2025

BRICS SKILLS COMPETITION

(BRICS+ FUTURE SKILLS & TECH CHALLENGE)

Intelligent Electronic Products Design and Manufacturing

BRICS-FS-46

Technical Tescription

(International Finals_Online)

August, 2025

Catalogue

1. Project Introduction

1.1　item description

Project number: BRICS-FS-46

Course name: Design and production of intelligent electronic products

Industry to which the competition belongs: electronic information industry, strategic emerging industry

1.2　Purpose of the competition

To further implement the spirit of skill development outlined in the BRICS Xiamen Declaration, Johannesburg Declaration, Brasilia Declaration, Moscow Declaration, and New Delhi Declaration, and to advance President Xi Jinping's initiative of "hosting BRICS Vocational Skills Competitions to build a platform for exchange and cooperation between vocational colleges and enterprises," we aim to establish a high-standard competition platform with distinctive vocational education characteristics. This initiative will facilitate in-depth educational collaboration and cultural exchanges among BRICS countries, pragmatically promote the "Education Follows Output" model and school-enterprise partnerships, and advance the "Vocational Education Going Global" action plan alongside international industry-education integration. Focusing on key areas such as advanced manufacturing, digital economy, emerging industries, innovative business models, and cutting-edge technologies, we will enhance the innovation, coordination, organizational capabilities, and collaborative skills of teachers and students in BRICS+ countries' vocational institutions. This effort will enrich cooperation between BRICS+ vocational colleges and enterprises, ultimately cultivating globally competitive technical professionals and cultural exchange talents across BRICS nations.

1.3　The skills a player needs

(1) Requirements for professional knowledge

1. Computer Science and Technology: Candidates should have a solid basic knowledge of computer science, including data structure, algorithm analysis, programming language, etc. In the development of intelligent products, they should be able to use computer science knowledge to solve

practical problems, such as optimizing product performance, improving data processing capacity, etc.

2. Electronic Engineering and Automation: For intelligent products involving hardware development, the contestants need to master the basic principles of electronic engineering and circuit design skills, and be able to independently complete hardware selection, circuit design, debugging and other work.

3. Internet of Things technology: With the rapid development of the Internet of Things, players need to understand the basic principles and application scenarios of the Internet of Things, and be able to use the technology to realize remote monitoring, data transmission and other functions of products.

(2) Skill requirements

1. Programming ability: Candidates should be proficient in at least one programming language and able to write efficient and stable code to realize product functions. At the same time, they should also have good code specification awareness and team cooperation ability to complete project tasks together with other members.

2. Project management ability: In competitions, contestants usually need to form a team for project development. Therefore, good project management ability is crucial, including project schedule control, team member coordination, risk prediction and response, etc.

3. Innovative thinking and problem solving ability: The field of intelligent product development and application is constantly developing and innovating, so the contestants need to have innovative thinking and problem solving ability, be able to propose innovative solutions for practical problems, and continuously optimize and improve products in the competition.

2. Registration and organization of competition teams

2.1 Eligibility of participants

The 2025 BRICS Vocational Skills Competition will have no age or category restrictions. Participants may include vocational college students

(including higher vocational and technical institutions), undergraduate students, faculty members, and employees from enterprises and public institutions aged between 16 (born before January 1, 2009) and 35 (born after January 1, 1990), as long as they are enrolled in academic programs.

2.2 Team formation

Each team consists of participants, instructors and team support personnel (team leader), among which participants and instructors are essential for registration.

Each team is limited to one instructor, and each team is limited to two instructors for the multi-player competition. For the same team, the instructor and the contestant cannot be the same person.

2.3 Promotion rules

If the number of valid applicants is less than or equal to 10, each project will be promoted by 2 slots;

If the number of valid applicants is more than 10, they will be promoted by 20%;

Only one team will advance from the same event in the same unit.

3. Competition items

3.1 Competition module

The competition consists of module A and Module B, and the total time of the competition is 6 hours.

Module	Module name	Duration of competition	Percentage of achievements
A	Electronic product design	Six hours	30%
B	Simulation design and development		30%

C	Embedded application software development		30%
D	professional quality		10%

3.2 Module description

Module		Primary coverage
Module A	Electronic product design	According to the function description, technical documents and constraints of electronic products provided in the production site, the schematic diagram and PCB diagram of electronic products are designed by using EAD software.
Module B	Simulation design and development	According to the requirements, I used Proteus software to complete the circuit board design and STM32 single-chip microcontroller program. The main contents include: engineering creation, GPIO driver development, external interrupt, IIC driver, SPI driver, etc.
Module C	Embedded application software development	The assessment evaluates the contestants' ability to develop embedded application software using development tools. They are required to complete the development and debugging of functions according to application scenario requirements, including: application interface development, data processing, data display, chart display, database-related tasks, etc.

Module D	professional quality	All documents generated during the competition were properly archived, and the discipline and safety regulations of the competition were strictly observed throughout the process. They showed good team spirit and communication ability, civilized participation in the competition, calmly dealt with emergencies, and maintained a high sense of safety.

3.3 Questioning mode

The proposition work of this competition is responsible for the proposition expert group designated by the executive committee of the competition, which is designed according to the content requirements of the technical documents of the competition and the requirements of intelligent electronic product talent training and enterprise job needs. After completing the proposition, the proposition experts are submitted to the experts designated by the executive committee of the competition for review.

3.4 Competition process

(1) Competition time: 360 minutes.

(II) Competition schedule:

The competition process is as follows: Participants register —— Introduce the rules of the competition and draw lots —— Organize participants to get familiar with the venue before the competition —— Official competition —— Expert judges evaluate the results —— Closing ceremony and award ceremony.

Specific competition schedule:

Date	Time	Item	Participant
C-2	08:30-17:30	Construction of the stadium and arrival of facilities and equipment	Site Manager and Assistant Implementation

			guarantee unit Exhibition service unit
C-1	08:30-17:30	Construction of the stadium and commissioning and acceptance of facilities and equipment	Site Manager and Assistant Implementation guarantee unit Exhibition service unit
C-1	15:30-17:00	Pre-match briefing	team of experts All participating units
C1	08:00	Get to the arena	team of experts All participating units Technical support unit
	08:00-08:40	Contestants shall present their participation certificate, ID card and student card to the staff for registration	
		The entry number is determined once and for all	Site manager and assistant implementation support unit
		Each contestant will enter once encrypted The number is encrypted by a second draw to determine the race number	
	08:40-09:00	The player enters the work station and confirms the equipment, tools and materials	

	09:00-15:00	Official competition
	15:00-17:30	Module scores
	17:30-18:00	The date is confirmed on the same day
	18:00-19:00	Summarize the results
	19:00-21:00	Results announced, closing ceremony

4. Scoring rules

4.1 Evaluation method

After the end time of the competition, the judging panel will evaluate the participating teams in groups, with at least three judges per group. Each judge has a scoring sheet and scores according to the requirements of the scoring sheet and the submission results of the designated path in the test according to the standards in the scoring sheet.

4.2 Scoring procedure

Evaluation scores (subjective) and measurement scores (objective). According to the scoring tables of each module, a scoring team is set up respectively. The chief expert appoints judges for each group to score each module respectively. Each scoring team is responsible for on-site scoring of all contestants' indicators under the same criteria, and signs to confirm the scoring results.

4.3 Performance calculation

(1) Evaluation score (subjective)

Judgment scoring method: Three or more (N) judges form a panel. Each judge independently evaluates the item, calculates an average weighted score, divides it by three (N), and then multiplies by the sub-item's assigned value to determine the final score. The difference between any judge's scores must be

less than or equal to one point. If discrepancies occur, the judge must provide specific reasons and the score must be adjusted under the supervision of the panel chair or chief expert.

(2) Measurement score (objective)

Scoring Method: Set up multiple scoring groups per module, each consisting of three or more judges. All members of each group will collectively deliberate and reach a consensus on the contestant's actual score for that event, ultimately assigning only one final grade. If there are more judges, alternative grouping methods may also be established.

（3） score ranking

The candidate with the highest overall score will be ranked first. If the overall scores are the same, the candidate with the highest module A score will be ranked first, followed by module B and then module C.

4.4 Composition and grouping of the panel

Expert group leader:

The competition implements the chief expert responsibility system, which is fully responsible for the competition and adjudication of the event. The expert leader is selected and approved by the organizing committee of the event.

Conditions and composition of the Referee Team:

(1) The referees shall comply with the working management standards of referees, and the competition executive committee shall organize the training of referees before the competition.

(2) Referees shall comply with the management of the chief expert. Their assignments shall be determined either through the chief expert's directives or by lottery. During working hours, referees must not engage in favoritism, be absent without cause, leave early, abandon their post midway, or neglect duties. Violations will result in disciplinary actions based on the severity of the offense, up to and including revocation of their officiating credentials, with corresponding records filed in the case file.

(3) According to the work needs, the chief expert divides the judges into

several groups such as the on-site judging group and the result scoring group to carry out their work. The on-site judging group is divided according to the competition stations and sessions, and each group carries out corresponding work under the unified arrangement of the chief expert.

No.	Professional technical direction	Presiding judge, teaching, working experience	Professional and technical titles (Professional qualifications)
1	Internet of things	The instructor has the experience of judging provincial or above competitions	Intermediate and above professional titles
2	Electronics, communications		
3	computer		

4.5 Evaluation basis

In the process of event design, the selection of standards and evaluation methods will be determined by scoring scheme and competition questions.

Evaluation criteria, including but not limited to:

Module	Competitive tasks	Score point	Code of points	Partition
A	Electronic product design	Principle diagram design	File naming, component packaging, schematic wiring and layout according to test requirements.	Thirty
		PCB design	According to the constraints and rules required by the test, PCB file design is carried out based on the schematic design principle, and screen	

Module	Competitive tasks	Score point	Code of points	Partition
			printing information is added and 3D packaging is made. The PCB layout is required to be reasonable.	
B	Simulation design and development	Protues circuit diagram design	According to the functions required by the test, select appropriate components and MCU to complete the circuit design, which should be able to clearly show each functional module of the circuit without error.	Thirty
		Microcontroller program development	Use keil5 tool to complete the project creation, add STM32 standard library, complete the driver development of related functions, the program can be compiled normally, the variable or function naming in the program complies with the specification, and the code function should be annotated in key positions.	
		Program introduction	The compiled hex file is burned into the MCU of Protues, and the functions required by the test can be	

Module	Competitive tasks	Score point	Code of points	Partition
			demonstrated.	
C	Embedded application software development	Engineering creation	Use QT software to complete the project creation of Gui application.	Thirty
		interfacial design	According to the test requirements, select appropriate materials to complete the UI design of the application program, and the interface should be consistent with the test requirements.	
		Data display and control	According to the provided protocol document, it can process the sensor data in the electronic product and display it in the program interface, and can also control the equipment in the electronic product with correct instructions below.	
		Scenario applications	According to the test requirements, the sensor and control equipment scene linkage effect should be completed. The response time should not exceed 1s, and the linkage function can be normally withdrawn.	

Module	Competitive tasks	Score point	Code of points	Partition
D	Professional quality	Archiving of information	During and after the competition, all digital assets such as schematic diagrams and codes can be systematically sorted out, named and archived in accordance with professional norms and requirements, with clear directory structure for easy reference.	Ten
		profes sional quality	They strictly followed the discipline and safety regulations of the competition, showed good team spirit and communication ability, participated in the competition in a civilized manner, calmly dealt with emergencies, and maintained a high sense of safety.	
Amount to				100

5. Competition related facilities and equipment

5.1 Competition technology platform standard

The competition technology platform and the proposition of the competition

project are formulated according to the talent training needs of enterprise smart agriculture related vocational positions, and refer to the following relevant standards:

1. National Occupational Standard for Intelligent Hardware Installation and Adjustment Personnel (6-25-04-05 Intelligent Hardware Installation and Adjustment Personnel);

2. National Occupational Standard for Electronic Circuit Logic Wiring (6-25-01-12 Electronic Product Plate Making);

3. National Occupational Standard for Hybrid Integrated Circuit Installation and Adjustment Workers (6-25-02-06 Semiconductor discrete Devices and Integrated Circuit Installation and Adjustment Workers);

4. National Occupational Standard for Assembly of Semiconductor Discrete Devices and Integrated Circuit Microsystem (6-25-02 Electronic Device Manufacturing Personnel);

5. National Occupational Standard for Computer Network Equipment Assembler and debugger (6-25-03-00 Computer and External Equipment Assembler and debugger);

6. National Occupational Standard for manual installation and connection of radio, television and communication equipment (6-25-04-07 Electronic installation and connection of radio, television and communication equipment);

7. National Occupational Standard for Radio and Television and Communication Equipment Debuggers (6-25-04-08 Radio and Television and Communication Equipment Debuggers).

8. GB/T 30961-2014: Embedded Software C Language Coding Specification;

9. GB/T 28169-2011: Embedded Software Quality Measurement;

10. GB T 28171-2011: Reliability test method for embedded software;

11. ISO/IEC 15962-2004: Radio Frequency Identification (RFID) for project management. Data protocol;

12. GB/T 16657.2-1996: Industrial Control System Fieldbus Part 2: Specifications and Service Definitions for the Physical Layer;

13.GB 15629.1104-2006: Wireless LAN media access control and physical layer specifications;

14.GB/T 30976.2 2014: Information security of industrial control systems;

15.GBJ232-92: Code for construction and acceptance of electrical equipment engineering;

16.GB/T4728.1-2018: Electrical schematic diagram uses graphic symbols;

17.LD/T81.1-2006: Technical specifications for vocational skill training and appraisal equipment.

5.2 Environmental requirements

The competition venue shall ensure adequate natural lighting, proper illumination, and ventilation systems, along with stable water supply, electricity, and emergency power equipment. A dedicated instructor lounge will be provided. Each work area within the venue shall be equipped with a single-phase AC power supply rated at 220V/3A or higher. Every workspace must include a workbench for placement of computers and debugging tools. Two office chairs will be available. The technical support zone will provide contestants with shared spare parts and competition-related equipment. The service area will offer medical assistance and other essential support services.

5.3 Equipment list

The technical platform used in this competition is the "Intelligent Electronic Product Training Platform" competition platform selected by the cooperative enterprise Shandong Shiru Information Technology Co., LTD.

A competition platform

(1) Software environment

No.	Name of main equipment	Qty.
1	Intelligent electronic product training platform	1
2	Microsoft Windows 10 (64-bit) trial edition	1
3	WPS	1

4	SOLIDWORKS	1
5	VMware16	1
6	Qt Creator	1
7	Altium Designer15	1

(2) Hardware equipment

No.	Name of main equipment	Unit	Qty.
1	staging	fix	2
2	computer	short for Taizhou	2

5.4 Recommended competition area and layout of competition positions

一次加密区（6m*8m） 二次加密区（6m*8m） 技术支持区（6m*6m） 设备区（6m*6m）

出入口

参观通道 参观通道

技术实操区

参观通道

参观通道

备用赛位 备用赛位

参观通道 参观通道

出入口

监督仲裁区 裁判区 医疗区
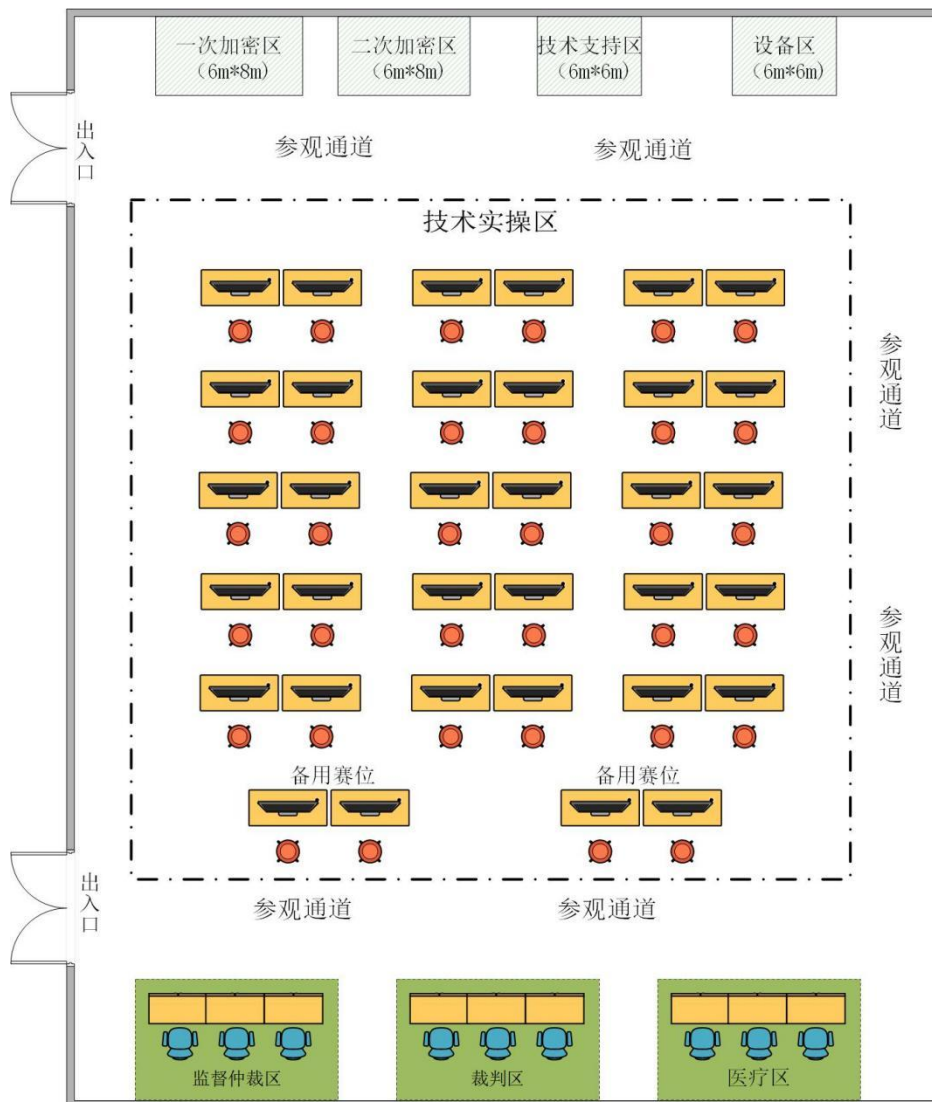
6. Competition information

6.1 Safety operation regulations

(1) Participants shall confirm the safety and integrity of their work stations, equipment and tools according to the regulations, strictly abide by the rules and operating procedures of the competition, pay attention to personal and equipment safety, accept the supervision and warning of the judges, and compete in a civilized manner.

(2) When installing the equipment, the contestants should understand the performance parameters of the equipment in advance to ensure correct use of the equipment.

(3) When installing sensors and other equipment, the contestants must

pay attention to the short circuit of the positive and negative poles of the power supply to avoid burning out the equipment and safety accidents.

(4) When installing equipment, the contestants should keep the power supply of the work station off and do not connect the equipment with electricity. If leakage is found, they should report to the judges in time and contact technicians to check the equipment.

(5) Contestants should pay attention to anti-static safety during the installation of equipment, and should not put the circuit board on a metal surface or without protective stacking.

(6) Participants should not touch or open the power distribution box of the training station, and pay attention to the safety of using the 220V strong power behind the work station.

(7) During the competition, the contestants shall not enter the work station of other teams or interfere with the competition of other teams.

6.2 Information for Teams

(1) Each team shall purchase personal accident insurance for the participants during the competition.

(2) Each team shall manage and educate the participants and team leaders for safety, and the team leaders shall keep communication open during the competition.

(3) All participating teams shall obey and implement the arbitration results. Any malicious appeal, once verified, the organizing committee will investigate the responsibility of relevant personnel.

(4) The team leader is responsible for the management and organization of the team during the competition.

6.3 Leader's Notes

(1) The team leader shall resolutely implement the competition and various rules, obey the arrangement and management of the event executive committee, strengthen the management of the participants, and do a good job in all preparations.

(2) The team leader is responsible for drawing the number of the

participating team and shall not enter the competition site during the competition.

(3) The team leader shall be responsible for coordinating and communicating with the executive committee of the competition during the event.

(4) If the team considers that there is something that does not conform to the competition regulations, the team leader shall submit the written appeal materials signed by the team leader to the arbitration group of the event within 2 hours after the end of the competition. Oral appeal is invalid and the arbitration group will not accept it.

6.4 Instructions for Participants

(1) Participants should strictly abide by the rules and regulations of the competition, ensure the safety of their own person and equipment, accept the supervision and warning of the judges, and compete in a civilized manner.

(2) Participants shall enter the competition with the entry certificate issued by the organizing committee and valid certificates (ID card or passport).

(3) Participants shall enter the competition site at the prescribed time, confirm the on-site conditions and sign. They shall operate according to the unified instructions. Each team shall decide the division of labor, working process and time arrangement of the participants

Complete the competition at the designated workstation within the time. Do not enter the workstation of other teams at will.

(4) After entering the competition, the participants shall confirm whether the equipment and tools are safe and intact according to the regulations, strictly abide by the rules and regulations of the competition, and ensure the safety of their own person and equipment.

(5) During the competition, if the equipment fails due to factors other than the players, please inform the on-site referee in time, and the technical staff will repair or replace the equipment. The referee team may give additional time according to the specific situation.

(6) When installing and deploying the competition equipment, the participants should understand the performance parameters of each

equipment, such as power supply and input, to ensure the normal use of the equipment.

(7) When connecting sensors and other equipment, contestants should pay attention to prevent short circuit between positive and negative poles and avoid burning out the equipment. Do not touch or open the power distribution box of the training station, and pay attention to the safety of using 220V strong electricity behind the work station.

(8) Food and drinking water will be provided uniformly during the competition. The rest, food and toilet time of the contestants will be counted into the competition time.

(9) After the end of the competition, the participating team shall clean up the site and restore the venue to the state before the competition.

(10) During the competition, if the contestant does not obey the instructions of the referee or disrupts the order of the competition, the chief expert will deduct the score of the team at his discretion; in serious cases, the contestant will be disqualified. If there is cheating, the contestant will be disqualified directly.

6.5 Staff information

(1) The competition staff shall be employed and assigned by the competition executive committee.

(2) Obey the leadership of the organizing committee, observe professional ethics, adhere to principles and act in accordance with regulations. Do a good job with a high sense of responsibility, serious attitude and rigorous style.

(3) Be familiar with the Competition Rules and conscientiously implement the competition rules.

(4) Stick to the post, do not be late, do not leave early, do not leave the post without permission.

(5) The staff of the competition should actively maintain the order of the competition, so as to facilitate the normal performance of the competitors.

(6) The staff shall not answer any technical questions raised by the

players during the competition. In case of any dispute, it shall be reported to the Executive Committee.

(7) Those who bring influence or losses to the competition due to violation of regulations will be dealt with as necessary.

7. Requirements for stadium layout

(1) Competition Venue. The competition site is equipped with a competition area, referee area, service area and technical support area. The venue ensures good lighting, illumination and ventilation; provides stable water, electricity and emergency power supply equipment. At the same time, there is one rest room for all instructors.

(2) Competition equipment. All competition equipment shall be provided and guaranteed by the competition executive committee. The competition area shall prepare the required hardware and software platforms according to the number of participating teams, and provide standard competition equipment for the participating teams.

(3) Competition Workstations. Each work area at the competition venue is equipped with a single-phase AC power supply rated 220V/3A or higher. Each workstation is numbered and features a dedicated workbench for placing computers and debugging tools. Two workbenches are provided, each accompanied by two matching chairs (stools).

(4) The technical support area provides the participants with public spare parts and other equipment related to the competition. The service area provides medical services and other support.

8. Health, safety and green environmental protection

8.1 Competition environment

The site shall meet the floor space required by each functional area of the competition and the number of workstations corresponding to the parameter team. The lighting, illumination and ventilation shall be good; stable water, electricity and emergency power supply equipment shall be provided.

8.2 Safety requirements

(1) The layout of the competition site, the equipment and facilities in the competition site comply with relevant national safety regulations, the installation of competition equipment and facilities is carried out in strict accordance with safety construction standards, and the power wiring and electrical installation are carried out in accordance with specifications. The simulation test of the competition site is conducted before the competition to find out possible safety problems.

(2) Each set of competition equipment uses an independent power supply to ensure safety. When the contestants are operating the computer or editing documents, they should save them in time to avoid data loss caused by sudden power failure.

(3) Fire extinguishers shall be configured according to fire safety requirements, and the safety responsible person of the competition site shall be designated to use them in case of emergency.

(4) Set up a warning line around the stadium to prevent irrelevant personnel from entering and accidents.

(5) The site shall be arranged and divided into areas, evacuation channels shall be set up according to safety requirements, and safety evacuation channels and route diagrams shall be posted in prominent places on the walls. In case of safety problems, the site shall be evacuated quickly along the emergency evacuation routes under the command of the site safety responsible person.

(6) During the competition, all vehicles and personnel entering the competition area shall have access to the area with certificates and take the initiative to show valid certificates to the staff.

(7) In the areas with dense crowd and traffic flow, the organizing committee of the competition will set up complete indicators, increase guidance personnel, and open up standby channels.

8.3 Environmental protection

(1) Nothing in the competition should damage the environment around the venue.

(2) Promote the concept of green environmental protection, all recyclable

materials should be classified and collected.