

V1.2

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field-oriented control (FOC), the  
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RoboMaster System Specification Manual,  
RoboMaster System User Manual, Introduction  
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The M300S Assembly Kit includes several  
sensors and a terminal board, providing a  
complete robotic system driven by four  
independent motors.

# ROBOMASTER 2022

## UNIVERSITY TECHNICAL CHALLENGE

# RULES MANUAL

Prepared by the RoboMaster Organizing Committee  
Updated on March 2022

## Intellectual Property Statement

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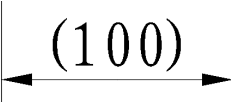
Relevant suggestions for open source materials can be found in this link: <https://bbs.robomaster.com/thread-7026-1-1.html>.

## Using this Manual

### Legend

 Prohibitions	 Important notes	 Hints and tips	 Definitions and references
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### Legend for Battlefield Drawings

	
The plane on which the battlefield is located is its lowest plane	Dimensions are for reference only

## Release Notes

Date	Version	Changes
2022.03.29	V1.2	1. Added definition, restriction and penalty related to Engineer carrying minerals

Date	Version	Changes
		2. Adjusted the dart gate opening time
2022.01.11	V1.1	1. Adjusted competition criteria for RoboMaster Robot Self-Assembled Version Type A and RoboMaster AI Robot 2020 Standard Version 2. Removed rotating elevator 3. Updated the relevant battlefield components drawings 4. Adjusted the releasing mechanism of the minerals on the Resource Island 5. Updated the rotation strategy of the Power Rune
2021.10.15	V1.0	First release

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# 1. Introduction

The RoboMaster 2022 University Technical Challenge (hereinafter referred to as “RMUT 2022”) consists of four components: Engineer Mining; Standard Racing and Smart Firing; Dart Targeting; and Hero Lob Shot.

## 1.1 Main Changes to New Competition Season

Compared with RMUT 2021, the RMUT 2022 has been updated with the following changes:

### Challenge

- Added the Hero Lob Shot
- Added Standard Racing and Smart Firing (Balancing Standard Group)

### Robots

- Radars are allowed on the battlefield for Dart Targeting and Hero Lob Shot
- Added Balancing Standard Robots

### Competition Mechanism

- Adjusted the rotation strategy of Power Rune
- Adjusted the releasing mechanism of the minerals on the Resource Island

### Competition Area

- Re-designed the Battlefield
- Adjusted the mineral positions for Engineer Mining

## 1.2 Robot and Operator

Building specifications for robots can be found in the [“RoboMaster 2022 University Series Robot Building Specifications Manual”](#).

### 1.2.1 Robot Line-up

The robot lineup for the RMUT 2022 is as follows:

Table 1-1 Line-up of Robots

Challenge	Quantity of Robots on Battlefield	Backup Robots (optional)	Robot Numbering
Engineer Mining	1		Engineer: Red 2
Standard Racing and Smart Firing	1		Standard: Red 3



Challenge	Quantity of Robots on Battlefield	Backup Robots (optional)	Robot Numbering
<b>Dart Targeting</b>	1-2 (The Dart System must be deployed and must include four darts)	Only one backup robot is allowed for each challenge. For Dart Targeting, each team is allowed to carry at most four backup darts.	<ul style="list-style-type: none"> <li>● Dart System: Red 8</li> <li>● Radar: Red 9</li> </ul>
<b>Hero Lob Shot</b>	1-2 (Heroes must be on the battlefield)		<ul style="list-style-type: none"> <li>● Hero: Red 1</li> <li>● Radar: Red 9</li> </ul>

- Teams that did not qualify for the offline competitions of the RMUC, RMUT or RMUL in the 2021 season are only allowed to have one RoboMaster Robot Self-Assembled Version Type A or RoboMaster AI Robot 2020 Standard Version on the battlefield. The RoboMaster AI Robot 2020 Standard Version must also meet the new structural design requirements.



- Other teams are not allowed to converse the above robots into newly designed robots when building their robots, nor use key components such as frame profiles, and only allowed to use some of the components, such as motor coupling, launching mechanism, and loading mechanism.
- The Radar is optional. It can relay images back to the gimbal display in the Operator Room and provide a full view of the match.

## 1.2.2 Basic Robot Information

The basic robot information for the RMUT 2022 is as follows:



- In the absence of any special classification, Standard Robots include Regular, Automatic and Balancing Standard Robots.
- If any special classification is provided, Standard Robots will include the same robots excluding the specified type of Standard Robots.

Table 1-2 Basic Robot Information

Robots Specifications	Engineer Robot	Regular Standard Robot	Balancing Standard Robot	Hero Robot	Dart System	Radar
Initial Projectile Quantity (round)	-	50	50	15	-	-
Maximum Chassis Power Consumption (W)	No limit	80	100	90	-	-
Initial HP	500	200	500	250	-	-
Initial Launching Speed Limit (m/s)	-	30	30	16	-	-
Barrel Heat Limit	-	240	240	200	-	-
Barrel Cooling Value per Second	-	40	60	60	-	-
Projectile Launch Speed (round/s)	-	Note 1	Note 1	Note 1	-	-
Initial Position	Starting Zone	Starting Zone	Starting Zone	Sniper point	Dart Launching Station	Radar Base

Note 1:

For details please refer to “3.2.1Exceeding the Initial Launching Speed Limit” and “3.2.2Barrel Overheating and Cooling”.



- Robot Chassis: A mechanism that carries a robot propulsion system and its accessories.
- Chassis Power Consumption: The power propulsion system that enables a robot to move horizontally, not including the power used for special tasks (e.g., power consumption for functional movements such as moving the upper mechanical structure).

- Initial Launching Speed: The speed detected by the relevant modules of Referee System after a projectile or dart has completed its acceleration.
- Initial Projectile Quantity: The quantity of projectiles that a Pit Crew Member can load into the magazines of a robot before the start of a round.
- Barrel Heat: A mechanism for limiting the firing of projectiles by robots. For more details, please refer to “3.2.2 Barrel Overheating and Cooling”.

### 1.2.3 Operator Line-up



- An operator must be a Regular Member of a team in the current season.
- After the end of each round, teams can replace their operators with their other members on the Battlefield.
- Hero robot operators must be situated next to the gimbal display.

The operator line-up is as follows:

Table 1-3 Line-up of Operators

Type	Robot Operated	Full Team Lineup Size
Standard Racing and Smart Firing	Standard Robot	1
Engineer Mining	Engineer Robot	1
Hero Lob Shot	Hero Robot, Radar	1
Dart Targeting	Dart System, Radar	1

## 2. Operator Room and Projectiles

### 2.1 Operator Room

Each Operator Room must be equipped with a corresponding number of computers with official equipment such as monitors, mice and keyboards.

An Operator Room is not provided with additional power supply.

### 2.2 Projectiles

The parameters and scenarios of use for projectiles in the competition are as follows:

Table 2-1 Projectile Parameters and Scenarios of Use

Type	Appearance	Color	Size	Weight	Shore Hardness	Material	Scenarios of Use
<b>17mm projectile</b>	Spherical	Yellow-green	16.8mm ± 0.2mm	3.2g ± 0.1g	90A	Plastic (TPU)	Standard Racing and Smart Firing
<b>42mm projectile</b>	Similar to a golf ball	White	42.5mm ± 0.5mm	41g ± 1g	90A	Plastic (TPE)	Hero Lob Shot

## 3. Competition Mechanism

### 3.1 Robot Status

Robots will display the following statuses during the competition as shown below:

Table 3-1 Robot Status

Status	Description
<b>Survive</b>	Robot's HP is not zero.
<b>Defeated</b>	Where a robot's HP drops to zero after its Armor Module has been attacked or hit; it has exceeded its Chassis Power Consumption limit, Initial Launching Speed limit or Barrel Heat limit; its Referee System module has gone offline, etc.
<b>Ejected</b>	Where a robot is ejected directly by the Referee System as a penalty after being issued with a Red Card or having accumulated 8 violation scores.
<b>Offline</b>	The Referee System Main Controller Module is unable to connect to the Referee System Server due to power outage on the robot or other reasons.
<b>Temporary Activation</b>	After a robot is defeated or ejected, the referee may revive the robot temporarily and instruct the relevant operator to control the robot. During this time, the robot is not allowed to fire projectiles. If the Referee System detects that the robot has launched any projectile, all the robots and Battlefield Components of the opposing team will receive 100% defense for a duration of two seconds. The referee can discontinue the temporarily activated status of the robot at any time. After termination, the robot will reset to its status before the temporary activation.



After a robot is defeated or ejected, the Referee System will cut off power supply to the robot (except for the Mini PC).

### 3.2 HP Deduction Mechanism

The HP of robots may be deducted in any of the following situations: the Barrel Heat limit, Initial Launching Speed limit or Maximum Chassis Power Consumption of a Launching Mechanism is exceeded; an Armor Module is struck in a collision; an important module of the Referee System goes offline; as a penalty for violation of rules; etc.

The Referee System will round down the HP deduction and keep the integer when calculating the HP.

### 3.2.1 Exceeding the Initial Launching Speed Limit

Set the Initial Launching Speed limit as  $V_0$  (m/s), the actual initial speed detected by the Referee System as  $V_1$  (m/s).

When  $V_1 > V_0$ , if it is a 17mm projectile, the deducted HP = Maximum HP \* L%. If it is a 42mm projectile, the deducted HP = Maximum HP \* M%. The values of L% and M% are correlated to the margin of excess. The larger the margin of excess, the greater the values of L% and M%.

Table 3-2 Penalty Mechanism for Exceeding Initial Launching Speed Limit

17 mm projectile	L%	42 mm projectile	M%
$0 < V_1 - V_0 < 5$	10%	$V_0 < V_1 \leq 1.1 * V_0$	10%
$5 \leq V_1 - V_0 < 10$	50%	$1.1 * V_0 < V_1 \leq 1.2 * V_0$	20%
$10 \leq V_1 - V_0$	100%	$1.2 * V_0 < V_1$	50%

### 3.2.2 Barrel Overheating and Cooling

Set the Barrel Heat limit as  $Q_0$ , the current barrel heat as  $Q_1$ , For each 17 mm projectile detected by the Referee System, the current barrel heat  $Q_1$  is increased by 10 (regardless of its initial speed) For each 42mm projectile detected, the current barrel heat  $Q_1$  is increased by 100 (regardless of the 42mm projectile's initial speed). The barrel cools at a frequency of 10 Hz. The cooling value per detection cycle = cooling value per second / 10.

- A. When  $Q_1 > Q_0$ , the first-person-view (FPV) visibility of the client screen is reduced. The FPV will only return to normal when  $Q_1 < Q_0$ . The FPV for the client is as follows:

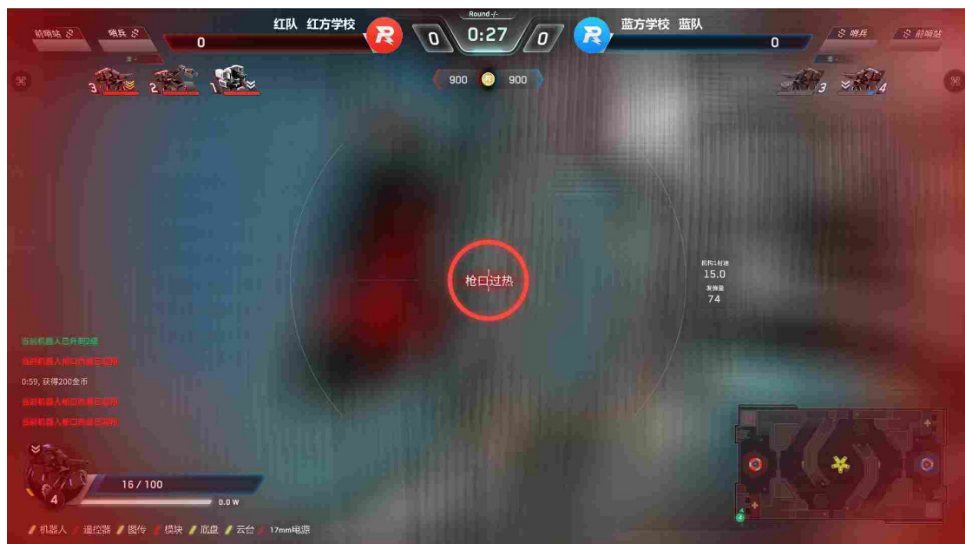


Figure 3-1 FPV of Client

- B. When  $2Q_0 > Q_1 > Q_0$ , the deducted HP for every 100 ms =  $((Q_1 - Q_0) / 250) / 10 * \text{Maximum HP}$ . After the HP deduction, the barrel cooling will be calculated.
- C. When  $Q_1 \geq 2Q_0$ , the immediate deducted HP =  $(Q_1 - 2Q_0) / 250 * \text{Maximum HP}$ . After deducting HP, set  $Q_1 =$

$2Q_0$ .

The below shows the HP deduction and cooling logic when the Barrel Heat limit is exceeded:

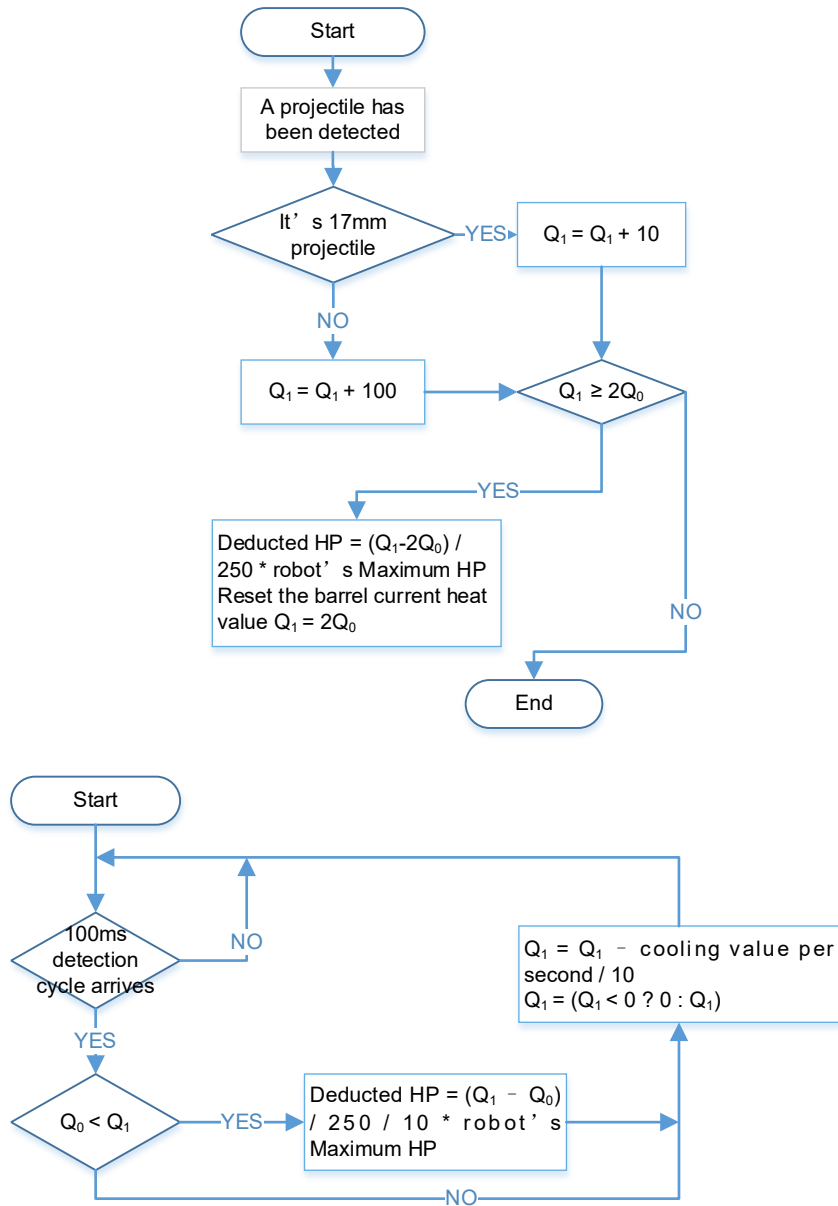


Figure 3-2 (Above) HP Deduction Logic and (Below) Cooling Logic when Barrel Heat Limit is Exceeded

### 3.2.3 Exceeding Chassis Power Consumption Limit

The Chassis Power Consumption of robots will be continuously monitored by the Referee System, and the robot chassis needs to run within the chassis power consumption limit. Considering it is difficult for a robot to control instantaneous output power when in motion, a buffer energy (Z) has been defined in order to avoid the penalty that accompanies. The buffer energy value of standard and hero robots is 60J.

After the buffer energy has been depleted, if the Chassis Power Consumption of a Standard or Hero Robot exceeds the limit, the deducted HP in each detection cycle = Maximum HP \* N% \* 0.1.

The Referee System monitors Chassis Power Consumption at a frequency of 10Hz.

Excess Percentage:  $K = (P_r - P_l) / P_l * 100\%$ , where  $P_r$  is the instantaneous Chassis Power Consumption output and  $P_l$  is the power consumption limit.

Table 3-3 Penalty Mechanism for Exceeding Chassis Power Consumption Limit

<b>K</b>	<b>N%</b>
<b><math>K \leq 10\%</math></b>	10%
<b><math>10\% &lt; K \leq 20\%</math></b>	20%
<b><math>K &gt; 20\%</math></b>	40%



The logic graph for chassis power consumption detection and HP deductions for a Standard or Hero Robot is shown below:

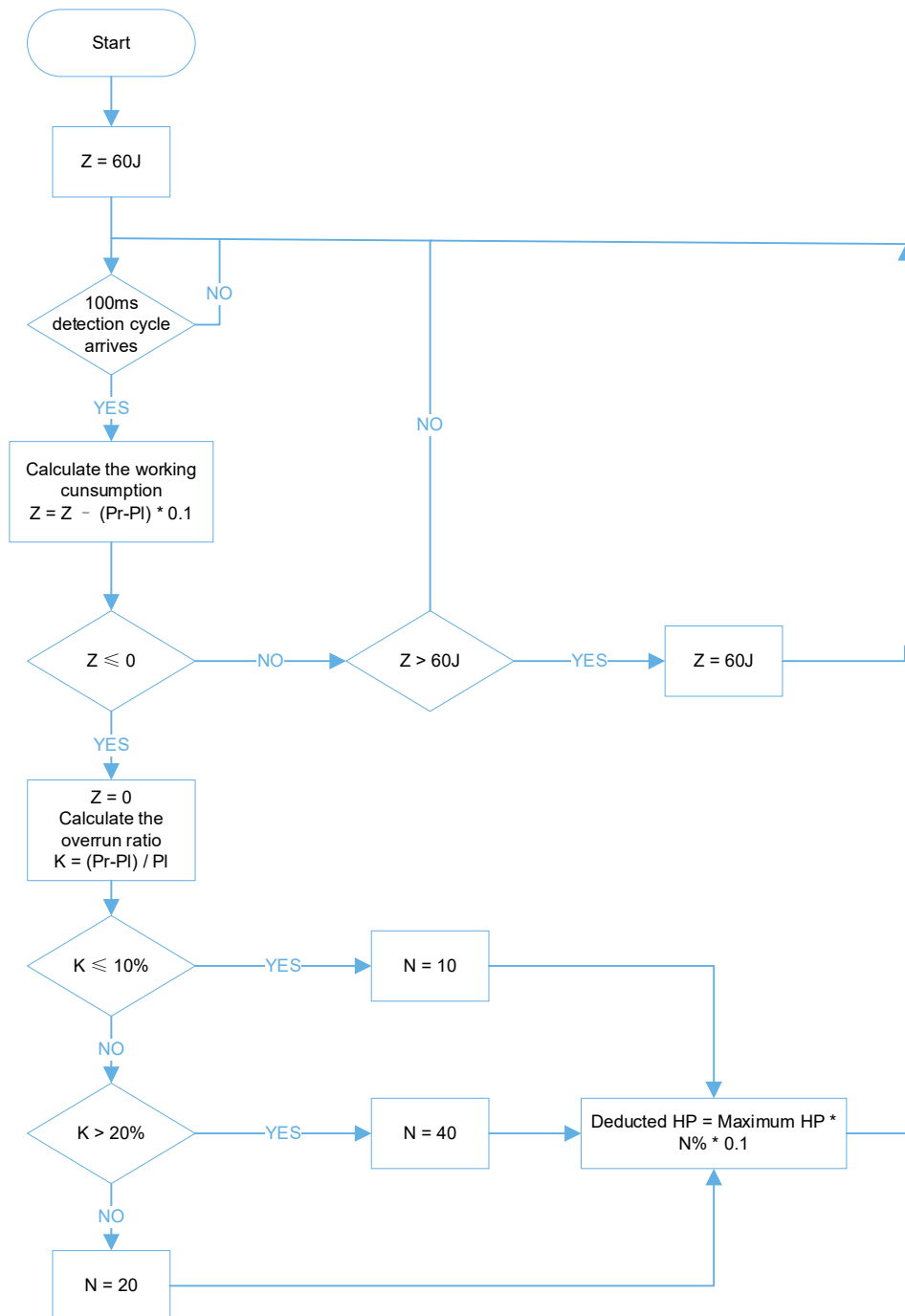


Figure 3-3 Chassis Power Consumption Detection and HP Deduction Logic of Standard and Hero Robots

### 3.2.4 Attack Damage

The Dart Detection Module detects attacks from Darts and 42 mm projectiles through the Armor Module and the phototube. The interval for dart detection is one second.

An Armor Module detects projectile attacks through pressure sensors and the vibration frequency on the armor panel. The shortest detection interval for an Armor Module is 50 ms (when an Armor Module is hit with a 42 mm projectile, the detection interval can be extended to a maximum of 200 ms).

The projectile needs to come into contact with the impact surface of the armor module at a certain speed in order to be successfully detected. The velocity range for the detection of different projectile types by an armor module is as follows:

Table 3-4 Velocity Range for the Detection of Different Projectile Types by an Armor Module

Armor Module	17 mm projectile	42 mm projectile
Large Armor Module, Small Armor Module	Higher than 12m/s	Higher than 8m/s
Triangular Armor Module	Not detected	Higher than 6m/s



In an actual match, the normal speed of a projectile that touches the Armor Module attack surface is different from its initial Launching speed due to the projectile's speed decay and its incident angle not being normal to the Armor Module attack surface. Damage detection is based on the normal component of the projectile's speed upon contact with the Armor Module attack surface.

A robot will experience damage when its Armor Module is hit in collision.

The table below sets out the HP deductions for different armors assuming no buff points are received:

Table 3-5 HP Deduction Mechanism for Attack Damage

Damage Type	HP Damage Value
42mm projectile	<ul style="list-style-type: none"> <li>● Armor Modules of the Base and Outpost : 200</li> <li>● Triangular Armor Modules of the Base and Outpost: 300</li> </ul>
Collision	2
Dart	1/2 of the Maximum HP of Base or Outpost

### 3.2.5 Referee System Going Offline

In accordance with the latest version of the “RoboMaster 2022 University Series Robot Building Specifications Manual”, robots must be mounted with their corresponding Referee System Modules, and each Referee System Module must have a stable connection to its server throughout the competition. The Referee System server detects the connectivity of each module at a frequency of 2 Hz. If important Referee System Modules go offline due to design or structural problems, then the HP of the corresponding Ground Robots will be deducted.



Important Referee System Modules: Speed Monitoring Module, Armor Module and Supercapacitor Management Module.

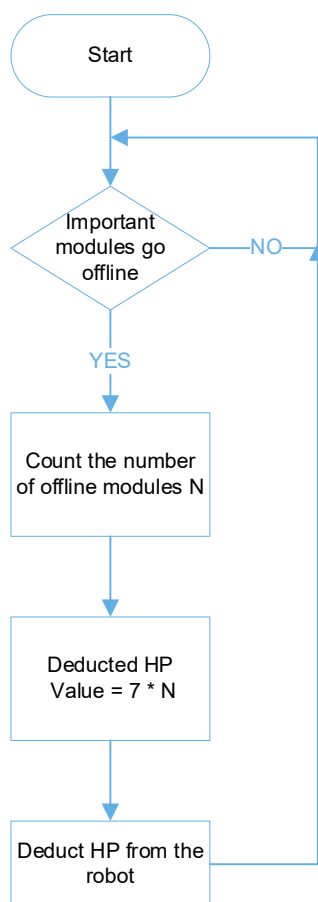


Figure 3-4 HP Deduction Mechanism for Important Referee System Modules When Offline

## 3.3 Revival Mechanism

For the Standard Racing and Smart Firing, the Revival Mechanism is as follows:

- **Revival Mechanism:** In each round, a Standard Robot can be revived twice at any location of the Battlefield. Upon revival, its HP will be restored to the Maximum.
- **Time Required for Revival:** It takes 10 seconds for a Standard Robot to be revived after being defeated.

### 3.4 Light Effects on the Battlefield

Some Battlefield Components will display different light effects at different stages of the competition, as shown below:

Table 3-6 Light Effects on the Battlefield

<b>Battlefield Components Competition Stage</b>	<b>“R” Light Indicator of the Exchange Station</b>	<b>Exchange Station (Where the minerals are placed)</b>	<b>Light Indicator of Resource Island Mechanical Claws</b>	<b>Light Indicator of the Dart Launching Station</b>
<b>Setup Period (Battlefield Components are not connected to the server)</b>	Off	Off	Off	Off
<b>Setup Period + Initialization Period (Battlefield Components are connected to the server)</b>	Solid white	Off	<ul style="list-style-type: none"> <li>Without minerals: white flashes (1Hz)</li> <li>With minerals: solid white</li> </ul>	<ul style="list-style-type: none"> <li>Robot not connected to the server: white flashes (1Hz)</li> <li>Robot is connected but the sliding rail is not in place: white flashes (1Hz)</li> <li>Robot is connected and the sliding rail is in place: solid white</li> </ul>
<b>Competition Stage (Normal status)</b>	Solid white	Solid red, solid blue	<ul style="list-style-type: none"> <li>Released: off</li> <li>Unreleased: solid white</li> </ul>	<ul style="list-style-type: none"> <li>Robot is connected and the sliding rail is in place: solid white</li> </ul>

Battlefield Components Competition Stage	“R” Light Indicator of the Exchange Station	Exchange Station (Where the minerals are placed)	Light Indicator of Resource Island Mechanical Claws	Light Indicator of the Dart Launching Station
				<ul style="list-style-type: none"> <li>● Robot is connected and the sliding rail is not in place: white flashes (1Hz)</li> <li>● Robot is not connected: off</li> </ul>
Competition Stage (In operation)	<ul style="list-style-type: none"> <li>● Within 2 seconds after each mineral is exchanged: white flashes (5Hz)</li> <li>● If a new mineral is exchanged during the 2 seconds, the new mineral will be covered with the light effect of the previous mineral.</li> </ul>	The RFID Interaction Module Card in the mineral is detected: red flashes (5Hz)	3 seconds before release: white flashes (3Hz)	<ul style="list-style-type: none"> <li>● When opening: white flashes (3Hz)</li> <li>● After it is open: solid white</li> <li>● When closing: white flashes (3Hz)</li> </ul>

## 4. Challenge

### 4.1 Engineer Mining

In each round, teams are given 1 minute to prepare for and 3 minutes to complete the Engineer Mining.

The Engineer Robot leaves the Starting Zone, procures minerals on the Battlefield, and exchanges them at the Exchange Station. Participants will be scored and ranked based on the quantity of minerals each Engineer Robot has exchanged and the time spent on the mission.

#### 4.1.1 Competition Site

The Battlefield is 10m long and 8m wide. It consists of the Starting Zone, Resource Island and Exchange Station.

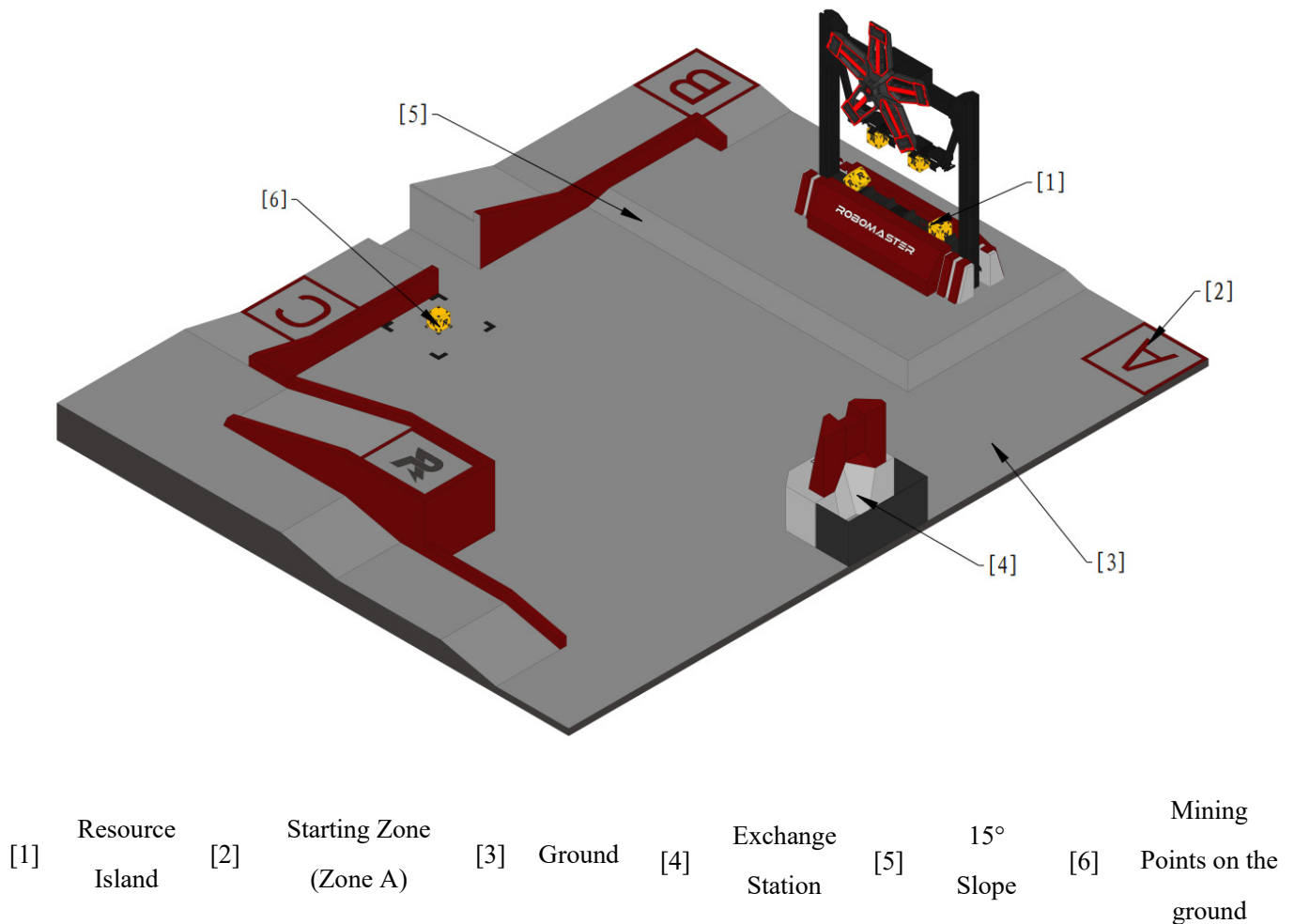


Figure 4-1 Axonometric View of the Engineer Mining Battlefield

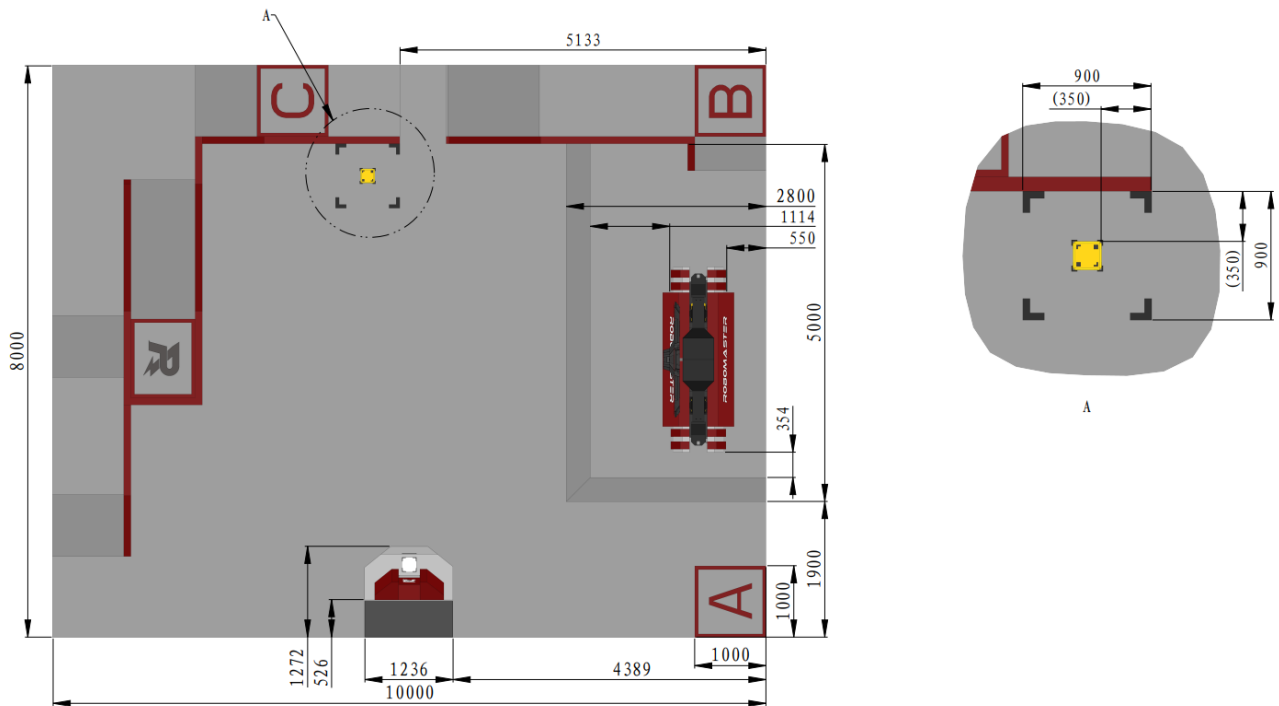


Figure 4-2 Top View of the Engineer Mining Battlefield

#### 4.1.1.1 Resource Island

The Resource Island includes its mechanical claws and base. There are five sets of mechanical claws on the Resource Island. At the start of the competition, claws 2 and 4 will each hold a mineral, while the minerals 1 and 5 will be in the groove. Ten seconds after the start of the competition, Operator will have two opportunities to press the “U” button in order to release Mineral 2 and 4 respectively.

Each set of claws has two status light indicators. For details on the light effects, please see “3.4 Light Effects on the Battlefield”.

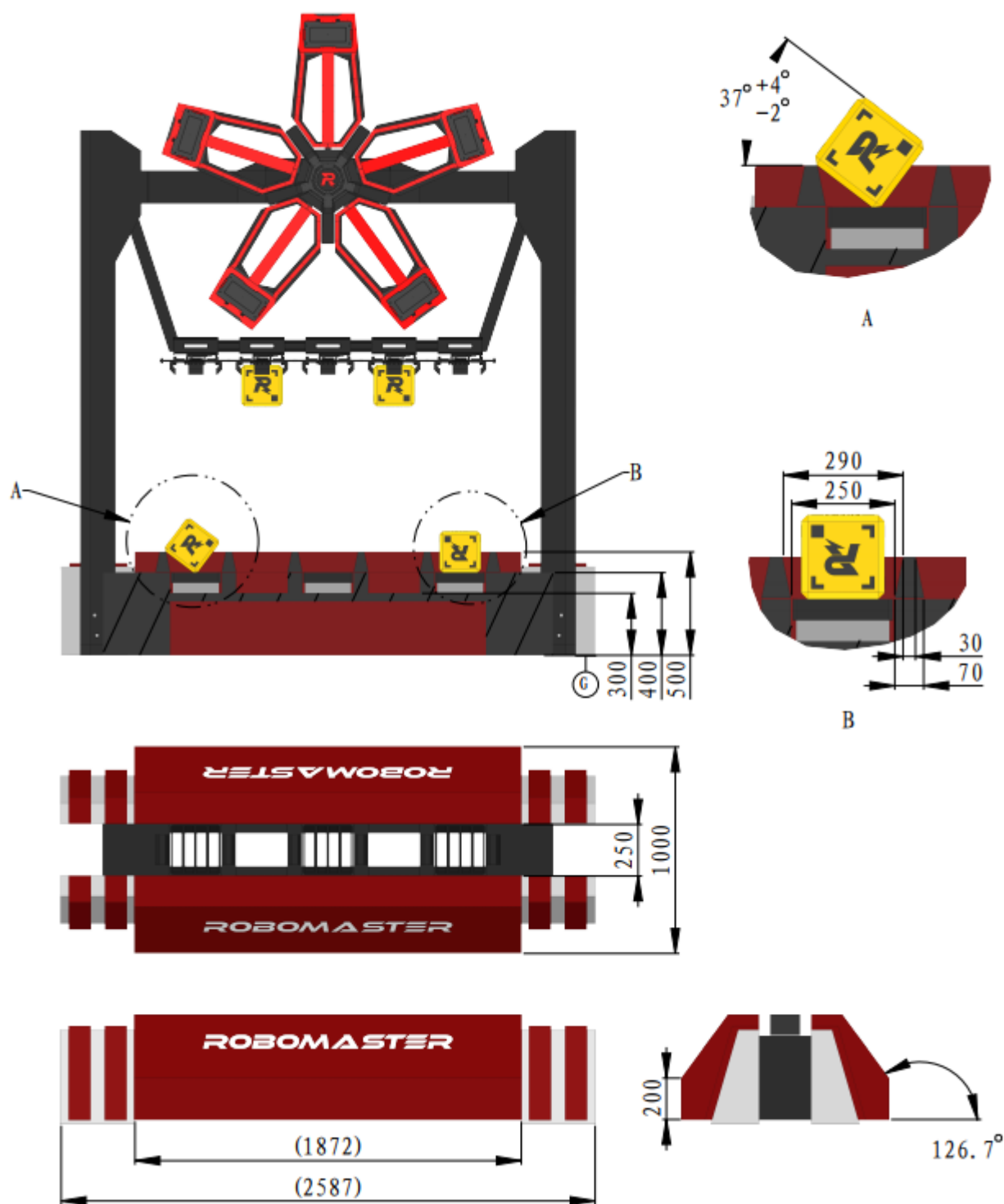


Figure 4-3 Dimensions of Resource Island



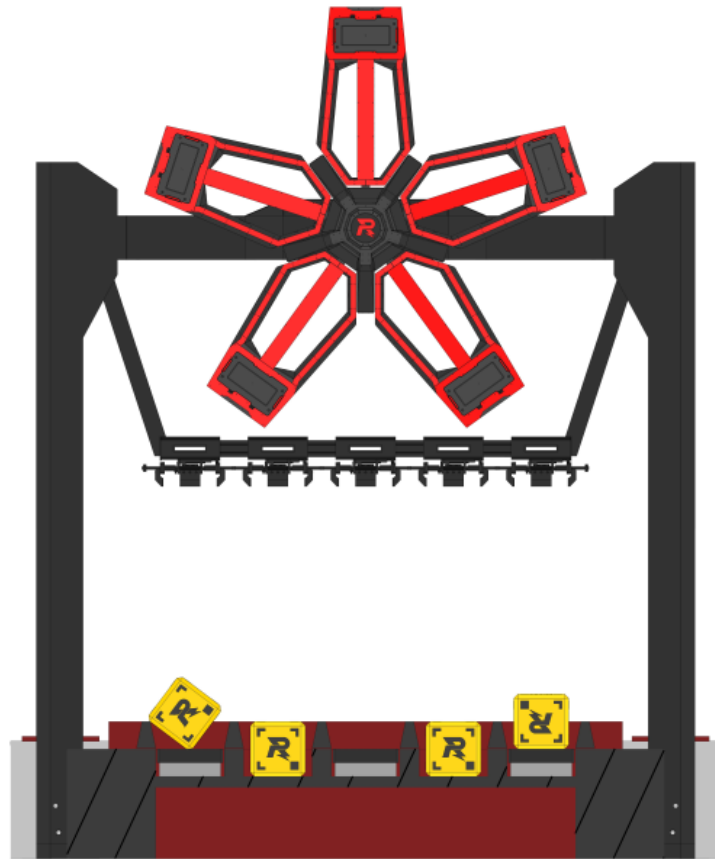


Figure 4-4 View of the fallen minerals

- When a mineral is dropped, the side with the barcode will be facing down.
- After a mineral is dropped, its position may differ from before, where the side with the barcode may not be facing down.
- The minerals should be able to fall into their respective slots, barring any external interference.
- The slots for minerals 2 and 4 are deeper.



#### 4.1.1.2 Minerals

A mineral is an EVA cube with beveled edges, dimensions of 200\*200\*200 mm, a mass of 600g~700g, hardness of  $38\pm 5\text{HC}$ , and contains an RFID Interaction Module Card. The barcode images on all the minerals are the same, and the parallel distance between their RFID Interaction Module Cards and the surface of their barcode images is 5 cm.

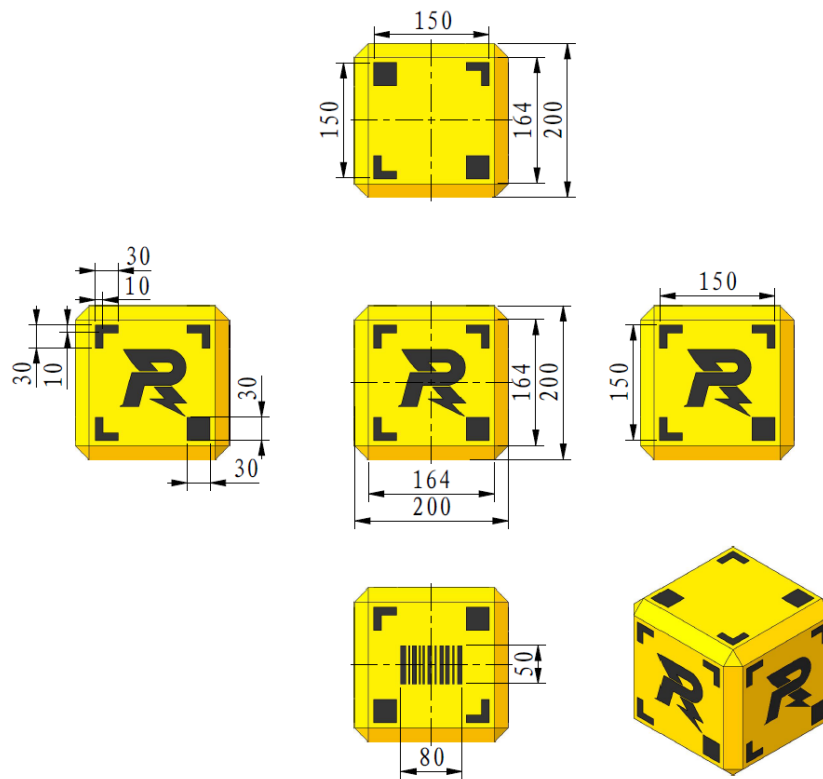


Figure 4-5 Mineral

### 4.1.1.3 Exchange Station

During the competition, an engineer robot can exchange a mineral by placing the mineral it is carrying in the Mineral Identification Zone of its team's Exchange Station in the correct position (with the barcode facing down), and then pushing the mineral into the Exchange Station.

The following two steps must be completed in order to exchange a mineral:

1. The RFID Interactive Module of the Mineral Identification Zone detects the RFID Interactive Module Card in the mineral (the Card in each mineral has a unique ID for identification by the Referee System)
2. After the RFID Interactive Module detection is completed, the robot pushes the mineral into the collection slot of the Exchange Station within three seconds and triggers the photoelectric sensor (the sensor's status is high when idle, and is triggered by the mineral's bottom edge), to complete the exchange of the mineral

#### Example 1:

If Mineral A has been detected by the RFID Interactive Module but has not been pushed into the collection slot and has been removed from the Mineral Identification Zone, while Mineral B is pushed into the collection slot within three seconds of the removal (Mineral B not having been detected by the RFID Interactive Module before being pushed into the collection slot), Mineral A will have been successfully exchanged. If Mineral A is pushed into the collection slot within the remaining time of the competition, the system will detect that the mineral has already been used and it will not be exchangeable.

#### Example 2:

If a mineral has been pushed onto the photoelectric sensor of the collection slot but its Card has not been detected by the RFID Interactive Module, the mineral will not be exchangeable.

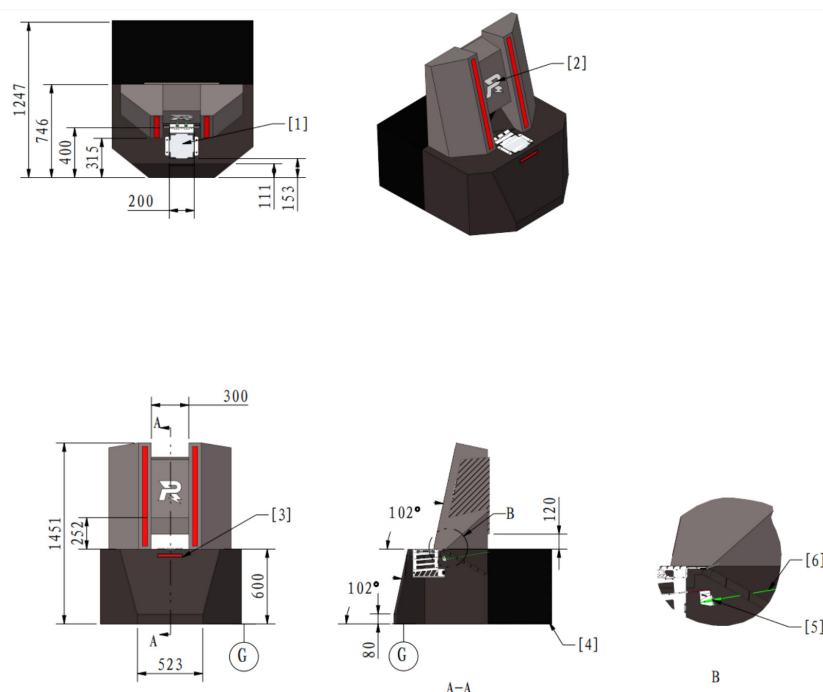
### Scenario 3:

If two different minerals are pushed into the collection slot quickly at the same time, either of the following two situations may occur:

- Only the RFID Interactive Module Card of one mineral has been detected, therefore only that mineral will be exchangeable.
- The RFID Interactive Module Cards of both minerals have been detected but the photoelectric sensor has detected only one bottom edge, meaning only the mineral that was closer in time to the point of detection will be exchangeable.



When a mineral's other surfaces without the barcode comes into contact with the Mineral Identification Zone, they may also be detected by the RFID Interactive Module.



	Mineral				Mineral
[1]	Recognition Zone	[2]	R-figure status light indicator	[3]	RFID Interactive Module light indicator
				[4]	Receptacle
[5]	Photoelectric sensor	[6]	Photoelectric sensor beam (non-visible)		

Figure 4-6 Exchange Station

### 4.1.2 Mission

The Engineer Robot stands by in the Starting Zone before the match. Minerals 1 and 5 are in the Resource Island slots; Mineral 3 is on the mining point on the ground near the Launch Ramp; Minerals 2 and 4 are held by the mechanical claws of the Resource Island. Ten seconds after the start of the competition, Operator will have two opportunities to press the “U” button in order to release Mineral 2 and 4 respectively.

After the start of the competition, the engineer robot must procure minerals from within the Competition Area and place them in the Exchange Station to complete the exchange. The match ends after all the minerals have been placed in the Exchange Station and their exchange completed, or the time for the match has run out.



The Engineer can only carry one mineral each time and move the mineral by carrying it.



Carrying a mineral: The Engineer has continuous direct or indirect contact with a mineral, resulting in significant displacement of the mineral.

Table 4-1 Mineral Status

Mineral No.	Mineral location	Initial position	Changes after start of round
1	In Mineral Slot 1	Bar code facing down, the mineral on the outer partition in a tilted position, with its edge parallel with the top of the partition, and the mineral inclined at an angle of 37°	Not Available
2	Held by Claw 2	Bar code facing down, the mineral held by the claw	Released by Operator
3	Mining Points on the ground	Bar code facing down, the mineral located in the mining point on the ground	Not Available
4	Held by Claw 4	Bar code facing down, the mineral held by the claw	Released by Operator
5	In Mineral Slot 5	Bar code facing up, located in the Mineral Slot	Not Available

### 4.1.3 Scoring

Five points will be given for each mineral exchanged successfully at the Exchange Station. If all five minerals have

been successfully exchanged with N seconds left, then further N points will be added to the score.

#### 4.1.4 Ranking

The teams will be ranked based on the following rules:

1. Each team can attempt the challenge twice and take the highest total score out of the two attempts as its final score. Teams with the higher scores are ranked higher.
2. In the case of two or more teams having the same scores, the team whose robot is lighter will be ranked higher.

#### 4.1.5 Award Criteria & Eligibility

The Engineer has exchanged at least two minerals.

### 4.2 Standard Racing and Smart Firing

Teams are given 1 minute to prepare for and 1 minute and 30 seconds to complete the challenge.

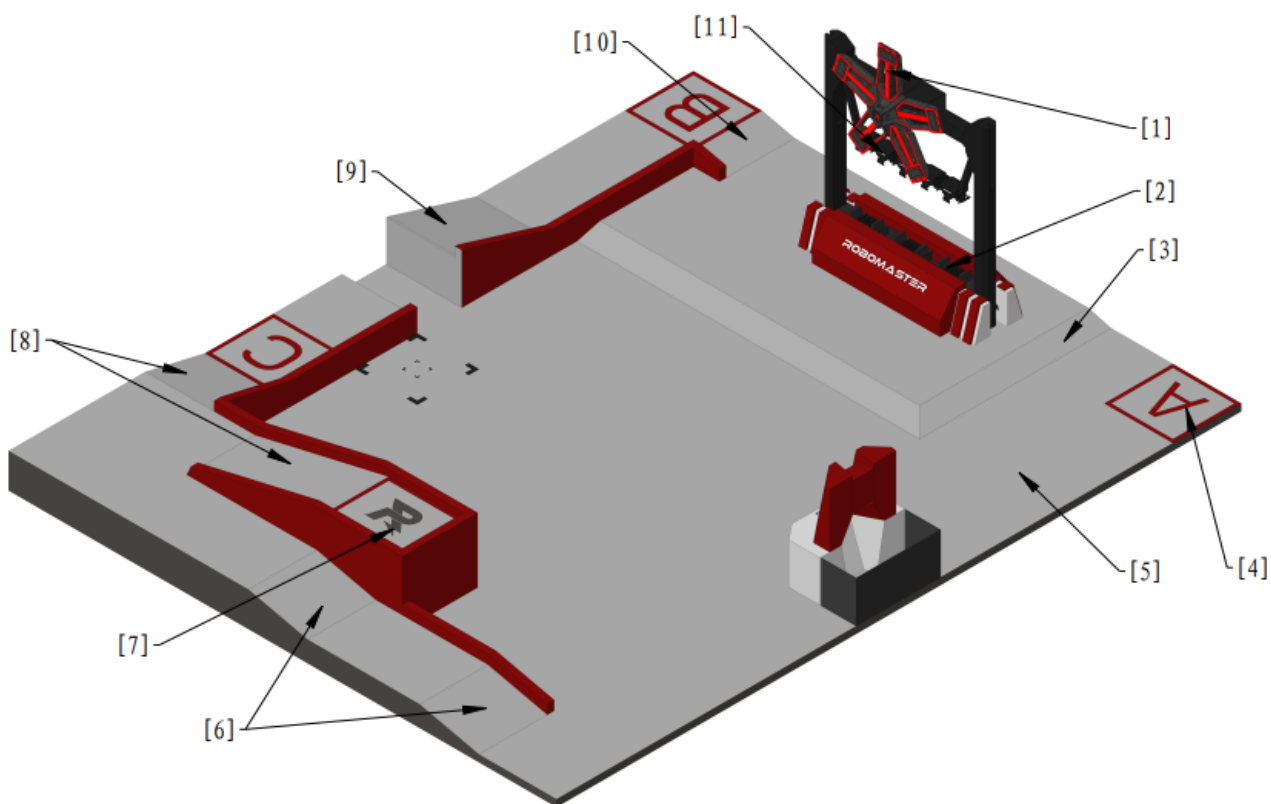
The Standard Racing and Smart Firing as well as the Engineer Mining share the same Battlefield.

A Standard Robot will move from the Starting Zone, pass through the designated task points one by one as quickly as possible, and arrive at the Power Rune activation point. The task is deemed completed as soon as the Power Rune is successfully activated. The final scores and ranking will be based on the time spent completing the task.



- The challenge is divided into two categories: Balancing Standard Group and Regular Standard Group. Teams shall register, compete and be awarded separately for either category.
  - No minerals will be present on the Battlefield during the Standard Racing and Smart Firing.
-

## 4.2.1 Competition Site



[1] Power Rune	[2] Resource Island Base	[3] 15° Slope
[4] Starting Zone (Zone A)	[5] Ground	[6] 13° slope
[7] Power Rune Activation Point (Zone D)	[8] 13° slope	[9] 17° slope
[10] 13° slope	[11] Mechanical Claw	

Figure 4-7 Axonometric View of Modules on the Standard Racing and Smart Firing Battlefield

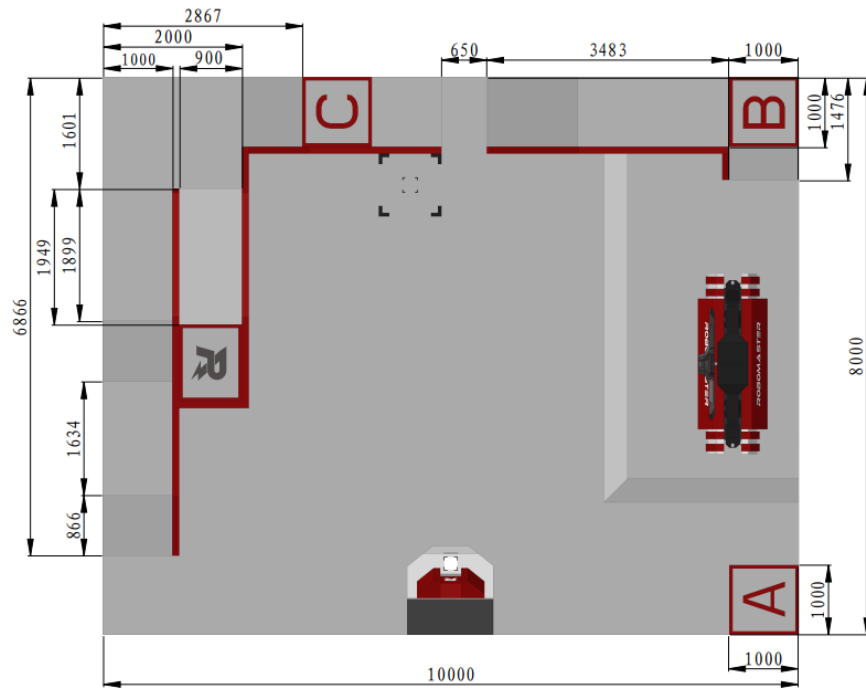
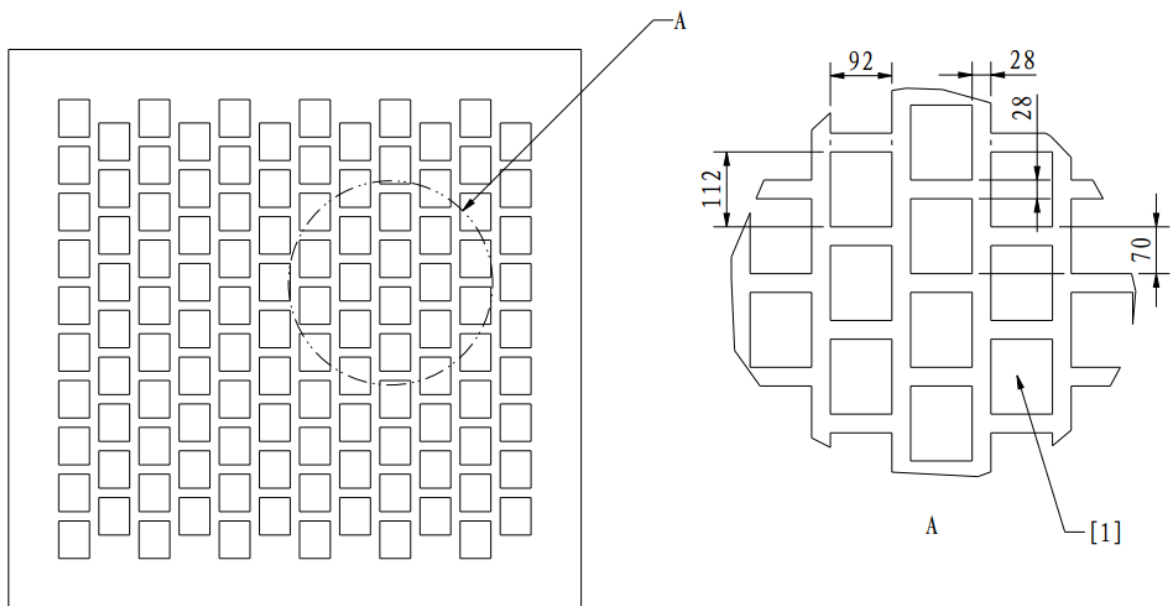


Figure 4-8 Top View of Modules on the Standard Racing and Smart Firing Battlefield



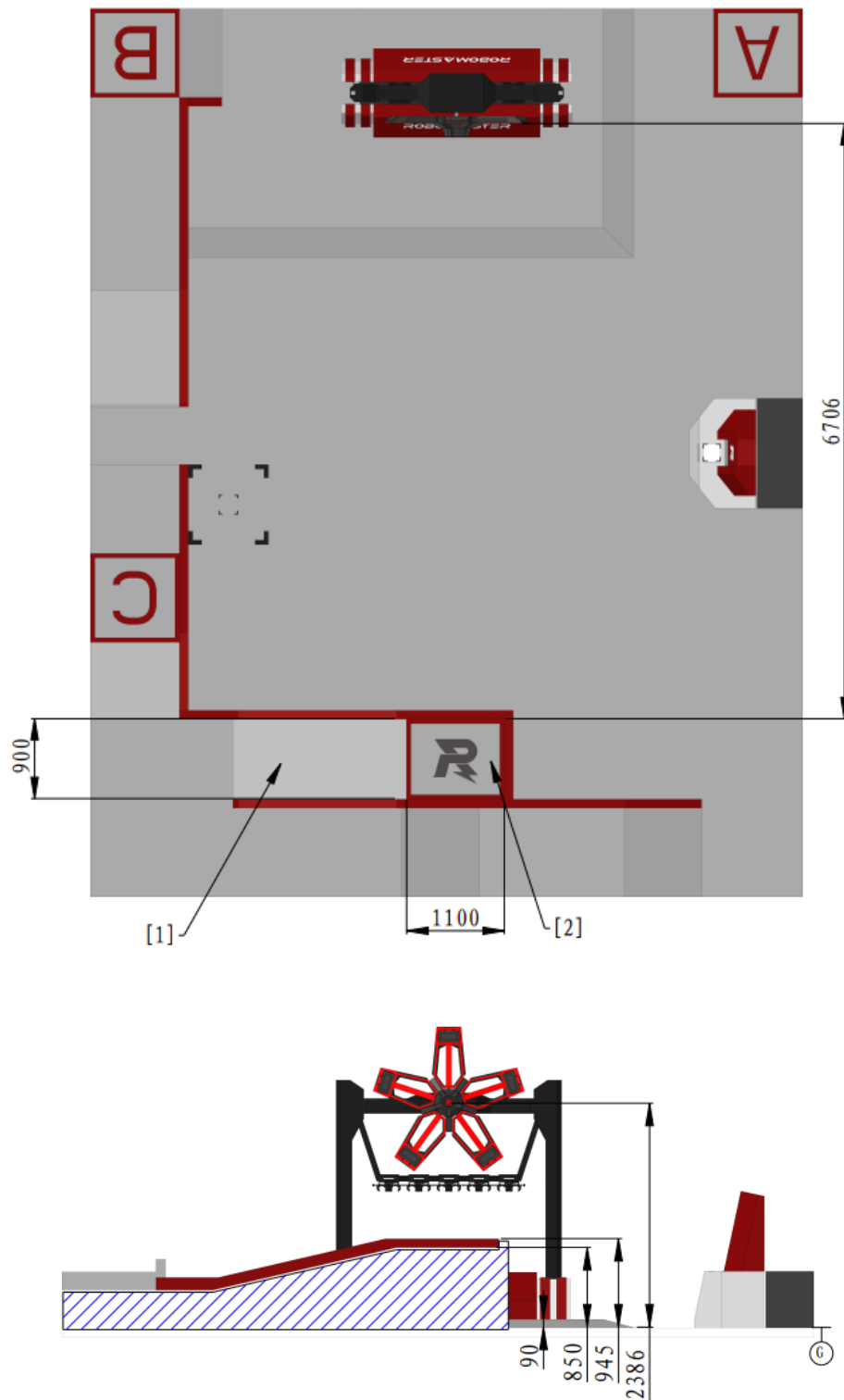
[1] Layout of the RFID Interaction Module Cards

Figure 4-9 Layout of the RFID Interaction Module Cards



Deadbands may exist for the RFID Interaction Module Cards at the Buff Points in the Battlefield. The teams have to adjust on their own.

### 4.2.1.1 Power Rune Activation Point



[1] 13° slope [2] Power Rune Activation Point (Zone D)

Figure 4-10 Dimensions of the Power Rune Activation Point



### 4.2.1.2 Road

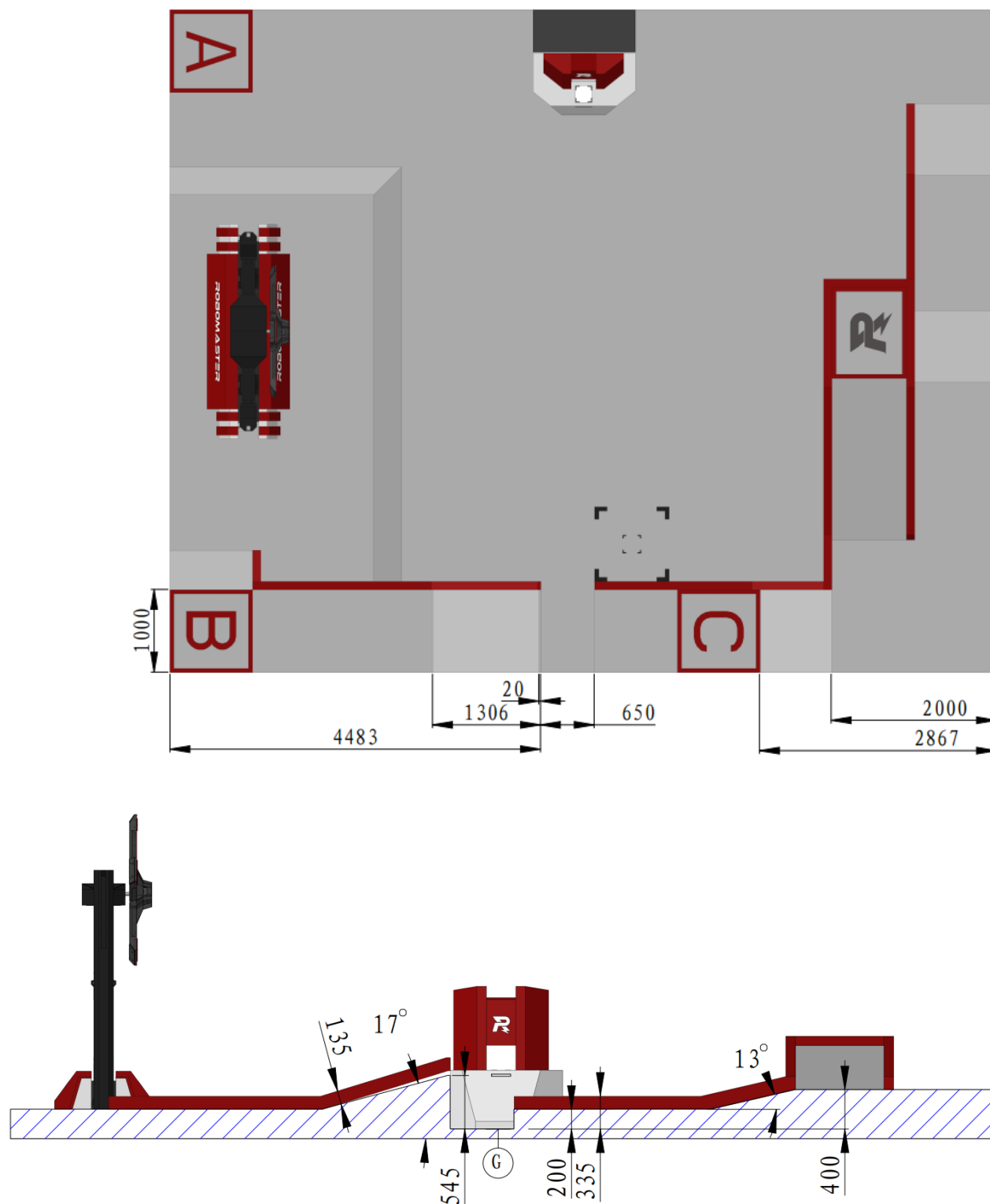


Figure 4-11 Road

### 4.2.1.3 Power Rune



- The Power Rune will have a slight dip in the middle due to its weight. The dip is around 0~50 mm.
- During the RMUT, no light effects will be displayed on the support columns on both sides of the Power Rune.

The Power Rune is located directly above the Resource Island. The Power Rune is powered by the motor and rotates at a regular rhythm. The robot needs to occupy the Power Rune Activation Point

to activate the Power Rune. The red team's Power Rune is used in RMUT.

A Power Rune has five light arms that are distributed evenly. The end of each light arm is installed with a Large Armor Module. The specific location and dimensions of the Large Armor Module are as

follows:

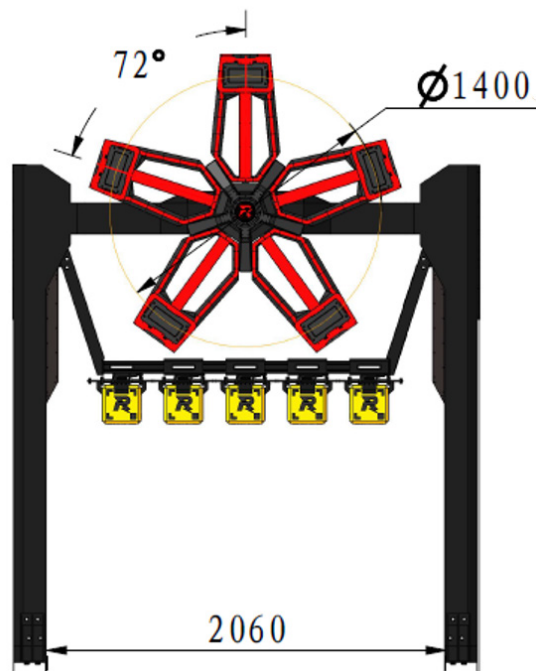


Figure 4-12 Power Rune

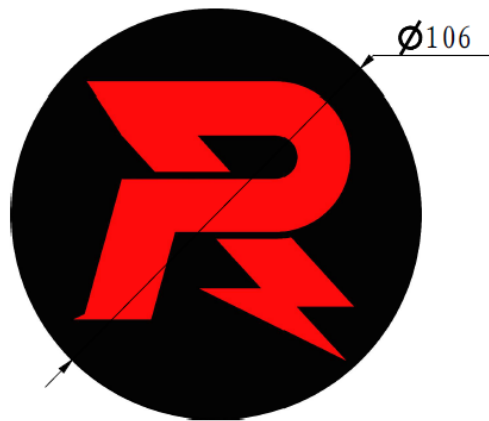


Figure 4-13 Central Logo of the Power Rune

## Rotation Strategy

After the round has begun, the Power Rune starts to rotate in a random direction and remains the same throughout the round.

The rotational speed of the Power Rune is based on the cyclical change of a trigonometric function. The target function for speed is:  $spd = a * \sin(\omega * t) + b$ , where the unit of “spd” is rad/s; the unit for “t” is s; the value range of “a” is 0.780~1.045; the value range of “ $\omega$ ” is 1.884~2.000; “b” always satisfies “b=2.090-a”. Each time the Large Power Rune becomes available, all parameters will be reset, where “t” is reset as 0, “a” and “ $\omega$ ” is reset to any value within their range.

The margin of error for time between the actual spinning speed of the Large Power Rune and the target speed function is within 500 ms.

## Status

### 1. Unavailable

Before the start of a match, the Power Rune is in the unavailable state.

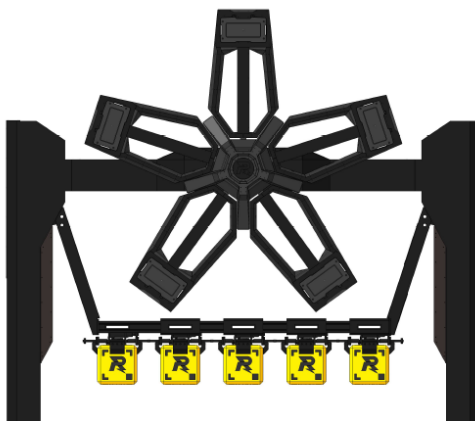


Figure 4-14 Power Rune when Unavailable

### 2. Available

After a match begins, the central logo of the Power Rune turns on, and the Power Rune is in the available state.

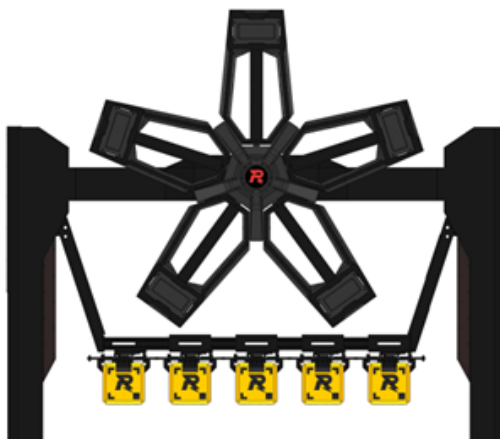


Figure 4-15 Power Rune when Available

### 3. Activating

When the Power Rune is available, a Standard Robot that occupies the Power Rune Activation Point and stays there for 3 seconds will launch the Power Rune into the activating state (“Figure 4-16 Power Rune when Activating”). The arrow light effects on the light arms of any of the 5 Armor Modules will be turned on at random. If a projectile manages to hit the Armor Module within 2.5 seconds, its light arm will be completely lit up. At the same time, the Power Rune will randomly illuminate one of the remaining four armor modules, so on and so forth, as shown below:

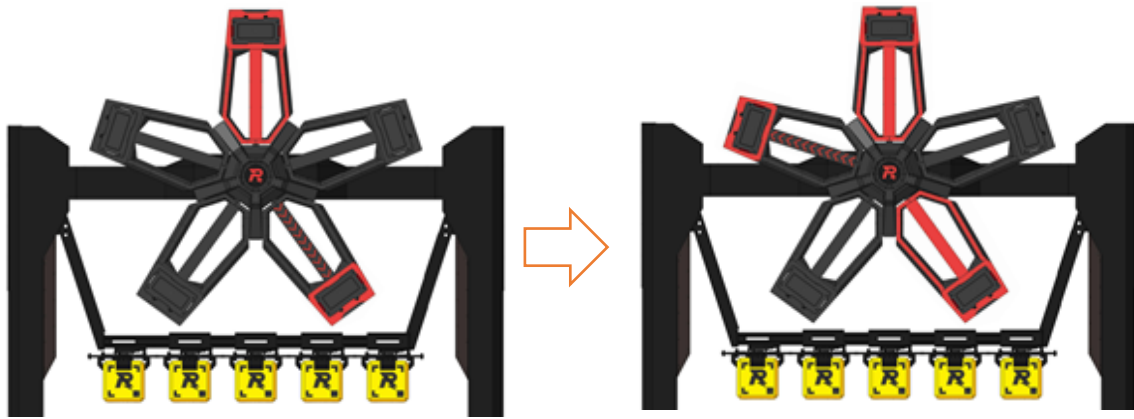


Figure 4-16 Power Rune when Activating

#### 4. Activated

If all five light arms are illuminated, the Power Rune is then activated as shown below:



Figure 4-17 Power Rune when Activated

#### 5. Activation Failed

If any of the following conditions occur during activation, the activation will fail and the Power Rune will be reset to the activating status again:

- Failure to hit a randomly lit Armor Module within 2.5 seconds
- A non-randomly lit Armor Module is hit

## 4.2.2 Mission



**Occupied:** When a robot has reached a Buff Point area and its RFID Interaction Module has detected the RFID Interaction Module Card in the area.

The Standard Robot is pre-loaded with 17 mm projectiles. During the competition round, the robot must complete the following missions in order:

1. Depart from Zone A, pass through Zone A, B and C on the site, and eventually reaching Zone D. The barrel cooling value per second of the Standard Robot is now five times its original value.
2. The robot activates the Power Rune in Zone D. The match ends once the Power Rune is activated completely.
3. The competition ends once the robot has fired 50 rounds of projectiles.

The team can decide the route of the Standard Robot's movements.

### 4.2.3 Ranking

Each team can attempt the challenge twice. The teams will be ranked based on the following order of priority:

1. Participants with the higher number of lit light arms on the Power Rune will receive a higher ranking.
2. Participants who had a longer time remaining (accurate to the second) after lighting up their first light arm will be ranked higher.
3. The robots with higher remaining HP will be ranked higher (the HP for revived robots will be 0).
4. Robots that are lighter will be ranked higher.

### 4.2.4 Award Criteria & Eligibility

Teams that have lit at least two light arms on the Power Rune are eligible for the award.

## 4.3 Dart Targeting

Dart Targeting shares the same Battlefield with the RMUC 2022. The Dart's object is the Outpost and Base of the opposing side.

For more details on the Battlefield and the Dart Launching Mechanism, refer to the latest version of the [RoboMaster 2022 University Championship Rules Manual](#).



- During the Dart Targeting, the gate can be opened five seconds after the start of the competition and will close automatically five seconds before the end.
  - It takes around 7 seconds for the gate to open completely.
- 

### 4.3.1 Mission

The preparation time for the first, second and third rounds are three, two and one minute respectively.

Before the start of a match, the team must place its Dart Launcher at the corresponding Dart Launching Station on

the Battlefield, with the Dart Launcher carrying a maximum of four Darts. The Radar (if available) must also be placed on the Radar Base. After the preparation is done, the Operator shall launch all the Darts within 1 minute. The mission is deemed completed once all the Darts have been launched. The team with the highest remaining HP on their Outpost and Base will be the winner.

If the Outpost has not been destroyed, a Dart's attack on the Outpost will be ineffective. For more details on damage inflicted by Darts, refer to "3.2.4 Attack Damage".

### 4.3.2 Ranking

The teams will be ranked based on the following rules:

1. Each team can initiate two challenges and take the highest total Damage HP of the two challenges as the final score. All teams will be ranked from high to low based on their total Damage HP.
2. If the total Damage HP is the same, the robot with the longer remaining time after inflicting the final damage will be ranked higher (the time to be accurate to the millisecond and based on the records of the server).
3. If the ranking cannot be decided based on the above criteria, the participants whose darts are lighter in total will be ranked higher



The time remaining after a target is hit will be calculated based on the time remaining after the darts launched by the robot have hit the target. For example, if a team has launched four darts, where the first and third hit the target while the other two did not, the remaining time shall be calculated from when the third dart hit the target.

---

### 4.3.3 Award Criteria & Eligibility

The Dart must be able to hit the Outpost at least once.

## 4.4 Hero Lob Shot

Hero Lob Shot shares the same Battlefield with the RMUC 2022.

The preparation time for the first and second rounds is three and two minutes respectively. The duration of the actual competition is two minutes and thirty seconds.

The Hero Robot attacks the armor on top the enemy's base from its team's Sniper Point. The teams will be ranked based on their time spent completing the mission, Damage HP and other factors. For more details on the Battlefield and the Sniper Point Mechanism, refer to the latest version of the [RoboMaster 2022 University Championship Rules Manual](#).

- During the challenge, the Hero Robot is not allowed to leave its team's Sniper Point.
- Radar can be deployed to provide guidance through imagery.
- The base is unshielded and its armor is closed, with a HP of 5000. The base does not have a defense period.



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### 4.4.1 Mission

Before the competition, the team must preload 42mm projectiles and place their Hero robot on their Sniper Point and their Radar (if available) on the Radar Base.

During the competition, the Hero Robot needs to attack the armor on top of the enemy's base from the Sniper Point. The robot is allowed to fire up to 15 rounds of 42mm projectiles within the specified time frame. The competition ends once the team has launched 15 rounds of projectiles or the enemy's base has been destroyed.

### 4.4.2 Ranking

The teams will be ranked based on the following rules:

1. Each team can initiate two challenges and take the highest total Damage HP of the two challenges as the final score. All teams will be ranked from high to low based on their total Damage HP.
2. If the total Damage HP is the same, the robot with the longer remaining time after inflicting the final damage will be ranked higher (the time to be accurate to the millisecond and based on the records of the server).
3. If the ranking cannot be decided based on the above criteria, the participants whose robots are lighter in total will be ranked higher

### 4.4.3 Award Criteria & Eligibility

Teams that have hit the target twice are eligible for the award.



## 5. Competition Process



Each challenge is called a round, and a match consists of multiple rounds.

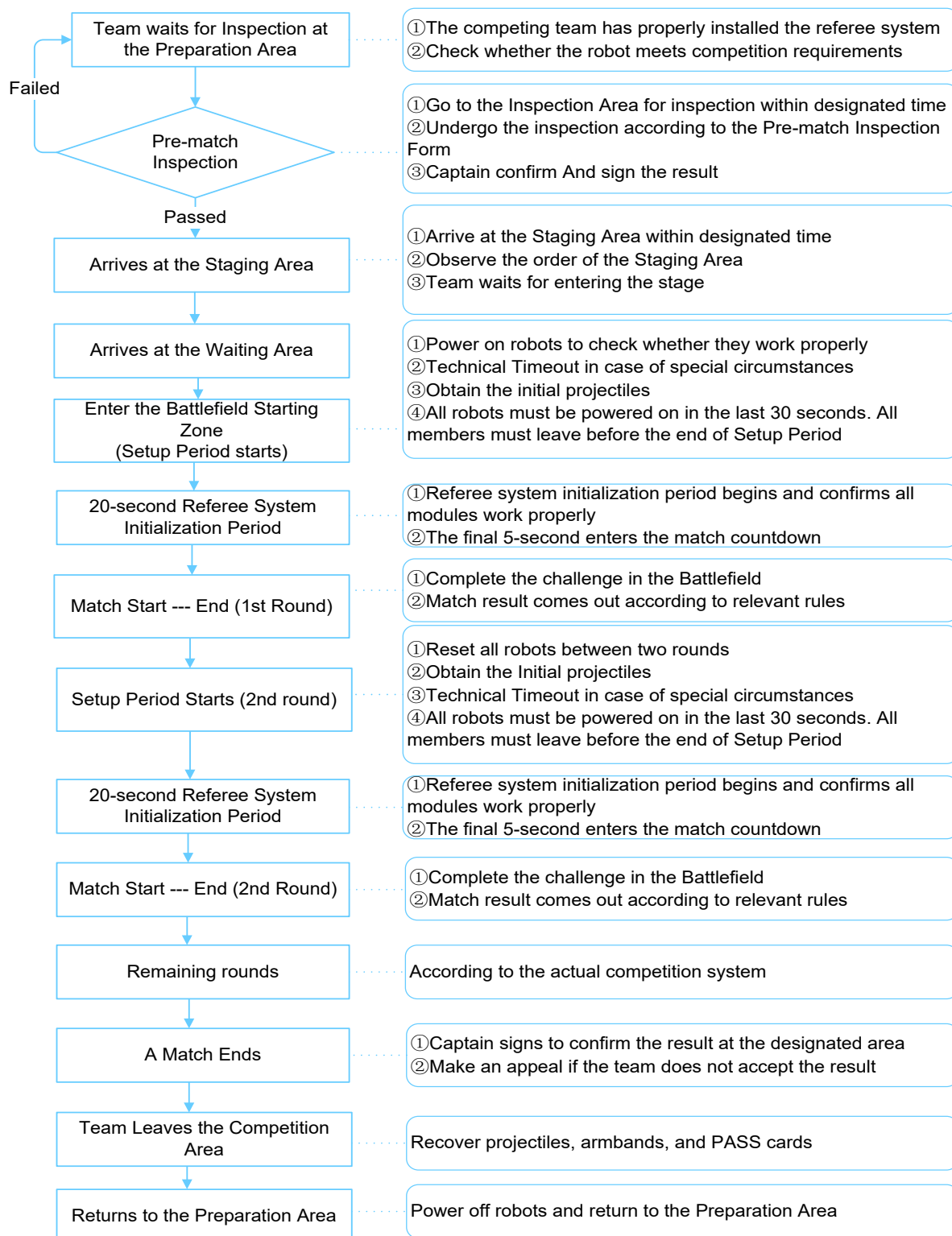


Figure 5-1 Process of A Single Match

## 5.1 Pre-Match Inspection

To ensure that robots meet the required standard specifications, each team must undergo Pre-match Inspection in the Inspection Area 40 minutes before the start of each match. For the requirements of the Pre-Match Inspection, please refer to the “[RoboMaster 2022 University Series Robot Building Specifications Manual](#)”. The inspection process is as follows:

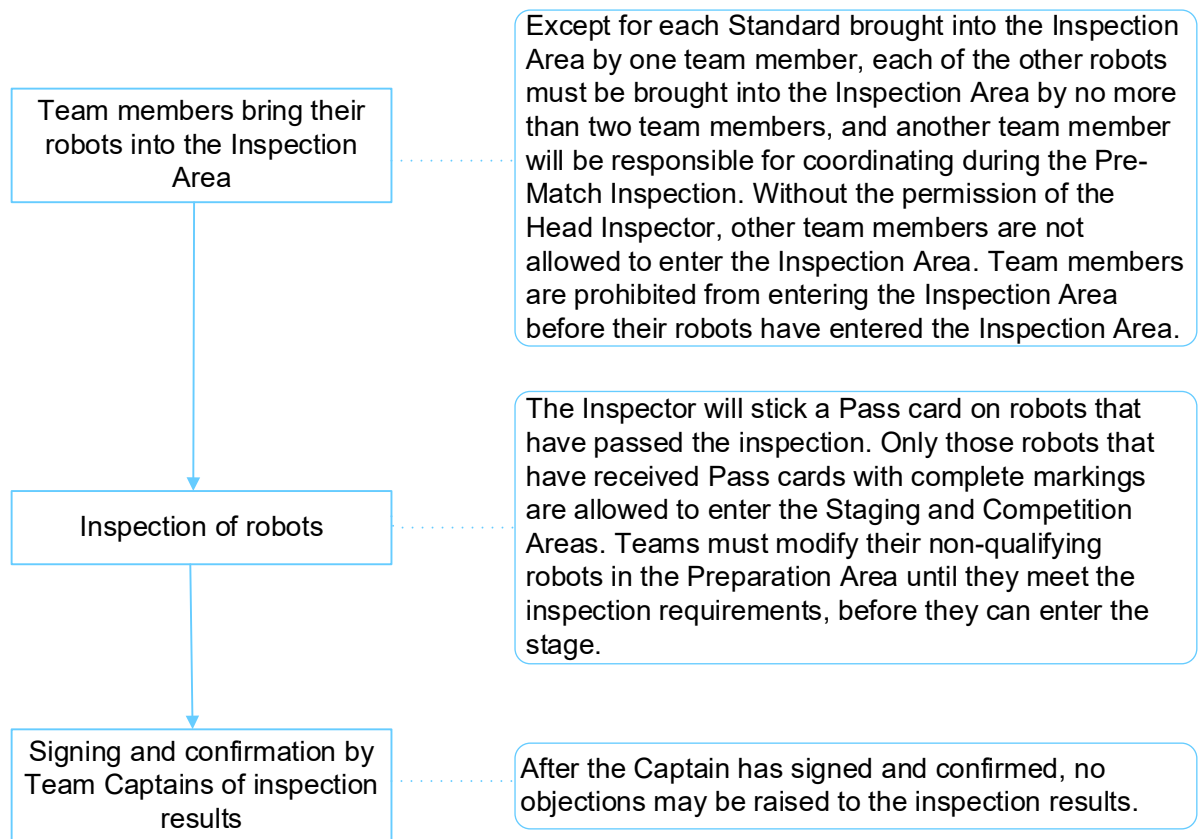


Figure 5-2 Pre-match Inspection Process

The rules regarding backup robots are as follows:

- Each team is allowed to have backup robots for each match. For the specific numbers allowed are, refer to “1.2.1 Robot Line-up”
- After passing the Pre-match Inspection, backup robots cannot be replaced without permission. During Mock Inspection, the RMOC will issue Referee Systems to backup robots that have passed Mock Inspection. A team can borrow the Referee System for no more than one backup robot.



The results of the Pre-match Inspection and Practice Match are for reference only and are not taken into account for the inspection in the actual competition.

## 5.2 Staging Area

Teams must arrive at the Staging Area 10 minutes before the match. The staff at the Staging Area will check the status of the participating robots and the Pit Crew Members' information.

If any team needs to repair its robots after entering the Staging Area, it must obtain the permission of the staff at the Staging Area. A robot may leave the Staging Area for repair only after the staff at the Staging Area have removed the Pass Card on the robot. When repair is finished, the robot needs to be brought back to the Inspection Area for another Pre-Match Inspection before re-entering the Staging Area. If the team is unable to arrive at the Staging Area in time as a result of this delay, the robot will not be able to enter the match, and the team will bear the consequences.

After leaving the Staging Area, the participating teams will enter the Waiting Area of the Competition Area to place their robots. When the previous match has ended and with the permission of the referee, the next pair of participating teams will wait at the entrance of the Battlefield with their robots for further instructions. After the referee has confirmed that the team is ready, he or she will open the door and lead the team members into the Competition Area. The countdown for the Setup Period begins the moment the door is opened.

## 5.3 Setup Period

During the Setup Period, the Pit Crew Members need to check whether the Referee System is working normally, load initial projectiles on robots whose Initial Projectile Quantity is not zero, load Darts on the Dart Launcher, and fix the Radar on the Radar Base. The Pit Crew Members may repair robots or perform replacements using equivalent parts. The referee may initiate an Official Technical Timeout at any time and perform immediate inspections on robots.



Equivalent parts: Standard modules or components having the same material, form and functions, for example motors of the same model and self-built friction wheel modules.

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Thirty seconds before the Setup Period ends, the Operator should preferably be in the Operator Room to complete commissioning for the keyboard and mouse (which can be brought on your own), and double-check whether the robot controls and official equipment are operating properly. If any official equipment does not operate normally, the Pit Crew Members must raise the issue before entering the final 15 seconds of the Setup Period. Otherwise, no technical timeout will be allowed by the referee. Besides the operator, no other Pit Crew Members are allowed inside the Operator Room.

Thirty seconds before the end of the Setup Period, all robots on the Battlefield must be powered up, and personnel on the Battlefield should leave the Competition Area in an orderly manner. Pit Crew Members should place the commissioning remote controller for the Radar in the designated area at the Battlefield entrance.

### 5.3.1 Official Technical Timeout

During the Setup Period, if the Referee System, equipment inside the Operator Room or other components experience any faults (for details see “Table 5-1 Descriptions of Technical Faults”), the Chief Referee may announce an Official Technical Timeout and pause the countdown.

During an Official Technical Timeout, team members can only work with the staff in eliminating the relevant faults of the Referee System or other official equipment, and are not allowed to repair other faults. When the relevant fault of the Referee System or official equipment has been eliminated and the Chief Referee has resumed the countdown, Pit Crew Members are required to follow the set procedures for the Setup Period and leave the Battlefield within the specified time.

Table 5-1 Descriptions of Technical Faults

Rule	Description
1	A fault occurs with the official equipment in the operator room, and any key competition component in the Battlefield experiences structural damage or functional irregularity.
2	During the Setup Period of the first round, the Referee System Module on a robot fails, for example where the robot is unable to transmit images back to the Operator Room normally or connect to the Referee System server.
3	Other situations determined by the Chief Referee as requiring an Official Technical Timeout.

If the malfunction referred to in Rule 2 occurs during the Setup Period between rounds or during a round, it will be categorized as “regular battle damage”, as it cannot be determined whether the malfunction was caused by the Referee System Module, a flaw in a robot’s circuit or structural design, or robot combat from a previous match. Regular battle damage does not trigger an Official Technical Timeout, and the referee will provide a backup Referee System Module. Teams may request for a “Team Technical Timeout” to repair their robots.

### 5.3.2 Team Technical Timeout

If the mechanical structure of a robot, a software system, the keyboard or mouse in the Operator Room or other equipment experiences any faults, the Team Captain may make a request to the referee in the Battlefield or Operator Room for “Team Technical Timeout” before entering the final 15 seconds of the Setup Period, and indicate the requested timeout length and reasons for the request. Once a Team Technical Timeout request has been made and conveyed to the Chief Referee, the Technical Timeout cannot be revoked or revised.

Even if the team did not enter the Battlefield or ended the Technical Timeout early, the opportunity used will still be the opportunity corresponding to the timeout length indicated by the team during its request. At this time, the Chief Referee will continue the countdown of the Technical Timeout, or the Chief Referee may end the Technical

Timeout early after confirming that both teams are ready.

After the match, the Match Results Confirmation Form will state whether Technical Timeout opportunities have been used during the match. The type of technical timeout allowed is determined by the Chief Referee based on the request of the team. The team cannot dispute the type of Technical Timeout allowed, and the Technical Timeout process cannot be the basis for any appeal after the match.

For every challenge, each team is entitled to one technical timeout opportunity for two minutes, in both the Regional and Final Competitions. A team cannot request for more Team Technical Timeout opportunities once they have been used up.

## 5.4 Referee System Initialization Period

After the Setup Period, the match enters a 20-second Referee System Initialization Period. During the Initialization Period, the competition server will automatically detect the connection status of the client, the Referee System module status of the robot, the status of Battlefield Components and restore the HP of all robots, ensuring their HP are full when the match officially begins.

If a robot experiences a technical fault with the Referee System during a first challenge, which causes the initialization countdown to stop, a maximum of two Pit Crew Members for the team are allowed to enter the Battlefield to inspect and solve the issue.

When the Referee System Initialization Period is left with 5 seconds, a clear countdown sound effect and live animation will be played. At this time, the keyboard connected to the computer in the Operator Room will be locked. When the countdown finishes and the keyboard unlocks, the match starts immediately.

## 5.5 Competition Round

The teams complete the mission of the challenge.

## 5.6 End of Competition

A challenge is deemed completed after its time has run out or the team fulfills the criteria to end the challenge early.

## 5.7 Match Results Confirmation

During a match, the referee will record on the Match Results Confirmation Form the penalties issued for each round, the key competition data at the end of the match, the use of Technical Timeout opportunities by the teams, and other relevant details.

Within 5 minutes after a match ends, the Captains of both teams must confirm the match results by signing at the Referee Area. If a Team Captain is not at the Referee Area within 5 minutes to sign and confirm the results and has not requested an appeal, it is deemed that the team agrees with the match results. Once a Team Captain has signed and confirmed the results, no further appeals can be made. Please refer to “8 Appeals” for details on the appeal process.

## 6. Violations and Penalties



Any penalty issued before the start of a competition will be executed after the competition officially starts. Penalty of violation stated in this chapter will be determined by the Chief Referee according to the actual situation.

To ensure the fairness and uphold discipline in the competition, teams and robots should strictly adhere to the competition rules. Referee will issue the appropriate penalty against any violation of rules. Any penalty issued before the start of a competition will be executed after the competition officially starts. Serious violations and all appeals in the competition will be publicized.

Penalty of violation stated in this chapter will be determined by the Chief Referee according to the actual situation. If any incident has occurred during the competition that affects the fairness of the competition but does not trigger any penalty or amount to a serious violation, the Head Referee shall decide on the issue of penalty based on the circumstances.

During the competition, the Chief Referee has the final right of interpretation on the Competition Rules. Any questions related to the Competition Rules must be referred to the Chief Referee only.

### 6.1 Penalty System

#### 6.1.1 Forms of Penalties

During a match, the referee may issue penalties against participants and robots that have failed to comply with competition rules. The forms of penalties are as follows.

Table 6-1 Forms of Penalties

Forms of Penalties	Description
<b>Automatic penalties by the Referee System</b>	HP deductions as a result of a robot exceeding its parameter limits or a Referee System Module going offline. The HP deductions mentioned in “3.2 HP Deduction Mechanism”, except those caused by attacks, are all automatic penalties by the Referee System.
<b>Manual penalties through the Referee System</b>	Penalties issued by the referee through the server against participants and robots for violation of rules.
<b>Manual Penalties</b>	Used in situations where penalties cannot be issued through the Referee System, for example giving a verbal warning or disqualifying a team

## 6.1.2 Violation Scores

Before the start of each round, each robot has a violation score of zero. A robot that is issued a Yellow Card during the round will receive 2 violation scores.

- When a robot has 4 violation scores, a yellow exclamation point will appear on the robot's avatar on the client interface.
- When a robot has 6 violation scores, a red exclamation point will appear on the robot's avatar on the client interface
- When a robot has 8 violation scores, the robot will be ejected automatically from the current round of the match.

## 6.1.3 Types of penalties

Five types of penalties may be issued during a match, as shown below:

Table 6-2 Types of Penalties

Types of penalties	Description
<b>Verbal Warning</b>	A Verbal Warning is given to the offending team with no HP deducted.
<b>Yellow Card</b>	<ul style="list-style-type: none"> <li>● The operation interface of all operators from the offending team will be blocked for 5 seconds.</li> <li>● The Referee System automatically deducts 15% of the robot's Maximum HP, while for each Yellow Card issued against the robot in the next 30 seconds, the deducted percentage will be twice that of the previous deduction.</li> <li>● The offending robot will receive 2 violation scores.</li> </ul>
<b>Red Card (Ejection)</b>	<ul style="list-style-type: none"> <li>● The offending robot is ejected: <ul style="list-style-type: none"> <li>➤ If it is before a match, the offending robot will be barred from the match and must leave the Battlefield</li> <li>➤ If the Dart System is ejected during the competition, the dart launching button will be hidden from view, the gate of the Dart Launching Station can no longer be opened; if the gate is already open, it will close immediately.</li> <li>➤ If a radar is ejected during the competition, the Radar's display in the Operator Room will be disconnected</li> </ul> </li> </ul>



Types of penalties	Description
	<ul style="list-style-type: none"> <li>➤ If a robot other than an Aerial, Dart and Radar is ejected during the competition, the robot's HP will be reduced to zero immediately and the video downlink display will become monochrome</li> <li>● Ejection of Pit Crew Members: Members ejected by the referee must immediately leave the Competition Area and no substitute Pit Crew Members are allowed in the remaining rounds of the match. The robot operated by the ejected Operator will be ejected for this round, and will not be allowed to enter or be substituted by other robots in all other rounds of the current match.</li> </ul>
<b>Forfeiture</b>	The team's results for the challenge are revoked.
<b>Disqualification</b>	<ul style="list-style-type: none"> <li>● The team member is disqualified from the current competition season.</li> <li>● The team is disqualified from the current competition season, but its results so far in this season will be maintained as a reference for other teams.</li> </ul>

If a robot's remaining HP is less than or equal to that needs to be deducted from penalty, this robot's HP reduces to 1.

### 6.1.4 Miscellaneous

Apart from forfeiture, no other penalties can form the basis for an appeal by a team. The Arbitration Commission may reject an appeal if it has been made on such a basis.

## 6.2 Penalty Rules

This chapter sets out the penalty rules and defines the relevant measures to be taken by the referee after a violation has occurred. Rules with a serial number R# are rules that must be adhered to by participating teams, team members and robots.

### 6.2.1 Staff

#### 6.2.1.1 Participating Teams/Personnel

R1 The requirements stated in [RoboMaster 2022 Technical Challenge Participant Manual](#) must be met.

Penalty: The highest penalty that can be imposed on the offending team is disqualification.

- R2 Teams must not set up their own wireless networks or communicate with team members using walkie-talkies in the relevant competition zones (including but not limited the Preparation Area, Inspection Area, Staging Area and Competition Area).

Penalty: The highest penalty that can be imposed on the offending team is disqualification.

- R3 Except for emergencies, teams must be at the Inspection Area at least 40 minutes before the start of a match to undergo the Pre-match Inspection.

Penalty: The most serious penalty that can be imposed is forfeiture of the match.

- R4 Except for emergencies, teams must stand by at the Staging Area before the start of a match.

Penalty: Forfeiture of the current match.

- R5 Team members must wear protective goggles when entering official designated areas such as the Preparation Area, Staging Area, Competition Area, and Projectile Unloading Area.

Penalty: The offender will be prevented from accessing the area.

- R6 Team members must not turn on the power and commission or repair their robots in the Staging Area.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the team shall be issued a Forfeiture of the match.

- R7 Team members are not allowed to power their equipment using the power supply for official equipment in the Competition Area. However, they may bring their own power supply.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offender shall be issued a Red Card. The highest penalty that can be imposed on the offending team is disqualification.

- R8 Team members are not allowed to leave the Staging Area or Competition Area without permission.

Penalty: Offending members are prohibited from entering the Staging Area and Competition Area. The most serious penalty that can be imposed on offenders is disqualification from the competition.

- R9 Apart from Pit Crew Members who have entered the Staging Area and Competition Area beforehand due to match-related reasons, no participants are allowed inside either area without special reasons.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offender shall be disqualified.

- R10 Except projectiles preset in the Inspection Area, teams must not bring their own projectiles into the Staging Area or Competition Area, and also must not take official projectiles away from the Competition Area.

Penalty: The staff will confiscate the projectiles and issue a verbal warning. If the warning is ineffective, the most serious penalty can be imposed on the offending participants is disqualification from the competition.

- R11 Teams must not damage any official equipment (including but not limited to equipment in the Competition

Area, Staging Area, Preparation Area and Inspection Area).

Penalty: Verbal Warning, and the offending team is required to pay compensation as per the price. The team may be issued a maximum penalty of disqualification, as judged based on the team's subjective intention and the impact of its violation on the competition process.

R12 Participants are not allowed to bring wireless headsets into the Operator Room.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the team shall be issued a Forfeiture of the match.

R13 During the Setup Period, team members must ensure their robots are operating safely and will not cause harm to any person or equipment in the Competition Area.

Penalty: The offending team must bear the relevant responsibility.

R14 In the lighting on a dart's triggering device malfunctions, such as when a light bead is damaged and unable to light up normally, team members will need to replace the dart's triggering device, otherwise the Base and Outpost will not be able to detect the damage inflicted by the dart.

Penalty: The Base and Outpost will not be able to detect the damage inflicted by the dart.

R15 During an Official Technical Timeout, Pit Crew Members are not allowed to fix faults other than those in modules related to the Referee System.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offender shall be issued a Red Card.

R16 After a match is over, members from both teams must power off all their robots, remove them from the Competition Area and empty all projectiles inside the robots at the Projectile Unloading Area.

Penalty: The offending robot will be detained in the Projectile Unloading Area, until its projectiles are cleared.

## 6.2.1.2 Pit Crew Members

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- Pit Crew Members: Regular Member and Supervisor who have registered for this Season and have been entered into the registration system, can walk into the Preparation Area and Competition Area.
- Captain Armband: Any regular member that wears the 'Captain' armband performs the Captain role during the match. Captain needs to control the team's competition schedule, confirms result, raises Team Technical Timeout and appeal.

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R17 Pit Crew Members must meet the identity and quantity requirements of the corresponding challenge. For details, refer to [RoboMaster 2022 Technical Challenge Participant Manual](#). One Pit Crew Member should wear the "Captain" armband and undertake the Captain's role.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the team shall be issued a Forfeiture of the

match.

R18 Pit Crews must wear armbands which must not be covered. The “Captain” sign of the Captain's armband must face the front.

Penalty: Verbal Warning.

R19 Pit Crew Members entering the Competition Area must not communicate with anyone from the outside.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the team shall be issued a Forfeiture of the match.

R20 During the final 30 seconds of the Setup Period or the final 20 seconds of a Team Technical Timeout, Pit Crew Members must leave the Battlefield as quickly as possible.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offender shall be issued a Red Card. If the offender does not obey the penalty order, the team shall be issued a Forfeiture of the match.

R21 After the end of the Setup Period, Pit Crew Members must return to the designated area outside the Battlefield. During the competition, Pit Crew Members are not allowed to leave the area without the permission of the referee.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offender shall be issued a Red Card. If the offender does not obey the penalty order, the offending team shall be issued a Forfeiture of the match.

R22 Pit Crew Members are not allowed to debug a Radar with a remote controller after the five-second countdown has started.

Penalty: Verbal Warning. If the verbal warning is ineffective, the team shall be issued a forfeiture of the match.

### 6.2.1.3 Operator

R23 The use of one's own computers is prohibited in the Operator's Room.

Penalty: Forfeiture of the round.

R24 Operators must remain in the relevant Operator's Room during the Referee System Initialization Period and the Match, to operate the relevant computers, and must remain in position after a match has started, unless otherwise permitted by the referee.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offender shall be issued a Red Card. If the offender does not obey the penalty order, the offending team shall be issued a Forfeiture of the match.

R25 During the competition, an Operator must operate the relevant robots and wear a headset, equipped with at most one remote controller.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offender and the robots operated by the

offender shall be issued a Red Card. If the offender does not obey the penalty order, the offending team shall be issued a Forfeiture of the round.

## 6.2.2 Robots

R26 The robots must meet the requirements in “[RoboMaster University Series 2022 Robot Building Specifications Manual](#)”.



- The RMOC will conduct random inspections on the robots from time to time.
- Any report made against a robot for not complying with the robot building specifications manual must be supported by the relevant evidence.

Penalty: Verbal warning. If the Verbal warning is ineffective, the most serious penalty that can be imposed is disqualification from the competition.

R27 Robots entering a match must pass Pre-match Inspection.

Penalty: Forfeiture of the round.

R28 In any challenge, the quantity of participating robots must meet the requirements stated in “1.2.1 Robot Line-up”.

Penalty: Forfeiture of the current match.

R29 When waiting in the Staging Area, team members are not allowed to bring robots out of the Staging Area without permission.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the highest penalty that can be imposed on an offending robot is a Red Card.

R30 Robot must not carry or present safety issues including but not limited to short circuits, crashing and falling to the ground. If safety issues are present or have arisen, the relevant personnel must execute the relevant operations in accordance with the referee’s instructions.

Penalty: Before the start of the competition, Pit Crew Members must resolve the safety issue as required by the referee. Otherwise the offending robot will not be allowed to enter the match, and the relevant Operator will not be allowed to enter the Operator’s Room or must surrender its remote controller, and must return to the Pit Area. Verbal Warning given during the competition. If the Verbal Warning is ineffective, a Red Card shall be issued against the offender and the robot operated by him/her or the offending robot. Any situation involving serious safety hazards shall be dealt with by the Chief Referee in accordance with “6.3 Serious Violations”.

R31 During the 5-second countdown in the Referee System Initialization Period, robot is not allowed to transform beyond their Maximum Initial Size.

Penalty: After the start of the competition, the offending team is issued a Yellow Card.

R32 During the Setup Period and the Referee System Initialization Period, robots in the Battlefield are not allowed to leave their corresponding initialization zones.

Penalty: If it is during the Setup Period, a Verbal Warning shall be given. If the Verbal Warning is ineffective, the highest penalty that can be imposed on the offending team is a Red Card. If it is during the Referee System Initialization Period, the Chief Referee shall issue a Yellow Card or Red Card against the offending team, judged based on the offending team's subjective intention and the impact of its violation on the competition.

R33 During the competition, the robot is not allowed to disintegrate into sub-robots or sub-systems connected by multiple flexible cables, and must not cast or launch their own parts.

Penalty: The offending robot will be issued a Red Card.

R34 Standard Robots to be fitted with a balancing chassis must meet the definition of a Balancing Standard Robot when it is living. This does not apply to Standard Robot under Non-surviving Status.



Balancing Standard Robot: A Standard Robot that meets the definition of a Balancing Standard Robot can be fit with a balancing chassis. Only Standard Robots with a balancing chassis are allowed additional Barrel Heat Buffs. These Standard Robots are called "Balancing Standard Robots".

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Penalty: Warnings shall be issued against the offending team based on the length of the violation. If it exceeds 3 seconds, a first Yellow Card is issued. Thereafter, each 10 seconds will incur a further Yellow Card. This carries on until the robot is depleted.

R35 No robot may continuously launch projectiles or darts out of the Competition Area.

Penalty: Verbal warning. If the Verbal warning is ineffective, the offending robot shall be issued a Red Card.

### 6.2.3 Interaction

R36 During any match in this season, participating robots may only use projectiles supplied by the RMOC.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the highest penalty that can be imposed on the offending team is disqualification, based on the seriousness of the situation.

R37 Robots are not allowed to procure directly projectiles that have fallen to the ground.

Penalty: The offending robot will be issued a Red Card.

R38 The Engineer can only carry one mineral each time and move the mineral by carrying it.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offending robot will be issued a Red Card.

R39 The Hero Robot is not allowed to leave the Sniper Point.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offending robot shall be issued a Red Card.

R40 During the competition, the moving mechanisms of robots must not actively cause any damage to the core components of the Competition Area.

Penalty: The highest penalty that can be imposed on an offending team is Forfeiture for that match.

## 6.3 Serious Violations

The following actions are considered serious violations of rules. The highest penalty a referee may impose on an offending team for serious violations is disqualification.

Table 6-3 Categories of Serious Violations

Rule	Type
1.	The participants are not members of the team, or the participating robots do not belong to the team.
2.	Replacing backup robots without permission, or exceeding the maximum quantity limit for backup robots
3.	Violating rules mentioned in this chapter and refusing to accept penalties, for example a Pit Crew Member interfering with the regular work process of a referee.
4.	Tampering with or damaging the Referee System, or interfering with any detecting function of the Referee System through technical means.
5.	Installing explosives or other prohibited materials on robots
6.	A situation has occurred in the Competition Area that violates Pre-Match Inspection requirements
7.	A team member deliberately damaging the opponent's robots, Battlefield Components and related equipment.
8.	Causing delays deliberately or refusing to immediately leave the Competition Area after a match has ended, thereby disrupting the schedule of the competition
9.	A team member using robots to collide into or attack other people deliberately, putting themselves and other people at risk of injury
10.	Serious verbal or physical conflicts between team members and the staff of the RMOC, other participating teams, audience, etc.

Rule	Type
11.	A team member's refusal to cooperate, deliberate delay or provision of false materials and information during the RMCO's handling of an appeal request.
12.	In respect of any violation of local laws and regulations occurring inside the Competition Area, Audience Area, dormitories or other relevant competition zones during the competition, the RMOC, apart from issuing the most severe penalty of "disqualification", will fully cooperate with the relevant authorities to pursue appropriate legal actions against the offenders.
13.	Any other violation that seriously affects the progress of the matches, goes against the spirit of fair competition, or is deemed as serious in nature by the Chief Referee.



## 7. Irregularities



There may be some degree of delay in the referee's issuance of a manual penalty and handling of an irregularity. If the competition's outcome has been seriously affected, the Chief Referee will determine the final penalty based on the actual circumstances.

If any of the following anomalies occur during the competition, it shall be handled in accordance with the corresponding process, to which the teams may not object. The handling process is as follows:

- When a robot safety hazard or irregularity in a robot has occurred on the Battlefield, such as battery explosion, the breakage of an Aerial Safety Rope by an Aerial Robot, stadium power outage, explosion of a compressed gas cylinder, or interpersonal conflict), the Chief Referee will notify the operators after discovering and confirming the emergency, and eject all robots through the Referee System. The result of the round will be invalidated. The round will restart after the safety hazard or exception has been eliminated.
- If non-key Battlefield Components are damaged during a match (damage to the ground rubber surface, ground lighting, or Base lighting), which do not affect the fairness of the match, the match will proceed as usual.
- If key Battlefield Components experience logical or structural faults, for example where the network connections are disrupted causing a robot to go offline, no buff is gained after a Power Rune is hit, or a Battlefield Component does not operate normally, the referee will solve the problem manually through the Referee System. If the problem cannot be solved manually, the referee will notify the operators and eject all robots. The round of the match ends immediately and its results are invalidated. The round will restart after the issue has been solved.
- During a match, if the fairness of a match has been affected by the malfunction or structural damage of a key Battlefield Component, and the Chief Referee did not confirm the situation and end the competition in time, causing a round that should have been ended to continue and thereby producing a winner, a rematch will be required and the results of the round will be invalidated, after an appeal has been made or the Chief Referee has made a determination to that effect after the end of the round.
- In the case of a serious violation that would clearly have triggered a penalty of forfeiture, and the Chief Referee did not confirm and execute it in time, the results of the round will be invalidated after an appeal has been made or the Chief Referee has made a determination to that effect after the end of the round, and the offending team will be issued a forfeiture.

## 8. Appeals

For every challenge, each team has one appeal opportunity during the Regional Competition and one during the National Competition. Appeal opportunities cannot be used cumulatively across competitions. If an appeal is successful, the team involved retains its right to appeal again in future matches. If it is unsuccessful, the team will have exhausted its one opportunity to appeal. When a team has exhausted its opportunity to appeal, the RMOC will no longer accept any appeal from the team. When processing an appeal, an Arbitration Commission will be formed by the Chief Referee and heads of the RMOC. The Arbitration Commission has the final right of interpretation on all appeal decisions.

### 8.1 Appeal Process

Teams lodging an appeal must follow the procedure below:

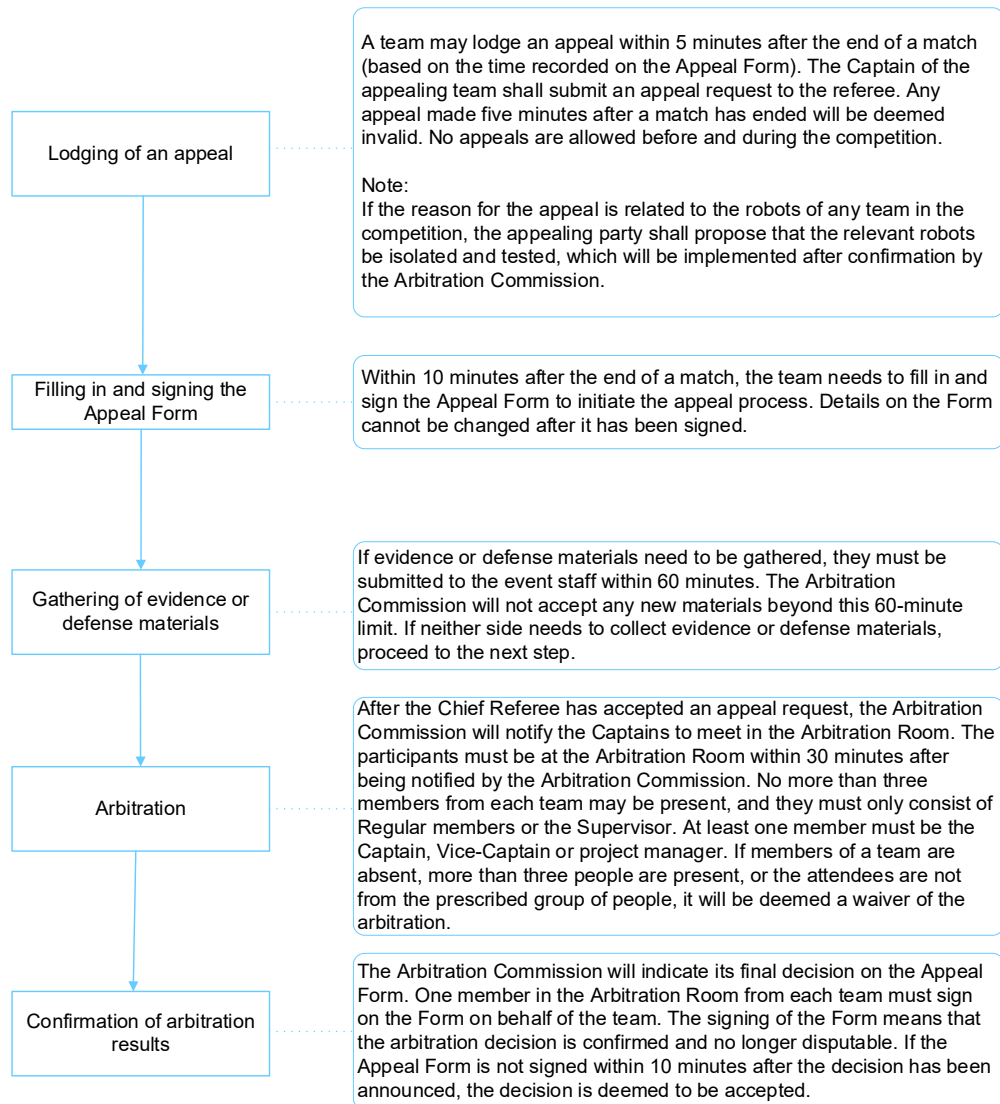


Figure 8-1 Appeal Process

## 8.2 Appeal Materials

Appeal materials submitted by teams must follow the below specifications:

- **Material type:** Only materials stored on a USB flash drive and the robots themselves will be accepted as appeal materials. Materials submitted in other forms will not be accepted by the Arbitration Commission.

- USB flash drives: The edited video (the video materials should be prepared by the team itself) and the text files for the appeal should be placed according to the directory.
- Material format: No video may exceed one minute in length or 100MB in size. The name of the video must indicate the specific match, the round of the match and the time it was taken (rounded to minutes). The videos should be compatible with the latest version of Windows Media Player; the photos must be in JPG format; and the text documents must be in PDF format and not exceed 1,000 words in length.
- Material naming: The file name of each video and photo must be within 30 Chinese characters.
- Text requirements: One text file can only correspond to one video or a photo, which must be indicated in the text. Text files only need to explain the violations reflected in the corresponding materials.
- Robot evidence: The Arbitration Commission has the authority to isolate any relevant robot from both teams after an appeal has been made. These robots will be returned to the teams at the latest when the arbitration decision is announced.

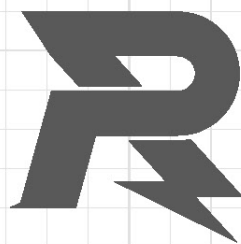
## 8.3 Appeal Decision

The Arbitration Commission may either rule to maintain the match results or to have a rematch. Teams are not allowed to appeal against the decision made by the Arbitration Commission.



Provided it does not affect the schedule of the entire competition, the rematch will in principle be held on the same day after all the other matches.

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