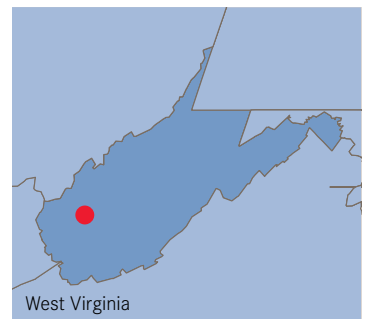
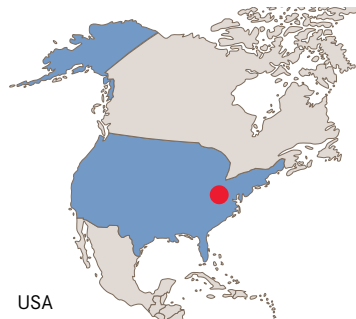


# Patriot Coal tags MTU Series 4000 engine for heaviest loads in repower of Komatsu 730E overburden truck



**Who:** Patriot Coal Corporation  
**What:** MTU 12V 4000 Tier 2 diesel engine in place of original equipment 16-cylinder engine  
**Why:** Repower mine haul truck to reduce emissions and fuel expenses, obtain longer engine life between overhauls  
**Where:** Charleston, West Virginia, USA



**A new 12-cylinder MTU Series 4000 Tier 2 diesel engine is outperforming the 16-cylinder Tier 1 engine it replaced in a West Virginia surface coal mine haul truck while reducing both fuel consumption and emissions.**

At a surface coal mine operated by Patriot Coal, the job of removing the tons of rock overburden is reserved for the most powerful haul trucks in the company's fleet – the beefy diesel-electric Komatsu 730-Es. Many of the coal mines in this part of Appalachia are so-called "mountaintop" mines where the top of the mountain is literally removed to expose the seam of coal. To reduce fuel expenses and get longer engine life, Patriot Coal has been replacing the haul truck's original-equipment Tier 1 engines with powerful and efficient MTU Series 4000 Tier 2 engines from Western Branch Diesel in Charleston, WV. "Patriot Coal already had successful experience with MTU Series 4000 Tier 1 engines in 16 of their Komatsu 830 haul trucks," says Curtis Bartlett of Western Branch Diesel, the region's MTU distributor. "So, when it came time to repower one of the powerful Komatsu 730-E haul

trucks, the company decided to use the new MTU Series 4000 Tier 2 engine. In addition to having the objectives of lower emissions, longer engine life and better fuel economy, Patriot wanted to standardize its fleet to reduce costs associated with parts and maintenance."

### **More compact and powerful engine**

The original engine power supplied in the Komatsu 730 was from a different manufacturer, had 16 cylinders and produced 2,000 hp. The MTU Series 4000 engine that was installed is capable of producing 2,250 hp with only 12 cylinders. MTU's improvements to the Series 4000 achieved EPA Tier 2 emissions compliance by cutting nitrogen oxides and particulate emissions in half, while creating an engine with significantly higher power density, according to Bartlett.

**Curtis Bartlett**, off-highway territory manager, Western Branch Diesel

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The MTU 12V 4000 Tier 2 engine features lower emissions, better fuel economy and more horsepower than the Tier 1 original-equipment engine in the coal mine's Komatsu haul truck.

"The MTU Series 4000 Tier 2 engine has a higher specific horsepower than the original-equipment engine," says Bartlett, "meaning that each cylinder generates more power per cubic inch of displacement." The higher output is due to a combination of improvements that include second-generation common-rail fuel injection, advanced electronic engine controls and more precise fuel metering for improved combustion compared to Tier 1 engines.

#### **Big fuel savings**

In addition to its compact size and higher power output, the Tier 2 Series 4000 12-cylinder engine delivers up to 20 percent better fuel economy, according to Bartlett. "The original 16-cylinder engine consumed 34.8 gallons per hour, and the MTU 12-cylinder engine consumes only 26.4 gallons per hour. That's about 20 percent better fuel economy. Since these Tier 1-engine trucks burn about 80,000 gallons of fuel per year, the MTU Tier 2 engine is saving 16,000 gallons a year. At \$3 per gallon, the savings can really add up," Bartlett comments.

While the MTU 12-cylinder engine can produce 2,250 hp, the existing General Electric traction alternator and electronics in the haul truck are designed and limited to 2,000 hp. With this lower power requirement, MTU was able to limit the output of the new engine to 2,000 hp by simply installing a lower power calibration. This promotes longevity because the engine is operating at less than full power. Bartlett estimates the life of the new MTU Tier 2 engine to be at least 30,000 hours before an engine overhaul is required, or the truck is rebuilt.

#### **Repowering required careful planning**

The MTU 12-cylinder Tier 2 engine differs dimensionally compared to the original-equipment engine. As a result, substantial planning was required to achieve the repower design and installation. Although the MTU engine was considerably shorter due to fewer cylinders, the rear intercooler location made the back of the engine taller than the truck's original engine. At first, Bartlett says the installers were concerned whether the rear of the engine would fit under the truck's "horse-collar," a transverse structural frame arch at the back of the engine compartment.

"But, after careful measurements, we determined that we had at least four inches of clearance on the top and sides, and from then on, the installation went very smoothly," says Bartlett. The total repower took five working days – about the same amount of time required to swap out an original-equipment engine, he adds. "When a haul truck is down, it represents about \$8,000 a day in lost production, so minimizing the time in the shop is very important. Then, once you've got all your engineering worked out, it's a snap," he says.

While Patriot Coal's goal in the engine conversion was to gain the benefits of the cleaner and more efficient MTU Series 4000 Tier 2 engine, Western Branch Diesel was also focused on making the project run smoothly from a strategic standpoint. "There are more than 50 Komatsu 730-Es within our territory, and so we wanted a successful introduction of this new engine to the coal-mining market. The experience gained on this project will benefit all of the mining companies that want to make the switch to cleaner, more efficient and longer lasting MTU haul truck engines," Bartlett concludes.

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MTU is a brand of Rolls-Royce Power Systems AG. MTU high-speed engines and propulsion systems provide power for marine, rail, power generation, oil and gas, agriculture, mining, construction and industrial, and defense applications. The portfolio is comprised of diesel engines with up to 10,000 kilowatts (kW) power output, gas engines up to 2,150 kW and gas turbines up to 35,320 kW. MTU also offers customized electronic monitoring and control systems for its engines and propulsion systems.



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