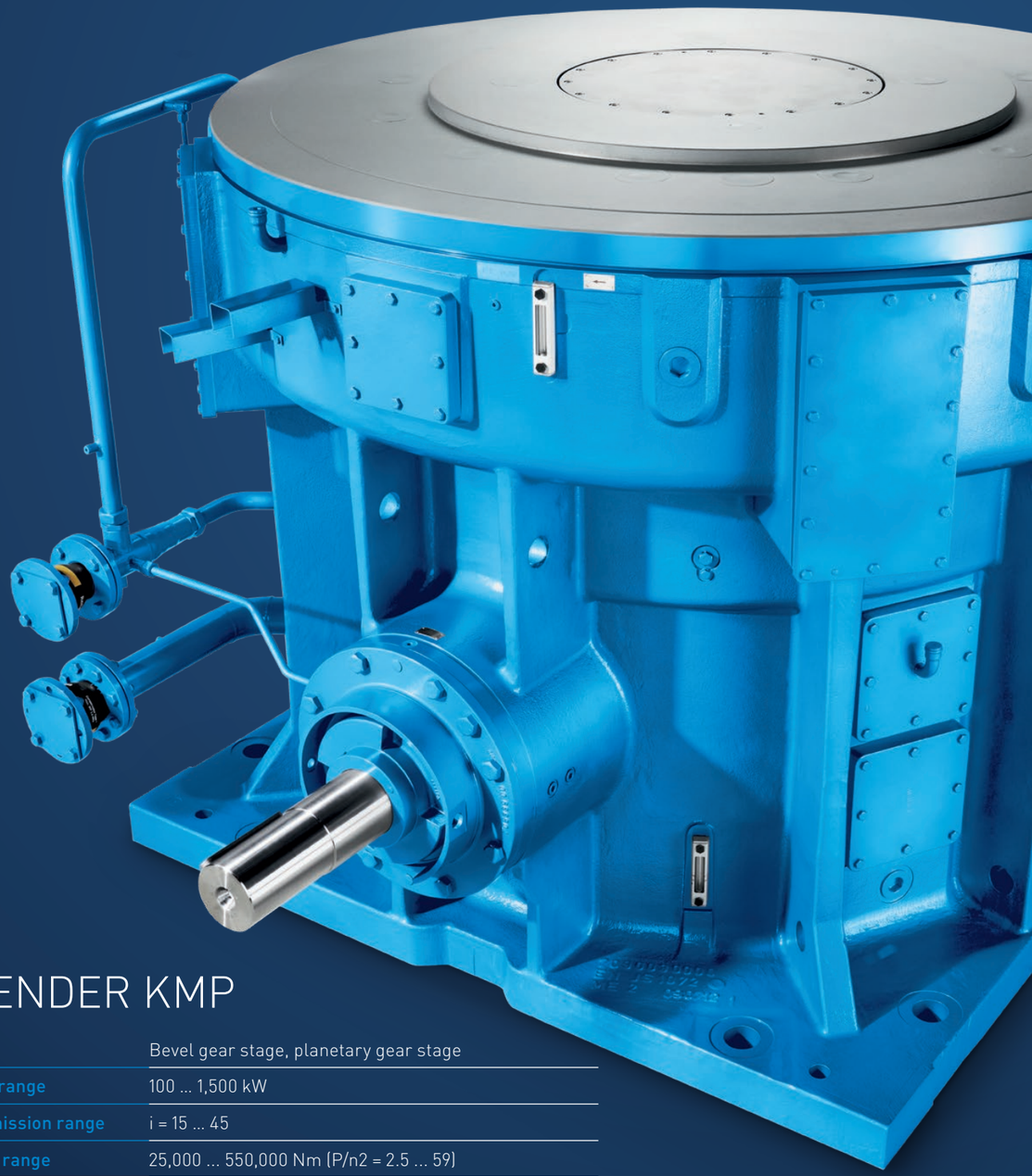
Not all housings are created equal

Only those who have been using a wide variety of cast housings for decades understand the fine details and their great relevance in housing production. This is another particular strength of Flender gear units. The gear housings, either steel welded or made of spheroidal graphite, ensure that axial forces are introduced evenly into the foundation, depending on the customer's needs.

KMP GEAR UNITS BY FLENDER ARE SETTING BENCHMARKS INTERNATIONALLY.

Flender solutions are particularly impressive in the mass market in capacity ranges up to 1,500 kW not only because of their especially good energy balance, but also due to their optional measuring sensor technology. This is another crucial factor for efficient processes right from day one of production. With over 6,000 tried-and-true standard and special solutions, we continue to prove that the highly advanced, mature KMP gear units have set benchmarks for grinding. They are virtually fault-free, based on statistics.

BY REQUEST, OUR KMP GEAR UNITS ARE ATEX 2014/34/EU COMPLIANT.



FLENDER KMP

Design	Bevel gear stage, planetary gear stage
Power range	100 ... 1,500 kW
Transmission range	i = 15 ... 45
Torque range	25,000 ... 550,000 Nm (P/n2 = 2.5 ... 59)
Sizes	18
Thrust bearings	Hydrodynamic, opt. Starting aid, opt. Fully hydrostatic
Advantages	• Tried-and-true concept with approx. 6,000 references • Global availability • International service locations • Wide variety of options

PRECISION LANDING DIRECTLY IN THE RAW MEAL

Our KMPS gear units are used for pre-grinding in the capacity range of up to 2,000 kW. These gear units combine a helical gear stage supported by a rolling bearing with a planetary gear stage also supported by a rolling bearing. Due to highly individual machine designs, the gear units are available in many different variants. Large quantities can be realized due to our global presence, which ensures that high production and assembly capacity is always available for KMPS gear units.

OUR KMPS SERIES OFFERS THE OPTIMUM SOLUTION FOR CAPACITIES UP TO 2,000 KW.

FLENDER KMPS

Design	Bevel gear stage, helical gear stage, planetary gear stage
Power range	1.000 ... 2,000 kW
Transmission range	i = 30 ... 45
Torque range	550,000 to 800,000 Nm (P/n2 = 55 ... 81)
Sizes	4
Thrust bearings	Fully hydrostatic
Advantages	• Tried-and-true concept with more than 500 references • Global availability • International service locations • Wide variety of options

KM2P: THE TRIED-AND-TRUE DOUBLE PLANETARY GEAR UNITS

For many years, drive technology has been confronted with the challenge of output speeds falling as capacity requirements increase, causing a disproportionate increase in torques. But this has not been accompanied by more installation space for gear units. To deal with the problem of increasing transmission and power density at the same time, gear unit technology is evolving from three to four planetary gears in the output stage up to five.

FOURTEEN DESIGNS FOR CAPACITY RANGES FROM 1,000 TO 12,000 KW.

THE KM2P IS PRACTICALLY ALWAYS THE BEST SOLUTION.

It covers nearly the entire capacity range and scores even more points with mill-based standardization, extensively optimized components, maximum reliability and an impressive price-performance ratio.

The high demand for double planetary gear units demonstrates our customers' high level of satisfaction with this gear unit concept. We are boldly continuing down this successful road with the perfected technology of the KM2P gear unit generation. The large amount of positive feedback from operators and customers demonstrate this as well: the KM2P is quickly ready for operation, while its performance in everyday use is extremely reliable.

All of the components have been optimized based on our decades of experience in the vertical mill sector while staying true to the tried-and-tested concept. The increased reliability of the gear unit achieved in this way is accompanied by the customer-oriented establishment of a standard that is key to the success of the series on the market. This minimizes the time and effort required for project planning and installation along with the related costs. Moreover, the design was customized with regards to the requirements and standards already established on the market for mills, so compatibility is always ensured. There is a suitable KM2P for every mill, and in general, it is even part of the standard modular system with a cost-effective cast housing.

KM2P gear units can be used in a capacity range from 1,000 to 12,000 kW, which includes grinding raw meal, clinker and slag, for example. Because it covers this huge capacity range, has a compact design and requires a minimal amount of oil, the KM2P can be integrated into nearly any system.

THE KM2P AT A GLANCE:

- Compact design thanks to very high power density
- High global availability and short delivery times
- Accommodation of high operating forces
- High reliability due to the continual optimization of all components
- Application of decades of experience
- Maximum compatibility with mill design through customer-oriented standardization
- Maximum flexibility resulting from customized dimensioning
- Reduced handling costs thanks to low weight
- Low operating costs due to increased efficiency and minimized oil and electrical power requirements

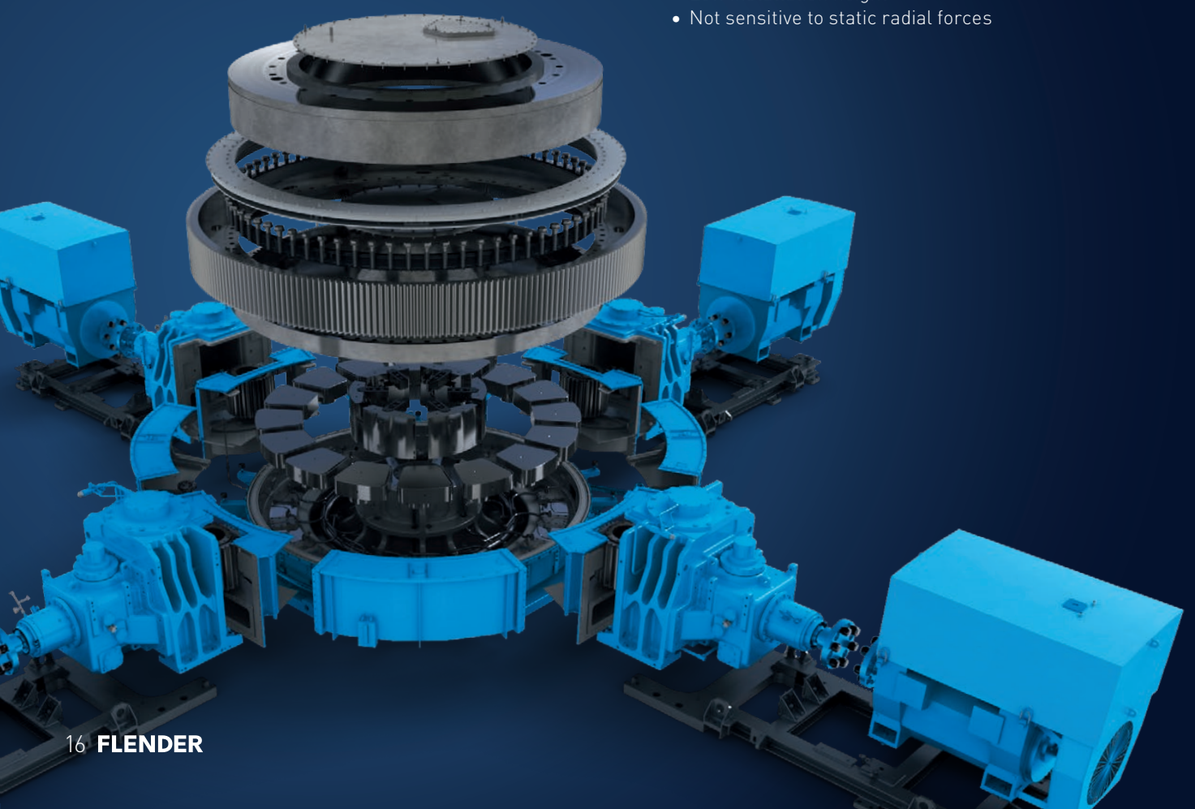
FLENDER KM2P

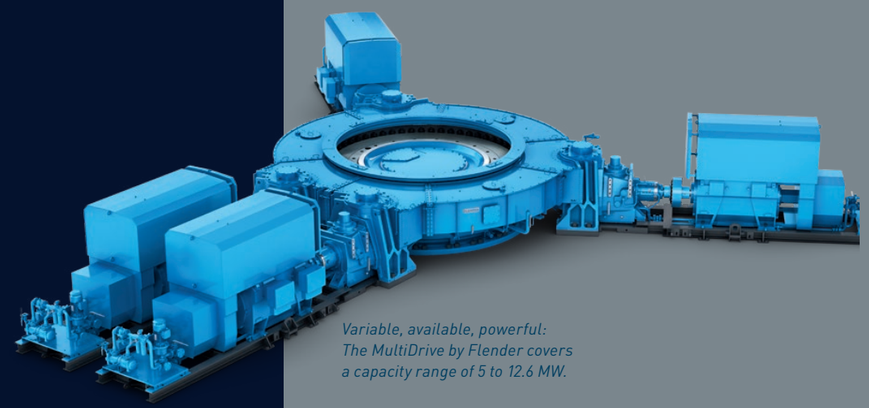
Design	Bevel gear stage, 2 planetary gear stages
Power range	1,000 ... 12,000 kW
Transmission range	i = 31 ... 57
Torque range	800,000 to 4,000,000 Nm (P/n2 = 100 ... 600)
Sizes	14
Thrust bearings	Fully hydrostatic
Advantages	• Not subject to wear • High power capacity • Standardized components • Fully exchangeable with KMPP • Tried-and-true concept with more than 100 references

THE MULTIDRIVE PRINCIPLE

MULTIDRIVE

Design	Squirrel-cage motor or slip ring motor, gear unit (bevel gear stage/helical gear stage), grinding plate bearing (girth gear)
Power range	5,000 ... 12,600 kW
Transmission range	i = 50 ... 120
Torque range	2,000,000 to 5,800,000 Nm (P/n2 = 220 ... 600)
Sizes	4
Thrust bearings	Fully hydrostatic
Advantages	• Highest capacity class • Electrical and mechanical redundancy ensures maximum availability • Standard components with simple stocking • Low installation height • Not sensitive to static radial forces





Variable, available, powerful: The MultiDrive by Flender covers a capacity range of 5 to 12.6 MW.

The MultiDrive® was developed in cooperation with the Gebr. Pfeiffer SE company to provide solutions for vertical mills in the highest capacity classes and to meet requirements for redundancy. The common girth gear is driven by two, three, four, five or even six autonomous drive units. Each drive unit consists of the gear, coupling, motor and lubrication supply unit and can operate either at variable speed with a frequency inverter or speed-controlled. The variable arrangement as either a single or double drive with regard to the girth gear offers a maximum amount of freedom in plant planning.

If one of the installed MultiDrive drive units by Flender has to be serviced, it can be simply disengaged. The other units continue to drive the girth gear, preventing a complete production stoppage. The pre-arrangement of the drive units on a carrier also makes it easier to replace the units quickly. Moreover, the MultiDrive is not sensitive to static radial forces, so it gives you greater freedom: for example, when servicing individual rollers.

Other advantages

The lower installation height of the MultiDrive (up to two meters) in comparison with other vertical mill drives reduces factory and operating costs because the material does not need to be transported so far upward and the peripheral equipment need not be so large. Of course, a suitable oil supply system directly on the drive is standard.

The MultiDrive is the only drive with true mechanical redundancy. The simple, inexpensive stocking of small, standardized components can lead to invaluable advantages in plant availability. The MultiDrive is a complete system with maximum availability and a modular design from a single source. This modular system offers the greatest possible flexibility in design and layout based on customer needs.

The high capacity range enables two plants to be replaced by one plant with significantly greater throughput, keeping the necessary construction work to a minimum.

UNLIMITED POSSIBILITIES:

The modular MultiDrive by Flender offers many design options.

5.1 MW (3 × 1.7 MW)

7.6 MW (4 × 1.9 MW)

12.6 MW (6 × 2.1 MW)

PROCESS STABILITY ...

... is not just an expression: it is a major goal for the entire cement and mining industry all around the world. Stability and safety in grinding ensure plant availability and are the pivotal requirements for every vertical mill drive. Their relevance increases exponentially with increasing mill power input.

Variable speed in drive technology plays a very important role in both process stabilization and optimization with regard to varying materials to be ground. Driven by technological possibilities, the idea that "bigger is better" is continuing to gain currency in the cement world. Against this backdrop, the industry has come to agreement on one thing: speed variability, drive intelligence and, with increasing plant size, modular drive systems are the critical parameters for plant efficiency and success in the face of growing demands with regard to torque and plant availability. But you can rely on our system expertise.

OUR COMPONENT RANGE INCLUDES:

- Transformers
- Frequency inverters
- Motors
- Couplings (including electrically insulated couplings)
- Auxiliary gear units/auxiliary drives
- Maintenance drives/geared motors
- Main gear units
- Oil supply systems
- Sensor technology
- Condition monitoring
- Drive controls
- Financing

Consultancy

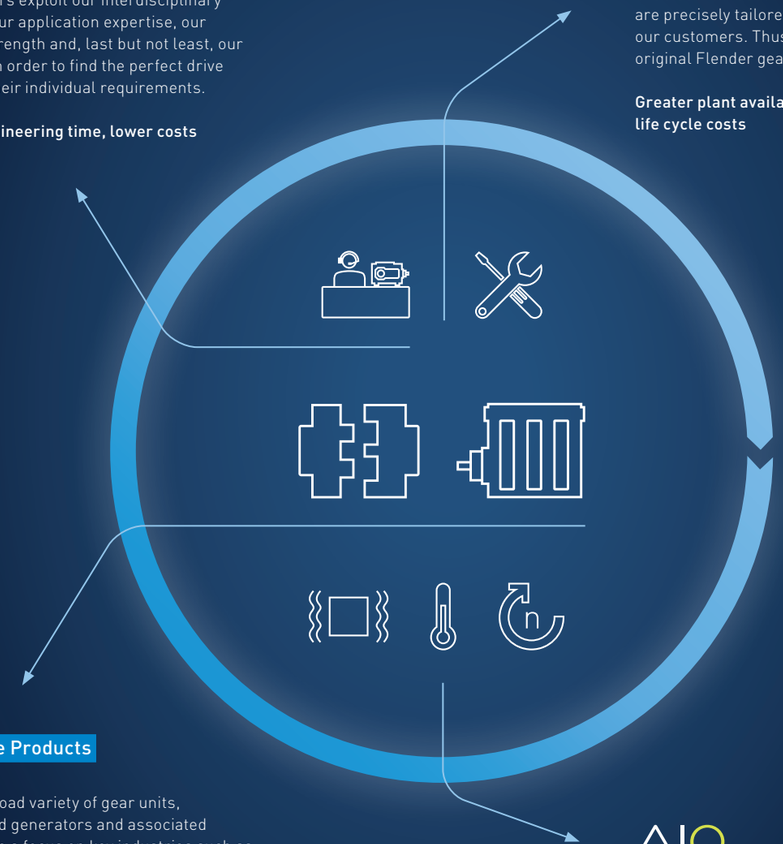
Our customers exploit our interdisciplinary know-how, our application expertise, our innovative strength and, last but not least, our experience in order to find the perfect drive system for their individual requirements.

Reduced engineering time, lower costs

Flender Service

From diagnostics and support to spare part and repair services to maintenance and retro-fitting services – the Flender service portfolio enables individual solutions to be created that are precisely tailored to meet the needs of our customers. Thus, a gear unit remains an original Flender gear unit.

Greater plant availability, lower life cycle costs



Qualitative Products

We offer a broad variety of gear units, couplings and generators and associated services, with a focus on key industries such as wind power, cement, mining or sugar. Flender products combine the latest technology with extremely high quality.

Greater efficiency, higher reliability

AIQ

Maintenance support, failure prediction and diagnostics: AIQ makes Flender gearboxes smarter than ever before. Our gearboxes can be equipped with sensor technology and intelligent tools for drivetrain and process automation.

Less downtime, optimized plant control

WE **MOVE** the WORLD

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