



Timely Research into Tyre Explosions

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The dangers associated with the explosive behaviour of inflated tyres under stress has become an emerging safety issue, with 18 serious incidents being recorded in NSW in the past 4 years, resulting 12 serious injuries and three fatalities. Two of these fatalities have been the subject of prosecutions by WorkCover's Country South Team inspectors when over inflated tyres exploded off their steel rims.

Recently TestSafe combined with Klinge & Co. Pty. Ltd. and CCI Pope as part of a research project sponsored by funding from the Australian Coal Association Research Program (ACARP) to try to identify the mechanisms involved in tyre explosions. A Project team comprised of TestSafe staff Ben Cabot, Senior Technical Officer, Les Golder, David Wood, Paul Tilbury and Vince Higginbotham, Tilman Rasche from Klinge and David Crosher from CCI Pope to carry out the testing.

Over a weeklong period, the impact of fire and overheating on a sample of 15 large inflated tyres was examined in a controlled research environment at TestSafe. These were tested to destruction. Thermocouples were placed inside the tyres to measure the temperatures and a pressure transducer fitted to a remote inflation pipe was used to measure



Tyre No 2 - Under Test

the increase in pressure. The tyres were either set alight, with buckets of diesel or soaked rags, or the rim heated with an oxyacetylene torch. These two methods were used to simulate the impact on tyres from situations such as engine fires or overheating brakes.

The mechanism of failure depended upon the test done. The tyres which were burnt with the buckets of diesel failed with rapid venting of the pressurised air at the point of the localised heating. The internal temperatures at failure often only reached 120°C with the pressure close to normal (7.5 Bar). Rubber temperature varying significantly with temperatures of 15°C in the immediate vicinity of the burning rubber. The tyres with the oxyacetylene torch heating the rim failed, with the tyre popping off the bead at the point closest to the torch.

Massive pressure released during these failures obviously poses a significant safety risk to people working in the near vicinity.

The most spectacular failure occurred during the second tyre test when a large tray of fuel was used to heat the tyre.

After 5 ½ mins, the tyre bead on one side exploded off the entire rim causing permanent deformation and an enormous bang that rattled TestSafe buildings more than 500m away! Before the explosion, in the last 45 seconds of the test, the pressure increased 13 Bar and the temperature increased 300°C. A similar event also occurred during one of the rim heating tests. This suggested that a combustion reaction was taking place inside the tyre, possibly involving fumes from the rubber acting as the fuel.

This phenomenon has also been witnessed in other projects and truck incidents, with seemingly normal tyres exploding minutes after a truck has accidentally come into contact with power lines, and drivers have evacuated their vehicles.

The research clearly identified the need to extinguish tyre fires as soon as possible (water is suitable), and not to do any work (i.e. welding or heating) on a rim with an inflated tyre attached, regardless of whether air or nitrogen is used to pressurise it.



Tyre No 2 test - Full Extent of Explosion



Tyre No 2 test - After Explosion