21 JUNE 2024 / VERSION 2.0

Recognised Standard 13

Tyre, wheel and rim management

Coal Mining Safety and Health Act 1999

Resources Safety & Health Queensland

Contents

Recognised Standards may be updated from time to time. To ensure you have the latest version, check the website: https://www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/legislation-standards or contact your local office.

This publication has been compiled by the Resources Safety and Health Queensland.

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Recognised standards

This document is issued in accordance with PART 5—RECOGNISED STANDARDS and section 37(3) of the *Coal Mining Safety and Health Act 1999*.

PART 5 - RECOGNISED STANDARDS

71 Purpose of recognised standards

A standard may be made for safety and health (a "recognised standard") stating ways to achieve an acceptable level of risk to persons arising out of coal mining operations.

72 Recognised standards

(1) The Minister may make recognised standards.

(2) The Minister must notify the making of a recognised standard by gazette notice.

(3) The CEO must publish on a Queensland government website each recognised standard and any document applied, adopted or incorporated by the standard.

(4) In this section—

Queensland government website means a website with a URL that contains 'qld.gov.au', other than the website of a local government

73 Use of recognised standards in proceedings

A recognised standard is admissible in evidence in a proceeding if—

(a) the proceeding relates to a contravention of a safety and health obligation imposed on a person under part 3; and

(b) it is claimed that the person contravened the obligation by failing to achieve an acceptable level of risk; and

(c) the recognised standard is about achieving an acceptable level of risk.

PART 3 - SAFETY AND HEALTH OBLIGATIONS

37 How obligation can be discharged if regulation or recognised standard made

(3) …. if a recognised standard states a way or ways of achieving an acceptable level of risk, a person discharges the person's safety and health obligation in relation to the risk only by—

(a) adopting and following a stated way; or

(b) adopting and following another way that achieves a level of risk that is equal to or better than the acceptable level.

Where a part of a recognised standard or other normative document referred to therein conflicts with the *Coal Mining Safety and Health Act 1999* or the Coal Mining Safety and Health Regulation 2017, the Act or Regulation takes precedence.

Issued under the authority of the Minister for Resources and Critical Minerals.

Gazetted 21 June 2024

1.0 Purpose

The purpose of this standard is to give an outline of what elements must be considered in a mine's Safety and Health Management System (SHMS) and to assist in the development of a Standard Operating Procedure (SOP), and other procedures, for the management of tyres, wheels and rims at a coal mine. It provides a managed approach to achieve an acceptable level of risk to persons using the SOP required by section 72(a) of the Coal Mining Safety and Health Regulation 2017.

> *72 Miscellaneous*
> *A coal mine must have standard operating procedures for the following—*
> 1. *fitting, removing, testing, maintaining and repairing tyres and rims on fixed and mobile plant;*

2.0 Scope

This standard applies to all tyres, wheels and rims on mobile, transportable and fixed plant at a mine and includes all associated tools and equipment as mentioned in this standard.

Note: Recognised standards are not mandatory

Recognised standards are not mandatory, but when followed provide a way of meeting safety and health obligations. A person may adopt another way of managing that risk, however in the event of an incident the person may be required to show that the method adopted was equivalent to the method in the recognised standard.

3.0 Application Framework

3.1 General

The application framework for tyre, wheel and rim management includes:

- SOPs and procedures for tyre, wheel and rim management underpinned by detailed risk assessments, including the identification and implementation of fatal hazard controls.
  The International Council on Mining and Metals (ICMM) publications on critical control management and implementation provide guidance (refer Appendix 2 References).
  SOPs and procedures developed should focus on preventative controls based on the application of the hierarchy of controls e.g., adopting engineered designs which prevent uncontrolled disassembly of wheels.
  Steps that should be considered as a minimum in the risk assessment are shown in Appendix 3.
- All plant, including but not limited to mobile, transportable, and fixed plant (open cut, underground and exploration equipment). Includes owner, hired and contractor supplied plant.
- The lifecycle of tyre, wheels and rims, including:
  - design, manufacturing and/or supplying tyres, wheels, and rims (new or previously used).
  - installing or commissioning.
  - operating.

  - maintaining, repairing, or overhauling and other life cycle activities of tyres, wheels, and rims.
  - decommissioning and disposal of components.
  - changes or alterations to tyre, wheel & rim management systems.
- Designers, manufacturers, importers and suppliers of original plant to the mine.
- Repairers and service providers for the mine site.
- Any person, permanently or temporarily employed at the mine in any capacity that requires them to interact with, maintain or rely upon tyres, wheels and rims.
- Competency assessment.
- System review, including:
  - reviewing the adequacy of risk controls following an incident
  - assessing/auditing existing standards and practices.
- The recognised standard does not preclude the use of documented standards and practices that result in superior safety and health outcomes than would otherwise be achieved by following this standard.

Note: Critical Controls

The SOP and other procedures, for tyre, wheel and rim management shall be underpinned by detailed risk assessments and shall include critical controls.

3.2 Wheels and Rims

There are many designs of wheels and rims in use at mines including single piece wheels, industrial two piece and multi piece wheels and rims (refer Appendix 5).

3.3 Tyres

There many types of tyres in use at a mine, pneumatic tyres (radial and bias construction), filled tyres (polyurethane, rubber insert, water ballasted) and solid tyres (refer Appendix 5).

3.4 Associated tools, plant and equipment

Plant and equipment mentioned in this standard that is used for fitting, removing, and handling of tyres, wheels and rims, for example tyre handler, forklift, jacks, stands, hand tools etc.

3.5 Single SHMS

Where a contractor's safety and health management plans including SOPs are proposed for use at a mine the plans, SOPs and underpinning risk assessments including critical control assessments shall be reviewed by the Site Senior Executive and if necessary, require changes to be made to those plans to enable them to be integrated into the mines single SHMS.

3.6 Exclusions

Tyres, wheels, and rims that the mine risk assessment identifies as having a proven low risk (such as tyres and wheels or rims fitted to gas trolleys, wheelbarrows, parts trolleys, ride on lawnmowers) may be excluded from this standard. The controls for all excluded items are to be contained in the mine's SHMS; this standard may be used as guidance material in developing the controls.

> **Note:** Risks associated with overpressure, split wheels and plastic wheels fitted to plant such as wheelbarrows or trolleys must be considered.

4.0 Technical Guidance

The controls mentioned in this standard will form part of the mine's SHMS and may be an integral part of the SOP. The system is to have regard for the guidance given in this section that covers the life cycle of tyres, wheels, and rims from design to disposal.

Major hazards associated with tyres and wheel, or rim components include their physical size, weight, complexity of multi-piece wheels and rims, stored pressure energy, potential for explosion and the damage resulting from the arduous conditions to which they are subjected.

Manual handling is possible for only a few types of tyres, wheels, or rims as most are of a size and weight that necessitates machine assistance.

Trained personnel are needed for work on the wheel and rim assemblies due to the complexity and critical nature of the work. The consequences of rapid deflation, tyre fire, ejection of wheel or rim components and toppling of assemblies have resulted in fatal accidents and serious injuries to mine workers. The structure of Section 4 Technical Guidance is shown in Table 1:

Sound tyre and rim management – safe production	4.1	Tyre and rim – selection and procurement
	4.2	Receipt and storage of tyres and rims
	4.3	Mounting, demounting, assemble and disassemble
	4.4	Fit for purpose tyre maintenance facility
	4.5	Maintenance and upkeep
	4.6	Operation and hazardous conditions management
	4.7	Removal and disposal
	4.8	Information documentation and tracking
	4.9	Competency
	4.10	Systems

Table 1: Section 4 Technical Guidance Structure

4.1 Tyre, Wheel, and Rim – Selection and Procurement

The first element in development of a tyre, wheel and rim management system is selection and procurement of the tyre and wheel or rim. The systematic risk assessment approach requires that competent people are involved, for instance the tyre, wheel, and rim manufacturers, mine designers and operators, tyre, wheel and rim technicians and maintainers and the plant Original Equipment Manufacturer (OEM). Information required for the risk assessment should include:

- application data:
    - Plant type: Earthmoving, large tyres, wheel or rims, light vehicle, or fixed plant.
    - Wheel or rim construction: multi-piece, divided (two piece or split rim), single piece or drop centre.
    - Mount: demountable, or disc mounted.
    - Tyre tread requirements: smooth, tread pattern, lugs, etc.
    - Pneumatic, solid fill or solid tyres. Note: solid or solid fill are generally used for slow moving or occasionally moved equipment (underground personnel transports & LHDs, trailers, crib huts).
    - For applications using solid fill or tyre inserts particular attention to the load/duty cycle must be considered due to limited information available on TKPH for non-pneumatic tyres.
    - TKPH (earthmoving) or duty cycle requirements near term and over the product lifecycle.
    - Conditions of operation, type of plant, payload, speed, environment conditions, equipment utilisation, road gradients and road surfaces.

Other considerations at this stage include:

- management of change by the introduction of new tyres, wheels or rims into service (for instance training of on-site personnel, new style truck).
- equipment sourcing such as OEM, hire, contractor plant.
- tooling requirements, including tyre handlers, if different from those presently in use.
- unique identifier, branding of tyres, stamping of wheels or rims for tracking and recordkeeping (in protected places on the wheel or rim to retain legibility, refer AS 4457.1 for earth-moving machinery wheels and rims).
- consistency of types of tyres, wheels, or rims to provide standardisation on site and reduce confusion.
- establishment of a wheel, rim, components and tyre supply guidelines, detailing:
    - how the wheel, rim, components, and tyres are packaged for transport (taking into consideration the site's transport, unload, and load procedures).
    - rim identification nomenclature.
    - wheel, rim and component colour coding.
- choice of modern 'safer' designs, for instance:
    - bead seat band designs (for certainty of lock ring correct fitment and retainment).
    - double gutter rims (for reduction of hazard exposures such as vibration and manual handling when replacing tyres in duals).
    - two-piece lock rings to eliminate sprung potential energy, minimise manual handling and line of fire risks (these many also have lock ring retainers, bolted connectors).
- if the tyres are regroovable, retreadable, or repairable. Repaired tyres should have repair marks on the sidewall and be tracked in the mine site's management system (refer AS 4457.2, AS 1973).
- reconditioned tyres may have speed or load restriction and may only be fitted to certain positions on the plant.

- determine via risk assessment the appropriate location and orientation to install repaired tyres on mobile machinery:
    - risks associated with repaired tyres are different depending on the tyre, repair location/s, machine type and size. For example, a haul truck will have different requirement to a grader.
    - use of repaired tyres should be risk assessed prior to use especially as steer tyres. Refer AS4457.2 for guidance on major, intermediate, and minor repairs.
    - it is recommended that repairs on tyres should face the inside of the machine.
- introducing and managing third-party latent risk:
    - on-site acceptance of wheel and rim components and wheel and rim assemblies, assembled off site.
    - visitors vehicles and goods delivery to the site.
    - mobile or fixed plant introduced by contractors.
- if a dispensation has been given for the application:
    - where the tyre loading exceeds the manufacturers branding on the sidewall of the tyre, the manufacturer or supplier may raise the load rating by increasing the tyre pressure, restricting the speed of the haul, provide specific training for the operators and written instructions for the mine records (applies specifically to earthmoving trucks and on-road haulage used at mine sites).
    - ensure wheel or rim rating matches or exceeds tyre load rating.
    - consider equipment design parameters e.g., wheels or rims and fasteners (studs, nuts and cleats), suspension components, steering.

Note: Dispensation in this document refers to the term used in the recommendations made by the Coroner in the Wayne MacDonald inquiry (Appendix 2).

Image 1: Example of unique identifier

Image 2: Earthmover wheel with two-piece lock

Other items to be supplied to the site include:

- the OEM or suppliers recommended tyre pressure, wheel or rim fastener torque settings and any dispensation (assists the mine to develop and post a wall chart for relevant personnel information).
- the OEM or suppliers ‘reasons for removal’ of a tyre, wheel or rim (posted wall chart).
- guidance on management of fasteners (reference manufacturer’s guidance when considering the effects of broken or missing fasteners).
- maintenance requirements during the life of the wheel or rim. (AS 4457.1 has types of inspection and tests, for earth-moving machinery wheels and rims).

4.2 Receipt and Storage of Tyres and Rims

4.2.1 Transportation, receipting, loading, handling and unloading.

Risk assessments shall be conducted to identify the controls for transporting and handling including:

- specifically, the prevention of injury to personnel or damage to tyres (bead area), wheels and rims (gutter section, grooves and mating surfaces) and assemblies. Appropriate controls include using competent personnel, manual handling techniques, transporting with lock ring fitted and appropriate lifting aids (tyre handler).
- containerised delivery which has its own inherent hazards.
- on highway transport contractors, consideration of other road users (e.g., transport earth-moving machinery tyres vertically to reduce the need for wide loads).
- an appropriate inflation pressure for handling and transport of assemblies, mounted on or off the vehicle.
- handling hazards of solid and solid fill tyres (polyurethane and inserts) due to their weight.

On receipt of assemblies, where tyres have been fitted off site:

- verify the competencies of the person assembling the wheel or rim assembly have a competent person check that wheel assembly components are correctly fitted and mated.
- check that tyres are at the sites nominated pressure, prior to storage.

Conduct a similar check of all equipment arriving on site including contractors' equipment e.g., introduction to site process, change management, machinery inspection. Tyre, wheel and rim site register to be updated with:

- owner and contractors' equipment introduced to site.
- the wheels and rims that have stamped or branded serial numbers, prior history of tyres, wheels and rims where known.

A tyre management and tracking system for tyres, wheels and rims shall be implemented that is functional, effective and followed. It shall contain:

- tyre/wheel/rim details (e.g. TKPH).
- application (equipment and working environment).
- pressures, tread history, damage, position, rotation history, hours.
- NDT history.
- maintenance records including repair history.

Image 3: Vertical transport of tyres

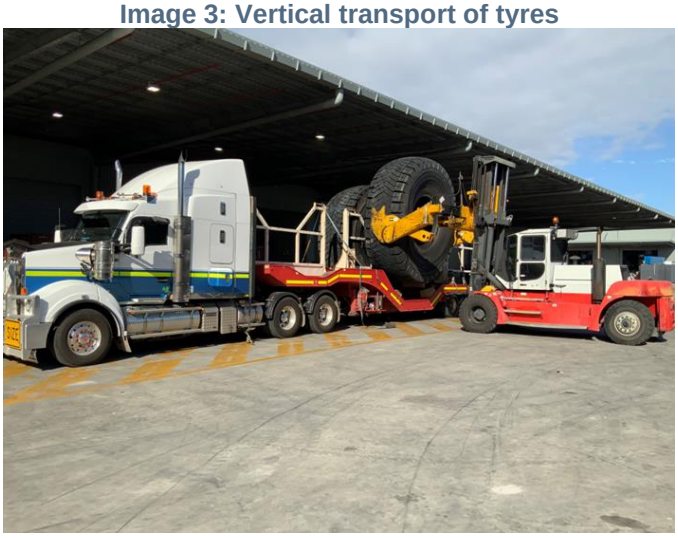


Image 4: Unloading tyre using fit-for purpose equipment

4.2.2 Handling equipment

All equipment used on site for handling tyres, wheels and rims shall have been:

- risk assessed prior to use.
- approved by the Site Senior Executive (SSE) as fit-for-purpose for its intended applications (considerations include risk based manning requirements e.g., two-man operation operating plant energised and unattended, and Safe Work Australia publications for lift trucks and forklifts (refer Appendix 2).

4.2.3 Storage of tyres, wheel and rim and assemblies

Tyres, wheels and rims should be stored in a safe and clean environment using the controls developed from a risk assessment. The following points should form part of the risk assessment:

- Stored:
    - so that they do not present a hazard and cannot be damaged. Typical hazards could include fire, toppling over, falling off a stack, rolling away and injuring a person.
    - to minimise the accumulation of water in or around tyres & components.

    - in a way that minimises biohazards such as long grass, water accumulations conducive to mosquito breeding.
    - away from traffic to prevent interaction or damage.
    - with adequate working space and adequate lighting for working during hours of darkness and easy access for fire-fighting equipment.
    - sidewall information or relevant information marked with a compatible tyre crayon/chalk/paint stick that is clearly visible.
    - in defined and segregated areas for tyre types and wheel and rim components:
        - to avoid confusion and mixing of unmatched components to avoid reintroduction of quarantined or damaged items,
        - to lower the risk of fire hazards.
- For tyres stored under pressure in confined areas such as workshops and undercover stores, the tyre storage pressures shall be based on risk assessment.
- A stock rotation strategy should exist to limit storage time of all components, 'first in first out', based on manufacturers recommendations (e.g., tyre manufacture date, age of tyre, noting that rubber products have a 'use by' date, corrosion induced cracking).
- Wheel and rim components should be stamped/branded for ease of identification and differentiation between manufacturers, to facilitate selection before fitment and service life tracking:
    - stamping should include unique serial number, manufacturing date, repair date, rim style, size etc.
    - stamping in a number of places will aid visibility and legibility.
    - outward facing when fitted to plant.
    - AS4457.1 provides guidance for earth-moving machinery wheels and rims. Standards guidance may be applicable for all size tyres and rims.
- Tyres should also be classified by manufacturer, application, retread, reconditioned, quarantined, size, pattern, tread depth and status (for instance new, used, scrap, awaiting inspection).
- Storage areas should be free of petroleum products, electrical equipment producing ozone and, if possible, out of direct sunlight. Water accumulation in tyres, rims and components should be minimised.
- Clear signage to identify stored items. Areas for storage of tyres and component should be clearly delineated.

4.2.4 Storage methods

For earth-moving machinery and large tyres, wheels and rims AS4457.1 and AS4457.2 provides guidance. Storage methods used shall be risk assessed:

- Tyres and wheel or rim assemblies should be stored in an appropriate tyre holding device or restrained such that they cannot roll away, topple or be dislodged.
- When storing large tyres and assemblies horizontally the tyre at the base of the stack may suffer structural integrity damage to the tyre. Technical advice shall be sought on acceptable stack heights to prevent structural damage.
- Stack heights for stored tyres shall be determined by risk assessment.

- Tyres should be stacked to minimise the risk of a dislodged tyre toppling or rolling away in an uncontrolled manner. The risk assessment should consider factors such as: type of terrain, skill of operators, size of tyres, and capability of tyre handler or forklift.

Image 5: Vertical tyre storage showing inspection corridors and segregation

- To overcome tyre bead issues, assemblies must be inflated to site storage pressures, as determined by a risk assessment process, for the size and type of assembly (earth-moving machinery tyre typically between 20 psi and 30 psi, 140 kPa to 210 kPa) to maintain the bead in the correct seating location on the rim base. It is recommended that the inflation pressure and date of inflation is written on the tyre sidewall with a compatible tyre crayon/chalk/paint stick.
- Prior to inflation to full pressure from site storage pressure, tyre & rim components (i.e., lock ring, beadseat band) should be checked for cleanliness.
- Valve caps shall be fitted to all valve stems to prevent ingress of dirt into the valve stem and provide airtight seal against leakage.
- Consideration should be given to metal valve caps.

Image 6: Large tyre racking

Image 7: Wheels, rims and their components

Image 8: Rim component storage

Image 9: Wheel and rim storage

- Signs shall be in place for all categories of wheel, rim and component storage.
- Stored in designated and clearly identifiable areas in a stable configuration, sorted by manufacturer, size, lock ring, bead seat profile and common design (single or multi-piece etc.) to simplify selection of like components and avoid selection of incompatible rim/wheel components.
- For heavy earthmoving equipment tyres >24”, stored on the ground on a compacted well drained area that allows all-weather access for forklifts and other load shifting equipment, such as tyre handlers.
- Rim components such as bead seat, flange rings and lock rings must be stored in a manner that retains their serviceability and segregates compatible and incompatible components. Colour coding reduces the possibility of assembling incompatible components. (Components from different manufacturers are not necessarily compatible).
- Components waiting for testing or repair shall be clearly marked and stored in a designated and clearly identified ‘quarantine area’ to prevent accidental return to service.
- Damaged, worn-out, or unserviceable components shall be:
    - rendered inoperable (e.g., by cutting up lock rings)
    - discarded to a designated area or metal recycling bin.
    - stacked (including tyres and items on pallets) within risk assessed limits.

4.3 Mounting, Demounting, Assemble and Disassemble

Note: Safety critical steps in the mounting, demounting, assembly and disassembly and their controls shall be identified and highlighted in procedures.

Fitting a wheel or rim assembly to a vehicle or plant, assembling wheel or rim components and mounting a tyre to a wheel or rim are tasks that require care and attention to detail. The steps vary depending on the type and size of the tyre, wheel and rim. This section outlines the controls and points to consider ensuring mounting, demounting, assembly and disassembly are done correctly and safely. It is not a step-by-step guide.

- Each vehicle, type of tyre, wheel and rim, application and size (earth-moving machinery, large, light truck and passenger vehicle) presents a different risk profile. For instance, fitting of tyre chains presents a unique set of risks.
- All activities and procedures must be based on risk assessment principles and developed by a representative group. It is recommended that the ICMM risk and critical control methodology be used.
- Specifying supervision requirements
- The safety critical steps and their controls shall be identified and highlighted in any developed procedure. For multi piece earthmover applications the safety critical steps include specifying:
    - the number of people, competency, experience, acknowledgement of understanding of SOP requirements per task and their specific roles that ensure risks are controlled. The information shall be presented to CMWs in an accessible and easily understood format. **An example of a risk-based tyre change skills matrix is shown in Table 2.**
    - who can inflate/ deflate tyres, including the re-inflation of partially deflated tyres.

Tyre Change Skill Matrix						
Wheel / Rim		**Competency required**				
Task Configuration	Assembly Type	Tyre Fitter	Plus	Spotter		
				Trainee		Other Trade
Vertical Assembly	OTR (Over 24”)	2		3rd	or	3rd
Horizontal Assembly	OTR (Over 24”)	1		2nd	or	2nd
Pre-Built Wheel / Rim	OTR (Over 24”)	1		2nd	or	2nd
Pre-Built Wheel / Rim	Light Vehicles	LV or MV Site License (Single piece up to 24” only)				
Pre-Built Wheel / Rim	Medium Vehicles					

Tyre Fitter

- Site competency completed – AURKTJ012 and AURKTJ011

Other Trade

- Trade qualified and competent in the site’s Tyre / Rim SOP and has the practical experience and exposure working with tyres and rims.

Trainee

- Competent in the site’s Tyre / Rim SOP and has the practical experience and exposure working with tyres and rims. Has completed the required practical and theory assessments in initial training off-site (AURKTJ012 and AURKTJ011) and requires completion of hours on task for full sign-off.

Table 2: Tyre Change Skills Matrix

- Working around suspended loads.
- Working around equipment and plant that is energised whilst a task is being undertaken (e.g., tyre handler, forklift).
- Establishing all components to be reused meet the manufacturer’s component reusability criteria.

- Minimising and controlling exposure to chemicals and airborne contaminants (e.g., dust generated whilst cleaning components)
- Establishing all the components to be reassembled are compatible components, reference to manufacturers manual.
- Confirmation of correct seating of components prior to;
    - partial inflation.
    - increasing the pressure from partial inflation to full inflation.
- Establishing the use of exclusion zones to exclude personnel from hazardous areas during the assembly/disassembly (e.g., lifting wheel & rim components, vertical standing of components) of tyre, wheel & rims and the criteria on when access to these areas can be allowed by competent personnel.
- During fitting (installing or removal) of >24" wheel assemblies, ensuring the wheel assembly remains secure (i.e., retained to the wheel hub) unless the tyre handler/ manipulator is in positions and has the assembly secured.
- Establishing the use of exclusion zones to exclude personnel from hazardous areas during inflation and deflation and the criteria on when access to these areas can be allowed by qualified personnel.
- Identification and implementation of steps to prevent failure of controls (e.g., independent person sign-off at critical steps completed prior to the next step being undertaken).

4.3.1 Industrial 2-piece (Split rims)

Risks associated with the inadvertent disassembly of industrial 2-piece rims shall be assessed.

Image 10: Industrial 2-piece (split rims)

- **Note:** split rim nuts can be inadvertently removed whilst the rim is under pressure.
- Image 10.1 shows an industrial 2-piece wheel.
- In Image 10.2 the bolts & nuts retaining the 2-piece rim assembly are not readily distinguished from the wheel retaining nuts.
- Image in 10.3 shows D-bolts holding the wheel together and nuts holding assembly to the hub.
- Split rim retention nuts and bolts are to be clearly identified.

4.3.2 Polyurethane (or similar) filled tyres

- Mine use of polymeric compound SOPs should consider filled tyres.
- For polyurethane filling of tyres, the manufacturer's process must be followed.

- The process includes pre-stretching of the tyre carcass, predrilling of the tyre tread area (to allow air to escape as the fill material is injected) and the method of ensuring a complete fill. An incomplete fill will allow the fill material to move during operation of the vehicle and subsequent frictional heating inside the tyre. Monitoring of tyre temperature post filling should be considered.
- Implementation of a quality assurance process is considered critical. The process shall be periodically audited.
- The impact of a fill compound on tyre TKPH should be considered.
- Tyre inspection programs for foam fill or solid tyres considering structural integrity, tyre damage, wear and tread depth.
- Risks associated with the increased mass of a filled tyre must be considered.
- Cutting & welding near urethane filled tyres should not be allowed.

4.3.3 Tyre inserts

- Use of tyre inserts should be in accordance with supplier recommendations for the specific mine application.
- The impact of tyre inserts on tyre TKPH should be considered.
- The insert must be matched to the tyre construction.
- Wheel rims should not be modified.

4.3.4 In a fit for purpose facility (tyre bay)

Planning

Some things will exist in the tyre maintenance facility but should be checked before any maintenance work. They include:

- fit for purpose hand tooling.
- fit for purpose jacks and stands, OEM nominated jacking and support points.
- inflation tool.
- tyre inflation cage.
- mobile remote inflation/deflation and pressure monitoring ability.
- methods showing demarcated zones during inflation (reflective cones, marker tape, painted hazard areas).
- calibrated torque tool, pneumatic and manual.
- torque tester apparatus to enable in-service torque calibration checks outside of scheduled calibration periods.
- current chart showing torque for the plant being maintained and re-torque schedule.
- pressure gauges and calibrated master gauge.
- current chart showing the recommended cold inflation pressure for the plant being maintained.
- tyre handler for large or earthmover tyres, wheels and rims. Fitted with safety devices e.g., fall back arrest arms, relief valves in tyre handler arms (to avoid overloading arms, if inflating tyre while between arms), clamp pressure indicators, hydraulic isolation systems.
- truck mounted tyre handler or forklift for smaller wheel or rim assemblies if required.
- use of steel plates should be avoided. Should steel plates be used they must be engineered and certified for the specific equipment type.

- tyre bay floor to be certified for the loads imposed.
- traffic areas adjacent to the tyre bay shall suitably engineered and maintained.
- lighting.

Preparation

In preparation for tyre, wheel & rim work consider:

- Vehicle introduction to workshop documentation specifying items such as vehicle cleanliness, condition, defects, work scope.
- Clean and inspect vehicle on entry to the tyre bay, prior to any maintenance (load in the tray, product hang up in tray and rocks between duals).
- Potential tyre damage that may lead to a failure in the tyre bay or workshop.
- Secure vehicle (e.g., isolate and wheel chocks).
- Identify tyre type and specification (pneumatic, solid and application). New, used, re-tread and reconditioned tyres (restriction on fitting position).
- Identify wheel or rim type, multi-piece, two-piece, single (preference is for the use of drop centre single piece rather than two-piece).
- Fit for purpose valve stems (inner and outer), their accessibility and the possibility of fitting fusible links (pressure or thermal).
- Lock ring retainer, driver (bead seat band).

Image 11: Lock ring retainer and driver

Control points

Control points to be considered include:

- Earth-moving machinery and large rim assemblies including their duals shall (and wheel assemblies should) be deflated to zero, or a safe handling pressure before being removed from the plant (handling of assemblies at zero pressure may introduce unintended risks).
- For earthmoving equipment use staged jacking because of rearward movement of the jacking point as the rear wheel rotates to the rear, (maximum single lift 200mm i.e., lift 200mm, set and hold on stand, reset jack ground position, lift another 200mm etc). See graphical representation below.
- Risks associated with jacking, OEM procedures.
- Inspection of the wheel or rim assembly prior and during the inflation process and prior to fitment on plant.
- Post-fitment inspection and release to production – quality control check (possibly by supervisor or another competent person not involved in the task).

- If tyres were fitted away from the mine, then a check/signoff by a designated & competent person at the site before use on the site. If a doubt exists, the tyre is to be removed, inspected and refitted.

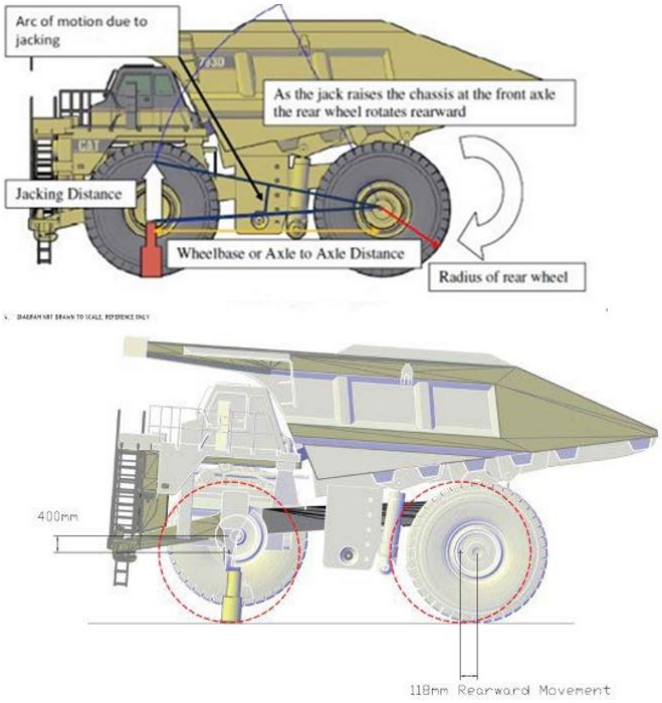


Image 12: Jacking considerations

4.3.5 Away from tyre bay (in pit or in workshop)

When tyre, wheel and rim work is to be undertaken away from the tyre bay also consider:

- Area lighting sufficient for the task.
- Environmental conditions including dust.
- Communications with pit users and demarcation of the plant.
- Equipment should be parked away from traffic, people, and hazards; a clear area to perform the task.
- Demarcation of hazardous area.

Many items may be needed to be transported to the work site remote from the tyre bay, they include:

- mobile remote inflation/deflation and pressure monitoring ability (RIDS – remote inflation deflation station) so that persons are not positioned in the high-risk zone of an air blast from an uncontrolled assembly failure (during inflation/deflation).
- JSAs and procedures.
- First aid equipment, fire-fighting equipment.
- Lock out equipment.
- Wheel chocks.
- Transport of tyre, wheel or rim assembly to and from the worksite.
- Spare tyre or assembly.
- Consumables e.g., wheel nuts, cleats etc.
- Tyre handler, or tyre handler machine.
- Communications equipment.
- Lift and lock jacks and vehicle stands.

- Cribbing (e.g., timber or plastic) where used must be rated.
- Jacking plates. Jacking plates must be certified by a competent person as being suitable for the tasks, including lifting and towing point.
- Demarcation equipment for establishing an exclusion zone around the work area to prevent unauthorised entry.
- Witches' hats.
- Compressor.
- Hand tools.
- Torque tool.
- Pressure gauge (checked against a master gauge).
- Signage.

4.4 Tyre Maintenance Facility

A fit for purpose tyre maintenance facility is important for the safe fitting and removal of tyres, wheel and rim assemblies. The maintenance facility specific needs should be considered by using a risk assessment process and be completed prior to fitting and removal of any tyres on site. The type, location and design features of the facility should consider the specific site and equipment requirements and would in usual circumstances include a permanent maintenance facility.

For a permanent facility there are a number of design principles that would support the ongoing safe fitting and removal of tyres, these considerations should include the following.

4.4.1 Building and surrounds

Buildings and surrounds should include:

- a level concrete slab that provides a stable platform for jacking:
    - large enough for the largest item of equipment to be serviced and the plant servicing the equipment.
    - designed with appropriate drainage.
    - with consideration of the weight of the largest equipment, particularly point loading during jacking and using safety stands.
    - the slab design and construction should be certified by a competent person.
- The maintenance facility should have a roof in order to protect workers from the elements yet appropriately ventilated, this roof may extend over a building and equipment service area, having regard to the prevailing wind direction. The roofed area should be large enough to provide safe access to both sides of the truck or plant.
- Provisions for the control of the hazard of rapid tyre deflation or uncontrolled release of the wheel or rim components during assembly/disassembly, inflation or deflation, where appropriate:
    - demarcation to show exclusion zones (may be temporary indicators such as marker tape or reflective cones or the workshop floor may be permanently marked. Size and shape of the zone should reflect the size of the tyre and the pressure it contains.
    - exclusion zones where tyres & rim assemblies may fall or topple.
    - exclusion zones adjacent safety cages.

- engineered hard barriers to segregate people from any zone of risk.
- a system of gates and interlocks to restrict personnel access.
- the technical/engineering basis for the size and location of demarcation zones shall be documented.

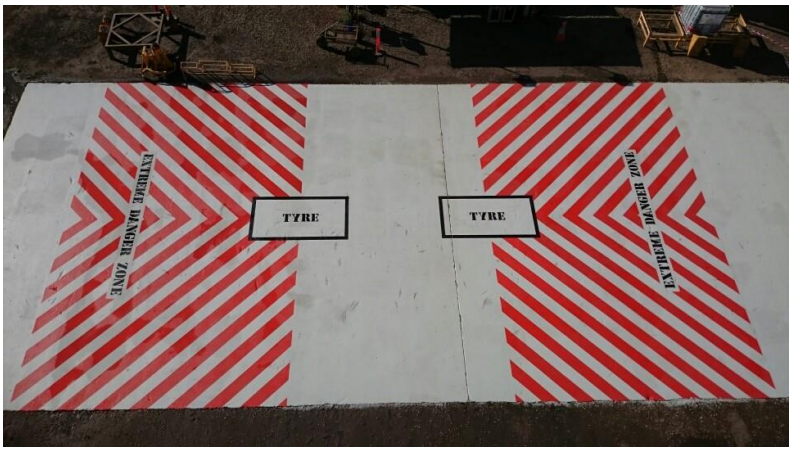


Image 13: Exclusion zone

- A parking area for a tyre handler, trucks or plant and light vehicles adjacent to the facility should be designed to minimise vehicle interaction and not be within the blast direction angle (preferably located at 90 degrees to the facility).
- Laydown, storage or parts staging areas for tyres, wheel and rim components are to be designated and clearly signed. They need to be in close proximity to the work area to encourage selection of a replacement for high frequency items (rather than refit a questionable item).
- Provision of good visibility lighting where critical steps in the assembly of components are conducted and general lighting to all other areas, including parking, without causing glare, AS1158.3 and AS1680 may be used to provide guidance.
- Artificial ventilation should be considered when inflating or deflating nitrogen filled tyres.

4.4.2 Tyre handlers, Forklifts, manipulators, grabs

- Selection and use of tyre handlers, forklifts, manipulators, grabs should consider:
- EMERST guidance on machine design when selecting tyre handling plant
- Pressure identification of grabs – installation of pressure gauges in clamp circuits to monitor system pressure and changes in grab pressure that may indicate system faults
- Fallback arrestors
- Use of proximity detection on forklifts, tyre handlers
- Unattended machine operation:
  - separation of fitting operations whilst machine still powered,
  - risks associated with the operator leaving cabin whilst tyre suspended
  - Safe Work Australia – industrial lift truck guidance – “get out, park it”
- Positive confirmation that brakes are activated, transmission neutralised and hydraulic functions stable, (ie clamp pressure retained) prior to use of tyre handling attachments.
- Remote controls (manipulators). Effectiveness of remote-control operations including validation of controls and procedures.

4.4.3 Tools

- Appropriate fit for purpose work benches including sufficient number of power and air outlets at the workbench.
- Designated areas and cabinets for the storage of consumables, tools and tyre maintenance documents (e.g., manuals, maintenance procedures, SOPs and material safety data sheets).
- Display and notice board - Charts – documenting cold inflation pressure and torque charts, wheel and rim profiles, image of exclusion zones and dispensation criteria.
- Tools, including a register and maintenance procedures to undertake tyre, wheel & rim maintenance. Maintenance procedures should include calibration procedures, establishing basis for calibration testing, and in-service confirmation of calibration (i.e., torque testers) for devices used for torquing nuts etc.
- Tools to measure tolerances and dimensions of wheel and rim (to compare with predetermined wear limits).
- Certified safety inflation cage to suit assembly size. Located to redirect air blast and contain ejected wheel or rim components (a clearly identified restricted area during the inflation process).
- Work platforms – various to allow for largest equipment.
- Thermal imaging tools.
- Tyre additive – reticulation system, distinctive colour of additive provides critical indication of leaks (slow puncture or wheel or rim cracking).
- Sufficient number of rubbish bins, spillage kits and metal recycling bin.

4.4.4 Jacks and stands

- Jacks, jacking plates and stands shall either be to a recognised standard or certified for use.
- Jacking plates shall be indelibly (i.e., by a permanent means) marked and identified.
- Tyre inspection stand.
- Wheel or rim fitment stand.
- Jacking plates. Risks associated with using steel on steel (i.e., jacking plates and jacks/stands) shall be considered.
- Lift and lock jacks and pin-lock stands.
- Ratchet stands that cannot be locked securely in position shall not be used.
- Jacking extensions and stands not to be used unless they have been designed and certified for use with a particular jack or stand. Where used systems and process shall be in place that ensure they are used in accordance with the supplier's recommendations.

4.4.5 Compressed air/nitrogen and water

- Compressors and Air Receivers should provide sufficient pressure and volume for the tyres in use (cater for the largest volume and highest pressure) and sited away from personnel and mobile machinery.
- Consideration of an air dryer sufficiently rated to minimise moisture entering the wheel or rim assembly. Moist air is appropriate if tyre additive is used.
- Air used to inflate tyres should be oil free.

- Air receivers and safety valves to be tested as per AS3788.
- Any other valves, air fittings and air lines fitted to the compressed air system shall be rated to withstand the highest air pressure the compressor can produce (AS1271).
- A regular service program should be implemented for the compressor and air dryer incorporating OEM recommendations.
- Remote inflation/deflation (fitted with noise suppression) and pressure monitoring ability (RIDS – remote inflation deflation station) so that persons are not positioned in the exclusion zone of an air blast from an uncontrolled assembly failure (during inflation/deflation).
- Separate compressed air lines/reels for air tools and tyre inflation.
- Water supply lines to be able to reach all the tyre bay.
- Nitrogen or an inert gas are alternatives to compressed air inflation.
- Nitrogen
    - Implement assurance processes to maintain >95% nitrogen within the tyre.
    - Where purity falls below specified levels actions to be undertaken must be specified.
    - Measuring devices must be calibrated and in-service calibration confirmed.
- All lines to clearly identify the fluid (for instance compressed air for tools and dry, oil free air for inflation).

4.4.6 Safety

- CCTV to record work on both sides of equipment. Where CCTV is implemented, footage should be proactively reviewed to confirm controls being followed.
- Personnel proximity detection on mobile plant e.g., forklifts and tyre handlers.
- Communication system – two-way, phone, distress alert buttons.
- Firefighting equipment/system.

4.5 Maintenance and Upkeep of Tyres, Wheels and Rims

4.5.1 General

Risk assessments shall be undertaken for each activity, for instance the hazards of being in close proximity of a pressurised tyre when inspecting for separation, delamination or cuts.

- Inspection frequencies should be dependent on the history of the tyre, wheel and rim performance at each mine.
- Inspection frequencies should consider the operating environment and impact on wheels, studs and nuts.
- Recording of the results of inspections will guide future inspections. All activities associated with tyres, wheels and rims should be recorded as part of the maintenance history and the scheduling system to predict future maintenance work. Life cycle records will assist in the purchase of new and replacement tyres wheels and rims.

- In-situ wheel and rim maintenance during tyre changes is incredibly important as it provides critical information of whether the test frequencies should be changed to accommodate increases in operating severity.

4.5.2 Environmental Inspections

- People conducting inspections should include supervisors of the locations listed and operators of the vehicles working in those areas.
- Inspect the tyre environment looking for tyre damaging conditions in the loading area, surface and underground roads, dump and stockpile areas.
- Inspect the area where a tyre handler, crane, water truck or service vehicle will be used.

4.5.3 Tyres

Inspection of tyres is the first step in tyre maintenance. Documented frequency of inspections and recording and analysis of the results will assist in purchase of replacement tyres or confirm the choice of tyre in the application at the mine.

Tyre condition monitoring includes:

- regular visual inspection by vehicle operators
- examination for separation, delamination and cuts
- routine tread wear measurements
- thorough external and internal inspection by tyre technicians at each tyre change.
- tyre tracking and tyre rotation e.g., P1, P2 tyres rotated to the rear

Results of tyre inspections will indicate removal for re-use, such as matching with a similar dual, discard, recondition or re-tread.

- Wear and damage are triggers for removal of the tyre; a chart that includes photographs of tyre damage posted at the tyre bay will guide the tyre technician when a tyre should be reconditioned or discarded or at the very least to question the tyre manufacturer whether it should continue in service.
- The tyre supplier, manufacturer or tyre repair facility would provide guidance on recondition and discard of tyres.
- AS 4457.2 is the reference document for earthmover tyres and AS 1973 for passenger, light truck and truck/bus tyres. The Standards provide guidance on continued use or ability to repair.

Readily available consumables should be in the tyre bay. For instance, replacement valves, valve caps, swivels, extensions, studs and nuts. A ready supply of tyre additive and corrosion inhibitor, where used on site, should be available or reticulated in the tyre bay. The tyre additive has a distinctive colour that may assist in discovering a slow leak from puncture or crack in a wheel or rim (the use of a tyre additive or corrosion inhibitor may not be warranted where nitrogen is used to inflate tyres).

Pressure in a tyre is critical to its load carrying capacity and fatigue life.

- Tyre Pressure Monitoring Systems (TPMS) are beneficial in keeping the tyre pressure within its stated pressure envelope.
- Some monitoring systems also include temperature monitoring of the tyre air chamber.

- The capability to inform the vehicle operator (by remote sensing) of a tyre pressure outside of the envelope can ensure swift action to correct the situation or prevent tyre damage.
- The introduction of TPMS to haulage fleet tyres on mine site vehicles has been recommended by the Queensland Coroner in a recent fatality inquiry (Appendix 4). This should also be considered for earthmover and light vehicle tyres.

A process and schedule for taking pressure readings of:

- earth-moving machinery and large vehicle tyres.
- preset rims – periodically testing storage pressures.
- recording of the results should form part of the maintenance history of the mine.

Inflation pressures not within the inflation pressure envelope for the tyre are to be adjusted as required.

- This is not an easy task as the correct pressure of a tyre is always taken ‘cold’ (manual or TPMS).
- The hot pressure must be confirmed as over inflated (greater than a normal hot pressure would be) before pressure bleeding.
- Pressure bleeding can result in an under inflated tyre once the tyre cools.
- For accessibility, the inner dual tyre shall have extended inner valve stems.
- If TPMS is installed on a vehicle, its integrity should occasionally be ensured by manually checking the pressure and comparing against the TPMS reading.

A Trigger Action Response Plan (TARP) for tyres should include pressure as a trigger for response. For earthmover and large tyres in operation the triggers should include:

- low pressure, less than 70 per cent of the tyres cold inflation pressure will require the tyre to be removed and inspected internally (running at low pressure can cause fatigue loading in the tyre structure) AS 4457.2 expands this point. The adjacent dual tyre should also be removed and inspected as this tyre will have been overloaded and may have suffered structural fatigue if it has been operated next to a low-pressure tyre.
- high pressure, above the pressure envelope should be investigated:
    - over inflated due to error or defective pressure gauge.
    - heat from tread separation (some TPMS also include temperature monitoring)
    - speed, overload (TKPH).
    - road conditions or design.

4.5.4 Wheels and rims

As with tyres the first level of wheel and rim maintenance is inspection.

- Regular visual inspection by vehicle operators (at the same time as tyre inspection) provides an early indication of problems.
- Thorough visual inspection of cleaned wheel and rims at each tyre change by a tyre technician will highlight cracks, areas of wear, corrosion and fretting.
- Results of the latter inspections should be recorded in the maintenance history files or may require the wheel or rim to undergo further inspection, possibly non-destructive testing.

Earthmover wheels and rims that have had damage or fatigue identified by the inspection may require non-destructive testing to establish the competence of the wheel or rim.

- These wheels and rims should also undergo a non-destructive test schedule throughout their life.
- AS 4457.1 is the guidance document for testing and recondition of earth-moving machinery wheels and rims but can also be used as an information document for other wheels and rims.
- The frequency of NDT may require adjusting depending on results of previous testing and component deterioration.
- Wheels and rims must be checked to ensure fitting and wear tolerances in multi-piece wheels or rims are not exceeded; they may need to be reconditioned or discarded.
- For two-piece lock rings a condition acceptance document should be developed in conjunction with the manufacturer as measuring wear tolerances is complex in this design.

Wheels should be examined for damage to the wheel stud holes, cracking of wheel spokes, corrosion, and damage.

Passenger and light truck vehicle wheels and rims may also be tested (non-destructive testing) however these are usually considered consumable items and discarded if cracked, corroded, or worn beyond continued use.

Hot work (welding or cutting) and heat application to fasteners is prohibited with tyres mounted (including deflated tyres).

4.5.5 Protector and traction chains

For protector and traction chains, readjustment and tightening presents a unique risk profile, the controls for this task should be assessed using the expertise of the manufacturer or supplier.

4.6 Operation and Hazardous Conditions Management

In operation a number of hazardous conditions can be encountered. It is essential to develop a documented plan for dealing with these conditions before they arise. A risk assessment detailing the control measures should form part of the tyre, wheel and rim management system. Preventative controls (eg ensuring there are no foreign materials (rags, timber etc.) inside the tyre prior to installation) as well as mitigating controls should be implemented. It is equally important that mine workers who will come in contact or will manage the hazardous condition be trained in the recognition of tyre, wheel and rim hazards and their controls.

Mobile equipment operators are most likely to identify hazardous conditions during pre-start or in-shift inspections. Check sheets shall be developed so that guidance is given on what to look for and how to report the defect or condition.

4.6.1 General controls

Vehicle parking areas should consider risks of rapid tyre deflation or tyre explosion. Considerations include:

- parking orientation relative to buildings, other traffic and areas where people are likely to be in the vicinity.
- vehicle parking separation.
- parking on top of dump areas when there is a risk of lightning strikes or lack of protection from projectiles.

- use of segregated park up areas, hazardous tyre bay parking areas, bunding, military grade blast containers. Location of hazardous bays considered as part of the evolving mining operations.

Redundant/parked vehicles should have an active tyre maintenance plan which includes regular pressure checks.

If a defect is identified or suspected by an operator during an inspection, the suspect area of the component clearly marked and supporting documentation prepared (to eliminate confusion of the defect location).

- The vehicle must not be taken into the tyre bay until the defect has been inspected by a competent tyre person. This reduces the exposure of mine workers to a potential hazardous situation.

During removal of a wheel or rim assembly from a vehicle or machine, if a defect is discovered, remove the defective component from service and send for testing and repairs if warranted, (Reference AS 4457.1 for earth-moving machinery wheels and rims).

- Unsafe or damaged, non-repairable wheels and rims or their components are to be permanently rendered unusable by cutting apart, to prevent the component from being inadvertently re-used.
- Damaged or deformed lock rings are not to be re- used.
- Where there is evidence of cracking or movement of a wheel or rim assembly, the removal process (for single or dual fitment) should be stopped, and the tyre(s) immediately deflated to zero.

Prior to loosening securing fasteners, any tyre fitted to a wheel or rim assembly should be deflated to zero pressure or nominal handling pressure.

- If the pressure is to remain above zero, undertake a risk assessment to consider the risk from the hazards. This assessment should include comparison of the handling difficulties of assemblies at zero pressure with catastrophic failure or disassembly of wheel or rim components at pressures above zero.
- For dual assemblies (specifically multi piece rims) both tyres shall be deflated.
- No fasteners should be removed from a rim until all cleats/wedges have been released/loosened and the rim loosened on the hub taper.
- Follow component (i.e., cleat, wedges, nuts) removal sequences which should be included in documented procedures.
- When removing fasteners (incl. cleats and wedges), ensure sufficient number of fasteners are left on the assembly to prevent uncontrolled movement of the assembly, until the assembly is held securely by mechanical means (e.g., tyre handler).

A useful control prior to deflating a tyre is to check the pressure and chalk it onto sidewall this will alert the tyre technician if the pressure was below 70 per cent of normal cold pressure, therefore needing a more stringent inspection of the tyre (possibility of carcass or casing damage). This control will also alert the technician, when selecting an assembly to be fitted, that a tyre stored at a nominal storage pressure has leaked in storage.

4.6.2 Hazardous conditions (not an exhaustive list)

Hot tyre

- Causes: operating outside TKPH / OEM limits, poor road condition, potentially overloaded tyres (including duals).
- Identification: pressure build-up exceeds maximum permissible OEM operating pressure of tyre, high pressure alarm triggered from the TPMS.

- Controls: prevent tyre operating above OEM limits, redirect vehicle to slower or shorter cycle or lower payload until alarms have deactivated or tyre pressure and temperature (taken manually) have reduced to acceptable levels (normal hot running pressure).

Side wall bubble (follows on from previous, tyre generally hotter)

- Identification: smell of hot rubber due to separation, visible smoke or bubbles, series of crescent shaped marks on the tyre near the shoulder, sometimes known as 'eye brow' marks.
- Controls: park vehicle in safe area as soon as possible, tyre technician to assess the tyre condition and effect of temperature, monitor vehicle until visible smoke has ceased. Water cart may assist in cooling the tyre, when tyre has cooled, truck to return to the tyre bay and tyre removed. TPMS will show if excessive internal heating is present.
- A side wall bubble should be marked for identification and size. If the bubble enlarges from the initial size mark, the tyre manufacturer should be consulted to determine the action required.

Note: If over inflation of the tyre is suspected then the equipment is to be parked to let the tyres cool, pressures are to be adjusted only after the tyres have cooled, (tyre pressure must not to be adjusted while the tyre is hot).

Tyre fire

- Causes: external heat source such as hot spoil, ground coal spontaneous combustion, vehicle fire, spilt fuel or oil, hot work on truck, cut separations in tyres, friction from delamination, tyre rubbing against other components of the truck, excessive haul distance or payload (TKPH).
- Identification: external smell, smoke, and flames.
- Control: operator awareness, fire suppression (e.g., engine fire), permit to work, TARP for working in spontaneous combustion conditions.
- Stop or place vehicle in safe area as soon as possible, evacuate driver, quarantine e.g., spatial separation (refer Appendix 2 References; including; Lightning strikes stationary truck: Mine Safety Report No: SA08-03 for input into risk assessment for establishing a safe stand-off distance).
- Cooling of assembly if safe to do so (truck NOT to return to the tyre bay), park and deluge where safe to do so, (using water cart cannons, reversing towards the fire), procedures, emergency response teams trained in tyre emergency techniques.
- Where a TPMS system is installed, data from the TPMS may assist in decision making, however, it should not be relied on due to the various causes and nature of fires. **Note that the TPMS may be disabled if the vehicle is electrically isolated.**
- Abnormal temperature rise may trigger diffuser valves or diffuser plugs to deflate the tyre (particularly for a slow temperature rise).
- Hot work (welding or cutting) and heat application to fasteners is prohibited with tyres mounted (including deflated tyres).
- Nitrogen filled tyres may reduce the possibility of an internal fire, however maintaining purity inside the chamber becomes critical to continued protection.

Electrification, arcing, internal tyre fire

- Causes: suspected or actual contact with electrical power source, suspected or actual (witnessed) lighting strike, welding, dragging or seized brakes, hot wheel motors, contaminants (wood, rags, flammable lubricants) and pyrolysis inside tyre air chamber.

- Identification – very difficult to identify, no smell, tyre pressure and temperature monitoring technology the prime alert mechanism (TPMS may not respond to a rapid temperature rise in time to alert to a potential explosion).
- Controls: In the event of potential internal tyre fire the following mitigating controls should be implemented.
- If the source is a power line, firstly de-energise the power line.
- Immediately park in a safe location and evacuate all personnel, de-energise and quarantine the vehicle for 24 hours, exclusion zone as per risk assessment (refer Appendix 2; Lightning strikes stationary truck: Mine Safety Report No: SA08-03 for input into risk assessment for establishing a safe stand-off distance).
- TPMS (monitoring) may provide knowledge of the escalation or otherwise of an internal fire (if not disabled when vehicle is electrically isolated).
- If monitoring technology identifies a slow internal temperature rise but pressure is not excessive then deflation of the tyre may be considered (if safe to be conducted).
- Hot work (welding or cutting) and heat application to fasteners is prohibited with tyres mounted (including deflated tyres).
- Nitrogen filled tyres may reduce the possibility of an internal fire or tyre explosion, however maintaining purity inside the chamber becomes critical to continued protection.

Unable to deflate

- The hazard is the stored pressure energy that cannot be reduced to a safe level, no actions can be performed on a tyre that cannot be deflated.
- Mainly affects large and earthmover tyres.

Connect the deflation tool to a remote inflation line, and ‘open valving for inflation’, confirm that the tyre is not deflating. The following escalating steps should be followed:

- pressurise the inflation line to a nominated pressure (less or equal to OEM cold inflation pressure).
- stop inflation, bleed and disconnect inflation line.
- check pressure in the tyre is equal or greater than the nominated inflation pressure.
- continue to deflate, check pressure intermittently and verify it is decreasing.

If pressure is not decreasing, the blockage has not been dislodged, attempt to clear blockage using the above approach by repeating several times.

If pressure is still not decreasing (blockage may be rubber nodules in the valve stem or the tyre inner liner creating a flap over the valve hole):

- competent person to insert a probe (or a similar method) to achieve full deflation, after conducting a risk assessment.
- attempt deflation by removing valve from rim/wheelbase, or fusible link/burst disc.
- As last resort, consider spiking after a specific risk assessment conducted.

Additional hazards to be considered

- Under-inflated tyre (Less than 70% of recommended cold inflation pressure).
- Persistent loss of inflation pressure.
- Non-compatible wheel/rim components.
- Cracked Rims, Loose or Missing Nuts / Studs.

- Tyre or wheel/rim assembly making cracking or popping noise.
- Tread Separation.
- Sidewall Damage.
- Heat or Belt Edge Separation.
- Cut separation/tread detachment.
- Repair failure - split or loss of plug.
- Bead Erosion.
- Bead Bubbles.
- Foreign object penetration.
- Rock caught between dual tyres.
- Ozone cracking.

4.7 Removal and Disposal of Tyres, Wheels and Rims

4.7.1 General

Risk assessments should be undertaken for each activity, for instance removal of a hot tyre, suspected cracked wheel or rim or electric arc. There are many reasons for the removal of a tyre, wheel or rim for instance:

- worn tyre, beyond further use or for tyre matching.
- puncture.
- tyre repair, tread or lug separation, cuts and delamination.
- scheduled testing of wheel or rim.
- damage to wheel or rim.
- suspected crack in wheel or rim.
- hot tyre or suspected electric arc.
- replacement tyre to suit changed operating conditions.

The site should document the activities involved in the removal, particularly when the reason is a confirmed or suspected hazardous condition, the manufacturer or supplier should be consulted to assist in preparation of the document.

Wear and damage limits should be determined with tyre manufacturers or suppliers.

A manual showing the fitting and wear tolerances for wheel and rim components will guide the tyre technician in deciding to refit, recondition or discard; these may be OEM manuals or guidelines.

Alternatively, the site may choose to use an off-site facility for examination and repair.

4.7.2 Triggers

Scheduled examination of earth-moving machinery wheel or rim, including non-destructive testing and fitting and wear tolerance measurements may result in recondition or discard.

Wear and damage are triggers for removal, a tyre removed because of wear or damage may be reconditioned but may result in discard.

Documented criteria for repair or discard should be prepared and communicated; a chart that includes photographs of tyre damage posted at the tyre bay will guide the tyre technician, the criteria may be different for each tyre type and manufacturer.

- An under inflated operational tyre must trigger a response. For earthmover and large tyres in operation, low pressure, will require the tyre to be removed and inspected internally as running at low pressure can cause fatigue loading in the tyre structure, (low pressure is less than 70-80 per cent of the tyres cold inflation pressure, tyre manufacturer's guidance will provide the appropriate figure for their tyres). Rim and components shall also require inspection.
- Inspect both tyres of a dual assembly. An examination may result in discard of the tyre.
- For truck/bus tyres the examination may include inflating the tyre to 120 per cent of cold inflation pressure (in a cage) to ensure 'zipper' failure of the sidewall does not occur in use. This test was recommended by the Queensland Coroner in a recent fatality inquiry (Appendix 4) but should only be conducted in consultation and agreement of the tyre manufacturer. (Truck/bus tyres are those listed in the Tyre and Rim Association Standards Manual).
- An over inflated tyre resulting from a hot tyre caused by tread separation or tyre fire must be removed from service.

4.7.3 Disposal

A defined area should be chosen where all damaged, worn or suspect tyres, wheels and rims can be located prior to inspection and processing for re-use, reconditioning or disposal. This will remove confusion as to their condition and prevent them being put into service before they have been examined.

Scrap tyres should be rendered unserviceable to prevent further use. The possibility of tyre fires should be considered in determining storage locations and methods. Site storage locations should be documented, and survey records maintained as applicable.

Unsafe, damaged and non-repairable wheels or rims and componentry are to be rendered unusable so they cannot accidentally be reused.

- Damaged or deformed lock rings are not to be reused.
- Cracked, damaged nuts or studs and stretched studs are not reused.
- Chains that are cracked, damaged or worn are not to be reused.

4.8 Information Documentation and Tracking

A documented tyre, wheel and rim management system when implemented, contains provision for storage of information and records, facilitates the tracking of tyres, wheels, rims and plant and provides readily available relevant information to the end user. The system is to include all plant and equipment fitted with tyres. Information may be stored electronically or in hard copy.

The system:

- contains risk assessments used to determine the controls contained in the safe work procedures.
- safe work procedures.

- critical task/control checklist (hold points/signoff) documented in procedures, checklists and forms used.
- records information in a format that ensures ease of data entry, retrieval and reporting.
- provides an effective mechanism for handover of information between successive maintenance crews.
- contains OEM tyre, wheel and rim data (including dispensations) to ensure they are fit for purpose and satisfy the operations envelope. For instance;
    - tyre, wheel and rim details.
    - equipment details.
    - installation details.
- has maintenance details of handling equipment.
- records the status, identity and history (from purchase to disposal) of tyres, wheels and rims.
    - tyre life, usage, age, utilisation (monitoring of life of components on low utilisation plant).
- where an OEM or supplier provides information regarding tyre pressures, for example increase or decrease in air pressure due to operating environment, the information must be in writing and appropriately recorded at the mine site.
- contains further controls for the tyre, wheel or rim (size or application) that are identified (including all equipment types e.g., LV, MV, HV) by risk assessment.
    - wheel and rim assemblies shall be permanently marked with a unique, unambiguous and clearly visible identification. Such identification shall be visible after the tyre has been fitted and inflated. (Refer AS 4457.1 – Sect 2.3).
    - provides tyre temperature pressure monitoring system (TTPMS) or tyre pressure monitoring system (TPMS) as an added alert system for high- and low-pressure monitoring and possible tyre air chamber temperature monitoring (Recommended by the Coroner following Wayne MacDonald fatality 2010, Appendix4).

Records of all tests, inspections and audits:

- pressure checks, manual and remote (TPMS, TTPMS)
- tyre tread wear
- tyre condition (by exception)
- inspection and calibration information for specialised tooling such as: Jacks, torque tools, stands, master gauges, and support equipment (tyre manipulator, forklifts, HIABs, compressor(s), tyre bay work platforms, airlines, tyre service truck, Ute, etc)
- TKPH reports
- audit and validation of TPMS (reliability and accuracy)

Records of all repairs:

- tyre repairs e.g., ‘patches’, re-lugs, re-treads and re-grooves etc. (AS 4457.2 Earthmover, AS1973 Passenger car and light truck/buses).
- component repairs/replacements for wheels, rims and structural load handling equipment (tyre handlers, forklifts, cranes, cages).

Record of work performed:

- tyre, wheel and rim work performed.
- ‘checked by’ information.
- NDT tests, rim test methods and results.

4.9 Competency

4.9.1 Structure

The mine's training and management structure shall include onsite people with competencies in line with the current Resource & Infrastructure Industry and Automotive Industry Retail, Service and Repair competencies or equivalent, including assessment requirements such as performance and knowledge evidence.

- The mine will have training procedures and training needs analysis, in accordance with this Recognised Standard.
- General awareness of tyre, wheel and rim and hazards for all site employees (including contractors) who are to work in the vicinity of inflated tyres shall be provided.
- All tyre, wheel & rim activities shall be supervised. The site SSE shall appoint competent persons to supervise tyre, wheel & rim activities. The SSE shall determine the minimum competencies that supervisors of tyre, wheel and rim work must hold.
- In addition to the RII competencies, persons undertaking tyre maintenance tasks must also be trained on the specific requirements for the tyres and rims used on site. Where tyre maintenance is done offsite, the same competency principles shall apply.
- Tyre, wheel and rim competencies: AUR Version 7.1 Units of Competency.
    - AURKTJ011: Remove, inspect and fit earthmoving and off-the-road tyres.
    - AURKTJ012: Remove, inspect and fit earthmoving and off-the-road wheel and rim assemblies.
    - AURKTJ013: Perform minor repairs to earthmoving and off-the-road tyres.
    - AURKTJ015: Select earthmoving and off-the-road tyres, wheels and rim assemblies for specific applications.
    - AURKTJ016: Use earthmoving and off-the-road tyre handlers.
    - AURHTJ104 - Remove, inspect, repair and refit agricultural equipment tyres and tubes.
    - AURLTJ113 Remove, inspect and refit light vehicle wheel and tyre assemblies or equivalent.
    - AURLTJ102 Remove, inspect, repair and refit light vehicle tyres and tubes or equivalent.
    - AURHTJ103 Remove, inspect and refit heavy vehicle wheel and tyre assemblies or equivalent.
    - AURHTJ106 Remove, inspect, repair and refit heavy vehicle tyres and tubes or equivalent.
- Prior to authorising a coal mine worker to undertake tyre maintenance tasks the Site SSE must validate that a person is competent to perform tyre maintenance task (including performance or challenge test).
- Where the coal mine worker is to use equipment for tyre fitting, they should be assessed against the mine site procedures and specifically for the tasks to be undertaken prior to being authorised. Task competencies shall be dependent on the equipment to be used (e.g., machine jacking, tyre handler, truck mounted handler, forklift, tyre press).
- Verification of Competency training (Refresher) every five years at a minimum. Refresher training intervals should consider the frequency of undertaking the tasks.
- Training shall be provided for any new equipment before it is used.

4.9.2 Training

Tyre, wheel & rim hazard awareness – general

Personnel that work on or around mobile equipment who do not possess the required competencies, (operators, supervisors of tyre bay and maintenance personnel (e.g., technicians)), shall receive awareness training in basic tyre, wheel and rim hazards, as their work is often in the direct vicinity of equipment-mounted tyres. Training and education for this group of people should focus on identifying tyre, wheel and rim hazards and taking effective precautions (focus on critical controls!). Site training and education units should be determined by risk assessment.

Content should include such topics as (not an exhaustive list):

- Tyre, wheel and rim safety.
- Tyre hazardous conditions and response e.g., tyre fires (including nitrogen filled tyres), hot Tyre, sidewall bubbles, operator evacuation, park-up, lightning strike, potential tyre explosion.
- Tyre, wheel and rim care and maintenance.
- Plan & prepare for Tyre Fitting Operations.
- Equipment isolation, stability, jacking and lifting.
- Hand Tools & Equipment.
- Non-earthmover tyre fitting e.g., light vehicles, truck, cranes.
- Inflation and deflation procedures; including requirements to re-inflate partially deflated tyres.
- TARPS e.g., removal reasons (worn out and damage).
- Use and application of TPMS in operations maintenance applications. The use of TPMS systems in emergency or hazardous situations and system limitations.
- Specific instruction for operators of trucks where loading has been permitted to exceed the tyre load rating.
- LV wheel changing procedures including re-torquing procedures.

Only persons trained and competent in changing LV wheels shall be permitted to do so. Due to the complex nature of wheels and rims, it is strongly recommended that training should be provided on wheels and rims by the manufacturer and or their agents.

ERT personnel

Emergency responders likely to have to deal with vehicle and/or tyre fires or hazardous conditions shall be provided structured training in how to respond to fires/hazardous tyre conditions which may result in tyre burst or explosion.

Contractors

Mine management shall ensure that onsite contractors comply with site competency requirements and the sites single SHMS. Consideration needs to be given to the risk associated with delivery vehicles.

Off-site assembly

Off-site assembly introduces a third-party latent risk, effective controls should be in place for the mine to manage these processes (reconditioning, assembly, inspection), for tyre, wheel and rim assemblies that will be used onsite. For instance; tyre, wheel and rim management system auditing, facility inspections, training needs analysis, QA document reviews, NDT record reviews will confirm the competence of the personnel involved in the off-site processes.

Protector and traction chains

Training conducted in fitting and adjustment of tyre chains for appropriate personnel.

4.10 Systems Review

A tyre, wheel and rim management system or systems will encompass the elements for those parts of the mine SHMS that deals with the hazards and risks of tyres, wheels and rims on a mine site and will include documented systems. The system is to have regard for the guidance given in Section 4 of this Standard that covers the life cycle of tyres, wheels and rims from procurement to disposal.

The system is to include:

- schedules for review and auditing.
- effectiveness audits of critical controls.
- compliance and effectiveness audits (applicable to Sections 4.1 to 4.9 of this standard).
- audit of contractors on site and where applicable off site (e.g., tyre fill, wheel and rim assembly and maintenance).
- review and verification of tyre fitter competencies.
- review and incorporation of lessons learnt from incident investigations and industry communications.
- records of completed audits/inspections/checklists with remedial action plans.

Appendix 1: Definitions

Term / Acronym	Definition
AURT	Training package for Auto Skills Australia (nomenclature AU- automotive, R-retail, service and repair, T-transport)
Competent	As defined in the Qld Coal Mining Safety & Health Act and Regulations
CCTV	Closed circuit television
FFP	Fit for purpose (specifically fit for mine site)
MSDS	Material Safety Data Sheet
NDT	Non-Destructive testing
OEM	Original equipment manufacturer as specified in section 44 of the *Coal Mining Safety and Health Act 1999* - Designer, manufacturer, importer and supplier.
QA	Quality Assurance
RA	Risk assessment (includes JRA, JSA, SLAM, WRAC, Take 5 etc)
RII	Resources Industry Infrastructure
SHMS	Safety and Health Management System
SOP	Standard Operating Procedure
SSE	Site Senior Executive
TARP	Trigger Action Response Plan
TKPH	Tonne, kilometre per hour (duty cycle calculation or rating)
TMS	Tyre Management System
TNA	Training Needs Analysis
TPMS	Tyre Pressure Monitoring System
TTPMS	Tyre Temperature Pressure Monitoring System
Compatible components	Components that are intended to be assembled as per their design. Components of the same design from different manufacturers may not be compatible.
Incompatible components	Incompatible components are components that are not intended to be assembled together as per their design and are known to create a mismatch (not a matching set). Components that are said to be mismatched: • do not physically fit together correctly; or • can be inadvertently assembled but are not intended by design to be assembled together. This mismatch compromises the integrity of the assembly and can create dangerous situations.
Rim	The assembly on which the tyre is mounted and supported. A typical rim comprises a number of components, e.g., back section, centre section and gutter section (which are welded together to form the rim base) and flanges, bead seat band and lock ring. A rim is mounted to a vehicle or plant by a system of wedges or cleats.
RSHQ	Resources Safety & Health Queensland
Tyre & Rim assembly	Rim plus tyre.
Size (tyre, wheel, rim)	Earthmover is used to mean rims/wheels fitted to earthmoving machinery. Large is used to mean tyres, wheels and rims that cannot be handled safely by manual means and are fitted to trucks, cranes etc. (tyre handlers, or forklifts are needed to handle them). Passenger or light truck are used to mean tyres, wheels and rims that can be manually handled and are fitted to passenger vehicles, light trucks, and machinery
Wheel	A rotating load-carrying member between the tyre and axle. It usually consists of the rim base and the wheel disc/nave plate that is mounted to vehicle or plant by nave plate and studs/nuts.

Term / Acronym	Definition
Wheel assembly	Wheel plus tyre.
Wheel disc / nave plate	Part of the wheel which is the supporting member between the axle or hub and the rim base.

Appendix 2: References

- AS 4457.1 Earth Moving machinery - Off the road wheels, rims and tyres -Maintenance and Repair - Part 1 Wheel assemblies and rim assemblies
- AS 4457.2 Earth Moving machinery - Off the road wheels, rims and tyres- Maintenance and Repair - Part 2 Tyres
- AS 3788 Pressure equipment - In-service inspection
- AS 1271 Safety valves, other valves, liquid level gauges, and other fittings for boilers and unfired pressure vessels
- AS/NZS 1158.3.1 Lighting for roads and public spaces – Pedestrian area (Category P) lighting – Performance and design requirements
- AS/NZS 1680.0 – 2009 Interior lighting – Safe movement
- AS1973 Pneumatic tyres – Passenger car, light truck, and trucks/bus – re-treading and repair
- Safe Work Australia - Guide for split rims December 2015
- Safe Work Australia - General Guide for Industrial Lift Trucks – July 2014
- Safe Work Australia - Forklifts Information Sheet for owners and Operators – July 2014
- WA Department of Mines and Petroleum- Guideline Tyre safety for earth-moving machinery on Western Australian mining operations
- ACARP report 51036 'Fit for purpose' tyre maintenance equipment and management practises for non-earthmover vehicles. Author Dr Tilman Rasche.
- ACARP report C13049 'Tyre Fires and Explosions of Earthmover Tyres' Author Dr Tilman Rasche.
- ACARP report C15046 'Tyre Related Accidents and Incidents - A Study with Recommendations to improve Tyre & Rim Maintenance and Operational Safety of Rubber Tyred Earthmover Equipment' Author Dr Tilman Rasche.
- EMESRT - Design philosophies DP 2 – Tires and rims
- ICMM, Critical Control management Implementation Guide; 2015
- ICMM, Health and safety critical control management good practice guide; 2015
- Riskgate: Tyres; http://www.riskgate.org/

RSHQ Chief Executive Officer's Mining Hazards Database

Safety Notices issued by the Queensland Mines Inspectorate

- Safety Alert 421 "Tyre explosion on rear dump truck following lightning strike" - 16 December 2022.
- Safety Alert 392 "Sudden tyre failure ejects rock shrapnel through a dozer's cabin" - 9 June 2021.
- Safety Alert 389 "Hazards associated with some super large bore inflator adaptors" - 1 April 2021.
- Safety Alert 383 "Tyre explosion following lightning strike" - 23 December 2020
- Safety Bulletin 188 "Mobile Plant Contacting Energised Overhead Powerlines" - 8 September 2020.
- Safety Newsflash "Fatality – Tyre Fitting Mines" - 14 January 2020.
- Safety Bulletin 176 "Lightning strikes on rubber-tyred vehicles" - 27 November 2018.
- Safety Bulletin 164 (version 2) "Circumferential failure of lockrings" - 31 July 2017 and 22 June 2023.
- Safety Alert 334 "Earthmover tyre and rims" - 6 December 2016.
- Safety Alert 287 "Alloy rim cracking and failure" - 25 May 2012.
- Safety Bulletin 118 "Working safely with tyres: highway-style haulage trailer" - 14 May 2012.
- Safety Alert 275 "Tyre air-blast catches three maintenance personnel" - 27 September 2011.

- Safety Bulletin 1 “Earthmover tyre and rim safety” - 28 March 2011.
- Safety Alert 211 “Light vehicle rim cracking” - 18 November 2008.
- Safety Alert 208 “Incorrectly assembled split rims on forklift” - 18 November 2008.
- Safety Bulletin 77 “Earthmover tyre and rim safety” - 25 June 2008.
- Safety Alert 187 “Vehicle/mobile plant support stands” - 18 March 2008.
- Safety Bulletin 70 “Hazards of stored energy” - 8 November 2007.
- Safety Alert 173 “Rubber tyred equipment” - 7 November 2007.
- Safety Alert 138 “Tyre handler clamping fork failure” - 27 October 2005.
- Safety Alert “Fatal injury to prime mover operator as rim assembly fails” - 22 August 2005.
- Safety Bulletin 55 “Vehicles hitting overhead powerlines” - 20 April 2005.
- Safety Alert 107 “Rear hub failure and subsequent fire” - 2 February 2004.
- Safety Alert 83 “Violent tyre rupture on dump truck” - 2 September 2002.
- Safety Alert 29 “Tyre rim assembly blew apart” - 26 July 2000.
- Safety Alert 27 “On-highway quarry truck spare wheel causes fatality” - 12 June 2000.

Safety Bulletins, Alerts and Reports issued by NSW Resources Regulator

- Report into death of Mr Quinton Moore: Report 1 June 2020.
- Tyre falls from forklift: 21 December 2018.
- Worker fatally injured when tyre falls: Information release: 13 November 2018.
- Safety Alert: Tyre exploded during inflation: 12 December 2013.
- Handling earthmoving equipment tyres; Safety Bulletin: 1 June 2010 Mine Safety Report No: SB10-02.
- Vehicle-mobile plant support stands Safety Bulletin: 25 March 2008 Mine Safety Report No: SB08-03.
- Overheated tyres require miners to use self-rescuers: 17 June 2008
- Queensland fatality - Prime mover rim assembly failure: 2 September 2005
- Tyre Safety: 16 June 2005
- Operator killed changing tyre: 31 May 2004
- Queensland fatality during wheel removal: 23 February 2004
- Fitter seriously injured by split rim: 10 February 2001 SA 01-15
- Lightning strikes stationary truck: Mine Safety Report No: SA08-03
- Information release: Worker fatally injured when tyre falls: 13 November 2018

Queensland Coroners’ reports

Queensland Coroners Court inquest findings - https://www.courts.qld.gov.au/courts/coroners-court/findings

- Peter Marshall 2004
- Shane Davis 2005
- Wayne MacDonald 2010

Appendix 3: Risk Assessment Outline

The table below shows the steps and sub steps that should be considered in the development of tyre, wheel & rim SOPs and other supporting procedures.

Step in Operation or Issue	Sub-step
Fitment of tyre to rim or wheel – assembly	Tyre selection and procurement - application
	Loose Tyre inspection prior to fitment
	Tyre preparation
	Rim/wheel & components selection
	Rim/wheel & components inspection and preparation prior to fitment.
	Preparation of the fitment area
	Assessing immediate tyre/rim assembly, and area hazards.
	Preparation of vehicle including park up
	Standing and jacking
	Mounting tyre onto rim or wheel on ground, including inflation
	Removing tyre assembly(s) off vehicle
	Stripping / disassembly assembly (removal and demounting)
	Fitting wheel assembly to vehicle
	Fitting rim assembly to vehicle
	Use of mechanical aids
	Competent people
Hazardous Tyre and Rim conditions ‘Critical hazard’	Potential hot tyre Heat affected
	Potential tyre fire – external
	Potential tyre fire – internal (leading to tyre explosion) Electrical contact incl. lighting strike
	Sidewall bubbles
	Damaged components e.g., rim cracks, bead seat bands, etc.
	Components dislodgement e.g., lockring
	Loose wheel
	Missing wheel nuts/studs. (fasteners)
	Unable to deflate
	Working with chemicals / fumes/solvents - tyre repair materials (buffing liquid, glues)
	Tyre stockpile fire risk – fires in stock area (laydown area)
	Nitrogen (N_2) inflation
Maintenance of Tyre chains, or removal fitment of chains during tyre maintenance.	
Competencies	
Equipment with low hours / low usage	
Water filled/ ballasted/PUR/ insert filled tyres	

Appendix 4: Coroner's Recommendations

Peter Marshall

Coroner's recommendations

Zinifex Century Zinc Mine – Peter Whitoria Marshall 9 February 2004

Recommendation 1 - An analysis of the safety culture at the mine

I recommend that Zinifex Century and REJV engage a competent consultant with an industrial or organisational psychology background to review the safety culture of the operation with a view to better informing management of how safe work practices can be internalised by staff of the mine.

Recommendation 2 - Supervision of autonomous skilled workers

I recommend that the Mines Inspectorate investigate how meaningful supervision can be delivered to a heterogeneous workforce of skilled autonomous workers engaged on a disparate site and that they publish their findings and practical examples applicable to various mining activities.

Recommendation 3 – Continued development of AS 4457

I recommend that the Mines Inspectorate, SIMTARS and industry participants continue with the revision of AS 4457 and that special attention be given to tyre handling, lock ring retention and rim maintenance.

Shane Davis

Coroner's recommendations

Foxleigh Mine – Shane William Davis 7 August 2005

I recommend that:

1. The coal mine operators critically review the effectiveness and implementation of their mine safety and health management system as they are obligated to do under section 41(f) of the *Coal Mine Safety and Health Act 1999*. It is recommended that particular attention be paid to how the mine system controls the activities of contractors and ensures they are carrying out their task in a safe manner.
2. 2.1 That senior site executives of coal mines be required to have a competency such as MNCG1107(a) establish and maintain the mine occupational health and safety management system.

   2.2 The safety and health advisory council consider the range of competencies required for supervisors and persons charged with the development of safety and health management systems.

   2.3 All SSEs of coal mines develop a system to ensure that all supervisors are able to and are effectively applying risk management competencies in the performance of their duties. That consideration be given to amending section 44(6) of the Coal Mining Safety and Health Act 1999 to require that manufacturers and suppliers inform the regulator, as well as their customers, in the event they become aware of the hazardous aspect of, or defect in the equipment that the supplier has supplied to a coal mine.
3. That consideration be given to amending section 44(6) of the *Coal Mining Safety and Health Act 1999* to require that manufacturers and suppliers inform the regulator, as well as their customers, in the event they become aware of the hazardous aspect of, or defect in the equipment that the supplier has supplied to a coal mine.
4. That a body such as the Resources and Infrastructure Skills Counsel develop a suite of competencies for persons providing advice on safety and health management systems in the coal mining industry.
5. 5.1 The earthmoving committee of Standards Australia review the suitability of retaining rim sizes as a limiting factor in determining the applicability of Australian Standard 4457.

   5.2 Standards Australia should review all associated tyre and rim standards and, if necessary, introduce a standard in similar terms to AS5547 which applies to all multi-piece rims irrespective of size and industry application.
6. 6.1 That all coal mines employing contractors create a senior position for the control of contractors. Duties should include monitoring contractors, implementation of the mine safety and health management system including familiarisation and training of the contractor's workers and compliance with the mine safety and health management system.

6.2 This position should be included in accordance with section 55 of the Coal Mining Safety and Health Act 1999 in the management structure of the mine as a senior position and the role and responsibilities of the position should be specified.

7. 7.1 That a system be established by all coal mines to ensure the next of kin of any person involved in a serious or fatal accident can be expeditiously contacted and kept informed of the developing situation. The system should address the name and contact details of the next of kin and be kept current, how the next of kin should be informed and by who, guide on how and under what circumstances the next of kin should be kept informed of developments.

   7.2 That the protocol between the Inspectorate and the Queensland Police Service be reviewed to ensure effective and timely communications between the organisations during the investigation.

And

8. That the Inspectorate liaises with other departments, industry, and professional bodies to ensure that the safety message relating to the hazard of uncontrolled release of stored energy from tyres, particularly when affixed to multi-piece rims and the need for training of those exposed to the hazard is disseminated across all industries and applications of the equipment.

Wayne MacDonald

Coroner's recommendations

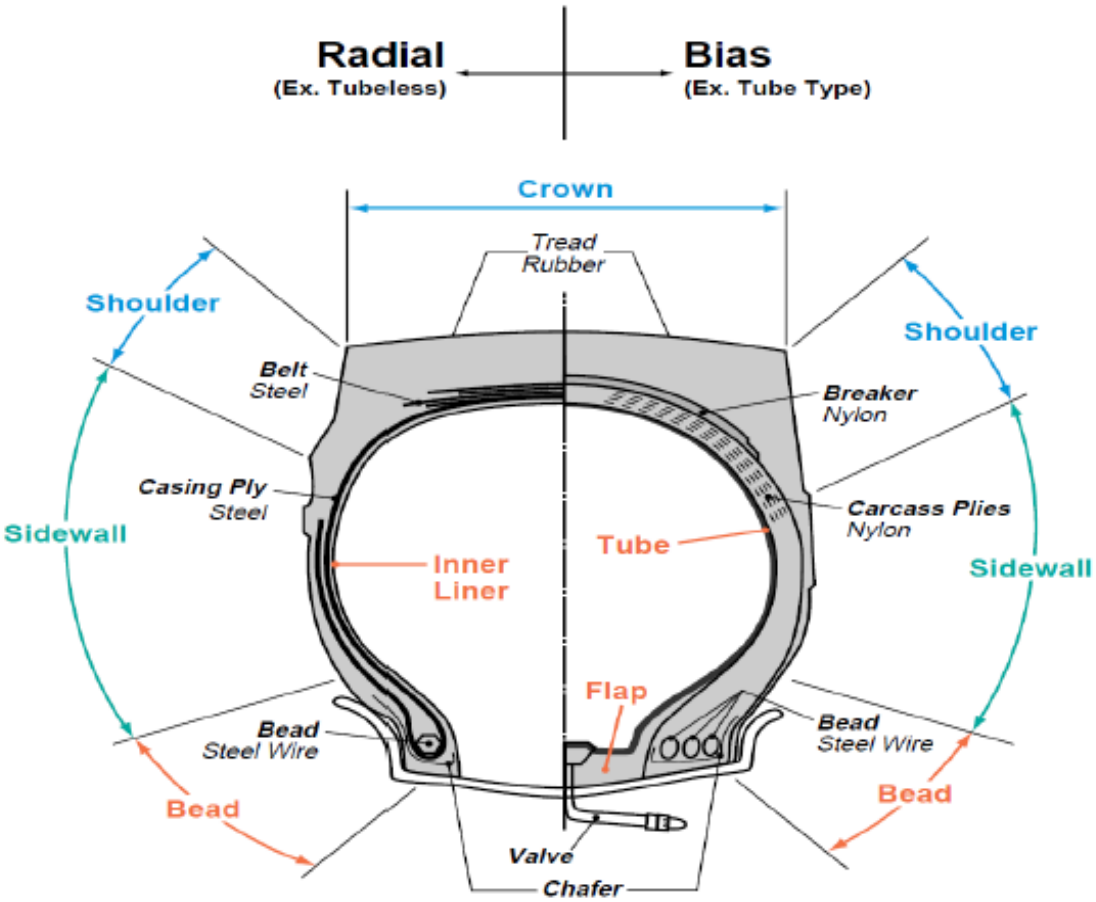
Foxleigh Mine – Wayne MacDonald 18 December 2010

In consideration of the evidence of this case, and for the reasons I have set out above, I recommend the following:

1) That management of mine sites, and their engaged contractors, review all tyre management practices to ensure that tyres on their mine sites are being operated within their specific design parameters applicable for their use. This review needs to occur within three months, and then annually the mine site needs to ensure that compliance is being maintained.
2) That any jack used by an operator has a handle of sufficient length to allow the operator to safely use the jack without the operator being in, or under, the truck or trailer, or within close proximity of the vehicle's tyres whilst jacking occurs.
3) That the industry investigate, and implement within two years, remote, or wireless, tyre pressure sensing equipment to allow operators to monitor tyre pressures from within the cabin of the truck.
4) That until remote or wireless tyre pressure sensing equipment is introduced for these mine site tyres that the practice of tyre tapping should not be continued, and that accurate, calibrated, pressure gauge should be used to check correct tyre inflation whenever operational requirements dictate that pressures are to be checked.
5) That an Australian Standard for up to 24 inch diameter truck tyres be investigated, created, and, if considered appropriate, implemented into law by regulation within a period of two years, and if no Australian Standard is created within two years then a Recognised Standard under Part 5 of the Coal Mining Safety and Health Act 1999 be implemented within one year.
6) That whenever a tyre supplier grants a dispensation from the designed operating parameters of a tyre, that the tyre supplier provide, and receive written acknowledgement of from the customer, an appropriate and formal information package which clearly specifies the approved conditions of operation of that dispensation.
7) That whenever a tyre supplier grants a dispensation which a mine site operator uses, that the equipment's owners and operators incorporate into their written training and operating procedures the specific details of those dispensations.
8) That whenever a tyre manufacturer grants a dispensation from the designed operating parameters of a tyre, that the variations be permanently embossed (alternatively termed 'tyre stamping') on the sidewall of the tyre, and that the embossing be completed in a method which is not readily removable, and remains legible, throughout the tyre's serviceable life.
9) That every tyre, whether new or repaired, undergo integrity testing by its inflation in a suitable tyre inflation cage, to a pressure of 120% of the tyre's recommended minimum cold operational inflation pressure, and then left for 20 minutes to test its integrity, before its pressure is then reduced to its recommended minimum operating pressure before the tyre is then fitted for use.

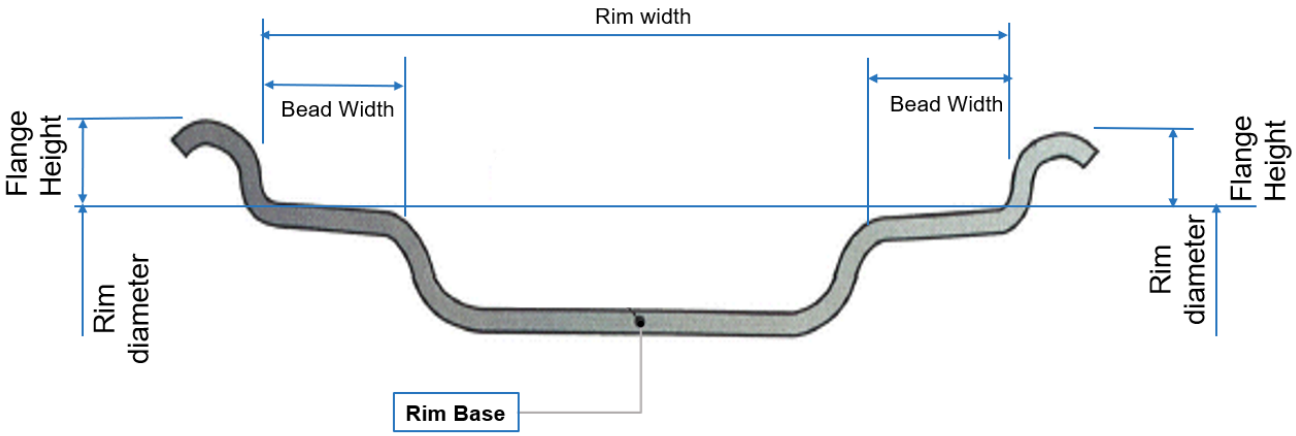
Appendix 5: Tyre, Wheel and Rim Nomenclature

Tyres

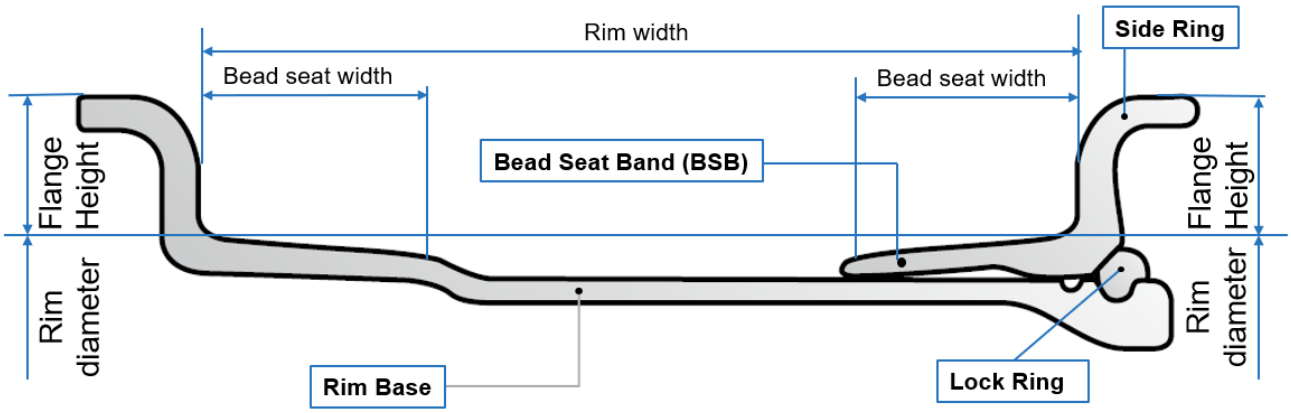


Wheels and Rims

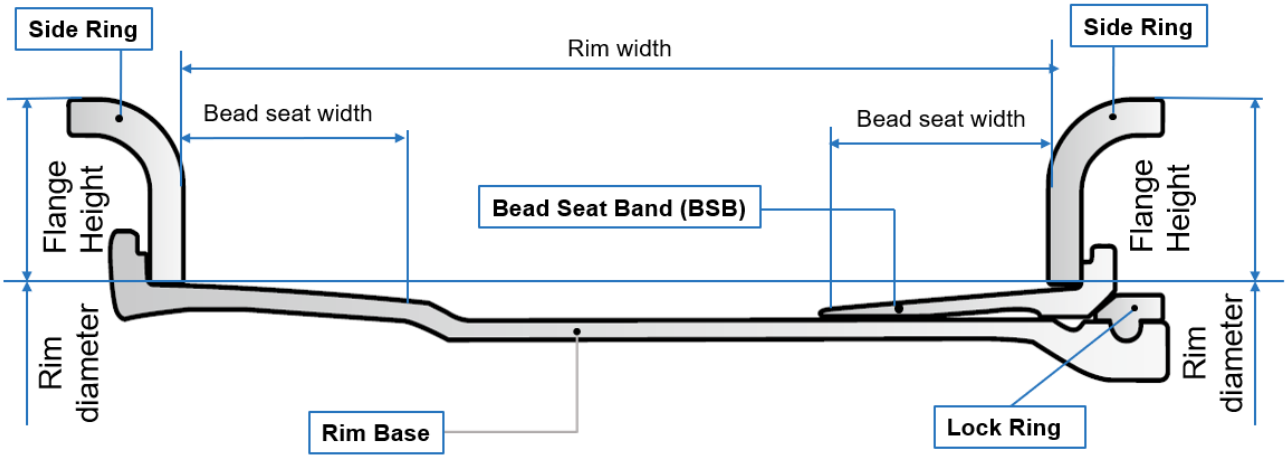
Names and specifications of 1 piece Rim Components



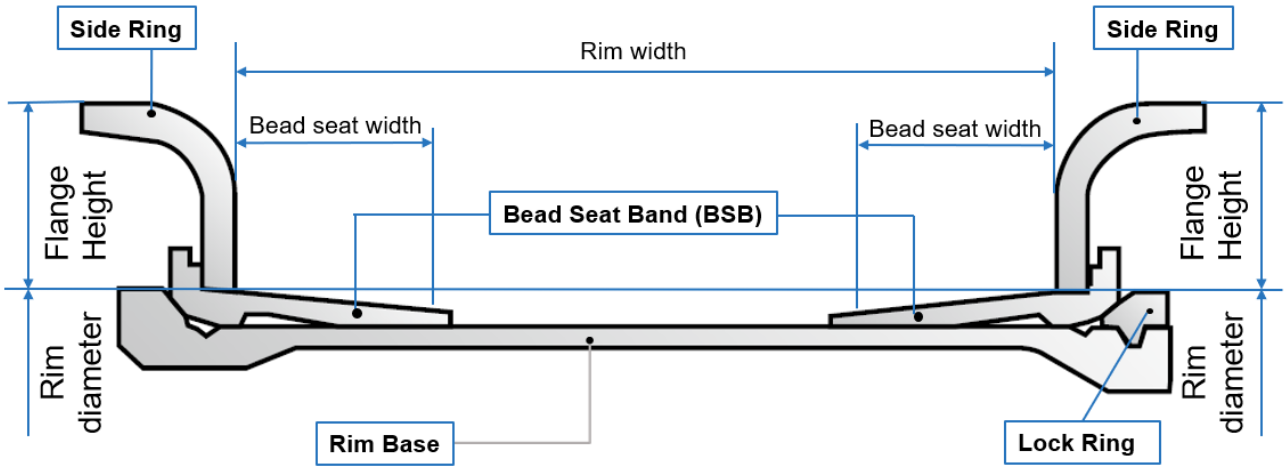
Names and specifications of 3- piece Rim Components



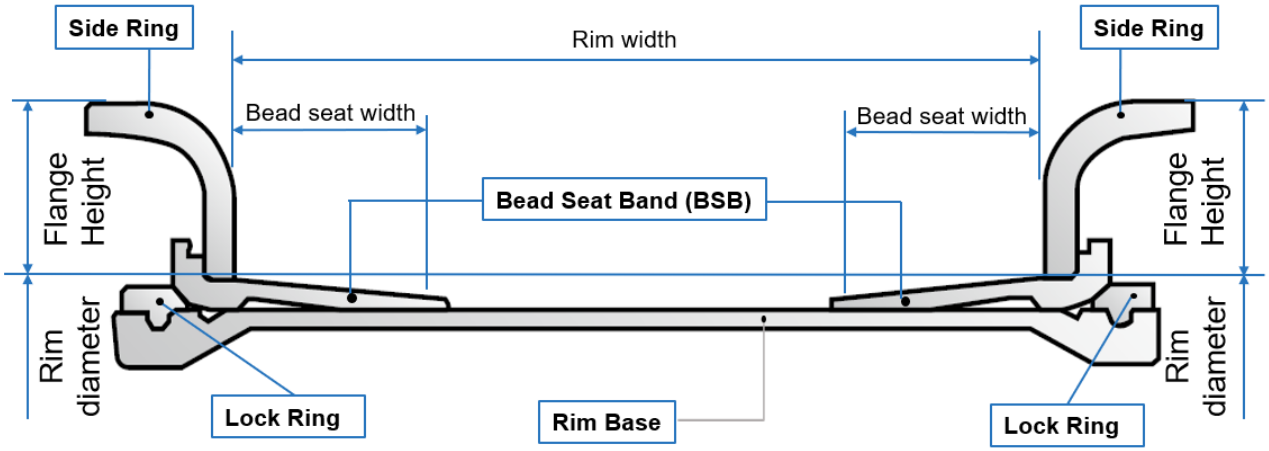
Names and specifications of 5- piece Rim Components



Names and specifications of 6- piece Rim Components



Names and specifications of 7- piece Rim Components



Names and specifications of Split Rim Components