

Standard

Rolling Stock - Tram - Environmental Systems

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PROUD OPERATOR OF



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1 PURPOSE

The purpose of this document is to provide the minimum requirements for the environmental systems on Yarra Trams' existing fleet, considering the differing age profiles and tram designs in use, and any changes to the existing trams

2 SCOPE

The requirements described in this standard apply to the maintenance and modifications to existing trams. This standard does not apply to the specification, design and procurement of new trams.

2.1 Maintenance of Existing Trams

This standard defines the minimum requirements to support the safe maintenance of the environmental systems on Yarra Trams' existing fleet. This standard considers the differing age profiles and tram designs in use and any changes to the existing trams. This standard recognises that owing to the fleets age range, 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.

This standard recognises that some of the existing trams will have been designed to standards no longer in force and possibly no longer available, consequently the as designed or current modification level performance characteristics and maintenance requirements for each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
- The original specifications for the trams
- Standards available at the time of design
- Local Subject Matter Expert knowledge

2.2 Modifications to Existing Trams

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 in accordance with the 'Deviation from Engineering Standards' procedure (CE-021-PR-0004).

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

- An engineering risk assessment in accordance with the Enterprise Risk Assessment and Assurance Framework (c016wi11).
- 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 the environmental systems. 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 \pm 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 Enterprise Risk Assessment and Assurance Framework (c016wi11) 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

4.1 Technical Maintenance Plan

4.1.1 Technical Maintenance Plan

4.1.1.1 The Technical maintenance plan shall specify the periodicities, tolerances and repair methods for each class of tram operated by Yarra Trams. The Technical maintenance plan and associated maintenance instructions shall include, but not be limited to:

- Heating and ventilation
- Air-conditioning

4.1.2 Seasonal Management

4.1.2.1 Seasonal ambient temperature variations and weather can adversely affect the performance of the trams. The differing tram types may be affected in different ways, so Yarra Trams Engineering Design Authority should develop a thorough understanding of seasonal effects on each of the Yarra Trams tram types.

4.1.2.2 To maximise the level and consistency of fleet performance during seasonal variances a Seasonal Preparedness Plan should be developed. The Seasonal Preparedness Plan should cover all the seasons. Examples of process and equipment checks are given in the following sections. Routine maintenance plans shall either be enhanced to include specific seasonal checks or separate maintenance instructions shall be developed for activation during specific dates.

4.1.2.3 Material stock holding review should be conducted in advance of each season and deployment of spares to strategic locations should be planned and implemented to support the operational requirements of the fleet.

4.2 Modification Requirements to Environmental Systems

Any new or modified environmental systems shall consider the following:

4.2.1 HVAC General

4.2.1.1 HVAC systems shall provide comfort for passengers under all passenger loading conditions.

4.2.1.2 Air supplied by the heating, ventilation and air conditioning (HVAC) system air filters should be filtered to remove particles, contaminants and impurities. Particulate filters shall comply with AS 1324 and any high efficiency particulate air (HEPA) filters shall comply with AS 4260.

4.2.1.3 The HVAC system shall be compatible with and powered from the tram's auxiliary power supply. Reference shall be made to Yarra Trams Standard – Tram – Power.

4.2.1.4 HVAC systems shall have the capability to automatically adjust the interior set temperature (set point) according to a sliding scale dependent on the outside temperature.



4.2.2 HVAC – Cab

Any new or modified cab HVAC system shall consider the following:

- 4.2.2.1 The Cab HVAC system shall maintain the comfort of the driver in all weather conditions in Melbourne.
- 4.2.2.2 The Cab HVAC shall be compliant to EN14813 Zone 1 except that the minimum fresh air volume should be 80m³/hr (40m³/hr/person) and that the equipment shall be capable of operating in ambient temperatures up to 50°C maintaining the same temperature difference between internal and external temperatures as specified in EN 14813 at 40°C.
- 4.2.2.3 The Cab HVAC should be capable of being adjusted by the driver to the personal preference of the driver within the 18°C to 25°C temperature range.
- 4.2.2.4 The Cab HVAC shall, so far as is reasonably practicable, be capable of maintaining the temperature to within $\pm 1^{\circ}\text{C}$ of the temperature set by the driver.
- 4.2.2.5 The capacity of the Cab HVAC shall be such that a cab should, so far as is reasonably practicable, achieve the temperature range specified above within 15 minutes of being initialised.
- 4.2.2.6 The design of the Cab HVAC power supply shall mitigate interruptions and voltage fluctuations to ensure continuous operation.

4.2.3 HVAC – Saloon

Any new or modified saloon HVAC system shall consider the following:

- 4.2.3.1 The saloon HVAC shall capable of maintaining the air temperature in the saloon within the range of 18°C to 30°C under all temperature conditions in Melbourne and with the tram setting down and picking up passengers in service. The maximum relative humidity at 30°C shall be not more than 40%.
- 4.2.3.2 The saloon HVAC shall be compliant to EN 14750 Zone 1 except that the equipment shall be capable of operating in ambient temperatures up to 50°C maintaining the same temperature difference between internal and external temperatures as specified in EN14750 at 40°C .
- 4.2.3.3 The saloon temperature shall be able to be set to a minimum of 18°C with the external temperature at 18°C or less.
- 4.2.3.4 The saloon temperature shall be able to be set to a maximum of 30°C with the external temperature at 35°C or greater.
- 4.2.3.5 The saloon temperature shall be capable of operating in the range of 20°C to 22°C with 40% relative humidity with the external temperature in the range of 18°C to 30°C.
- 4.2.3.6 The capacity of the saloon HVAC shall be such that a tram should, so far as is reasonably practicable, achieve the temperature specified depending on the ambient air temperature within 15 minutes of being initialised.
- 4.2.3.7 The design of the HVAC system, including any alterations to the tram interior such as glazing or glazing film design, shall minimise the effect of thermal load on the tram.



4.2.3.8 The HVAC shall interface to the Tram Operating System, if fitted.

4.3 Energy Efficiency

4.3.1 Energy Efficiency

4.3.1.1 Energy efficiency for railways means reducing the energy consumption and, by this way, reducing the energy costs and the emissions of pollutants and CO₂ while there is further growth of tram traffic. Any modification shall, so far as reasonably practicable, seek to reduce the energy consumed by the tram through the use of new technology, materials or processes.

5 RELATED LEGISLATION & DOCUMENTS

Document Number	Name
CE-021-PR-0006	EMS04 Manage Design Procedure
CE-021-PR-0020	EMS06 Engineering Change Management Procedure
CE-021-PR-0004	Deviation from Engineering Standards
c016wi11	Enterprise Risk Assessment and Assurance Framework
IEC 61508	Functional Safety
AS 1324	Air Filters for Use in General Ventilation and Airconditioning
AS 4260	High efficiency particulate air (HEPA) filters
EN 50155	Railway Applications - Rolling Stock - Electronic Equipment
EN 14813	Railway applications - Air conditioning for driving cabs
EN 14750	Railway applications. Air conditioning for urban and suburban rolling stock. Comfort parameters
CE-021-ST-0020	Rolling Stock – Tram - Power Systems

6 DOCUMENT VERSION CONTROL

Version History	Date	Detail
1.0	13 March 2020	Original approved issue
1.01	28 July 2020	Corrected minor errors in clause numbering.



6.1.1 GLOSSARY

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.
HEPA	High Efficiency Particulate Air
HVAC	Heating Ventilating Air Conditioning
IEC	International Electrotechnical Commission
OEM	Original Equipment Manufacturers
SIL	Safety Integrity Level
Waiver	Waiver process as per EMS05 Deviation from Standards Procedure.