Standard

Rolling Stock - Tram - Couplers

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1 PURPOSE

The purpose of this document is to specify the minimum requirements for coupling arrangements for towing and recovery on the existing Yarra Trams rolling stock fleet.

2 SCOPE

The scope of this standard is only requirements for:

- Pushing/Pulling one tram with another tram or approved road recovery vehicle on Yarra Trams network in recovery situations.
- Movement of connected trams that may be pushed or pulled in a depot environment.

Inter-car/inter-module permanent coupling arrangements are not within the scope of this standard.

Information: The use of road recovery vehicles for towing of trams is subject to approval by the relevant Rolling Stock Engineering Design Authority.

The requirements described in this standard apply to the maintenance, operation and modifications to existing trams.

This standard defines the minimum requirements to support the safe maintenance and operation for towing/recovery on Yarra Trams' existing fleet.

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

This standard considers the differing age profiles and tram designs in use and any prior changes to the existing trams. This standard recognises that any previous designs or modifications to a tram system 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 Some of the existing trams will have been designed to standards no longer in force and possibly no longer available. Accordingly, this standard only documents the 'as designed' or current modification level function, performance characteristics and maintenance requirements for existing tram types in use at Yarra Trams.

The requirements in this standard are derived from the following sources:

- OEM manuals supplied at the time of manufacture.
- Previous upgrades/ modifications undertaken since the time of manufacture.
- The 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 'EMS04 Manage Design Procedure' (CE-019-PR-0005).

3 COMPLIANCE

This standard shall be fully complied to when undertaking maintenance, operation 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 in accordance with the Yarra Trams Engineering Change Management Procedure (CE-019-PR-0016).

The Yarra Trams Engineering Change Management Procedure (CE-019-PR-0016) shall be followed in all circumstances where change is proposed to the Yarra Trams' existing fleet. 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 activities on Yarra Trams' existing fleet. 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-007-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

The following requirements apply to the operation of coupling equipment and components to allow for trams to be connected in recovery situations on the network.

4.1 Maintenance and Operation of Existing Trams

4.1.1 General

4.1.1.1 The current design of all tram classes does not include a fixed coupling arrangement to allow connecting and separating of trams automatically for the purpose of network recovery or movement around the maintenance yard.

4.1.1.2 All recovery or movement activities shall require the use of a tow bar and adaptor, which differ depending on the trams in question. These are described in Yarra Trams Rolling Stock Tram Recovery - Towing and Pushing document (RS-020-WI-0238).

4.1.2 Interfleet Tram Towing Matrix

4.1.2.1 Full details of interoperability shall be consulted in Rolling Stock Recovery Manual (RS-020-MA-0012) and E-Class recovery Manual (TI-00-002).

4.1.3 Couplers and Draw gear

4.1.3.1 All connections within the body of the tram and connections between trams shall be able to withstand and accommodate all expected loads and articulation during normal operation and during recovery operations.

4.1.3.2 Couplers and draw gear connectors as a minimum requirement shall be able to tow a tram equivalent or less than its own its own mass in tare load condition.

4.1.3.3 Where fitted, mechanical and electrical coupling interfaces shall be maintained to be in a serviceable condition to enable recovery.

4.1.3.4 The configuration and operation of coupled trams shall ensure that the trams remain within the tram outline which involves successfully negotiating the minimum horizontal curve radius, vertical curve radius, and clearance requirements. These requirements apply to coupled trams during a recovery situation.

4.1.3.5 Coupled trams should retain full functionality of Driver Communication System (DCS).

4.2 Towing procedure

4.2.1.1 Yarra Trams has a unique set of procedures governing the towing or pushing of all classes of disabled trams during maintenance and emergency/recovery operations. The following documentation shall be reviewed in such scenarios:

- Rolling Stock Recovery Manual (RS-020-MA-0012).
- Rolling Stock Tram Recovery - Towing and Pushing (RS-020-WI-0238). This document also includes towing limitations including the tram classes each tram class can or cannot tow.
- Specialist operational equipment used for coupling all tram classes for towing or pushing: Tram Tow Bars (Asema type) - Operation Manual (RS-019-MA-0028).
- Tram Tow Bars (Asema type) - Maintenance Manual (RS-022-MA-0006).

4.3 Modifications to Existing Trams

Any modifications to the couplers or associated equipment shall consider the following requirements.

4.3.1 Introduction of a Permanent Coupler

No tram type has a permanent coupling arrangement to facilitate this function.

4.3.1.1 Should a permanent coupling arrangement be fitted to the existing trams the design shall follow as a minimum EN 12663-1. This shall ensure that no significant permanent deformation or fracture of the tram structure shall occur as result of the load cases being applied. The requirement shall be achieved by satisfying the yield or proof strength of connected trams structures by analysis and testing.

4.3.2 Secondary Restraints

4.3.2.1 A Secondary Towing Restraint Attachment is required for all Z3, A, B2 and D class trams and the Scania Recovery Vehicle ‘R10’ to arrest a towed tram without brakes should it break away on failure of the primary towing attachment.

4.3.2.2 Modification or procurement of the Secondary Towing Restraint Attachment shall comply with the requirement set out in Specification for the Design of a Secondary Towing Restraint Attachment (RS-022-IS-0189). As a minimum the secondary restrains shall comply with the following requirements:

- The minimum rated capacity is 75 kN applied within angles: +/- 60° laterally, +/- 15° vertically.
- The strap length shall have a minimum value of 3.76 m.
- Maximum slack length between trams is 180 mm.
- The attachment is required to an appropriate point(s) on the underframe of the tram or rear chassis of the R10 truck.

4.3.2.3 Modifications of connections to the tram body, including secondary restraints, shall comply with EN 12663-1.

5 RELATED LEGISLATION & DOCUMENTS

Document Number	Name
CE-019-PR-0005	EMS04 Manage Design Procedure
CE-019-PR-0016	EMS06 Engineering Change Management Procedure
c016wi11	Enterprise Risk Assessment and Assurance Framework
IEC 61508	Functional Safety
EN 12663-1	Railway applications. Structural requirements of railway vehicle bodies - Part 1: Locomotives and passenger rolling stock (and alternative method for freight wagons)
EN 50155	Railway Applications - Rolling Stock - Electronic Equipment
RS-022-MA-0012	Yarra Trams Rolling Stock Tram Recovery - Towing and Pushing document
RS-022-MA-0006	Tram Tow Bars (Asema type) - Maintenance Manual
r022im10 / RS-019-MA-0028	Operation manual - Yarra Trams (Asema type) Towbars, Pins & Adaptors
r022ts3875 / RS-022-IS-0189	Specification for the Design of a Secondary Towing Restraint Attachment (STRAT) - Z3, A, B2 & D class and R10 Scania Recovery Vehicle
TI-00-002	E-Class recovery Manual

6 DOCUMENT VERSION CONTROL

Version History	Date	Detail
1.0	13/03/2020	Original approved issue
1.01	24 /02/2022	Minor formatting changes and reference updates
1.02	25/02/2022	Minor changes including updating of references to align with current CDMS numbering
1.03	20/02/2023	Minor change to author and authoriser

DEFINITIONS & ABBREVIATIONS

Term	Definition
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.
DCS	Driver Communication System
IEC	International Electrotechnical Commission
OEM	Original Equipment Manufacturer
SIL	Safety Integrity Level
STRAT	Secondary Towing Restraint Attachment
SWL	Safe Working Load
Waiver	Waiver process as per EMS05 Deviation from Standards Procedure.