MAKEX V1.0

2022 MakeX Robotics Competition

# RULES GUIDE

## MAKEX EXPLORER

Edited By MakeX Robotics Competition Committee

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| Date | Version | Modifications Record |
|---|---|---|
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# 1. Introduction

## 1.1 About MakeX

MakeX is an international robotics competition and education platform that promotes multidisciplinary learning within the fields of science and technology. It aims at building a world where STEAM education is highly appreciated and where young people are passionate about innovation by engaging them in exciting Robotics Competition, STEAM Carnival, Tech Event, Educational Conference etc.

As the core activity of MakeX, the namesake MakeX Robotics Competition provides exciting, challenging and high-level competitions in the spirit of creativity, teamwork, fun and sharing. It is committed to inspiring young people to learn Science (S), Technology (T), Engineering (E), Art (A) and Mathematics (M) and apply such knowledge in solving real-world problems.

## 1.2 MakeX Spirit

**Creativity:** we advocate curiousness and innovation, encouraging all contestants to create unique high-tech works with their talent, and challenge themselves for continuous progress!

**Teamwork:** we advocate solidarity and friendship, encouraging all contestants to develop a sense of responsibility and enterprising spirit, and sincerely working with their partners for win-win development!

**Fun:** we encourage contestants to build a positive, healthy mindset in the competition. Enjoy the journey and grow in the process.

**Sharing:** we encourage contestants to have an open mind as a maker and share their knowledge, responsibility, and joy with everyone, including their teammates and competitors.

MakeX spirit is the cultural cornerstone of the MakeX Robotics Competition. We hope to provide a platform for all contestants, mentors and industry experts to exchange ideas, study and grow up, and help young people acquire new skills during creation, learn to respect others in teamwork, gain an enjoyable life experience in the competition, take delight in sharing with the society their knowledge and responsibility, and work hard to achieve their grand aspiration of changing the world and creating

the future !

## 1.3 About MakeX Explorer

MakeX Explorer is a confrontational competition program for elementary and junior high school students aged 8-15. This program fully integrates the essence of sports events and is highly interesting and a delight to watch. The competition requires the contestants to design and build robots from scratch, which systematically develops the contestants' comprehensive abilities in robot design, mechanical construction, and programming. Also, the form of alliance confrontation improves the contestants' ability to solve imperative problems and develop strategic thinking.

# 2. Competition Application

## 2.1 Participation Requirements

Participants: Contestants shall participate in teams, the number of contestants is 2-4 for each team, with 1-2 mentor(s).

Age: Team members must be between the age of 8-15 (born between January 2, 2006 and December 31, 2014), or are currently elementary school and junior high school students. The mentor must be at least 18 years old.

Team Number: The mentor will receive a team number after finishing registration on MakeX official website.

Team Roles: Everyone in the team can play their respective roles as operator, observer, mechanist, programmer and so on. In each competition, one team can only appoint 1 operator and 1 observer to participate. Each alliance includes 2 operators and 2 observers, and one of whom is designated as the captain of the alliance. The operator is responsible for operating the robot, and the observer is responsible for assisting the operator in observing the status of props and making suggestions.

Identification Symbols: Each team must have a team logo, team name, and team slogan. Teams are encouraged to use uniforms, flags, posters, badges, base decorations, etc. to show the team culture.

## 2.2 Registration and Application

Contestants and mentors that meet participation requirements can register on MakeX official website (www.makex.cc). After registration, mentors are able to form a team and sign up for a competition by using mentor's account.

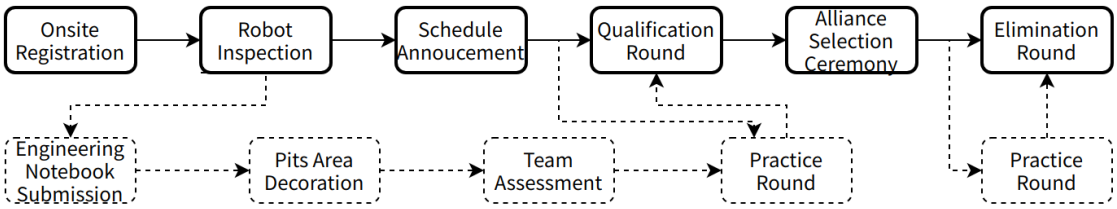
If participating team wants to change their members before competition, which leads to inconsistency with the registration information, they should inform MakeX Robotics Competition Committee in advance to finish re-registration.

For more details about the registration and application, please refer to MakeX Registration & Competition Application Guide

# 3. Competition Procedure

Participating teams shall pay close attention to related notices and Program Brochures published before each competition. If there are some updates in brochures, the latest rules will be adopted for the competition. MakeX Robotics Competition Committee reserves the rights and final interpretation to amend competition rules and system based on actual situation of different points race.

The schedule for each competition is determined by actual situation, and generally includes following procedures.




* Note: The solid line frame refers to necessary procedure of each match, while the dotted line frame refers to non-essential procedure. The specifications of non-essential procedure can be understood based on **Appendix 6 Supplementary Explanation of Competition Procedure**. Please keep abreast of updates.

**Onsite Registration**

When a team arrives at the venue, mentors and contestants should show ID cards or other valid certificates (e.g., passport) for onsite registration and to get the competition material pack. It is necessary for mentors to inform team members about the fire exit, match schedule, arena, pits area, etc. After the match schedule is announced, the team registration and robot inspection will no longer be accepted.

**Robot Inspection**

The inspectors will strictly check the safety of robots on request. Teams can pre-check their robots in advance based on "Appendix 3 MakeX Explorer Eco- Pioneer Robot Self-Check List". The robot and self-customized environmental flag will be inspected before competition. If the inspection fails, the team needs to adjust their robots and check again until they pass the inspection. Those who fail to pass the inspection are not qualified for the competition.

**Schedule Announcement**

The committee will announce the match schedule at least 30 minutes ahead of

competition through online official website and onsite announcement. The schedule includes match-up chart, match session and specific time, red alliance and blue alliance, etc.

**Qualification Round**

Normally, each team is requested to participate in four matches during qualification round. However, the session of qualification round may be different based on distinct points race. In qualification round, red alliance and blue alliance are automatically matched by the system. Points will be obtained by teams according to the winning or losing result. It is conducted in the form of alliances confrontation and each team's alliance and the opponents will be allocated randomly by the system.

In each qualification round, team will receive corresponding points (including win, tie, loss) regardless of competition type. Three points for a win, one point for a tie, and no point for a loss. The final ranking is based on the sum of win-loss points and judging points, and the top-ranking teams will be promoted to the elimination round. If the team with the same ranking points, the ranking sequence will be determined according to following rules:

1) Team with higher win-loss points in the qualification round has a higher ranking.

2) If win-loss points are the same, team with higher total point differential in all qualification round has a higher ranking.

3) If above conditions are the same, team with highest total point in all qualification round has a higher ranking.

4) If above conditions are the same, team with highest point of a single round in all qualification round has a higher ranking.

5) If above conditions are the same, teams with the same ranking will play one-on-one extra match, and those who with the highest total point will be the winner.

**Alliance Selection Ceremony**

In alliance selection ceremony, promoted teams will select their alliance team in turn according to their ranking in qualification round. During this procedure, teams must abide by following rules (these rules only available for point race, other competitions must follow the rules unveiled before the competition. Point Race is currently limited to China, which is currently not open to many overseas regions.):

When being chosen by other teams, promoted teams ranking top 50% can refuse for only once, and those teams ranking bottom 50% cannot refuse. If the team is refused by another team, they can continue to choose another team until the alliance is

formed.

The promoted teams who are not present before the start of alliance selection are deemed as voluntarily giving up the right to choose alliance, and those who are not present before the end of the alliance selection are considered to be as voluntarily quitting the elimination round. If the promoted teams quit amid the alliance selection ceremony, the promotion places will be given to the following teams according to the ranking in the qualification round.

The promotion proportion for 2022 season overseas competition is as follows. However, the promotion quota in different competitions may be different according to actual situation.

*

| Number of participating teams | Number of promoted teams |
|---|---|
| 121 or more | 64 |
| 65-120 | 32 |
| 32-64 | 16 |
| 12-31 | 8 |

**Elimination Round**

In elimination round, the alliance generated in the alliance selection will be the opponent (red alliance and blue alliance are automatically matched by the system). The winner will be evaluated by BO3（Best of 3） and the alliance who achieve "two wins" or "one win and two ties" can advance to next round until the champion, runner-up and second runner-up are elected.

If the alliance achieves "1 win, 1 loss, 1 tie" or "3 ties" in three rounds, the winning alliance will be decided according to the following rules:

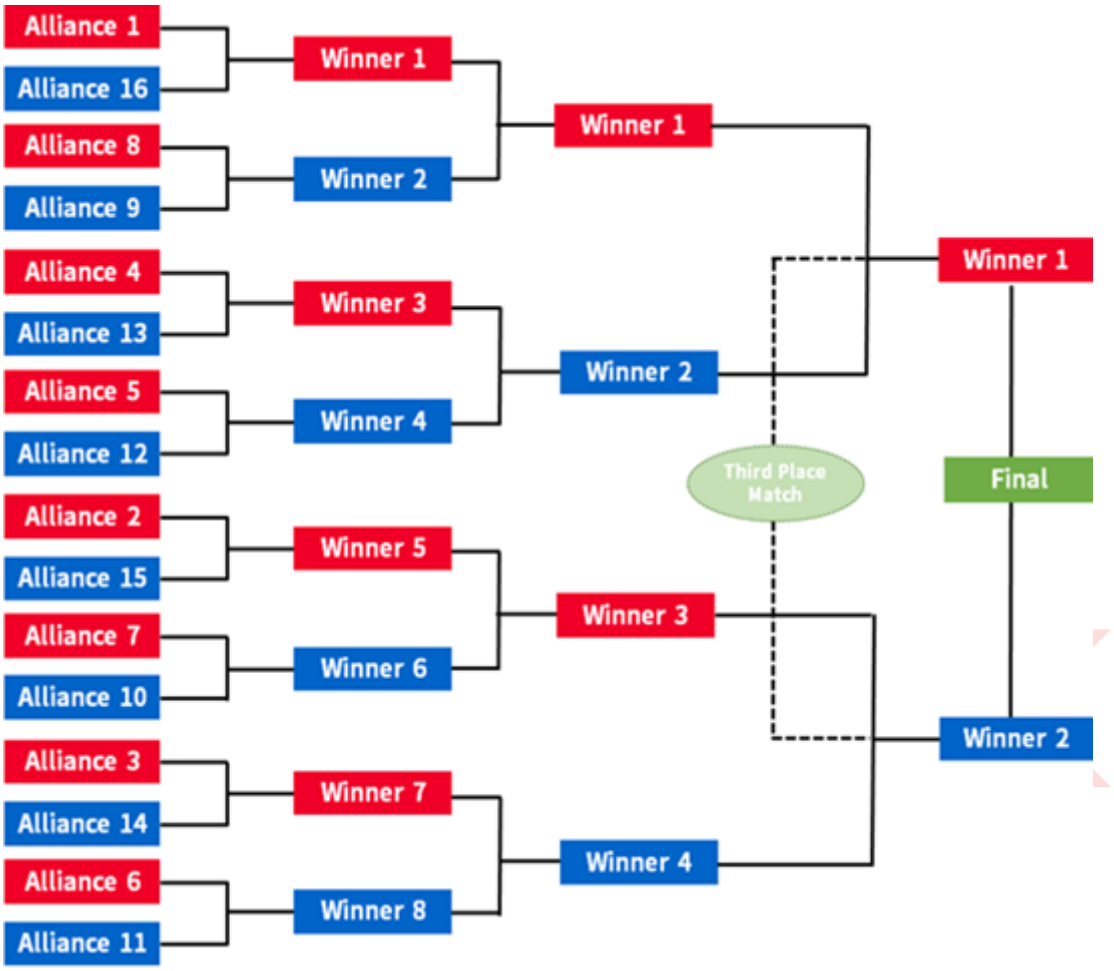
1) If win-loss points are the same, team with higher total point differential in BO3 has a higher ranking.

2) If above conditions are the same, team with higher average points in BO3 has a higher ranking.

3) If above conditions are the same, team with highest point in BO3 has a higher ranking.

4) If above conditions are the same, teams will play an extra match until the winner is elected.

Taking the promoted 32 teams as an example, the schedule of elimination round is as follows:



# 4. Competition Details

The theme of the 2022 MakeX Explorer is "Eco-Pioneer".

In the past century, high emissions of carbon dioxide, water vapor, nitrous oxide, methane, and other greenhouse gases have led to the rapid increase in Earth's temperature. In addition to actively reducing greenhouse gas emissions, the solution to global warming is also proven effective by using advanced equipment to capture carbon dioxide. The collected carbon dioxide can be further used in chemical production, sustainable fuel production, agriculture, and medicine to reduce greenhouse gas emissions, slow climate warming, and ultimately achieve the goal of sustainable development.

## 4.1 Introduction

MakeX Explorer is a confrontational competition, among which red and blue alliance for each match, and two teams for each alliance.

Each match comprises automatic stage and manual stage. Teams are required to control the robot to finish tasks in an automatic or manual manner. At the end of the competition, the referee will calculate all of the task points for both teams, and the alliance with the highest score will be the winner.

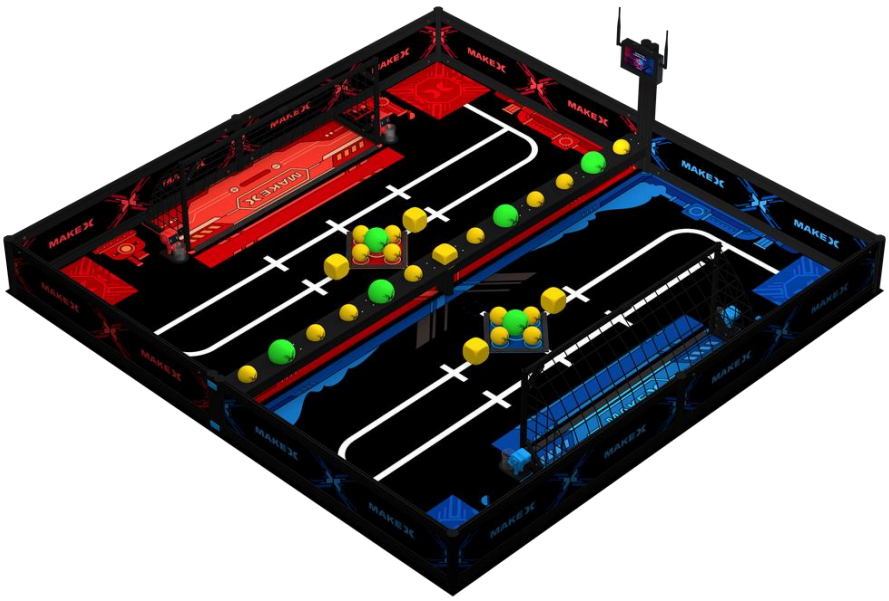


**Fig 4.1 Axonometric View of the Arena**

## 4.2 Arena

The venue of MakeX Explorer is a rectangular area with the size of 2440 mm × 2440 mm, which is composed of a map and frames. The map is measured by 2317mm × 2357mm and the frame is 255mm in height and 15mm in thickness. The arena mainly consists of CO2 emission zone (central area), starting area, CO2 conversion area (goal area), max cylinder, anti-leakage device area and manufacturing area. There will be a time screen for some onsite competition.

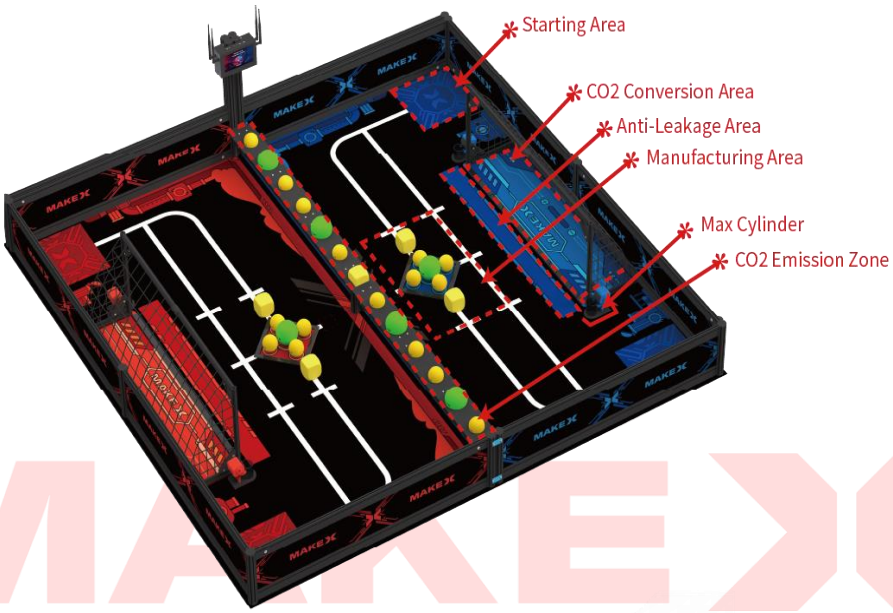



**Fig 4.2-1 Arena Illustration**

The competition arena is divided into red camp, blue camp and central area. Robots are only allowed to finish corresponding tasks in individual camp.

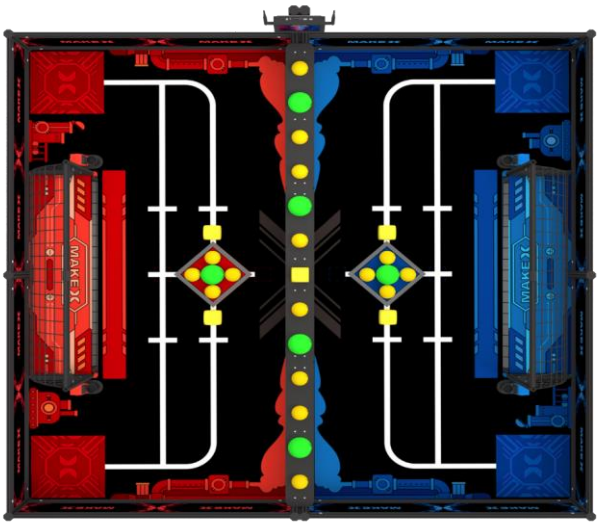


**Fig 4.2-2 Top View of Arena**

### CO2 Emission Zone (Central Area)

There is only one CO2 Emission Zone (central area), including a central partition made of flat beam and octagonal pillars, along with the resource placement area. There is an 80 mm gap in height below the central partition, which only allows the passing of yellow cubes and small yellow balls. The resource placement area is made of plank with the size of 2292mm × 120mm and a height of 160mm from the floor.

There are carbon capture containers (ball) and anti-leakage devices (cube) in the central area. The yellow cube is placed in the middle of the placement area, with large green balls and small yellow balls placing symmetrically on both sides.

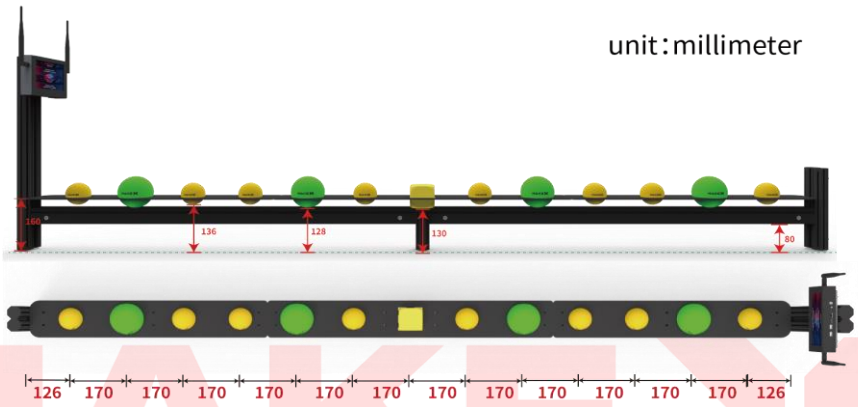



**Fig 4.2-3 CO2 Emission Zone (Central Area)**

### Starting Area

With the size of 320mm × 320mm, the starting area, four corners of the arena, is where robots are placed before the competition. There are two starting areas for red alliance and blue alliance.

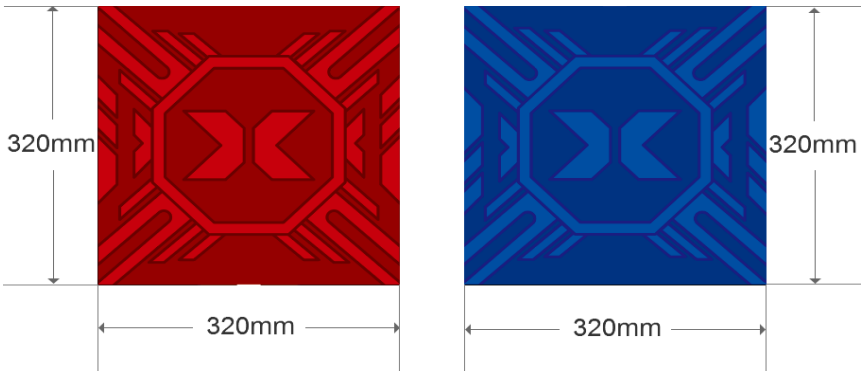



**Fig 4.2-4 The Starting Area**

### CO2 Conversion Area (Goal Area)

There is one CO2 Conversion Area (Goal Area) for red alliance and blue alliance. The goal area is composed of metal beams and black net. There is a foam threshold in front of the goal area, with metal beams pasting on the Velcro paste area.

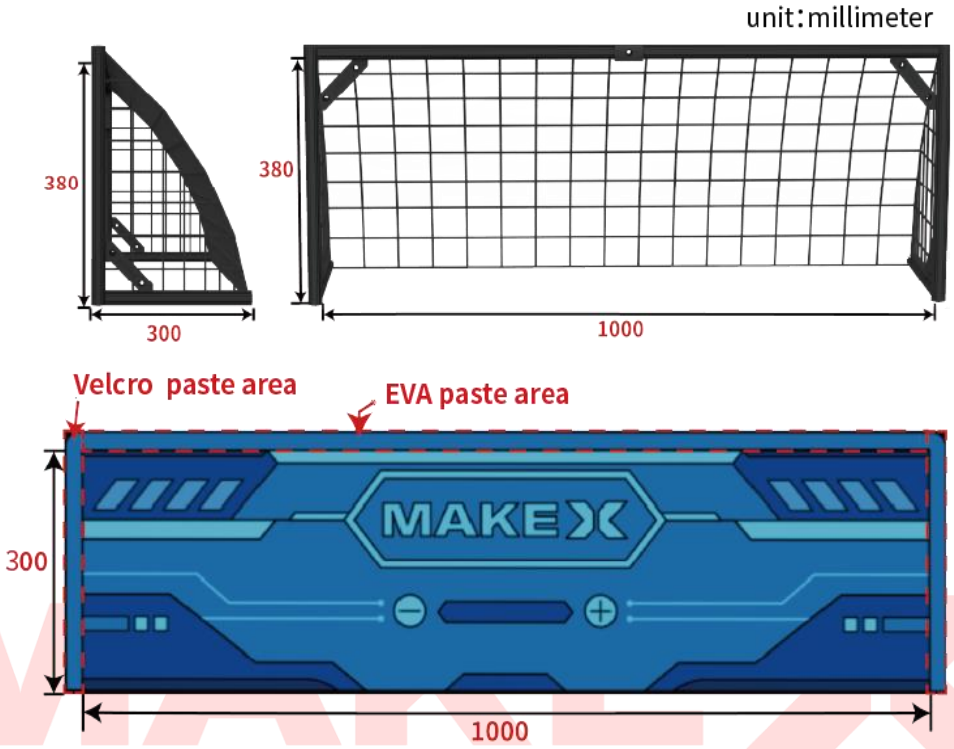



**Fig 4.2-5 The Goal Area**

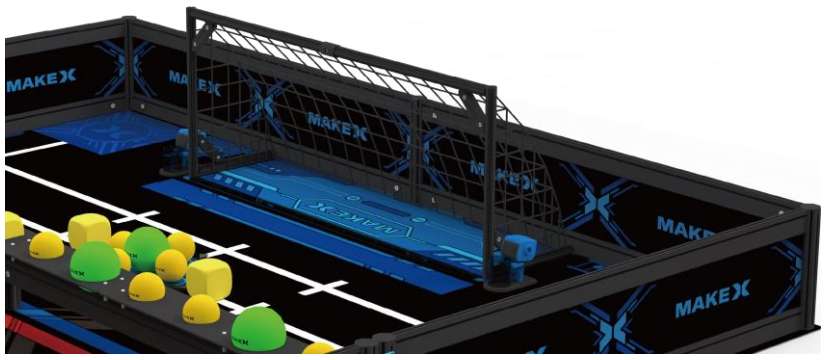



**Fig 4.2-6 Axonometric View of the Goal Area**

**Max Cylinder**

There are two Max Cylinders for red alliance and blue alliance respectively. Max Cylinder is composed of max (model), cylinder and pedestal. Max and cylinder are fixed on the cylinder pedestal with screws, while the pedestal is attached to the map with Velcro. The cylinder is 46mm long in inner diameter and 58mm in height.


**Fig 4.2-7 Max Cylinder**

**Anti-Leakage Device Area (Device Area)**

Anti-Leakage Device Area (Device Area) is a rectangular area in the front of the goal area, with the size of 1070mm × 100mm. There is one device area for red alliance and blue alliance.

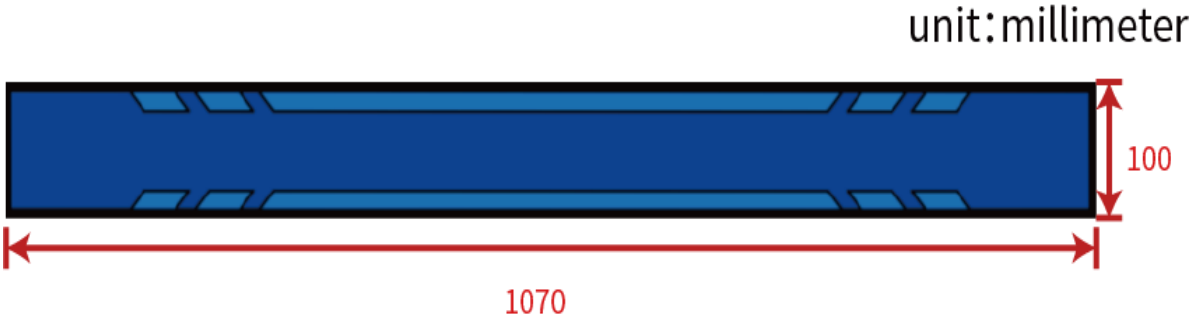



**Fig.4.2-8 Device Area**

**Manufacturing Area**

There is one manufacturing area for red alliance and blue alliance respectively, which includs diamond-shaped area and cube wireframe. Anti-leakage device (yellow cube) and carbon capture container (ball) are placed in the manufacturing area. There is an area in 10mm width around the diamond-shaped area for pasting Velcro. Anti-leakage devices will be placed randomly in two of four cube wireframes by drawing lots before the match.

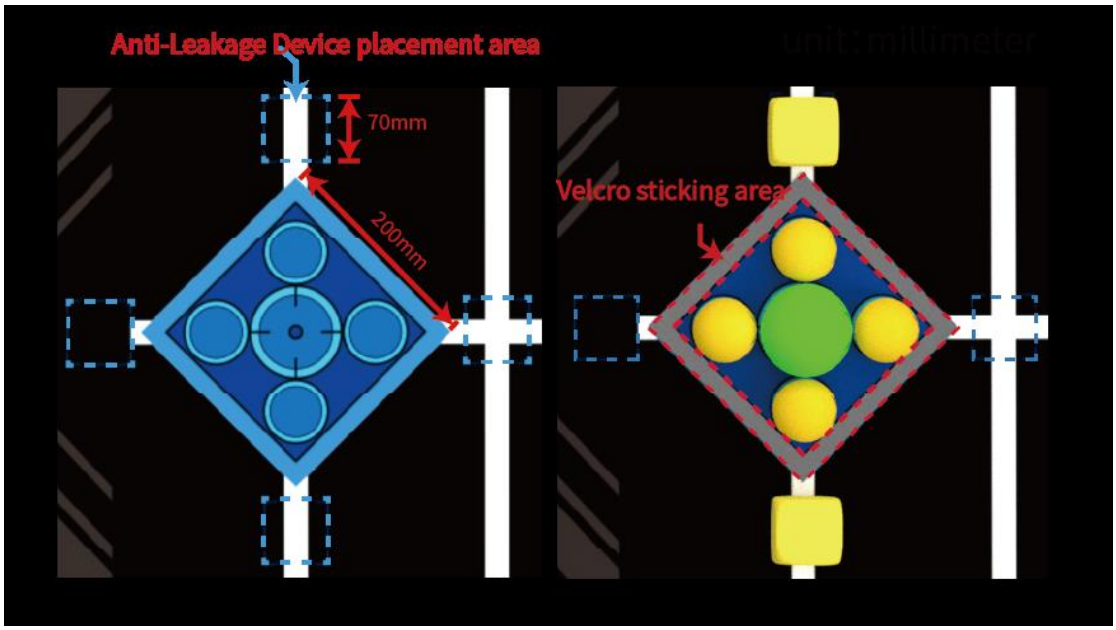



**Fig.4.2-9 Manufacturing Area**

## 4.3 Lists of Props Carbon Capture Container（Ball）

There are two types of ball, representing different sizes of carbon capture containers. The initial position is in the central area and manufacturing area. These balls are made of EVA, including sixteen small yellow balls and six large green balls. The diameter of small yellow ball and large green ball is 70mm and 100mm respectively.

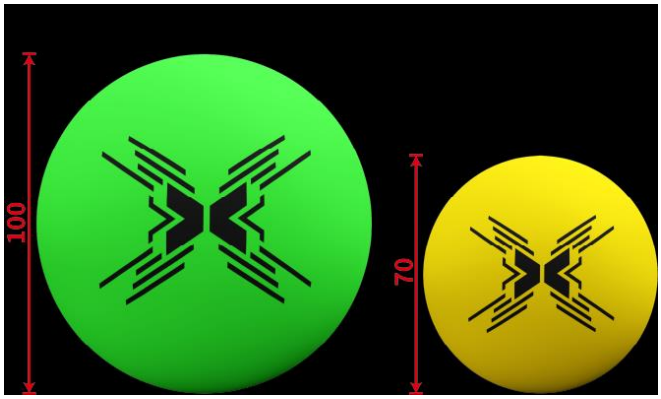



**Fig.4.3-1 Carbon Capture Container**

**Anti-Leakage Device (Cube)**

The yellow cube represents the anti-leakage device, with the side length of 70 mm. There are five EVA cubes in the arena, among which two cubes are in respective manufacturing area, one cubes in the central area.

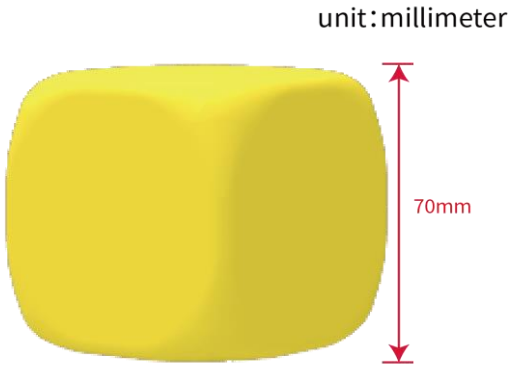



**Fig.4.3-2 Anti-Leakage Device (Cube)**

**Environmental Flag**

The size of the self-customed flag is no less than 80mm × 60mm. The diameter of the flagpole is smaller than the inner diameter of the cylinder, with the length no less than 100mm. Please refer to "5.2 Specifications for Environmental Flag" for the details.

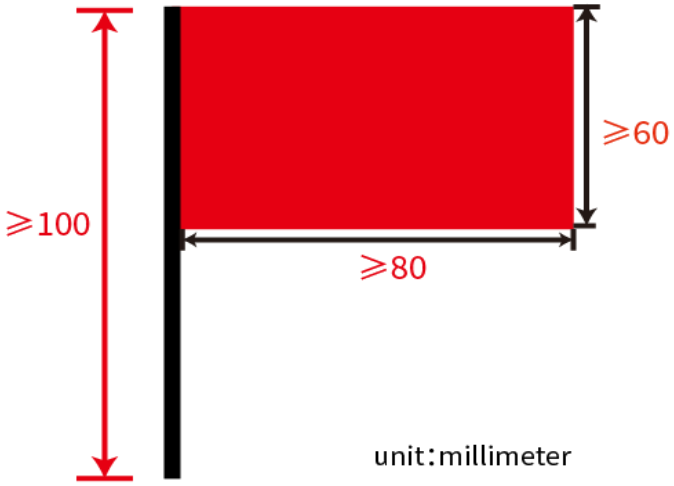



**Fig.4.3-3 Environmental Flag**

* Note: All areas and props have certain tolerances. If there are any objection to the size of the props or other problems, the final decision is on referee.

## 4.4 Tasks Introduction and Scoring State Judgement

The competition lasts for 4 minutes, including automatic stage (30 seconds) and manual stage (210 seconds). Task details of each stage are shown as follows. At the beginning and the end of each stage, the referee will remind the contestants by counting down. Please refer to **"4.6 Single Match Flow"** for the specifications.

| Stage and Time | Tasks | Task Details |
|---|---|---|
| Automatic Stage （30 seconds） | Installing Anti-Leakage Device | Running automatic program to make the cube in manufacturing area enter respective device area; |
| | Transferring Carbon Capture Container | Running automatic program to make the ball in manufacturing area enter opponent's goal area; |
| Manual Stage (210 seconds） | Installing Anti-Leakage Device | Controlling the robot to make the cube in individual camp or central area completely enter respective device area; |
| | Transferring Carbon Capture Container | Controlling the robot to make the ball in individual camp or central area enter opponent's goal area; |
| | Inserting Environmental Flag | Inserting environmental flag into respective Max Cylinder； |

**Fig.4.4 Competition Stage and Task Introduction**

### 4.4.1 Task Name: Installing Anti-Leakage Device

**Task Description:**

This task can be finished in automatic stage and manual stage.

In automatic stage, robots are required to run automatic program to make the cube in manufacturing area enter respective device area.

In manual stage, the contestants control the robot to make the cube in individual camp or central area completely enter respective device area.

**Scoring State Judgement:**

At the end of the competition, it can be scored if the cube is completely in the device area, and contactless with the robot, which refers to the vertical projection of the cube is completely located in the device area. Forty points for successfully moving a cube into the device area.

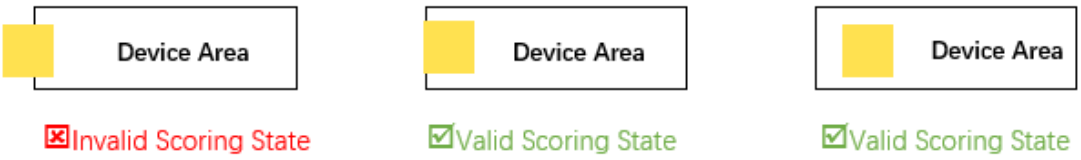



**Fig.4.4-1 Scoring State Judement of Cube**

### 4.4.2 Task Name: Transferring Carbon Capture Container

**Task Description:**

This task can be finished in automatic stage and manual stage.

In automatic stage, robots are required to run automatic program to push or toss the ball in manufacturing area into opponent's goal area.

In manual stage, contestants are required to control the robot to push or toss the ball in individual camp or central area into opponent's goal area.

**Scoring State Judgement:**

At the end of the competition, it can be scored if the ball enters the goal area and meets one of the following two conditions:

1. The ball has direct contact with the map of the goal area, but has no contact with the map outside the goal area;

2. The ball has indirect contact with the goal area, and the vertical projection of the ball is completely in the goal area;

Sixty points for one large green ball; Thirty points for one yellow small ball.

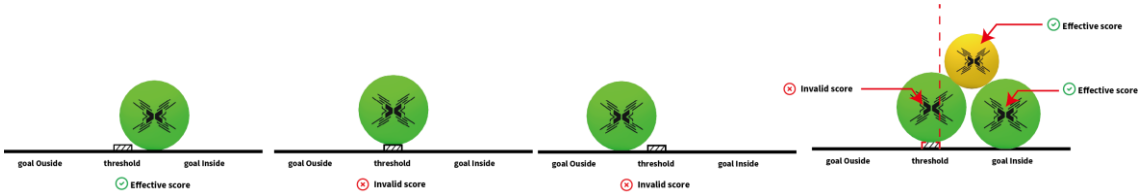



**Fig.4.4-2 Scoring State Judgement of Ball - Side View**

### 4.4.3 Task Name: Inserting Environmental Flag

**Task Description:**

This task can only be finished in manual stage;

In manual stage, contestants are allowed to apply for robot modification. They can control the robot to insert environmental flag into their respective Max Cylinder. Only one environmental flag can be available to place in the Max Cylinder.

**Scoring State Judgement:**

The following situation is regarded as successful insertion of environmental flag: the flagpole must be in the Max Cylinder, while the flag surface and flagpole need to be contactless with the ground and robots. The flag is not allowed to lean on the other props except for the Cylinder and Max. Fifty points for one environmental flag.

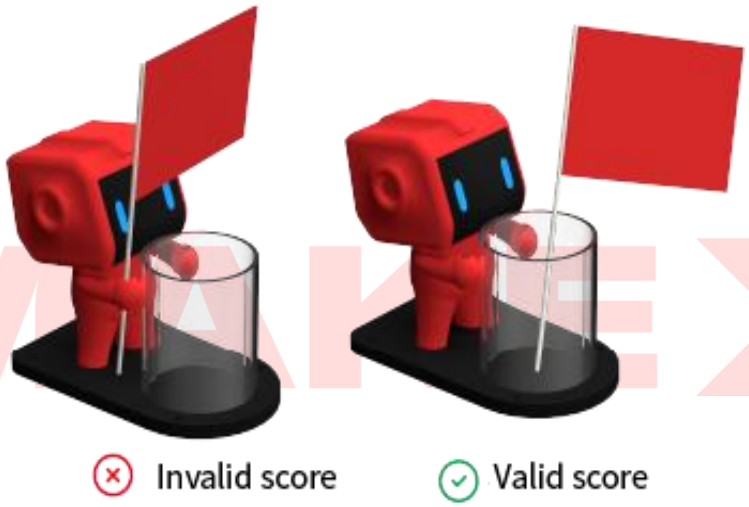



**Fig.4.4-3 Scoring State Judgement of Environmental Flag**

**Boundary State Judgement**

During the match, if there is any uncertainty about the position of the robot (or props) and designated boundary, the following state judgement can be explained:

## 4.5 Scoring Explanation

The final score of the competition is determined by the final static state of the scoring prop after the competition. Competition tasks, scoring props and its corresponding points are as follows. After the competition, the referee calculates the sum of scores of each task, and the alliance with the highest score will be the winner.

Alliance point of single match= cube point + large ball point + small ball point+ environmental flag point - penalty points

| Task | Scoring Props | Point of Single Prop | Maximum Task Point |
|---|---|---|---|
| Installing Anti-Leakage Device | Cube | 40 Points | 120 Points |
| Transferring Carbon Capture Container | Large Ball Small ball | 60 Points 30 Points | 360 Points 480 Points |
| Inserting Environmental Flag | Environmental Flag | 50 Points | 100 Points |

**Fig.4.5 Task and Corresponding Points**

## 4.6 Single Match Flow

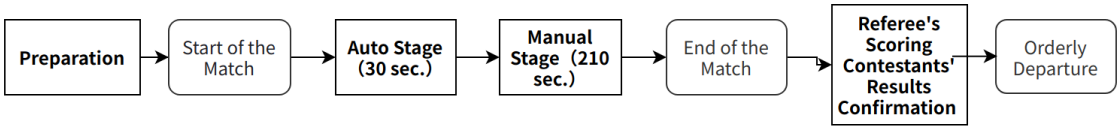



**Fig.4.6 Single Match Flow Chart**

**Preparation**

Before the single match, contestants should arrive to the competition area ahead of schedule, and make preparations under the guidance of referee.

Power on the robot and place it in the starting area, with blue tooth controller powering on and placing outside the arena.

One representative will be appointed by their team to draw a mission card and then place the cube accordingly;

Check the standard of camp and props placement.

**Automatic Stage**

The automatic stage begins after referee's five-second counting down.

1. Contestants are not allowed to touch the robot after running automatic program.
2. Before the end of automatic stage, robots are required to run the automatic program and remain stationary. Besides, robots do not need to return to the starting area.
3. It is not allowed for robots to rob or directly touch the props in the central area, they are only allowed to use respective props to complete the task. Please refer to "**6.2 Competition Rules-Operation Rules**" for the specifications.

The automatic stage ends after referee's five-second counting down.

**Manual Stage**

The manual stage begins after referee's five-second counting down.

1. Contestants control the robot with blue-tooth controller;
2. Contestants can apply for an opportunity to modify the robot, thereby placing the flag on the robot. During the modification, the competition will not pause. Please refer to **"6.3 Modification Rules"** for the specifications.
3. The referee will remind the contestants when there is one minute left for competition.

The manual stage ends after referee's five-second counting down. After manual stage, contestants must put down the blue-tooth controller to stop robot controlling.

**Referee's Scoring and Contestant's Results Confirmation**

The referee will count the scores after the competition. If there is no objection to the competition, the captains of both alliances must confirm the match's result. If there is any doubt about the result, the captain of the alliance may appeal to the referee without signing the score sheet.

After results confirmation, contestants shall actively assist the referee to restore the props, and leave the competition area with their robots and blue-tooth controller in an orderly manner.

# 5. Technical Specifications

## 5.1 Specifications for Robot Construction

The specifications for robot construction are designed to create a fair competition rule that ensure the participation safety. The committee encourages teams to conduct hardware construction and software programming on the premise of observing the specifications. During the competition, it is a must for robots to abide by the specifications. Any robot that violates the specifications will be required to be modified. Those who commit serious offense will be punished for cancelling the results or disqualification.

**T01.** Each team can participate in the match with one robot. It is not allowed for one robot to participate in the match, while the other to conduct construction and modification outside the arena.

**T02.** Except for mainboard, chassis wheels and tracks that make the robot move on the flat are non-replaceable, contestants can replace other parts due to parts malfunction or competition tasks.

**T03.** During the competition, the maximum extension size of robot shall not exceed 320mm*320mm*360mm (length * width * height). The maximum extension size refers to the size that the robot extends its mechanic limit during operation.

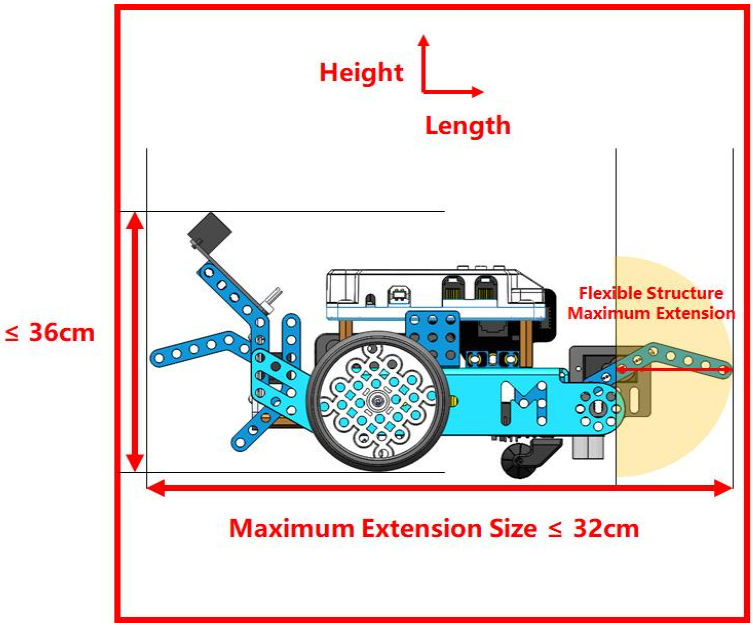



**Fig 5.1-1 Maximum Extension Size -Side View**

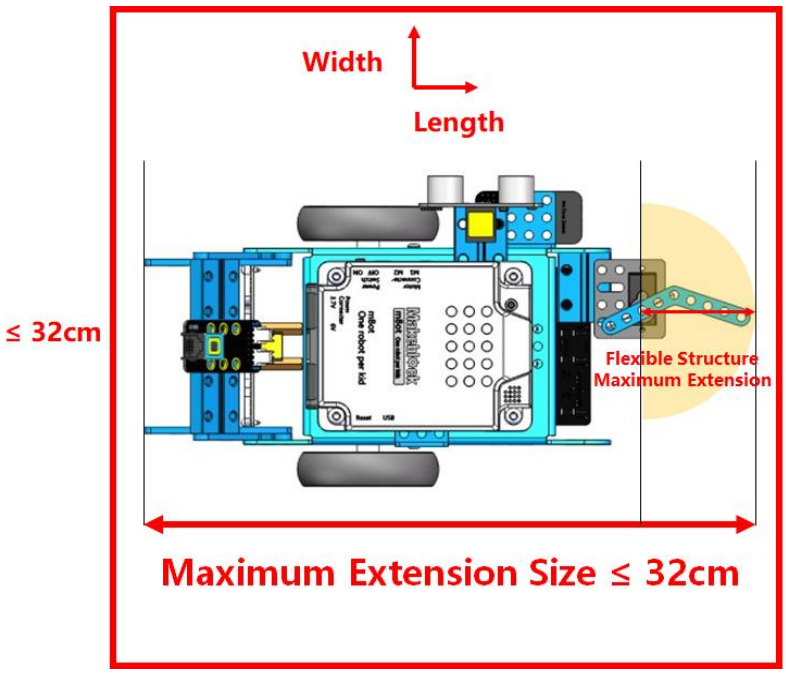



**Fig 5.1-2 Maximum Extension Size -Top View**

**T04.** During the competition, the maximum net weight of the robot shall not exceed 4 kg, including the weight of battery and excluding the weight of environmental flag.

**T05.** The equipment with high performance that infringes the competition fairness is prohibited, which must be operated with following performance indicators:

| Equipment | Component | Specification | Note |
|---|---|---|---|
| **Motor& Servo** | High Speed TT Motor | Rated Voltage: DC 6V<br>No-load speed :312RPM±10%<br>Gear Ratio: 1:48 | No more than 4 motors are installed on the robot<br>No more than 4 servos are installed on the robot<br>It is forbidden to change the mechanical structure and electrical layout of any motor or servo. |
| | Encoder Motor | 180 Photoelectric Encoder Motor<br>Driving Voltage： DC 5-7.4V<br>Speed Range： 5v 1~207RPM 7.4V0~350RPM±5%<br>Rotation Accuracy： ≤5°<br>Reduction Ratio： 39:43 | |
| | Servo | MECDS-150 Servo | |

| | | | |
|---|---|---|---|
| | | Working Voltage： DC 6.0V<br>Torque Peak： 16.5kg.cm<br>MS-1.5A Servo<br>Working Voltage： 4.8-6V DC<br>Torque： 1.31-.7kg.cm | |

**T06.** In order to prevent the team from using some high-performance electronic devices to damage the fairness of the competition, the main control electronic devices used by the team should meet and not exceed the following performance indicators:

*

| System | Module | Specification | Note |
|---|---|---|---|
| **Power System** | Build-in Battery | 18650 Lithium Battery：<br>3.7V 2500mAh | One build-in battery and one external battery are allowed, which are required to securely fastened inside the robot |
| | External Battery | 18650 Battery Pack<br>Battery Capacity： 2500Ah-8000Ah<br>Discharge Rate： 3-5c |  <br>Fig. External Battery Pack |
| **Controlling System** | Mainboard | Processor： Highly Integrated ESP32-WROVER-B<br>Dominant Frequency： 240MHz<br>Working Voltage： 6V ~ 13V（The minimum input voltage of motor is required to meet the requirement of motor's working voltage. ）<br>Communication Ports and Protocols： Serial Port /mBuild | Only one mainboard is allowed |

| | | | |
|---|---|---|---|
| | | Protocol | |
| | Extension Board | Micro Processor： GD32F403<br>Input Voltage/Current： 5V 2000mA（Rapid Charging）5V 500mA（Simultaneous using and Charging）<br>Communication Mode：<br>Serial Communication：Mainboard to Extension Board<br>Digital Signal： Digital Servo Interface<br>PWM： DC Motor Interface | |
| **Sensor System** | | Vision Sensor<br>Viewing Angle： 65.0 degrees<br>Effective Focal Length： 4.65±5% mm<br>Identification Speed： 60 frames/seconds<br>Identification Distance： 0.25-1.2m is the best range<br>Method of Power Supply： 3.7V Lithium Battery or 5V build Power Module<br>Power Consumption Range ： 0.9-1.3W<br>Ultrasonic Sensor<br>Working Voltage： DC 5V<br>Distance Range： 5-300cm<br>Tolerance of Distance： ±5%<br>Line Finder Sensor<br>Working Voltage： DC 5V<br>Detected Height： 5mm-15mm | Type and quantity are not limited<br>It is forbidden for robots to use any sensors that will interfere with the perception ability of other robots |
| **Wireless Control System** | Bluetooth Controller | Bluetooth Version: Support 4.0+<br>Distance of Remission： 20m<br>Working Current： ≤25mA | During the competition, one Bluetooth controller is available for one team. |

| | | | |
|---|---|---|---|
| | | Transmit Power：4dBm<br>Transmit Data：Data packets within 100ms can be acquired by Bluetooth devices (low latency)<br>Battery：Two No.5 AA Dry Batteries<br>Supported Platform：macOS / Windows | |
| | Bluetooth Module | Bluetooth Version：BT4.0<br>Band Range：2402~2480MHz<br>Antenna Gain：1.5dBi<br>Energy Consumption Grade：≤4dBm<br>Working Current：15mA | It is forbidden to use any form of wireless control device to communicate with robots other than the official blue-tooth controller, including but not limited to any artificially triggered sensors |

**T07.** If the robot uses a laser sight, the power of the laser sight must be less than or equal to 5mW (grade 3 A /R below). Each robot is allowed to install no more than one laser sight.

**T08. Teams are not allowed to build robots using multi-dOF commercial products:**

- Including but not limited to multi-dOF manipulator, manipulator, etc.
- Metal and plastic structural parts are not included.

**T09.** The following robot's parts that may cause danger are forbidden:

- Sharp angle;
- Oil pressure parts or hydraulic parts;
- Switches or contacts containing mercury;
- Parts that will conduct electrical current from robots to arena;
- Parts that tend to develop connections with other robots, such as hook-shaped parts and other parts;
- Other dangerous parts as determined by the judges.

**T10. The following materials that may cause danger are forbidden:**

- Flammable and explosive gases;
- Materials containing liquids or gelatinous substances (except for glues and lubricants used in prescribed and small quantities);

- Materials that may cause arena contamination, such as sand, ink, etc.;
- Materials made from animal tissue;
- Materials that may cause danger as determined by other judges.

## 5.2 Specifications for Environmental Flag

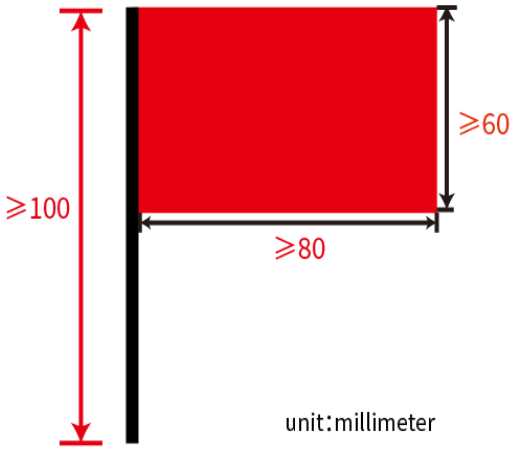



**Fig 5.2 Environmental Flag**

- Flag can be carried to the competition arena after robot inspection and pre-match inspection.
- At most one flag for per team.
- The Committee encourages teams to draw personalized patterns or words on the flag, which calls for positive content reflecting competition theme and spirit, without showing words or pictures related to MakeX Robotics Competition Committee.

# 6. Competition Rules

## 6.1 Penalty

**Verbal Warning**

**E01.** The referee gives the team a verbal warning of the first violation and asks them to stop any violation and obey the referee's instructions. In the meantime, no points will be deducted and the competition will not pause.

Violation

**E02.** The referee issues a violation to the team, and immediately deducts 20 points. In the meantime, the competition will not pause.

**Yellow card**

**E03.** If alliance members' behavior seriously affects the competition fairness or violates the safety rules, the alliance will receive a yellow card with 60 points deductions.

Two accumulated Yellow Cards will be upgraded to a Red Card, which will be cleared after qualification round.

If a team receives a yellow card, 60 points will be deducted from its alliance.

During the qualification round, yellow cards are accumulated by teams. While in the elimination round, yellow cards are accumulated by alliances.

**Red Card**

**E04.** If alliance members' behavior seriously affects the competition fairness or violates the safety rules, the alliance will receive 60 points deductions, and its robot will be suspended. If a team receives a red card in automatic stage, its robot must be taken out from arena after the end of automatic stage.

Penalty of Red Card:

Qualification Round: If a team of alliance receives a red card, the alliance will receive 120 points deduction and their robot will be suspended, but the match will continue as usual. If two teams of alliance receive a red card, the alliance will be disqualified. (The winner will receive extra 10 points higher than the final score of the loser)

Elimination Round: If the alliance receives a red card, the alliance will be disqualified in the match. (The winner will receive extra 10 points higher than the final score of the

loser)

**Suspension**

**E05.** The referee issues a suspension to ask the robot to stop its action. Besides, the referee is entitled to whether to remove the suspended robot out of arena based on specific condition.

The contestants shall ask the referee to suspend the robot while encountering robot malfunction and uncontrollability.

**Disqualification**

**E06.** If the team receives a disqualification by the referee, its robot will be immediately suspended, and the team will lose the chance to participate in this match and next match. If two teams from the same alliance are disqualified, the alliance will be disqualified with zero point, while another alliance will be the winner with current score as their final score.

## 6.2 Operation Rules

**Dangerous Structure**

**R01.** The measure of safety protection should be taken if robot's structure may cause damage to humans, such as sharp angles.

- The contestants must modify the robot after receiving verbal warning, otherwise the robot will be suspended.

**Destructing or Contaminating Arena**

**R02.** Robots are not allowed to maliciously "climb" or "collide" the boundary of the arena and the central partition.

- The robot that violates the rules will be suspended. If the robot continues to be a participant, contestant should modify it to accept re-inspection. A second violation will be disqualified.

**R03.** If arena contamination caused by the robot, the robot will be regarded as in an unsafe state. Robots are not allowed to use double-sided tape or glue to fix arena elements during competition.

- The robot that violates the rules will be suspended. If the robot continues to be a participant, contestant should modify it to accept re-inspection. A second violation will be disqualified.

**Destructing Other Robots**

**R04.** Robots are not allowed to collide with other robots during competition.

- The robot that violates the rules will be suspended. If the robot continues to be a participant, contestant should modify it to accept re-inspection. A second violation will be disqualified.

**Robots Out of Boundary**

**R05.** Any parts of robot are not allowed to go beyond the arena boundary or enter opponents' camp. The robot that goes beyond the boundary must return to its own area within three seconds and the referee will give a countdown reminder.

- The team who couldn't return to its own camp on time will be given a violation, and those who commit multiple offenses will be disqualified.

Using Banned Materials

**R06.** The following hazardous materials or dangerous structures embedded in robot are forbidden, such as:

- Flammable gases, fire or smoke generating equipment, hydraulic oil or hydraulic parts, switches or contacts containing liquid mercury (mercury);
- Hazardous Substances (e.g., Lead);
- Materials that may cause arena contamination, such as sand and other objects that may be scattered during competition;
- Materials that develop connections with other robots;
- Materials with sharp edges that may cause injury.
- Materials made from animal tissue (for health and legal consideration).
- Materials containing liquids or gelatinous substances (except for glues and lubricants).
- Parts that can conduct electrical current from robots to any other parts in arena.
- The robot that violates the rules will be suspended. If the robot continues to be a participant, contestant should modify it to accept re-inspection. A second violation will be disqualified.

**Other Unsafe Factors**

**R07.** In addition to R06, referees are entitled to decide whether the robot is safe or not.

The robot that violates the rules will be suspended. The robot needs to be modified

and inspected before it can be back to the match. A second violation will be disqualified.

**Team Role**

**R08.** One operator and one observer for each team. Each alliance includes two operators and two observers, one of them is selected to be the captain of the alliance.

- Operators are responsible for controlling the robot in each match.
- The operator and the observer can freely switch their roles during the match.

**Contestants' Requirements**

**R09.** Contestants should tie up their long hair during competition preparation, robot debugging and on-field match. Toe-baring shoes are forbidden.

**Contestants' Standing Position**

**R10.** Contestants shall stand in certain range as shown in the following figure（the size of the operating area is subject to actual conditions).

- The team will receive a verbal warning, and those who commit a second offense will receive a violation.

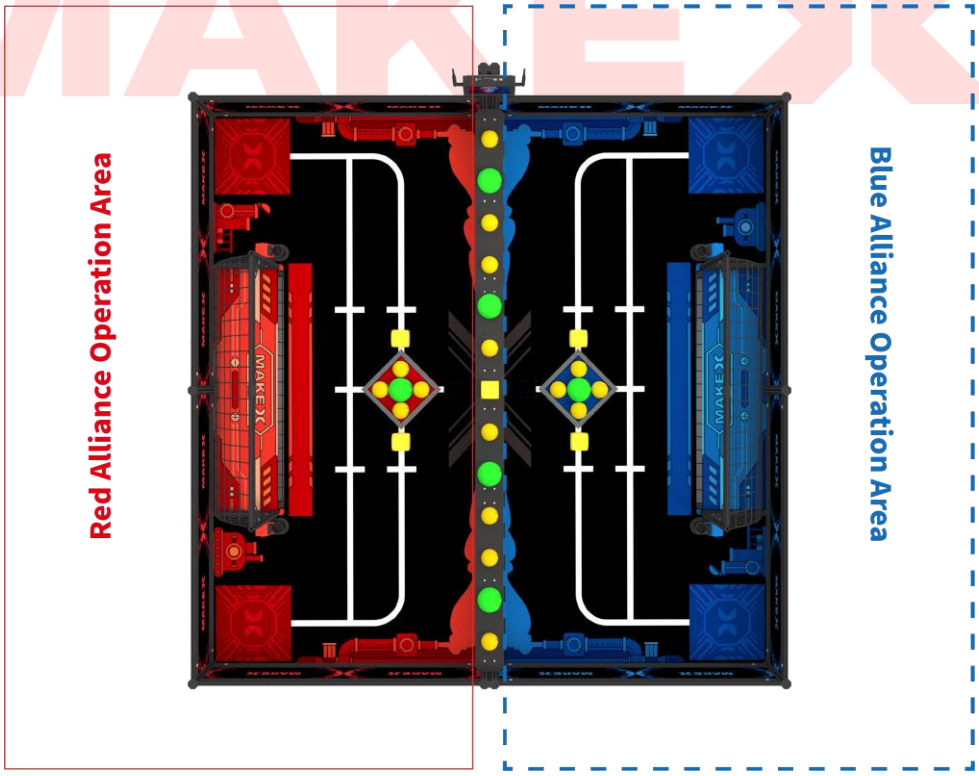



**Fig. 6.2 Contestant's Standing Position**

**Substitution of On-Arena Players**

**R11.** It is not allowed for a third person as a substitution of on-arena players.

- The team will receive a red card.

**Rules of Elimination Round**

**R12.** After the end of each elimination round, each alliance has 5 minutes for debugging.

- The team will receive a verbal warning, and those who commit a second offense will receive a violation.

**Operating the Robot in Advance**

**R13.** Robots are not allowed to operate until referee's announcement to start the competition.

- The team will receive a violation, and those who commit a second offense will receive a yellow card.

**Delay the end of the Competition**

**R14.** After the end of automatic stage and manual stage, operator should stop controlling the robot or stop robot's operation program (except for the motion caused by inertia).

- The team will receive a violation. An invalid point will be given to those offenders who enjoy the advantage as a result of delayed end of competition. Besides, the offender is required to reset the original state of the arena.

**Using Bluetooth Controller in Automatic Stage**

**R15.** Blue-tooth controller should be connected with robot before the match, and the former one needs to be switched on. It is not allowed to use blue-tooth controller in automatic stage, otherwise the referee has the right to give the team a disqualification.

- The team will receive a red card.

**Bringing Banned Electronic Device**

**R16.** It is not allowed for contestants to bring electronic communication devices (mobile phone, transceiver, computer, wireless network devices and etc.) into the competition area except for prescribed devices.

- The team will receive a violation for the first time, a yellow card for a second time. Those who commit serious offense will be disqualified.

**Blue-tooth Pairing in Advance**

**R17.** The Blue-tooth controller should be paired with the robot in advance. In

automatic stage, the blue-tooth controller should be placed outside the arena; After the end of automatic stage, contestants can pick up the blue-tooth controller; After the end of manual stage, contestants are required to stop controlling the robot.

- The team will receive a violation, and those who will receive a red card if they use blue-tooth controller in automatic stage. Contestants with serious offense will be disqualified.

**Operating Banned Robot**

**R18.** The operator is not allowed to control the robot after the robot is suspended.

- The team will receive a violation, and those who commit serious offense will be given a yellow card until they are disqualified.

**Robot's Left-Behind Components**

**R19.** During the competition, the following situation is forbidden, such as detachment of robot and its component and left-behind mechanical devices (detachment refers to detachment of robot ontology and its components). This rule is exception to the shedding caused by collision of opponent's robot or direct contact with other robots.

- The team will receive a violation in case it affects the progress of the competition. A second offense will be given a yellow card.

**Robot Inconformity**

**R20.** Robots must comply with the size, weight and other parameters specifications during the match. Except that the robot size exceeds the requirements caused by opponent's toss of arena elements.

- The team will receive a red card.

**Toss in Violation**

**R21.** Robots are not allowed to toss arena elements to opponent's camp.

- The team will receive a yellow card. The arena elements need to be restored if it causes any changes of arena elements in the opponent's side.

**Difficult Detachment of Arena Elements and Robots**

**R22.** The robot shall be designed to easily remove competition elements from any inherent mechanical structure that is available to grab. Even if the power supply is suspended or turned off, robots can be taken out of arena on the premise of arena intactness.

- Contestants are required to modify the robot, and those who commit a second offense will be disqualified.

**Completely in Opponent's Camp**

**R23.** During the competition, the vertical projection surface of the robot shall not partially or completely enter the vertical projection surface of the opponent's area in any form

- The team will receive a yellow card.

Restricting the Movement of Opponent's Robot

**R24.** Robots are not allowed to prevent the robot of other alliance from moving in all directions or touching arena elements.

- The team will receive a violation, and those who commit serious offense will receive a yellow card.

**R25.** As the robot partially enters opponent's camp, which leads to the other side's alliance robot being stopped or restricted, the competition will be suspended based on actual situation, and robots of both alliances must be detached as soon as possible.

- The team will receive a violation, and those who commit serious offense will receive a yellow card.

**Contact in Violation**

**R26.** In automatic stage, robots must finish the task with individual props rather than grabbing or directly touching the props in central area.

- Those who maliciously toss the ball in central area to individual camp will receive a yellow card. A red card will be given for those who commit a second offense. This robot will be suspended, and those who commit multiple offense will be disqualified. This rule is exception to the initial position of prop being changed due to the stuck of robot or the toss of individual ball.

**R27.** During the competition, contestants cannot touch any arena elements or robots (except modified robots), and their bodies cannot extend into competition area to affect opponent's score.

- The team will receive a violation, and a yellow card will be given If it affects the score or the progress of the match. Those who commit serious offense will receive a yellow card.

**Finishing Automatic Program**

**R28.** Robots shall stop automatic program and remain stationary before the end of automatic stage.

- The team will receive a violation, except for robot's constant movement caused by

malfunction. A yellow card will be given to those offenders who enjoy the advantage as a result of robot movement. Those who commit multiple offenses will be disqualified.

**Entering Individual Goal Area**

**R29.** No part of the robot is allowed to enter the goal area during the match.

- First infractions will be violation, second and more infractions will be judged each time, malicious infractions will be disqualified.
- If the robot enters the goal and causes the opponent's ball scoring props to change from valid scoring state to invalid scoring state, the team will be given a red card and the robot will be disabled.
- If the robot enters the goal and remains stationary, affecting the opponent's score, the team will be given a red card and the robot will be disabled and removed from the field.

**Removing Props in Violation**

**R30.** Robots shall not remove any arena props out of competition area.

- The team will receive a violation, and those who commit multiple offenses will be disqualified.

**Maliciously Affecting Opponent's Points**

**R31.** During the competition, both parties shall not remove scoring prop in individual goal area.

- A yellow card will be given for first violation, and a red card for a second violation.

**Mentoring in Violation**

**R32.** No person (including but not limited to the parents or mentors of the players) other than the team members shall enter the competition area by any means, and no instruction shall be given in or outside the competition area in any form. In case of any violation, the referee has the right to disqualify the team on the spot.

- The team will receive a verbal warning, and those who will receive a violation if they refuse to correct their mistake. Those who will be disqualified based on actual situation.

**Off-Arena Contact**

**R33.** During the competition, contestants are not allowed to have any direct contact with off-arena person and audiences, including but not limited to the delivery of the parts and blue-tooth controller.

A second violation will result in a yellow card, repeat violation will result in disqualification

## 6.3 Modification Rules

**In terms of those behavior that seriously violate the medication rules, the committee referee is entitled to give the team a disqualification.**

**Times of Modification and Rebooting**

**R34.** Each team will have only one chance for modification and rebooting in manual stage. In modification stage, the team is allowed to insert their team flag in Max Cylinder, and to conduct robot's repairing.

- The team will receive a violation, and those who commit a second offense will be given a yellow card.

**Application for Modification and Rebooting**

**R35.** Contestants should submit application for modification and rebooting. These two operations can only be carried out with the consent of referee.

- The team who conducts robot's modification without submitting application to referee will receive a violation.

**Robot's Failure to Entering the Starting Area**

**R36.** At the end of manual stage, the robot needs to be taken out from the starting area for modification. It will not be allowed to conduct any operation during modification stage if the robot fails to enter the starting area.

- Those who modify the robot that fails to enter the starting area will be given a red card.

**Modification in Undesignated Area**

**R37.** The team can only modify the robot after the vertical projection plane of the robot is completely outside the arena. Modification cannot be conducted when the robot is lifted just above the arena.

- The team will receive a violation.

**Changing the State of Arena Elements**

**R38.** Contestants are not allowed to change the state of arena elements on purpose or touch the scoring props (such as robots but except to small yellow cubes) when they

are taking out the robot.

- The team will receive a violation. An invalid point will be given to those offenders who enjoy the advantage as a result of changing the state of arena elements. Besides, the offender is required to reset the original state of the arena.

**Failure to Enter the Starting Area After Modification Stage**

**R39.** Robots should be placed in the starting area (partially in or completely in) before modification stage.

- Robots that violate this rule will be suspended.

**Modified Robots Are Not in Conformity with Inspection State**

**R40.** The modified robot shall conform to the modified state at the time of inspection.

- The team will receive a red card.

# 7. Appeal and Arbitration

## 7.1 Results Confirmation

**Results Confirmation**

When a single match ends, captains of both teams need to confirm the results with the referees and then sign the score sheet. The committee will not accept any appeal of the game after the captains have signed and confirmed the result.

**Dispute Settlement**

If the participants on still disagree with the result of the competition and do not agree with the explanation of the referee, they can refuse to sign the result, but the participant must write down the situation in the remarks column of the result confirmation form before leaving.

## 7.2 Appeal Procedure and Valid Appeal Period

**Appeal Procedure**

Appeals should be lodged within the "valid appeal period" by the prescribed procedure and follow the civil participation spirit. The captain of the team needs to fill in the Appeal Form, then cooperates with the Arbitration Commission to investigate the actual situation. Both sides will be required to arrive at the designated place if the Arbitration Commission requires. During the investigation, the captain of the appeal team must be present, and only captains or contestants of both teams can be present. The Arbitration Commission has the right to communicate with the appealing party alone, avoiding the mentor, the parents of the contestants, their relatives, or friends. The appellant should express facts clearly and objectively, not being over-emotionally.

**Valid Appeal Period**

Normally, the appeal should be lodged within 30 minutes after the end of every single match. The appellant and the respondent must be present before the time appointed by the referee.

**Appeal Response**

Normally, the Arbitration Commission responds to the appeal after the end of the competition on the same day or before the start of the competition on the next day.

## 7.3 Invalid Appeal

**Overdue Appeal**

Appeals that are not lodged within the "valid appeal period" will be considered invalid and inadmissible. If the appellant fails to be present on time or leaves without any reason during the investigation, the appeal will be considered invalid. If the respondent fails to be present on time, the Arbitration Commission will directly determine the arbitration result and render it as a final result.

**Appellants out of Stipulation**

The appellants must be the participating contestant and the appeal of other person is inadmissible. The Arbitration Committee will caution the offending team if parents, mentors, or other persons out of the stipulation participate in the arbitration process without the permission of the Arbitration Committee.

*A disqualification will be given for multiple invalid warnings.*

**Vague Appeal's Requests**

If the Arbitration Commission is unable to understand the appeal or conduct the normal investigation due to emotion factor of the appealing party, the team will receive a verbal warning.

*A disqualification will be given for multiple invalid warnings.*

**Uncivil Appeal**

Neither side shall make uncivil behavior nor offensive action and remarks.

*A disqualification will be given for multiple invalid warnings.*

## 7.4 Arbitration Procedure

**Arbitration Procedure**

The Arbitration Commission consists of the chief referee, the arbitration consultant, and the competition technical director. The Arbitration Commission is responsible for accepting the appeals and conducting arbitration investigations, to ensure the smooth progress of the competition and the fairness and justice of the competition results. The playback videos and photographs of any competition may be inaccurate due to the shooting angle, which is only used as reference but not arbitration evidence.

**Arbitration Results**

The arbitration results can be divided into “maintaining the original result of the match” or “re-match”, and the two teams shall not appeal again. If the arbitration result is a "re-match", the two teams shall have a re-match according to the time and arena stipulated in the Appeal Form. If either team fails to reach the arena within 5 minutes after the beginning of the match, the team shall be deemed to quit the match.

**Additional Remarks**

The Arbitration Commission determines the final arbitration result, and neither side shall dispute the result of the appeal anymore.

# 8. Statement

MakeX Robotics Competition Committee reserves the final interpretation of *2022 Season MakeX Explorer Eco-Pioneer Rules Guide.*

## 8.1 Rules Explanation

In order to ensure a fair competition and high-quality competition experience, MakeX Robotics Competition Committee has the right to update and complement this Rules Guide regularly, issue and implement the latest version before the competition.

During the competition, all matters not stated in the Rules Guide shall be decided by the referee team.

This Rules Guide is the basis for refereeing, and the referee team has the right of adjudication during the competition.

## 8.2 Disclaimer

All contestants in MakeX Robotics Competition shall fully understand that safety is the most important issue for the sustainable development of the MakeX Robotics Competition. To protect the rights and interests of all contestants and organizers, according to relevant laws and regulations, all mentors and contestants registered for the 2022 MakeX Explorer Eco-Pioneer, shall acknowledge and abide by the following safety provisions:

- Contestants shall take adequate safety precautions when constructing the robots, and all parts used for constructing the robots shall be purchased from legal manufacturers.
- Contestants shall ensure that the structural design of the robots takes into account the convenience of the inspection and actively cooperate with the host of the competition.
- When modifying and using the parts with potential safety hazards for the robots, it must conform to the national laws, regulations, and quality & safety standards. Those operations shall be manufactured and operated by persons with relevant professional qualifications.
- During the competition, the teams shall ensure that all the actions such as

construction, testing, and preparation will not do harm to their team and other teams, referees, staff, audiences, equipment, and arenas.

- In the process of construction and competition, if any action that may violate the national laws, regulations, or standards occurs, all consequences will be borne by the contestants themselves.

The competition kits and parts sold and provided by the supporter, Shenzhen Makeblock Co., Ltd., shall be used by the instructions. Shenzhen Makeblock Co., Ltd. and MakeX Robotics Competition Committee will not be responsible for any injury or loss of property caused by improper use.

The official language for MakeX is Chinese. English or other language translations are prepared to facilitate the team's preparation process. All documents translated to English are for reference only.

## 8.3 Copyright Declaration

# Appendix 1. Awards and Annual Points

In 2022 season, the annual points rules of MakeX Explorer are consistent with MakeX Challenge. According to the scale of the competition and the number of teams, the competition will be classified into Points Race/Regional Competition, National Competition, Intercontinental Competition, and World Championship. In MakeX Robotics Competition, participating teams can obtain the points according to the number of wins, ties and losses in the match, and each team can voluntarily sign up for all kinds of Points Race throughout the season to accumulate the annual points. The accumulation of annual points is based on the Team Number.

In each competition, the annual points that teams can obtain are based on the winning points they get for every single match.

| Category | Rounds | Win | Tie | Loss |
|---|---|---|---|---|
| **Points Race Regional Competition** | Qualification | 5 | 2 | 1 |
| | Elimination (Best of 3) | 10 | / | 2 |
| **National Competition** | Qualification | 10 | 4 | 2 |
| | Elimination (Best of 3)) | 20 | / | 4 |
| **Intercontinental Competition** | Qualification | 15 | 6 | 3 |
| | Elimination (Best of 3)) | 30 | / | 6 |

Teams that have won the champion, runner-up, second runner-up and other awards can obtain additional annual points. For the details of award list, please refer to **2022 MakeX Awards Guide.**

| Category | Awards | Regional /Points Race | National | Intercontinental |
|---|---|---|---|---|
| **Explorer, Challenge & Premier** | Champion | 15 | 30 | 45 |
| | Runner-up | 10 | 20 | 30 |
| | Second runner-up | 5 | 10 | 15 |
| | Innovative Design Award | - | 5 | 10 |
| | Engineering Notebook Award | - | 5 | 10 |
| **Excellence Award** | Outstanding Mentor Award | - | - | - |
| | Promotion Ambassador Award | - | 5 | 10 |
| | Technology Sharing Award | - | 5 | 10 |
| | MakeX Spirit Award | - | - | 10 |

For example, team X20000 wins the champion in one Points Race, and all the results show as below.

| Qualification Round 1 | Qualification Round 2 | Qualification Round 3 | Qualification Round 4 | Annual Points from Qualification=13 |
|---|---|---|---|---|
| Win (5) | Loss (1) | Tie (2) | Win (5) | |
| Top Eight Battle | Semi-final | Final | | Annual Points from Elimination=30 |
| Win (10) | Win (10) | Win (10) | | |

The total annual points that team X20000 obtains = 13+30+15 = 58.

# Appendix 2. Engineering Notebook Guideline

**2022 MakeX Robotics Competition**

**Engineering Notebook Guideline**

***Instruction:**

1. The value of engineering notebook: It helps the team establish files and record the whole learning process. Therefore, it is necessary to record engineering notebook during the entire preparation for the competition.
2. Engineering notebook submission: Teams can use online documents or handwriting. No matter which way to use, each team must submit a paper version onsite.

   Paper engineering notebook: As the Challenge & Premier programs require the assessment process, 1 copy of the paper version shall be submitted by each team to the judges onsite. If there is no assessment process (Starter & Explorer), each team will need to submit 1 copy of the paper version to the staff at the inspection area. Teams that cannot submit the original engineering notebook should prepare their own copies.
3. An engineering notebook will be required for the evaluation of all technical awards. Please refer to the Competition Guide for the evaluation criteria.

**Basic Requirements for Cover**

The team's name, team number, and competition program must appear on the cover of the engineering notebook.

Basic Requirements for Contents

**1. Clear content**

Contents shall be clear and convenient for judges to review.

**2. Process records （Required）**

Every improvement of the robots should be recorded from prototype design, construction, to the debugging. **Keep pictures of all manuscripts, design drawings, calculation processes, circuit diagrams, etc., and insert them into the engineering notebook in the form of pictures.**

1）Schedule of robot building progress

2）Design inspiration/sketch

3）Technical principle (it can be disassembled into different parts)

4）Production step by step (with clear pictures)

5）Problems encountered and solutions

Examples of problems:

What technical failures did you encounter? Why did you fail? How did you solve the problems finally?

What efforts have you made for the robots? What improvements have been achieved?

Does your project progress schedule go as planned? What accidents or delays have occurred? How to fix it?

Have there been any disputes among the team members and how to settle them in the end？

**3. Projects summary**

1）The structure and function of the project (with pictures and text enclosed)

2）The technical innovations of the project

3）Competition strategies for scoring and defence

**4. Team introduction**

1）A brief biography of each team member and their role on the team

2）Culture displaying (logo, team flag, slogan, posters, T-shirt, etc.)

3）Excellent achievements sharing (Stories)

**5. Feelings and other things you want to share (optional)**

1) Achievement in the competition (Technical)

2) Growth in the competition (Spiritual)

3) Suggestions for competition

# Appendix 3. MakeX Explorer Eco-Pioneer Robot Self-Check List

| MakeX Explorer Robot Self-Check List (Eco-Pioneer) | | | |
|---|---|---|---|
| Number, Size and Weight of Robots | | | |
| **SN** | **Items** | **Specific Requirements** | **State** |
| **1** | **Number** | Only one robot is allowed to participate in the competition. The replacement of robot is not allowed after inspection. | |
| **2** | **Size** | Maximum size refers to the maximum extended size of the robot moving to the limit state during operation. The maximum size of the robot during competition is required to be 320mm（length）x 320mm（width）x 360mm（height）。 | |
| **3** | **Weight** | The weight of the robot must not exceed 4 kg. (It refers to the maximum net weight including the weight of batteries and excluding the weight of environmental flag during the competition). | |
| **4** | **Environmental Flag** | The material of flag surface is not limited, and the flag size is no less than 80mm（length）x 60mm（width）. The diameter of the flagpole is smaller than the inner diameter of the cylinder, and its length is no less than 100mm. | |
| **Safety** | | | |
| **5** | **Safety Protection** | The robot's structure that may do harm to people is required to ensure safety protection in the process of robot loading, unloading and transporting. | |
| **6** | **Competition Area Destruction** | Competition area destruction is prohibited in the process of robot loading, unloading and transporting. | |
| **7** | **High-power Equipment** | High power equipment is not available during competition and preparation. | |
| **8** | **Energy Storage Equipment** | Please keep safe while using energy storage devices (spring). | |

| | | | |
|---|---|---|---|
| **9** | **Banned Material** | Robots are not allowed to use the flammable gases, pyrotechnic equipment, hydraulic components, mercury-containing components, exposed hazardous materials, unsafe counterweights, designs that may cause entanglement and competition delays, sharp edges and angles, materials containing liquids or gelatinous substances, and any part that the electric current on the robot may be conducted to the competition area. | |
| **10** | **Personal Safety** | Long hairs shall be tied up; contestants are prohibited from wearing toe-baring shoes to enter the competition area. | |
| **Robotic Equipment Manual** | | | |
| **11** | **Mainboard and Extension Board** | Processor: high ESP32-wrover-B<br>Frequency: 240 MHZ<br>Working voltage: 6V ~ 13V (if the motor is used, the lowest input voltage must meet the requirements of the motor working voltage)<br>Communication port and protocol: Serial port /mBuild protocol | quantity: 1 |
| **12** | **Sensor** | Field Angle of vision sensor: 65.0 degrees<br>Effective focal length: 4.65±5% mm<br>Recognition speed: 60 frames /s<br>Identification distance: 0.25-1.2m is the best range<br>Power supply: 3.7V lithium battery or 5V mBuild power module<br>Power consumption range: 0.9-1.3W<br>Ultrasonic sensor working voltage: DC 5V<br>Read value range: 5-300cm<br>Read value error: ±5%<br>Line sensor working voltage: DC 5V<br>Detection height: 5m-15mm | |
| **13** | **Motor and Servo** | 180 photoelectric coded motor, high-speed TT motor, MS-1.5A intelligent steering gear, MECDS-150 steering gear, and the total number shall not | |

| | | | |
|---|---|---|---|
| | | exceed 8 | |
| **14** | **Blue-tooth Controller** | Teams have to use designated controller, and it is only be used by the operator. | |
| **15** | **Self-Customized Parts** | Self-customized parts can be used: 3D printing pieces, corrugated fiberboard, wood, acrylics and rubber band. These all materials cannot be printed with manufacturer's logo. | |
| **16** | **Mechanical Parts** | The team is not allowed to use multi-dOF commercial products to build robots, including but not limited to multi-Dof mechanical arms and manipulators, excluding metal and plastic structural parts. | |
| **17** | **Power Supply** | 18650 lithium ion battery<br>Battery parameters: 3.7V 2500mAh<br>Output voltage/current: 5V 6A | |

# Appendix 4. MakeX Explorer Eco-Pioneer Penalties List

| Scope | Items | Generalization | Violation | Yellow card | Red card | Suspend | Disqualification |
|---|---|---|---|---|---|---|---|
| Safety Rules | Dangerous Structure | If it is found that robot's structure may cause damage to humans, contestant must modify it after receiving verbal warning. | | | | ✔ | ✔ |
| | Destruct Arena or Other Robots | It will be disqualified if have a second violation. | | | | ✔ | ✔ |
| | Contaminate Arena | Under the preconditions | | | | ✔ | ✔ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | without contaminating arena, the robots can use the glue, adhesive tape and lubricant; These materials will be suspended if be found, and a second violation will be disqualified. | | | | | |
| | Use Banned Materials | If it is found that contestant use banned materials, these materials will be suspended. A second violation will be disqualified. | | | | ✔ | ✔ |
| | Robots Out of Bounds | Any parts of robot are not allowed to go beyond the arena boundary. | | | | ✔ | ✔ |
| | Other Unsafe Factors | The referee has the right to suspend contestants' robot and ask them to operate modification if other unsafe factors to be found. A second | | | | ✔ | ✔ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | violation will be disqualified. | | | | | |
| | Dress Code | Long hairs shall be tied up. Contestants are prohibited from wearing toe-baring shoes into the competition arena. | | | | | ✔ |
| Operation Rules | Bring Electronic Communication Devices | A second violation will receive a yellow card. | ✔ | ✔ | | | ✔ |
| | Early start or delay the end of the competition | The corresponding score will be deducted. | ✔ | | | | |
| | Grab or contact props in central area in the automatic stage | To finish the task using individual pros in automatic stage. | | ✔ | ✔ | ✔ | ✔ |
| | Robot do not remain stationary after the end of automatic stage | It not includes robot's constant movement caused by malfunction. | ✔ | ✔ | | | |
| | Contact arena or robot | A yellow card will be given If it affects the score or the progress of the match. | ✔ | ✔ | | | |
| | The body is not allowed to extend into the arena to affect opponents' | A yellow card will be given If it affects the score or the progress of the | ✔ | ✔ | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | score. | match. | | | | | |
| | Do not move in designated area | The violators will be given a verbal warning, and second violation will be penalized for violation. | ✔ | | | | |
| | Robot goes beyond the arena boundary or enter opponent ‘s arena. | The robot that goes beyond the boundary must return to its own area within 3 seconds and the referee will give a countdown reminder. | ✔ | | | | |
| | Robots enter the goal area | The robot who’s some parts enter the goal area must get out of this area within 3 seconds. The referee will give a countdown reminder. | ✔ | ✔ | ✔ | ✔ | ✔ |
| | Illegal use of blue tooth controller | The controller should be placed outside the arena in automatic stage. | ✔ | | ✔ | | |
| | Any robot components are left in the arena | Those who commit serious offense will be given a violation, a | ✔ | ✔ | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | yellow card for second violation. | | | | | |
| | Operating prohibited robots | For the first time, violators will be penalized for violation. Those who commit serious offense will be given a yellow card or be disqualified. | ✔ | ✔ | ✔ | ✔ | ✔ |
| | Remove other arena elements outside the arena | The scoring behavior is not included. | ✔ | ✔ | ✔ | ✔ | ✔ |
| | Contact and exchange parts outside the arena | This behavior is prohibited during competition. | ✔ | ✔ | ✔ | ✔ | ✔ |
| | Misconduct | Misconduct is including but not limited to: repeated or blatant offense; Impolite behaviors to the operators, referees, staff, or contestants; Repeated or blatant offense of safety rules; A second violation will be disqualified. | ✔ | ✔ | ✔ | ✔ | ✔ |
| | Mentoring in Violation | A verbal warning will be given for the | ✔ | ✔ | ✔ | ✔ | ✔ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | first time. Repeated or blatant offense will be given a violation. Those who commit serious offense will be disqualified. | | | | | |
| Modification Rules | Modification without referee's authorization | The modification is allowed only with referee's consent. | ✔ | | | | |
| | Unauthorized modification without entering the starting area. | Entering the starting area is subject to the direct contact with the line of starting area. | ✔ | | | | |
| | Modification in the arena | Contestants have to modify outside the arena | ✔ | | | | |
| | Modification for several times | Each team has only one chance to modify the robot. | ✔ | ✔ | ✔ | ✔ | ✔ |
| | Incompatible the state of inspection after modification | If there are any major changes, contestants should declare to the referees for inspection after being put into the arena. | | | ✔ | ✔ | ✔ |

# Appendix 5. MakeX Explorer Eco-Pioneer Score Sheet

MAKEX ROBOTICS COMPETITION

**2022 MakeX Explorer Eco-Pioneer - Scoring Results**

**Competition Info: Qualification Round ☐ / Elimination Round ☐ ___ (Arena) No.___ (Session)**

| Registration | Match Points | | | Winner |
|---|---|---|---|---|
| Red Alliance | Red Alliance | | Blue Alliance | Red Alliance |
| Team 1 (No.) : | *(40 points each)* | Cube | *(40分/个)* | |
| Team 2 (No.) : | *(60 points each)* | Green Ball | *(60分/个)* | |
| Blue Alliance | *(30 points each)* | Yellow Ball | *(30分/个)* | Blue Alliance |
| Team 1 (No.) : | *(50 points each)* | Flag | *(50分/面)* | |
| Team 2 (No.) : | | Penalty | | |
| | | Total Points | | |

| Captain of Red Alliance: | Captain of Blue Alliance: | Remark |
|---|---|---|
| *(Please confirm the scoring results and sign here.)* | *(Please confirm the scoring results and sign here.)* | *(If there's any disagreement about the results, please write down the situation clearly and sign here.)* |
| Referee of Red Alliance: | Referee of Blue Alliance: | |
| *(Please confirm the scoring results and sign here.)* | *(Please confirm the scoring results and sign here.)* | |

# Appendix 6. Competition Resources

Competition resources include but are not limited to official resources provided by the committee, such as Competition Rules Guide, Equipment Instructions, Rules Videos, etc. The contestants are obliged to keep abreast of the update of competition resources before the competition, and any problems caused by the players' failure to keep abreast of the updates shall be borne by the players themselves. All official competition resources will be updated in MakeX Website www.makex.cc/en.

MakeX Robotics Competition Committee will revise and improve the Rules Guide with the progress of the competition and the new version will be announced on MakeX Official Website

www.makex.cc/en. The contestants and mentors can download the latest version in MakeX

Website Download https://www.makex.cc/information/download

MakeX Official Website: www.makex.cc/en

Any Feedback & Question Please Sent to: makex_overseas@makeblock.com

MAKEX

Edited By MakeX Robotics Competition Committee

# RULES GUIDE

## MAKEX EXPLORER

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