

# **The First World Vocational Colleges Skills Competition**

## **Competition Rules**

### **I. Name of the Skill**

No.: W01

Chinese name: 机电一体化项目

English name: Mechatronics Project

Industry: Equipment manufacturing industry

### **II. Competition Purpose**

The World Vocational Colleges Skills Competition aims to bring together standards, technologies, equipment, teachers and students in the field of vocational and technical education at home and abroad, adhere to promoting Chinese vocational education to go global and serve international cooperation in production capacity, build an important platform for teachers and students of international vocational schools to deepen friendship, exchange skills and show styles, and promote the construction of a world community of skills. Through skills competition, display and experience exchange, the best practices of international vocational and technical education are expected to be shared, the influence of Chinese vocational and technical education in the world in this field is to be enhanced, and China's vocational and technical education will be aligned with global vocational and technical education.

The Mechatronics Skill Competition in the First World Vocational College Skills Competition (the “Competition”) focuses on the simulation of assembly, programming, debugging, optimization and troubleshooting of the automatic production line for flexible filling of particle drugs, as well as the professional quality of competitors, covering many specialized technologies and core and professional technical skills, such as the application of electromechanical technology, operation and maintenance of intelligent

equipment, mechatronics technology, electromechanical equipment technology, industrial robot technology, electrical automation technology, intelligent manufacturing equipment technology, mechanical and electronic engineering technology, automation technology and application and intelligent control technology. It aims to examine the comprehensive abilities of competitors majoring in automation, mechanical design and manufacturing, electromechanical equipment and other related majors in vocational schools to install, debug and maintain mechatronics equipment, to promote the cooperation and exchange among teachers and students in vocational schools around the world, and to show the professional skills and teamwork spirit of competitors from all over the world. It also focuses on new changes, new methods and new skills, and cultivating high-quality technical talents, so as to help the development of vocational and technical education in the post-pandemic era, and explore new models of global vocational education for personnel training under the new situation.

### **III. Competition Content**

The Competition takes the mechatronics intelligent training platform as the competition platform. Three competitors should complete the following tasks according to the Test Project (“TP”): empty bottle feeding, particle material feeding, material sorting, particle filling, capping, screw capping, material detecting, bottle cap detecting, finished product sorting, robotic grabbing into boxes, box cover packaging, labeling and warehousing, as well as the mechanical installation and debugging, pneumatic connection, troubleshooting, and programming of units, to enable each unit work continuously and stably.

Competitors should, according to relevant materials and competition TP provided in the competition workshop, complete the basic competition tasks and comprehensive competition tasks within the specified time (i.e., two days,

three hours per day and six hours in total) through on-site operation. The specific competition content and result ratio are as follows:

Module 1: Including the mechanical installation and debugging, the electrical installation and debugging, and troubleshooting of the units

i. Mechanical installation and debugging (15%)

Competitors should complete the mechanical and pneumatic installation of several units or modules in the equipment according to the mechanical assembly drawings provided in the TP, and conduct preliminary debugging.

ii. Electrical installation and debugging (20%)

Competitors should complete the circuit connection of several units or modules in the equipment according to the electrical schematic diagram and wiring diagram provided in the TP, and conduct preliminary debugging.

iii. Troubleshooting (9%)

For the typical faults preset in several units of the equipment, competitors are required to correctly select detection tools, apply standardized detection methods, and accurately determine and eliminate faults.

Module 2: Including the programming and debugging of units, and the programming, debugging and optimization of mechatronics systems

iv. Programming and debugging of units (30%)

Competitors should complete the PLC programming, touch screen configuration, industrial robot system configuration, programming and debugging, servo driver and frequency converter parameter setting of several units in the equipment according to the equipment functions and requirements provided in the TP, so as to realize the debugging and operation of the working units.

v. Programming, debugging and optimization of mechatronics systems (20%)

Competitors should complete touch screen configuration, system network communication setting and programming, system optimization,

programming and debugging, as well as necessary hardware transformation, programming and debugging required for system performance and function upgrade according to the requirements for the TP, to realize the overall operation of the system.

vi. Professional quality and safety awareness (6%)

This part assesses competitors' performance in safety operation, use of facilities and equipment, tools and instruments, hygiene and cleaning habits, dress, work discipline and courtesy and politeness.

#### **IV. Competition Method**

i. Team formation

1. The Competition adopts the “1+1” mode, namely, one group of Chinese competitors (from Chinese schools) and one group of foreign competitors (from foreign schools) join hands to form a team (“joint team”). Each group consists of two students and one teacher. Competitors should sign up, compete and win prizes in teams.

2. Domestic competitors must be registered full-time students and full-time teachers from higher vocational colleges, as well as vocational education undergraduate colleges. Students and teachers of one group should come from the same school.

3. Competitor replacement: If a competitor is unable to participate for any reason during the preparation, the relevant department should issue a written explanation ten working days before the start of the corresponding Competition. The competitor will be replaced after verification by the office of the Executive Committee of the First World Vocational Colleges Skills Competition (the “Executive Committee”). After the Competition starts, the teams are not allowed to replace the competitor.

ii. Competition method

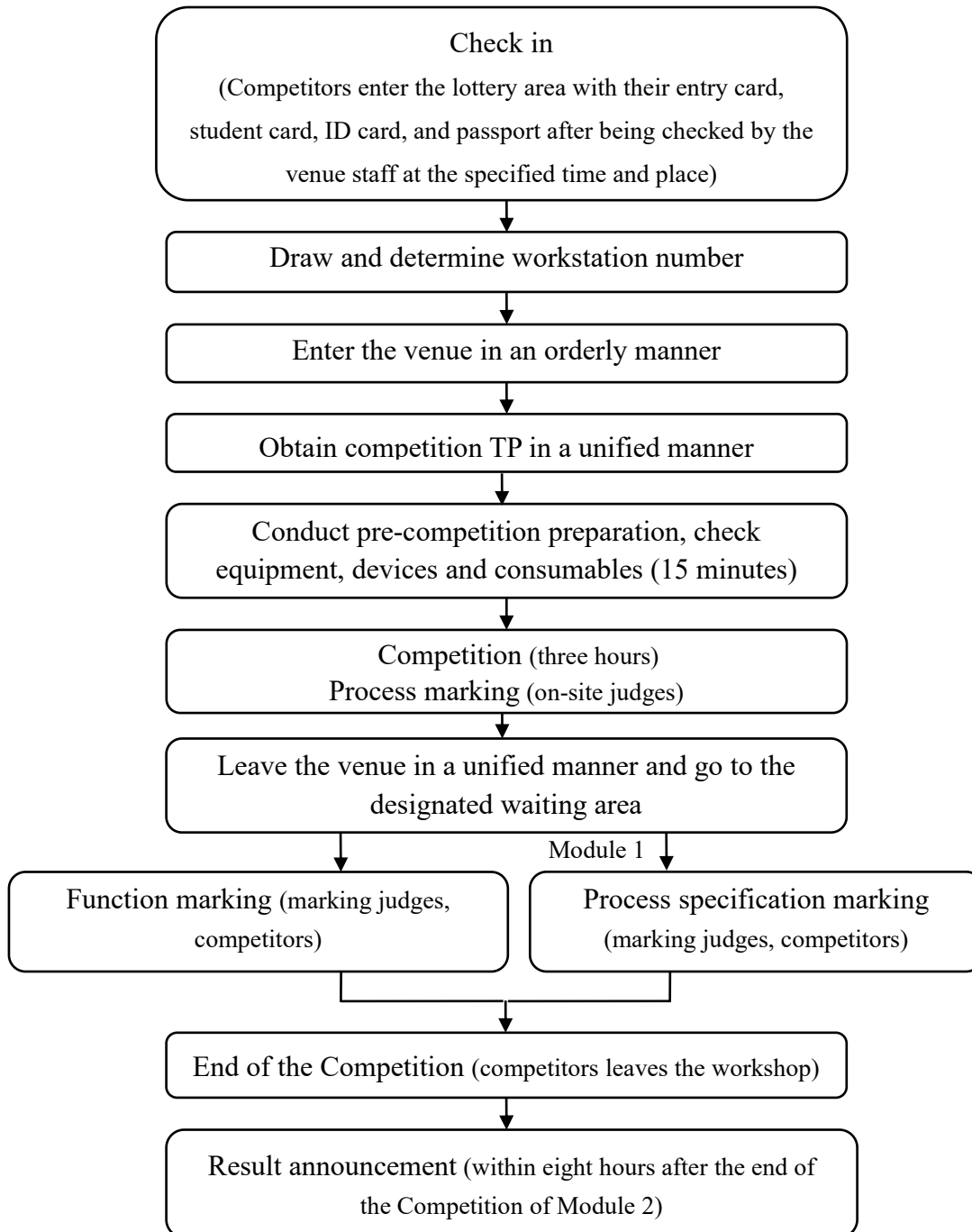
The Competition will be conducted in the forms of on-site Competition +

recorded broadcast. Domestic competitors will compete on site; if foreign competitors are unable to attend the on-site competition, they may compete through recorded broadcast. Foreign competitors should send the competition videos that meet the competition requirements to the mailbox designated by the Executive Committee seven days before the official competition day, and the Executive Committee will uniformly conduct examination and trial broadcast of the videos and seal them for the record. On the official competition day, the videos should be unsealed by the jury, and those from the foreign competitors will be broadcast on the big screen on site. The marking criteria will be the same as those for on-site competition.

Requirements for competition video: The file format should be MP4; the resolution should not be lower than 1280\*720; the recommended aspect ratio should be 16:9, and the video content should fully display the competition process. As for the the troubleshooting item in Module 1, the videos explaining the competitors' diagnosing approach should be submitted.

## V. Competition Process

### i. Competition process



ii. Competition timeline

| <b>Date</b> | <b>Time</b> | <b>Content</b>  |
|-------------|-------------|---|
| Day 1       | 09:00-10:00 | Competitors familiarize themselves with the venue and equipment                             |
|             | 10:00-11:30 | Pre-competition explanation and exchange session  |
|             | 15:20-15:40 | Competitors check in, draw workstation number   |
|             | 15:40-16:00 | Competitors enter the venue to check the equipment, components and tools at the workstation |
|             | 16:00-19:00 | Competition of Module 1   |
|             | 19:30-22:30 | Result evaluation of Module 1   |
| Day 2       | 08:40-09:00 | Competitors check in  |
|             | 09:00-12:00 | Competition of Module 2   |
|             | 12:30-15:30 | Result evaluation of Module 2   |

- Notes:
1. The competition venue is uniformly arranged by the Executive Committee, and the jury president can adjust the arrangements according to specific situation.
  2. During the Competition, there is no encryption process, and competitors can directly draw the workstation number to participate in the Competition.
  3. The domestic and foreign groups of each team should draw the number at the same time.
  4. The time for result announcement can be adjusted by the Executive Committee according to the specific competition process.
  5. During the Competition, the organizer will organize and

arrange observation activities according to the on-site situation, and control the number of visitors according to the requirements for pandemic prevention.

## **VI. Competition Task Paper**

For details of the competition task paper, please see: Test Project for Mechatronics Projects in the Task Papers of the First World Vocational Colleges Skills Competition.

The competition task paper will be publicly released in advance. Test projects will be released one month in advance on the designated online information release platform for the Competition.

## **VII. Competition Rules**

### **i. Qualifications for registration and requirements for teams**

For qualifications of teams and competitors and change of competitors, see “IV. Competition Method”.

### **ii. Familiarization with the venue**

1. The team leaders, instructors and competitors should enter the designated observation area of the venue at the specified time. They are not allowed to enter the competition area, but they can familiarize themselves with the venue environment and equipment.

2. When familiarizing with the venue, the teams are strictly forbidden to communicate with on-site staff, and should not make ungrounded remarks that can cause damage to the overall image of the World Vocational Colleges Skills Competition.

3. When familiarizing with the venue, the teams should strictly abide by the Competition rules. Crowding and noise are strictly prohibited to avoid accidents.



### iii. Admission rules

1. Competitors should arrive at the check-in area on time according to the time stipulated by the Competition.

2. Staff will check the identity of each competitor. The competitors must provide the entry card, ID card or passport, and student card registered by the school. The name, age and facial features on the documents should be consistent with the information on the entry card.

3. Staff will check the tools, gauges and writing items of competitors. They are not allowed to carry any equipment with communication and storage functions, paper materials and other items. After passing the inspection, competitors can enter the lot drawing area.

4. Competitors should draw the competition workstation number in sequence according to the drawing sequence number, and then wait in the designated area. They should enter the competition workshop in an orderly manner under the guidance of staff, and take their places according to the obtained competition workstation number. They are not allowed to change or adjust their places without authorization.

5. Competitors who do not arrive within 15 minutes after the competition starts are considered as waiver of eligibility.

### iv. Venue rules

1. After entering the competition workshop, competitors must obey the unified arrangement and command of the on-site judges.

2. After the competition TP is distributed, competitors can analyze the competition tasks, place tools, and check equipment according to the instructions of the jury president, but they are not allowed to use tools to operate the competition tasks.

3. Only after the jury president announces the start of the Competition can competitors start to perform the operation of the competition tasks.

4. During the Competition, competitors must strictly observe the safety operating procedures to ensure personal and equipment safety, and accept the supervision and warnings of the on-site judges and technicians.

5. In case of unclear handwriting in the TP during the Competition, competitors can signal to the on-site judges for solution. If a competitor thinks that there is any defect with the competition equipment or component which needs to be replaced or any consumable needs to be supplemented, they should fill in the name, specification and model of the equipment, component or consumable to be replaced, the reason for replacement and the replacement time in the corresponding columns of the workshop record form which should be confirmed with signature, and then the on-site judges and technicians will replace them. After the replacement, it will be inspected by the on-site judges and technicians, and the result will be recorded in the corresponding column of the workshop record form. The competitor should sign and confirm the form.

6. Competitors should report to the on-site judges or technicians first when they need power on to check or debug equipment. They can check or debug only after they have passed the safety inspection before turning on the power.

7. After the inspection by the on-site judges and technicians, if a competitor indeed needs to have the equipment or component replaced due to their fault or damage, the time from reporting to the on-site judges to the completion of the replacement should be added as appropriate, but the added time should not exceed ten minutes. If the equipment or component has no fault, the time will not be added.

8. During the Competition, competitors are not allowed to leave their workstations at will. Any competitor who terminates the Competition or completes the task ahead of the competition time and needs to leave the workshop should report to the on-site judges, fill in the departure time and the

reason for leaving the workshop in the corresponding column of the workshop record form which should be signed by the on-site judges, and confirmed and signed by the competitor.

9. During the Competition, the competitors from two countries in the joint team can conduct technical cooperation and exchanges. The competitors can apply to the on-site judges twice in each session (module); the duration of each exchange should not exceed ten minutes, and the operations cannot be performed on behalf of each other.

10. During the Competition, competitors not in the joint team are not allowed to transmit information in any way, such as transmitting slips of paper, using hand gestures or argots.

11. During the Competition, those who seriously violate the discipline of the workshop and affect other competitors, those who violate the operating procedures and refuse to follow advice, those who cross the boundary and affect others, and those who intentionally damage the equipment or facilities of the workshop, should be reported to the jury president by the on-site judges. With the approval of the Executive Committee, the jury president can announce their disqualification of the Competition.

#### v. Departure rules

1. 15 minutes before the end of the Competition, the jury president will remind competitors of the remaining time of the Competition.

2. When the signal for the end of the Competition is given, the jury president will announce the termination of the Competition.

3. After the jury president announces the termination of the Competition, competitors should stop the operation of all competition tasks. Competition TP, drawings, and workshop record form should be neatly placed on the workbench and cannot be taken out of the workshop; tools, multimeters, and stationery for answering questions must remain as they are and cannot be

reorganized.

4. After the jury president announces the termination of the Competition, the on-site judges organize and supervise competitors to leave the workstation and stand in the aisle beside the workstation. When the jury president announces the departure, the on-site judges direct competitors to leave the venue uniformly.

5. After all the competitors leave the workshop, the competitors who need added time should re-enter the competition workstation and start the operation after the on-site judges announce the start of the added-time operation. When the on-site judges announce that the added time is up, competitors should stop the operation and leave the workshop.

6. After leaving the workshop, competitors could go to the designated resting place to have a meal and wait for the Competition result.

7. Competitors in the competition workstation instructed by the marking judges enter the workshop and cooperate with the marking judges to evaluate the results of the function part. Competitors should operate relevant components of electrical equipment to achieve relevant functions according to the instructions of the marking judges.

8. Competitors who have completed the result evaluation on the function should clean up the tools at the competition workstation, and tidy up and clean up the competition workstation and its surroundings according to the requirements for the electrical installation professional position, so as to meet the professional standards.

#### vi. Result evaluation and management

##### 1. Organization and division of labor for result management

The result management organization consists of the jury and the supervision and arbitration team. The judges are randomly selected from the pool of judges, and the supervision and arbitration team is assigned by the

office of the Executive Committee.

(1) The jury is under the “jury president responsibility system” with one jury president, who is fully responsible for the labor division of judges, reviewing judges' marks and handling disputes arising from the Competition.

(2) Judges should be classified into check-in, on-site, marking and counting judges, according to competition requirements.

Check-in judges: Responsible for the registration and identity verification of the teams (competitors);

On-site judges: Responsible for maintaining the discipline of the workshop according to the regulations, making records of the workshop according to the operating specifications, filling in the workshop record form, and evaluating the teams' process marks;

Marking judges: Responsible for evaluating the mechatronic equipment and their functions assembled by teams according to the marking rules.

Counting judges: Responsible for summarizing and reviewing the marks of on-site judges and marking judges, and filling in the mark summary form.

(3) The supervision team is responsible for supervising the entire work of the jury and reviewing the results of the Competition by sampling.

The arbitration team is responsible for accepting appeals against the judging results submitted by leaders of teams, organizing reviews and providing timely feedback on the results of the reviews.

### 3. Result evaluation

The marking of the Competition includes process marking and result marking (paper marking and function marking), which will be conducted by the on-site judges and the marking judges, respectively. The marking judges will conduct function marking by group for the tasks completed by teams according to each marking item, the marking form and marking process, and each mark in the Marking Form must be confirmed by signature of the competitors, marking judges and jury president.

### (1) Process marking

The on-site judges should mark competitors' operating specifications, professional quality, and performance at the workshop according to the marking form. The evaluation contents include:

- ① The use of facilities, equipment, tools and devices;
- ② The hygiene and cleaning status of the competition workstation, and the dress specifications;
- ③ Competition discipline, courtesy and politeness.

### (2) Result marking

The result marking consists of two parts: paper marking and function marking, both of which are completed by the marking judges.

① Paper marking: The marking judges in charge of marking paper should give a mark according to the marking criteria, and fill in the Marking Form with the corresponding marking results. After the competitors who have no objection sign and confirm the form, the judges will sign it.

② Function marking: The jury president organizes marking teams according to the distribution of on-site workstations, and the marking order is based on the workstation number from small to large; each marking team must consist of at least three judges, and for steps that are highly professional, complicated to operate, and have a long competition timeline, the number of judges should be appropriately increased; each marking team will jointly mark the positions, installation processes, and functions of the components of the equipment assembled and debugged by competitors according to the Function Marking Form; after the marking, competitors will check their results and sign for confirmation if they have no objection.

### (3) Point deduction for violations

If competitors have the following circumstances, their points should be deducted:

In the process of completing the competition task, if a competitor damages the competition equipment due to improper operation which does not affect the others' competition, five points should be deducted; if it affects others' competition, ten points should be deducted.

#### (4) Mark counting of the Competition

The jury president should assign two judges to be responsible for the mark counting; after the counting judges collect the Marking Forms, they should review each mark on the Marking Forms one by one, and sign them for confirmation if they believe the marks are correct; the marks in the reviewed Marking Forms should be counted in the Total Result Form, and the final marks of each team should be calculated; the paper copy of the Total Result Form should be printed and then signed and confirmed by the counting judges; the jury president should review the paper copy of the Total Result Form and sign it for confirmation.

### **VIII. Competition Environment**

i. The working area of each team's workstation should be about 63 m<sup>2</sup> (14 m × 4.5 m) to ensure that the teams do not interfere with each other. There should be one workbench, three work chairs (stools), and three computer desks in the working area of the workstation, and AC 220 V/50 Hz power supply should be provided. The area of the venue should be more than 600 m<sup>2</sup>, the net height of the venue should not be less than 4.5 m, and no less than 14 competition workstations could be placed.

ii. The Competition should be held indoors, and the venue should be well ventilated and well lit. The workstations should be marked with numbers and guidelines for safety operation should be pasted in the workstation. Each workstation should adopt AC 220 V/50 Hz AC power supply with the load of not less than 2 kw, and it should be equipped with not less than four AC 220 V/50 Hz AC power sockets, with power protection devices and safety

protection measures.

iii. The competition venue is divided into the check-in area, the waiting area, the on-site service and technical support area, the rest area, and the medical area.

iv. The fire-fighting facilities inside the venue should be complete, and there should be not less than two evacuation gates. Evacuation channels should be unobstructed, and fire evacuation signs should be clear and complete; there should be a channel for emergency vehicles such as ambulance and fire engines beside the venue.

v. The workstation should be equipped with competition equipment, single-phase AC power supply, console and seats. Teams should complete all competition tasks in the workstation.

vi. Every two workstations should form a joint workstation marked with the joint workstation number. The joint number drawn by the two teams of the “1+1” Chinese-foreign joint team corresponds to the joint workstation number, and the two teams in the joint workstation should independently decide their workstations.

vii. Computer: Two computers should be provided for each competition workstation. The minimum requirements for computer configuration: CPU 4-core processor (3.5 GHZ), DDR4-8G memory, 1 TB HDD, LCD monitor, and communication port with 9-pin serial port. Computers should be installed with PLC programming software, industrial robot programming software, and HMI application software, as well as technical manuals for related devices.

## **IX. Technical Specifications**

The Competition uses as a reference the teaching standards and professional curriculum standards of majors related to manufacturing automation technology and electronic information, and achieves the alignment with the teaching implementation content.



i. Professional skill requirements for the Competition

Competitors should have the knowledge and skill requirements for mechanical assembly and debugging, industrial robot, machine vision, radio frequency identification, PLC and communication, touch screen configuration, sensor, stepper motor, inverter motor, servo motor, pneumatic transmission and other aspects in the teaching contents specified by relevant majors such as mechatronics technology, electromechanical equipment technology, industrial robot technology, electrical automation technology and intelligent manufacturing equipment technology.

ii. Technical standards

ISO 12100: Safety of Machinery - General Principles for Design - Risk Assessment and Risk Reduction

IEC 60204-1: Safety of Machinery - Electrical Equipment of Machines

IEC 61508 series: Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems

ISO 13849-1: General principles for design in the Safety of Machinery - Safety-related Parts of Control Systems; IEC 62061: Safety of Machinery - Functional Safety of Safety-related Electrical, Electronic and Programmable Electronic Control Systems

DIN ISO 1219-1 to 3: Fluid and Pneumatic Power Systems and Components - Graphical Symbols and Circuit Diagrams

DIN EN ISO 9787: Robotics

DIN EN 60617-1 to 12: Circuit Symbols

DIN EN 61082-1: Marking of Circuit Diagrams

DIN EN 60529: Safety Protection

## X. Technology Platform

The Competition adopts a mechatronics intelligent training platform as its equipment, which consists of the particle feeding unit, the capping and

screw capping unit, the detection and sorting unit, the industrial robot handling unit and the intelligent storage unit. It also contains intelligent assembly, automatic packaging, automatic three-dimensional storage and intelligent logistics, automatic detection on quality control, the acquisition of production process data and the control system. It is a complete intelligent factory simulation device. The platform applies technologies related to industrial automation such as industrial robots, machine vision, RFID identification, PLC control, frequency conversion control, servo control, industrial sensors and motor drives, which can realize the whole process of intelligent manufacturing such as empty bottle feeding, particle material feeding, material sorting, particle material feeding, capping, screw capping, material detection, bottle cap detection, finished product sorting, robot grabbing into boxes, box cover packaging, labeling, and warehousing.

i. Basic parameters

| Item                       |        | Parameter  |
|----------------------------|--------|--|
| System power               |        | Single-phase three-wire AC 220 V   |
| Equipment weight           |        | 500 kg   |
| Rated voltage              |        | AC220V $\pm$ 5%  |
| Rated power                |        | Not less than 1.8 kw   |
| Environment humidity       |        | $\leq$ 85%   |
| Dimension of equipment     |        | Not more than 400 cm $\times$ 104 cm $\times$ 160 cm (L $\times$ W $\times$ H)   |
| Workstation size           |        | Not more than 550 cm $\times$ 350 cm (L $\times$ W)  |
| Safety protection function |        | Emergency stop button, leakage protection, overcurrent protection  |
| PLC                        |        | The equipment includes: Five PLC modules, all supporting network interface   |
| Touch screen               |        | 7-inch TFT LCD screen with resolution 800*480 and network port communication   |
| Servo system               | Driver | Three-phase or single-phase AC 170 V-64 V; rated current: 1.1 A; error: $\pm$ 3 revolutions; encoder resolution: 131072 pulses/rev |

| Item                |        | Parameter  |
|---------------------|--------|--|
|                     | Motor  | Rotational speed: 4500 r/min; torque: 4500 r/min; load inertia ratio: 15 times or less; rated current: 0.9 A   |
| Frequency converter |        | Power: 0.4 KW, single-phase AC 220 V input   |
| Smart camera        |        | Dynamic range: 71.4 db; fast ethernet interface with two input signals and three output signals; DC 24 V power supply  |
| RFID                |        | Write range: 0-100 mm; read range: 0~120 mm; read and write time: Not less than 15m s.   |
| Stepper system      | Driver | 100 W, DC 24 V pulse signal, suitable for 86 motors  |
|                     | Motor  | Torque: Not less than 0.4 N.M  |
| Industrial robots   |        | Load: Not less than 2 kg; working range: Not less than 500 mm; equipped with Ethernet communication interface  |
| Platform software   |        | Computer operating system: Windows 10<br>Pre-install PLC programming software, robot programming software and touch screen programming software, WPS office and PDF reader |

## ii. Introduction to structure and function

The platform is mainly composed of particle feeding unit, capping and screw capping unit, detection and sorting unit, industrial robot handling unit, and intelligent storage unit. Each unit has independent PLC control, independent button input and indicator light output, for which, not only can each unit operate independently, but also online control can be realized through communication.

Particle feeding unit: The conveying mechanism conveys the empty bottles to the feeding conveyor line one by one, and the feeding conveyor belt conveys the empty bottles to the filling conveyor belt one by one; at the same time, the particle feeding mechanism pushes out the material in the barrel according to the system command; when the empty bottles reach the filling position, the positioning and clamping mechanism will fix the empty bottles; the suction mechanism will suck the sorted particle materials and put them

into the empty bottle; when the particle materials in the bottle reach the set quantity, the positioning and clamping mechanism release the bottles; the belt is started, and the bottle is conveyed to the next workstation. This unit can be set with a variety of filling methods, which can be combined according to the color of the particle material (white and blue) and the number of particle materials (up to four) to produce different filling methods.

Capping and screw capping unit: After bottles are conveyed to the capping mechanism, the cap-positioning and clamping mechanism fixes the bottles, and the capping mechanism starts the capping procedure to add the caps to the bottles; the bottles with the caps continue to be conveyed to the cap-screwing mechanism; below the cap-screwing mechanism, the screw-cap positioning and clamping mechanism fixes the bottles, and the cap-screwing mechanism is activated to tighten the bottle caps. Bottle caps are divided into white and blue ones.

Detection and sorting unit: The bottles whose caps are screwed come to this unit for detection: The retro-reflection sensor detects whether the bottle caps are tightened; the detection mechanism detects whether the particles inside the bottles meet the requirements; the cap color is judged and distinguished for the bottles with qualified screw capping and particles; the bottles with unqualified screw capping and particles will be pushed by the sorting mechanism to the waste belt for sorting; the bottles with qualified screw capping and particles will be conveyed to the end of the belt, waiting for the robot to handle them.

Industrial robot handling unit: Two lifting platforms A and B store packaging boxes and box covers; Lifting Platform A pushes the packaging boxes to the material table; six-axis robots grab the bottles and put them into the packaging boxes on the material table; after the packaging boxes on the four workstations are filled with bottles, the six-axis robots pick up the box covers from Lifting Platform B and cover them on the boxes; the six-axis

robots label the boxes at the label position on the box cover according to the color of the bottle caps and wait for the finished product to enter the storehouse after sticking four labels.

Intelligent storage unit: It is composed of a three-dimensional storehouse and a four-axis stacking mechanism. The packaging boxes on the material table of the industrial robot handling unit are conveyed out, and then placed in the corresponding storehouses in sequence according to the requirements. Each position of the storehouse is installed with a detection sensor; the rotating shaft of the stacking mechanism is a turbine rotating mechanism; the vertical mechanism is a linear module lifting mechanism. All of them are controlled by precision servo motors with high precision. The horizontal shaft is driven by a synchronous belt, controlled by a stepper motor, and its extension and retraction are controlled by a cylinder.

Material accessories: Material accessories mainly include particle materials (white and blue), bottles, bottle caps, packaging boxes and labels.



Material Boxes and Label Material

Bottles

### iii. Equipment configuration

| No. | Material Name         | Parameter  | Unit | Quantity | Notes |
|-----|-----------------------|--|------|----------|-------|
| 1   | Particle feeding unit | Size: 800 mm × 1040 mm × 1300 mm<br>PLC: Not less than 32 inputs and not less than 32 outputs (relay output) | Set  | 1        |       |

|   |                                |   |     |   |  |
|---|--------------------------------|---|-----|---|--|
|   |                                | <p>Frequency converter of 0.4 kw: 1</p> <p>Touch screen: 1</p> <p>Sensor: Photoelectric/fiber optic 6</p> <p>Cylinder: Single rod/double rod 6</p> <p>Solenoid valve: DC 24 V single solenoid valve 6</p> <p>15-pin terminal interface board: 3</p> <p>37-pin terminal interface board: 1</p> <p>DC motor control board: 3</p> <p>Conveyor module: 1 set</p> <p>Feeding and conveying mechanism module: 1 set</p> <p>Main conveying mechanism module: 1 set</p> <p>Particle feeding mechanism module: 1 set</p> <p>Particle filling mechanism module: 1 set</p> <p>Button operation panel: 1 set</p> <p>Control panel: 1 set</p> <p>Work training platform: 1</p> |     |   |  |
| 2 | Capping and screw capping unit | <p>Size: 800 mm × 1040 mm × 1300 mm</p> <p>PLC: Not less than 16 inputs and not less than 16 outputs (relay output) 1</p> <p>Touch screen: 1</p> <p>Sensor: Photoelectric/fiber optic 3</p> <p>Cylinder: Single rod/double rod 6</p> <p>Solenoid valve: DC 24 V single solenoid valve 7</p> <p>15-pin terminal interface board: 3</p> <p>37-pin terminal interface board: 1</p> <p>DC motor control board: 2</p> <p>Capping mechanism: 1 set</p> <p>Screw capping mechanism: 1 set</p> <p>Positioning mechanism: 2</p> <p>Conveyor mechanism: 1 set</p> <p>Button operation panel: 1 set</p> <p>Control panel: 1 set</p>  | Set | 1 |  |

|   |                                |   |     |   |  |
|---|--------------------------------|---|-----|---|--|
|   |                                | Spare material storehouse: 1 set<br>Work training platform: 1 set   |     |   |  |
| 3 | Detection and sorting unit     | Size: 800 mm × 1040 mm × 1300 mm<br>PLC: Not less than DI 32 and not less than DO 32 (relay output) 1<br>Touch screen: 1<br>Sensor: Photoelectric/fiber optic 12<br>Cylinder: Single rod 4<br>Solenoid valve: DC 24 V single solenoid valve 4<br>15-pin terminal interface board: 3<br>37-pin terminal interface board: 1<br>DC motor control board: 2<br>Detection mechanism: 1 set<br>Sorting mechanism: 1 set<br>Conveyor mechanism: 2<br>RFID mechanism: 1 set<br>Visual detection mechanism: 1 set<br>Button operation panel: 1 set<br>Control panel: 1 set<br>Work training platform: 1 set | Set | 1 |  |
| 4 | Industrial robot handling unit | Size: 800 mm × 1040 mm × 1300 mm<br>Six-axis robotic arm and supporting controls: 1 set<br>PLC: Not less than DI 32 and not less than DO 32 (transistor output) one piece of each<br>Touch screen: 1<br>Sensor: Photoelectric/magnetic 11<br>Limit switch: Micro 4<br>Cylinder: Single rod/double rod 4<br>Solenoid valve: DC 24 V single solenoid valve 7<br>Air pressure switch with digital display: 2<br>Stepper motor: 2<br>Planetary reducer: 2<br>Stepper motor driver: 2  | Set | 1 |  |

|   |                          |   |     |   |  |
|---|--------------------------|---|-----|---|--|
|   |                          | 15-pin terminal interface board: 3<br>37-pin terminal interface board: 2<br>Material box lifting mechanism: 1 set<br>Material cover lifting mechanism: 1 set<br>Assembly table: 1 set<br>Positioning mechanism: 1 set<br>Label storage table: 1 set<br>Button operation panel: 1 set<br>Control panel: 1 set<br>Work training platform: 1 set   |     |   |  |
| 5 | Intelligent storage unit | Size: 800 mm × 1040 mm × 1300 mm<br>PLC: Not less than DI 32 and not less than DO 32 (transistor output) 1<br>Touch screen: 1<br>Servo driver: 2<br>Servo motor: 2<br>Stepper driver: 1<br>Stepper motor: 1<br>Sensor: Photoelectric 21<br>Limit switch: Micro 4<br>Encoder: Incremental 1<br>Cylinder: Single rod/double rod 1<br>Solenoid valve: DC 24 V single solenoid valve 2<br>15-pin terminal interface board: 4<br>37-pin terminal interface board: 2<br>Storehouse mechanism: 1<br>Stacking horizontal moving mechanism: 1 set<br>Stacking rotating mechanism: 1 set<br>Stacking lifting mechanism: 1 set<br>Stacking insertion and extraction mechanism: 1 set<br>Button operation panel: 1 set<br>Control panel: 1 set<br>Work training platform: 1 set | Set | 1 |  |



|    |                                  |   |       |    |  |
|----|----------------------------------|---|-------|----|--|
| 6  | Computer desk                    | Not more than 563 mm × 600 mm × 1067 mm                                     | Piece | 1  |  |
| 7  | Assembly table                   | Not more than L 1200 mm × W 750 mm × G 800 mm<br>With two layers of drawers | Piece | 1  |  |
| 11 | Product accessory                |   | Set   | 1  |  |
| 12 | Download line                    | Cable   | Piece | 1  |  |
| 13 | Plug board                       |   | Piece | 1  |  |
| 14 | Internal thread straight through |   | Piece | 1  |  |
| 15 | Round bottle for particles       |   | Piece | 24 |  |
| 16 | Blue bottle cap                  |   | Piece | 12 |  |
| 17 | White bottle cap                 |   | Piece | 12 |  |
| 18 | Blue material block              |   | Piece | 40 |  |
| 19 | White material block             |   | Piece | 40 |  |
| 20 | Air compressor                   |   | Set   | 1  |  |
| 21 | Material box cover assembly      |   | Set   | 6  |  |
| 22 | White label sheet assembly       |   | Piece | 15 |  |
| 23 | Blue label sheet assembly        |   | Piece | 15 |  |
| 24 | Debugging box                    | 16 inputs/16 outputs, suitable for 37-pin terminals                         | Piece | 1  |  |

iv. Pre-installed software

Operating system: Windows 10

Software: WPS Office, PDF reader, PLC programming software, industrial control configuration software and robot programming software

v. Tool list

In the venue, the following tools are provided:

| No. | Material Name           | Specifications & model                    | Unit  | Quantity | Notes |
|-----|-------------------------|---|-------|----------|-------|
| 1   | Digital multimeter      |   | Piece | 3        |       |
| 2   | Long nose pliers        | 8 inches                                  | Piece | 2        |       |
| 3   | Diagonal pliers         | 7 inches                                  | Piece | 2        |       |
| 4   | Pincer pliers           | 6 inches                                  | Piece | 2        |       |
| 5   | Screwdriver             | Large cross tip screwdriver (6.0*100 mm)  | Piece | 3        |       |
| 6   | Screwdriver             | Large flat blade screwdriver (6.0*100 mm) | Piece | 2        |       |
| 7   | Screwdriver             | Small cross tip screwdriver (3.0*75 mm)   | Piece | 3        |       |
| 8   | Screwdriver             | Small flat blade screwdriver (3.0*75 mm)  | Piece | 3        |       |
| 9   | Allen key wrench        | M1.5—M10 9 piece                          | Set   | 3        |       |
| 10  | Circlip pliers          | For shaft                                 | Piece | 2        |       |
| 11  | Circlip pliers          | For holes                                 | Piece | 2        |       |
| 12  | Steel ruler             | 500mm                                     | Piece | 3        |       |
| 13  | Vernier caliper         | 0-150 mm with 0.02 division value         | Piece | 2        |       |
| 14  | Tape measure            | 3 m                                       | Piece | 2        |       |
| 15  | Horizontal ruler        |   | Piece | 2        |       |
| 16  | Automatic wire stripper |   | Piece | 2        |       |
| 17  | Crimping tool           |   | Piece | 2        |       |

|    |                      |          |       |   |  |
|----|----------------------|----------|-------|---|--|
| 18 | PU tracheal scissors |          | Piece | 2 |  |
| 19 | Rubber hammer        |          | Piece | 2 |  |
| 20 | Watch screwdriver    | 6 pieces | Set   | 3 |  |
| 21 | Monkey wrench        | 6 inches | Piece | 2 |  |
| 22 | Marker pen           |          | Piece | 3 |  |

vi. List of spare parts for consumables in the venue

| No. | Material Name                       | Specifications & model          | Unit  | Quantity | Notes |
|-----|-------------------------------------|---------------------------------|-------|----------|-------|
| 1   | Optical fiber head                  | FN-D076                         | Piece | 10       |       |
| 2   | High-precision fiber optic sensor   | FM-E31                          | Piece | 20       |       |
| 3   | Optical fiber head                  | FN-T064                         | Piece | 10       |       |
| 4   | Fuse core                           | RT14-20/10A                     | Piece | 10       |       |
| 5   | Round head screw for cross tank     | GB/T 818 M3*10 Stainless steel  | Piece | 100      |       |
| 6   | Round head screw for cross tank     | GB/T 818 M5*10 Stainless steel  | Piece | 100      |       |
| 7   | Inner Hexagon Socket Head Cap Screw | GB/T 70.1 M3*10 Stainless steel | Piece | 200      |       |
| 8   | Inner Hexagon Socket Head Cap Screw | GB/T 70.1 M3*12 Stainless steel | Piece | 100      |       |
| 9   | Inner Hexagon Socket Head Cap Screw | GB/T 70.1 M3*15 Stainless steel | Piece | 100      |       |
| 10  | Inner Hexagon Socket Head Cap Screw | GB/T 70.1 M4*10 Stainless steel | Piece | 100      |       |
| 11  | Inner Hexagon Socket Head Cap Screw | GB/T 70.1 M5*10 Stainless steel | Piece | 200      |       |
| 12  | Inner Hexagon Socket Head Cap Screw | GB/T 70.1 M5*16 Stainless steel | Piece | 100      |       |
| 13  | Inner Hexagon Socket Head Cap       | GB/T 70.1 M6*10 Stainless       | Piece | 100      |       |

| No. | Material Name                            | Specifications & model           | Unit  | Quantity | Notes |
|-----|--|----------------------------------|-------|----------|-------|
|     | Screw                                    | steel                            |       |          |       |
| 14  | Inner Hexagon Socket Head Cap Screw      | GB/T 70.1 M8*30 Stainless steel  | Piece | 100      |       |
| 15  | Countersunk head screw for cross tank    | GB /T 819.1 M2*6 Stainless steel | Piece | 100      |       |
| 16  | Countersunk head screw for cross tank    | GB /T 819.1 M3*6 Stainless steel | Piece | 100      |       |
| 17  | Hexagon countersunk head screw           | GB /T 70.3 M3*8 Stainless steel  | Piece | 100      |       |
| 18  | Hexagon countersunk head screw           | GB /T 70.3 M4*10 Stainless steel | Piece | 100      |       |
| 19  | Hexagon socket set screw with flat point | GB/T 77M3*4 Stainless steel      | Piece | 100      |       |
| 20  | Hexagon socket set screw with flat point | GB/T 77M4*6 Stainless steel      | Piece | 100      |       |
| 21  | PU trachea                               | Φ4 orange                        | Meter | 300      |       |
| 22  | PU trachea                               | Φ6 orange                        | Meter | 300      |       |
| 23  | PU trachea                               | Φ4 black                         | Meter | 300      |       |
| 24  | Tie                                      | 3*150 mm, black                  | Piece | 2000     |       |
| 25  | Cable tie holder                         | HC-0(S)                          | Piece | 100      |       |
| 26  | Cable tie holder                         | HC-1(S)                          | Piece | 100      |       |
| 27  | Cable tie holder                         | HC-2                             | Piece | 200      |       |
| 28  | Magnetic switch                          | D-A93L                           | Piece | 10       |       |
| 29  | Magnetic switch                          | D-Y59B                           | Piece | 10       |       |
| 30  | One-way throttle valve                   | ESL4-01                          | Piece | 10       |       |
| 31  | Two-position single solenoid valve       | SY5120-5LZD-01                   | Piece | 10       |       |
| 32  | Vacuum suction cup                       | ZPT13UNJ10-U6-A10                | Piece | 10       |       |
| 33  | Vacuum generator                         | EV-05                            | Piece | 10       |       |

| No. | Material Name        | Specifications & model         | Unit  | Quantity | Notes |
|-----|----------------------|--------------------------------|-------|----------|-------|
| 34  | Blue material block  | THJDMT-5B.1J-58                | Piece | 50       |       |
| 35  | White material block | THJDMT-5B.1J-57                | Piece | 50       |       |
| 36  | Cable marker         | No. 3, one set per unit        | Piece | 70       |       |
| 37  | Wire casing          | PVC serrated wireway /35*35 mm | Meter | 20       |       |

## XI. Result Evaluation

### i. Marking criteria and result calculation

A comprehensive evaluation should be conducted based on the completion of competitors; the professional ability of competitors should be comprehensively evaluated according to the relevant national and industry standards and norms; the marking criteria should be formulated based on the principles of “being scientific and rigorous, fair and impartial”.

#### 1. Marking criteria and marks

The full mark of the Competition is 100 points, and it is divided into six modules: A, B, C, D, E, and F. The detailed marking rules are as follows:

| Module | Question Task                                  | Proportion | Marking requirement                  | Points Method  | Scores Specific gravity (SG) |
|--------|--|------------|--------------------------------------|----------------|------------------------------|
| A      | Mechanical installation and debugging of units | 15%        | Completeness of component assembly   | Result marking | 7%                           |
|        |  |            | Mechanical assembly process          | Result marking | 5%                           |
|        |  |            | Mechanical assembly performance      | Result marking | 3%                           |
| B      | Electrical installation and debugging of units | 20%        | Circuit connection I/O test          | Result marking | 8%                           |
|        |  |            | Neat, beautiful and correct          | Result marking | 3%                           |
|        |  |            | Correctness of electrical connection | Result marking | 4%                           |
|        |  |            | Electrical connection process        | Result         | 5%                           |

| Module | Question Task   | Proportion | Marking requirement  | Points Method   | Scores Specific gravity (SG) |
|--------|---|------------|--|-----------------|------------------------------|
|        |   |            |  | marking         |                              |
| C      | Troubleshooting of units  | 9%         | Description of the fault   | Result marking  | 3%                           |
|        |   |            | Analysis of fault location   | Result marking  | 3%                           |
|        |   |            | Troubleshooting, automatic operation is normal   | Result marking  | 3%                           |
| D      | Programming and debugging of units                              | 30%        | Programming and debugging of PLC and touch screen function   | Result marking  | 16%                          |
|        |   |            | Robot programming  | Result marking  | 10%                          |
|        |   |            | Sensor, frequency converter parameter, servo parameter, stepper motor parameter setting and debugging etc. | Result marking  | 4%                           |
| E      | Programming, debugging and optimization of mechatronics systems | 20%        | Network communication setting and programming  | Result marking  | 5%                           |
|        |   |            | Program optimization for PLC or robot  | Result marking  | 10%                          |
|        |   |            | Touch screen configuration and optimization  | Result marking  | 5%                           |
| F      | Professional quality  | 6%         | Operation safety specifications  | Process marking | 2%                           |
|        |   |            | The use of facilities, equipment, tools and devices  | Process marking | 1%                           |
|        |   |            | Hygiene and cleaning status  | Process marking | 1%                           |
|        |   |            | Proper wearing   | Process marking | 1%                           |
|        |   |            | Work discipline, courtesy and politeness etc.  | Process marking | 1%                           |

## 2. Result calculation

Each team's total result is the average value obtained by adding up the results of the team's two participating groups and dividing the total by the number of results. The total result of each team is ranked. When the total result is the same, the team with higher total result in professional quality will be ranked higher; when the total result and the total result in professional quality are the same, the team with higher total result in Module 2 will be ranked higher; when the total result, the total result in professional quality and the total result in Module 2 are all the same, two groups in the same team with higher total scores in Module 1 will be ranked higher.

## ii. Marking method

1. A combination of paper marking and informatization is adopted for evaluating and marking. The process marking is conducted and recorded by the judges in the paper file. The competition information system can also be used as a competition evaluation tool. Competitor information, competition schedule, marking criteria, result statistics and the rankings of each item are digitized.

2. If the evaluation is based on subjective evaluation by means of pen and paper measurement, the judges should make an independent evaluation according to the marking criteria and the jury president.

3. If the evaluation method is used to evaluate on-site operation based on objective data, the jury president will form marking teams, with each team comprising three judges; each judge will make an independent evaluation according to four mark levels of “0-3” (0 point for not meeting the skill requirements, 1 point for basically meeting the skill requirements, 2 points for meeting the skill requirements, 3 points for exceeding the skill requirements); if the difference between the evaluation results of the three judges exceeds one mark level, the evaluation should be re-made.

4. Competitors and judges should jointly mark the results of the

evaluation items in the function realization part and the troubleshooting part. The evaluation process should reflect the craftsmanship spirit of competitors. During the capping process, the operations that cause unqualified products will not be awarded points, such as pushing caps, pressing caps, jamming caps, falling caps, cap skewing, failing to screw caps or screw caps tightly, equipment collision, exceeding the desktop range, box edge friction, wrong labeling sequence, label falling, deviation from the cover label position. Competitors are not allowed to use their hands during the operating process of mechanism; in case of jamming or dropping, a second chance to be marked will be given to competitors, otherwise the marking will end here.

5. The judges will mark the results of each evaluation item according to the marking form, and the professional quality part will be marked throughout the process.

6. During the Competition, if competitors disobey the instructions of the judges and invigilators, and disturb the order of the workshop, and if the circumstance is serious, the team will be disqualified. If there is cheating, the team will be disqualified from the award. When the judges announce that the competition time is up but competitors still forcibly operate, the team will be disqualified from the award.

7. If competitors have the following circumstances, their points should be deducted:

(1) If a competitor violates the competition rules and operate in advance or continues to operate after the competition is terminated, the on-site judges will record and deduct 1-5 points as appropriate.

(2) During the Competition, if a competitor violates the discipline of the workshop, the judges will record the violation of discipline by the competitor on the spot, and 1-5 points will be deducted according to the circumstance.

(3) In the process of completing tasks, if a competitor violates the operating procedures or causes equipment damage or affects the competition



of other competitors due to improper operation, 5-10 points will be deducted; if a competitor causes personal or equipment safety accidents due to improper operation, 10-20 points will be deducted; if the circumstance is serious, it will be reported to the Executive Committee for approval, and the jury president will announce the termination of the competitor's competition, and the competition will be marked 0 point.

(4) If the behaviors do not conform to professional norms, such as damaging the equipment provided at the workshop and polluting the environment of the workshop, points will be deducted depending on the circumstances.

### iii. Result review and announcement

#### 1. Sampling review

① In order to ensure the accuracy of the evaluation results, the supervision and arbitration team will review the results of all teams (competitors) that rank in the top 30% of the total results of the Competition; the rest of the results will be checked and reviewed by random sampling, and the sampling coverage rate should not be lower than 15%.

② The supervision and arbitration team should promptly notify the jury president of any marking errors identified during review in writing, who will correct the results and sign for confirmation.

③ If the error rate of review and sampling exceeds 5%, it will be identified as a non-small probability event, and the jury should review all the results.

#### 2. Result announcement

The jury president will submit the marking results of the workstations (competition entries) within eight hours of the end of the Competition. After the results are re-checked and confirmed to be correct, the jury president, supervising personnel and arbitrators will sign for confirmation before

announcement, and the announcement time is two hours. If there is no objection on the announcement, the arbitrators will sign on the marking form and announce the results. The marking form will be submitted simultaneously to the Competition management system.

#### iv. Judge requirements

| No.   | Professional and technical directions | Requirements for knowledge and competence   | Judging, teaching and work experience   | Professional and technical titles (professional qualification level) | Head count |
|-------|---------------------------------------|---|---|--|------------|
| 1     | Machinery, automation                 | Be familiar with electromechanical projects, have practical ability and strong analytical ability | Have experience in selection, guidance and training in the World Skills Competitions, and English proficiency is preferred                        | Have deputy senior professional title or above                       | 7          |
| 2     | Machinery, automation                 | Be familiar with electromechanical projects and have practical ability                            | Have worked as a mechatronics professional teacher, have strong practical ability and experience in judging, and English proficiency is preferred | Have deputy senior professional title or above                       | 8          |
| 3     | Machinery, automation                 | Be familiar with electromechanical projects and have practical ability                            | Have worked as a coach for mechatronics project national competition, and English proficiency is preferred  | Have deputy senior professional title or above                       | 5          |
| Total | 20                                    |   |   |  |            |

|                        |  |
|------------------------|--|
| number<br>of<br>judges |  |
|------------------------|--|

## **XII. Awards and Prizes**

One gold medal, one silver medal and one bronze medal will be awarded for the Competition to three teams, respectively, and the teams in the top 50% of the total results (other than the Top 3) will be awarded the winning prize.

## **XIII. Preliminary Plans for the Competition Venue**

### **i. Contingency plan for firefighting**

1. The division shall establish coordination mechanisms with public security and fire departments to ensure Competition safety. It shall also formulate contingency plans to respond to emergencies in a timely manner.

2. Safety exits, firefighting access, alert areas and evacuation lanes for emergencies shall be marked on the floor plan of the venue.

3. The venue shall provide emergency measures for medical care and firefighting.

4. Fire extinguishers shall be equipped in accordance with the safety requirements for firefighting, and persons in charge shall be designated for leveraging amid emergencies.

5. Special contact lines between firefighters and security personnel shall be set, with the contact persons of both sides determined. Persons in charge of the venue safety shall take charge of the special communication.

### **ii. Contingency plan for power supply**

1. A team for ensuring the safe use of electricity should be established to bear the responsibility for communicating with power departments, safeguard the normal supply of electricity during the Competition, and address issues swiftly when abnormal events occur.

2. A special venue power room should be set up and industrial standard power distribution cabinets should be configured.

3. Protection measures for conducting dual power:

(1) In addition to the normal mains, a backup diesel generator or uninterruptible power supply (UPS) should be added, and the diesel generator should be far enough away from the venue to ensure that the venue is quiet and free of noise pollution.

(2) The power supply of the equipment should be separated from the computer power supply at each competition workstation at the workshop, to ensure that the computer power consumption will not be affected by competitors' false operation on the equipment.

(3) The outlet of the power distribution cabinets must ensure 5 channels for backup.

(4) The equipment itself is equipped with a distribution box and an isolation transformer, which has functions such as leakage protection, overvoltage, and overcurrent protection, and each unit should supply power independently without interfering with each other.

iii. Contingency plan for medical care

1. A medical secure service station should be set within the scope of the alert line to offer emergency services such as first aid and wound treatment for potential emergencies.

2. The workshop should introduce medical and firefighting measures, and set the special contact lines for medical workers, with the contact persons determined. Persons in charge of the venue safety should be responsible for special communication.

iv. Contingency plan for equipment

1. The workshop shall be equipped with at least one set of backup equipment, preventing the technical faults that may take place during the

Competition.

2. A certain number of technical engineering personnel for equipment maintenance should be allocated at the workshop with the aim to handle issues that may occur to the equipment. Moreover, assistant judges should confirm the status of competition equipment and computer software so that the root cause can be rapidly identified and effective measures be taken in a timely manner, securing a successful Competition.

3. Two weeks before the Competition, the competition platform should be taken into the venue according to the requirements of the expert panel, and a full-load motion test should be conducted for 24 consecutive hours on the platform to ensure zero fault.

4. The computer configuration of the competition workstation should be unified and relevant software should be installed; the software operation and running test should be carried out continuously for more than 24 hours, and adequate backup computers should be provided at the workshop.

#### v. Pandemic prevention and control

In order to effectively promote and implement the organization of the National Vocational Students Skills Competition under the normalization of pandemic prevention and control, and ensure the safety and health of participating teachers and students, the pandemic prevention and control requirements during the Competition are as follows:

##### 1. Organizer

The organizer is the main responsible unit for pandemic prevention, and it should scientifically implement the territorial pandemic prevention requirements, establish relevant organizations, and be responsible for the organization of pandemic prevention. During the competition organization, the organizer should strengthen the communication and contact with local guiding institutions for pandemic prevention, develop implementation plans

for the Competition, fulfill the requirements throughout the Competition, and define the requirements in the guidelines for the Competition. The organizer should arrange for dedicated personnel to coordinate with participating schools, and inform them of specific requirements in a proactive manner regarding competition arrangements and personnel registration. The organizer should ensure the temperature detection for competitors, examine their health codes, offer essential prevention supplies, and conduct relevant tasks for pandemic control, so as to secure a successful Competition.

## 2. Participating colleges

Participating schools should reinforce the unified management of competitors, and reduce the number of other staff besides team leaders, competitors and instructors. A special bus should be arranged to pick up and drop off competitors point-to-point to ensure their safe arrival and departure.

The organizer should designate personnel for the preparation of pandemic prevention, and prepare materials related to the prevention for competitors (including team leaders and instructors). Competitors must submit the Competitors' Health Status Inspection Commitment Letter and Personal Health Status Commitment Letter, provide their health code, phone roaming query results (travel card), and the negative report of 48-hour nucleic acid check. They should complete the registration with the temperature detected as normal, and then check in the hotels designated by the organizer. During the Competition, competitors should take personal protective measures, prepare sufficient disposable surgical face masks, and avoid staying at crowded sites and areas with poor ventilation. Competitors should be subject to the inspections of pandemic control launched by organizing colleges. In case of fever, fatigue, dry cough and breathing difficulties, please immediately contact the colleges' pandemic control teams, and visit the hospital in time depending on the disease condition to ensure that the Competition is held in a secure manner.

## **XIV. Safety**

Event safety is a prerequisite for the smooth running of all work of the skills competition and a core issue that must be considered in the preparation and operation of the Competition. The Executive Committee should strictly implement the requirements and regulations for pandemic prevention, and take practical and effective measures to ensure the personal safety of competitors, judges, staff, and audience during the Competition.

### **i. Competition environment**

1. The Executive Committee should organize a special inspection on the venue, accommodation places and transport before the Competition, and make explicit safety requirements. The arrangement of the workshop, the equipment and facilities within the workshop, should comply with the relevant national safety regulations. If necessary, workshop simulation tests can also be conducted to identify possible problems. The organizer must exclude hazards in accordance with the requirements of the Executive Committee before the Competition.

2. A cordon should be set up around the venue, and all the competitors should enter the venue with valid documents issued by the Executive Committee to prevent the entry of unauthorized persons in case of accidents. The necessary labor protection should be provided for the competitors with reference to the requirements of the relevant occupational posts within the competition site. In the section with dangerous operation, the judges should take strict precautions against the wrong operation of the competitors.

3. The organizer should provide conditions to ensure the implementation of the contingency plan. For competitions involving work at height, possible falling objects, large electricity consumption, fire prone and other circumstances, policies and plans must be specified, and first aid personnel and facilities must be equipped.

4. Flammables, explosives, and all kinds of hazardous materials unrelated to the Competition are strictly prohibited from being brought into the venue and school bags are not allowed to be brought into the workshop.

5. Advanced equipment should be provided to prevent someone from using electromagnetic waves to interfere with the Competition. Network security control should be carried out on the competition site to avoid the exchange of information inside and outside the Competition site, so as to fully reflect the seriousness, fairness and impartiality of the Competition.

6. The Executive Committee must formulate an evacuation plan for the open venue and experience area in conjunction with the organizer. In addition to complete indication signs, additional guidance personnel shall be assigned and alternate lanes shall be opened in areas where there are crowded and intersecting traffic and pedestrian flow in the workshop environment.

7. In order to ensure the smooth progress of the Competition, the host school should establish the corresponding safety guarantee system during the Competition; at the same time, the security, campus environment and health and medical protection team should implement:

(1) During the Competition, all vehicles and personnel must enter with a certificate and show it to the staff when entering the division.

(2) Before the start of the Competition, competitors should carefully read the Entry Instructions and the emergency evacuation map posted in the venue.

(3) Judges should supervise and complete the whole process of inspection on the electrical control system before the system is energized, and promptly remind and stop any hidden dangers in operation.

(4) Each competition equipment should use an independent power supply to ensure safety. Competitors should save data in the computer in time to avoid data loss caused by sudden power failure.

(5) During the Competition, competitors should strictly abide by the safety operating procedures. In case of emergency, they should cut off the



power immediately and exit the workshop in an orderly manner under the arrangement of the staff.

(6) All types of personnel must strictly abide by the rules of the workshop, and they are strictly prohibited from bringing in items that are strictly prohibited by the Competition.

(7) Security personnel should promptly notify the personnel in charge of the venue when they discover unsafe hidden dangers.

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

(9) If there is a safety problem, under the command of the security personnel, competitors should quickly evacuate the scene through the emergency evacuation route.

8. During the Competition, the organizer should take key positions in the management of the workshop, increase efforts and establish a security management log.

#### ii. Competition scene

A competition safety guarantee team should be set up. The leader of the team should be taken charge of by the director of the Executive Committee, and the members should be the security leaders of each competition workshop.

1. A person in charge of safety should be appointed at the workshop to be fully responsible for the safety of the workshop. In case of an accident, he/she should be responsible for mobilizing rescue teams and professional rescuers to arrange the evacuation of people at the workshop.

2. Special contact lines with medical staff, firefighters and security personnel should be set, with their contact persons determined. Persons in charge of safety should take charge of the special communication. The layout of the competition workshop and the use of equipment should strictly

conform to the safety construction regulations. The workshop should be divided into different areas, and evacuation channels should be set according to safety requirements, and safety evacuation channels and route diagrams should be posted in prominent positions on the wall.

3. The installation of competition equipment and facilities should be constructed in strict accordance with the safety construction standards, and the power routing and electrical installation should be constructed in accordance with the specifications.

4. Fire extinguishers shall be equipped in accordance with the safety requirements for firefighting, and persons in charge shall be designated for leveraging amid emergencies.

### iii. Living conditions

1. During the Competition, in principle, the Executive Committee will arrange the food and accommodation for competitors and team leaders. The organizer shall respect the culture and beliefs of ethnic minorities and arrange the food and accommodation for the competitors and coaches of ethnic minorities in accordance with relevant national ethnic policies.

2. The place of accommodation arranged during the Competition should have the business permit for hotel/accommodation. If the school dormitory is used for accommodation, the Executive Committee and the school providing the dormitory will be jointly responsible for the accommodation, health, and food safety during the Competition.

3. The Executive Committee and the organizer should ensure the transport safety for competitors, instructors and judges, and staff during the Competition.

4. The security management of the Competition, in addition to necessary security quarantine measures that can be taken, should strictly comply with the relevant national laws and regulations to protect personal privacy and

freedom.

iv. Team responsibility

1. Each school should arrange to purchase personal accident insurance for competitors during the Competition when organizing the teams.

2. After the teams of each school are formed, the relevant management policy should be formulated and safety education should be provided to all competitors and instructors.

3. The teams should strengthen the safety management of competitors and achieve the alignment with the safety management of the workshop.

v. Emergency response

If an accident occurs during the Competition, whoever finds it should report to the Executive Committee immediately, and also take measures to avoid further deterioration. The Executive Committee of the Competition should immediately activate the preliminary plan to address the problem and report to the Executive Committee of the division. A Competition may be suspended if there is a major safety problem, and whether to suspend it should be determined by the Executive Committee of the division. After the event, the Executive Committee of the division should report the details to the Executive Committee.

vi. Penalties

1. If a major safety event is caused by a team, the team will be disqualified from prizes.

2. Teams involved in a major safety risk may be disqualified from continuing the Competition, if they are alerted and warned by the staff of the workshop but of no avail.

3. Staff who violate rules will be held accountable according to the corresponding policies. Where the circumstances are serious and cause major security incidents, the relevant parties will be held legally accountable by the

judicial authorities.

## **XV. Competition Notice**

### **i. Competition Notice**

Competition-related equipment and tools are provided at the workshop, and competitors are not allowed to carry any items other than those stipulated in the competition rules.

### **ii. Notice for teams**

1. Competitors should not be replaced, in principle, after their sign-ups are confirmed. However, if a competitor fails to join the Competition during the preparation for the Competition, his/her school should issue a written explanation, replace him/her with a substitute in line with relevant competitor qualifications, and have the substitute reviewed. After the Competition begins, teams should not replace members. Competitors are allowed to miss the Competition.

2. Teams should hold a entry card issued by the Executive Committee and valid IDs to participate in the Competition and relevant activities, in accordance with the Competition process. Teams should wear uniforms in line with the requirements for safety production and the Competition.

3. When competitors familiarize themselves with the venue the day before the Competition, each team should enter the venue to familiarize themselves with the environment in the specified time period and they are not allowed to bring photographic equipment and communication tools or touch the competition platform and the equipment at the workshop.

4. When checking in on the competition day, teams are only allowed to bring equipment and tools designated by the Competition. They are not allowed to bring their own components, communication tools, self-edited electronic or written materials into the venue, which will be confiscated immediately upon discovery.

5. During the Competition, competitors are not allowed to activate the operation before receiving the start signal. Each team should decide on the division of labor, work procedures and time arrangement on its own, and complete the competition project at the designated workstation. Cheating is strictly prohibited.

6. If a team wants to end the Competition in advance, the team leader should raise hands to give a sign to the on-site judge. The judge will record its end time of the Competition. After the Competition is terminated, no further competition-related operations are allowed.

7. If any team has any objection to the competition process, the team leader may submit a written report to the supervision and arbitration team of the Competition within the specified time.

### iii. Notice for competitors

1. Competitors should enter the venue with a valid card, strictly comply with the regulations, operating procedures and technical guidelines of the venue, and ensure personal and equipment safety. They should accept the supervision and warnings of the judges and compete in a civilized manner.

2. Competitors must check in before operating in the Competition. Competitors should present their ID cards or passports, student ID cards and entry cards during the check-in. Only after passing the check-in can they participate in the Competition. Those who fail to check in on time or fail to pass the check-in should be disqualified from the Competition.

3. This Competition lasts six hours in total. All the competition periods are considered competition time; the time for competitors to rest, eat or go to the toilet is included in competition time. Competitors who need to leave the venue halfway must be approved by the invigilator and accompanied by the staff throughout the whole process. If they leave without authorization, they should be withdrawn from the Competition and should not be allowed to

continue their competition.

4. During the Competition, if a competitor cannot compete due to serious operational errors or safety accidents, the on-site judges have the right to terminate the team's competition.

5. 30 minutes after the start of the Competition, if a competitor needs to replace accessories due to damage, loss and other reasons, he/she must fill in the accessory requisition form, and the accessories should be issued after the judge confirms and agrees, but it will affect the competition result.

6. After the inspection by the on-site judges and technicians, if a competitor indeed needs to have the equipment or component replaced due to their fault or damage, the time from reporting to the on-site judges to the completion of the replacement should be added as appropriate, and the added time should not exceed ten minutes. If the equipment or component has no fault, the time will not be added.

7. Competitors should pay attention to saving the file in time. If the file is lost due to the crash caused by improper operation, the competitor should be responsible for it. Staff (including judges) are not allowed to operate teams' computers without permission. At the end of the Competition, technical related documents should be submitted according to the requirements of TP.

The jury has the right to make a ruling on the violation of the relevant competition content instructions by a team or competitor. In case of a dispute, the decision made by the supervision and arbitration team would be considered as the final decision, and no media information would be referred to.

#### iv. Notice for staff

1. Staff should obey the leadership of the Executive Committee, abide by professional ethics, adhere to principles, and act according to rules. Besides, judges should perform their duties in a strict, conscientious, fair, accurate, and

civilized manner.

Staff should perform their duties properly with a strong sense of responsibility, serious and conscientious attitude, and rigorous and meticulous style. They must be familiar with and conscientiously implement competition rules, and act in strict accordance with the work procedures and relevant regulations.

2. Staff must wear the badge and the uniform, have a tidy and clean appearance and good manners, and talk politely, which should be supervised by members of the arbitration team and competitors.

4. Staff must attend the pre-competition training organized by the Executive Committee.

5. Staff should keep competition secrets during the Competition rather than disclose or imply such secrets to team leaders, instructors and competitors of teams.

6. Staff should strictly conform to competition disciplines. Except for the notice for competitors, staff should not give a hint to or answer competitors' questions related to the Competition. Furthermore, they should not provide instructions or convenience for competitors.

7. The avoidance system should be implemented, and staff should not contact competitors and related personnel.

8. Staff should stick to the position, and should not be late or leave early.

9. Staff should supervise competitors to observe competition rules and safe operating procedures, and properly handle issues that occur during the Competition, and should not intervene with competitors.

10. Staff should follow the principle of justice and fairness, maintain discipline at the workshop, and record information about the workshop truthfully.

11. In case of security emergencies, staff should organize evacuation in a timely manner according to the work plan to ensure personnel safety.

12. Staff are not allowed to publish remarks about the Competition or accept interviews without permission.

## **XVI. Appeal and Arbitration**

### **i. Arbitration**

1. Teams may file an appeal against equipment, tools and materials that do not comply with the Competition regulations, unfair monitoring and judging, as well as rule violations of staff. The subject of the appeal is the team leader.

2. Appeals related to equipment, tools and software should be filed within two hours after competitors have familiarized themselves with the competition environment the day before the Competition; other appeals should be filed within two hours after the session of the Competition ends, and should not be accepted after the time limit has expired. When appealing, the team should submit a written appeal to the arbitration team in accordance with the stipulated procedures, and on-site verification should be conducted. A written appeal should give a full and factual account of the incident, time, personnel involved and the basis for the appeal. Appeals with insufficient factual basis and based solely on subjective assumptions should not be accepted.

3. After receiving the appeal report, the arbitration team should review it according to the reasons for the appeal. The head of the jury should give the result as well as its basis and reason according to the appeal.

4. The complaining party should not refuse to accept the handling result without any reason, and should not take extreme actions to create difficulties for or attack the staff, otherwise it will be regarded as giving up the appeal.

### **ii. Appeal**

An arbitration team should be set up for the Competition to accept appeals against the judging results and other issues submitted by teams. The



arbitration team should organize a review within two hours after receiving the appeal and timely feedback the arbitration result. If the complaining party still disagrees with the review result, the team leader may submit an appeal to the Supervisory Arbitration Committee of the division. The arbitration award of the Supervisory Arbitration Committee of the division shall be final.

## **XVII. Competition Observation**

The Competition workshops are open to visitors with visiting lanes set, which means that visitors can observe and experience the on-site Competition, on the premise of not intervening with competitors and in line with the specified time and routes.

### **i. Observers**

Experts, technicians, instructors from enterprises, institutions, colleges and industrial associations, and students in colleges and high, secondary and primary schools.

### **ii. Observation method**

Observers can enter the workshops for observation in an orderly manner within specified time.

### **iii. Observation discipline**

1. Observers must wear the observation cards;
2. No discussion or conversation is allowed during observation, and communication with players is strictly prohibited;
3. Observers should not stay in front of a workstation during observation for fear of influencing competitors;
4. Observers should not raise any question to the workshop judges and staff during observation;
5. Observers are not allowed to take pictures during observation;

For those who violate the above rules, their observation qualifications will be canceled immediately.

## **XVIII. Live Competition**

Under the unified arrangement of the Executive Committee, the whole process of the Competition will be broadcast live in an all-round way.

i. Live broadcast method: Video recording equipment without blind spots should be deployed at the workshop to record and display the Competition in real time.

ii. Live broadcast arrangements: Dedicated personnel should be arranged for interview and shooting at the opening and closing ceremonies, and for ensuring the normal running of live broadcasts during the Competition.

iii. Live broadcast content: The opening and closing ceremonies shall be shot by multiple cameras. In addition, videos on interviews with outstanding competitors and instructors, comments by experts and judges, and interviews with businessmen shall be produced to highlight the skills and characteristics of the Competition. Comprehensive information and materials should be provided for publicity and arbitration.

## **XIX. Resource Conversion**

A plan for resource conversion should be submitted to the office of the Executive Committee within 30 days after the Competition. Resource conversion should be completed within three months. Converted resources of the Competition, after being reviewed by the Executive Committee, should be uploaded to the online information release platform designated by the Competition.

The results of resource conversion should include basic and extended resources, including text documents, presentation documents, video files, Flash files, graphs/images, and web-based resources.

### **i. Basic resources**

Basic resources should contain three major modules, namely, charm show, skill overview, and training resources.

1. Charm show: A 15-minute competition promotional video and a 10-minute winning team (competitor) video for charm show should be produced immediately after the Competition for broadcast and promotion by professional media.

2. Skill overview: It should include the production of skill introduction, skill operation points and assessment indicators etc.

3. Teaching resources: It should fully cover the contents of the Competition. The content resources of the Competition can be listed separately or integrated into the teaching units. The resources include teaching plans, training instructions, homework/tasks and experiments/practice/practice resources. The presentation forms can be presentations, pictures and videos of operation process demonstrations, animations and related micro-courses and micro-resources etc.

#### ii. Extended resources

Extended resources are mature and diverse auxiliary resources that mainly reflect skill characteristics and support skill teaching and learning and can be used in all teaching and training processes. They can strengthen the cooperation between schools and enterprises, and the combination of teaching and production, and optimize the existing teaching or training mode. For example: Videos on comments and interviews, and material resource library.

### iii. Resource conversion results and completion time

| Name of resource |               | Form of expression                        | Number of resources | Resource requirements | Completion time        |                               |
|------------------|---------------|---|---------------------|-----------------------|------------------------|-------------------------------|
| Basic resources  | Charm show    | Competition promotional video             | Video               | 600MB                 | > 15 min               | 30 days after the Competition |
|                  |               | Charm show video                          | Video               | 400 MB                | > 10 min               | 30 days after the Competition |
|                  | Skill summary | Assessment indicators for skills points   | Text                | 1 set                 | Text with pictures     | 30 days after the Competition |
|                  |               | Process case                              | Text                | 1 set                 | PPT                    | 70 days after the Competition |
|                  |               | Skills operating points                   | Text                | 1 set                 | PPT                    | 70 days after the Competition |
|                  |               | Operation explanation of key skill points | Video               | 600MB                 | 5 skill points or more | 70 days after the Competition |

## XX. Miscellaneous