



# 2025

## BRICS SKILLS COMPETITION

(BRICS+ FUTURE SKILLS & TECH CHALLENGE)

### Intelligent Manufacturing Equipment Integration Technology (CNC Multi-Axis)

BRICS-FS-52

### Test Projects

(International Final \_Online)

October, 2025



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## **I. Competition Format**

Before the competition, the two contestants in the same group shall log in to their respective accounts, search for the competition tasks on the competition platform, click "Register" to participate in the competition, and wait on the "Examination Information" page. When the competition starts, click "Refresh" to officially access the competition tasks.

After accessing the competition tasks, both contestants shall complete the contents of Module A, Module B, Module C, Module D, and Module E in their respective accounts, while Module F shall be completed jointly by the two contestants on one computer. Contestants can independently choose to give priority to completing the electrical part or the mechanical part according to their areas of expertise. During the competition, contestants in the same group are allowed to communicate with each other and cooperate, but they are not allowed to directly assist in the operation. Finally, the total score is calculated as the average score of Module A, Module B, Module C, Module D, Module E, and Module G of the two contestants in the same group plus the score of Module F.

## **II. Competition Content**

This competition consists of 7 modules, and the competition content includes the following task modules based on the application of intelligent manufacturing equipment integration technology (CNC multi-axis direction):

Module A: Electrical Design and Connection of Intelligent Equipment

Module B: Electrical Fault Diagnosis and Troubleshooting of Intelligent Equipment

Module C: Disassembly of Mechanical Components of Intelligent Equipment

Module D: Assembly of Mechanical Components of Intelligent Equipment

Module E: Repair of Mechanical Components of Intelligent Equipment

Module F: Construction and Programming of Intelligent Manufacturing Integration Environment

Module G: Professional Ethics and Safety Norms

## **III. Project Modules and Time Requirements**

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### 3.1 Project Modules and Time Requirements

The competition event of Intelligent Manufacturing Equipment Integration Technology (CNC Multi-axis Direction) consists of 7 modules, which require contestants to complete within 6 hours. For the specific names of project modules and time requirements, please refer to Table 1.

Table 1 List of Project Modules and Time Requirements

Serial Number	Module Name	Time Allowed for Completing Competition Content
1	Module A: Electrical Design and Connection of Intelligent Equipment	360 min
2	Module B: Electrical Fault Diagnosis and Troubleshooting of Intelligent Equipment	
3	Module C: Disassembly of Mechanical Components of Intelligent Equipment	
4	Module D: Assembly of Mechanical Components of Intelligent Equipment	
5	Module E: Repair of Mechanical Components of Intelligent Equipment	
6	Module F: Construction and Programming of Intelligent Manufacturing Integration Environment	
7	Module G: Professional Ethics and Safety Norms	

### 3.2 Task Content

#### Module A: Electrical Design and Connection of Intelligent Equipment (25 points)

##### A.1 Green Electrical Component Selection

After entering the software, complete the selection of corresponding functional circuits (tool magazine circuit, cooling circuit, chip removal circuit, servo main circuit). Once completed, click the bottom left corner to end the electrical installation assessment.

##### A.2 Electrical Functional Wiring

In accordance with the wiring schematic diagram provided earlier, complete the corresponding green electrical connections. All circuits on the left side of the software without a checkmark (servo main circuit, tool magazine circuit, DC power circuit, emergency stop circuit) need to be connected.

#### Module B: Electrical Fault Diagnosis and Troubleshooting of Intelligent Equipment (15 points)

### **B.1 Machine Tool Electrical Fault Troubleshooting**

There are 10 electrical fault questions in total. Each question related to the servo main circuit, chip removal circuit, tool magazine circuit, DC power circuit, emergency stop circuit, and start-stop circuit contains two faults. First, select the corresponding question, then click the circuit without a checkmark. Use a multimeter to find the faulty circuit. Next, click the "Show Fault Answer Interface" at the bottom right corner of the software, double-click the faulty circuit, and the content of the fault location will be automatically filled in. Finally, click "Submit".

### **Module C: Disassembly of Mechanical Components of Intelligent Equipment (5 points)**

#### **C.1 Disassembly of Machine Tool X-axis Components**

1. Disassembly of X-axis Worktable

In the simulation software, disassemble the X-axis worktable of the machine tool.

2. Disassembly of X-axis Ball Screw

In the simulation software, disassemble the X-axis ball screw of the machine tool together with the motor base, bearing seat, and oil distributor on the screw.

3. Disassembly of X-axis Guide Rail

In the simulation software, disassemble the X-axis guide rail of the machine tool together with the limit stop, ensuring no parts of the X-axis are missed.

#### **C.2 Disassembly of Machine Tool Y-axis Components**

1. Disassembly of X-axis Base

In the simulation software, disassemble the X-axis base of the machine tool.

2. Disassembly of Y-axis Ball Screw

In the simulation software, disassemble the Y-axis ball screw of the machine tool together with the motor base, bearing seat, and oil distributor on the screw.

3. Disassembly of Y-axis Guide Rail

In the simulation software, disassemble the Y-axis guide rail of the machine tool together with the limit stop, ensuring no parts of the Y-axis are missed.

### **Module D: Assembly of Mechanical Components of Intelligent Equipment (20 points)**

#### **D.1 Installation of Machine Tool Y-axis Components**

(1) Installation of Y-axis Guide Rail

In the simulation software, install the Y-axis guide rail of the machine tool together with the limit stop, ensuring no parts of the Y-axis are missing.

(2) Installation of Y-axis Ball Screw

In the simulation software, install the Y-axis ball screw of the machine tool together with the motor base, bearing seat, and oil distributor on the screw.

(3) Installation of X-axis Base

In the simulation software, install the X-axis base of the machine tool.

#### **D.2 Installation of Machine Tool X-axis Components**

(1) Installation of X-axis Guide Rail

In the simulation software, install the X-axis guide rail of the machine tool together with the limit stop, ensuring no parts of the X-axis are missing.

(2) Installation of X-axis Ball Screw

In the simulation software, install the X-axis ball screw of the machine tool together with the motor base, bearing seat, and oil distributor on the screw.

(3) Installation of X-axis Worktable

In the simulation software, install the X-axis worktable of the machine tool.

**Module E: Repair of Mechanical Components of Intelligent Equipment (10 points)**

**E.1 Spindle Bearing Repair**

(1) Sorting of Spindle Bearing Repair Steps

In the simulation software, correctly sort the steps for spindle bearing repair.

(2) Spindle Bearing Repair

In the simulation software, perform operations according to the sorted steps to repair the spindle bearing.

**E.2 Guide Rail Repair**

(1) Sorting of Guide Rail Repair Steps

In the simulation software, correctly sort the steps for guide rail repair.

(2) Guide Rail Repair

In the simulation software, perform operations according to the sorted steps to repair the guide rail.

**Module F: Construction and Programming of Intelligent Manufacturing Integration Environment (20 points)**

**F.1 Construction of Industrial Robot and Simulation Environment**

(1) Create an Industrial Robot

In the software, create an industrial robot with the model "ARC Mate 100iD".

(2) Create a Simulation Environment

In the software, build the simulation environment using the built-in models in the simulation environment according to requirements.

**F.2 Offline Simulation**

(1) Conveyor Belt Simulation Action Setting

In the software, control the material conveying of the conveyor belt through the industrial robot.

(2) Machine Tool Safety Door Simulation Action Setting

In the software, control the opening and closing of the machine tool's safety door through the industrial robot.

(3) Write Simulation Programs

In the software, complete the industrial robot program writing according to requirements and perform simulation verification in the offline programming software.

(4) Simulation Operation and Recording

Adjust to an appropriate angle in the software to fully view the operation process of

the simulation workstation, execute the simulation operation of the software, and record the simulation operation process with screen recording software.

**Module G: Professional Literacy and Safety Awareness (5 points)**

The following content is used to evaluate the contestants' professional literacy and safety awareness throughout the competition.

(1) Compliance with Norms

Abide by standards and norms during operations.

(2) Independent and Undisturbed Space

The submitted monitoring video must fully show that the room where the operation area is located is unoccupied throughout the process. Except for the contestants, no other personnel enter, stay, or interact with the contestants in the video. The monitoring can cover door and window areas to verify that no outsiders break in.

(3) Valid Time Watermark

The submitted monitoring video must clearly display continuous, accurate, and untampered time information, and the time watermark covers the video pictures throughout the process (no occlusion or disappearance periods).

(4) Complete Video

The submitted monitoring video must be an unedited, uninterrupted, and non-fast-forwarded/non-slowed-down original record, completely covering all operation cycles specified by the module from the contestant entering the operation area, preparation stage, to the entire operation process and ending departure, without any missing pictures or content jumps.

(5) Clear Picture

The submitted monitoring video must clearly capture the contestant's hand movements, operation objects, and key areas of the operation environment, without blurriness, backlighting, occlusion, etc., to ensure that operation details and safety behaviors can be accurately judged through the video.



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