

## Overview

This standard is about diagnosing and repairing faults on Tram vehicle assets, components, equipment and systems. You will be able to use fault finding methods and techniques to locate, diagnose and repair faults that involve the following interactive technologies: mechanical, electrical, electronic, hydraulic, pneumatic, fixtures and fittings and ancillary systems. The type and range of problems and faults could be complex and involve the interaction between two or more assets, components, equipment and systems. Fault diagnosis could include continual and intermittent faults and be affected by factors such as environmental, ageing, human error and inherent design problems. From the evidence gained, you will be expected to identify the fault and probable cause. You will be able to confirm the repair activities to be undertaken and carry out these repairs within the limits of your own authority.

Your acquired underpinning knowledge will provide an understanding of your work and an informed approach when applying fault diagnosis procedures within an integrated system. You will understand the various fault diagnosis methods and techniques in use, and their application. You will know how to apply and interpret information obtained from the diagnostic aids and equipment, when carrying out the activities and identifying faults or conditions that are outside the required specification. You will know and understand the interaction of the other associated integrated technologies and will have sufficient knowledge to carry out effective fault diagnosis of the Integrated system.

You will understand the safety precautions required when undertaking fault diagnosis activities, especially when isolating the equipment and taking the necessary safeguards to protect yourself and others in the workplace.

This standard is for those who work in the Tram engineering environment at supervisor/technician level.

## Performance criteria

### *You must be able to:*

- P1 confirm you are wearing the correct PPE (Personal Protective Equipment) and following the relevant **health and safety procedures**
- P2 interpret and analyse the received **information** on the symptoms and problems associated with the Tram vehicle assets, components, equipment and systems
- P3 identify the **fault finding activities and diagnostic tests** to be undertaken in line with organisational procedures
- P4 prepare **diagnostic tools and equipment** in line with organisational procedures
- P5 take action to prevent damage or interference with other components, equipment or systems during fault finding activities
- P6 select, use and apply diagnostic techniques, tools and aids to locate faults
- P7 complete the fault diagnosis within the agreed timelines and inform the relevant stakeholder when this cannot be achieved
- P8 investigate and analyse the diagnostic results in order to draw conclusions about the **nature and probable cause of the fault**
- P9 establish the implications of the fault on other work activities and on the safety of the Tram and Tramway environment
- P10 confirm the repair activities to be undertaken and the resources required
- P11 obtain organisational approval for repair activities to take place
- P12 carry out **repair activities** on Tram vehicle assets, components, equipment and systems in line with organisational procedures
- P13 carry out **integrity test and checks** on the repaired Tram vehicle asset, component, equipment or system to confirm it is functioning correctly
- P14 record details on the extent and location of the faults and repairs in line with

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organisational procedures

## Knowledge and understanding

### *You need to know and understand:*

K1 the relevant health and safety procedures appropriate to the activity including safe systems of work  
K2 the general operational and functional principles of Tram vehicle assets, components, equipment and **\*\*systems\*\***  
K3 the relationship between an ancillary system and Tram vehicle assets, components, equipment and systems  
K4 the types of diagnostic tests, aids and equipment available for the Tram vehicle  
K5 how to analyse the available information for fault diagnosis  
K6 the **\*\*hazards\*\*** associated with undertaking fault diagnosis on Tram vehicle assets, components, equipment and systems  
K7 the range of actions that can be taken to prevent damage or interference with other components, equipment and systems  
K8 the methods and techniques for diagnosing faults on Tram vehicle asset, components, equipment and systems  
K9 the methods and techniques for analysing and determining diagnostic results  
K10 how to assess the risks arising from faults and how the faults can affect the performance and safety of Tram vehicle assets, components, equipment and systems  
K11 how to prioritise repair activities  
K12 the methods and techniques for carrying out repair activities on Tram vehicle, assets, components, equipment and systems  
K13 the importance of carrying out integrity tests and checks prior to a Tram vehicle returning to operational service  
K14 the types of integrity tests and checks that can be undertaken  
K15 when independent testing may be required  
K16 the extent of your own authority and to whom you should report if you have problems that you cannot resolve  
K17 the methods and techniques for recording and reporting information relating to the activity in line with organisational procedures

## Scope/range related to performance criteria

P1 **Health and safety procedures** may include; ergonomic working, moving and manual handling, Personal Protective Equipment (PPE), working time and breaks, lone working, Personal Track Safety, safe systems of work (authorised access/egress points, signage, lighting, CCTV, walking to and from a work site, planned protection arrangements, emergency stop protection arrangements, possession arrangements, isolation requirements, communication/warning arrangements and techniques, positions of safety, safety zones, lookout arrangements, first aid points, emergency assembly point, safety briefings, fire evacuation, working at height requirements, working in confined spaces requirements, authorised walking routes, emergency service support (as required), walking to and from a vehicle, designated parking areas). P2 **Information** may include; electronic or paper records and documents (drawings, defect history, fault reports, handbooks, manuals, charts, maintenance specifications/schedules, maintenance history, images, warrantee, instructions, schedules, catalogues, logbooks), eye witness accounts, operator reports, sensory (sight, smell, touch, sound). P3 **Fault finding activities and diagnostic tests** may include; inspection (wear, breaks/bends, signs of overheating/fretting, missing parts, loose components/fittings, sensory input, leaks, software interactions), Measurement (voltage/resistance/frequency, torque, temperature, dial test, luminescence, power, continuity, current, flow, half-split technique, emergent sequence, unit substitution, input/output, function/performance testing, six point technique, injection, sampling, equipment self-diagnostics), operational (systematic testing, alignment checks, pressure checks, vibration checks, thermal checks, calibration, simulation). P4 **Diagnostic tools and equipment** may include; computer test equipment, in built management system, algorithms, manuals, analysis charts, trouble shooting guides, probability charts, fault analysis charts, diagrams and specifications, manufacturers manuals, measuring devices and indicators. P8 **Nature and probable cause of the fault** may include; environmental, aging, accidental, human error, inherent/intermittent design problem, recurrent defect, component defect, fitting defect, partial failure, reduced performance, out of specification, maintenance technique, maintenance frequency, complete breakdown. P12 **Repair activities** may include; rectification, replacement, monitoring, referral. P13 **Integrity test and checks** may include; inspection, count, security, profile, labelling, configuration, correlation, compliance, physical condition, continuity, interference, resistance, frequency, performance, insulation, function, magnetic.

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## Scope/range related to knowledge and understanding

K2 **Systems** may include ancillary systems such as; security cameras, CCTV, digital recording systems, air systems, audio/visual equipment, two way radio, route information systems, global positioning systems, in cab signalling systems, cleaning systems and equipment.

K6 **Hazards** may include; stored pressure/force, electrical contact, electrical/electronic interfaces, handling fluids, using faulty/damaged tools and equipment, using unauthorised procedures, working at height, working in confined spaces.

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## Glossary

### **Tram**

Tramcars, tram vehicle, and any other rail vehicles that operate on tramways. It includes one or more trams coupled together and includes non-passenger-carrying vehicles.

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### **Tramway environment**

Includes the tramway (a set of rails, switches and crossings which form the route of a Tram) , infrastructure (fixed assets used for the running of the Tram transport system, including, the tramway, bridges, tunnels, stops, stations and fixed equipment for signalling, communications and electrification), depots, stabling yards.

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