TRANSPORTATION AND LOGISTICS

# Rail Vehicle Technology

## WorldSkills Occupational Standards

 WSC2022_WSOS61_Rail_Vehicle_Technology

worldskills

# WorldSkills Occupational Standards (WSOS)

## Occupation description and WSOS

### The name of the occupation is

Rail Vehicle Technology

### Description of the associated work role(s) or occupation(s)

Rail transit for goods and people is a vast, worldwide sector. As need and demand grows for sustainable forms of transit, the potential for rail to replace less energy-efficient forms of transportation will increase. This in turn will drive innovation. Rail transit is efficient, safeguards the environment, and adds to people's travel experience and quality of life. Rail is the world's first green transportation system, due to its safety, convenience, punctuality, and speed.

All rail transit operations require maintenance, which is the focus of rail vehicle technology occupations. Modern rail vehicles use integrated technologies, and therefore require maintenance technicians both to have diverse skills and expertise, and to work in teams to extend their collective expertise yet further. The quality of the team's joint output is a mark of their expertise.

Overall, the rail vehicle technician's role comprises vehicle inspection, maintenance, disassembly, assembly, repair, commissioning, and troubleshooting. To maintain the safe operation of an entire system's or sub-system's vehicles, the rail vehicle technician must work efficiently, within deadlines, both to solve problems, and to carry out preventative measures to ensure continuity of service. They should fulfil planned maintenance operations according to specifications and process standards.

A rail vehicle maintenance team usually comprises two or more technicians who together carry out mechanical and electrical engineering operations. For both commissioning and repair, they work on high voltage current collection and traction systems, air supply and brake systems, door operation systems, vehicle bogie systems, air-conditioning systems, as a minimum, to ensure the safety, efficiency and economy of vehicle's operation.

High performing rail vehicle technicians have comprehensive knowledge, understanding, and expertise relevant to rail vehicles. They must understand rail vehicles' structures and the working principles, standards, and processes of their components, and of vehicle control, maintenance, and repair. They must stay abreast of current and emerging rail vehicle technology developments, and use these in their work processes. They should be able to contribute their special expertise to the team, to enhance its performance. These demands require rail vehicle technicians to keep improving their skills for solving more complicated diagnostic tasks, and for repairing vehicles that adopt the most advanced and newest technologies. With further professional development, a capable and committed rail vehicle technician can be part of the continuing global advance of rail transit, including in leading technical or managerial positions.

# General notes on the WSOS

The WSOS specifies the knowledge, understanding, and specific skills that underpin international best practice in technical and vocational performance. It should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSOS).

The skill competition is intended to reflect international best practice as described by the WSOS, and to the extent that it is able to. The Standard is therefore a guide to the required training and preparation for the skill competition.

In the skill competition the assessment of knowledge and understanding will take place through the assessment of performance. There will only be separate tests of knowledge and understanding where there is an overwhelming reason for these.

The Standard is divided into distinct sections with headings and reference numbers added.

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards. This is often referred to as the "weighting". The sum of all the percentage marks is 100. The weightings determine the distribution of marks within the Marking Scheme.

Through the Test Project, the Marking Scheme will assess only those skills that are set out in the Standards Specification. They will reflect the Standards as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme will follow the allocation of marks within the Standards to the extent practically possible. A variation of up to five percent is allowed, provided that this does not distort the weightings assigned by the Standards.

# WorldSkills Occupational Standards

| Section | | Relative importance (%) |
|---|---|---|
| 1 | **Work organization and management** | **5** |

The individual needs to know and understand:

- Rail vehicle maintenance manuals
- Health and safety legislation, obligations and documentation
- Approved manuals, and data from manufacturers and government
- Situations when a range of personal protective equipment (PPE) must be used
- Safety protection measures for the on-site working environment
- The purposes, uses, care, and safe storage of materials
- Sustainability measures relating to the use of environmentally friendly materials, minimization of waste, and recycling materials
- Principles of workflow, time management, measurement, and cost analysis
- The importance of researching, planning, accuracy, checking, and attention to detail in all working practices
- The importance of working within a team to accomplish tasks in a timely and economical manner
- The importance of teamwork
- Individual roles and responsibilities within team settings
- Strengths and limitations of team members and how to organize teams to optimize the available resources

The individual shall be able to:

- Consistently and diligently follow health and safety standards, rules and regulations
- Identify and use the appropriate personal protective equipment
- Organize site protection measures and ensure the safety of the work environment
- Apply professional skills to each assignment
- Select, use, clean, maintain, and store all tools and equipment safely
- Select, use, and store all materials safely
- Plan work areas to maximize efficiency
- Maintain the discipline of keeping work areas clean and tidy
- Use the latest versions of approved manuals and data, following defined processes and procedures for vehicle repair
- Establish and consistently maintain high quality standards and working processes when under pressure
- Plan the workflow within team environments to ensure safe, successful competition of tasks within given time periods

Organize and carry out a set of tasks, using team resources to best effect

| Section | | Relative importance (%) |
|---|---|---|
| 2 | **Communication and interpersonal skills** | 5 |

The individual needs to know and understand:

- The significance of establishing and maintaining customer confidence
- The roles and responsibilities of related colleagues
- The value of building and maintaining productive working relationships
- The importance of developing and maintaining an industry-accepted attitude
- Interpersonal techniques for effective teamwork
- The importance of swiftly resolving misunderstandings and conflicting demands
- Human factors as they relate to work environments and standards.

The individual shall be able to:

- Interpret customer requirements and manage customer expectations positively
- Make recommendations which exceed the customers' requirements, within budget
- Produce cost and time estimates for customers
- Contribute positively to teams, showing care and concern for others' welfare, and for team performance
- Undertake investigative discussions, for example, to resolve technical problems
- Keep colleagues regularly informed/updated on planned maintenance procedures
- Negotiate timings to minimize negative impacts on work/productivity levels
- Reflect positively and respond constructively to feedback on own performance, and the performance of other team members
- Recognize and respond to the needs of support organizations, such as logistical suppliers and engineering authorities.

| | | |
|---|---|---|
| 3 | **Problem-solving, innovation, planning** | 10 |

The individual needs to know and understand:

- The common types of problem which can occur within work processes
- The distinctions between sector or national standards, and international best practice
- Diagnostic approaches to problem solving
- The importance of following manufacturers' most recent "Amended Issue" manuals and documents, for problem-solving processes
- Trends and developments in the industry including new materials, methods, and technologies
- The importance of making safe, timely and efficient work plans while collaborating in teams' ambience

| Section | | Relative importance (%) |
|---|---|---|
| | The individual shall be able to:<br>• Check work regularly to minimize problems at later stages<br>• Challenge incorrect instructions and regulations to prevent problems<br>• Recognize and analyse problems swiftly, in order to follow a self-managed process for solving them, using manufacturers' latest maintenance manuals and documents<br>• Undertake fault diagnosis discussions with drivers to determine the underlying causes of technical problems<br>• Persist and show resilience in solving complex problems<br>• Recognize opportunities to contribute ideas to improve outcomes and overall levels of customer satisfaction<br>• Show willingness to try new methods and embrace change<br>• Interpret and apply vehicle maintenance procedures<br>• Check one's own, and others', work to ensure it meets best practice, given the environment and available resources | |
| **4** | **Vehicle mechanical part repair, maintenance, and commissioning** | **35** |
| | The individual needs to know and understand:<br>• International Union of Railways (UIC), and the International Electrotechnical Commission (IEC) standards<br>• Manufacturers' vehicle maintenance manuals<br>• Standard rules, procedures, methods, and so on, for vehicles' overall or parts repair<br>• Vehicles' composition and structure, mainly including their roofs, bodies, drivers' cabs, passenger compartments, underframes, and gangways.<br>• The structure and motion principles for main components, especially core parts such as pantographs, vehicle doors, and vehicle bogies<br>• Correct procedures for checking, disassembly, assembly, commissioning, maintenance, and tests, of main components<br>• How and when to inspect and repair tools<br>• How and when to Inspect and update related material inventories<br>• Hazardous elements during work, and corresponding safety protection measures. | |

| Section | | Relative importance (%) |
|---|---|---|
| | The individual shall be able to:<br>• Make and maintain personal and site safety protection based on the working conditions<br>• Read and use vehicle and parts structure diagrams, operation manuals, and repair maintenance manuals, as supplied by manufacturers<br>• Identify and source various specialist materials for vehicle repair<br>• Identify and source various vehicle repair tools, and use to best effect<br>• Select and use correct and efficient inspection measures, such as visual detection, tactile detection, measuring, and testing<br>• select and use parts maintenance measures, such as dedusting, cleaning, lubricating, adjusting, fastening, and replacement<br>• Follow repair procedures to check vehicles and their parts<br>• Identify vehicle parts defects and faults<br>• Use the correct tools and methods to disassemble and assemble vehicle parts<br>• Test main vehicle parts' mechanical motion and identify abnormal status<br>• Adjust the motion and status parameters for main vehicle parts, to ensure that they meet technical requirements<br>• Make and maintain accurate work reports. | |
| 5 | **Vehicle electrical systems care, maintenance, and testing** | **35** |
| | The individual needs to know and understand:<br>• International Union of Railways (UIC), and the International Electrotechnical Commission (IEC) standards<br>• Manufactures' vehicle maintenance manuals<br>• The standard rules, procedures, methods, and other considerations for each vehicle's electrical system maintenance, care, and testing<br>• The electrical structure of rail vehicles<br>• Vehicle electrical subsystems' composition, working principles, control principles, mainly relating to:<br>  • high voltage traction systems<br>  • brake systems<br>  • electrical assistant systems<br>  • vehicle door control systems<br>  • air conditioning systems<br>  • network and monitoring systems<br>  • fire alarm systems<br>  • passenger information systems<br>  • lighting systems<br>• Vehicle electrical installation wiring process standards<br>• Vehicle standard electrical legends, icons, symbols<br>• The purposes and uses of electrical equipment, tools, and gauges<br>• Electrical materials<br>• Hazardous factors and elements during electrical work, and corresponding safety protection measures. | |

| Section | | Relative importance (%) |
|---|---|---|
| | The individual shall be able to:<br>• Take personal and site safety protection measures based on working conditions<br>• Access and use each electrical subsystem's principle diagrams, assembly diagrams, wiring diagrams, electrical layout diagrams, maintenance manuals, and so on, which are supplied by manufacturers<br>• Identify various vehicle electrical components<br>• Select and use various vehicle electrical instruments (such as Ground Test Bench, and commissioning software.), tools and gauges<br>• Select and use electrical maintenance methods, such as testing, measuring, assembly, and wiring<br>• Install vehicles' main control electric circuits and pneumatic circuits, according to electrical schematic diagrams, assembly drawings, wiring diagrams, and process standards<br>• Test each electrical subsystem's functionality according to test procedures<br>• Identify the working condition of each electrical subsystem, and take action accordingly<br>• Test each vehicle's entire electrical functions in relation to their actual operational environments<br>• Make and maintain accurate work reports. | |
| **6** | **Vehicle fault diagnosis and repair** | **10** |
| | The individual needs to know and understand:<br>• International Union of Railways (UIC), and the International Electrotechnical Commission (IEC) standards, IEC 61735 standards, train network control systems, and their data<br>• Manufacturers' vehicle maintenance manuals<br>• Vehicles' electrical structures<br>• Vehicle subsystems' composition, working principles, and control principles, mainly relating to:<br>  • high voltage traction systems<br>  • brake systems<br>  • electrical assistant systems<br>  • vehicle door control systems<br>  • air conditioning system<br>  • network and monitoring systems<br>  • fire alarm systems<br>  • passenger information systems<br>  • lighting systems<br>• The normal fault phenomena and repair methods for each vehicle's electrical system<br>• Vehicle standard electrical legends, icons, and symbols<br>• The purposes and uses of electrical equipment, tools, and gauges | |

| Section | Relative importance (%) |
|---|---|
| The individual shall be able to:<br>• Source and apply each electrical subsystem's principle diagrams, wiring diagrams, electrical layout diagrams, fault repair manuals, and other information supplied by manufacturers<br>• Identify various vehicle electrical components, their purposes and uses<br>• Identify each train network's status and analyse network data<br>• Identify each vehicle's electrical subsystems' fault phenomena<br>• Analyse and assess the cause and scope of electrical faults<br>• Investigate and pinpoint each electrical fault by testing, measuring, and other acceptable methods<br>• Correct faults by wiring, replacement, and other methods, and test to ensure that the faults have been removed.<br>• Accurately record faults and repair processes. | |
| **Total** | **100** |

# References for industry consultation

WorldSkills is committed to ensuring that the WorldSkills Occupational Standards fully reflect the dynamism of internationally recognized best practice in industry and business. To do this WorldSkills approaches a number of organizations across the world that can offer feedback on the draft Description of the Associated Role and WorldSkills Occupational Standards on a two-yearly cycle.

In parallel to this, WSI consults three international occupational classifications and databases:

- ISCO-08: (http://www.ilo.org/public/english/bureau/stat/isco/isco08/)
- ESCO: (https://ec.europa.eu/esco/portal/home )
- O*NET OnLine (www.**onet**online.org/)

The following table indicates which organizations were approached and provided valuable feedback for the Description of the Associated Role and WorldSkills Occupational Standards in place for WorldSkills Shanghai 2022.

There were no responses to the requests for feedback this cycle