

SAFETY ALERT

Transport Service Brake Failure

INCIDENT

The service brake failed to stop an underground man transport vehicle while travelling around a corner at slow speed when the operator applied the service brake. The transport vehicle was on full steering lock.

CIRCUMSTANCES

The vehicle had been operating normally before this incident. At the time the emergency brake was not activated.

INVESTIGATION

The vehicle was dynamically tested (on the surface in a straight line) for brake performance. The service brake passed by operating and stopping the vehicle, within the required stopping distance for the test speed. The emergency brake operated and stopped the vehicle however the stopping distance was longer than required, failing the brake test.

The braking circuit was then checked. It was found the –

- service brake accumulators had failed and did not hold hydraulic charge pressure.
- steering valve was bypassing due to the worn state of the steering valve.

The vehicle is of an older design with pressure applied service brakes and spring applied emergency brakes. A single hydraulic pump provides hydraulic power to both the steering and service brake circuits. Accumulators in the brake circuit provide reserve power to the service brakes when the pump is on peak demand or operating at low revs.

With the steering on full lock and the engine revving low all of the hydraulic power was being utilised by the steering circuit.

There are two causal factors which both contributed to the loss of service brakes on this vehicle.

1. The brake accumulators failed and the failures were not identified through regular maintenance.
2. The steering valve was worn allowing the hydraulics to bypass through the steering valve.

When originally designed, the original equipment manufacturer's (OEM) inspection, testing and maintenance system did not cover the testing of the accumulators, or the steering valve. However the OEM had upgraded this information to include the accumulator at a later stage. The mines maintenance system did not cover testing of the accumulator nor testing/replacement of the steering valve. The vehicle was operated under an exemption for its brake circuit, exemption conditions required maintenance to be in accordance with the OEM requirements.

RECOMMENDATIONS

Note: Both the steering and braking functions on a vehicle are safety critical systems. Inspection, testing and maintenance instructions should be sufficient to ensure the safety critical system remains in a safe condition to use over its lifecycle. Further information is provided in SA06-12 & SB10-03

OEMs for mobile plant should –

1. Review safety critical systems to ensure all critical components are identified and risk assessed for their probability to failure and consequence/severity of risk if failure occurs. Note: A Failure Modes and Effects Analysis (FMEA) or other similar risk assessment methods should be carried out to identify all failure modes for safety critical systems and components of those systems
2. Review recommended inspection, testing and maintenance documentation to ensure it covers failure modes for all safety critical systems and either –
 - identifies means to detect failures, as identified in the FMEA, by setting appropriate inspection, testing, maintenance activities, methods and frequencies, or
 - nominates critical component replacement life or required intervals of replacement for all safety critical components.

If gaps are identified these documents should be revised and reissued to all owners.

All mines and organisations carrying out maintenance on vehicles should -

1. Carry out a gap analysis/review the maintenance schedule and checklist for the braking and steering systems against the latest recommendations from the OEM for all mobile plant.
2. Follow the mines/organisations change management procedures and process to update if required the maintenance system for brakes and steering systems on mobile plant.

3. Train the maintenance personnel on the changes to the maintenance system.
4. Review the Conditions of use specified in the exemption Order/Design Registration documentation.

NOTE: Please ensure all relevant people in your organisation receive a copy of this Safety Alert, and are informed of its content and recommendations. This Safety Alert should be processed in a systematic manner through the mine's information and communication process. It should also be placed on the mine's notice board.

Signed



Rob Regan
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MINE SAFETY OPERATIONS BRANCH
INDUSTRY & INVESTMENT NSW

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