

Standard

Rolling Stock – Tram – Air Systems

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PROUD OPERATOR OF



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Table of Contents

1	PURPOSE.....	3
2	SCOPE	3
3	COMPLIANCE	4
4	REQUIREMENTS.....	5
4.1	Maintenance of Existing Trams	5
4.1.1	Sanding Equipment	5
4.1.2	Maintenance of Sanding Equipment.....	5
4.1.3	Braking.....	5
4.1.4	Maintenance of air brake equipment	5
4.2	Modification to Air Systems	6
4.2.1	Sanding	6
4.2.2	W Class Brake Compressor.....	7
4.2.3	Pressure Equipment	7
5	RELATED LEGISLATION & DOCUMENTS	8
6	DOCUMENT VERSION CONTROL	8
7	GLOSSARY	8



1 PURPOSE

The purpose of this document is to **guide the consideration** of requirements for the air systems on existing Yarra Trams rolling stock fleet.

2 SCOPE

The scope of this standard is **related to** functional 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 the air systems 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 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 Some of the existing trams will have been designed to standards no longer in force and possibly no longer available.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 performance characteristics and maintenance requirements for each tram type.**

The requirements in this standard are 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

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

Any future modifications or enhancements to **in-service** trams, for example for obsolescence, safety or to improve performance, **shall take into consideration So Far As Is Reasonably Practicable (SFAIRP) the currently accepted standards.**

The design and review process shall comply with requirements of the Yarra Trams **‘Engineering Change Management Procedure’ (CE-021-PR-0020).**



3 COMPLIANCE

This standard should be considered when undertaking maintenance or modifications on the existing tram fleets. Deviation from this standard is permitted upon design consideration (within the limitations of time, cost and practicality) and quantification of the risk based on the application of risk control(s).

The Yarra Trams Engineering Change Management Procedure (CE-021-PR-0020) 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 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.~~
- **Consider** the requirements of EN 50155 for any modification that has electronic equipment.
- A list of all applicable laws and standards **taken into consideration** for that modification for review and agreement by Yarra Trams Engineering Design Authority.

A **schedule of consideration** shall be completed and returned for any engineering change activities on Yarra Trams' existing fleet. Assessment of conformance shall be provided for each requirement, defined by one of three permissible responses:

- Conforms;
- Partially conforms;
- Non-conformance.

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 Maintenance of Existing Trams

4.1.1 Sanding Equipment

- 4.1.1.1 For information, C, D and E class trams have a small electrically powered (24V DC) air compressor that supplies the sanding system with compressed air to aid distribution of sand to the rail head.
- 4.1.1.2 For information, W, Z, A and B class trams have no compressed air for sanding. For these classes of tram sand is dropped by gravity onto the rail head.
- 4.1.1.3 For further information see Yarra Trams Standard, Rolling Stock - Tram – Sanding Systems (CE-021-ST-0016).

4.1.2 Maintenance of Sanding Equipment

- 4.1.2.1 The electric air compressor on the C, D and E class trams forms part of the sanding systems and shall be maintained in accordance with the equipment manufacturer maintenance instructions or approved tram maintenance instructions.

4.1.3 Braking

- 4.1.3.1 For information, only the W class trams have an air powered braking system.
- 4.1.3.2 For further information see Yarra Trams Standard, Rolling Stock - Tram - Braking Systems (CE-021-ST-0029)

4.1.4 Maintenance of air brake equipment

- 4.1.4.1 The maintenance, repair, overhaul and testing of air brake equipment is a highly specialised field of engineering and so it shall be carried out by trained staff.
- 4.1.4.2 The maintenance, repair and overhaul of all air brake equipment shall be carried out in accordance with Yarra Trams maintenance procedure.
- 4.1.4.3 The maintenance plan shall define the examination method and periodicity that is necessary to check that all parts of the system are in a safe condition and should be able to continue to operate safely during the intervals between examination. The maintenance scheme should:
 - Identify those parts of the system that are to be examined and or tested.
 - Define the type of examination or test required.
 - Define the criteria by which the system or component parts are considered no longer fit for further service.
 - Define the interval between examination or test.
 - Define any preparation or condition necessary to ensure that the examination or test can be undertaken satisfactorily.
- 4.1.4.4 The interval between examinations shall be appropriate for both the utilisation of the tram and the characteristics of the system and components. If appropriate, different parts of the system or components may be given an examination at different intervals.
- 4.1.4.5 Where appropriate, the following limits shall be specified, at which components shall be renewed or repaired:
 - Permissible extent of corrosion on metal parts.
 - Permissible defects in non-metallic parts.



- 4.1.4.6 Reservoirs designed to contain compressed air shall be subject to internal and external examination together with a hydraulic pressure test in accordance with their design standard. The maintenance plan should define the intervals between both the examinations and the hydraulic test. The date and location of the test should be recorded on a metal label fixed securely to the reservoir.
- 4.1.4.7 All protection devices in the system designed to protect against overpressure should be subject to a functional test, to check their correct operation at the required pressure and the maintenance scheme should define the intervals between the test.
- 4.1.4.8 Hoses shall be checked on exam and replaced if cut, abraded or perished.
- 4.1.4.9 Pipes unions/fittings shall be checked and tightened, adjusted or replaced if loose, kinked or damaged.
- 4.1.4.10 Cocks shall be checked on exam and replaced if their operation is stiff or loose.
- 4.1.4.11 All workshops should keep traceable records of all overhauled and retested equipment.
- 4.1.4.12 Valves and chokes shall be checked on exam and maintained/replaced if showing signs of damage.
- 4.1.4.13 Filters shall be cleaned on exam or replaced if felt type or filter is damaged.
- 4.1.4.14 Reservoirs shall be checked and changed if damaged or severely corroded. If in doubt, arrangements should be made for the pressure vessel to be examined by an inspector in accordance with the requirements of AS 1210 (for guidance see AS 3788).
- 4.1.4.15 The W8 air compressor should be overhauled in accordance with Atlas Copco Instruction book no. 9819 9060 53.

4.2 Modification to Air Systems

Any modifications to the air systems or equipment **should** consider the following requirements.

4.2.1 Sanding

- 4.2.1.1 Any modification to the sanding compressor shall not reduce the braking performance of the tram and comply with the requirements described in Yarra Trams Standard, Rolling Stock - Tram - Braking Systems (CE-021-ST-0029).
- 4.2.1.2 Sanding systems on Yarra Trams rolling stock **should** comply with the requirements described in Yarra Trams Standard, Rolling Stock - Tram – Sanding Systems (CE-021-ST-0016).



4.2.2 W Class Brake Compressor

Any modification to the compressor or purchase of new compressor **should take into consideration** the following requirements.

- 4.2.2.1 The air compressor shall be suited for railroad / tram service, including fixings compliant to EN 12663. All other standards to be met are to be provided by supplier.
- 4.2.2.2 The air compressor shall be suitable for mounting to the underside of a W Class tram or mounted in a frame suited for underside mounting for ready unit exchange.
- 4.2.2.3 The air compressor shall fit within the space envelope available.
- 4.2.2.4 All components should be accessible and readily maintained without undue labour time to access and remove components.
- 4.2.2.5 Maintenance periodicity shall ensure consistency with current maintenance.
- 4.2.2.6 Noise tests described in ISO 2151 shall be conducted to ensure noise levels do not exceed 75dBa at 1m.
- 4.2.2.7 Any electrical/electronic components shall be IP 55 rated or better.

4.2.3 Pressure Equipment

- 4.2.3.1 Pressure equipment shall comply with the design, manufacture, use requirements and safety requirements described in AS 1200.
- 4.2.3.2 Pressure vessels, such as receivers, shall undergo inspection, repair and alteration which complies with the requirements set out in AS 1210 (for guidance see AS/NZS 3788).
- 4.2.3.3 Piping subject to internal pressure or external pressure or both shall comply to the requirements set out in AS 4041.
- 4.2.3.4 Any new air receiver design pressure and volume shall be calculated to comply with the requirements of the entire air system. Design calculations shall be demonstrated to Yarra Trams Engineering Design Authority.



5 RELATED LEGISLATION & DOCUMENTS

Document Number	Name
CE-021-PR-0004	EMS05 Deviation from Standards Procedure
CE-021-PR-0006	EMS04 Manage Design Procedure
CE-021-PR-0020	EMS06 Engineering Change Management Procedure
AS 1200	Pressure equipment
AS 1210	Pressure Vessels
AS 4041	Pressure Piping
AS 3788	Pressure equipment - In-service inspection
c016wi11	Enterprise Risk Assessment and Assurance Framework
EN 12663	Railway Applications - Structural Requirements of Railway Vehicle Bodies
EN 50155	Railway Applications - Rolling Stock - Electronic Equipment
IEC 61508	Functional Safety
ISO 2151	Acoustics - Noise test code for compressors and vacuum pumps - Engineering method (Grade 2)
N/A	Atlas Copco Instruction book no. 9819 9060 53
CE-021-ST-0016	Rolling Stock – Tram - Sanding Systems
CE-021-ST-0029	Rolling Stock – Tram - Braking Systems

6 DOCUMENT VERSION CONTROL

Version History	Date	Detail
1.0	12 March 2020	Original Approved Issue

7 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.



Term	Definition
IEC	International Electrotechnical Commission
OEM	Original Equipment Manufacturer
SIL	Safety Integrity Level
Waiver	Waiver process as per EMS05 Deviation from Standards Procedure.