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Wikov - Driving change in the gear industry

Wikov Group is a leading mechanical gear manufacturer for the wind, marine, rail and other sectors, including the cement and mineral processing industries. *Global Cement* recently visited its plants in Pilsen and Hronov in Czechia to profile the company and to find out what drives it forward...

Gear manufacturer Wikov faces a challenge. Owing to the company's composite history from different Czech gear manufacturers such as Škoda and ČKD it is well suited to both custom projects and mass production ranges. The expertise and technical knowledge of the company's design division Orbital 2 and its plants at Pilsen and Hronov offer German levels of engineering but with a cheaper workforce, well placing it to tackle bespoke projects and develop new solutions and products. However, cutting-edge innovation requires industry partners and is financially risky. On the other hand, the group also has the production capacity to support standardised ranges of components at a competitive price as it grows its original equipment manufacturer (OEM) status in the cement industry.

History

Wikov Group comprises a group of well-known Czech engineering companies brought together by geologist-turned-investor Martin Wichterle over the past 15-20 years. Each of the main strands of the group has their own distinct heritages, dating back to the 19th Century.

The group takes its name from Wichterle's family company **Wichterle-Kovářík**, giving the group its name of Wikov. This company started out in 1878 producing agricultural machines and tools. It merged

in 1918 to form Wichterle-Kovářík, before diversifying into diggers, steam engines, generators and cars. Later it was nationalised and Wichterle acquired the brand name in 2004.

Wikov Gear, based in Pilsen, joined the group in 2004. It dates back to 1859 and was originally a part of Škoda machine works. Specialised gear production at Škoda started in 1918 and Wikov Gear continues this technical knowledge and heritage.

Wikov MGI, based in Hronov, joined the group in 2002. Previously it was known as ČKD Hronov with a production history at the site that dates back to 1884. In 1898 Mach & Fišer started making agricultural equipment and bending machines. Following nationalisation after the Second World War the factory was merged into ČKD Group, with production refocused on large scale machine production for the Russian market. ČKD Hronov started production of gearboxes for ships in 1974 and gear and gearbox manufacture has gradually come to dominate its output since that time.

Other parts of the group include Orbital 2, Wikov's research, development and design wing, based in Prague and the UK. This company was set up by British flexible pin pioneer Ray J Hicks together with Frank Cunliffe in 2002 before joining the group as an independent member in 2004. The group also includes Wikov Sázavan, a precision parts and machining manufacture unit, as well as sales subsidiaries in North America, China and Russia.

Production process

Gears and gearboxes are produced at the sites in Pilsen and Hronov by Wikov Gear and Wikov MGI. Wikov Gear focuses on products for cement and mineral processing as well as for oil and gas, power generation, turbo applications, sugar production and the marine sector. Wikov MGI concentrates on rail, hydroelectric power generation, wind and tidal power, rubber and plastics and metallurgy applications, also building complete drive chains.

At Wikov Gear, the production process consists of six stages: hobbing, grinding, heat treatment, inspection, assembly and testing. The process functions as a series of workshops, with workers passing parts onto

Below: Outside the Wikov Gear plant in Pilsen, Czechia. This part of Wikov Group was originally part of Škoda. The older logo was kept to preserve the history and show the evolution of the Wikov brand.





the next team in the production process. As Wikov Gear's Technical Director Radovan Rašpl explains, the company's expertise lies first in designing gearboxes followed by precision production.

Hobbing is the process where the gears are initially cut out of the raw metal. Wikov uses forgings from Czechia or Western Europe. This is followed by grinding, the most important step due to the exacting precision these products require. Accuracy is critical, as mistakes can generate cracks that lead to scrappage. Both hobbing and grinding use a mixture of manual and computer numerical control (CNC) machine tools. Heat treatment takes place at Wikov MGI in Hronov, nearly 250km away. A shuttle truck travels between the sites to transfer parts back and forth every day. This support from within the group means that Wikov Gear does not have to outsource heat-treatment services, unlike some other manufacturers.

Inspection then follows back in Pilsen to ensure accuracy. This takes place in a climate-controlled environment at 20°C with a fixed humidity. Parts acclimatise to the conditions for up to several days before being inspected for accuracy of gearing geometry using 3D measuring devices. Once the parts

have been cleared by inspection, they are released to assembly where the gearboxes, drives, housings and other products are put together manually by a team of specialists. Worker skill at this stage is critical as misassembly can damage parts. Another requirement is for a clean working environment, which means no drilling, grinding or other such work in the inspection area.

Each half of the Pilsen factory has its own crane with a capacity of up to 50t. This posed particular challenges for a 120t Side Drive ordered for a horizontal ball mill from Russia's OAO Spassk-Cement. On this occasion the gearbox was assembled, tested and then disassembled before shipping in what Rašpl describes as 'a big job'.¹

Wikov Gear also has a dynamic testing lab for completed high-speed gearboxes of up to 35,000rpm. Principally this is used for high-speed applications in the power and oil and gas sectors and represents a unique capability for gearbox manufacturers in Europe. Typically a test will last four hours, with inputs such as lubricant consumption measured from a control room. In addition the group has three other testing facilities at its Hronov plant, including cold climate gearbox testing of down to -50°C.

Wikov Gear can produce gearboxes from 800kg to 120t. Actual production time depends on the product in question. For example, a Side Drive - one of Wikov's specialist gearboxes, could be produced in three months depending on design time, a clear production schedule and the availability of third party parts such as bearings. Normally a month is required for a design to be prepared. Then forging the gears themselves can take 6-12 weeks.

Above left: A Klingelberg C100 U HPG machine at Wikov Gear. This tool is used for bevel gear cutting.

Above: Gear production at Wikov Gear operates as a series of workshops, with workers passing completed parts onto the next team in the chain



Left: The Wikov 7-28 was the very first series model of Wikov company. It was made in 1925 and it had an advanced four cylinder overhead camshaft engine. The cars were hand-made in low-series production.



Above: Inspection of parts at Wikov Gear takes place in a climate-controlled environment at 20°C with a fixed humidity.

Above right: Wikov Gear has a dynamic testing lab for completed high-speed gearboxes up to 35,000rpm. The group has three more testing labs at Wikov MGI, including cold climate gearbox testing of down to -50°C.



Key products for cement plants

Wikov's main products for the cement industry are its Side Drive range for horizontal ball mills and its planetary gearbox range Orbi-fleX with flexible pin for horizontal ball mills and roller presses. It also offers its parallel-shaft range for horizontal ball mills and kiln drives, its CM range for horizontal ball mills, its VMH range for vertical roller mills and other offerings including bevel-helical gearboxes for vertical mill drives and heavy duty belt conveyors and bevel gear sets for cone crushers. In addition, the company affords a wide range of customisation as well as fully bespoke options. Recently the group has also started to offer its remote monitoring service, WiGuard, to provide online gearbox monitoring and diagnostics.

Planetary Gearboxes Orbi-fleX

Wikov's 'ace-in-the-hole' since the group came into being is its Planetary Gearboxes Orbi-fleX range using flexible pin technology. The creator of the flexible pin, Ray Hicks, founded Orbital 2 with Frank Cunliffe in the UK in 2002 to develop design and license the manufacture of epicyclic flexible pins for the renewable energy industry, specifically wind power applications.

This company was subsequently purchased by Wikov in 2004 and it took development of the concept further. A flexible pin with patented overload stop was introduced to the market by Wikov in 2005. Wikov MGI in Hronov then ran the development work with Orbital 2 before expanding the concept out to the rubber, sugar and then cement and mineral processing industries.

As Zbynek Berger, the managing director of Wikov MGI explains, the technology is extremely reliable, with no failures reported in nearly 10 years across 550 references. It has been a major success for Wikov. Berger says that Wikov's experience with the Orbi-fleX design means that Wikov MGI supports Wikov Gear to implement sophisticated planetary gearboxes in cement sector products without repeating the mistakes that always arise when embarking on the 'learning curve' of making planetary gearboxes. The key features of the range are higher power density and smaller size and weight that planetary gearboxes allow and the protection against power overload that the flexible pin concept offers.

Side Drive

The Side Drive was originally developed for a client in Turkey in 2006. Radovan Rašpl was part of the development team for the Side Drive and he detailed how it was created. "The biggest problem in cement is very small particles of 2µm and they are everywhere. It goes to the oil and after some time they have an abrasive function. So all the gears become very worn after several years and also it can transfer to the nozzles that spray the oil to the lubricating points. After one to two years we saw that a lot of gearboxes failed."

To combat this, Wikov decided to completely enclose the lubrication system. Following a project development cost of Euro1m, a



Right: Staff assemble the gearboxes at Wikov Gear by hand. High skill and precision is mandatory to meet Wikov's demanding standards.

prototype was designed by Wikov Gear and built and tested in conjunction with the Research and Testing Institute Plzen. Owing to grant restrictions the original prototype was destroyed but subsequently Wikov received a large number of orders for the Side Drive, particularly in Turkey and from customers in the Middle East and Africa, where it has become a core product for the company.

The key innovation of the Side Drive is its separate lubrication system. Reducing the contamination of the lubrication system reduces wear to gears, bearings and other components, leading to extended product lifespan. The range comes in three models with a power of 2500-6000kW and a related torque of 255,000-450,000Nm with, as ever with Wikov, endless customisation options.

WiGuard

One of Wikov MGI's newer initiatives, the WiGuard system is a continuous remote monitoring service for any of the group's gearboxes. On site sensors monitor vibrations, temperature, pressures, flow capacity, torque, oil quality and oil particles. Reporting takes place via an internet connection to Wikov, allowing the company to provide diagnostics and continuous measurement, safety alarms and ultimately reduced maintenance and service costs, higher reliability and extended gearbox lifespan. As Tomas Zrostlik, the managing director of Wikov Gear in Pilsen explained, the WiGuard system has helped the company spot problems in customer installations before they cause too much damage. "A gearbox is the heart of the complete system. All the forces go through the gearbox and it has to absorb them and sometimes it isn't designed for that."

The product launched in 2014 and has offered useful data, particularly for remote sites such as those in the Far East. Product sales are growing and Wikov Gear now needs to increase the size of its WiGuard team to handle demand.

Interview with managing team at Wikov Gear and Wikov MGI

Global Cement (GC): What share of your business comes from the cement industry?

Tomas Zrostlik, Managing Director of Wikov Gear (TZ): The cement sector these days for Wikov Gear comprises maybe 15% of business. It's difficult because it varies. For example, at present we have successfully signed some big contracts so it's higher than it has been in the past right now.

GC: Where are Wikov Gear's markets located for the cement industry and how are they served?



Left: Wikov Gear's Technical Director Radovan Rašpl stands in front of a Gleason Pfauter P 2400 / 2800 hobbing machine.

TZ: These days we see a lot of requests from the Middle East and North Africa. We can't talk about OEM applications but we signed a pretty good contract with a significant player in Germany using the Side Drive application. The rest of our OEMs are in the US.

On the aftermarket side, it is a different story because we are flexible. We do lots of replacements for end users, wherever they may be in the world.



Left: Tomas Zrostlik, managing director of Wikov Gear, in the assembly area. Note the designs in the background that the staff use to assemble the gearboxes by hand.

GC: What is the most common piece of equipment requested by cement plant customers now?

TZ: At the moment we are getting a lot of requests for helical gearboxes from the cement sector.

GC: How has the gear industry evolved with respect to the cement industry in recent decades?



Left: Zbynek Berger, managing director of Wikov MGI, stands in the heat treatment area at Wikov MGI. Heat treatment for parts at both plants takes place in Hronov with a shuttle truck running daily.



TZ: Compared to the gears we supplied 20 years ago, everything today is smaller, more efficient and more precise. Whereas previously a gearbox might weigh, say 30t, the same gearbox today would weigh more like 10-15t. There is now a high demand for efficiency and the customer is asking for a three, four or five year guarantee. To enable us to keep up with these increasing requirements, we invested a lot in the past decade in new technologies such as new profile grinders, measuring devices, a new Visual Tool Setter (VTS) and analysis system, as well as in the building itself at Wikov Gear.

Also, a lot of gearbox manufacturers are standardising their products. When we started to develop planetary gearboxes for different applications, we knew how to do it and we used a standardisation system for the products. The gearbox is not the same but the components, the method and the layout are very similar. The same method is also applied in the railway industry for example, where Wikov MGI is quite strong.

GC: Can you explain how Wikov's service and spare parts network fits into your business?

TZ: The cement industry is complicated for us because we call it a 'low speed industry.' The accuracy of the gears themselves is not as high as in, for example, a high-speed gearbox. So there are many companies that are able to do repairs, refurbishments and upgrades locally. For example, in Egypt there are a lot of companies that can maintain gearboxes and make spare parts. However, if somebody asks for a complete mill they definitely go for a good quality because they want it to last for 15 years. In addition when a gear is broken they need to replace it right away. In that situation, they can pay somebody to do it very quickly. So definitely, the spare parts business

is good. We would like to extend it but today it is, maybe, 10% of our sales. The majority of the business is new supply, the complete gearbox.

GC: What are your plans for the WiGuard remote condition monitoring system?

TZ: We want to develop WiGuard further and we hope to move to a full 24/7 service for our customers. This can also generate other revenue for us as we build up our data on the operation of our gearboxes. We can then implement this knowledge into future development to decrease the cost of manufacturing. It may also help us to extend product lifespan.

GC: What are the technical key challenges that Wikov faces with respect to the cement industry?

TZ: I would say that the answer depends on the application. The quality of the gears influences the lifetime of the bearings and the gearbox itself. For example, the Side Drive has a high risk of improper installation. For the helical gearbox it is the alignment of the couplings compared to the input shafts. For the vertical mill it is definitely the loop of the axial bearing. For the roller press it is the good timing of both roller presses. For the kiln it is the alignment of the shafts itself. There are certain issues that appear on different applications.

GC: How has Wikov Gear coped with the economic downturn since 2008 and subdued construction markets in Europe?

TZ: Generally I would say the first two years were very worrisome because the market stopped, everybody panicked, there was no new investment and everything was postponed. It was tough. The end users, the cement plants, still had to do some maintenance because there was still demand for cement and clinker. So we still supplied pinions, shafts and sometimes replacements of gears, but the market definitely dropped.

GC: Are you expecting any changes in the cement industry going forward?

TZ: I would say that the cement industry is conservative so I don't feel that there will be big changes. We might see the replacement of helical gearboxes with planetary ones, but some parts of the sector are quite resistant to new technologies. It's a big step due to existing space and technology, but it's possible.

Lukas Steiner, Marketing Manager at Wikov Gear (LS): In the broader sense of things, we also need to know how many new cement plants are being built and where. At the moment, however, the market is consolidating globally.

Below: Part of an Orbi-flex planetary gearbox originally commissioned for a large scale wind turbine.





Right: A Niles ZP 20 profile grinding machine. Grinding requires the most accuracy of the gear production process and it is here that Wikov's expertise shines.



GC: What investments have been made recently?

TZ: At Wikov Gear lots of new machines were added after 2004, with the majority coming between 2007 and 2009 when we purchased our largest grinding machines and a shaping machine. In 2016 we bought a three-axis machine and a new profile grinding machine, which we received in January 2017. We spent around Euro15m just on machines.

Later in 2017 we will buy a five-axis machine. This machine will allow offset milling and turning on a single lathe. When you clamp the piece you can do the turning and the milling out of axis, not only in the axis but outside.

LS: At Wikov MGI over Euro55m has been spent over the last decade covering new machine tools, a new administration building and testing facilities.

MS: Investment in testing has been huge, including the cold climate chamber. This allows gearboxes to be properly load tested and tuned. The results are worth their weight in gold!

Right: Heat treatment of parts produced at Wikov Gear in Pilsen takes place 250km away at Wikov MGI's plant in Hronov. Wikov is the only gearbox manufacturer in Central Europe that operates its own heat treatment facility.



GC: Do you have any plans to expand or upgrade your production sites?

TZ: Our building in Pilsen is almost 70 years old. At the start the building was only used by Škoda for gear production. But since privatisation, new machines were added, making everything more compact. The site is also limited by our 50t crane. We would like to keep the shape of the factory and do some reconstruction. There was a plan and a proposal in 2009 but the financial crisis stopped the project. So now we are waiting. We might start the project in 2019.

GC: What are Wikov Gear's goals in the short and long term with regards to the cement industry?


TZ: We still aim to become a member of a big OEM in Germany. To work with different end users is nice but it takes lots of time because it's one project at a time. But when you work with an OEM, it sells the complete line. It definitely brings more aftermarket activities because the end users will need spare parts. It is easier to go to one OEM with a standardised gearbox than different variations.

GC: How do you think Wikov is perceived within the global cement industry?

TZ: I think they view Wikov as Škoda and many people view the Škoda brand highly. Then they think about our location near to Germany and our price. Our flexibility is also unique. We can make a decision in hours on a customer request to give the

customer our standard solutions but we can also modify them to a very high degree. We can be very specific and very accurate with it.

GC: Gentlemen, thank you for your time.

All: You are very welcome indeed! 

References

1. Steiner, L. 'Spassk Cement - Higher efficiency with a Wikov Side Drive,' in *Global Cement Magazine*, October 2015.