2025

BRICS SKILLS COMPETITION

(BRICS FUTURE SKILLS AND TECHNOLOGY CHALLENGE)

Maintenance of Railway Signal Equipment
BRICS-FS-24

Technical Description

International Finals-Onsite

May 2025

Catalogue

1.Project Introduction

The competition is designed with the typical application scenario of railway signal equipment maintenance — Maintenance of Railway Signal Equipment is designed as the assessment direction. According to the given project description and requirements, the participating team completes the railway signal equipment maintenance project in accordance with the relevant technical requirements of railway signal equipment maintenance.

The assessment includes: railway signal professional theoretical knowledge assessment, interlocking system software operation assessment, railway signal equipment software maintenance assessment, railway signal equipment fault troubleshooting and professional quality related content.

1.1 Name and description of skills competition

1.1.1 Name of the skills competition

Name of the competition: Railway signal equipment maintenance skills competition

1.1.2 Description of skills competition

The offline competition of the 2025 BRICS Vocational Skills Competition on Railway Signal Equipment Maintenance is based on the task content of railway signal equipment maintenance skills. The offline competition of this event is a two-person team competition.

Railway signal equipment maintenance professionals need to have the following

skills: able to understand the structure and basic working principle of common signal equipment; able to overhaul signal equipment, be able to troubleshoot and handle signal equipment faults; able to operate computer interlocking system.

1.2 Relevance and importance of the document

This document contains the standards required for this skills competition, as well as information on the evaluation principles, methods and procedures for managing the competition.

Each expert and contestant must understand this technical description.

In the event of any conflict between technical descriptions in different languages, the English version shall prevail.

2. Skill standards

2.1 General description of skill standards

The skill standards define knowledge, understanding and specific skills that represent international best practices in technology and occupational performance. They reflect a global consensus on what relevant jobs or occupations mean in industry and business.

The skills competition is designed to reflect the international best practices described in the skill standard and the extent to which they can be achieved. Therefore, the standard serves as a guide for the training and preparation required for the skills competition. The standard is divided into different sections with headings and reference numbers.

The total score for all percentages is 100, and each part is assigned a percentage

of the total score to indicate its relative importance in the criteria. This is often referred to as "weighting". Weighting determines how points are allocated in the scoring criteria.

Through the test items, the scoring scheme only evaluates the skills listed in the standards. They will reflect the standards as comprehensively as possible under the constraints of the skills competition.

The scoring scheme will be based on the scores assigned in the criteria within the practical possibility of doing so, allowing for a 5 per cent variation but not altering the weights assigned by the standard specification.

2.2 Skill standards

No.	Type of skill	weight（%）
1	**Work organization and management**	2.5
	Players need to understand and understand: Principles and methods for the implementation of safety work; The use, use, maintenance and maintenance of all equipment and materials and their impact on safety; Environmental and safety principles and their application in good workshop management; Principles and methods of work organization, control and management; Communication and cooperation principles; The scope and limitations of the roles, responsibilities and obligations of the player and others individually or collectively; Parameters to be followed when planning activities; Principles and techniques of time management.	
	The candidate should be able to: Prepare and maintain a safe, clean and efficient work area; Prepare for the task at hand and give full consideration; Arrange work to maximize efficiency and	

	minimize schedule disruptions; Restore the working area to an appropriate state; Contribute to teamwork and organizational performance in both general and specific aspects; Provide and receive feedback and support.	
2	**communication skill**	**2.5**
	The candidate should be able to: Understand the task; Emphasizing the positive quality of the project is beneficial. Clarify and protect your design decisions; Show your achievements professionally; Clarify the implementation methods and steps; be punctual ; Prepare to answer questions; Be able to speak English fluently; Persuade others to believe the advantages of the proposed solution; play the game 。 Process bidding documents;	
3	**Railway signal basic knowledge**	**60**
	Players need to understand and understand: Main functions of railway signal equipment assessment platform; Theoretical knowledge of railway signal;	

	Signal machine schematic diagram and wiring diagram; Switching machine schematic diagram and wiring diagram; Track circuit schematic diagram and wiring diagram; Signal equipment data measurement; Use of interlocking equipment; Signal cabinet type;	
	The candidate should be able to: Perform signal equipment maintenance operation; Carry out troubleshooting and processing operations of signal equipment; Perform interlocking operations;	
4	**The railway signal professional implements equipment debugging**	**25**
	Players need to understand and understand: Main functions of railway signal equipment assessment platform; Working principle of signal machine; Working principle of the switch machine; Working principle of track circuit; Operation of interlocking equipment; The internal circuit routing of the signal equipment	
	The candidate should be able to:	

	Configure the switch machine; Installation and use of various tools; Configure signal machines; Configure track circuit; Configure interlocking equipment; Debug railway signal equipment;	
5	**Power on verification of equipment in railway signal specialty** Players need to understand and understand: The role of certification mark; Operating steps for powering on the device; The importance of data validation; Data content to be verified; The range and limitations of technologies, methods, and operating environments for testing different data types. The candidate should be able to: Use multimeter to check and verify the data of physical equipment; Data changes are generated by the operation equipment; Use multimeter to verify the accuracy of platform data;	**10**

3. Scoring scheme

3.1 Scoring method

The judges will score the competition offline. If the players cheat or violate other rules during the competition, the judges will deal with the players according to their violations, and those with serious circumstances will cancel their results.

3.2 Scoring rules

1. Those with higher overall scores will rank first;

2. In case of the same total score, those with higher scores in Module D, Module C, Module A and Module B will be ranked first according to the principle of ranking first according to the higher scores, and those with shorter cumulative competition time will rank first.

3.3 Evaluation basis

In the process of competition design, the criteria and evaluation methods are determined by the scoring scheme and test items.

Evaluation criteria include but are not limited to:

- Completeness and standardization of the operation process
- Completeness and standardization of operation record card filling
- Assembly process, completeness and correctness of components
- The result of the troubleshooting
- Personal protection
- Results of maintenance inspection
- The result of filling in the assessment score sheet

4 .Test items

4.1 Precautions

Whether a single module or a series of independent or related modules, the test item can evaluate the application of knowledge, skills, and behaviors defined in the Skill Specification.

Combined with the scoring scheme, the purpose of the test item is to provide a comprehensive, balanced and authentic opportunity for evaluation and scoring against the standard. The relationship between the test item and the scoring scheme and the standard will be a key indicator of quality, just as the relationship between the standard and actual performance is.

The test items do not include aspects outside the standards and do not

affect the balance of scores within the standards.

The test project evaluates knowledge and understanding only through its application in actual work.

4.2 Test item format/framework

The test project consists of five relatively independent and related modules:

Module A: Railway signal professional theoretical knowledge assessment

Module B: Operation assessment of rail transit interlocking software

Module C: Railway signal equipment maintenance software assessment

Module D: Assessment of troubleshooting and handling of railway signal equipment faults

Module E: Professional quality

4.3 Time allocation and score weight of test items

module	duration（min）	Score weight (%)
Module A: Railway signal professional theoretical knowledge assessment	40	20.00
Module B: Operation assessment of rail transit interlocking software	80	10.00
Module C: Railway signal equipment maintenance software assessment		30.00
Module D: Assessment of troubleshooting and handling of railway signal equipment faults	90	40.00
Total	210	100

4.4 Module operation content and requirements

The competition covers the assessment of railway signal professional theoretical knowledge, the operation assessment of rail transit interlocking software, the maintenance software assessment of railway signal equipment, and the troubleshooting and processing assessment of railway signal equipment, etc., comprehensively examining the contestants' ability to apply the railway signal equipment maintenance skills platform and implement engineering operations;

Module A: Railway Signal Professional Theory Knowledge Assessment: This module is based on the signal professional theory knowledge, covering

the basic theory of signal, construction technology and core equipment principle;

Module B: Rail Transit Interlocking System Operation Assessment: This module uses the rail transit computer interlocking operating system for assessment, focusing on the operator's interlocking operation skills. It includes train route arrangement, shunting route arrangement, section fault unlocking, poor turnout fault setting, button blocking, and guiding total lock.

Module C: Railway signal equipment maintenance software assessment: This module mainly focuses on the operation assessment of railway signal equipment maintenance software, and completes the virtual simulation maintenance operation of railway signal equipment according to the requirements with the help of the virtual scene assessment system of railway signal equipment;

Module D: Assessment of troubleshooting and handling of railway signal equipment: This module focuses on the assessment of troubleshooting and handling of railway signal equipment, and uses the virtual scene assessment system and interlocking system of railway signal equipment to complete the troubleshooting of turnout, signal machine and track equipment according to the allocation of assessment content.

No.	Module name	Scope of work
A	Railway signal professional theory knowledge assessment	The scope of this examination can refer to the signal worker vocational skill appraisal question bank
B	Operation assessment of rail transit interlocking software	1. Establishing entry and other interlocking operations; 2. Use the function button to operate the disk; 3. Interlocking operation when the signal equipment is faulty;
C	Evaluation of railway signal equipment maintenance software	1. Inspection of computer interlocking equipment 2. Power supply screen inspection; 3. Inspection of track circuit; 4. Inspection and measurement of turnout switching equipment; 5. Inspection of railway signal machines;
D	Assessment of troubleshooting and handling of railway signal equipment	1. Switching machine troubleshooting; 2. Signal machine troubleshooting; 3. Track circuit fault troubleshooting;

4.5 Announcement of test items

The test items will be published through the website

(http://www.brskills.com/jzzy/productjs.html)

4.6 Test item changes

The test items will be changed by 30% before the official competition.

5. Skill management and communication

5.1, Expert Group

The skills expert group, consisting of chief experts, associate chief experts and expert members, is responsible for further revising the technical documents for the remote final of the competition and for daily skills management.

5.2 Discussion forum

Before the competition, participants can enter the forum section of the technical training and competition platform for railway signal equipment maintenance skills to give feedback on questions related to software and hardware preparation, test environment deployment, etc. The training and communication of this competition will also be carried out through the forum before, during and after the competition.

Online communication will be conducted through instant messaging tool WhatsApp (alternative: WeChat International version) and conference tool Zoom (alternative: Tencent Conference International version). The organizing committee will release the meeting time for offline discussion forum.

6. Safety requirements

6.1 Organizational structure

1. Establish a competition safety assurance team, with the head of the event executive committee serving as the team leader. Members are the safety officers from each venue. Each venue appoints a safety officer who is fully responsible for the venue's safety. In the event of an emergency, this officer is responsible for mobilizing rescue teams and professional personnel, and arranging the evacuation of personnel within the venue.

2. Establish a coordination mechanism with relevant departments such as public security, fire control, judicial administration, transportation, health, food safety, and quality inspection to ensure the safety of the competition. Develop emergency response plans and promptly address any emergencies. Set up dedicated lines for communication with medical personnel, firefighters, and security personnel, designate contact persons, and have the venue safety officer coordinate these contacts. The layout of the competition venue and the use of equipment must strictly follow safety construction regulations. The venue should be divided into zones, with evacuation routes set up according to safety requirements, and the safety evacuation routes and route diagrams should be prominently displayed on the walls.

6.2 Safety management of events

1. The installation of competition equipment and facilities shall be carried out in strict accordance with the safety construction standards, and the power

wiring and electrical installation shall be carried out in accordance with the specifications.

2. Place fire extinguishers according to fire safety requirements, and designate responsible persons to use them in case of emergency.

3. The competition regulations of the event specify the norms, regulations and qualification certificate requirements of relevant national (or industrial) occupational positions.

4. The organizing committee of the competition shall conduct safety training for all judges and staff members before the competition. According to the Labor Law of the People's Republic of China and other laws and regulations, a sound safety accident prevention system shall be established and improved, and the athletes shall be trained before the competition to avoid personal injury accidents.

5. The organizing committee of the event will establish a special program to ensure the safety of the competition proposition, the storage, distribution, recovery and evaluation process.

6.3 Competition environment safety management

1. Before the competition, the organizing committee of the event organizes a team to inspect the competition venue, accommodation facilities, and transportation services, and sets clear safety requirements. The venue layout and equipment must comply with national safety regulations. Simulated tests are conducted to identify potential issues. The organizing unit must eliminate all safety hazards according to the committee's requirements before the event.

2. A warning line is set up around the competition area to prevent unauthorized personnel from entering and to prevent accidents. The competition site provides necessary labor protection for the athletes according to the requirements of relevant professional positions. Before the competition, the referee must check and confirm that the equipment is in good condition. During the competition, strict measures are taken to prevent athletes from making any operational errors.

3. In order to ensure the smooth progress of the competition, the hosting college has established a corresponding safety guarantee system during the competition, which is implemented by the security, campus environment and health care groups.

(1) During the competition, all vehicles and personnel entering the competition area should enter with certificates and show them to the staff.

(2) Before the start of the competition, players should read carefully the "Entry Notice" and emergency evacuation map posted in the venue.

(3) The referee shall supervise the whole process of checking the electrical control system before it is powered on, and timely remind and stop any operation risks.

(4) Each competition equipment uses an independent power supply to ensure safety. When the contestant is programming, he/she should save the data in time to avoid data loss caused by sudden power failure.

(5) During the competition, the participants shall strictly abide by the safety operation rules. In case of emergency, they shall immediately cut off the power supply and leave the venue in an orderly manner under the arrangement of the

staff.

(6) All kinds of personnel must strictly abide by the rules of the competition, and are strictly prohibited from carrying prohibited items into the competition.

(7) Security personnel shall inform the person in charge of the stadium of potential safety risks in time.

(8) Smoking is strictly prohibited in the competition venue, and security personnel are not allowed to lend their certificates to others.

(9) In case of safety problems, evacuate the site quickly according to the emergency evacuation route under the command of security personnel.

4. The organizing committee shall, together with the organizing unit, set up complete signposts and increase guidance personnel in the densely populated areas of the competition site where vehicles and people intersect, and open up backup channels.

5. During the competition, the organizing unit of the competition shall increase the strength in key positions of the competition site management and establish a safety management log.

6. When the contestants enter the competition position and the competition judges and staff enter the workplace, the competition organizer shall remind and urge the contestants and the competition judges and staff to prohibit the carrying of communication, photography and recording equipment, prohibit the carrying of unauthorized recording tools, and conduct security check on the personnel entering the important areas of the competition site.

6.4 Living conditions guarantee

1. During the competition, the organizing unit shall arrange the accommodation and food for the participants and instructors. The organizing unit shall respect the religious beliefs and cultural customs of the ethnic minority participants and arrange the food and accommodation of the ethnic minority participants and teachers in accordance with the relevant national ethnic and religious policies.

2. The accommodation arranged during the competition shall have hotel and accommodation operation license.

3. The traffic safety of organized visits and observation activities during the competition shall be the responsibility of the executive committee of the competition area. The executive committee of the competition and the organizing unit shall ensure the traffic safety of the players, instructors, referees and staff during the competition.

4. In addition to necessary security isolation measures, strictly abide by relevant national laws and regulations to protect personal privacy and personal freedom.

6.5 Responsibilities of the participating team

1. Each participating unit shall arrange to purchase personal accident insurance for the participants during the competition when organizing the team.

2. After the formation of each unit's team, relevant management system shall be formulated, and safety education shall be provided to all participants

and instructors.

3. All participating teams shall strengthen the safety management of their participants and coordinate with the safety management of the competition site.

4. If the participating team has a vehicle, they shall enter and leave the competition site with the certificate issued by the organizing committee, drive according to the designated route and park at the designated place.

6.6 Emergency handling

In the event of an accident during the competition, the discoverer should immediately report it to the event executive committee and take measures to prevent the situation from escalating. The event executive committee should promptly activate the contingency plan to address the issue. In cases of major safety issues, the venue executive committee will decide whether to suspend the competition. Following the incident, the venue executive committee must provide a detailed report on the situation.

6.7 Punishment measures

1. If a major safety accident occurs in the event, the qualification of the organizer to host the event shall be suspended.

2. If a major safety accident is caused by the participating team, it will be disqualified from the award.

3. If the participating team has a major safety accident hazard and fails to be warned by the staff of the competition venue, it will be disqualified from

continuing the competition.

4. If the competition staff violates the rules, they shall be held accountable according to the corresponding system. If the circumstances are bad and cause major safety accidents, the judicial organs shall investigate the corresponding legal responsibilities.

7 Materials and equipment

7.1 List of infrastructure

The infrastructure list details all the equipment and facilities that participants need to prepare for, as shown in "Infrastructure List for Railway Signal Equipment Maintenance Skills Competition of the 2025 BRICS Vocational Skills Competition".

7.2 Contestant's toolbox

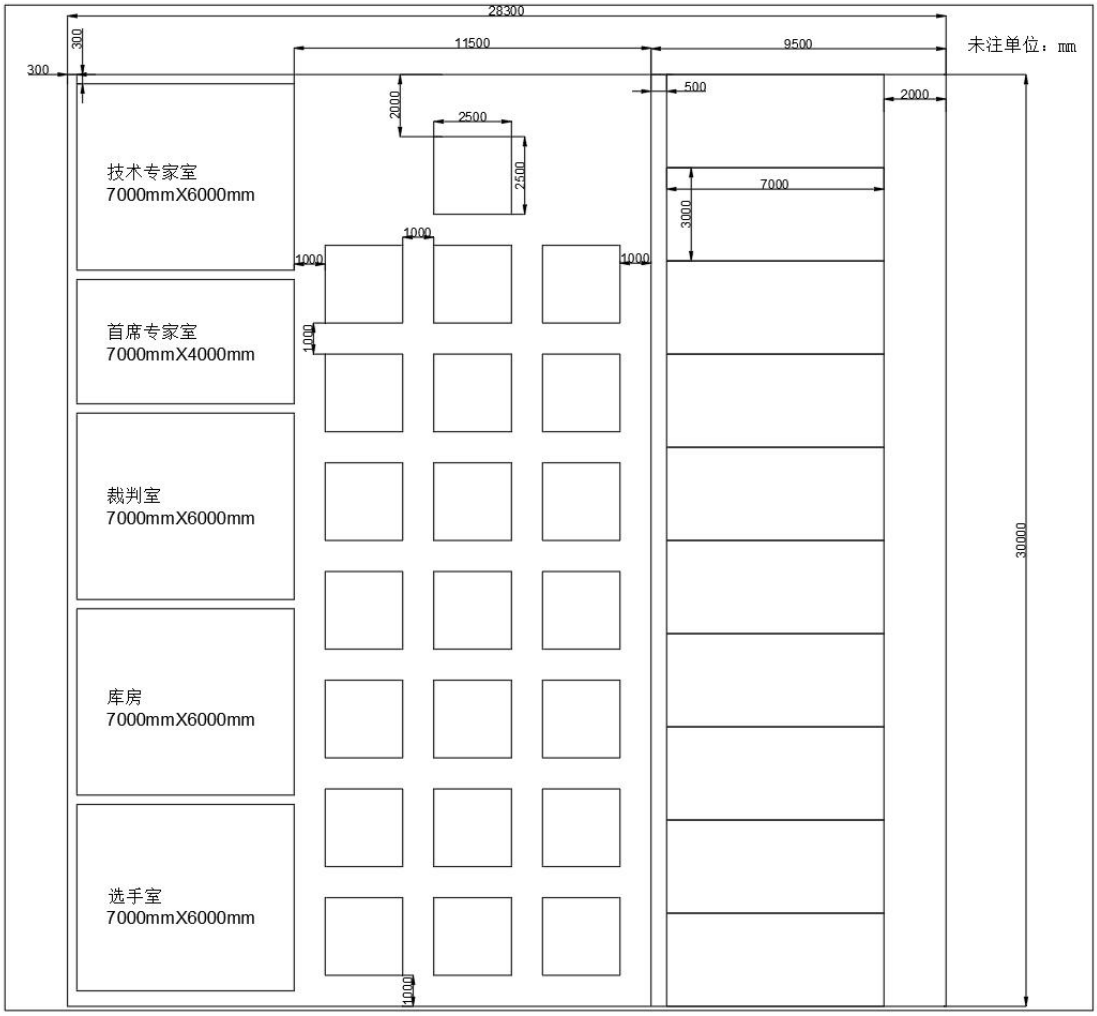
The tools used by the participants are provided by the organizer. Participants are not allowed to bring their own tools.

When other special tools are needed, the chief expert of the competition will announce them.

7.3 Materials and equipment prohibited in skill areas

Any materials and equipment carried by the participants shall be declared (produced) to the experts. The experts may prohibit the use of any items that are irrelevant to the performance of the task or may give an unfair advantage to the competitors.

7.4 Proposed competition area and workstation layout



Overall room layout: length * width =28.3m * 30m;

Railway signal equipment maintenance (physical) platform: length * width =7m * 3m;

Railway signal equipment maintenance (virtual) platform: length * width = 2.5m*2.5m;

Technical expert room: length * width =7m * 6m;

Chief expert room: length * width =7m * 4m;

Court room: length * width =7m * 6m;

Players' room: length * width =7m * 6m;

Warehouse: length * width =7m * 6m;

Power of the competition station (physical): 2KW, total power: 40KW;

Virtual working station power: 700W, total power: 28KW.

8. Rules specific to skills

Rules specific to skills must not conflict with or take precedence over the competition rules. They will provide detailed and clear specifications for various aspects, which vary depending on the skill competition. These include, but are not limited to, personal computing devices, data storage devices, internet access, work programs, and document management and distribution.

Topics/ tasks	**Rules for skills**
Technology used: Personal laptop, tablet and mobile phone	1. Experts and interpreters may use personal laptops, tablets and mobile phones. 2. Participants are not allowed to bring personal laptops, tablets or mobile phones into the test site.
Technology used: Personal camera	1. Experts and interpreters may use personal photography and video equipment in the examination room only after the completion of the test item or with the consent of the chief expert.
Evaluation of test items	For each workstation (module), the chief expert assigns a supervisor with the highest professional level in that field. During the participants 'completion of the test projects, the supervisor assesses whether the project points have been completed or not, and these assessments can only be made during the participants' task completion. The designated supervisor is fully

	responsible for the fairness of the participant's evaluation. 2. If the participants and experts are from the same organization at the workstation, the expert can be replaced once during the module duration.
Make 30% of the changes in the test project	1. During the introduction of the 30 per cent change, the expert must perform the following: 2. Equipment and software (all modules) provided by the sponsor of the competition: -Update the assembly drawing (or photo) of the installation; -Update the device schematic; -Update the task point description provided by the competition sponsor regarding the software and hardware features of the equipment.
The participants had technical problems during the task	1. If technical problems occur during the implementation of the test project (not due to the fault of the participant), the participant will be given additional time equal to the time from the discovery of the defect to the complete elimination of the defect. 2. If a technical problem is found to be caused by the fault of the participant, the participant will not be given additional time.
PPE (Personal Protection Equipment)	1. Personal protective equipment such as safety clothes and gloves shall be provided by the organizer.