Standard

# Rolling Stock - Tram - Body

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PROUD OPERATOR OF

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# 1 PURPOSE

The purpose of this document is to specify the minimum requirements for tram bodies on existing Yarra Trams rolling stock fleet.

# 2 SCOPE

The scope of this standard is function and performance requirements applicable to the maintenance and modification of existing trams.

This standard does not specify requirements for design or procurement of new trams or tram systems.

This standard supports the safe maintenance of tram bodies on existing Yarra Trams rolling stock fleet.

This standard considers the differing age profiles and tram designs in use and any changes to the existing trams. This standard recognises that previous designs or modifications to a tram system (the body) will have been designed to those standards in force at the time of the tram design and manufacture. Some of the existing trams will have been designed to standards no longer in force and possibly no longer available, consequently the as designed or current modification level performance characteristics and maintenance requirements for each tram type are documented. This information is derived from:

- OEM manuals supplied at the time of manufacture
- Previous upgrades/ modifications undertaken since the time of manufacture
- Original specifications for the trams
- Standards available at the time of design
- Local Subject Matter Expert knowledge

Unless otherwise stated, application of this standard is not retrospective to existing trams that are not being modified.

Any future modifications or enhancements to trams, for example for obsolescence, safety or to improve performance, shall, so far as is reasonably practicable, seek to comply with currently accepted standards.

The design and review process shall comply with requirements of the Yarra Trams 'Manage Design Procedure' (CE-021-PR-0006).

# 3 COMPLIANCE

This standard shall be fully complied to when undertaking maintenance or modifications on the existing tram fleets. Deviation from this standard is only permitted when a Waiver has been sought and approved by the Engineering Design Authority at Yarra Trams.

The Yarra Trams Engineering Change Management Procedure (CE-021-PR-0020) shall be followed in all circumstances where change is proposed the tram body. For the avoidance of doubt this shall include, but not be limited to:

- An engineering risk assessment in accordance with the Yarra Trams Safety Management System (SS-005-MA-0003).
- An assessment to determine the appropriate Safety Integrity Level (SIL) for any modification that has electrical/electronic/programmable electronic safety-related systems. The SIL assessment shall comply with International Electrotechnical Commission's (IEC) standard IEC 61508.
- Complying with the requirements of EN 50155 for any modification that has electronic equipment.
- A list of all applicable laws and standards to be complied with for that modification for review and agreement by Yarra Trams Engineering Design Authority.

A compliance schedule shall be completed and returned for any engineering change activity on the tram body. 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 and a tolerance level as a percentage or range e.g. [AM 4000mm ± 1%. or 3960mm to 4040mm].

Compliance terminology defined in this standard shall be adhered to with the following definitions:

- ‘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 an engineering risk assessment in accordance with the Yarra Trams Safety Management System (SS-005-MA-0003) and So Far As Is Reasonably (SFAIRP) Guidance Notes (Rail Safety Regulator).

**Note: All standards referred to within this document are correct at the time of writing. It is the responsibility of the user to always ensure the most current version of any standard is referred to when applying any given standard.**

# 4 REQUIREMENTS

*For information: The tram body comprises the main load carrying structure above the suspension units, including all components which are affixed to the structure which contribute directly to its strength, stiffness and stability.*

## 4.1 Fleet Maintenance Plan

The fleet maintenance plan shall determine the periodicities, tolerances and repair methods for each class of tram operated by Yarra Trams. The maintenance plan for car bodies and fixings should include the following activities.

### 4.1.1 Corrosion Inspection

4.1.1.1 The corrosion inspection shall specify the minimum operating criteria for allowable corrosion considering but not limited to:

- Location of corrosion – For example body to solebar and flooring.
- Type of corrosion – For example surface or holes.
- Dimensions of corrosion – The width, depth and length

4.1.1.2 The safe walking routes for access to the tram roof should be maintained in good order, i.e. free from corrosion and damage.

### 4.1.2 Damage Inspection

4.1.2.1 Inspection of damage or cracking shall be undertaken by staff who are trained employees in accordance with the maintenance plan, maintenance instructions and any special inspection briefings. In case of doubt as to the nature or severity of the damage or cracking, specialist advice should be sought.

4.1.2.2 Maintenance instructions and/or any special inspection briefings shall specify the minimum operating and reporting criteria for damage and/or cracking discovered during maintenance (routine and reactive) or from operational reporting. Criteria for damage and/or cracking should consider but not be limited to:

- Location of damage/cracking
- Cause of damage/cracking e.g. force of impact damage
- Dimensions of damage/cracking
- Materials type (e.g. steel, aluminum)
- Material condition (e.g. any corrosion present, which is particularly important in the case of cracking)

4.1.2.3 Damage and/or cracking inspection shall be part of routine maintenance within the fleet maintenance plan and should cover structures and equipment mountings or fixings anywhere on the tram, including the underframe, roof jacking and towing points.

### 4.1.3 General Water Inspection

4.1.3.1 All seals, guttering and other areas where water may ingress into the tram interior or equipment cases shall be inspected and repaired at scheduled maintenance intervals and from operational reporting. Repairs that have been undertaken should be verified by means of a water deluge test.

4.1.3.2 Guttering for the purpose of draining rainwater away from doors and hazardous components should be continuous and free from blockages that may prevent efficient drainage. Any modifications or repairs should be verified by means of a water deluge test.

4.1.3.3 Drainage provided for air-conditioning condensate should be free of blockages that may prevent efficient drainage.

### 4.1.4 External Lights

4.1.4.1 All external lights including indicators, brake lights, headlights and marker lights should be fully functional and maintained in good order.

4.1.4.2 Headlights, where adjustable should be adjusted in accordance with Australian Design Rules for motor vehicles and trailers.

4.1.4.3 External seals surrounding switches, lights and other components should be in good order to prevent water ingress.

### 4.1.5 Asbestos

4.1.5.1 Where asbestos is present on a tram, special care must be taken to ensure this is not damaged or exposed. If asbestos is found to be exposed or damaged, then work should cease immediately, and the tram should be withdrawn or will not allowed to enter service and the issue reported to Yarra Trams Engineering Design Authority. Safe removal of asbestos or repair of damaged or exposed asbestos should only be carried out in accordance with an approved procedure.

### 4.1.6 Internal and External fixtures and fittings

4.1.6.1 Internal and external fixtures and fittings shall be inspected during routine maintenance and tightened/adjusted or replaced if insecure or broken.

### 4.1.7 Flooring

4.1.7.1 The maintenance plan shall ensure that the flooring and substrate retains the original design features (e.g. slip-resistant, water tightness, structurally sound). Any tram that does not meet the maintenance plan criteria should be repaired.

### 4.1.8 Signage and labelling

4.1.8.1 Internal advertising and company logos should be maintained in good order and legible or replaced in accordance with the maintenance plan and maintenance instructions.

4.1.8.2 External signage and advisory notices should be in good order and legible or replaced in accordance with the maintenance plan and maintenance instructions.

4.1.8.3 All signage indicating electrical hazards or other safety criteria shall be maintained such that these are legible or replaced in accordance with the maintenance plan and maintenance instructions.

4.1.8.4 The location of tram jacking points should be clearly identified on the tram body.

## 4.2 Modifications Requirements to Tram Body

Any modifications to the tram bodies (which includes repairs, fixings, new components, equipment or materials) shall consider the following requirements.

### 4.2.1 General

4.2.1.1 Unless confirmed and agreed with Yarra Trams Engineering Design Authority through a waiver, any modifications shall be compliant with Disability Standards for Accessible Public Transport 2002 (DSAPT).

4.2.1.2 Any aesthetic modification related to W class should go through Heritage Listing National Trust / Heritage Victoria.

4.2.1.3 Any new or modified fixtures and fixings shall be designed so that parts can be readily replaced during an upgrade or refurbishment to address ambience or obsolescence.

4.2.1.4 Any modifications shall meet the requirements of Yarra Trams Standard - Fire.

4.2.1.5 Any modifications shall, so far as is reasonably practicable, accommodate any adult person within the Australian Anthropometry. Reference should be made to Australian Anthropometry as defined within the anthropometry dataset PeopleSize 2008.

4.2.1.6 Any welding undertaken on low floor tram classes shall comply with the requirements of EN 15085.

4.2.1.7 Any welding undertaken on high floor tram classes shall comply with the requirements of AS 1554.

### 4.2.2 Structures

4.2.2.1 Any structural repair procedures shall meet the original tram manufacturer's repair procedures and/or structural design and be approved by Yarra Trams Engineering Design Authority.

4.2.2.2 Where a tram has been designed to comply with requirements of EN 15227, including collapse zones and anti-climb features that will absorb energy in a controlled and predictable manner while maintaining suitably low decelerations to avoid unnecessary injury, any modification or damage repair to the tram body shall ensure the tram continues to meet the requirements of EN 15227.

4.2.2.3 Unless specified through a waiver by Yarra Trams Engineering Design Authority, any structural repairs or modifications shall meet the requirements of EN 12663.

4.2.2.4 When assessing the design for strength of any modification or repair to tram bodies, consideration shall also be given to VDV Recommendations 152.

### 4.2.3 Signage and labelling

4.2.3.1 Layout, content and style of any modified or new passenger information, safety, maintenance and warning signage or labelling shall meet Public Transport Victoria Master Fleet Guidelines.

4.2.4 **Noise and Vibration**

4.2.4.1 Modifications to the tram body or fittings shall be designed and constructed to a high standard to minimise the noise and vibrations experienced by the passengers and the driver under all conditions of passenger loading, operating speed and at any location on the Melbourne Tram Network. Measurements will be made as per ISO 3381.

4.2.4.2 Any modification to the tram body shall, where appropriate, comply with the shock and vibration testing requirements of EN 61373.

4.2.5 **Paint**

4.2.5.1 Any new paint apply to surfaces should meet the following criteria as required by Yarra Trams Engineering Design Authority:

4.2.5.1.1 Yarra Trams Rolling Stock Work Project Paint Color Specification - RAW-DOC-041.

4.2.5.1.2 Public Transport Victoria Master Fleet Guidelines.

4.2.5.1.3 Painted surfaces should show no penetration of the dry film when tested using a 20N counterweight in accordance with EN ISO 1518-1.

4.2.5.1.4 Painted surfaces should not crack or detach from the substrate when tested in accordance with EN ISO 1519.

4.2.5.1.5 Painted surfaces should not exceed adhesion classification 1 when tested in accordance with EN ISO 2409.

4.2.5.1.6 Painted surfaces should not suffer cracking, flaking or detachment from the substrate when tested using a 1kg weight in accordance with EN ISO 6272-1.

4.2.5.1.7 Painted surfaces should not lose a mass of more than 30mg after 500 cycles of testing using a CS10 wheel in accordance with EN ISO 7784-1.

4.2.5.1.8 Painted surfaces should not soften, swell, blister or suffer from under-film corrosion when subjected to 2000 hours of cycling in accordance with EN ISO 6270-1.

4.2.5.1.9 Painted surfaces should not crack, flake, blister, suffer loss of inter-coat adhesion or change in color when tested in accordance with EN ISO 11507.

4.2.5.1.10 Painted surfaces should suffer no adverse effects after 24 hours exposure to chemical agents in accordance with EN ISO 2812-4.

4.2.5.1.11 Painted surfaces should achieve a result of 'Slight' (or better) when tested in accordance with AU 148-15.

### 4.2.6 Bodyside wrapping (vinyl) and advertising material

4.2.6.1 Application of wrapping or advertising material shall not compromise the integrity of the body structure or any external fittings. This shall include, but not be limited to:

- Sensitive edge rubbers,
- Window rubbers
- Door hinge rubbers
- Switches/buttons
- Jacking points signage
- Safety/accessibility signage
- External lighting
- Intercar bellows

4.2.6.2 Application of wrapping or advertising material shall not compromise the access or operation of any access points (e.g. covers, hatches, flaps, grills).

4.2.6.3 Visibility through the door glazing shall not be compromised by the application of wrapping.

### 4.2.7 Internal fittings

4.2.7.1 New internal fittings shall be resistant to scuffing or abrasion damage from contact with wheelchairs, pushchairs, passenger luggage, or other reasonably foreseeable items.

4.2.7.2 Vandalism and graffiti resistance of each material shall be considered as a major aspect of the design of any new internal fittings.

4.2.7.3 Materials expected to be subject to graffiti attack shall be of a highly graffiti resistant type or be protected by acceptable graffiti resistant coating.

4.2.7.4 The method of attachment of new fixtures and fittings shall prevent removal except by maintenance staff with specialised tools. Use of external fittings and fasteners shall be minimised. Where used, exposed fasteners shall be of a tamper-proof, security fastener design.

4.2.7.5 New internal fittings shall meet the requirements of EN 12663.

### 4.2.8 Exterior fittings

4.2.8.1 Any new of modified exterior fittings shall not infringe the tram gauge as defined in Yarra Tram Standard – Tram Outline.

4.2.8.2 The modes of vibration of any new of modified exterior fittings on their mountings, in all operation conditions, shall be:

- Separated sufficiently from the modes of vibration of the body structure and suspension; or
- Decoupled from the modes of vibration of the body structure and suspension.

4.2.8.3 New exterior fittings shall meet the requirements of EN 12663.

### 4.2.9 Flooring

4.2.9.1 The design of the floor covering and floor markings shall incorporate, without limitation, the following features:

- Slip resistant when wet, dry and/or contaminated with any substances deposited by foot traffic;
- Non-reflecting and glare free;
- Hard wearing;
- Anti-static;
- Textured and/or coloured;
- Easy to clean; and
- Free from dirt traps.

4.2.9.2 The floor system design shall be agreed with Yarra Trams Engineering Authority.

4.2.9.3 Any replacement floor covering shall be compliant to AS 4663.

4.2.9.4 Security and sealing of the floor shall prevent ingress of water to the substrate.

### 4.2.10 Glazing

4.2.10.1 New or replacement cab windscreens, cab side and quarter windows (if fitted) shall be of a laminate design that shall meet the windscreen optical, mechanical and safety requirements of AS 2080.

4.2.10.2 New saloon exterior and interior glass shall meet the optical, mechanical and safety requirements of AS 2080.

4.2.10.3 Any glass protection, where fitted, shall not affect the performance of the glass or its transparency but provide resistance to vandalism, including scratching or application of paint or other manner of graffiti.

4.2.10.4 If glass is used to protect digital screens, it shall be suitably treated to prevent reflections and glare.

# 5 RELATED LEGISLATION & DOCUMENTS

| Document Number | Name |
|---|---|
| AU 148-15 | Methods of test for motor vehicle paints. Resistance to chipping |
| AS 1554 | Structural steel welding Set |
| AS 2080 | Safety glazing for land vehicles |
| AS 4663 | Slip resistance measurement of existing pedestrian surfaces |
| CE-021-PR-0006 | EMS04 Manage Design Procedure |
| CE-021-PR-0020 | EMS06 Engineering Change Management Procedure |
| CE-021-PR-0004 | EMS05 Deviation from Standards Procedure |
| SS-005-MA-0003 | Yarra Trams Safety Management Systems |
| EN 12663 | Railway applications. Structural requirements of railway vehicle bodies |
| EN 15085 | Railway applications. Welding of railway vehicles and components. |
| EN 15227 | Railway Applications - Crashworthiness Requirements for Railway Vehicle Bodies |
| EN 50155 | Railway applications - Electronic equipment used on rolling stock |
| EN 61373 | Railway applications. Rolling stock equipment. Shock and vibration tests |
| IEC 61508 | Functional safety of electrical/electronic/programmable electronic safety-related systems |
| ISO 1518-1 | Paints and varnishes — Determination of scratch resistance |
| ISO 1519 | Paints and varnishes — Bend test |
| ISO 2409 | Paints and varnishes — Cross-cut test |
| ISO 3381 | Railway applications - Acoustics - Measurement of noise inside rail bound vehicles |
| ISO 6272-1 | Paints and varnishes — Rapid-deformation (impact resistance) tests — Part 1: Falling-weight test, large-area indenter |
| ISO 7784-1 | Paints and varnishes — Determination of resistance to abrasion |
| ISO 6270-1 | Paints and varnishes — Determination of resistance to humidity — Part 1: Condensation (single-sided exposure) |
| ISO 11507 | Paints and varnishes — Exposure of coatings to artificial weathering — Exposure to fluorescent UV lamps and water |
| ISO 2812-4 | Paints and varnishes — Determination of resistance to liquids |
| VDV Recommendation 152 | Recommendations on the Design for Strength of Urban Rail Rolling Stock according to BOStrab |

# 6 DOCUMENT VERSION CONTROL

| Version History | Date | Detail |
|---|---|---|
| 1.0 | 16 March 2020 | Original approved issue |

# 7 GLOSSARY

| Term | Definition |
|---|---|
| DSAPT | Disability Standard for Accessible Public Transport |
| Engineering Design Authority | The person or position designated by the Franchisee with the authority to approve engineering design changes, modifications and the TMPs under a system which complies with AS/NZS ISO 9001 Quality Management Systems or similar standard and AS4292 Railway Safety Management as applicable to rolling stock providers. |
| IEC | International Electrotechnical Commission |
| OEM | Original Equipment Manufacturers |
| SIL | Safety Integrity Level |
| Waiver | Waiver process as per EMS05 Deviation from Standards Procedure |