



Mines Safety Bulletin No. 89

Date: 13 November 2009

Subject: Earth-moving equipment tyres and use of tyre handling machinery

Background

This bulletin is prompted by concern relating to a series of accidents involving heavy earth moving equipment tyres and the operation of tyre handling machinery. Seven fatalities involving the handling of tyres have occurred at various mines in the Australasian region in the past few years, including one in Western Australian in 2008.

An independent study of some 82 tyre accident events in the period 1987 to 2008 revealed:

- 33 per cent resulted in a fatality;
- 50 per cent clearly had the potential to result in a fatality;
- nine per cent resulted in a serious injury; and
- the remainder caused significant damage.

Clearly, earth-moving equipment tyres, rims and wheel assemblies must be regarded as safety critical items that need to be maintained by competent persons in accordance with documented systems of work addressing all of the risks involved.

Previous safety alerts issued by Resources Safety on this topic include Mines Safety Bulletin 9 (1993) and Mines Safety Significant Incident Report 124 (2003). This bulletin serves as a reminder for responsible persons at mines to review current work practices and ensure they are adequate.

Contributory factors and consequences

The independent report also confirmed that many employers, supervisors, operators and contractors were not sufficiently aware of all the hazards involved with the changing and inflating of earth moving tyres or the use of tyre handling machines, and existing safety procedures were not always followed.

Common identified causes included:

- employee induction and training processes did not effectively evaluate the trainee's understanding of the tyre changing process;
- operator competence was not re-assessed periodically or when tasks, procedures or the work environment changed;
- failure to plan tyre fitting tasks and ensure available employees had the necessary skills;
- failure to establish appropriate systems of work and workplace arrangements;
- operators were unaware of operational safety limits of equipment being used;
- defective or incorrectly assembled components and incompatibility of rims and tyre sizes; and
- inflation of tyres while being held in the 'grab' arms of the tyre handling machine.

Possible consequences of incorrect tyre inflation practices include:

- complete failure of any tyre handling machinery being used at the time;
- uncontrolled movement of the tyre or equipment being used to restrain the tyre; and
- wheel and rim components projected with explosive force.

In these circumstances, serious or fatal injuries to employees or bystanders are foreseeable.

Recommendations

- Employees carrying out tyre fitting work must undertake formal training and assessment prior to commencing work and when any changes to the task equipment or environment occur. Training of workshop supervisors is also necessary to ensure effective supervision.
- Tyre fitting workshop facilities should be constructed and arranged to minimise risk to both the operator involved and other persons that may be in the vicinity. Facilities should be periodically audited and expert advice sought as required.
- Comprehensive tyre fitting procedures must be established and adhered to. For further information, refer manufacturer's instructions and Australian Standard AS 4457.1:2007 *Earth-moving machinery – Off-the-road wheels, rims and tyres – Maintenance and repair – Wheel assemblies and rim assemblies*.
- Ensure tyre handling machines are inspected and tested regularly by a competent person. Maintain records of equipment component change-outs, repairs, testing and inspection.
- Tyre handling machines must only be used for the purpose for which they were designed, and information provided by the manufacturer should be kept readily available. All necessary safety warning decals (Figure 1) should be prominently displayed on the equipment and maintained.
- During inflation, tyre pressure should be continuously monitored via a suitably scaled gauge from a safe distance, which avoids any need to stand in front of the tyre or between the arms of a tyre handling machine.
- Inflation of a tyre held in the clamping arms of a tyre handling machine can produce extreme forces capable of causing the machine to catastrophically collapse. Hydraulic pressure limiting devices to safeguard against such a high potential event are strongly recommended. Any loose bolts securing sections of a machine's "grab" arm are an indicator of previous overload conditions and should be monitored during maintenance and pre-start checks.

Further information

Department of Industry and Resources, Western Australia, 2003, Significant Incident Report No. 124 – Tyre inflation fatal accident [available at www.dmp.wa.gov.au/6713.aspx#7002]

Department of Minerals and Energy, Western Australia, 1993, Safety Bulletin No. 9 – Off-highway mobile earthmoving equipment – tyre maintenance practices [available at www.dmp.wa.gov.au/6713.aspx#7061]

Department of Minerals and Energy, Western Australia, 1998, Safety Bulletin No. 40 – Induction, training and assessment of the competency of employees in the mining industry [available at www.dmp.wa.gov.au/6713.aspx#7061]

Department of Minerals and Energy, Western Australia, 1997, Significant Incident Report No. 72 – Tyre inflation – fatal accident [available at www.dmp.wa.gov.au/6713.aspx#7002]

Earth Moving Equipment Safety Round Table (EMESRT), Design Philosophy 12 – Tires and rims [available at www.mirmgate.com/tires_and_rims.asp]

MIRMGate, Causal factors database - TYREgate: Tyres & rims risk management decision support tool [available at www.mirmgate.com/tyregate/index.php]

Natural Resources and Mines, Queensland, 2005, Mines Safety Alert No. 138, Tyre handler clamping fork failure [available at www.dme.qld.gov.au/mines/mines_safety_alerts.cfm]

Otraco, 2004, Otraco incident notice update, 23 July 2004 incident, 2 September 2004 update: Fatal haultruck tire and rim disassembly during a tire change [available at www.otraco.com/techcentre/index.asp]

Otraco, 2004, Otracom incident notice, 9 February 2004: Catastrophic haultruck tire and rim disassembly during tire change [available at www.otraco.com/techcentre/index.asp]

DANGER

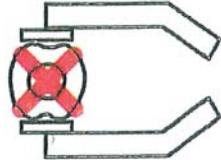
Death, Serious Injury or Damage to Machine & Equipment

will occur unless you follow these directions:

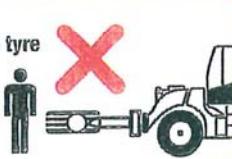
NEVER use the tyre handler beyond its maximum rated capacity. Instability of machine or structural failure of components will occur.



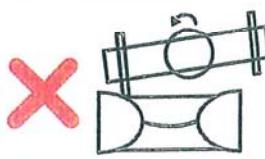
NEVER inflate or deflate tyres inside the clamp.



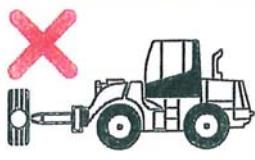
ALWAYS maintain a 5m clearance zone around the tyre handler until it is deemed safe to approach, site specific safety protocols must be followed.



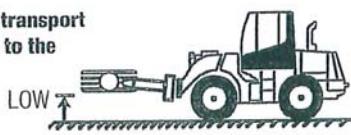
NEVER use tyre handler to break beads or similar.



ALWAYS transport tyre in horizontal position, **NEVER** in vertical position.



ALWAYS transport tyre low to the ground.



NEVER exceed recommended speed limits (Refer Operations Manual) and **REDUCE SPEED** to suit terrain.



NEVER use tyre handler arm to tow, push, jack or perform similar operations.



ALWAYS keep tyre parallel to ground and arms tilted back when transporting.



NEVER use tyre handler to grab or transport any object other than rubber tyres of rated capacity.



NEVER handle greasy tyres. WET TYRES should be dried when possible otherwise handle with extreme CAUTION.
NEVER handle tyres with ballast.



NEVER change factory-set hydraulic settings on tyre handler without consulting the manufacturer. **ALWAYS** follow maintenance and repair procedures to suit site.



IF IN DOUBT REFER TO OPERATION MANUAL FOR APPROVED FUNCTIONS

Figure 1

Example of tyre handler operating restriction decal. Courtesy of Austin Engineering


Simon Ridge
STATE MINING ENGINEER