Success Story:
Volkswagen Motor Polska

Markets Served
Machine Building

Refurbishment with Eaton low-harmonic regenerative drives has allowed us to address the challenge of bringing our engine test rigs up to date.

Robert Konieczny, automation specialist from the Volkswagen Centre of Technology and Innovation in Poland

Putting engines to the test

Location:
Polkowice, Poland

Segment:
Automotive

Problem:
Speedy refurbishment of automobile engine test rigs

Solution:
SPI and SPA frequency converters, xEnergy enclosures, NZM3 circuit breakers, easySafety safety products

Results:
Engine test rigs that perform reliably to the highest standards

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Background

At the heart of every vehicle is its engine and, unless the operation of the engine is stable and reliable, the performance of the vehicle can never be satisfactory.

For this reason, tight quality control and extensive testing play important roles in the engine production process. Within the framework of their quality control procedures, automotive manufacturers randomly select engines from their production lines and subject them to rigorous testing to confirm that they meet all of the key requirements and parameters set by the designers.

Recently, one of the leading manufacturers of passenger car engines in Poland decided to raise its engine testing standards to the next level. In its production plant were two engine test rigs that had given excellent service over many years, but they were starting to become unreliable and their capabilities no longer met current requirements.

As a technology leader in the field of engine manufacture, the company knew that this situation was unsatisfactory and took the decision to extensively refurbish the test rigs, a process that included completely replacing the measuring systems and the drives for the electric motors. It was essential for the work to be carried out as soon as possible and to be completed quickly.

Challenges

To move forward with the project, the engine manufacturer needed a technology partner that could guarantee fast delivery and speedy implementation. It also needed a solution that it could integrate easily with its existing control system. Finally, the partner had to fully understand the test procedure, in order to ensure optimal design of the new equipment.

For example, one of the tests involves measuring the engine operating parameters under load. For this, the engine is mounted on a test stand and conditions that are likely to occur during normal vehicle use are simulated. The engine is operated over a range of speeds with various loads while parameters that include torque, fuel consumption, oil temperature and coolant temperature are measured and recorded.

The tests range in duration from a few hours to several days. After testing, some of the engines are dismantled, and the wear on moving parts, such as piston rings, cylinder blocks and valves, is measured.

Solution

To perform the tests, it is necessary for the engine on the test rig to be mechanically coupled to an electric motor. The motor performs two basic functions: during the initial stages of the test, it operates as a starter to start up the engine. This is necessary because internal combustion engines generate no torque at zero speed and must,

therefore, be cranked by an auxiliary motor.

When the engine is running at a speed greater than its idling speed, the rotational speed of the rotor in the electric motor exceeds the speed of the rotating electromagnetic field and the motor acts as a generator. By controlling the amount of fuel fed to the engine, along with the voltage and frequency of the supply to the motor, the test rig can evaluate the performance of the engine under a wide range of operating conditions.

To power the electric motors in modern engine test rigs, four-quadrant frequency converters are used, as these allow the energy generated by the motors when operating in generator mode to be fed back into the utility supply system. This improves the energy efficiency of the test rigs and delivers valuable cost savings.

For this project, Eaton working in close cooperation with system integrator Simlogic supplied two four-panel drive cubicles equipped with four-quadrant frequency converters, while Simlogic was responsible for the overall systems integration (e.g. fuel transportation system etc.) The converters are based on Eaton SPI-series inverters and SPA-series active rectifier modules with LCL filters. The motors used in the test rigs are rated at 220 kW. Communication between the converters and the overall control system is handled by a Profibus DP link. The enclosures used for the project were selected from Eaton's xEnergy range.

"For the implementation of this project, we had to take into account the results of a comprehensive security audit as well as changes to the previous requirements for the test rigs," said Mariusz Jablonski, the owner of Simlogic. "This meant that achieving optimum design and parameterisation for the system was a big challenge."

"For example, at the design stage it became clear that the standard top panel would not provide sufficient ventilation for the equipment installed in the enclosures. Eaton's R&D division, however, quickly provided a solution. In just two weeks, the R&D team designed, manufactured and delivered a customised top panel with double the ventilation capacity, which was a perfect match for this application."

Results

The entire project was successfully completed on budget and on time. Commenting on the project, Robert Konieczny, an automation specialist from the Volkswagen Centre for Technology and Innovation in Poland, said: "The existing test rigs, which had been in use at our plant for many years, no longer met our requirements. In particular, the rigs had shortcomings in the areas of quality and reliability of control, as well as in the facilities they provided for monitoring and accessing device settings via the automation systems. Also, because of the age of the rigs, they were starting to need frequent maintenance and servicing."

"Refurbishment with Eaton low-harmonic regenerative drives has eliminated these problems. The refurbished test rigs have now been in operation for several months, so I can say that the solution implemented by Simlogic and Eaton fully meets our expectations and requirements in every way."

Cost savings by increasing energy efficiency: 4-quadrant variable speed drives from Eaton are used to control the electric motors in a modern engine test rig. These enable energy generated by the combustion engines in generator mode to be fed back to the supply.

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