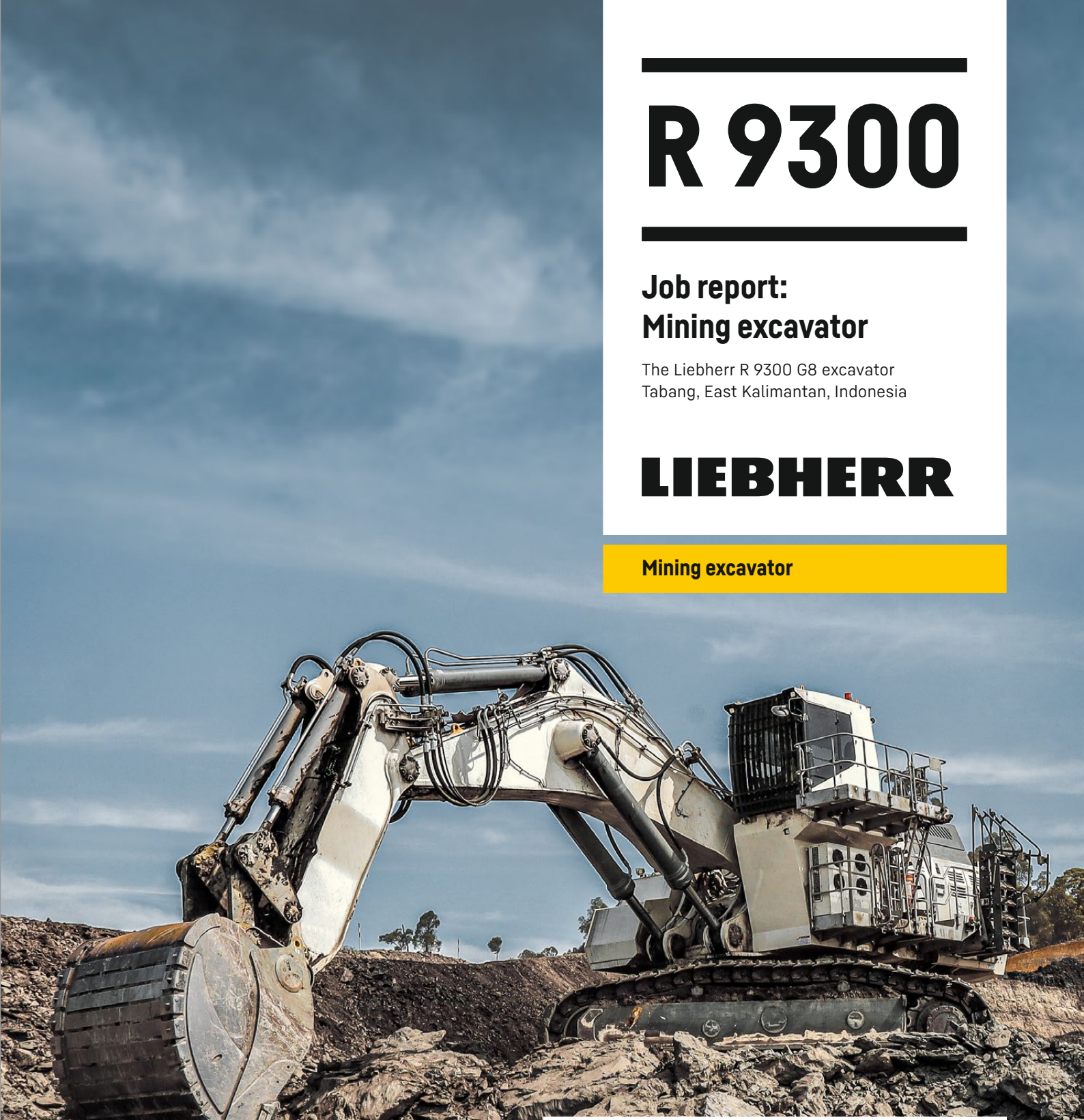
R 9300

Job report: Mining excavator

The Liebherr R 9300 G8 excavator
Tabang, East Kalimantan, Indonesia

LIEBHERR

Mining excavator



Karunia's R 9300 specifications

Operating weight
252 tonnes / 278 tons
Motor output
1,007 kW / 1,350 HP
Bucket capacity
17.5 m³ / 22.9 yd³
Max. digging force (ISO 6015)
810 kN
Max. breakout force (ISO 6015)
885 kN
Max. oil flow
2,048 l / min

Executive summary

From the very beginning of its time at the Tabang mine site – which began in September 2022 – the R 9300 Generation 8 excavator met the productivity, reliability, and fuel efficiency targets set by customer PT Karunia Armada Indonesia (Karunia). The performance of the R 9300 steadily increased over its first seven months of operation – September 2022 to March 2023 – and exceeded Karunia's performance targets set for the machine.

In March 2023, a production test conducted at the Tabang mine revealed that the R 9300 has the potential to be a valuable asset for customers, given the machine's fast cycle times and outstanding fuel efficiency.

Situation

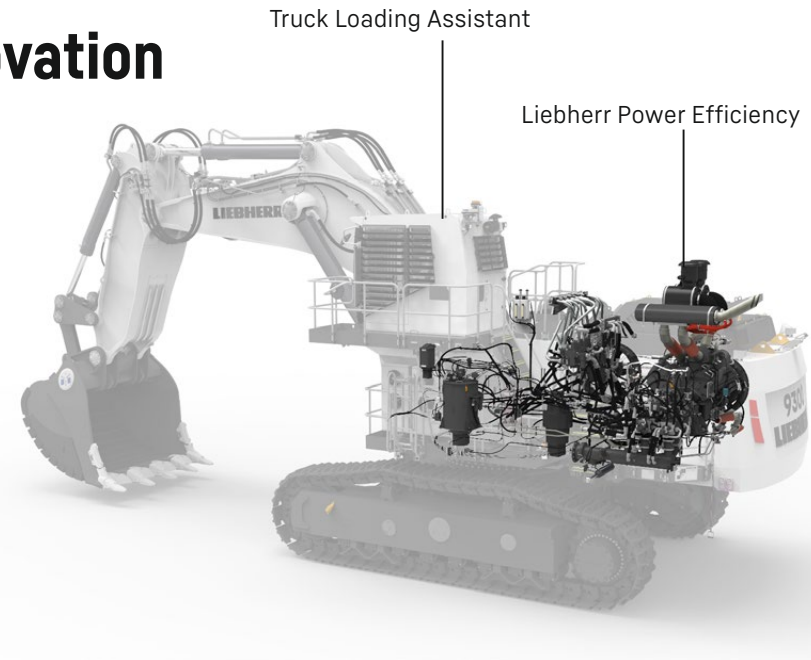
The Tabang mine is an open-cut thermal (low-ash, low-sulphur, sub-bituminous with 3,700 to 4,400 Kcal/kg – typical for Indonesia) coal mine located in the Eastern Kalimantan region of Indonesia – an area known for its abundant coal deposits. In 2022, the mine produced 34 million tonnes of coal.

The overburden ratio of 3.0 resulted in a total stripping volume of 102 million bank cubic metres (BCM) of overburden, of which Karunia mined a share of roughly 40%, including a proportional coal production. Karunia's overburden and coal production targets are expected to be increased to double the current level in the coming years, in line with the final mine production target.

Karunia is a mining contractor based in Balikpapan, East Kalimantan. In 2011, Karunia was offered a contract for the site by PT Bayan Resources Tbk (Bayan) which operates Tabang mine. The business relationship between Liebherr Mining and Karunia began in late 2021, when an R 9100 mining excavator was delivered to the Tabang mine site. Since this time, Karunia's fleet of Liebherr machines has grown to include three R 9200 excavators, four PR 776 dozers, a second R 9100, with a further six R 9200s, six PR 776s confirmed for delivery.

The latest in mining innovation

The R 9300 was first unveiled at the 2022 Bauma exhibition in Germany. The new excavator will replace the R 9250 in the 250-tonne class in Liebherr's portfolio once it enters serial production in 2024. Because the R 9300 is a Generation 8 machine, it benefits from the latest innovations from Liebherr Mining. These innovations help to increase the excavator's operational performance on site while also making the machine compatible with new mining technologies such as automation and zero emission energy sources. Generation 8 technology also supports the latest Digital Services from Liebherr Mining – a suite of data-driven products aimed to support customers with equipment performance, asset health, connectivity, and maintenance.



Onsite performance

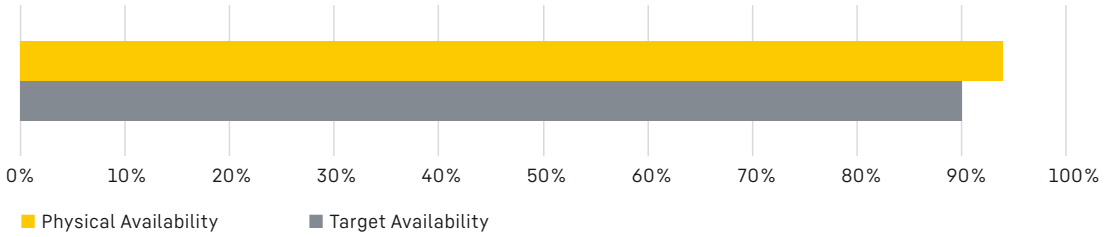
As part of the partnership agreement between Karunia and Liebherr Mining for the development and validation of the R 9300, Karunia has been operating one R 9300 pre-series unit, in backhoe configuration, since September 2022. Throughout the operation of this pre-series unit, Karunia has provided Liebherr with valuable insight into the overall performance of the excavator as well as the functionality of the latest Liebherr Mining technologies fitted into the machine. These new technologies provide increased operational efficiency, reduced fuel consumption and GHG (greenhouse gas) emissions, and improved operator safety and comfort.

During the very first seven months of use, the R 9300 achieved a total of 3,406 hours in operation, or approximately 486 hours per month.

The R 9300 is currently being used to remove overburden and load the material into 100- and 130-tonne mining trucks. On site, the excavator loads 100-tonne trucks in four passes and 130-tonne trucks in five passes, with a 17.5 m^3 bucket (at 1.5 t/m^3 density).

Availability rate

Average availability during the last seven months



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94 %

of availability rate

In the first seven months of operation, the R 9300 reached an average of 94% availability, exceeding Karunia's 90% target.

+12 % **vs target**

Production

From September 2022 to March 2023, the average production of the R 9300 exceeded Karunia's target by 5.5%. The performance numbers were reported by Karunia during the R 9300's first seven months of operation.

Fuel consumption

Karunia reported an average fuel consumption of below 130 litres per hour during the first seven month of operation.

< 130 **litres per hour**

Production test

Study conditions

The Liebherr Mining application engineering team – together with an operator instructor – conducted a production study at the Tabang mine site in March 2023. The objective was to measure the instantaneous production of the new R 9300. Throughout the study the engineer and operator trainer ensured optimal truck fleet match and loading conditions.

For the duration of the study, the R 9300 operated on a bench of overburden and was equipped with a 17.5 m^3 bucket. The excavator loaded a fleet comprised of both 100- and 130-tonne trucks. A total of thirty trucks – eight 100 tonne and twenty-two 130 tonne – were recorded for the purposes of this study.

The fuel consumption was calculated by the machine's electronics with information from the engine control unit.

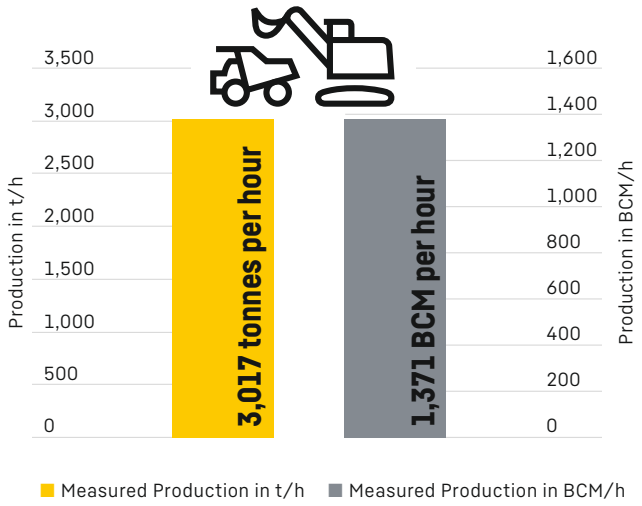
Study results

Total test duration	72.3 minutes
Total trucks loaded	30
Average load per truck	122.5 tonnes
Average excavator cycle time	26 seconds
Average fuel consumption	146 litres per hour
Measured production	1,371 BCM per hour

Machine efficiency and productivity

Productivity

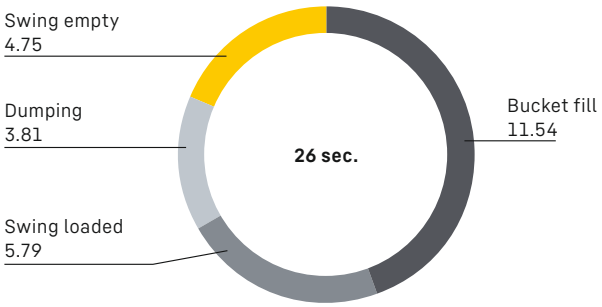
The productivity achieved by the R 9300 in this study was 1,371 BCM per hour (3,017 tonnes per hour). This is a remarkable achievement for a 250-tonne hydraulic excavator. This production figure was reached thanks to the R 9300's fast cycle times (26 seconds on average), combined with good exchange time between trucks (48 seconds on average).



Cycle time

The optimised design of the attachment, combined with the advanced hydraulic system, delivers breakout forces, which ensures fast movements during each cycle.

This has resulted in a 26-second average cycle time observed during the study.



Fuel efficiency

9.22 BCM/litre

The Liebherr Power Efficiency system (Liebherr's proprietary engine and hydraulics management system) comes standard with the R 9300. The engine control functionality of the system uses sensor and piloting signals to automatically adapt the excavator's engine to the different working phases of the machine. This significantly reduces fuel consumption and as a result decreases GHG emissions produced by the excavator.

With this system, the R 9300 achieved a fuel efficiency ratio of 9.22 BCM per litre. The machine consumed 181 litres of fuel over the course of the production study at a rate of 146 litres per hour. When considered with the production figures achieved by the R 9300, these are excellent results.

Assistance Systems

The pre-series unit of R 9300 operated by Karunia is fitted with Liebherr's on-board Assistance Systems. These include the Truck Loading Assistant, which supports operators in avoiding truck under- and overloading; and the Operational Analytics suite, which monitors and displays the excavator's KPIs. Throughout the production study, these Assistance Systems collected data about the performance of the R 9300. The data has subsequently been presented on the systems' dashboard to provide an overview of the machine's performance.

The following two images highlight different aspects of the R 9300's performance:

1. The Truck Loading Assistant calculates loading strategies for the truck fleet based on the specifications of truck payload and excavator bucket capacity. This helps to prevent under- and overloading the trucks and has resulted in an excellent truck load average for the R 9300.

2. The Truck Loading Assistant computes the number of trucks loaded and also the payload capacity of each one.

3. Visual representation of the composition of the truck fleet.

4. Average bench height is calculated based on bucket position. The optimal bench height for the R 9300 is 4 metres.

5 and 6. During the study, the Truck Loading Assistant calculated the average productivity of the R 9300 as 3,017 tonnes per hour or 1,371 BCM per hour. The fuel efficiency ratio was calculated to be 20.3 tonnes per litre or 9.22 BCM per litre.

1. The time distribution dashboard shows a mean truck loading time of 1 minute and 37 seconds during the production study.

2. The graph illustrates cycle time distribution and average cycle time.

3. The Truck Loading Assistant breaks down the distribution of working time in graph form. During the production study, the R 9300 loaded trucks for a total of 1 hour and 5 minutes.

4. The productive time distribution graph breaks down the different production phases of the R 9300.

Karunia expressed its satisfaction about both Liebherr Assistance Systems installed on the R 9300. The customer greatly valued the systems' user-friendly interface, the accuracy of the data, and the ability to generate reports with the figures the systems provided. In particular, the Truck Loading Assistant provided Karunia with reliable information to help limit the number of under- and overloaded trucks.

Opportunities

The information reported by Karunia from the R 9300's seven months on site, and collected from the production study, has confirmed that the R 9300 exceeds their onsite requirements. This is supported by the fact that Karunia has since increased the R 9300's production target by 12%. The company believes that with a combination of operator training, operational efficiency, and the excavator's ability to perform on site, the machine can meet this ever increasing production goal.

Karunia's confidence in the R 9300's abilities is also illustrated by the company's purchase of four additional units of the excavator to assist with increased activity at the Tabang mine.

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