

Safety Alert

Date: October 2022

Service brakes fail on moving articulated dump truck

This safety alert provides safety advice for the NSW mining industry.

Issue

A loaded Caterpillar 740 articulated ejector truck ran out of diesel fuel and shut down ascending a 10% gradient.

The truck stopped, then rolled backwards for 49 m when the truck's service brakes (dynamic brakes) failed. The truck was only brought to rest when the park brake was activated. Park brakes are not designed for dynamic applications.

Service braking systems on mobile plant are safety critical systems. Their failure during operation has potential for fatal consequences. This incident highlights the importance of:

1. maintaining hydraulic accumulators on service and secondary braking systems, and
2. ensuring identified defects are assessed and repaired in a timely manner.

Circumstances

The operator of the truck was transporting gravel from a crusher to a stockpile when the truck lost drive while travelling up a 10% ramp on 13 July 2022. The truck was hired but being operated by the mine.

As the truck has begun to roll backwards, the operator attempted to apply the service brake. The brake pedal had no resistance, and the service brake did not apply. As the truck continued to roll backwards, the operator used the park brake to stop the truck. The park brake was difficult to engage and required several attempts. The truck rolled 48.8 m before coming to a stop.

The fuel tank was empty, and the fuel gauge was faulty. At the time of the event the fuel gauge was reading at a quarter full.

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Figure 1 The Caterpillar 740 articulated truck involved in the incident



Service brake system

The original equipment manufacturer (OEM) certified the braking system complied with ISO 3450:2011 *Earth-moving machinery - Braking systems of rubber-tyred machines - Systems and performance requirements and test procedures*.

The service brake system was a typical pressure-applied braking system with braking pressure (brake force) being modulated by the operator through the operators' brake control pedal.

The brake circuit was split, between the front and rear wheels, which provides the secondary braking function under ISO 3450. Both front and rear brake circuits had hydraulic accumulators to provide braking energy in the event of a loss of hydraulic power, such as running out of fuel.

Figure 2 Front and rear brake accumulators



Investigation

The mine operator, contractor and OEM dealer carried out an investigation. The investigation identified:

1. The refuelling system was changed.

The regular practice was for night shift to refuel the truck, but because of wet weather, the truck wasn't used or refuelled on the night shift before the incident.

2. The defective fuel gauge was not repaired.

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On 18 March 2022, the operator's prestart inspection identified the fuel gauge was inaccurate. This was reported to the mine operator, however there was no record of it being passed onto the equipment owner (contractor) for repair and it was not repaired.

3. Brake pressure alarms were not actioned.

When data was retrieved from the truck, there were 53 low brake pump pressure alarms over the previous 829 hours of operation. This indicated an intermittent fault, such as failed brake accumulators for some time. These alarms were both inside the truck cabin and the vehicle monitoring system. There was no record of either the truck operator saying alarms were heard or the maintenance team acting on the intermittent alarms.

4. Both front and rear service brake accumulators were inoperable.

The truck was last serviced on 17 December 2021. A requirement of the 2000-hour service was to test the service brake accumulator standby pressure activity and service brake wear indicator. These checks were not completed during the service.

Both the front and rear service brake accumulators had no pre-charge pressure. The OEM required this to be checked at each 2000-hour service. The OEM dealer completed the previous 2000-hour service on the truck. This accumulator check was not done by the service technician at the time. The service sheet was submitted with accumulator tests marked with not applicable. Neither supervisors of the dealer, equipment owner or mine representative identified these 2 accumulators were not checked in the 2000-hour service.

5. The OEM had no regular test for accumulator functionality.

The OEM's maintenance information recommended recharging accumulator pressure at each 2000-hour service. There was no recommendation from the OEM on how the accumulator function could be checked regularly, such as test number of applications of the foot pedal after the vehicle was shut down, daily or weekly or other short interval service.

6. The cause of the park brake being difficult to apply was not investigated.

The park brake was discarded and replaced without investigating the cause of it being difficult to apply.

Recommendations

This incident serves as a warning of the critical nature of service braking systems, the importance of rectifying defects and acting on alarms, even if they are intermittent.

Mine operators should:

1. verify that accumulators on service brakes are being checked at the service intervals as recommended by the OEM
2. regularly check (daily or weekly) service brake accumulator. A test, such as turning off the vehicle and testing the number of brake pedal applications after shutting down should be developed with the OEM or a competent person
3. ensure their defect management system records and documents when a defect is rectified
4. ensure there is a system to identify, and investigate intermittent alarms and the system is documented
5. ensure there is documented system for communication of prestart checks, defects and maintenance activities between mine operators, vehicle owners and the organisation that maintain vehicles

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6. ensure completed vehicle service sheets are checked and signed off by a competent person, with copies retained by the mine operator, even if the work is completed by the OEM's representative
7. always investigate and document the cause of a failed component and implement controls to prevent a reoccurrence were applicable
8. report safety critical systems and component failures to OEMs or their dealers to ensure OEMs can address emerging issues with their designs.

Further information

1. [SA05-10 Fatal truck accident at quarry](#)
2. [SA06-12 Maintenance of safety critical systems](#)
3. [SB09-05 Failure of mobile equipment braking systems and procedures](#)
4. www.rshq.qld.gov.au/safety-notice/mines/serious-accident-involving-an-articulated-water-cart

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