

Keep on DRIVING



Carlos Jorge, CMD Gears, explains a maintenance-focused solution for central driven cement and raw mills.

The cement market has been facing challenges for years due to the economic crisis, strong competition, and the continued strengthening of environmental compliance requirements. The need for high quality cement has, however, remained, heightening the need for reliable and efficient production equipment.

There are a large quantity of ageing plants worldwide, and there has been a slowdown in new plants being built due to various factors such as longer return on investment, geopolitical instability, or overcapacity. As a result, it has been increasingly critical to maintain existing plants, with quality

equipment offering the reliable production of cement.

The recent developmental growth of emerging countries with increasing needs for cement has also highlighted the difficulty of finding expert maintenance teams locally. This has turned proper maintenance into a challenging aspect of cement manufacturing.

To address the two foremost aspects of maintaining existing plants and the need for operator-friendly equipment, CMD Gears has developed and continuously improved its central drive main gearbox solution, with the latest version being the Jumborex® NEO.

Common grinding solutions

During the process of cement manufacturing, the grinding is done in the following two phases:

1. Before the clinker kiln, grinding of the raw material is done in the raw mill.
2. After exiting the kiln and cooler, the cement mill grinds the clinker to cement.

Vertical and horizontal milling technologies are used. If horizontal, these mills can be laterally or centrally driven. The first historical solution that is still widely used is the laterally-driven horizontal mill. Another solution is the vertical mill, using a vertical planetary gearbox. Finally, the design that is of interest here is the central drive horizontal mill.



CMD Jumborex NEO at the CMD factory.



Typical layout of a lateral drive horizontal mill.



Typical set up of central drive ball mill

The benefits of this central drive design compared to lateral driven mills are, amongst other things, a reduction in equipment (there is no girth gear, pinion, girth gear cover, etc.), which makes the solution more reliable and easier to maintain. It also decreases the volume of lubricant used because the lubricant is recycled in the closed loop gearbox. The maintenance cost is therefore reduced.

In vertical mills, the grinding efforts are directly supported by the gearbox, which increases the sensitivity of the drive. Compared to the vertical mill design, the central mechanical drive is more reliable because it does not have to support the load of the process; it is there for rotation only.

For these central drives, the mechanical design of the gearbox can be done using planetary, helical, or split torque design principles.

The solution

Split torque design

The Jumborex NEO is used for central driven horizontal mills and is designed with split torque technology. It splits the torque to be transmitted via two mechanical chains, thus reducing the size of each internal part. The balancing of the efforts is achieved due to the self-adjustment of the input pinion.

This design has a symmetrical geometry, allowing clients to keep only half of the related spares when a complete full set of gears would be needed in regular parallel shaft and planetary reducer designs.

Comprehensive monitoring

The added advantage of this solution is the enhanced monitoring of the reducer through observing the movement of the input shaft, in addition to temperature and vibration sensors on each bearing. Preventative maintenance can therefore be planned easily, with all these values accessible directly at the gearbox (via local display) and/or at the main control room.

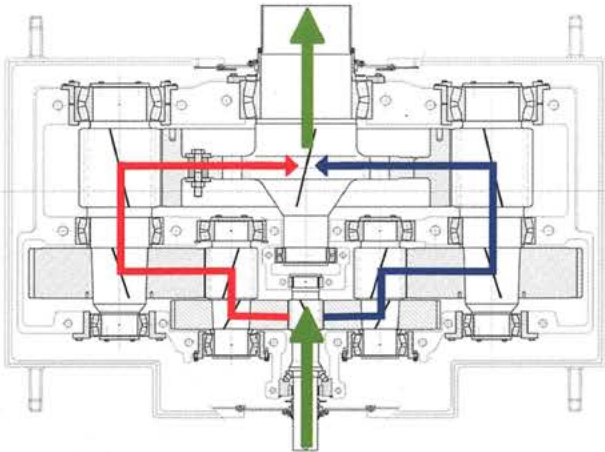
Interchangeability

The solution was designed to address the maintenance and operating issues of existing mill drives. It can be adapted to the existing dimensions and requested capacities that are required to replace any existing drive, due to an adaptable casing and gear design: a plug and play reducer.

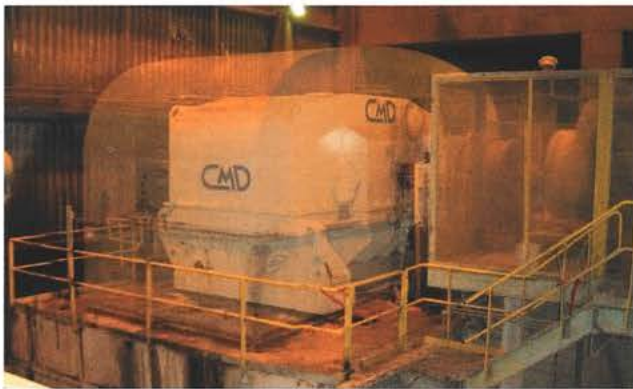
Whether a mill is experiencing running issues with a planetary gearbox, or is struggling with maintaining an older split torque gearbox design, the system is able to replace the existing drive as a drop-in gearbox. The replacement includes the main gearbox along with, upon end user request, low speed coupling, auxiliary drive, high speed coupling and lubrication unit. In most cases, the Jumborex NEO will be adapted to the existing

layout, so no change in civil work is needed (i.e. existing anchor points will be reused).

It was also observed that a shorter time is required for the installation and commissioning of the system compared to the installation of a complete set of internal gears in an existing gearbox. The interchangeability of the system is critical considering the current cost of spares for older technology gearboxes. With regard to the cost of supervision time and of the complete set of internal gears and bearings, the return on investment is improved with the new system.



Jumborex NEO split torque concept.



Interchangeable Jumborex to replace old reducer.



Jumborex NEO opening in 30 sec.

Additional enhancements

As a result of 40 years of experience with central drive gearboxes, the new system was designed to push the limits of customer-friendly equipment in the cement industry. The main advantage of the system is how easy maintenance becomes.

Indeed, it takes only 30 sec. to have full access to gearbox internals, as the upper and lower casings are not bolted together. A special inflatable seal and the top casing's inherent weight ensures effective sealing. The system allows quick access to the gears and bearings for the visual inspection of each gear, contact patterns, die penetrant tests, checking any bearing clearances, etc. Maintenance tasks such as bearings replacement can be performed without dismantling the entire reducer from the mill.

Compared to a planetary gearbox solution, the quick access to the Jumborex NEO is an advantage, as planetary gearboxes cannot be inspected so easily. Full access to the internal gears and bearings requires the removal of a planetary gearbox from the mill to a workshop, as well as rotating it vertically to dismantle the components.

In the CMD service team's experience, four days are needed in total to inspect a planetary gearbox, where only one day is required for the Jumborex NEO, and no heavy-duty lifting cranes are required either.

In addition, a planetary gearbox has more bearings compared to CMD's system with equivalent capacity. The total time needed for bearings replacement in a planetary gearbox will be increased by four full days, which represents almost one week of added shutdown time.

The system also features glass windows and internal LEDs, to allow a glimpse at the gearbox internals, as well as autoclave inspection doors for easy access.

Case study – Portlandzementwerk Wittekind

Based in Germany, Portlandzementwerk Wittekind operates a central drive cement mill. It recently experienced a critical difficulty that CMD helped it to overcome. Mr Michael Peitz, Maintenance Department Director, shared his experience:

"The original reducer (constructed in 1964) was commissioned in 1984 for a 2000 kW x 14.6 RPM cement mill. A thorough inspection was carried out in 2016 and it was concluded that all the internal gears were worn and had to be replaced within two years.

"The cost of spare parts and required shutdown time was high and we could get a complete new unit for the same money. After several meetings and projected scenarios, CMD offered its customised system, which was 100% interchangeable with the existing reducer (no foundation modification was needed and no motor move was required). The company also introduced new innovations and features, making maintenance easier and faster.

The supervision of installation and commissioning of the Jumborex NEO would be handled by the CMD service department. All in all, the company



Jumborex NEO inspection windows and LED lighting.



Existing older split torque gearbox – running conditions: 2000 kW at 496 RPM, ratio: 29.97:1.



Newly installed interchangeable Jumborex NEO.

JUMBOREX® NEO

Ball mill central drive
Up to 8000 kW



Typical view of drop-in Jumborex NEO.

offered a turnkey project matching our expectations. We selected the system based on the following considerations:

- ▶ 200 000 hour lifetime.
- ▶ Service factor: > 3 as per ISO 6336.
- ▶ L10a bearing lifetime: > 200 000 hours as per ISO 281.
- ▶ Weight: 47 300 kg.

“Supervision of installation and commissioning was completed in 20 days and in one shift in December 2017, coinciding with our yearly shutdown programme. Since commissioning, we have not faced any unexpected shutdown due to Jumborex NEO.

“We also increased our cement mill availability, so the production level has increased compared with the previous reducer. The consumption of lubricant has decreased and fewer inspections are needed, so I can use my staff on other tasks.

“With the CMD system, we perform periodical inspections observing more parameters. In seconds, we can lift the upper cover (there are no bolts) and obtain full visual access to all bearings, internal gears, sensors, and lubricant piping. The company also delivered a monitoring system (connected to our control room and onsite display), enabling us to follow the condition of the JC20sp in real time.

“In April 2019, a full inspection was carried out in one day as a result of easy accessibility. It showed the good condition of internals, which is consistent with the smooth running we observed.”

Field approved technology

Since the first model was installed in 1973, the Jumborex has spread globally, with a total of 120 installed references. Within these references, half were installed as replacements for existing gearboxes as drop-in reducers, and the remaining were for greenfield projects.

Full range

With a versatile design, the system can be adapted to a variety of central driven mills up to 8000 kW.

Conclusion

The Jumborex NEO is a user-friendly reducer that optimises total cost of ownership and tackles emerging difficulties in the cement industry. Development is continuing and new improvements will be made to keep the system at the highest level of reliability and satisfaction.

About the author

Carlos Jorge has worked at CMD Gears for 28 years and has been greatly involved in the development and growth of the company. He has been a critical element in the design of breakthrough technologies, including Jumborex NEO.