



TECHNICAL DESCRIPTION

Rail Vehicle Technology (Online)

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1. Introduction

1.1. Name and Description of the Skill Competition

1.1.1. Name

Rail Vehicle Technology

1.1.2. Description of the Skill Competition

2022 BRICS Skills Competition (BRICS Future Skills Challenge) - Rail Vehicle Technology (Online) will be held on an Internet-based platform that features a vehicle maintenance environment realized by the 3D virtual simulation technology. Competitors need to conduct online operations via 3D software installed on a computer. The contents of the Skill Competition are mainly from the actual job requirements. Rail Vehicle Technology is a team skill with two Competitors per team.

1.1.3. Competition System

The Skill Competition will be carried out through the RVT Online Training and Competition System developed by Global Industry Partner.

The System consists of the RVT Online Training and Competition Platform (<https://skills.jantech.cn:8080/#/login?redirect=%2Findex>) and the 3D software (RVT 3D Client). The platform provides reference documents and operation videos for the Skill, training and competition arrangements, score inquiry, rankings and the 3D software download access; the RVT 3D Client allows the daily training of Competitors and the launch of the Skill Competition.

1.2. The Relevance and Significance of This Document

This document contains information about the standards required to compete in this skill competition, and the assessment principles, methods and procedures that govern the competition. Every Expert and Competitor must know and understand this Technical Description.

In the event of any conflict within the different languages of the Technical Descriptions, the English version takes precedence.

2. Skill Specification

2.1. General Notes on the Skill Specification

The Skill Specification 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.

The Skill Competition is intended to reflect international best practice as described by the Skill Specification, and to the extent that it is able to. The Skill Specification is therefore a guide to the required training and preparation for the Skill Competition.

The Skill Specification 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 Skill Specification. 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 Skill Specification. They will reflect the Skill Specification as comprehensively as possible within the constraints of the Skill Competition.

The Marking Scheme will follow the allocation of marks within the Skill Specification 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 Skill Specification.

2.2. Skill Specification

Section	Relative importance (%)
1 Work organization and management	5
<p>The individual needs to know and understand:</p> <ul style="list-style-type: none"> • 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 • 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 <hr/> <p>The individual shall be able to:</p> <ul style="list-style-type: none"> • 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 	
2 Communication and interpersonal skills	5

Section	Relative importance (%)
<p>The individual needs to know and understand:</p> <ul style="list-style-type: none">• 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	
<p>The individual shall be able to:</p> <ul style="list-style-type: none">• 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• Recognize and respond to the needs of support organizations, such as logistical suppliers and engineering authorities.	
3 Problem-solving, Innovation, Planning	5
<p>The individual needs to know and understand:</p> <ul style="list-style-type: none">• 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• The importance of making safe, timely and efficient work plans while collaborating in teams' ambience	

Section	Relative importance (%)
<p>The individual shall be able to:</p> <ul style="list-style-type: none">• Check work regularly to minimize problems at later stages• Challenge incorrect instructions and regulations to prevent problems• Recognize and analyse problems swiftly, in order to follow a self-managed process for solving them, using manufacturers' latest maintenance manuals and documents• Persist and show resilience in solving complex problems• Recognize opportunities to contribute ideas to improve outcomes and overall levels of customer satisfaction• Show willingness to try new methods and embrace change• Interpret and apply vehicle maintenance procedures• 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	40
<p>The individual needs to know and understand:</p> <ul style="list-style-type: none">• International Union of Railways (UIC), and the International Electrotechnical Commission (IEC) standards• Manufacturers' vehicle maintenance manuals• Standard rules, procedures, methods, and so on, for vehicles' overall or parts repair• Vehicles' composition and structure, mainly including their roofs, bodies, drivers' cabs, passenger compartments, underframes, and gangways• The structure and motion principles for main components, especially core parts such as pantographs, vehicle doors, and vehicle bogies• Correct procedures for checking, disassembly, assembly, commissioning, maintenance, and tests, of main components• How and when to inspect and repair tools• How and when to inspect and update related material inventories• Hazardous elements during work, and corresponding safety protection measures.	

Section	Relative importance (%)
<p>The individual shall be able to:</p> <ul style="list-style-type: none">• Make and maintain personal and site safety protection based on the working conditions• Read and use vehicle and parts structure diagrams, operation manuals, and repair maintenance manuals, as supplied by manufacturers• Identify and source various specialist materials for vehicle repair• Identify and source various vehicle repair tools, and use to best effect• Select and use correct and efficient inspection measures, such as visual detection, tactile detection, measuring, and testing• Select and use parts maintenance measures, such as dedusting, cleaning, lubricating, adjusting, fastening, and replacement• Follow repair procedures to check vehicles and their parts• Identify vehicle parts defects and faults• Use the correct tools and methods to disassemble and assemble vehicle parts• Test main vehicle parts' mechanical motion and identify abnormal status• Adjust the motion and status parameters for main vehicle parts, to ensure that they meet technical requirements• Make and maintain accurate work reports.	
5 Vehicle electrical systems care, maintenance, and testing	35
<p>The individual shall be able to:</p> <ul style="list-style-type: none">• International Union of Railways (UIC), and the International Electrotechnical Commission (IEC) standards• Manufactures' vehicle maintenance manuals• The standard rules, procedures, methods, and other considerations for each vehicle's electrical system maintenance, care, and testing• The electrical structure of rail vehicles• Vehicle electrical subsystems' composition, working principles, control principles, mainly relating to:<ul style="list-style-type: none">• high voltage traction systems• brake systems• electrical assistant systems• vehicle door control systems• air conditioning systems• network and monitoring systems• fire alarm systems• passenger information systems• lighting systems• Vehicle standard electrical legends, icons, symbols• The purposes and uses of electrical equipment, tools, and gauges• Electrical materials• Hazardous factors and elements during electrical work, and corresponding safety protection measures.	

Section	Relative importance (%)
<p>The individual shall be able to:</p> <ul style="list-style-type: none">• Take personal and site safety protection measures based on working conditions• 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• Identify various vehicle electrical components• Select and use various vehicle electrical instruments (such as Ground Test Bench, and commissioning software.), tools and gauges• Select and use electrical maintenance methods, such as testing, measuring, assembly, and wiring• Install vehicles' main control electric circuits and pneumatic circuits, according to electrical schematic diagrams, assembly drawings, wiring diagrams, and process standards• Identify the working condition of each electrical subsystem, and take action accordingly• Test each vehicle's entire electrical functions in relation to their actual operational environments• Make and maintain accurate work reports.	
6 Vehicle fault diagnosis and repair	10
<p>The individual needs to know and understand:</p> <ul style="list-style-type: none">• International Union of Railways (UIC), and the International Electrotechnical Commission (IEC) standards, IEC 61735 standards, train network control systems, and their data• Manufacturers' vehicle maintenance manuals• Vehicles' electrical structures• Vehicle subsystems' composition, working principles, and control principles, mainly relating to:<ul style="list-style-type: none">• high voltage traction systems• brake systems• electrical assistant systems• vehicle door control systems• air conditioning system• network and monitoring systems• fire alarm systems• passenger information systems• lighting systems• The normal fault phenomena and repair methods for each vehicle's• Electrical system• Vehicle standard electrical legends, icons, and symbols• The purposes and uses of electrical equipment, tools, and gauges	

Section	Relative importance (%)
The individual shall be able to: <ul style="list-style-type: none">• Source and apply each electrical subsystem's principle diagrams, wiring diagrams, electrical layout diagrams, fault repair manuals, and other information supplied by manufacturer• Identify various vehicle electrical components, their purposes and uses• Identify each train network's status and analyse network data• Identify each vehicle's electrical subsystems' fault phenomena• Analyse and assess the cause and scope of electrical faults• Accurately record faults and repair processes.	
Total	100

3. Marking Scheme

3.1. Marking Method

Marking for the Skill Competition will be made automatically by computer. If a Competitor cheats on the Skill Competition or otherwise violates the rules during the Skill Competition, the Judges will deal with the violations or cancel the scores of the Competitor if the violation is serious.

3.2. Marking Rule

1. The Competitor with the highest total scores will be ranked first;
2. For Competitors with the same total scores, they will be ranked in order of score for Module D, Module A, Module B, and Module C.

If a ranking cannot be made according to the above two rules, the Competitors will be ranked according to the time they spend on the Skill Competition, and the Competitor who spends less time wins.

3.3. Assessment Terms

During the competition design process, the standard and assessment method chose is determined by assessment plan and Test Project.

The assessment terms contain but not limited to:

- The integrity and specification degree of the working process
- The integrity and specification degree of the operation record sheet
- The accuracy of the parts measurement

- The precision of the parameter adjustment for device motion and status
- If the fastening bolt is accord with the standard torque's requirement
- The process, integration, and correction condition for the parts assembly
- Troubleshoot of the defects of equipment and components
- The result of fault repair
- The personal protection condition

4. Test Project

4.1. General Notes

Whether it is a single entity, or a series of stand-alone or connected modules, the Test Project will enable the assessment of the applied knowledge, skills, and behaviours set out in each section of the Skill Specification.

The purpose of the Test Project is to provide full, balanced, and authentic opportunities for assessment and marking across the Skill Specification, in conjunction with the Marking Scheme. The relationship between the Test Project, Marking Scheme, and Skill Specification will be a key indicator of quality, as will be its relationship with actual work performance.

The Test Project will not cover areas outside the Skill Specification, or affect the balance of marks within the Skill Specification.

The Test Project will enable knowledge and understanding to be assessed solely through their applications within practical work.

4.2. Format/Structure of the Test Project

The Test Project is a series of four (4) standalone modules.

- Module A: Maintenance and Control of Pantograph
- Module B: Installation and Commissioning of Passenger Compartment Door
- Module C: Maintenance of Vehicle Bogie
- Module D: Fault Finding and Repair of Vehicle

4.3. Test Project Time Allocation and Weighting

Module	Time (min)	Weighting (%)
Module A: Maintenance and Control of Pantograph	70	25
Module B: Installation and Commissioning of Passenger Compartment Door	70	25
Module C: Maintenance of Vehicle Bogie	60	15
Module D: Fault Finding and Repair of Vehicle	100	35
Total	300	100

4.4. Operation Contents and Requirements of the 4 Modules

The Skill Competition comprehensively assesses Competitors' maintenance capabilities for the RVT skill, and covers contents such as the appearance inspection and maintenance of rail vehicle parts, maintenance of pneumatic circuit, equipment parameters adjustment and setting, replacement and installation of mechanical parts, fault finding and repair, etc.

Module A mainly assesses pantograph routine maintenance, motion parameters adjustment and setting and electrical tests; Module B the routine inspection, installation and electrical tests of passenger compartment door; Module C bogie routine maintenance, parts replacement and pressure maintaining test; and Module D vehicle mechanical parts routine inspection, electrical tests, the Train Control and Management System (TCMS) and Passenger Information System (PIS).

Module	Module Name	Operation Scope
A	Maintenance and Control of Pantograph	01 Appearance Inspection and Maintenance of Pantograph Parts 02 Pantograph Carbon Contact Strip Replacement 03 Pantograph Conductive Wire Replacement 04 Pantograph Lifting and Lowering Durations Adjustment 05 Pantograph Static Contact Force Adjustment 06 Pantograph Pneumatic Circuit Maintenance

		<p>07 Panto Down Position Sensor Adjustment</p> <p>08 Pantograph Electrical Function Test</p>
B	Installation and Commissioning of Passenger Compartment Door	<p>01 Passenger Compartment Door Appearance Inspection</p> <p>02 Door Mechanism Installation</p> <p>03 Door Leaves and Roller Swing Arms Installation</p> <p>04 Passenger Compartment Door Support Rollers Installation</p> <p>05 Passenger Compartment Door Isolation Lock Installation</p> <p>06 Passenger Compartment Door Emergency Egress Device Installation</p> <p>07 Passenger Compartment Door Vertical Cover Plates Installation</p> <p>08 Door Drive Unit Cover Plates Installation</p> <p>09 Passenger Compartment Door Electrical Function Test</p>
C	Maintenance of Vehicle Bogie	<p>01 Bogie Appearance Inspection and Maintenance</p> <p>02 Vertical Damper Replacement</p> <p>03 Axle Box Front Cover Replacement</p> <p>04 Brake Shoes Replacement</p> <p>05 Speed Sensor Installation</p> <p>06 Earthing Carbon Brush Replacement</p> <p>08 Brake Pipe Replacement</p> <p>07 Motor Wire Replacement</p> <p>09 Pressure Maintaining Test</p> <p>10 Bogie Parts Measurement</p>
D	Fault Finding and Repair of Vehicle	<p>01 Vehicle Appearance Inspection</p> <p>02 Activation and Occupation Tests</p> <p>03 Pantograph Test</p> <p>04 Door Opening and Closing Tests</p> <p>05 Train Control and Management System (TCMS) Test</p> <p>06 HSCB Function Test</p> <p>07 Lighting Function Test</p>

		08 Traction and Brake Static Test 09 Passenger Information System (PIS) Maintenance and Commissioning 10 Fire Alarm System Maintenance and Commissioning 11 Air Conditioner Maintenance and Commissioning
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4.5. Test Project Circulation

The Test Project is circulated via the website:

The Test Project is circulated 15 days prior to the Challenge.

4.6. Test Project Change

The Test Project will have a 30% change before the Challenge. This change is presented to the Experts and Competitors at the Challenge on C-2.

The 30% change is kept confidential and will not be disclosed to any Expert or to any Competitor prior to C-2.

5. Skill Management and Communication

5.1. Expert Team

The Skill Expert Team is composed of the Skill Chief Expert and other Experts selected by their own country. Jointly they are responsible for the further revision of the Technical Description of the Skill Competition and daily skill management.

5.2. Discussion Forum

Participants who have questions about the hardware and software preparations, Skill Competition environment layout, etc. ahead of the Skill Competition can give their feedback at the Forum section (<https://skills.jantech.cn/en/forum/>) of the RVT Training and Competition Platform. Training communication, re-, in- and post-challenge communication for the RVT skill can also be carried out through the Forum.

6. Safety Requirements

Refer to the BRICS Skills Competition Organizing Committee Health, Safety, and Environment Policy and Regulations.

7. Materials and Equipment

7.1. Infrastructure List

The Infrastructure List details all equipment, materials, and facilities that need to be prepared by the participating parties. Refer to the 2022 BRICS Skills Competition (BRICS Future Skills Challenge) - Rail Vehicle Technology - Infrastructure List (Online).

7.2. Proposed Work Site and Workstation Layouts

1.1.4. Workstation Layout Requirements

The Competitors' desk should be arranged in a quiet, well-lit, non-disturbing and unobstructed environment. The computer is placed at the middle of the Competitors' desk on which the national flag of the Competitors is put, and two seats for the Competitors should be arranged in front of the desk.

1.1.5. Mobile Monitoring Device Layout Requirements

The center line of the mobile monitoring device No. 1 is at a 45° angle with the plane of the computer monitor. The monitoring device should display the computer monitor and the Competitors' side faces, and an area of 1 meter around the workstation at a height about 1.5 meters above the ground.

The mobile monitoring device No. 2 is placed on the Competitors' Desk, and its center line is at an angle of around 45° with the plane of the computer monitor. The mobile monitoring device No. 2 is required to fully display the computer monitor (the image shown on the computer monitor fills in the screen of the mobile monitoring device No. 2 as much as possible).

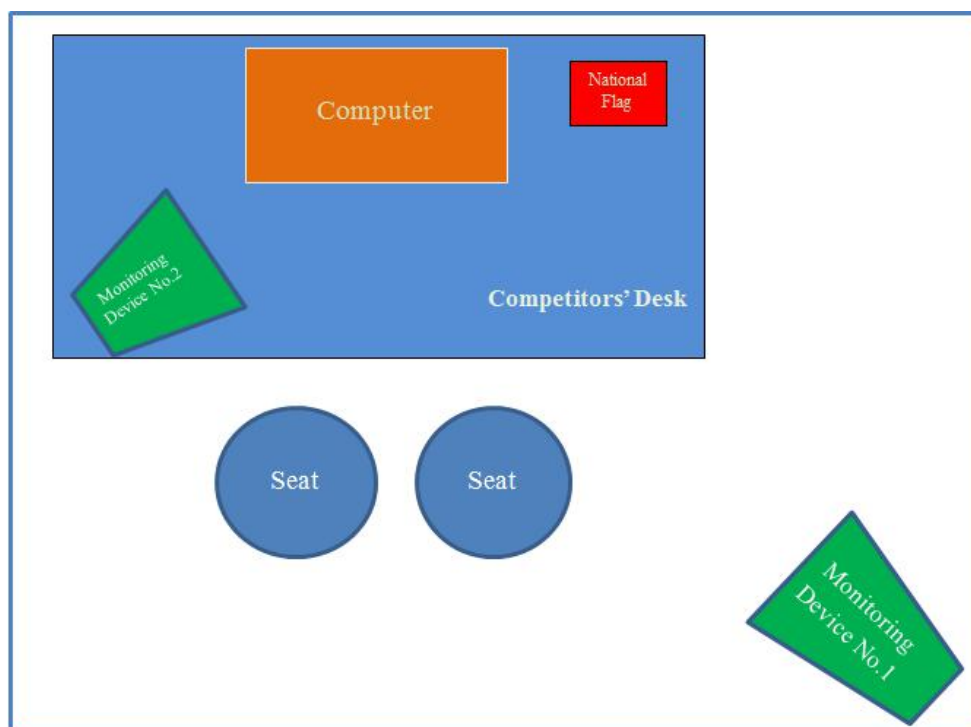


Figure 7.1 Workstation Overall Layout



Figure 7.2 Mobile Monitoring Device No. 1 Layout Example



Figure 7.3 Monitoring Example of Mobile Monitoring Device No. 1



Figure 7.4 Mobile Monitoring Device No. 2 Layout Example

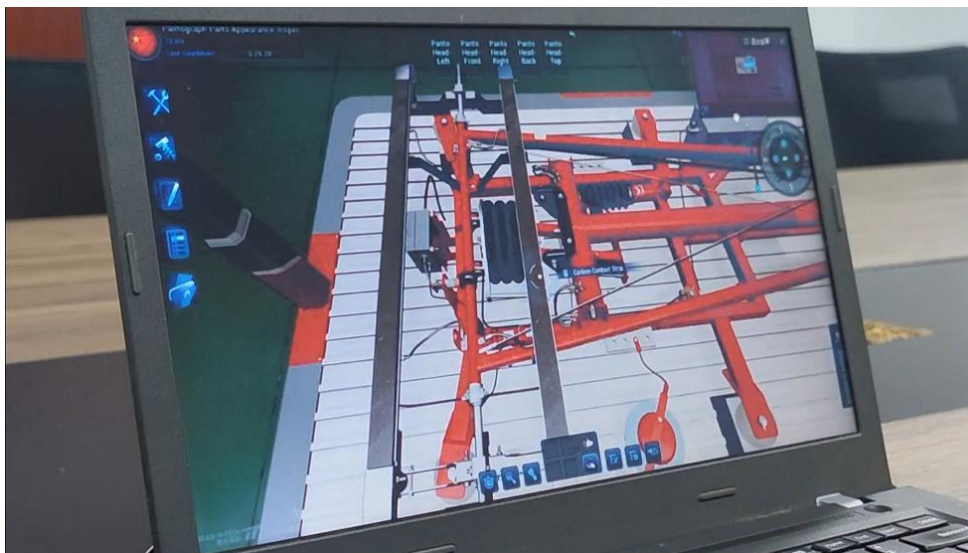


Figure 7.5 Monitoring Example of Mobile Monitoring Device No. 2