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Sustainable driving – and manufacturing

China's largest engine manufacturer opts for NC joining systems from Kistler



Three maXYmos NC process monitoring systems – with the matching display module – are used to control joining systems from Kistler at Yuchai's engine production plant in southern China.

Yuchai, the machinery group based in southern China, opts for the NCFN and NCFH electromechanical joining systems from Kistler to manufacture components for engines that comply with the China VI standard. Thanks in part to custom-designed press-fit solutions, Yuchai achieves high product quality, energy efficiency and process transparency.

China's latest exhaust emission standard for commercial vehicles shows that the country is taking a very serious approach to protecting the environment – in spite of the pandemic. "China VI", which is based on Euro VI in many respects, is being introduced in two stages: the VI-a standard already came into force on 1 July 2020, and the strict VI-b norm will apply from 1 July 2023 onwards – with some drastic goals for reductions of CO₂, particulate matter (PM) and oxides of nitrogen (NO_x) in the mid double-digit percentage range. Over the long term, this should significantly reduce air pollution due to exhaust gases, especially in the nation's mega-cities. But how will these requirements impact automobile manufacturers and suppliers to the automotive industry? There will certainly be major changes to the way vehicles are designed, manufactured and operated.

Guangxi Yuchai Machinery Co., Ltd. (GYMCL or Yuchai for short), has its headquarters at Yulin in the Guangxi Zhuang Autonomous Region (southern China). Yuchai numbers among those automobile manufacturers who foresaw the transformation at an early stage. Founded in 1951, this corporate group has seven other plants throughout China where it produces engines for trucks, buses and other commercial vehicles. With over 15,000 employees, Yuchai posts annual sales of RMB 40 billion (more than EUR 5 billion). As one of China's market and technology leaders for combustion engines, GYMCL embraces cutting-edge technologies and collaborates with universities across the globe including Brunel University in London, RWTH Aachen University in Germany, and Shanghai Jiao Tong University.

Focusing on product quality and resource efficiency

Back in 2016, the foundation stone was laid at Yuchai's Yulin site for two new production halls geared to manufacturing exceptionally resource-efficient, low-emission diesel engines. From day one, electromechanical joining systems from Kistler were deployed at the relevant stations for the press-fit processes – a choice based on their combination of accuracy, energy efficiency and real-time process monitoring. On 8 January 2018, Yuchai became the first manufacturer in the country to produce China VI-compliant engines with the low emission levels required by the standard – and in 2019, the production line in the second hall also went into operation.

This new manufacturing environment features state-of-the-art production lines. As Head of Operational Safety, Mr. Liu is responsible for technical equipment, maintenance and troubleshooting in the plant. He explains how things have changed: "We used to operate hydraulic and pneumatic press-fit systems. They function well, but they are energy-intensive – and above all, they are very noisy. Thanks to Kistler, we were able to opt for a better alternative – now, everything is much cleaner and quieter, and the whole process is far more orderly." This is an enclosed production environment equipped with large numbers of air conditioning systems, so limiting the noise level is a critical factor. The new approach also yields benefits in terms of setting up the individual stations, and for maintenance: "The systems from Kistler are more compact and more flexible, and they are simpler to commission – so regular maintenance jobs are easier as well," Liu continues.

Force-displacement monitoring – with customized design

Large numbers of NCFN and NCFH series modules from Kistler are deployed for joining processes at many different stations in both of Yuchai's new production halls. They are used to assemble components such as steel balls, valve seats and guides, seals, intake hoppers and outlet openings. Production of engine components

with press-fitted parts is now placed on an entirely new basis: integrated sensor-based force-displacement monitoring supplies two mutually independent indicators – force and displacement – to allow an accurate assessment of the press-fit process and the mechanisms of the components involved.

As Liu points out: “One simple test is sometimes not enough to detect potential defects and optimize the quality of the process. Thanks to systems from Kistler, we can now respond to challenges that may arise in many areas: part tolerances, machine instability, process errors, and other hidden factors that negatively impact process reliability. This means we can achieve – and maintain – very high quality in our press-fit processes.”

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Mr. Liu, Head of Operational Safety at Yuchai

As well as the advantages already mentioned, Yuchai also benefits from a customized solution developed by Kistler – in the form of a unique joining module that is not available to any other Chinese engine manufacturer at present. This is an individual variant of the NCFN joining system featuring a very long stroke: 1,000 mm as compared to the standard length of 400 mm (see the box). Liu’s final comment: “Thanks to this tailor-made solution, we’ve been able to sustainably optimize our production. Kistler has demonstrated outstanding flexibility and technical understanding throughout the process. Systems from Kistler are simple to operate, and they’re highly reliable – so there’s virtually nothing to complain about!”



Kistler specifically designed this customized NCFN electromechanical joining system – with a very long stroke of 1,000 mm – for Yuchai, the engine manufacturer based at Yulin (China).

More precision, less energy: optimizing press-fit processes

Of the total of six series of electromechanical joining systems offered by Kistler, Yuchai uses two modules – the NCFN and the NCFH:

- NCFN: standard joining module for medium to high forces (5 to 300 kN)
- NCFH: joining module with hollow-shaft motor for highly dynamic processes and short cycle times (force range from 1 to 60 kN)



The NCFH joining system from Kistler, comprising the joining module (servo press, left), the display module (center) and the maXYmos NC control module (right)

Both series feature integrated force control, high velocity and measurement accuracy, and they are equipped with active deflection compensation. In conjunction with the maXYmos NC (Numeric Control) process monitoring system from Kistler, these systems can be integrated efficiently into highly automated production lines via Ethernet.



Production engineer Liu of Yuchai shows his colleagues how to handle the maXYmos NC process monitoring system for electromechanical joining systems from Kistler.

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