A PHILLY SQUEEZE BREAK

Johnson Matthey helps Temple meet RICE NESHAP requirements in tight spot

Johnson Matthey's Modulex B80 CO catalytic converters were chosen to help Temple University achieve RICE NESHAP compliance with its 10 sets of tandem Caterpillar 3516 natural gas engines. The limited space in the university's facility made it a challenge to find the right emissions solution, the company said.

BY JACK BURKE

Temple University in Philadelphia had 10 sets of tandem Caterpillar 3516 natural gas engines that needed upgrades to comply with the Environmental Protection Agency's (EPA) RICE NESHAP stationary emissions regulations.

The school installed the natural gas engines in 1993 for peak shaving, but needed to add oxidation catalysts to meet the emission limits of Subpart ZZZZ of the RICE NESHAP regulation. To comply with the standards, Temple needed to reduce the CO emissions from each engine by a minimum of 93%.

Temple came to Johnson Matthey with questions about RICE NESHAP requirements and catalysts in early 2012. In this particular situation, the school faced three equal, but somewhat conflicting, challenges:

- The solution had to meet RICE NESHAP requirements.
- The catalytic units had to fit in the existing space available.
- The catalyst systems needed to function effectively within the backpressure limitation of the engines, because Temple couldn't derate the engines by allowing a higher backpressure.

Temple selected ENERActive Solutions, Asbury Park, N.J., to provide a complete turnkey retrofit project including design, material procurement, installation and guaranteed performance. In order to achieve the 93% CO reduction, ENERActive required CO catalyst systems that could operate at all engine conditions, including continuous load, part load, startup and standby — all without affecting the plant's operation. To do that, ENERActive chose Johnson Matthey's Modulex B80 CO catalytic converters.

Achieving that reduction wasn't a big technological challenge by itself, but getting that 93% in a constrained physical space, with specific backpressure constraints as well was a challenge, Johnson Matthey said.

In a way, it was sort of like trying to squeeze something into the engine compartment of a new car, the company said — there's just not a lot of room. So the catalytic converters had to be sized as small as possible, but still be able to provide the required emissions reduction.

Each engine in the tandem generator set had a vertical exhaust pipe that was connected to a silencer it shared with its twin. Each silencer had its own exhaust stack. To meet the space restriction, the catalytic converters had to fit between the engine's turbocharger outlet and the inlet of the silencer in the vertical exhaust pipe without placing a load on

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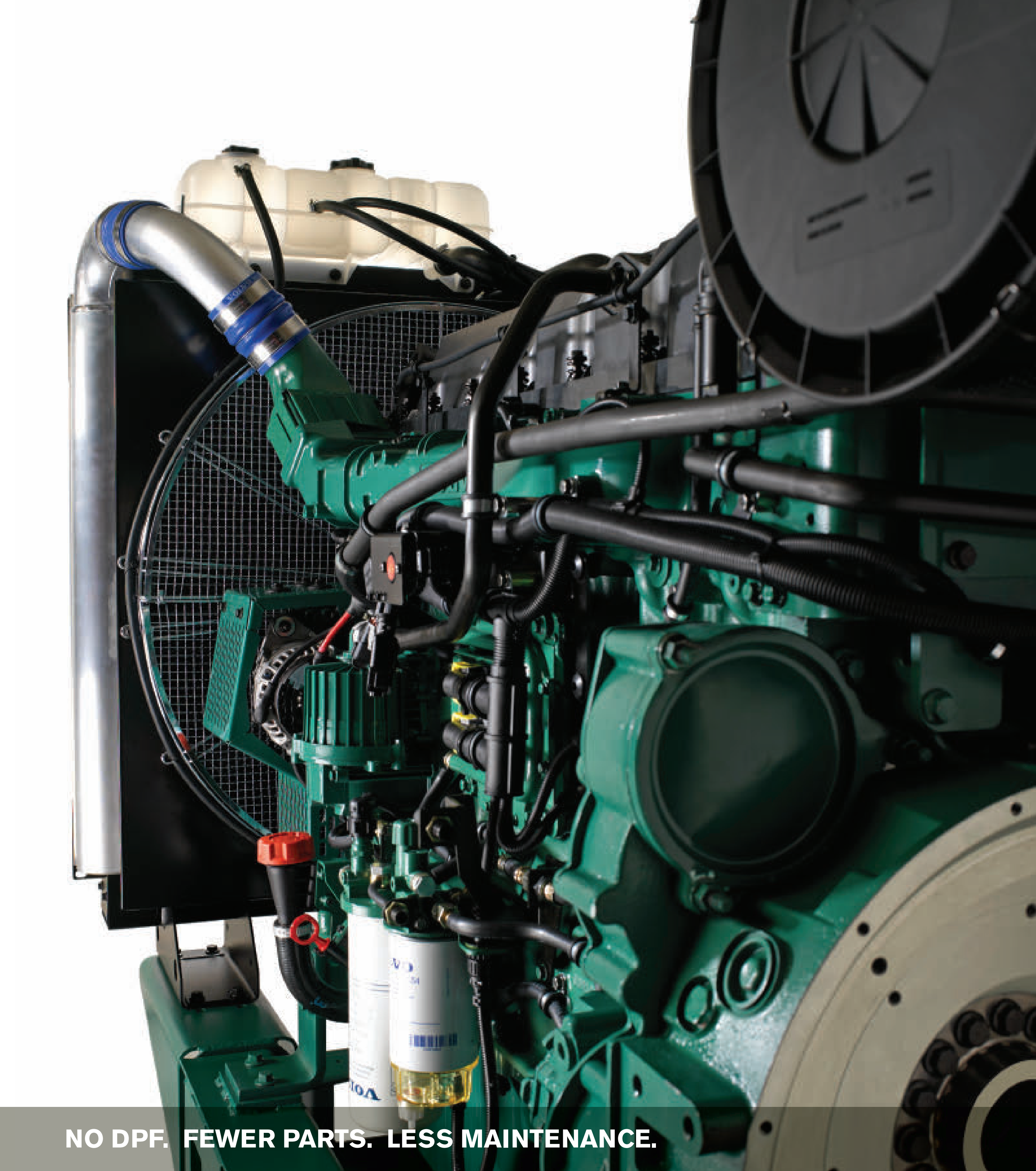

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Johnson Matthey said that along with the physical constraints, the pressure drop across the catalytic converter had to be small because the allowable backpressure on the engine was relatively low.

Independent emissions tests required by the Philadelphia Air Management Services showed that the Modulex B80 converters achieved CO reductions that exceeded the minimum 93% limit, the company said.

the turbocharger outlet. Each gen-set is capable of producing 1600 kW at 1200 rpm with an exhaust temperature of 762ºF. The exhaust from each engine discharges through vertical pipes into a common silencer mounted above each tandem set of engines.

Along with the physical constraints, the pressure drop across the catalytic converter had to be small because the allowable backpressure on the engine is relatively low.

Typically, if there's a low limit on what the pressure drop can be, the catalytic converter can be larger, Johnson Matthey said. In the Temple situation, the size of catalytic converter was limited because of physical constraints so a middle way was sought to achieve the minimum of 93% CO conversion, fit within the available space and still not exceed the available backpressure.

The Modulex B80 CO converters are about 400 lb. each and 4.5 ft. long. Each unit incorporates a catalyst element that is manufactured using Johnson Matthey's proprietary coating technology designed to assure uniform dispersion of the platinum group metals (PGM). The metal monoliths supporting the PGM are brazed, thin-walled, stainless-steel honeycomb that are nearly impervious to damage from mechanical or thermal shock and metallurgic erosion, according to the company.

Along with the catalytic converters, the Temple retrofit incorporated a multichannel HAPGuard continuous parametric monitoring system (CPMS) that allows the performance of all engines to be viewed on a single display screen.

RICE NESHAP requires that the inlet gas temperature before the catalyst is monitored and recorded and that catalyst differential pressure is recorded on a monthly basis.

Typically, each engine in an installation would have its own HAPGuard system. But Johnson Matthey was able to custom-design the system to incorporate one monitor that had 20 channels — one for each engine. The data from each engine is sent to the control room and viewed on a single monitor. That produced savings for the university, Johnson Matthey said.

Independent emissions tests required by the Philadelphia Air Management Services showed that the Modulex B80 converters achieved CO reductions that exceeded the minimum 93% limit. During the testing that took place in April, CO emissions from each engine and VOC emissions from three engines were found to be well within EPA compliance levels. In fact, all but one engine was under 1.7 ppmvd at 15% oxygen; while the 10th registered 5.8 ppmvd, yielding an overall CO conversion rate of 99%. Temple is permitted to operate each engine 500 hours a year. dp

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