Job Report

R 996 / T 282
Litronic®

Two R 996 Litronic backhoes and ten T 282 haul trucks reduce mine noise while boosting productivity at Australien mine.

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Situation

The BHP Billiton Mt Arthur Coal mining operation located in the Hunter Valley, New South Wales, Australia, needed to increase their production level to meet the requirements of their domestic and international coal customers.

The location of the open-cut operation, close to residential areas in the nearby town of Muswellbrook, required the company adhere to stringent environmental noise limits.

As significant reductions were required at the noise sources to comply with these limits, Mt Arthur Coal developed a Noise Specification that prescribes the maximum noise limits that can be emitted from mining equipment under a range of test conditions. The ability of the machines to meet the requirements of this Noise Specification was a critical factor in equipment selection.

The noise limits specified by the mine for excavators and trucks was 116 dB(A) and 113 dB(A) respectively. Ongoing compliance under a range of operating conditions in accordance with Australian and International Standards remains the responsibility of the equipment supplier.

Assignment Report

Liebherr and Mt Arthur Coal worked together during the project to achieve the required noise level reduction. The project team utilised engineering expertise from the production engineering departments of both Liebherr's truck factory in Newport News, Virginia, USA and Liebherr's excavator factory in Colmar, France. The noise team leveraged Liebherr's existing experience in the design and manufacture of noise suppression packages for smaller equipment to develop innovative packages for the larger machines. Liebherr met the required standards for both excavators and trucks without any negative lifetime operational or performance effects. This has established a new benchmark for mining equipment sound levels, with both machines being the quietest in their respective equipment classes.

Solution

Excavators

The R 996 Liebherr Litronic excavators were all fitted with sound suppression packages. The packages were designed as a series of suppression modules that work together to reduce the overall sound power of each machine. The sound attenuating devices include sound absorbing panels throughout the engine bay, under the deck area and inside the counterweight. Substantial enclosures, lined with further sound absorbing panels were placed around the power packs and the hydraulic cooler house. Access to these areas is maintained via modified catwalks and ladders.

Noise reduction from the engine fans was achieved by using multiple hydrostatically controlled units instead of a single belt driven fan. The engine fans were also electronically speed controlled to provide cooling only when required, reducing sound emissions further. Exhaust system sound emission reduction was achieved using primary and secondary mufflers tuned to reduce engine noise.

Haul Trucks

The T 282 diesel electric haul trucks were assembled at Mt Arthur Coal with comprehensive sound suppression packages. The noise reduction features include an aerodynamically designed fan coupled with a larger capacity radiator ensuring ample cooling capacity at lower fan speeds. Fan noise was further muted by a specially baffled grille, while still maintaining a similar profile to a conventional truck. Both the access stairway and the grille were also engineered to allow easy maintenance access. To reduce noise associated with retarding, a high volume, low noise radial fan was installed which delivers the cooling air to stainless steel quiet grids. This reduces both grid blower noise and the electrical humming often associated with retard resistors.

The trucks engine area was enclosed by a variety of baffles and enclosures, fire resistant blankets were also installed for their acoustical properties and durability. Access to the engine area was maintained through doors on each side of the engine bay and from below through double opening belly pans. A reduction in exhaust noise was achieved by utilising specially designed mufflers. Non reflective chain mesh mud-flaps were also installed to help the trucks meet the directional requirements of the noise specification.

Performance

The noise emission target of 116 dB(A) for excavators was required by Mt Arthur Coal in both the static (engine 1800 RPM) and dynamic conditions (engine speed, swing ring and attachment movement to simulate digging activity). Additional noise limits also applied across the noise frequency range of 63Hz to 8KHz. Liebherr achieved considerable better values at 113 dB(A) under static and 115 dB(A) under dynamic conditions. The operator noise exposure was substantially less again than Mount Arthur Coal's preferred level of 75 dB(A).

The R 996 shovels efficiently load all haul trucks on site with the T 282 Ultra Class trucks needing six passes to load.

Each Liebherr diesel electric truck was tested to Mt Arthur Coal's specifications for overall sound power and frequency targets; stationary, loaded, driven up a ramp under full power and unloaded and driven down a 10% ramp under retard. The overall Sound Power achieved the target of 113 dB(A) and complied with limits across all frequency ranges. Similarly, the operator noise exposure was substantially less than the 75 dB(A) level stipulated by Mt Arthur Coal.

Liebherr's successful delivery of these machines, achievement in meeting Mt Arthur Coal's Noise Specification and more importantly the lowest cost per BCM, has resulted in further orders. Mt Arthur Coal will have one of the largest fleets of Liebherr Mining equipment with new orders for 10 x T 282's bringing the fleet to 20 plus other orders for a third R 996 backhoe and a R 994 B face shovel.

Technical Data

R 996 Litronic Mining Excavator

Operating weight incl. sound suppression kit	670 t
Engine	2 Cummins Diesel K 1800E
Engine output per SAE J 1995	3000 HP/2240 kW @ 1800 RPM
Special requirement	Comprehensive sound suppression

T 282 Diesel Electric Truck

Engine	Cummins QSK 60
Engine output per SAE J 1995	2700 HP/2014 kW @ 1800 RPM
Operating weight incl. sound suppression kit	566 t
Payload capacity	327 t
Special requirement	Comprehensive sound suppression

Attachments

R 996 Litronic Mining Excavator

Backhoe Attachment
Backhoe bucket

Capacity	33,0 m^3
Cutting width	4700 mm
Max. digging force	1500 kN/153,0 t
Max. breakout force	1670 kN/170,2 t