Standard

Infrastructure – Facilities – Plant & Equipment – Specification, Design & Maintenance

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PROUD OPERATOR OF yarra trams

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1 PURPOSE

The purpose of this standard is to define the minimum requirements for function and performance of Plant and Equipment items applicable to procurement, maintenance or refurbishment within Yarra Trams.

2 SCOPE

The scope of this standard is Plant, Equipment and Vehicles used within Yarra Trams.

Plant and Equipment within Yarra Trams represents a wide and varied array of tools, maintenance and lifting equipment as well as operational support equipment.

This standard covers Plant, Equipment and Vehicle assets used within Yarra Trams for the following activities:

- Setup of the tram, road, and equipment in preparation for tram maintenance, including equipment to lift and support trams, tram systems/components, and equipment to retract overhead trolley wire and prepare the road for tram maintenance activities, primarily on the roof of the tram.
- Preparation and maintenance of the tram and tram systems, including tram preparation equipment such as sand machines, and tram washes; automatic wheel measurement and wheel lathes, hydraulic presses for wheel builds and component assembly.
- Ensuring safety of personnel working in tram maintenance sheds involving overhead gantry access, in confined spaces, and for working above waist height.
- Aids tram maintenance and workshop activities, material handling, material storage, cleaning equipment for parts, shop floor and depot.
- Movement of trams (or sections of trams), bogies, equipment within depots (and associated workshops), and couple trams for towing.
- Vehicles used for track/overhead maintenance, incident response and recovery, tram recovery, and personnel transport.

Design and specification of plant and equipment in accordance with this Standard will ensure that appropriate consideration is given to ensuring safety, engineering and business objectives are met.

3 COMPLIANCE

This Standard shall be fully complied with. Deviation from this standard is only permitted when a waiver has been sought and approved by Yarra Trams.

'Shall' statements are mandatory in the context of compliance with requirements stipulated in this Standard.

'Should' statements are considerations in the context of compliance with requirements stipulated in this standard.

'Information' statements provide additional content for clarification purposes only and are not requirements in the context of compliance with this Standard.

'So far as is reasonably practicable' statements must at a minimum result in the provision of a technical risk assessment including proposed list of design controls to demonstrate compliance to this Standard.

Any third party or contractor undertaking activities on Yarra Trams assets shall complete and return a compliance schedule for this Standard. Assessment of compliance shall be provided for each requirement, defined by one of three permissible responses:

- Compliant;
- Partially Compliant;
- Non-Compliant.

Absolute requirements in this standard are defined within square brackets i.e. [AM 4000mm +/-1%]. Absolute values shall not be accepted without prior consultation and acceptance by Yarra Trams. Deviation beyond Absolute values shall not be accepted under any circumstances.

4 REQUIREMENTS

4.1 General

4.1.1 General Requirements

4.1.1.1 Plant and equipment introduced into service within Yarra Trams from the time of publication of this Standard shall meet the requirements set out in the relevant section of this Standard.

4.1.1.2 Plant and Equipment requirements listed in this standard but without complete text, shall be taken to require compliance to the clauses in this Section 4.1. However, no additional compliance requirements exist for these items. Additional requirements would be in the form of specifications for the specific application for which these items will be used.

4.1.1.3 Design and selection of new or replacement plant and equipment introduced into service from the time of publication of this Standard shall meet the minimum specifications and standards described within each clause.

4.1.1.4 Safety of all new or replacement plant and equipment designed and selected for use within Yarra Trams from the time of publication of this Standard shall comply with all relevant and applicable requirements of the series *AS/NZS 4024 – Safety of Machinery*, according to the equipment's category.

4.1.1.5 Installation wiring for the installation of new plant and equipment shall comply with the requirements of *AS/NZS 3000 - Electrical Installations "Wiring Rules"*.

4.1.1.6 Wiring within newly installed plant and equipment shall comply with the requirements of *AS/NZS 3000 - Electrical Installations "Wiring Rules".*

4.1.1.7 Wiring within newly installed switchboards and control cabinets for the installation of new plant and equipment shall comply with the requirements of *AS/NZS 3000 - Electrical Installations "Wiring Rules".*

4.1.1.8 Internal design of new switch boards and control cabinets installed for the installation of new plant and equipment shall comply with *AS/NZS 3439 - Low-voltage switchgear and control gear assemblies*.

4.2 Tram Support and Setup

4.2.1 Lifting Equipment

Information: Lifting Equipment comprises equipment types that are used to lift or assist lifting movements at depots, including E-Gate.

4.2.1.1 Articulated Mobile Crane

Information: Articulated Mobile Crane is currently a "Franna" branded Mobile Crane that is used for lifting objects such as rail. It is used at E-Gate and on the network during track renewals, track fabrication works etc.

4.2.1.1.1 For the purchase of new articulated mobile cranes and the refurbishment of existing articulated mobile cranes, the hoists, winches and crane sections of the vehicle shall be compliant to *AS 1418.5 - Cranes, Hoists and Winches – Mobile Cranes*.

4.2.1.2 Bogie Platform

Information: Bogie Platform consists of bogie platform rotisserie, which is used to rotate bogies during bogies exchanges.

4.2.1.2.1 New bogie platforms designed and installed to depots shall comply with the requirements of *AS/NZS 2693 – Vehicle Jacks.*

4.2.1.3 Column Jacking Pads

Information: Column Jacking Pads are flat plates welded to supports to allow lifting of tram body using a portable jack.

4.2.1.3.1 For the replacement of existing Column Jacking Pads for existing Column Jacks, these shall be installed and certified by a competent person.

4.2.1.3.2 For the installation of new Column Jacking Pads for existing Column Jacks, these shall be installed and certified by a competent person.

4.2.1.3.3 For the installation of new Column Jacking Pads to suit newly acquired Column Jacks, these shall be designed, installed and certified by a competent person or persons to accommodate any variation from the design of existing pads.

4.2.1.3.4 For the installation of new Column Jacking Pads to accommodate altered fleet parameters, Column Jacking Pads shall be designed by a competent person to accommodate any variation to the requirements for the existing design.

4.2.1.4 Crane

Information: Cranes are used for lifting movements. They include overhead crane, floor crane, jib crane, gantry crane.

4.2.1.4.1 Determination of Crane Loading for the installation of new cranes and the refurbishment of existing cranes shall be carried out using the methods described in *AS 1418 - Cranes, Hoists and Winches* for each crane application.

4.2.1.4.2 Design of cranes for use within Yarra Trams Depots shall be compliant to *AS 1418 – Cranes, Hoists and Winches*, upon determination of the cranes application and loading as described by 4.2.1.4.1 in this Standard.

4.2.1.4.3 Selection and safe installation of cranes for use within Yarra Trams Depots shall be in accordance with the requirements of *AS 2550 – Cranes – Safe Use*.

4.2.1.4.4 New cranes installed to new or existing positions upon detection of design load exceedance shall not continue to lift.

4.2.1.4.5 On design load exceedance, new cranes shall provide feedback of the design load exceedance to the crane operator.

4.2.1.4.6 New cranes designed and installed to depots shall be capable of being integrated with the interlocking safety systems used within Yarra Trams as defined at clause 4.4.1 of this Standard.

4.2.1.5 Chains and Slings

Information: Chains and Slings are typically used by cranes for lifting objects.

4.2.1.5.1 For the purchase of all slings and chains; these shall comply to the requirements of the relevant Australian Standard for that type of sling or chain as listed in Table 1 below; or an applicable standard to a new type of chain or sling.

Table 1 - List of standards for lifting gears used to assist lifting of heavy materials and equipment.

Lifting Gears	Applicable Standards
Chain Slings T(80) and V(100):	AS 3751 – Chain Slings for Lifting Purposes-Grade T(80) and V(100)
Chain Slings:	AS 3775 – Chain Slings
Fibre Rope Slings:	AS 1380 – Fibre Rope Slings
Flat wire coil slings:	AS 1438 – Wire-Coil Flat Slings
WIRE Rope Slings:	AS 1666 – Wire Rope Slings
Round Slings – Synthetic Flat-Web:	AS 3585 – Synthetic Flat-Web Round Slings
Round Slings:	AS 4497 – Round Slings

4.2.1.5.2 Any slings determined by a competent person to be damaged shall lead to replacement of the sling with replacement complying to this Standard.

4.2.1.6 Drop Table

Information: Drop Table is used for bogies exchanges, whereby the bogie is released on to the table for safe movement from underneath the tram. Located at Southbank Depot.

Installed Drop Tables are lead-screw operated.

4.2.1.6.1 New drop tables designed and installed to depots shall comply with the requirements of *AS/NZS 2693 – Vehicle Jacks.*

4.2.1.6.2 New drop tables designed and installed to depots shall be capable of being integrated with the interlocking safety systems used within Yarra Trams as defined at clause 4.4.1 of this Standard.

4.2.1.7 Door and Window Carriers

Information: Door and Window Carriers are equipment that is used to transport doors and windows of trams using passive suction cups to hold the component. These units are hydraulically operated for lifting.

4.2.1.7.1 Lifting devices used for the transport of doors and windows to be fitted to trams shall comply with *AS 4991 – Lifting Devices*.

4.2.1.8 Forklift Lifting Attachments

Information: Forklift Lifting Attachments comprise of various attachments used in specialist forklift lifting actions.

4.2.1.8.1 Forklift attachments designed for lifting activities shall be designed and certified by a competent person prior to introduction of the attachment into service.

4.2.1.8.2 Forklift attachments designed for lifting activities shall provide permanent, clear and unambiguous Safe Working Load (SWL) limits visible on the attachment.

4.2.1.8.3 Where forklift attachments are powered either electrically or hydraulically; such designs shall also comply with applicable standards for safe operation, electrical safety and standards as well as hydraulic safety and standards.

4.2.1.9 Hydraulic Lift Table

Information: Hydraulic Lift Table comprises of fixed or mobile lifting tables that are primarily used in depot pits to lift heavy components and equipment.

4.2.1.9.1 New hydraulic lift tables designed and installed or provided to depots shall comply with the requirements of *AS/NZS 2693 – Vehicle Jacks.*

4.2.1.10 Jacking System

Information: Jacking System comprises of in-ground lifting jacks used to lift trams off the rails over the maintenance pits.

4.2.1.10.1 Jacks designed for the lifting of trams over maintenance pits shall be compliant to *AS/NZS 2693 – Vehicle Jacks*.

4.2.1.10.2 Jacks designed or installed for the lifting of trams over maintenance pits shall be synchronised to ensure the tram is level whilst the tram is raised.

4.2.1.10.3 Jacks designed or installed for the lifting of trams over maintenance pits shall ensure that the tram is unable to roll or move in an uncontrolled fashion during the lifting operation.

4.2.1.10.4 Jacks designed or installed for the lifting of trams over maintenance pits shall provide an unique visual and audible warning during operation to warn personnel in proximity that the tram is being raised or lowered.

4.2.1.11 Tram and Bogie Lifting Jack

Information: Tram and Bogie Lifting Jacks comprises of above ground tram lifting jacks.

4.2.1.11.1 New tram and bogie lifting jacks designed and provided to depots shall comply with the requirements of *AS/NZS 2693 – Vehicle Jacks.*

4.2.1.12 Tram Lifting Attachments

Information: Tram Lifting Attachments comprises of attachments such as the 'Z Bracket' used to assist in tram lifting.

4.2.1.12.1 Purpose designed lifting attachments shall comply with the requirements of *AS 4991 - Lifting Devices.*

4.2.1.12.2 Tram lifting brackets are required for certain of the tram class and therefore shall be designed for the singular purpose of adapting lifting jacks to the specific tram class being maintained.

4.2.2 Stands

Information: Stands comprise of tram, component, and equipment stands for support during lifting actions. They are used to support trams, bogies, and other heavy componentry to aid maintenance.

4.2.2.1.1 All new and replacement stands designed for the support of Trams, Tram equipment and other heavy components shall be compliant to *AS/NZS 2538 Vehicle Support Stands*.

4.2.2.1.2 All new and replacement stands designed for the support of Trams, Tram equipment and other heavy components shall be designed and certified by a competent person.

4.2.2.1.3 All new and replacement stands designed for the support of Trams, Tram equipment and other heavy components shall provide permanent, clear and unambiguous Safe Working Load (SWL) limits visible on the frame.

4.2.2.2 Bogie and other Tram Stands

Information: Bogie and other Tram Stands comprises of all support stands for tram maintenance.

4.2.2.2.1 For the design or selection of Bogie and other Tram Stands, the requirements of the sub clauses to clause 4.1.3 above shall be complied with.

4.2.2.3 Citadis Bogie Stand

Information: Citadis Bogie Stands comprises of all stands to support Citadis tram class bogies.

4.2.2.3.1 For the design or selection of Citadis Bogie Stands, the requirements of the sub clauses to clause 4.1.3 above shall be complied with.

4.2.2.4 Combino Bogie Stand

Information: Combino Bogie Stands comprises of all stands to support Combino tram class bogies.

4.2.2.4.1 For the design or selection of Combino Bogie Stands, the requirements of the sub clauses to clause 4.2.2 above shall be complied with.

4.2.2.5 Lifting Frames

Information: Lifting frame comprises of frame attachments that are used in lifting tram equipment such as air-conditioners, inverters, battery cradles, etc.

4.2.2.5.1 All new and replacement lifting frames designed for the lifting of equipment shall be compliant to *AS 4991 – Lifting Devices*.

4.2.2.5.2 All new and replacement lifting frames designed for the lifting of equipment shall be designed and certified by a competent person.

4.2.2.5.3 All new and replacement lifting frames designed for lifting of equipment shall provide permanent, clear and unambiguous Safe Working Load (SWL) limits visible on the frame.

4.2.2.6 Transmission Jack

Information: Transmission Jack comprises of mobile jacks that are used in tram maintenance activities that require raising and lowering of heavy tram components from under the tram.

4.2.2.6.1 Transmission Jacks shall be designed by a competent person to comply with *AS 2615 - Hydraulic Trolley Jacks* with safe working load defined for the application within an equipment application specification.

4.2.2.6.2 Transmission lifting jigs designed for the lifting of heavy tram components under trams shall be designed in compliance to *AS 4991 – Lifting Devices*

4.2.2.7 Trolley Jack

Information: Trolley Jack comprises of mobile jacks used for lifting heavy components in tram maintenance.

4.2.2.7.1 Trolley jacks purchased for the lifting of heavy components with respect to tram maintenance shall be compliant with the requirements of *AS 2615 - Hydraulic Trolley Jacks*.

4.2.2.8 Tailgate Loader

Information: Tailgate Loader comprises of auxiliary equipment at the back of a heavy/commercial vehicle used to assist in loading/unloading, including but not limited to tailboards platform lifts and tray mounted cranes of any type and configuration.

4.2.2.8.1 Vehicle mounted Tailgate Loaders shall be designed and installed to comply with AS 1418.8 - Cranes, Hoists and Winches – Special purpose appliances.

4.2.2.8.2 All vehicle modifications required to accommodate the installation of a tailgate loader shall comply with Australian Design Rules and other regulations, as provided in *Vehicles Standards Bulletin 6 (VSB6) Section R – Vehicle Mounted Lifting Systems*.

4.2.2.8.3 Vehicle loading limits and mass distribution provided by manufacturers of the vehicles to be modified to accept tailgate loaders shall be observed in design of the loading device.

4.2.2.8.4 The additional mass imposed by the tailgate loader shall be taken into account during vehicle operations so that the vehicle manufacturer's loading limits are not exceeded.

4.2.3 Retractable Overhead System

Information: Retractable Overhead provides capability to retract or in some way remove trolley wire, thereby removing obstructions above the tram, during maintenance activities. This allows the tram to be isolated from the overhead trolley wire enabling maintenance work on the roof of the tram; equipment to be safely removed from the roof of the tram; and maintenance of the pantograph e.g. checking full height functionality.

Equipment used to remove obstructions above a tram undergoing maintenance, such as the retractable overhead system mentioned here, does not specify the equipment, access control or interlocking required in providing safe access by personnel to tram roof assets; the requirements for which are defined elsewhere in this Standard.

4.2.3.1 A system providing safe, unobstructed access for the maintenance of assets located upon the roof of Trams shall be provided.

4.2.3.2 A means of providing safe access to the Tram roof without the risk of interference or electrocution from energised or de-energised overhead power supply shall be provided.

4.2.3.3 Where requirement 4.2.2.1 is provided by the installation of a retractable type of overhead power supply, similar to that presently installed at New Preston Depot; the design shall be capable of meeting the required deployment time and number of operational cycles.

4.2.3.4 As a lifting device, where requirement 4.2.2.1 is provided by the installation of a retractable type of overhead power supply; the design shall be compliant to *AS 1418 - Cranes, Hoists and Winches*.

4.2.3.5 As a lifting device, where requirement 4.2.2.1 is provided by the installation of a retractable type of overhead power supply; the equipment shall be selected and installed in compliance with the requirements of *AS 2550 – Cranes – Safe Use.*

4.2.3.6 Equipment installed to remove obstructions above a tram under maintenance shall integrate with the equipment interlocking system defined at 4.4.1 in this Standard.

4.2.3.7 Equipment installed to remove obstructions above a tram under maintenance shall provide unambiguous warning of its impending start and during its operation using at least, but not limited to, visual and audible warning methods compliant with *AS/NZS 4024.1201 – Safety of machinery – General principles for design – Risk assessment and risk reduction*.

4.3 Tram Maintenance

4.3.1 Hydraulic Press

Information: Hydraulic Press consists of hydraulic powered equipment used for assembly and removal of tram equipment and components.

The Sub Asset Types are

- *Bochum Press – Press used to build tram wheels in A, B, and Z3 tram classes (high floor trams). It assembles the tyre, wheel, and hub.*
- *Horizontal Press – Press used for dismantling a wheel\tyre assembly in A, B, and Z3 tram classes.*

- *Larzep Vertical Press – Press used to build wheels for C class trams. Note that wheels on E and D class trams do not need a press.*
- *Vertical Press – Press used for general tram components such as bearings etc.*

4.3.1.1 For the purchase of new or the refurbishment and upgrade of existing; safe operation, guarding and interlocks for Hydraulic Presses shall comply with shall *AS 1219 – Power Presses-Safety Requirements*.

4.3.1.2 Selection of hydraulic presses shall consider the purpose for the press so that the best appropriate equipment is installed.

4.3.1.3 Presses intended for general workshop use shall, in consultation with the affected teams, consider all activities within the maintenance and projects areas requiring the press, to ensure that the selected equipment is sized to carry out all such operations.

4.3.2 Sand Machine

Information: Sand Machine are used to store and / or deliver sand to trams through either a fixed installation or mobile dispensers.

4.3.2.1 Mobile sand replenishment systems shall be able to move between stabled trams. Presently, the minimum distance between stabled trams is 600mm.

4.3.2.2 Mobile sand replenishment units shall be of a design to fit under the dispensing equipment associated with the present sand storage silos.

4.3.2.3 Mobile sand replenishment units shall have visual and audible warns to alert personnel to the machine's presence.

4.3.2.4 Mobile sand replenishment units shall have a fill rate commensurate with efficient production.

4.3.2.5 Silos used to dispense sand to the mobile sand replenishment units, shall have a fill rate commensurate with efficient production.

4.3.2.6 Mobile sand replenishment units shall be capable of receiving sand replenishment at a fill rate commensurate with the output of the replenishment silo.

4.3.2.7 Fixed sand replenishment systems shall be capable of isolating each zone from sand and all energy sources in the event of a loss of containment.

4.3.2.8 Fixed sand replenishment units shall have a fill rate commensurate with efficient production.

4.3.2.9 All sand replenishment units, including dispensing silos, shall have silica mitigation systems to reduce airborne silica below the Australian exposure standard which requires a concentration less than 0.1 mg/m3 in an 8-hour day.

4.3.2.10 All sand replenishment units shall be capable of dispensing all grades of sand applied to each tram class.

4.3.2.11 All sand replenishment units shall prevent moisture from entering the sand during storage and dispensing operations so that the sand is not wet upon replenishing the tram.

4.3.3 Tram Wash

Information: Tram Wash consists of automatic tram wash equipment used to wash the exterior of trams. They detect the class of tram and automatically adjust the wash profile.

There are two automatic tram washes – Christ Tram Wash at Southbank Depot, and Italia Tram Wash at New Preston Depot.

4.3.3.1 Effluent resulting from the washing of trams shall consider the capacity and requirements of the trade waste treatment equipment prior to discharge to the depot waste treatment system.

4.3.3.2 The Tram wash shall be capable of using detergents which do not harm the environment.

4.3.3.3 Emergency shut off shall be provided at each access point to the Tram wash

4.3.3.4 Unambiguous visual and audible warning systems complaint with *AS/NZS 4024.1201 – Safety of machinery – General principles for design – Risk assessment and risk reduction* shall be provided to alert personnel when the Tram wash is in use.

4.3.3.5 Signage shall comply with the internal Facilities Depots standard.

4.3.3.6 Line marking unrelated to tram control shall comply with internal standard Facilities Depots standard

4.3.3.7 Tram control road marking shall comply with internal standard for signaling.

4.3.3.8 The Tram wash shall be capable of washing the entire tram; including, but not limited to the front, back and sides.

4.3.3.9 The Tram wash shall be able to identify the class of Tram presented for wash and adjust the wash program accordingly, SFAIRP.

4.3.3.10 The Tram wash shall be capable of safe operation at all times of the day (24 hours).

4.3.3.11 Signaling of Tram movements shall comply with the internal signaling standard for visibility of operational signals (“Stop”, “Go”, etc.).

4.3.3.12 The Tram wash shall mitigate inadvertent human contact with high pressure water and detergents.

4.3.3.13 The Tram wash shall be within an enclosure designed to reduce the effect of wind drift of water and detergents.

4.3.3.14 Where fitted with auxiliary pressure washers, these shall have individual isolation from the main Tram wash.

4.3.3.15 Dual vehicle movement shall be prevented, SFAIRP. Only Trams shall be able to access the Tram wash facility.

4.3.3.16 The Tram wash shall prevent damage to the tram or the tram wash components upon tram wash failure by ensuring that the system fails safely and that all equipment of the Tram wash is retracted prior to allowing the Tram to exit the Tram wash enclosure.

4.3.4 Wheel Lathe

Information: The Wheel Lathe is an under-floor wheel lathe system used to machine wheels and restore acceptable wheel profile. There are two under floor wheel lathes – at Southbank Depot and New Preston Depot. They are different models, but the same manufacturer, Hegenscheidt.

4.3.4.1 Area surrounding the Wheel Lathe shall exclude access by unauthorised personnel.

4.3.4.2 Area surrounding the Wheel Lathe shall have a clearly defined operation zone.

4.3.4.3 The Wheel Lathe control system shall facilitate remote fault diagnosis capability.

4.3.4.4 Where equipment is located remotely from the main workshop, duress alarm, estop monitoring and/or a means of communication with the shift supervisor or manager shall be provided.

4.3.4.5 A means of swarf removal shall be provided to prevent build up of swarf in the operational area.

4.3.4.6 Control system support shall be provided, to prevent obsolescence, in line with the required design life stipulated within any purchase arrangement.

4.3.4.7 Lighting of the work area shall comply with the requirements of *AS/NZS 1680.2 – Interior lighting – Industrial tasks and processes*

4.3.4.8 In addition to the requirements of AS/NZS 3000 already mandated by this Standard, specific consideration of the electrical installation shall protect them from the aggressive environment being; hot steel.

4.3.4.9 Air quality shall meet current requirements and regulations for workplace air quality.

4.3.5 Wheel Measuring

Information: Wheel Measuring System is integrated into the track outside Southbank and Preston Depots to automatically measure the profile and other characteristics of wheels on trams passing over the system.

The information is used to detect wheels that require re-profiling during the tram's 10K service.

4.3.5.1 Measuring instruments shall comply with applicable standards and regulations for the class of measuring instrument used in the design of a wheel measuring system.

4.3.5.2 Wheel dimensions shall be transmitted to internal Yarra Trams systems for monitoring and the trigger of action on the basis of the measured parameters.

4.4 Personnel Safety

4.4.1 Interlock Safety Systems

Information: Interlock Safety Systems comprises of the interlocking key system that is used in the interlocking of bollards, overhead gantry gates, and certain cranes (e.g. cranes used on maintenance roads with energised overhead). It ensures that maintenance personnel are not able to access overhead gantries and operate cranes unless they are de-energised and safe.

4.4.1.1 Interlocking Safety Systems shall be implemented for all plant and equipment requiring de-energising prior to access by personnel.

4.4.1.2 Interlocking Safety Systems shall comply with the general requirements of *AS/NZS 4024 – Safety of Machinery*, with specific reference to *AS/NZS 4024.1603 – Design of controls, interlocks and guards – Prevention of unexpected start-up.*

4.4.1.3 Interlocking Safety Systems shall prevent access to open voids such as may be created by the absence of a tram under an overhead gantry, platform or walkway intended to provide personnel with access to the roof of tram beneath it.

4.4.2 Confined Space Equipment

Information: Confined Space Equipment comprises of equipment used in confined spaces for both safe working and rescue - oxygen rebreather escape set; multi-gas detector; confined space retrieval loops; tripods spreader bars, blower fan etc.

Presently, this equipment is used whilst servicing the below ground Jacking System at New Preston Depot.

4.4.2.1 Equipment used for safe access to a Confined Space shall be compliant to the requirements of *AS 2865 – Safe working in a confined space*, with attention given to recommendations for safety equipment standards to be applied to safe work and rescue equipment.

4.4.2.2 The recommendations in *AS 2865 – Safe working in a confined space* are informative, however, these shall be used by a competent person as guidance to equipment selection.

4.4.3 Static Line Equipment

Information: Static Line Equipment comprises of safety and rescue equipment as stated below.

- *Safety equipment for staff working at heights and where there is a risk of fall. It contains static line, line anchor points, intermediate brackets, harnesses, and fall arresters (Type 2) to support workers in the case of a fall while working at heights.*
- *Rescue equipment to rescue workers in the event of a fall whilst using a static line.*

4.4.3.1 Static line and associated equipment purchased and installed for use as part of a fall arrest system shall be compliant to *AS/NZS 1891 – Industrial fall-arrest systems and devices*.

4.4.4 Depot Scaffolds, Platforms and Ladders

Information: Equipment used for working above waist height, comprising of scaffolds, platforms, and ladders used for access above ground. Primarily used in tram maintenance workshops.

4.4.4.1 Scaffolds and platforms constructed for one-off use or provided to be used in various places within depots shall comply with the requirements of *AS/NZS 1576 – Scaffolding*.

4.4.4.2 Ladders used within depots shall be selected based upon the requirements of *AS/NZS 1892.5 – Portable ladders Selection, safe use and care.*

4.4.4.3 Fixed platforms and walkways, along with their fixed access ladders and stairways, intended to provide safe access to assets on the roof of a tram shall be designed to comply with the

requirements of *AS 1657 – Fixed platforms, walkways, stairways and ladders – Design, construction and installation.*

4.4.4.4 Fixed platforms and walkways providing the capability for personnel to alight the platform onto the roof of the tram under maintenance shall provide access control that is interlocked using the Interlocking Safety Systems requirements defined in section 4.4.1 in this Standard.

4.4.4.5 Gaps between access points to the roof of the tram from platforms or walkways and the roof of the tram shall be mitigated to prevent personnel from tripping or from getting limbs caught between the tram and the platform or walkway.

4.4.4.6 Open voids created when a tram is present below a platform or walkway, intended to provide access to the roof of the tram, shall be mitigated to prevent falls by personnel working on the roof of the tram.

Information: An example of a void created in the situation above is where the tram is present with the gaps between platforms and tram being mitigated; voids may occur at either end of the tram.

4.4.4.7 Fixed platform and walkway systems intended to provide personnel with access to the roof of trams for normal maintenance and operational activities shall provide fall prevention such that the use of harnesses and fall arrest equipment is not required.

4.5 Ancillary Equipment

4.5.1 Battery Maintenance Equipment

Information: Units used as chargers to charge tram batteries

4.5.1.1 Battery Charging Units

Information: Units used as chargers to charge tram batteries

4.5.1.2 Battery Filling Units

Information: Units used to fill battery cells with water

4.5.2 Cleaning Equipment

4.5.2.1 Parts Washer – All Types

Information: All types of automatic parts washers used for degreasing of parts and components removed during tram service

4.5.2.2 Steam Cleaner

Information: Steam Cleaners are the manually operated hot water pressure washers for tram components

4.5.3 Compressed Air System

4.5.3.1.1 Hoses and hose fittings used with the compressed air system shall comply with the requirements and selection criteria described in *AS/NZS 2554 – Hose and hose assemblies for air*.

4.5.3.2 Air Receiver

Information: Air Receivers are air storage tanks that capture air from compressors

4.5.3.2.1 Air Receivers designed or purchased for use in the compressed air systems in and around depots shall comply with the requirements of *AS 1210 – Internal Pressure Vessel Design*.

4.5.3.3 Compressor

Information: Air Compressors used for the supply of high-pressure workshop air

4.5.3.3.1 The installation of Air Compressors purchased for use with all compressed air systems used in and around depots shall comply with *AS 3892 – Pressure Equipment – Installation*.

4.5.4 Dust and Fume Extraction Units

Information: Fixed and portable dust and fume extraction units used in the workshop, for example welding bays.

4.5.5 Oil and Grease Systems

4.5.5.1 Flushing Rig

Information: Mobile flushing rig used in flushing hydraulic lines, brake lines etc.

4.5.5.2 Oil Injection Machine

Information: Oil injection machine is mobile equipment used to assemble and disassemble wheels on tram axles

4.5.5.3 Oil/Grease Reticulation System

Information: Fixed lines for distribution of oil and grease to oil and grease stations

4.5.6 Paint and Spray Booth Equipment

Information: Equipment for application of air pressurised paint to tram components, trams etc.

4.5.6.1 Design of new and refurbishment of existing spray booths shall comply with *AS/NZS 4114.1:2003 – Spray painting booths, designated spray-painting areas and paint mixing rooms – Design, construction and testing*.

4.5.6.2 Design of new and refurbishment of existing spray booths shall have effective exhaust capture and filtration systems.

4.5.6.3 Design of new and refurbishment of existing spray booths shall, based upon recommendations by Safe Work Australia in their publication *Spray Painting and Powder Coating Code of Practice*, be able to maintain an average air flow rate (measured when the booth is empty) of at least:

- 0.3 m/s for full down draught booths
- 0.4 m/s for electrostatic spray painting booths
- 0.5 m/s for any other booth.

4.5.7 Sweeper

Information: Sweeping equipment at a depot to sweep pavement and shop floor areas.

4.5.7.1 Powered sweepers shall provide unambiguous warning of its impending start and during its operation using at least, but not limited to, visual and audible warning methods compliant with

AS/NZS 4024.1201 – Safety of machinery – General principles for design – Risk assessment and risk reduction.

4.5.8 Material Handling and Storage

4.5.8.1 Forklift

Information: Forklifts used for transport of heavy equipment within the workshop

4.5.8.1.1 New forklifts purchased for use in depots shall comply with *AS 2359.1 – Powered Industrial Truck – General Requirements*.

4.5.8.1.2 New forklifts purchased for use in depots shall be sized in mass lifting limit and reach to suit the tasks expected for the forklift in its normal area of operations.

4.5.8.1.3 Consideration to the constraints of the area in which the forklift will normally operate shall influence the selected configuration of new forklifts purchased for use in depots.

4.5.8.1.4 Forklifts shall provide unambiguous warning of its impending start and during its operation using at least, but not limited to, visual and audible warning methods compliant with *AS/NZS 4024.1201 – Safety of machinery – General principles for design – Risk assessment and risk reduction*.

4.5.8.2 Pallet Lifting Stations

Information: Pallet Lifting Stations are used to lift pallets in depot workshops

4.5.8.2.1 Pallet Lifting Stations purchased for lifting of pallets within depots and depot workshops shall provide permanent, clear and unambiguous Safe Working Load (SWL) limits visible on the equipment.

4.5.8.2.2 Pallet Lifting Stations shall provide unambiguous warning of its impending start and during its operation using at least, but not limited to, visual and audible warning methods compliant with *AS/NZS 4024.1201 – Safety of machinery – General principles for design – Risk assessment and risk reduction*.

4.5.8.3 Bogie Stillages

Information: Bogie Stillages are frames used for storage of bogies

4.5.8.3.1 Stillages for the storage of Bogies awaiting issue to Trams shall be designed to comply with the requirements of AS 4084 – Steel storage racking.

4.5.8.3.2 Design of the racking shall take account of the mass and dimensions of the Bogie to be stored with accommodated Bogie variants to be permanently, clearly and unambiguously visible on the racking.

4.5.8.3.3 Racking designed for the storage of Bogies shall provide permanent, clear and unambiguous Safe Working Load (SWL) limits visible on the racking.

4.5.8.4 Walker Stacker

Information: Walker Stackers are used for stacking and transport of heavy equipment

4.5.8.4.1 Walker Stackers purchased for use in stacking heavy equipment shall provide permanent, clear and unambiguous Safe Working Load (SWL) limits visible on the equipment.

4.5.8.4.2 Walker Stackers shall provide unambiguous warning of its impending start and during its operation using at least, but not limited to, visual and audible warning methods compliant with *AS/NZS 4024.1201 – Safety of machinery – General principles for design – Risk assessment and risk reduction*.

4.5.9 Welding and Cutting Equipment

4.5.9.1.1 Safety of welding and cutting equipment shall comply with AS 1674 – Safety in welding and allied processes

4.5.9.2 Gas and Oxy Acetylene Equipment

Information: Gas and Oxy Acetylene welding equipment used for welding and cutting

4.5.9.2.1 Provision shall be made for the correct use, storage and handling of portable and mobile oxygen and acetylene equipment in compliance with *AS 4839 - The safe use of portable and mobile oxy-fuel gas systems for welding, cutting, heating and allied processes.*

4.5.9.2.2 Provision shall be made for the correct use, storage and handling of acetylene gas bottles in compliance with *AS 2030.2 - The verification, filling, inspection, testing and maintenance of cylinders for the storage and transport of compressed gases Cylinders for dissolved acetylene.*

4.5.9.3 Welding Equipment

Information: ARC, MIG, and TIG welding equipment

4.5.9.3.1 For the purchase of new or the refurbishment and upgrade of existing Arc welding equipment to be used within Yarra Trams shall comply with *AS 60974 – Arc welding equipment*.

4.5.9.4 Plasma Cutter

Information: Plasma Cutting equipment used for cutting steelwork

4.5.10 Workshop Equipment

4.5.10.1 Folding and Bending Machines

Information: Equipment used for fabrication of sheet and plate metal work in the workshop

4.5.10.2 Guillotine

Information: Guillotine is used for various cutting jobs

4.5.10.3 Pedestal Drill

Information: Pedestal drills are stationary drilling stations used in the workshops

4.5.10.4 Planer

Information: Equipment used for planing timber surfaces

4.5.10.5 Saw

Information: Saws are used for cutting metal and or timbers

4.6 Tram and Equipment Movers

4.6.1 Traversers

Information: Traversers are overhead powered vehicles used to move trams from one road to another parallel road to transfer trams between different workshop sheds within the maintenance areas of the depot. There are two Traversers in service at New Preston Depot.

4.6.1.1 Traversers shall provide unambiguous warning of its impending start and during its operation using at least, but not limited to, visual and audible warning methods compliant with *AS/NZS 4024.1201 – Safety of machinery – General principles for design – Risk assessment and risk reduction*.

4.6.2 Tram, Bogie, Equipment Movers

Information: Tractors, tugs, and vehicles (including winches as applicable) used for the following within maintenance workshops.

- *Tow or push trams with their brakes released.*
- *Move equipment to and from stores via a trailer (e.g. Lansing and Bugnall).*
- *Move trams or sections of trams.*
- *Move bogies.*

These vehicles contain movers that are battery or petrol/diesel based and move over rail or road.

Note: Rolling Stock recovery vehicles are not included in this Asset Type.

4.6.2.1.1 Vehicle mounted winches used for the movement of trams, bogies and equipment shall be designed and installed to comply with AS 1418.8 - Cranes, Hoists and Winches – Special purpose appliances.

4.6.2.2 Tram, Bogie and Equipment Movers shall provide unambiguous warning of its impending start and during its operation using at least, but not limited to, visual and audible warning methods compliant with *AS/NZS 4024.1201 – Safety of machinery – General principles for design – Risk assessment and risk reduction*.

4.6.3 Tram Tow bar Depot Set

Information: Tram Tow bar Depot Set contains tow bar and connecting equipment for various tram classes. Tram recovery vehicles contain these sets, which are used for connecting a stranded tram on the network and towing it back to the depot.

4.6.3.1 Tram tow bars shall be designed by a competent person to carry the loads applied by all tram classes during the towing process.

4.6.3.2 Tram tow bar design shall provide sufficient vertical and horizontal movement to enable trams to be maneuvered through all parts of the tram network during recovery operations.

4.7 Vehicles

4.7.1 Vehicles General

4.7.1.1 All new vehicles shall be of a colour and bearing Yarra Trams approved insignia as defined in the Yarra Trams branding specification.

4.7.1.2 All new vehicles shall adhere to Australian Design Rules applicable to the type of vehicle; including the fit-out configuration and the fitment of ancillary equipment such as tow bars and Active Signage.

4.7.1.3 All new vehicles required to travel or operate below the network overhead shall be configured so that the highest point of the vehicle and fitted accessories are maintained within the vertical confines of the tram kinematic outline referenced in the internal Yarra Trams Standard, *Rolling Stock - Tram – Outlines (CE-021-ST-0019).*

Information: Remaining within the vertical component of the tram kinematic outline ensures that the vehicle will fit beneath the overhead, no matter how it may travel along the network. Depressions and pinnacles within the track surface will not cause the highest point of the vehicle and its fitted accessories to come into contact with the overhead. Note that the kinematic outline, by its name, is a dynamic measure, meaning that it

4.7.1.4 Heavy vehicles required to be modified for fitment of a tailgate loader including but not limited to tailboards platform lifts and tray mounted cranes of any type and configuration, shall comply with the requirement clauses in section 4.2.2.8 of this Standard.

4.7.1.5 Modification of any vehicle outside of the manufacturer's specifications and accessories shall be assessed using the guidelines in the VicRoads *Vehicle Standard Information sheet number 8 (VSI8)* as to the need or otherwise for a *Vehicle Assessment Signatory Scheme (VASS)* approval certificate.

4.7.1.6 VSI8 provides a list of modifications to vehicles that, provided they are carried out so as to not adversely affect the handling and braking of the vehicle, may be carried out. Other modifications are described where no VASS certificate is required, provided certain conditions are met. All other modifications shall be carried out in conjunction with a VASS signatory and VASS approval certificate obtained.

4.7.1.7 Where doubt exists as to the requirement for a VASS approval certificate to be issued for any given modifications, advice shall be sought from a VASS signatory.

4.7.2 Track Response Vehicles

Information: Track response vehicles consist of:

- Welding
- Points

4.7.2.1 Track Response Vehicles shall comply with Australian Design Rules applicable to the type of vehicle; including the fit-out configuration and the fitment of ancillary equipment such as tow bars and signage.

4.7.3 Overhead Response Vehicles

Information: Overhead response vehicles consist of:

- Elevating Platform
- Drum
- Winch

4.7.3.1 Overhead Response Vehicles shall comply with Australian Design Rules applicable to the type of vehicle; including the fit-out configuration and the fitment of ancillary equipment such as tow bars and signage.

4.7.4 Rolling Stock Response Vehicles

Information: Rolling stock response vehicles consist of heavy vehicles configured to respond to rolling stock incidents including the recovery of derailed rolling stock.

4.7.4.1 Rolling Stock Response Vehicles shall comply with Australian Design Rules applicable to the type of vehicle; including the fit-out configuration and the fitment of ancillary equipment such as tow bars and signage.

4.7.5 Cars

4.7.5.1 New Cars should be of a Hybrid design for the reduction of both fuel consumption and exhaust emissions.

4.7.5.2 New Cars should be of a Hybrid design with 50% of the car fleet to be of an Hybrid design by the end of 2021 and 100% of the car fleet to be of an Hybrid design by the end of 2022.

4.7.5.3 New Cars shall have a minimum ANCAP or equivalent safety rating of 5.

4.7.6 Utilities

4.7.6.1 New Utilities shall have a minimum ANCAP or equivalent safety rating of 5.

4.7.6.2 Fit out of Utilities shall comply with Australian Design Rules when used for transport and storage of tools and equipment within the vehicle.

4.7.7 Vans

4.7.7.1 New Vans shall have a minimum ANCAP or equivalent safety rating of 5.

4.7.7.2 Fit out of Vans shall comply with Australian Design Rules when used for transport and storage of tools and equipment within the vehicle.

5 RELATED LEGISLATION & DOCUMENTS

Name	Document number
Lifting Devices	AS 4991
Safety of Machinery	AS/NZS 4024
Cranes, Hoists and Winches	AS 1418
Low-voltage switchgear and control gear assemblies	AS/NZS 3439
Electrical Installations “Wiring Rules”	AS/NZS 3000
Cranes – Safe Use	AS 2550
Safety in welding and allied processes	AS 1674
Vehicle Jacks	AS/NZS 2693
Chain Slings for Lifting Purposes-Grade T(80) and V(100)	AS 3751
Chain Slings	AS 3775
Fibre Rope Slings	AS 1380
Wire-Coil Flat Slings	AS 1438
Wire Rope Slings	AS 1666
Synthetic Flat-Web Round Slings	AS 3585
Round Slings	AS 4497
Hydraulic Trolley Jacks	AS 2615
Interior lighting – Industrial tasks and processes	AS/NZS 1680.2
Vehicles Standards Bulletin 6 - Section R	VSB6-R
VicRoads - Vehicle Standard Information sheet number 8	VSI8
Vehicle Assessment Signatory Scheme	VASS
Spray painting booths, designated spray-painting areas and paint mixing rooms – Design, construction and testing	AS/NZS 4114.1
Safe Work Australia - Spray Painting and Powder Coating Code of Practice	
Powered Industrial Truck – General Requirements	AS 2359.1
The safe use of portable and mobile oxy-fuel gas systems for welding, cutting, heating and allied processes	AS 4839
The verification, filling, inspection, testing and maintenance of cylinders for the storage and transport of compressed gases Cylinders for dissolved acetylene	AS 2030.2
Rolling Stock - Tram - Outlines	CE-021-ST-0019

6 DOCUMENT VERSION CONTROL

Version History	Date	Detail
1.0	28 Mar 2020	Original approved issue

7 GLOSSARY

Word	Definition
ANCAP	Australian New Car Assessment Program
Active Signage	In the context of this Standard, Active Signage shall be taken to mean safety signage and the like to provide warning to people of activities. Examples are roof mounted arrow signs and flashing beacon lights.
Bogie	Assembly of two or more axles and wheel units, which can be removed from trailers or containers. (ref: Glossary, *Practical Guide to Railway Engineering* - American Railway Engineering and Maintenance of Way Association)
Car	Light motor vehicle of a sedan or Sports Utility Vehicle (SUV) style used for the transportation of personnel
Hybrid / Hybrid Vehicle	In the context of this Standard, an Hybrid or Hybrid Vehicle is a vehicle capable of utilising multiple sources of energy for propulsion of that vehicle.
Overhead Line	Overhead Lines the support system used provide traction power to the depot tram roads.
Pantograph	Device used on the roof of Rolling Stock to contact the Trolley Wire and therefore provide power to the tram.
RS	Abbreviation for Rolling Stock
Standard	In the context of this Standard, reference to a “Standard” is reference to a specific document or documents accepted and approved by an accredited and organised body, whereas reference to “standard” is a common or generally accepted concept, approach or thing that is not necessarily accredited. References to “this Standard” refer to this document, currently being read.
Traverser	Equipment used to move Trams and Bogies laterally for access to other facilities within a depot.
Trolley Wire	Trolley Wire is the Overhead Line wires that contact the Pantograph on a Tram.
Utility	Utilities are configured to provide support to infrastructure, rolling stock and OCMS for the maintenance of the depots, tram network and rolling stock. Incident first responder vehicles are normally utilities
Van	Vans are configured to provide support to infrastructure, rolling stock and OCMS for the maintenance of the depots, tram network and rolling stock