

SAFETY ALERT

Tyre exploded during inflation

INCIDENT

A tyre on an underground development jumbo exploded shortly after being topped up with compressed nitrogen in a surface workshop, injuring one person.

CIRCUMSTANCES

The development jumbo had been driven to the surface for a routine service. Maintenance personnel noticed the front right tyre was underinflated. The tyre was reinflated using nitrogen from a cylinder. The fitter set the desired pressure on the cylinder regulator. The tyre inflator was removed soon after, once the pressure in the tyre had reached the pressure set on the regulator.

Minutes after the inflator was disconnected, the tyre exploded. The side wall of the tyre ruptured and pieces of rubber were forcibly ejected, damaging the jumbo's wheel guard and making a hole in the workshop's sheet metal cladding. The fitter suffered bruising and received first aid treatment at the scene.

INVESTIGATION

The investigation showed:

- the tyre failure was due to carcass break up, which resulted in the tyre having insufficient strength to contain the inflation pressure. Over inflation can cause carcass break up.
- cylinders of compressed nitrogen were used to inflate the front tyres because the workshop compressor could not deliver the pressure required to properly inflate the tyres.
- tyres were inflated with nitrogen by setting the required pressure on the cylinder regulator and attaching a tyre inflator to the tyre. Filling continued until the tyre pressure reached the pressure set on the regulator.
- in this case, the fitter set the regulator to what he believed was 1000kPa (10 bar), the pressure specified on the jumbo's tyre placard.

- the tyres fitted to the jumbo were not the original equipment manufacturer's tyres and the correct pressure for these tyres was 880kPa (8.8 bar).
- the regulator and gauges used on the nitrogen cylinder were intended for supplying inert gas at high pressure and had been modified to fit a standard compressed nitrogen cylinder.
- the regulator was designed for extremely high outlet pressures - up to 20,000kPa (200 bar) - and consequently the outlet pressure gauges had a full scale deflection of 30,000kPa (300 bar).
- because the pressure required to inflate tyres is relatively low, the high pressure regulator and gauges used were not suitable.
- in this case the fitter intended to inflate the tyre to 1000kPa (10 bar), which is only 5% of the capacity of the regulator and 3% of the full scale deflection of the outlet pressure gauge. It would therefore have been impossible to accurately set the regulator to such a low pressure or to accurately read such a low pressure on the gauges.

The investigation concluded the tyre failed because it had been over inflated. This occurred because the:

- regulator was designed for high pressure applications and could not be set accurately to the relatively low pressure required for inflating tyres.
- system relied solely on the regulator to control inflation – there was no in line pressure relief valve and the tyre was left unattended during inflation.

It is likely the tyre had been over and/or under inflated throughout its life contributing to the carcass break up and its ultimate catastrophic failure.

Other issues identified were:

- The tyres fitted to the jumbo had a lower pressure rating than was shown on the tyre placard.
- The regulator was intended for use with extra high pressure inert gas cylinders but had been modified to fit a standard pressure nitrogen cylinder. Regulators should not be modified.

RECOMMENDATIONS

Gauges used for inflating tyres must be accurate and have an appropriate operating pressure range so the inflation pressure can be determined accurately.

Where nitrogen or another gas from a cylinder is used to inflate tyres, the inflation system must be properly designed. The cylinder regulator should not be used to control the inflation pressure, as would occur if the tyre was left to inflate unattended. Regulators can "creep" allowing the outlet pressure to gradually increase beyond the pressure set on the regulator.

If particular tyres, such as the front tyres on development jumbos, require inflation pressures higher than can be achieved using an existing compressed air source, consideration should be given to using methods of inflation other than compressed nitrogen. For example, the use of:

- a high pressure air compressor
- a booster air compressor
- tyre fill materials.

Other alerts and bulletins related to this issue are available on the department's website and include:

- [SB10-02](#) Handling earth moving equipment tyres
- [SA05-14](#) Queensland Fatality - Prime Mover Rim Assembly Failure
- [SA05-09](#) Tyre safety
- [SA04-01](#) Queensland tyre fitting fatality

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
DIRECTOR
MINE SAFETY OPERATIONS BRANCH
NSW TRADE & INVESTMENT

View more safety alerts at www.resources.nsw.gov.au/safety/safety-alerts. If you would like to receive safety alerts by email, enter your contact details at www.resources.nsw.gov.au/safety/signup

Disclaimer

The information contained in this publication is based on knowledge and understanding at the time of writing. (December 2013) However, because of advances in knowledge, users are reminded of the need to ensure that information on which they rely is up to date and to check the currency of the information with the appropriate officer of the NSW Department of Trade and Investment, Regional Infrastructure and Services or the user's independent advisor.