

V1.0

Using a 9V-5V motor driver chip and Field-Oriented Control (FOC), the RoboMaster C930 Brushless DC Motor Speed Controller enables precise control over motor torque.



Exclusively designed for the RoboMaster M600 P10 Brushless DC Motor and C930 Brushless DC Motor Speed Controller, the M1600 Assembly Kit includes screws, cables and a terminal board.

RoboMaster System Specification Manual, RoboMaster System User Manual, Introduction of RoboMaster System Module

The M600 Assembly Kit includes screw cables and a terminal board, ensuring a complete assembly system without any third-party modules.

ROBOMASTER 2020

ROBOTICS COMPETITION

RULES MANUAL

Prepared by the RoboMaster Organizing Committee
Updated on October, 2019

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Using this Manual

Legend

 Prohibition	 Important	 Hints and Tips	 Reference
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Release Notes

Date	Version	Changes
2019.10.31	V1.0	First Release

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1. Introduction

The core form of the RoboMaster 2020 Robotics Competition (“RM2020 Robotics Competition”) is a shootout between robots that are either remotely operated or fully-automated, where projectiles are launched to attack the opponent’s robots, Outpost or Base to win the competition. Teams are required to design, develop and create multiple robots to form a battle team to participate in the competition.

1.1 Main Changes to New Competition Season

The following are the new changes made to the RM2020 Robotics Competition compared to RM2019:

Robot

- Add Dart System and Radar and update robot lineup and numbering
- Update basic information such as robot parameters
- Adjust Level Up Mechanism for Hero and Standard
- Engineer can revive Standard and Hero by swiping the RFID card and supply projectiles via the Official Projectile Supplier
- Add new mechanism related to Outpost
- Add a new mobile 17mm Launching Mechanism is added

Competition Area

- Redesign the Battlefield, with a greater drop height
- Add new Battlefield Components such as Outpost, Dart Launching Station and Radar Base

1.2 Robot and Operator

RoboMaster requires robots to fight together as a team with good coordination and teamwork. Building specifications for robots can be found in the RoboMaster 2020 Robot Building Specification Manual.

1.2.1 Robot Lineup

The robot lineup for the RM2020 Robotics Competition is as follows:

Table 1-1 Robot Lineup

Type	Numbering	Full Team Size (Units)	Competition Stage
Hero	1	1	China Regional Competition, International Regional Competition, Wild Card Competition and Final Tournament
Engineer	2	1	

Type	Numbering	Full Team Size (Units)	Competition Stage
Standard	3/4/5	2	China Regional Competition
		3	International Regional Competition, Wild Card Competition and Final Tournament
Aerial	6	1	China Regional Competition, International Regional Competition, Wild Card Competition and Final Tournament
Sentry	7	1	
Dart System	8	1	
Radar	9	1	

Minimum lineup for each match: Except for Radar, four robots.

1.2.2 Basic Robot Information

The basic robot information for the RM2020 Robotics Competition is as follows:

Table 1-2 Basic Robot Information

Type	Objects	Initial Projectile (round)	Maximum Chassis Power Consumption (W)	Initial HP	Maximum HP	Initial Firing Speed Limit (m/s)	Barrel Heat Limit	Barrel Cooling Value per Second	Value of Experience Points	Projectile Launch Speed (round/s)	Initial Position
Hero	Enemy units except Aerial, Radar and Dart Launcher	0	Correlated to the robot's current level and performance level - refer to Table 3-4 and 3-5 For the buffer energy correlated to the maximum chassis power consumption - refer to 3.7.3 Chassis Power Consumption Exceeds the Limit							Negatively correlated to initial velocity -	Starting Zone

Type	Objects	Initial Projectile (round)	Maximum Chassis Power Consumption (W)	Initial HP	Maximum HP	Initial Firing Speed Limit (m/s)	Barrel Heat Limit	Barrel Cooling Value per Second	Value of Experience Points	Projectile Launch Speed (round/s)	Initial Position
										refer to 3.7.2 Barrel Heat Exceeds the Limit and Cooling	
Engineer	Except for Aerial, Radar and Dart Launcher	0	Unlimited	500	500	See Table 1-4			5	Negatively correlated to initial velocity - refer to 3.7.2 Barrel Heat Exceeds the Limit and Cooling	Starting Zone
Standard	Enemy units except Aerial, Radar and Dart Launcher	0	<p>Correlated to the robot's current level and performance level - refer to Table 3-2 and 3-3</p> <p>For the buffer energy correlated to the maximum chassis power consumption - refer to 3.7.3 Chassis Power Consumption Exceeds the Limit</p>							Negatively correlated to initial velocity -	Starting Zone

Type	Objects	Initial Projectile (round)	Maximum Chassis Power Consumption (W)	Initial HP	Maximum HP	Initial Firing Speed Limit (m/s)	Barrel Heat Limit	Barrel Cooling Value per Second	Value of Experience Points	Projectile Launch Speed (round/s)	Initial Position
										refer to 3.7.2 Barrel Heat Exceeds the Limit and Cooling	
Aerial	Enemy units except Aerial, Radar and Dart Launcher	250	-	-	-	30	-	-	-	Unlimited	Landing Pad
Sentry	Enemy units except Aerial, Radar and Dart Launcher	500	30 Buffer energy is 200J	600	600	30	480	160	7.5	Negatively correlated to initial velocity - refer to 3.7.2 Barrel Heat Exceeds the Limit and Cooling	Sentry Rail

Type	Objects	Initial Projectile (round)	Maximum Chassis Power Consumption (W)	Initial HP	Maximum HP	Initial Firing Speed Limit (m/s)	Barrel Heat Limit	Barrel Cooling Value per Second	Value of Experience Points	Projectile Launch Speed (round/s)	Initial Position
Dart System	Base, Outpost	-	-	-	-	18	-	-	-	-	Dart Launcher
Radar	-	-	-	-	-	-	-	-	-	-	Radar Base



- Robot chassis: A mechanism that carries and has mounted a robot propulsion system and its accessories.
- Chassis power consumption: The power propulsion system that enables a robot to move horizontally, excluding the power used for special tasks (e.g., power consumption for functional movements such as moving the upper mechanical structure).
- Initial Firing Speed limit: The speed detected by the Speed Monitor Module of Referee System after a projectile or dart has completed its acceleration. The Initial Firing Speed for 17mm projectile is 30 m/s, 42mm projectile 16 m/s, and dart 18 m/s.

1.2.3 Operator Lineup

The Operator lineup is as follows:

Table 1-3 Operator Lineup

Type	Robot Operated	Full Team Lineup Size
Ground Robot Operator	Hero	1
	Standard	<ul style="list-style-type: none"> ● China Regional Competition: 2 ● International Regional Competition, Wild Card Competition and Final Tournament: 3
	Engineer	1
Aerial Gimbal Operator	Aerial, Dart System, Radar	1

Type	Robot Operated	Full Team Lineup Size
Pilot	Aerial	1

1.2.4 Mobile 17mm Launching Mechanism



Ground Robot: Standard, Hero, Engineer and Sentry, collectively.

A mobile 17mm Launching Mechanism can be mounted on any Ground Robot except Sentry. The mobile 17mm Launching Mechanism can be equipped with a laser sight.

For example, a participating team can mount a mobile 17mm Launching Mechanism on a Standard as required. The Robot will then be equipped with two 17mm Launching Mechanisms.

The barrel heat of the 17mm Launching Mechanism shall be calculated separately from the existing Launching Mechanism. Its Initial Firing Speed limit, Barrel Heat limit and Barrel Cooling Value per Second shall be consistent with those of the existing Launching Mechanism.

For example, a participating team can mount the mobile 17mm Launching Mechanism on Hero. According to 3.6.2 Performance System, when Hero has reached Level 2, the Operator may use 2 performance points to upgrade its Initial Firing Speed limit from Level 0 to Level 2, which increases the Initial Firing Speed limit of the 17mm Launching Mechanism to 15 m/s, its barrel heat to 300, and Barrel Cooling Value per Second to 40. The Initial Firing Speed limit of a 42mm Launching Mechanism will be increased to 12 m/s, its barrel heat to 300, and barrel cooling rate to 40.

Table 1-4 Mobile 17mm Launching Mechanism

Type	Initial Firing Speed Limit (m/s)	Barrel Heat Limit	Barrel Cooling Value per Second
Hero	See Table 3-3	See Table 3-4	
Standard		See Table 3-2	
Engineer	15	300	50

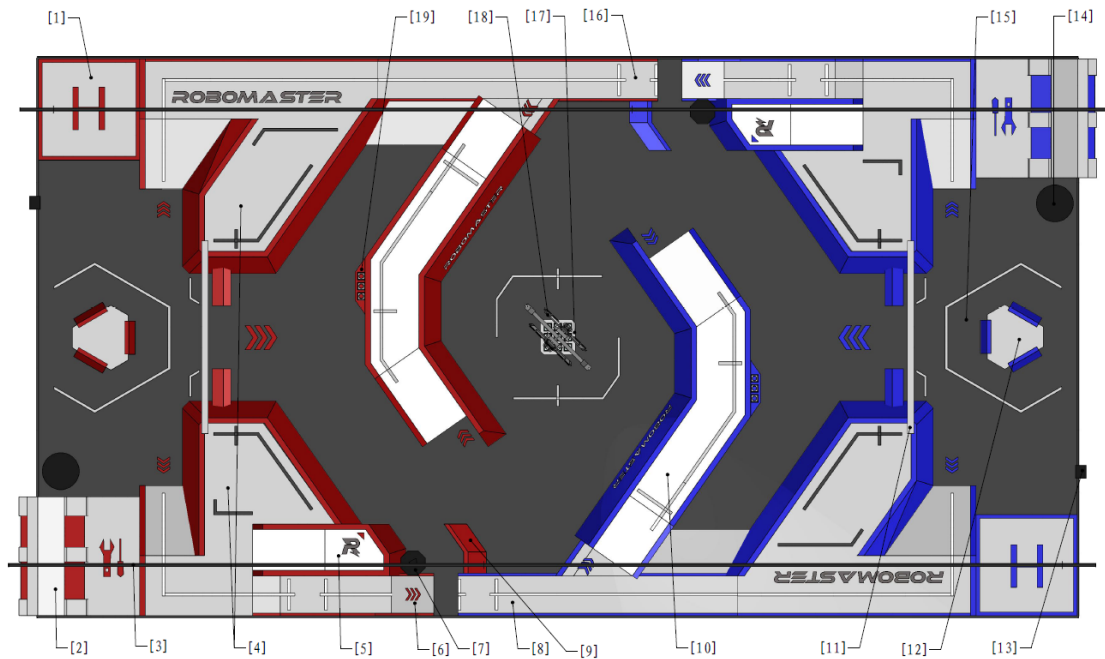
2. Competition Area

2.1 Overview



- The margins of error for all Battlefield Components described herein are within $\pm 5\%$. The unit for size parameters is mm.
- For the gain mechanisms of certain zones covered in this chapter, refer to [3.4 Gain Zone Mechanism](#).

The core Competition Area for the RoboMaster 2020 Robotics Competition is called the “Battlefield”. The Battlefield is an area with the size of 28m x 15m, consisting mainly of Base Zone, Elevated Zone, Resource Island, Supplier Zone, Flight Zone, etc.



[1]	Landing Pad	[2]	Supplier Zone	[3]	Aerial Rope	[4]	Safety	[5]	Elevated Ground on Base Zone
[6]	Power Rune Activation Point	[7]	Launch Ramp	[8]	Outpost	[9]	Road	[10]	Outpost Perimeter Wall
[11]	Ring-shaped Elevated Ground	[12]	Sentry Rail	[13]	Base Zone	[14]	Radar Base	[15]	Dart Launcher
[16]	Starting Zone	[17]	Launch Ramp Penalty Zone	[18]	Resource Island	[19]	Power Rune	[20]	Small Resource Island

Figure 2-1 Top View of Battlefield

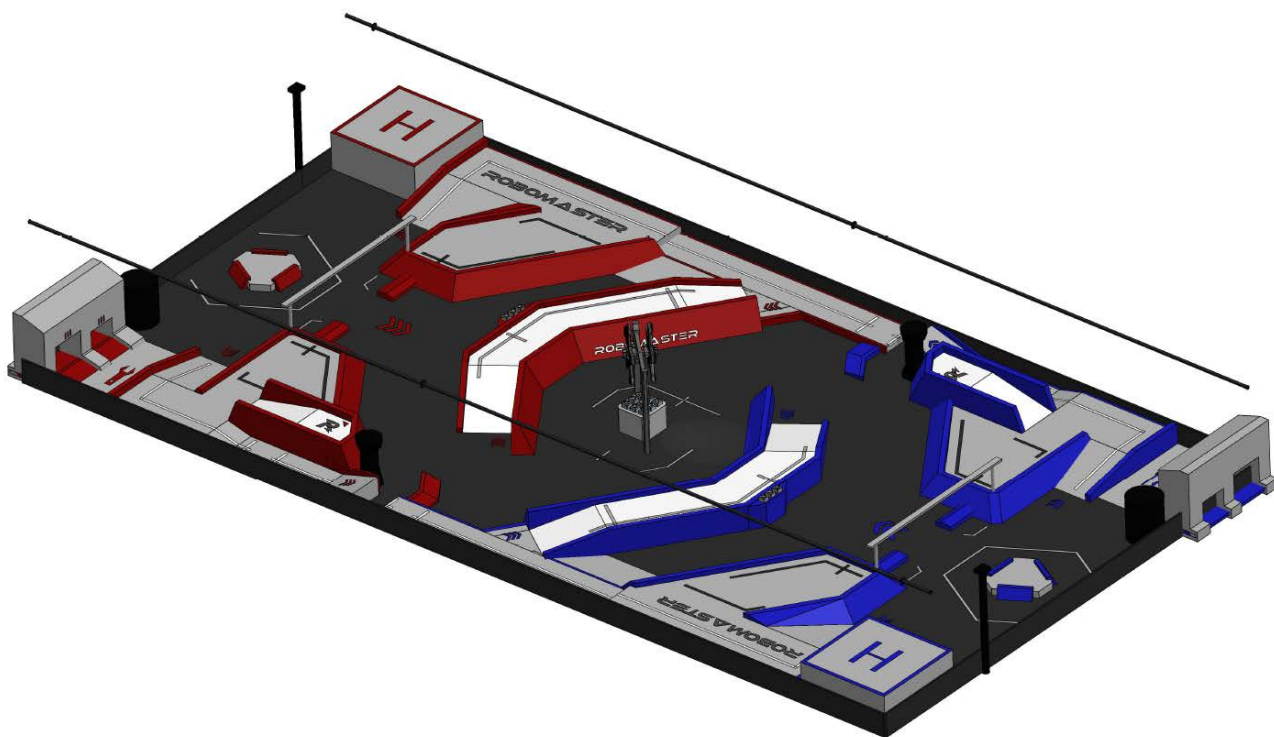


Figure 2-2 Axonometric View of Battlefield

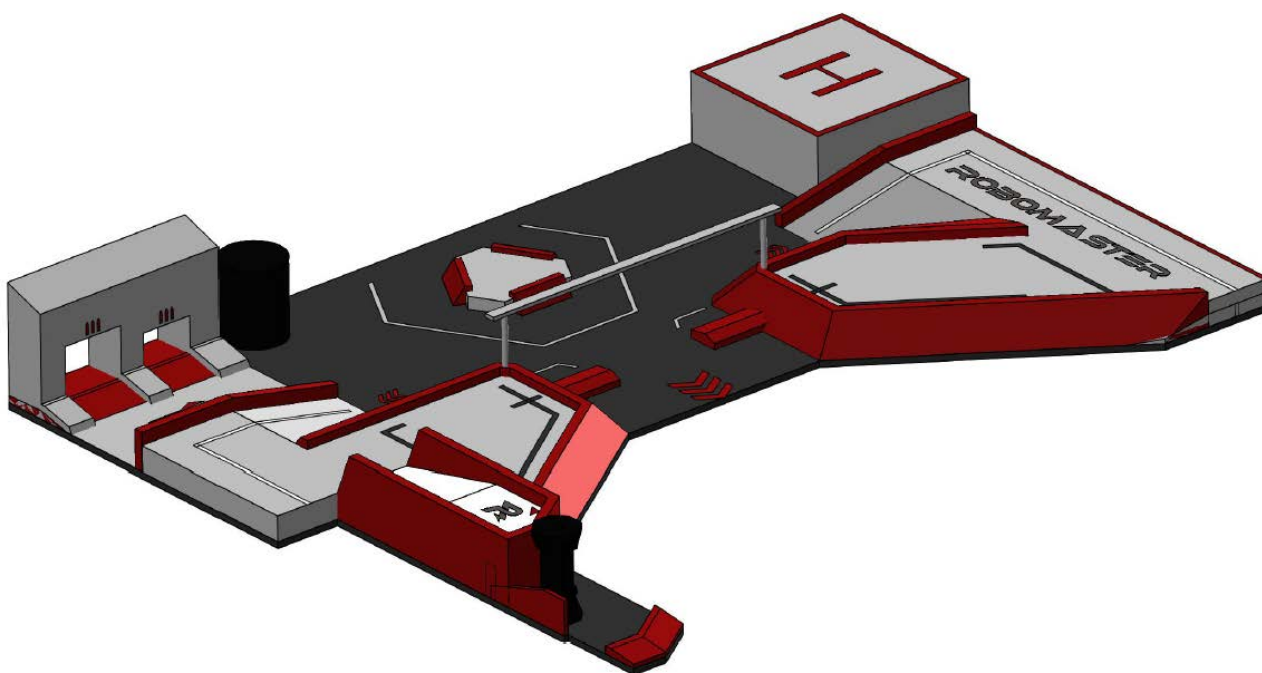
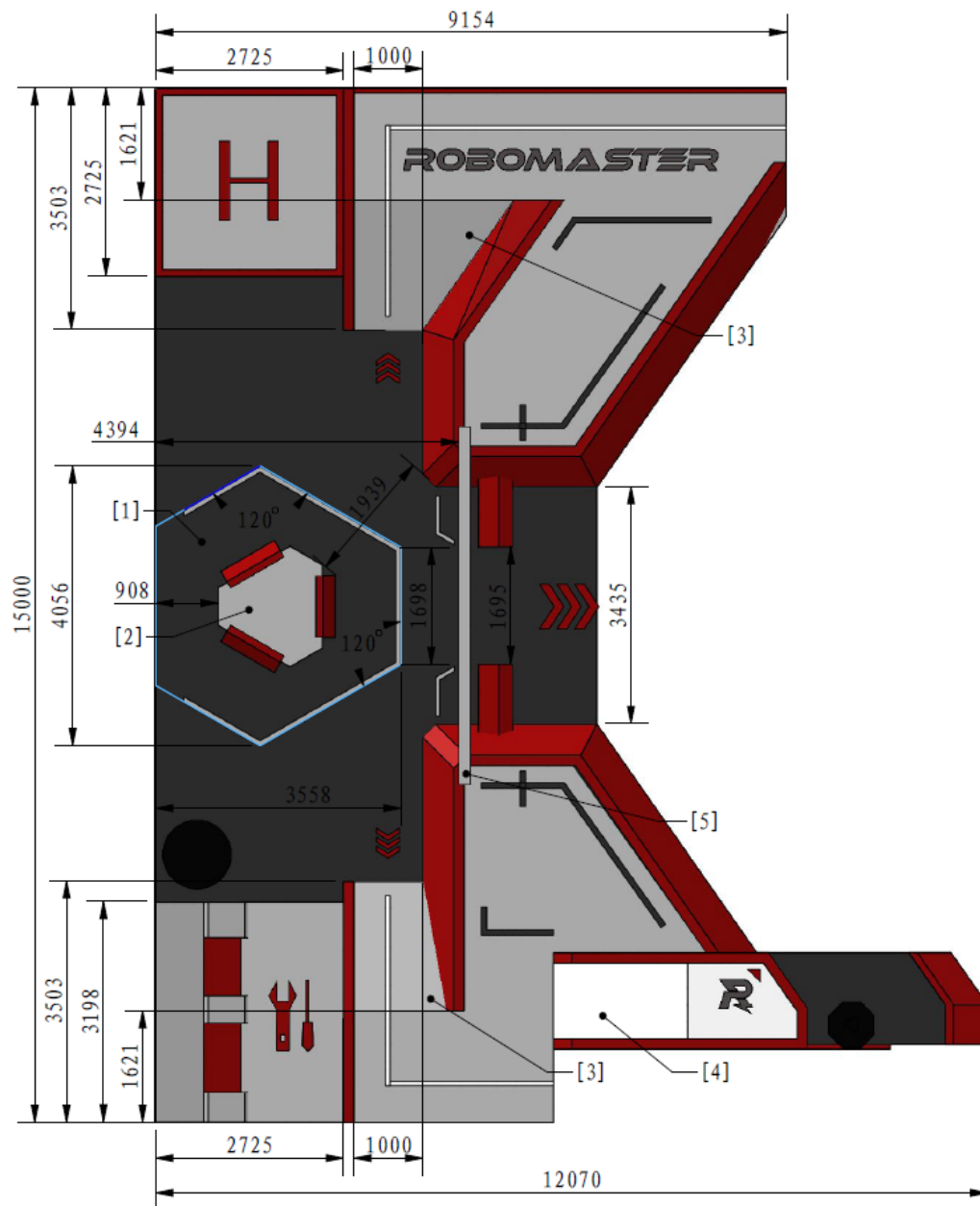


Figure 2-3 Axonometric View of Red Team's Area

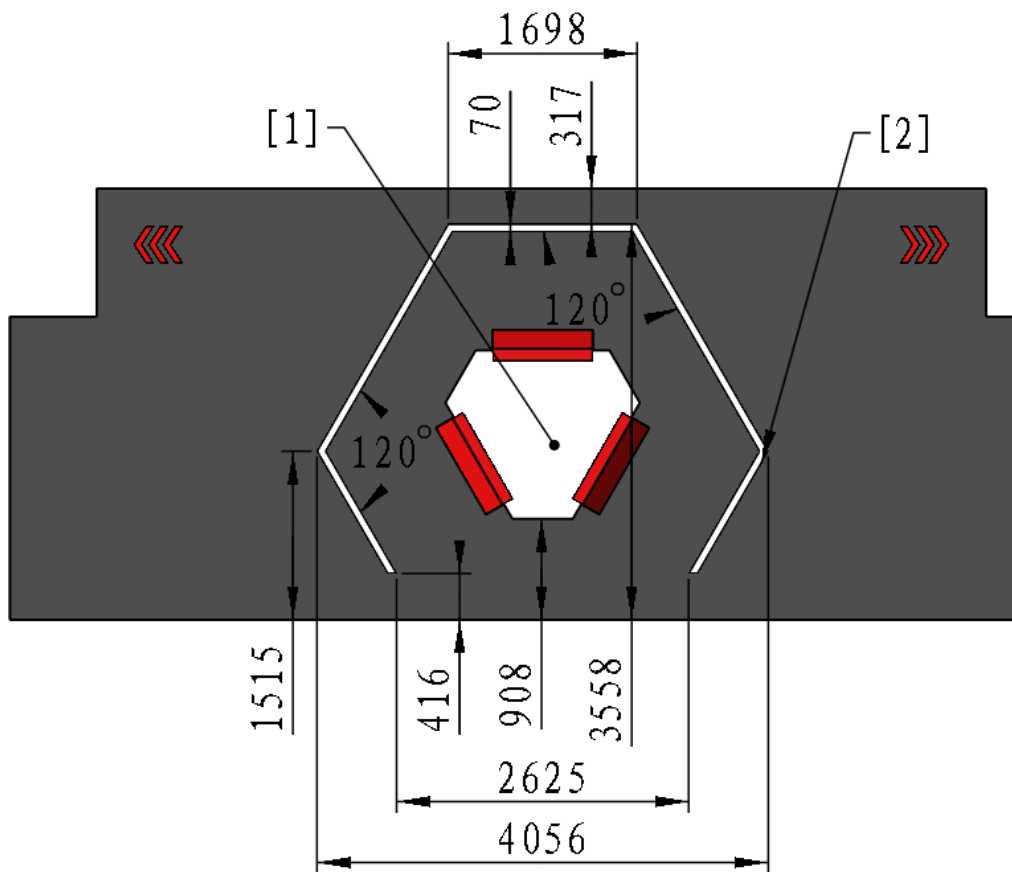


- [1] Starting Zone (within blue frame) [2] Base Zone [3] 12° slope
 [4] 13° slope [5] Sentry Rail

Figure 2-4 Top View of Red Team's Area

2.2 Base Zone

Base Zone is located in Starting Zone. A Base is in the center of the Base Zone. Base Zone platform and the space above are penalty zones for robots of both sides.



[1] Base Zone [2] Starting Zone

Figure 2-5 Base Zone Graph

2.2.1 Starting Zone

Starting Zone is where robots are placed before a match begins. The location of Starting Zone is shown above.

2.2.2 Base

The maximum HP of Base is 5000. The Red and Blue Teams each have their own Base.

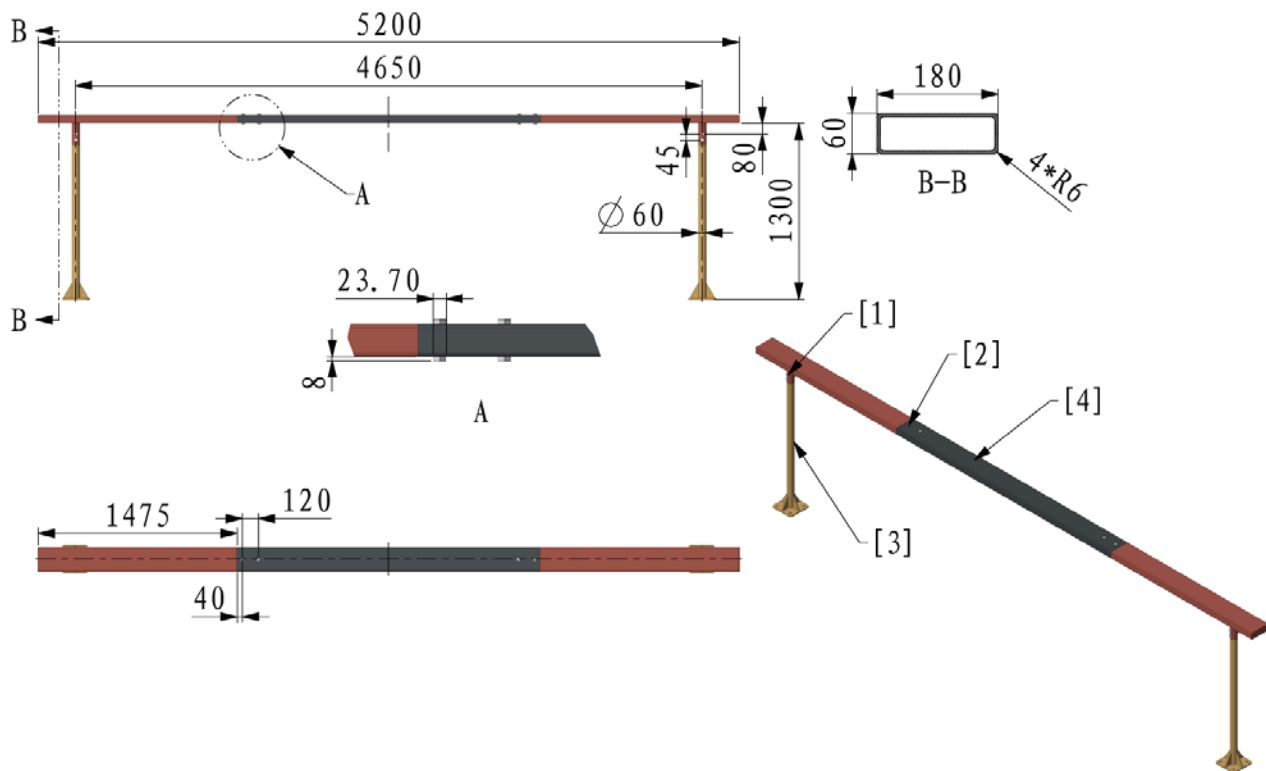
2.2.3 Sentry Rail



- Items with the same color in the drawing represent the same part.
- Parts are connected by bolts. A certain altitude difference and splicing gap will occur in the connection assembly.
- The flat tubes and round tubes of each part are welded together.
- Flat tubes are formed by folding the three corners, and the final corner is welded shut.
- The angle of the hexagonal bolt head after tightening is not fixed. The drawing is for reference only.

Sentry Rail consists of the main rail and its supporting frame. The main rail is the only area on which Sentry moves. The distance between the lower surface of the Sentry Rail and the Battlefield ground is 1300mm. However, due to the weight of the rail itself and other factors, a certain altitude difference will occur between the middle and the

ends of the Sentry Rail. Therefore, the actual distance between the lower surface of the Sentry Rail and the Battlefield ground is 1250-1300mm.



- [1] Connection of M8 Nut and Bolt [2] M16 Bolt
- [3] Rail Support [4] Rail Beam

Figure 2-6 Sentry Rail Graph

2.3 Elevated Zone

Elevated Zone includes Elevated Grounds, an Outpost and a Road. Elevated Zone is divided into the Base Zone Elevated Ground and Ring-shaped Elevated Ground, at an altitude of 400m and 600m, respectively.

A Ring-shaped Elevated Ground has a Small Resource Island. A Small Resource Island holds three Projectile Containers, each containing five rounds of 42mm projectiles.

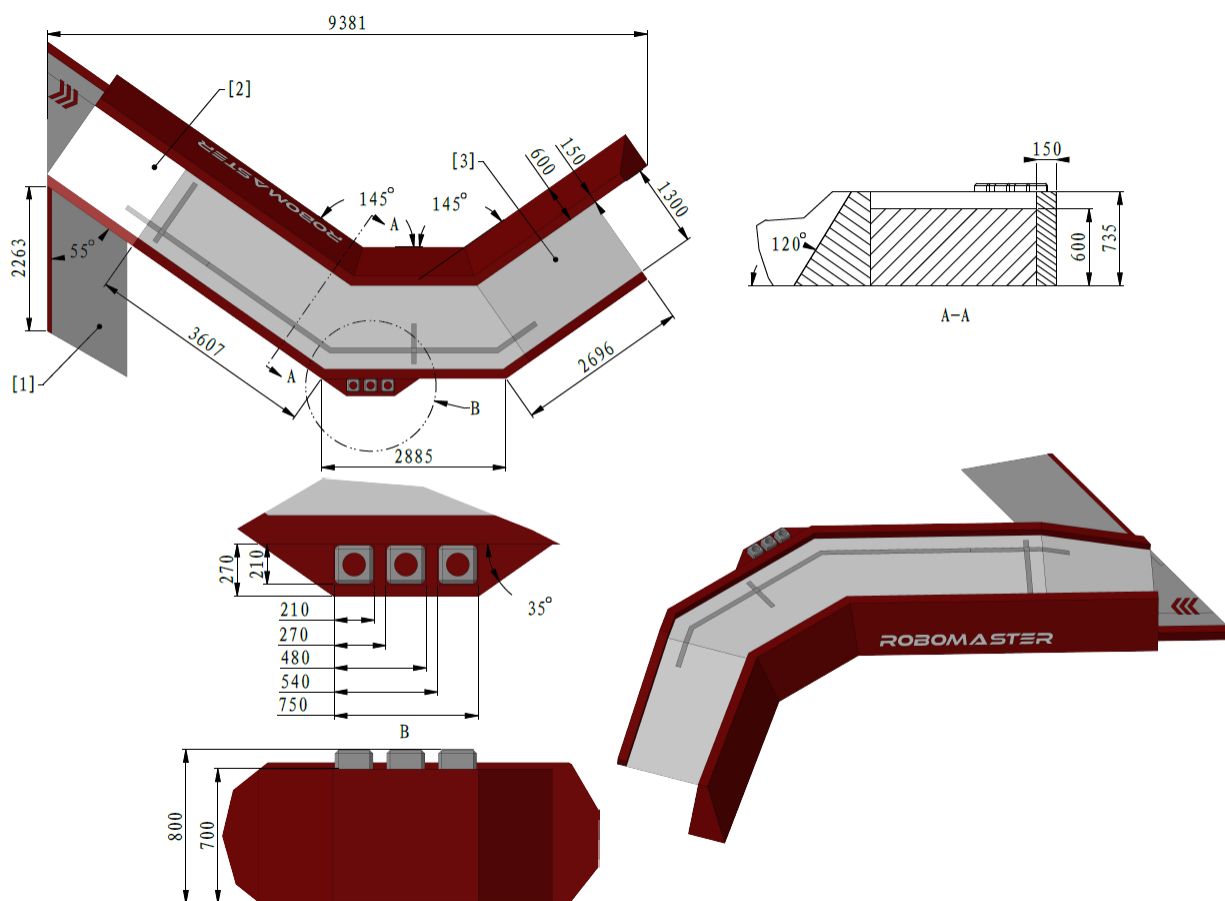


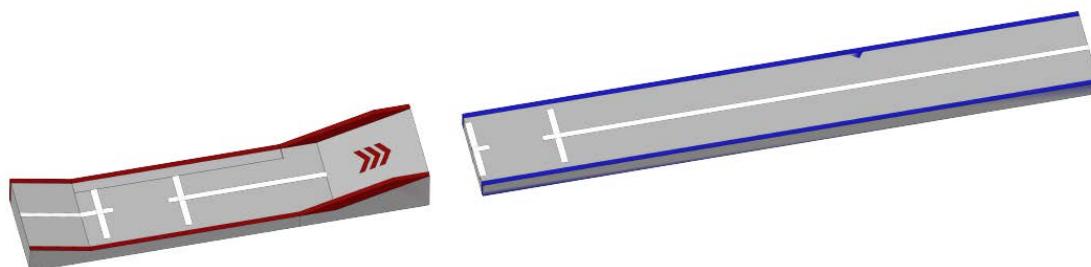
Figure 2-7 Ring-shaped Elevated Ground Graph

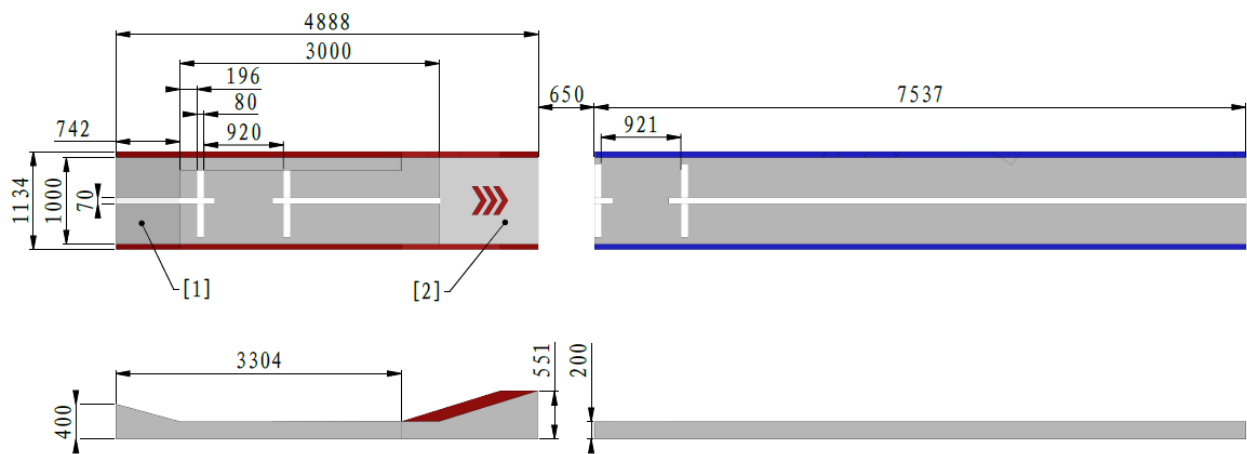
2.3.1 Outpost

The maximum HP of Outpost is 2000. The Red and Blue Teams each have their own Outpost.

2.3.2 Road

Road is located in the middle of the Elevated Zone, connecting the Base Zone Elevated Ground of one side and the Ring-shaped Elevated Ground of the other side. A Road consists of a Launch Ramp and a Launch Ramp Penalty Zone.





[1] 15° slope [2] 17° slope

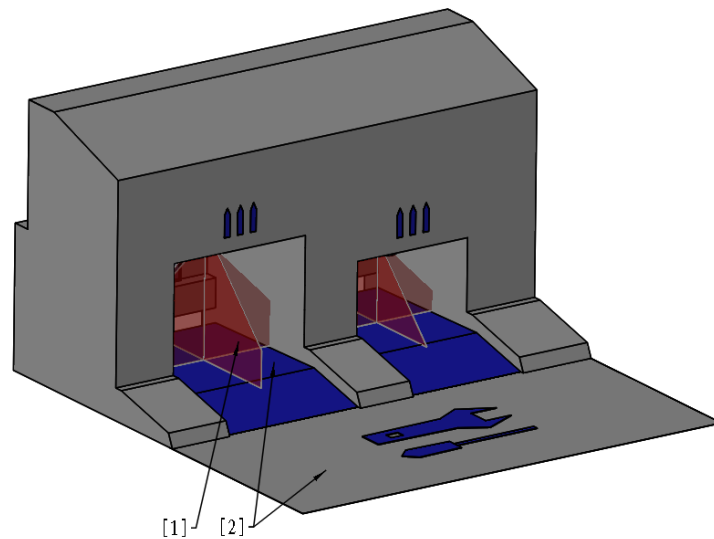
Figure 2-8 Road Graph

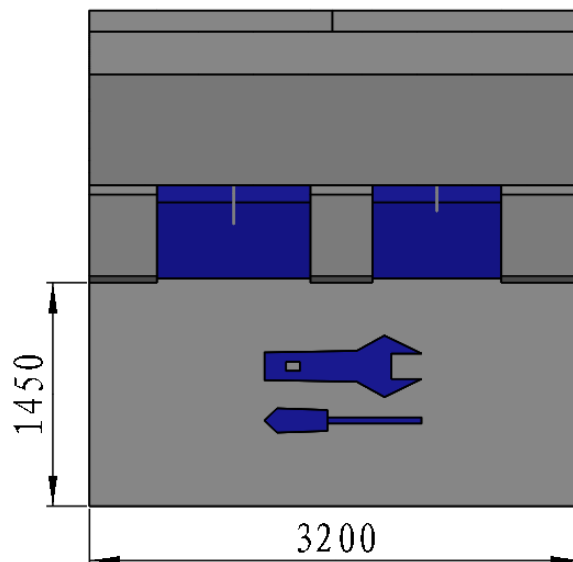
2.4 Supplier Zone

A Supplier Zone is an important area for robots to reload projectiles, revive defeated robots and restore HP. Both Red and Blue Teams each have a Supplier Zone. A Supplier Zone consists of a Restoration Zone and an Official Projectile Supplier.



Since the opening of the Projectile Outlet is large, teams are advised to enlarge the Projectile Loading Ports of robots and use buffer materials for the internal walls of magazines to prevent projectiles from scattering on the ground when they are loaded into a robot's magazine.





[1] Laser Light Path [2] Restoration Zone [3] 2° slope [4] 13° slope

Figure 2-9 Supplier Zone Graph

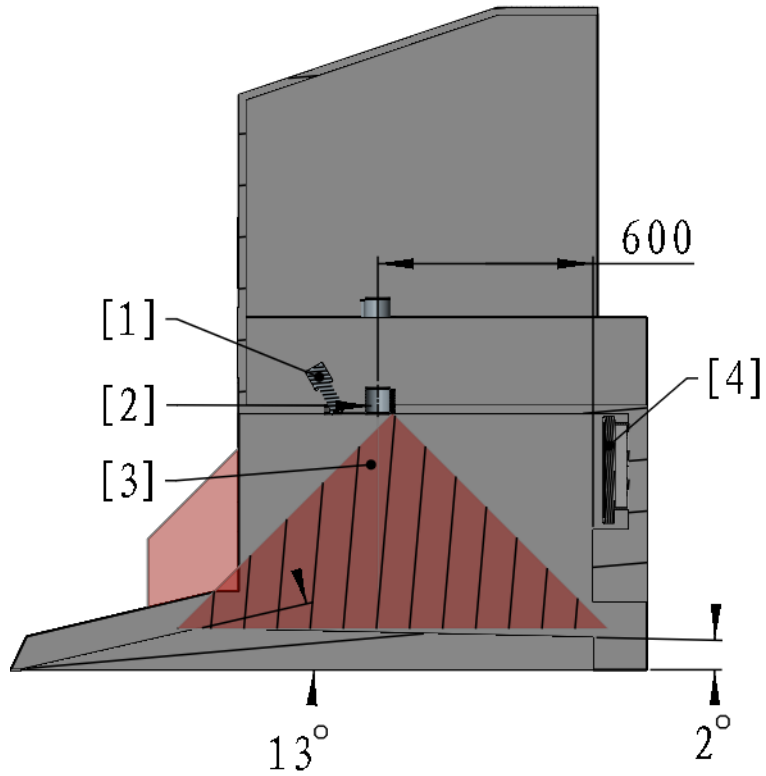
2.4.1 Restoration Zone

A Supplier Zone has three Restoration Zones, with the size of 1450*3200mm, 1000*1100mm and 1000*800mm, respectively.

2.4.2 Official Projectile Supplier

An Official Projectile Supplier provides 17mm projectiles during a match, including Projectile Outlets, a laser sight for alignment assistance, a camera and a monitor. Each team has its own Official Projectile Supplier. At the beginning of each round, an Official Projectile Supplier will issue 200 rounds of 17mm Projectiles, and then 50 rounds per 20 seconds up to six minutes into the match (i.e. countdown at 0:59).

The supply of projectiles at the Official Projectile Supplier is directly controlled by the Operator on the client interface. When a round starts, the Operator controls the robot and moves it toward the lower area of the Projectile Outlet of the Official Projectile Supplier. Then the camera will capture the image of the robot's magazine in real time and display it on the front monitor. The Operator can adjust the position of the robot through the laser projected by the cross laser light. This allows the Operator to determine whether or not to load projectiles. When it has been decided that projectiles will be loaded, the Operator will press the "0" key on the keyboard. If at this time the robot's own side has remaining projectiles and the robot has detected the RFID Interaction Module Card below the Supplier Zone, the Operator can directly select the quantity of projectiles to be supplied on the Projectile Supply panel to complete the loading process. If the robot fails to detect any RFID Interaction Module Card, the projectiles can be loaded using the "Force Projectile Loading" prompt command.



- [1] Camera [2] Projectile Outlet [3] Horizontal Laser Light Path [4] 21" Monitor

Figure 2-10 Official Projectile Supplier Graph

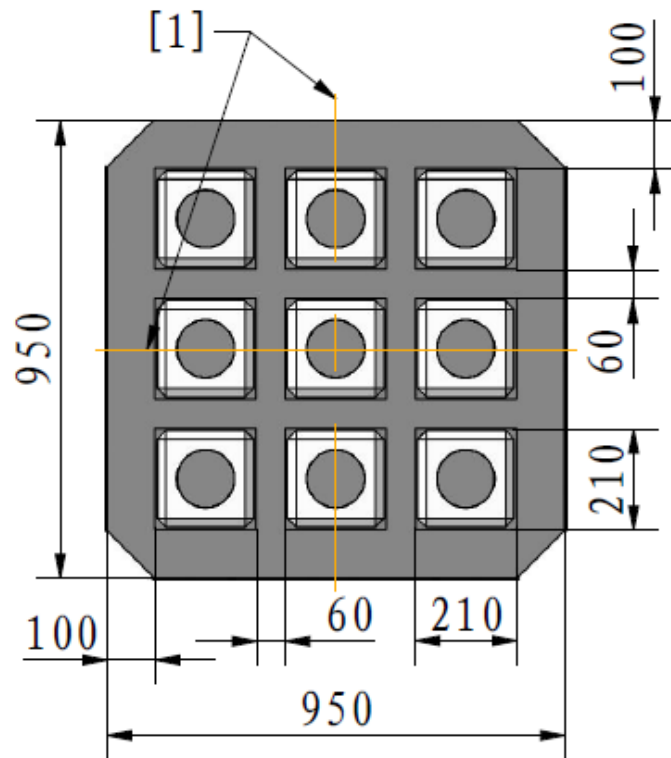
2.4.3 Supplier Penalty Zone

The Supplier Zone of one team is the Supplier Penalty Zone for the other.

2.5 Resource Island

The Resource Island is a public resource area in the center of the Battlefield consisting of a Projectile Depot and a Power Rune.

The Resource Island is not divided among the Red or Blue Teams. Engineer of both teams are allowed to procure Projectile Containers from the Resource Island.



[1] Resource Island Midline

Figure 2-11 Top View of Resource Island

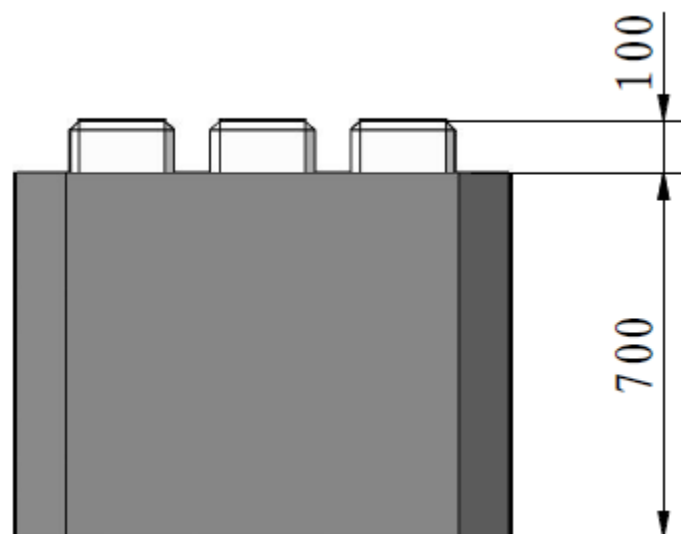


Figure 2-12 Main View of Resource Island

2.5.1 Projectile Depot



When a robot strikes the Power Rune, the 17mm projectiles may fall into a Projectile Container.

The Resource Island contains nine Projectile Container grooves at fixed locations. Each groove has a Projectile Container which contains 20 rounds of 42mm projectiles each. Engineer can shift or remove a Projectile Container to procure projectiles.

Projectile Containers are raised twice: the first time at the start of the match, and the second time three minutes into the match (i.e. countdown at 3:59). The Projectile Containers on the four corners will be raised during the first time, and then the remaining five Projectile Containers will be raised during the second time.

Projectile Container



The graphics on the outside of Projectile Containers will be changed and updated subsequently.

A Projectile Container is a 200*200*200 mm cube. Its six faces are chamfered and it is made out of EVA. The top side of a Projectile Container has a hole with a diameter of 115 mm. The hole depth for different types of Projectile Containers is different. The depth of the Projectile Containers in the middle of the Resource Island is 150 mm, and the depth of the Projectile Containers on a Small Resource Island is 70 mm.

During a match, robots may use Projectile Containers as obstacles.

Projectile Containers on the Small Resource Island:

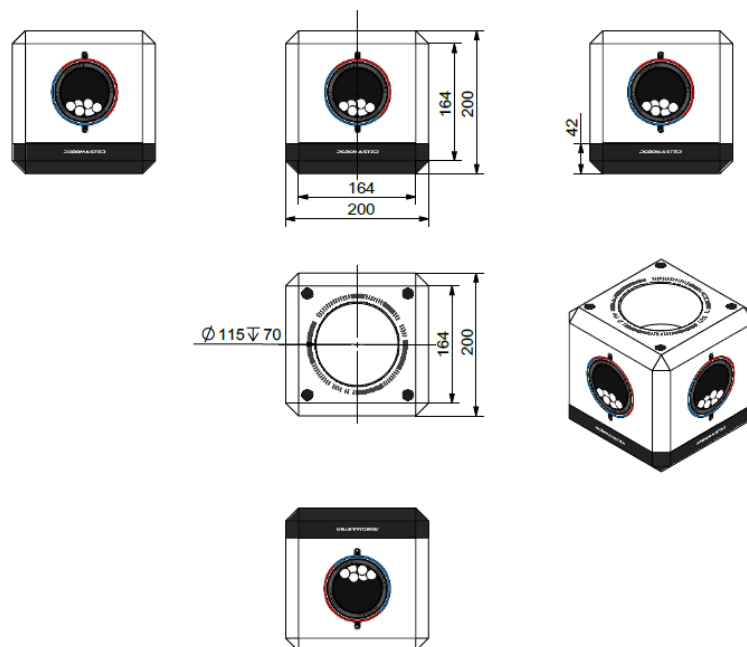


Figure 2-13 Graph of Projectile Containers on the Small Resource Island

Projectile Containers on the Resource Island:

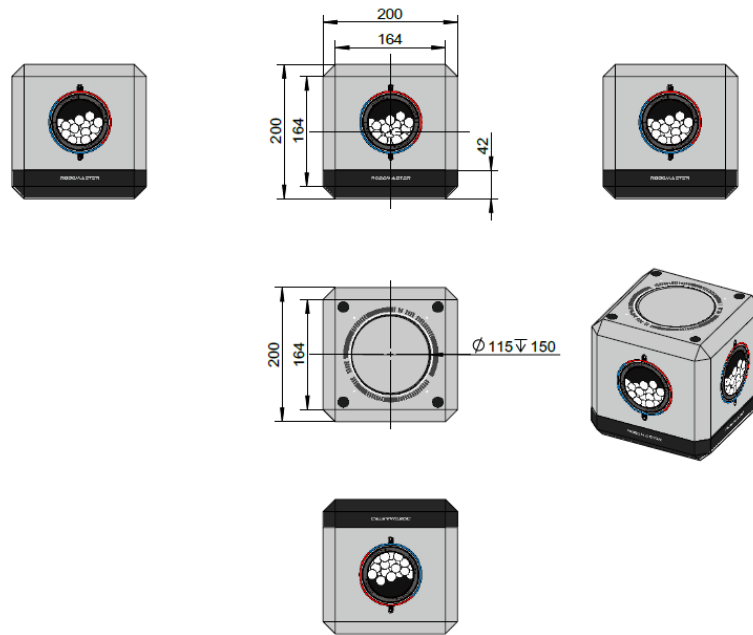


Figure 2-14 Graph of Projectile Containers of the Resource Island

2.5.2 Power Rune



- As the bridge is heavier in the middle, it may sag slightly within a range of 0-50 mm.
- When observing the Power Rune of one side, the Power Rune of the other side may be seen due to the viewing angle and transmission gaps.

The Power Runes are located in the center of the Resource Island, with the Blue Team's on one side and the Red Team's on the other. The Red Team can only activate the Red Team's Power Rune while the Blue Team can only activate the Blue Team's Power Rune. Both sides can strike the Power Rune at the same time. If one side's Power Rune has entered the active state, the other side's Power Rune becomes inactive.

The Power Rune consists of two stages: the Small Power Rune and Large Power Rune

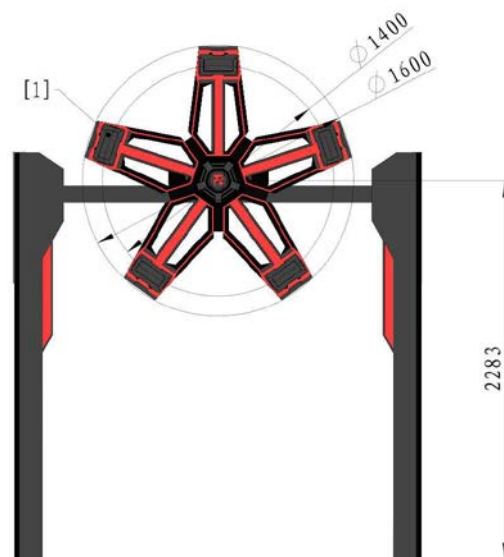
- **Small Power Rune:** One minute into the match until the fourth minute (i.e., countdown at 5:59-4:00), the Power Rune starts rotating and becomes available. After the robot from one side successfully activates the Small Power Rune, the robots of the side gain a 1.5-time attack power bonus for one minute.
- **Large Power Rune:** Four minutes into the match (i.e. countdown at 2:59), the Power Rune starts rotating and becomes available. After the robot from one side activates the Large Power Rune, the robots of the side gain a double attack power bonus and 50% defense bonus for one minute.

The Power Runes of the Red and Blue Teams will rotate together. If the Red Team's Power Rune rotates clockwise, the Blue Team's Power Rune rotates counterclockwise (the rotation direction is determined by the rotation direction facing the Power Rune of one's own side). During the competition, a Small Power Rune's rotation speed is 10RPM while the movement of a Large Power Rune functions based on specific strategies. The specific plans will be revised and updated subsequently.

The rotation direction of a Power Rune will be determined randomly each time it rotates.

The following description uses the Red Team's Power Rune as an example, which shall likewise apply to the Blue Team's Power Rune.

The Power Runes are distributed evenly across five Large Armor Modules. The specific locations and dimensions of the Large Armor Modules are as follows:



[1] Large Armor Module

Figure 2-15 Large Armor Module Graph

State

Power Runes can display five states: Unavailable, Available, Activating, Activated and Activation Failed.

1. Unavailable

Within the first minute of the match (i.e. countdown at 7:00-6:00), the Power Rune is unavailable and remains still as shown below:

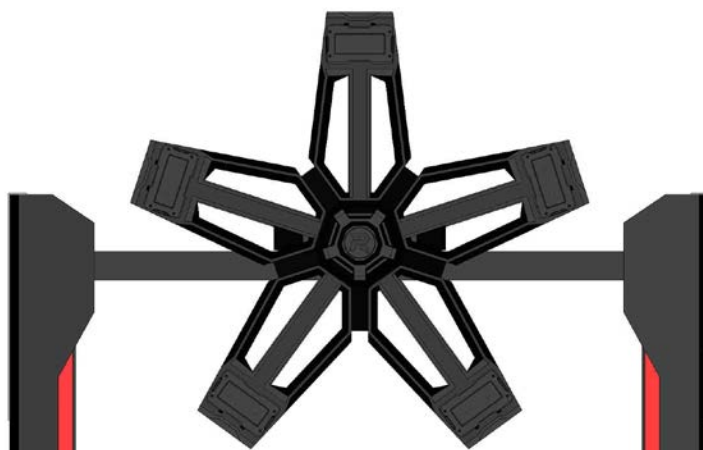


Figure 2-16 Graph of Power Rune When Unavailable

2. Available

After the first minute until the third minute of the match (i.e. countdown at 5:59-4:00) and four minutes into the match (i.e. countdown at 2:59), the Power Rune enters the available state as shown below:



Figure 2-17 Graph of Power Rune When Available

3. Activating

When the Power Rune is activating, if a projectile hits the Armor Module with flowing arrow lights on the central axis of the mounting bracket within 2.5 seconds, the bracket will be fully illuminated. At the same time, the Power Rune will randomly illuminate one of the remaining four Armor Modules, and so on and so forth, as shown below:

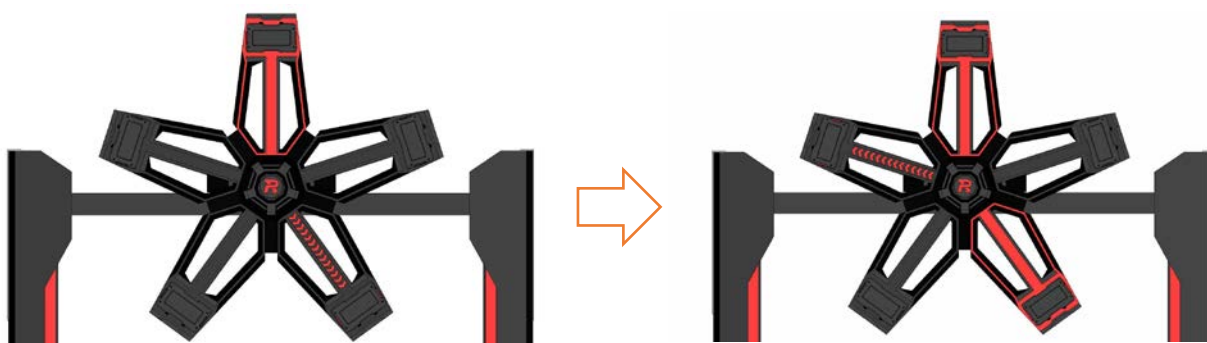


Figure 2-18 Graph of Power Rune Activating

4. Activated

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



Figure 2-19 Graph of Activated Power Rune

5. Activation Failed

If any of the following conditions occur during a shooting, the activation fails and the Power Rune becomes available

for activation again. Situations causing activation to fail:

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

2.6 Flight Zone

A Flight Zone is an area where Aerial is permitted to move, which includes a Landing Pad and Aerial Safety Rope.

2.6.1 Landing Pad

A Landing Pad is where Aerial takes off and lands. Before the start of each round, Aerial must be placed on the Landing Pad.

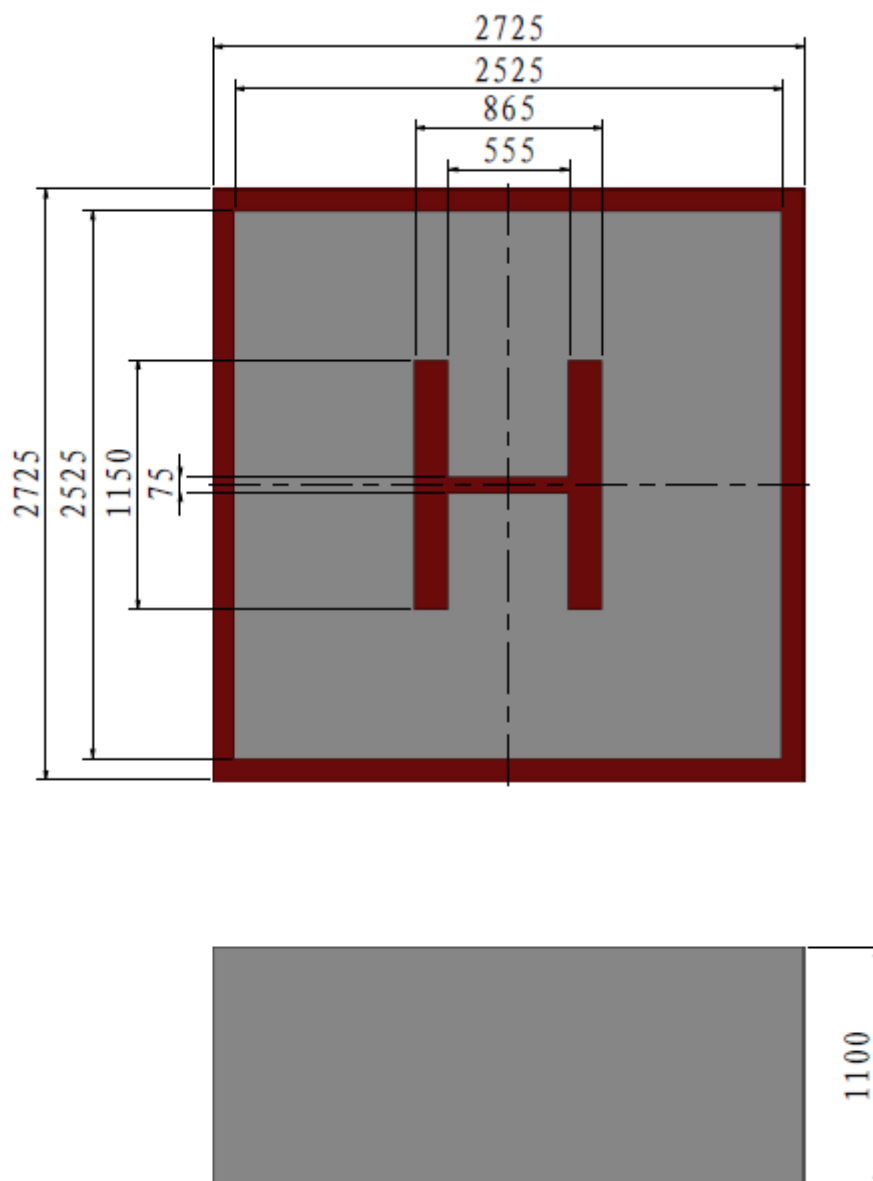


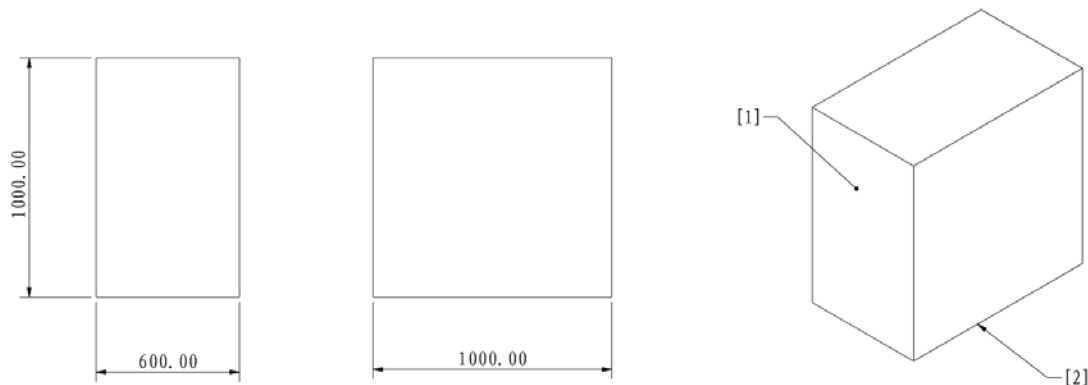
Figure 2-20 Landing Pad Graph and Size Parameters

2.6.2 Aerial Safety Rope

A snap ring is located in the middle of the steel cable of the Aerial Safety Rope that sets up Aerial (16 meters horizontally from the Battlefield Perimeter Wall on the side of its own team's Landing Pad). During its forward movement, Aerial will no longer be able to move forward if the sliding ring of the Aerial Safety Rope has reached the snap ring of the cable.

2.7 Dart Launcher

A Dart System is located in a Dart Launcher. A Dart Launch Opening can either be open or closed. When fully open, the size of a Launch Opening is 600*1000.



[1] Dart Launch Opening [2] Ground

Figure 2-21 Internal Graph of Dart Launch Opening

2.8 Radar Base

A Radar is placed on the Radar Base provided by the RMOC. Relevant computing equipment for the Radar is situated near the base.

2.9 Operator Room



Deterioration in performance is unavoidable from prolonged use of equipment.

Each Operator Room shall be equipped with a corresponding number of computers, each connected to its corresponding official equipment such as a monitor, mouse, keyboard, USB hub and wired headset. An Aerial Gimbal Operator shall be allocated two monitors.

An Operator Room is not provided with additional power supply.

2.10 Projectile

Robots attack the Armor Modules of enemy robots by launching projectiles, causing damage to their HP so as to

ultimately defeat them. 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
42mm Projectile	Similar to a golf ball	White	42.5mm±0.5mm	41g±1g	90 A	Plastic (TPE)	China Regional Competition, Wild Card Competition
17mm Fluorescent Projectile	Spherical	Yellow-green	16.8mm±0.2mm	3.2g±0.1g	90 A	Plastic (TPU)	During the entire RoboMaster Competitions

3. Competition Mechanism

3.1 Overview

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

Table 3-1 Robot Status

Status	Definition
Defensive	<p>Damage can be reduced when Armor Modules are hit by projectiles or struck.</p> <hr/> <p> Defense cannot be applied for HP Deduction penalties for rule violation, deductions for modules going offline, deductions for exceeding limits, etc.</p>
Defeated	<p>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 or initial firing speed limit, its Referee System module has gone offline, it has been ejected by the server due to a violation of rules, etc.</p>
Destroyed	<p>Where a robot attacks the Armor Module of an enemy robot until the latter's HP drops to zero.</p> <p>The destroy of a robot is determined in one of the following two ways:</p> <ul style="list-style-type: none">● Where a robot defeats an enemy robot with a critical hit, it is considered destroyed● If a robot is attacked by multiple enemy robots within 10 seconds before its defeat, then the last of the enemy robots to attack the defeated robot will be deemed the destroying robot

3.2 Relationships between Sentry, Outpost and Base

If the Outpost of one side has been destroyed, 100% of the defense status of its Sentry and the Invincible status of its Base will be disabled, and the Virtual Shield will be activated.

Where an Outpost has been destroyed, and if the Sentry have not entered the Battlefield or been defeated, the Armor of their Base will be deployed and the Virtual Shield will be disabled.

3.3 Virtual Shield Mechanism

After the Invincible status of a Base has been removed, the Virtual Shield of the Base will be enabled and will have 50 HP. When a robot attacks the enemy's Base, the HP of its Virtual Shield will first be deducted.

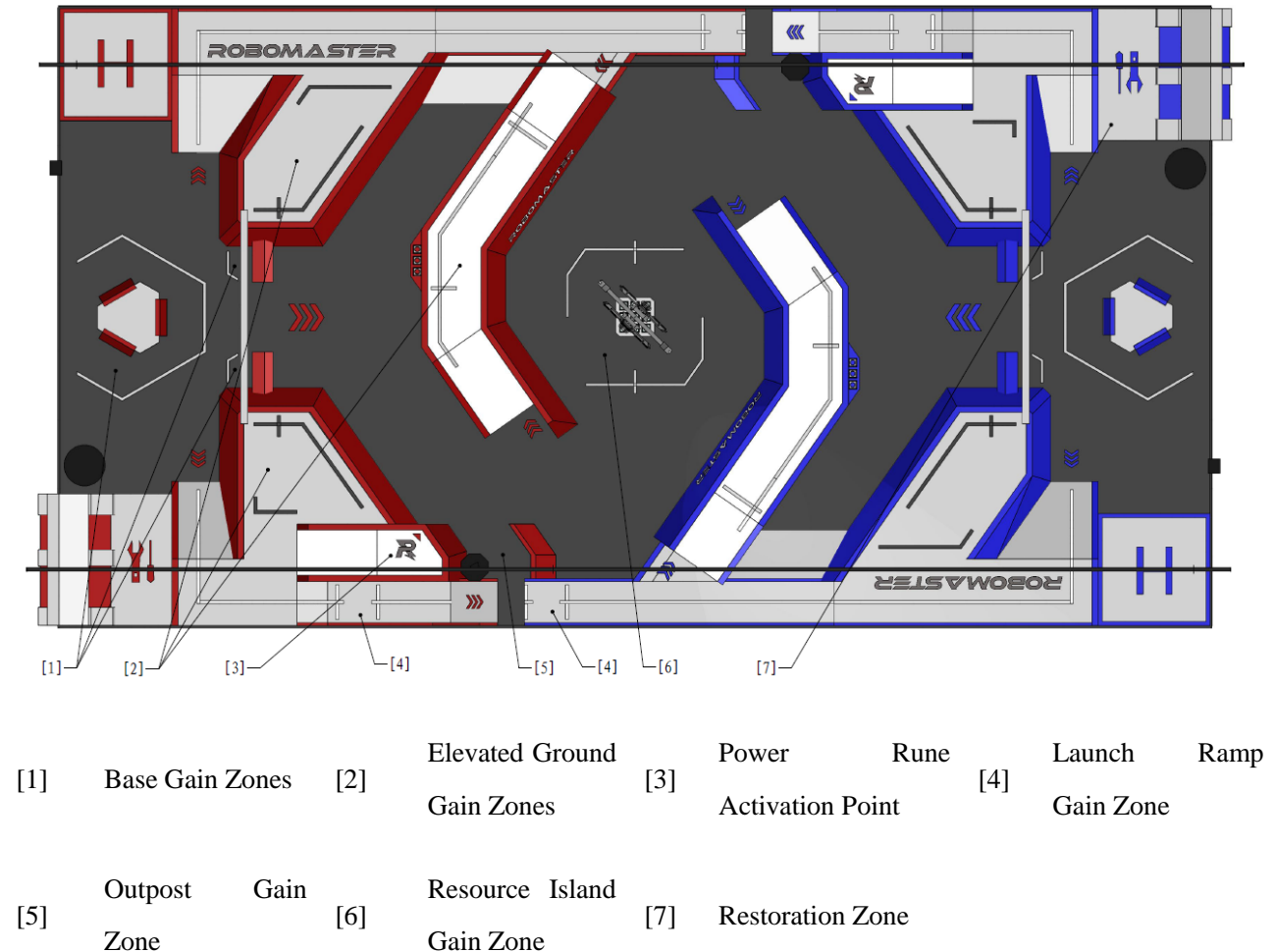
If the Virtual Shield's HP has reduced to zero, the Base's HP will be deducted. If the Base is not attacked within 10 seconds, the Virtual Shield will return to 50 points of HP. The amount of HP deducted from a Virtual Shield from attacks will not be counted as the enemy's HP Deduction.

3.4 Gain Zone Mechanism



Occupied: When a robot has reached a Gain Zone and its RFID Interaction Module has detected the RFID Interaction Module Card in the Zone.

All Gain Zones in the Battlefield are shown in the Graph below:



[1]	Base Gain Zones	[2]	Elevated Ground Gain Zones	[3]	Power Rune Activation Point	[4]	Launch Ramp Gain Zone
[5]	Outpost Gain Zone	[6]	Resource Island Gain Zone	[7]	Restoration Zone		

Figure 3-1 Battlefield Gain Zones

All Gain Zones are laid with multiple RFID Interaction Module Cards. A Gain Zone can be occupied at the same time by multiple robots. There may be a 2-second delay in the taking effect and expiration of bonuses gained due to the detection process of an RFID Interaction Module. If the occupying robot has been defeated, the bonus gained will expire.

3.4.1 Base Gain Zones

Base Gain Zones are located in the hexagonal area around the Base and the area behind the Bunker under the Sentry Rail.

- Robots that occupy the hexagonal area around their own Base will gain a 50% defense bonus, and their Barrel Cooling Value per Second will triple.
- Robots that occupy the area behind the Bunker under the Sentry Rail will have their Barrel Cooling Value per

Second increased to 5 times its original value.

After a Dart has hit the Base, the bonus gained at the Base will disappear temporarily for 30 seconds.

3.4.2 Elevated Ground Gain Zones

Elevated Ground Gain Zones are located on Base Elevated Grounds and Ring-shaped Elevated Grounds.

Robots that occupy the Elevated Ground Gain Zones will have their Barrel Cooling Value per Second increased to 5 times its original value. If a robot of one team occupies this area, the robots of the other team will not be able to occupy it at the same time.

3.4.3 Power Rune Activation Point

When a Power Rune is in an available state, it will enter into an activating state if its robot occupied its own Power Rune Activation Point (see [Figure 2-18](#)), and the robots occupying the zone will have their Barrel Cooling Value per Second increased to 5 times its original value.

3.4.4 Launch Ramp Gain Zone

Robots that occupy a Launch Ramp Gain Zone will gain a 50% defense bonus and buffer energy bonus (see [3.7.3 Chassis Power Consumption Exceeds the Limit](#) for buffer energy bonus), and their Barrel Cooling Value per Second will increase to 3 times its original value. The defense bonus and Barrel Cooling Value per Second gain will last for 20 seconds.

3.4.5 Outpost Gain Zone

Robots that occupy an Outpost Gain Zone will have their Barrel Cooling Value per Second increased to 5 times its original value.

After a Dart has hit the Outpost, the bonuses gained around the Outpost will disappear temporarily for 30 seconds.

3.4.6 Resource Island Gain Zone

Whenever a Hero or Standard occupies the Resource Island Gain Zone for more than 10 seconds (inclusive), for every additional 1 second the robot occupies the Zone the energy accumulated for Aerial will increase 2.5 points.

Both sides can occupy the Zone at the same time. Each side can only have a maximum of two robots occupy the Zone at the same time.

3.4.7 Restoration Zone

Ground Robots that occupy their own Restoration Zone will gain bonuses in the form of revival of defeated robots and HP recovery for surviving robots. Refer to [3.8 HP Recovery and Revive Mechanism](#) for the specific forms and value amounts of such bonuses.

3.5 First Blood Mechanism

When the first robot in a match is defeated, if the destroying robot is Hero or Standard, it will receive an extra 5 Value of Experience Points. Otherwise the 5 Value of Experience Points will be evenly distributed among the surviving Hero and Standard of the side gaining the First Blood. The average is rounded up and shall be accurate to one decimal place.

3.6 Level Up Mechanism

3.6.1 Experience System



Assist: Where a robot (except the destroying robot) that inflicts damage on the defeated robot within 10 seconds before its defeat.

At the beginning of the match, Standard and Hero are both at Level 1, and their performance level is zero. They upgrade themselves by gaining Value of Experience Points.

The Level Up mechanism during a match works as follows:

- If a robot from one side is defeated and the destroying robot is detected as Hero or Standard, the destroying robot will gain the Value of Experience Points in the corresponding Experience Value of the defeated robot, and any assisting Hero or Standard will gain 25% of the Value of Experience Points in the corresponding Experience Value of the destroyed robot (based on the calculation result of the Referee System server). The average is rounded up and shall be accurate to one decimal place.

For example, when a Level 1 Standard has been destroyed, and if the destroying robot is Hero or Standard, it will gain 2.5 Value of Experience Points directly. Each assisting Hero or Standard will gain $2.5 * 25\% = 0.6$ Value of Experience Points.

- If a robot from one side has been defeated and no destroying robot has been detected or the destroying robot is Sentry or Aerial, the Value of Experience Points in the corresponding Experience Value of the defeated robot (based on the calculation result of the Referee System server) will be evenly distributed among the surviving Hero and Standard of the enemy side. The average is rounded up and shall be accurate to one decimal place.

In addition, a Standard gains 0.2 Value of Experience Points every 12 seconds, and Hero gains 0.4 Value of Experience Points every 12 seconds. If a Standard or Hero have been defeated, their original Value of Experience Points will remain the same, but they will no longer gain any automatic Value of Experience Points during the time they are defeated. Any excess Value of Experience Points after leveling up will be counted towards the next level.

3.6.2 Performance System

After leveling up, the Barrel Heat limit, the Barrel Cooling Value per Second and the respective Experience Value of Standard and Hero will increase accordingly.

Before the match, the Performance Points of Standard and Hero are 0 points. At the start of the match and after each level up, Standard and Hero will gain 2 Performance Points for upgrading the robots' performance. The Operator

may choose from Maximum HP, Chassis Power Consumption and Initial Firing Speed limit, and grant the robot any of the disposable Performance Point(s). Once Performance Points have been used, they cannot be revoked.

For example, a Standard gains 2 Performance Points after the start of a match. The Operator chooses to use 1 Performance Point to increase its Maximum HP to Level 1 at 200 points. The Standard receives 2 Performance Points after leveling up, and the Operator chooses to use 3 Performance Points to increase its Initial Firing Speed limit to Level 3 at 30 m/s.

Table 3-2 Standard Levels

Level	Barrel Heat Limit	Barrel Cooling Value per Second	Cumulative Disposable Performance Points	Value of Experience Points Required for Leveling Up	Value of Experience Points
1	240	40	2	3	2.5
2	360	60	4	6	5
3	480	80	6	/	7.5

Table 3-3 Standard Performance Levels

Performance Level	Maximum HP	Maximum Chassis Power Consumption (W)	Initial Firing Speed Limit (m/s)
0	100	40	10
1	200	60	12
2	300	80	15
3	500	120	30



During a match, when Standard's HP is less than 20%, its 17mm barrel cooling value per second will double.

Table 3-4 Hero Levels

Level	Barrel Heat Limit	Barrel Cooling Value per Second	Cumulative Disposable Performance Points	Value of Experience Points Required for Leveling Up	Value of Experience Points
1	200	20	2	8	7.5
2	300	40	4	12	10
3	400	60	6	/	15

Table 3-5 Hero Performance Levels

Performance Level	Maximum HP	Maximum Chassis Power Consumption (W)	Initial Firing Speed Limit (m/s)
0	200	60	8
1	300	80	10
2	500	100	12
3	700	120	16

3.7 HP Deduction Mechanism

The HP of Ground Robots will be deducted in any of the following situations: The Barrel Heat limit, Initial Firing Speed limit or Maximum Chassis Power Consumption of a Launching Mechanism is exceeded; an Armor Module is attacked by a projectile or hit; an important module of the Referee System goes offline; penalty for violation of rules; etc.

The Referee System will round up the HP deduction when calculating the HP.

3.7.1 Exceeding the Initial Firing Speed Limit

Set the current barrel heat as Q_1 , the Barrel Heat limit as Q_0 , the current initial speed as V_1 (m/s), and the Initial Firing Speed limit as V_0 (m/s). Take Standard as an example: its Initial Firing Speed limit is $V_0 = 30$ m/s, and its barrel heat mechanism is described as follows:

When $V_1 > V_0$, each 17mm projectile with a speed of V_1 detected by the Referee System will result in a deduction, where the deducted HP = Maximum HP * L%. For each 42mm projectile detected, 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 3-6 Penalty Mechanism for Exceeding the Initial Firing Speed Limit

17mm projectile	L%	42mm 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%

3.7.2 Barrel Heat Exceeds the Limit and Cooling

For each 17mm projectile with a speed of V_1 detected by the Referee System, the current barrel heat Q_1 is increased

by V_1 . For each 42mm projectile detected, the current barrel heat Q_1 is increased by 100 (regardless of its initial speed). The barrel cools at a frequency of 10 Hz. The cooling value per detection cycle = cooling value per second / 10.

It is known that the Barrel Heat limit is Q_0 ,

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



Figure 3-2 FPV of Client

- B. When $2 * Q_0 > Q_1 > Q_0$, 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 = $(Q_1 - 2 * Q_0) / 250 * \text{maximum HP}$. After deducting HP, set $Q_1 = 2Q_0$.

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

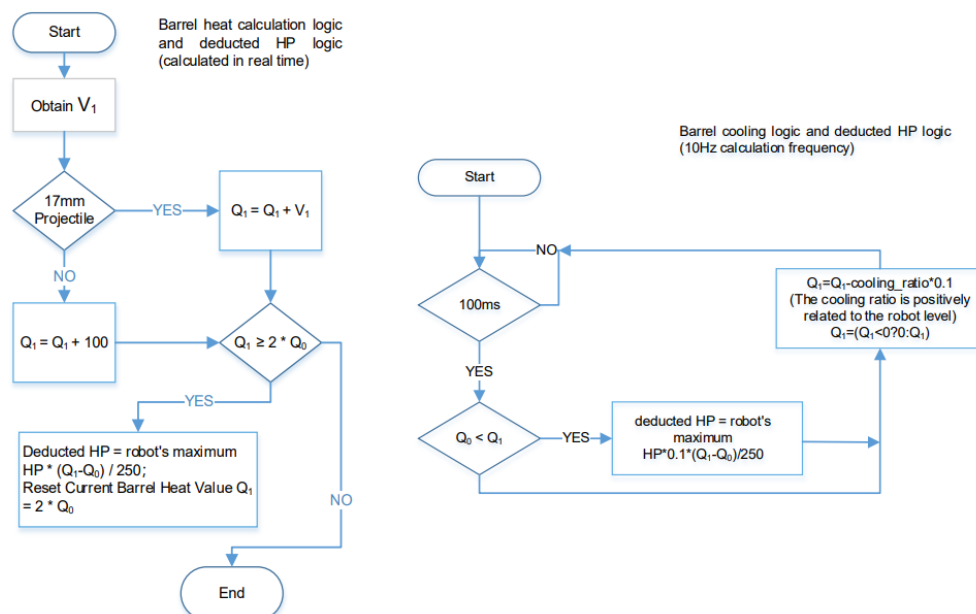


Figure 3-3 (L) HP Deduction logic Graph and (R) cooling logic Graph when Barrel Heat limit is exceeded

3.7.3 Chassis Power Consumption Exceeds the Limit

The chassis power consumption of robots will be continuously monitored by the Referee System, which will trigger the penalty mechanism when the chassis power consumption is exceeded. Different types of robots trigger different penalties. As it is difficult for a robot to control instantaneous output power when in motion, the RMOC has defined a buffer energy (W) in the Referee System server. The buffer energy (W) of Sentry is 200J; while the W values of Standard or Hero may differ according to these two scenarios:

- If Standard or Hero has not flown over a Launch Ramp of Road, its W value is equal to 60J.
- After Standard or Hero has flown over a Launch Ramp of Road, its W value increases from the current value to 250J. If it is subsequently consumed to below 60J, the W value can be restored to no more than 60J. Refer to [3.4.4 Launch Ramp Gain Zone](#) for the Launch Ramp gain mechanism.

The Referee System monitors chassis power consumption at a frequency of 10Hz.

Excess Percentage: $K = (Pr - P1) / P1 * 100\%$, where Pr is the instantaneous chassis power consumption output and P1 is the power consumption limit.

Table 3-7 Penalty Mechanism for Chassis Power Consumption Exceeds the Limit

K	N%
$K \leq 10\%$	10%
$10\% < K \leq 20\%$	20%
$K > 20\%$	40%

Standard or Hero:

When the Chassis Power Consumption of Standard or Hero is exceeded, the deducted HP = Maximum HP * N%.

For example: If Hero has a continuous power output of 140W, 60J of energy will be consumed after each second. The excess percentage that can be calculated in the next 100ms detection cycle, $K = (140 - 80) / 80 * 100\% = 75\%$. Since $K > 20\%$, the deducted HP = $300 * 40\% * 0.1 = 12$.

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

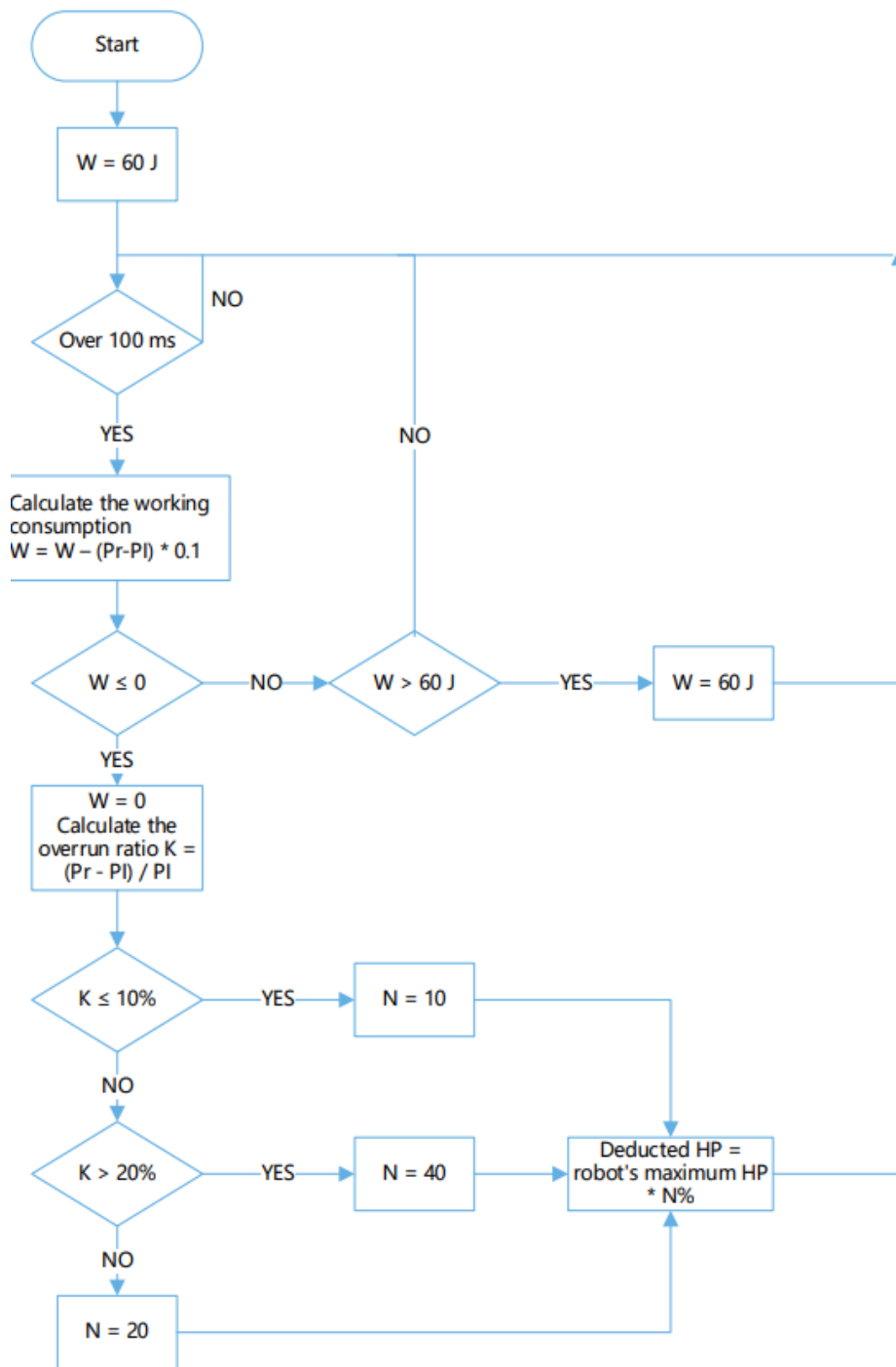


Figure 3-4 Logic Graph for Chassis Power Consumption Detection and HP Deduction

Sentry:

If the Chassis Power Consumption of Sentry exceeds the limit, its chassis will be powered off.

The logic graph for chassis power consumption detection of Sentry and chassis power-off is shown below:

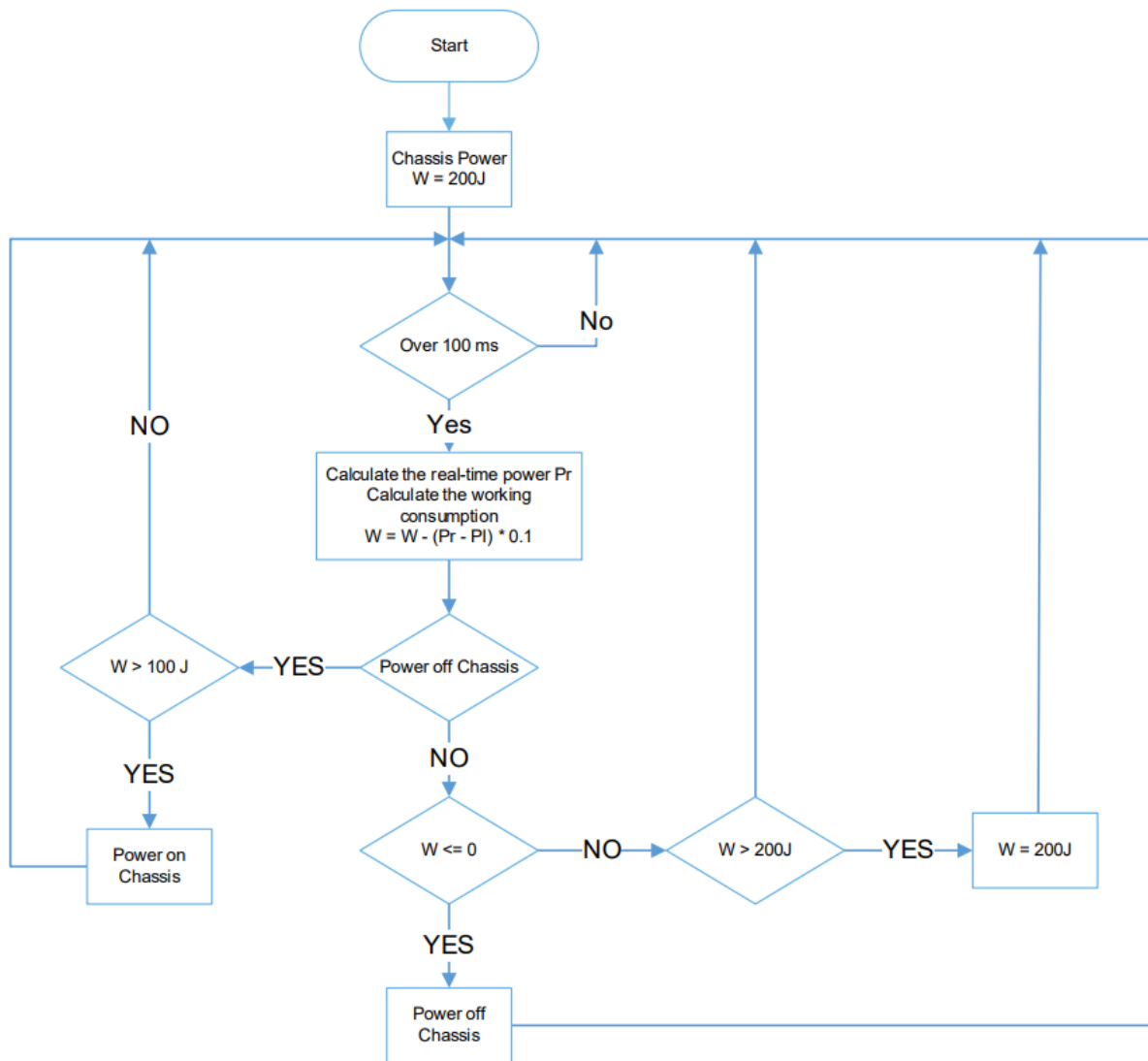


Figure 3-5 Logic Graph for Chassis Power Consumption Detection and Chassis Power-off

3.7.4 Attack Damage



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

A robot is only allowed to inflict damage on the enemy unit using projectiles and Darts.

An Armor Module detects projectile attacks using the pressure sensor combined with the Armor's vibration frequency. A Dart Target detects dart attacks using the Armor Module combined with the phototube.

A robot will also experience damage when its Armor Module is struck. However, a robot cannot cause HP damage to the other side's robots through striking (including collision with the robots or launching objects).

Below are HP deductions in situations of no bonus gains:

Table 3-8 HP deduction Mechanism for Attack Damage

Damage Type	HP Damage Value
42mm projectile	<ul style="list-style-type: none"> ● Robot's Armor Module: 100 ● Base and Outpost Armor Modules: 200
17mm projectile	10
Collision	2
Darts	1/5 of the Maximum HP of Base or Outpost

3.7.5 Referee System Going Offline

According to the latest version of the RoboMaster 2020 Robot Building Specification Manual, robots must be mounted with their corresponding Referee System module, 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 2Hz. If important Referee System modules such as a Speed Monitor Module, Positioning System Module or Armor Module goes offline due to design or structural problems, then the HP of the corresponding Ground Robots will be deducted.

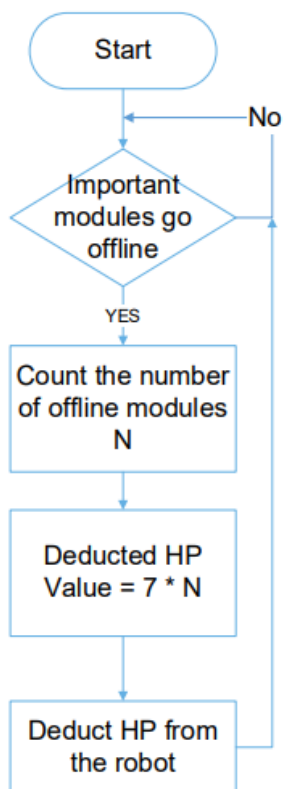


Figure 3-6 HP Deduction Mechanism for Important Referee System Modules Going Offline

3.8 HP Recovery and Revive Mechanism

Only Standard, Hero and Engineer are entitled to HP recovery and revival.

● HP Recovery Mechanism:

- Engineer: If Engineer has not received any damage for 30 seconds during a single round (including damage caused by collision, modules going offline, etc.) or has been revived after defeat, it will automatically recover 2% of its Maximum HP per second.
- Non-Engineer Robots: If an RFID Interaction Module has been detected in one's own Restoration Zone, the robot will recover 5% of its Maximum HP per second until the Maximum HP is reached.

● Revive Mechanism:

- Engineer: A robot can be revived on any location in the Battlefield
- Standard or Hero: They can be revived through any of the following methods
 - Revive Method 1: The RFID Interaction Module of a defeated robot detects the RFID Interaction Module Card carried by Engineer
 - Revive Method 2: Engineer rescues and brings a defeated robot to their own Restoration Zone, detects the RFID Interaction Module Card, and remains there for a certain length of time

After it is revived, a robot will maintain its Level, Performance Points and Value of Experience Points before it was defeated, and it will recover its HP to 20% of the Maximum HP. The robot is at 100% of defense status within 10 seconds of revival. For definitions of the defensive status, please refer to Table 3-1.

- **Time Required for Revive:** Engineer: If defeated for the first time, Engineer needs to wait for T seconds before it can be revived. For other robots, their RFID Interaction Modules need to detect the RFID Interaction Module Cards at the Restoration Zone or carried by Engineer, for a total of T seconds, before they can be revived. The time required for revival is related to the revival method used, the details of which are shown below. For every subsequent revival, the waiting time for Engineer and the RFID Interaction Module detection time for other robots will increase by 10 seconds each time. The number of revivals and the required time are calculated individually for each robot.

Table 3-9 First Defeat Revive Time for Different Robots

Type	T Second
Standard	<ul style="list-style-type: none">● Revive Method 1: 10● Revive Method 2: 5
Hero	<ul style="list-style-type: none">● Revive Method 1: 20● Revive Method 2: 10
Engineer	20

3.9 HP Gain Mechanism for Sentry

Sentry will receive HP Gain from attacking enemy Ground Robots. $\text{HP Gain for Sentry} = \text{HP Deduction by Sentry} * 0.2$.

3.10 Aerial Related Mechanisms

3.10.1 Energy Mechanism

Aerial is required to accumulate energy to exchange attack opportunities.

3.10.1.1 Energy Accumulation

Aerial may accumulate energy through the following methods:

- When Aerial lands stably on the Landing Pad, it gains one energy point per second. If Aerial starts its propellers before it has gained 300 energy points, the automatic increase of energy per second will be paused but its accumulated energy will not be cleared to zero. Aerial continues to accumulate energy when it has returned and landed stably on the Landing Pad.
- When Aerial lands stably on the Landing Pad, if robot of its own side has occupied the Resource Island Gain Zone, it will gain energy. For details refer to [3.4.6 Resource Island Gain Zone](#). If Aerial starts its propellers before it has gained 300 energy points, the energy gained by occupying the Resource Island Gain Zone will be paused but its accumulated energy will not be cleared to zero. Aerial continues to accumulate energy when it has returned and landed stably on the Landing Pad.
- If one of your robots is destroyed by the enemy, your Aerial will gain energy immediately. $\text{Aerial's Energy Gain} = \text{Experience Value of its team's defeated robot} * 4$. Energy gains are rounded up and shall be accurate to one decimal place.

For example: After the start of a match, the Red Team's Aerial lands on the Landing Pad and takes off after 75 seconds, then at this time $E = 75$. During the match, if a Level 2 Standard from the Red Team is destroyed by the Blue Team, the energy of the Red Team's Aerial will be $E = 75 + 5 * 4 = 95$.

3.10.1.2 Projectile Launching

The energy of Aerial at the start of the competition is $E = 0$.

When $E < 300$, the Launching Mechanism is powered off and Aerial cannot launch projectiles. When $E = 300$ and Aerial leaves the Landing Pad, the Aerial Gimbal Operator can choose whether to power up the Launching Mechanism.

When the Launching Mechanism of Aerial is powered up, its energy is cleared to zero, and it is given 30 seconds of attack time. During the 30 seconds, Aerial can launch projectiles at any firing speed but not exceeding the Initial Firing Speed limit of 30 m/s.

After its Launching Mechanism has been powered off, Aerial will start accumulating energy again after it has returned to and landed stably on the Landing Pad. If Aerial returns to the Landing Pad before its 30 seconds of attack time has elapsed, the remaining attack time will continue the countdown until it has run out before the robot can begin accumulating energy again.



E can never exceed 300. Any excess will be removed automatically.

The logic graph for Aerial's energy mechanism is as follows:

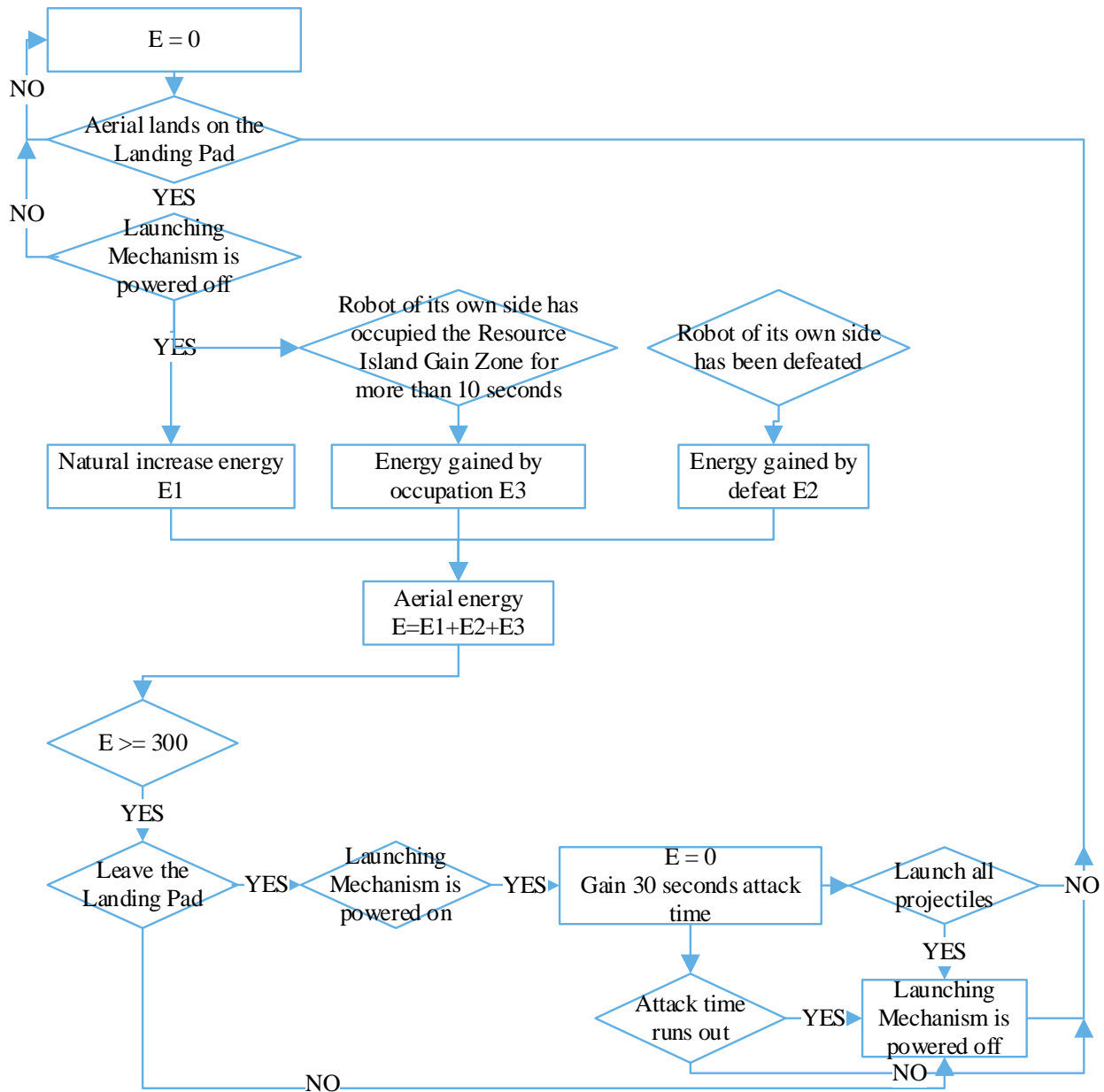


Figure 3-7 Energy Mechanism Graph

3.10.2 Attack Deductions

3.10.2.1 Initial Firing Speed Exceeds the Limit

If the Referee System detects that the projectile of Aerial exceeds the Initial Firing Speed limit, the attack time of Aerial will be reduced. If the current attack time is about to expire, the time deduction will be applied to the next attack time. Attack time reductions will be accumulated in the case of multiple times of excess.

Assume Aerial's current Initial Firing Speed is V_1 and the Initial Firing Speed limit is 30 m/s, when the Referee System's Speed Monitor Module detects one 17mm projectile that exceeds the speed limit, the Aerial's attack time will be reduced by: $t = 0.5 (V_1 - 30)^2$ s. Attack time deductions are rounded up.

3.10.2.2 Modules Going Offline

If a module of Aerial goes offline while it is accumulating energy, the automatic energy increase will be paused. If a module goes offline during attack time, the number of disposable projectiles of Aerial will be reduced. The correlation between the number of modules gone offline (M) and the number of projectiles reduced per second (N) is: $N = 25 * M$.

3.11 Dart Launching Mechanism

In each round, the Dart Launch Opening can be opened twice, and the Aerial Gimbal Operator can choose when to use it.

If the Aerial Gimbal Operator chooses to open the Launch Opening, the Launcher Station's light indicator will turn on when the Opening is fully open, and the client interface in the Referee System will display the corresponding indication. The Aerial Gimbal Operator can now launch Darts by controlling the Dart Launcher. The Dart Launch Opening can be fully open for 15 seconds. When the Launcher's light indicator is turned off and the client interface of the Referee System indicates the Opening is closed, the Aerial Gimbal Operator will not be able to launch any Darts.

Invalid Attacks

During the same opening time of the Launch Opening (for details of opening of Dart Launch Opening refer to [3.11 Dart Launching Mechanism](#)), if a Dart has exceeded its speed limit, its damage on an Outpost or Base will be invalid, so will any damage by any Dart launched subsequently by the Opening on the Outpost or Base.

For example: When an Aerial Gimbal Operator opens the Dart Launch Opening for the first time, where it launches a Dart at 25 m/s hitting the Outpost, and then launches a Dart at 15 m/s hitting the Outpost again, the damage by both Darts on the Outpost will be invalid.

3.12 Logic of Mechanism Overlap

When a robot gains more than one bonus of the same type, the maximum gain effect will be recorded. Bonuses gained include Attack Power, Defense, HP Recovery and Revive, and Barrel Cooling Value per Second.

For example, if Engineer has not suffered any damage for 30 seconds, it will recover its HP at 2% of its Maximum HP per second. If the Engineer is in its team's HP Recovery and Revive Zone, its HP will recover at 5% of its Maximum HP per second.

4. Competition Process

4.1 Pre-Match Inspection

To ensure that robots meet the required unified specifications, each team must undergo Pre-Match Inspection in the Inspection Area before each match. For requirements of Pre-Match Inspection refer to RoboMaster 2020 Robot Building Specification Manual.

Except for Standard which can only be brought into the Inspection Area by one team member, the other robots must only be brought into the Inspection Area by no more than two team members, and another team member will be responsible for coordinating during the Pre-Match Inspection. Without the permission of the Head Inspector, other team members are not allowed to enter the Inspection Area. Team members are prohibited from entering the Inspection Area before their robots have entered the Inspection Area.

During Pre-Match Inspection, inspectors will stick a Pass Card on robots that have passed the inspection. Only robots with a Pass Card that is fully marked can enter the Staging Area and Competition Area. Teams must modify their non-qualifying robots in the designated area or the Preparation Area until they meet the inspection requirements, before they can enter the match.

When Pre-Match Inspection is complete, the team Captain must sign the inspection form to confirm the inspection results. After the team Captain has signed and confirmed, no objections may be raised to the inspection results.

Each team can have a maximum of two backup robots for each match. A maximum of 4 backup Darts are allowed in the B02 and B03 Competition Systems, while a maximum of 8 backup Darts are allowed for the B05 Competition System. Team members are required to declare the types of backup robots they are carrying during Pre-Match Inspection. Apart from backup Standard Robots, other types of backup robots must be attached with armor stickers in the Inspection Area. If backup Standard Robots are needed on the field, a Pit Crew Member must obtain the relevant number sticker from the official technical referee. The stickers must follow the requirements in the “Robot Production Specifications for RoboMaster 2020 Robotics Competition”.

Backup robots cannot be replaced without permission after passing Pre-Match Inspection. In the Mock Inspection phase of the competition division, the Organizing Committee will issue Referee Systems to backup robots that have passed Pre-Match Inspection. Teams can borrow the Referee Systems of at most two backup robots. Teams need to immediately return the Referee Systems of backup robots after finishing the competition in the division.

4.2 Staging Area

After completing the Pre-Match Inspection, each team must be at the the Staging Area at least 15 minutes before the start of the match. The staff at the Staging Area will check the status of the participating robots and the team

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 of the applicant can only return to the Repair Area if a staff member at the Staging Area has removed the Pass Card on the robot and the Staging Area Statement originally signed is invalidated. When repair is finished, the team must bring their robots back to the Inspection Area for another Pre-Match Inspection before reentering the Staging Area, and their team Captain must sign another Staging Area Statement. If a Staging Area Statement cannot be signed in time as a result of this delay, the robot will not be able to enter the match, and the team will bear its own consequences.

After leaving the Staging Area, the competing teams will enter the Preparation Area of the Competition Area and set up their robots. When the previous match has ended and with the permission of the referee, the next pair of competing teams will wait at the entrance of the Battlefield with their robots for further instructions. After the referee has confirmed that both teams are ready, the Side Referee will open the doors and lead the team members into the Competition Area. The countdown for the 3-minute Setup Period will begin when the doors are opened.

4.3 3-Minute Setup Period

During the 3-minute Setup Period, Pit Crew Members will place robots on their respective initial positions, check whether Referee Systems are operating normally, load Aerial and Sentry with initial projectiles, mount Dart Robots on Dart Launcher, and place Radar on Radar Base.

When the Setup Period is left with one and a half minutes, the Operator should preferably be in the Operator Room to complete the debugging for the keyboard and mouse (which can be brought on your own), and double-check that the robot controls and official equipment are operating normally. If equipment in the Operator's Room cannot operate normally, the Operator must raise the issue before the Setup Period is left with 15 seconds. Otherwise, any request will not be entertained by the Technical Referee.

When the Setup Period is left with 30 seconds, all robots in the Battlefield must be powered up, and the staff in the Battlefield should leave the Competition Area in an orderly manner. The Pit Crew must place the Sentry's remote controller in the designated area at the Battlefield entrance.

4.3.1 Official Technical Timeout

During the Setup Period, if a Referee System, equipment inside the Operator Room or other modules related to a Referee System experience any faults (for details on technical faults refer to Table 6-1), the Head Referee can announce an Official Technical Timeout and pause the setup countdown.

During an Official Technical Timeout, team members can only cooperate with the Technical Referee in eliminating the faults of the relevant Referee System modules and cannot repair other breakdowns. After the faults in the relevant

Referee System modules have been eliminated and the Head Referee has resumed countdown, the team must comply with the specifications for the 3-minute Setup Period and leave the Battlefield at the designated time.

4.3.2 Team Technical Timeout

If the mechanical structure of a robot, a software system, the keyboard or mouse in the Operator's Room or other equipment experiences any faults, the team Captain may make a request to the referee in the Battlefield or Operator's Room for "Team Technical Timeout" before the 15-second countdown in the 3-minute 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 Head Referee, the Technical Timeout cannot be revoked or revised.

After a team's Technical Timeout has been allowed by the Head Referee, the Head Referee will inform both teams of the timeout regardless of which team requested the Team Technical Timeout. Pit Crew Members can enter the Battlefield to inspect and repair robots, while members of both teams can only inspect, repair and debug their own robots in their Starting Zone, Landing Pad, Dart Launching Station or Radar Base, respectively.

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 Head Referee will continue the countdown of the Technical Timeout, or the Head Referee may end the Technical Timeout early after confirming that both teams are ready.

To ensure that subsequent matches begin on time, only one Team Technical Timeout is allowed per the three-minute Setup Period on a first-come-first-served basis. 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 Head 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.

A team cannot request for more Technical Timeout opportunities once they have been used up. The Team Technical Timeout arrangements for different competitions are as follows:

Table 4-1 Team Technical Timeout Arrangement

Competition	Arrangement
China Regional Competition, International Regional Competition, Final Tournament	<ul style="list-style-type: none">● Group Stage: Two Technical Timeouts for 2 minutes each● Knockout Stage: One Technical Timeout for 3 minutes. Technical Timeout opportunities not used in Group Stage can be carried over to the Knockout Stage
Wild Card Competition	Two Technical Timeouts for 2 minutes each

4.4 Referee System Initialization Period

After the 3-minute 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, Battlefield Component status, etc. If a robot of team experiences technical faults during the Initialization Period causing the initialization countdown to stop, a maximum of two Pit Crew Members for each team are allowed to enter the Battlefield to check on the fault. After the fault has been rectified, the initialization countdown will resume, and the competition server will restore the HP of all robots, ensuring their HP are full when the match officially begins.

When the Referee System Initialization Period is left with 15 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. The match starts immediately after the countdown finishes.

4.5 7-Minute Round

During the 7-Minute Round, robots from both teams will engage in tactical combat on the Battlefield – the core Competition Area.

During the round, Aerial gains one opportunity to reload 500 rounds of projectiles when it uses one energy unit. The Pilot can request for projectile supply reload from the Pilot Referee. After the Referee has approved the reload, the Pilot has 30 seconds to reload the Aerial with projectiles. The 30 seconds for projectile supply reload starts counting when the Pilot opens the projectile supply reloading outlet.

During the round, the Aerial Gimbal Operator can launch Darts when the Dart Launch Opening is opened. For more details refer to [3.11 Dart Launching Mechanism](#).

4.6 End of Competition

A round ends either when time has elapsed for the 7-Minute Round or one team has fulfilled the conditions for winning. When a round ends, the match immediately enters the 3-Minute Setup Period for the next round. The match is over when the winner has been determined.

4.7 Match Results Confirmation

During a match, the referee will record on the Match Results Confirmation Form the penalties issued for each round and the HP Deduction of both sides at the end of the rounds, the Remaining HP of each Base, Outpost and Sentry, the winning teams, the use of Technical Timeout opportunities by teams, and other relevant details. After the end of each match, team Captains need to be at the Referee Area to confirm the results.

The Captains of both teams must confirm the match results by signing the Match Results Confirmation Form at the Referee Area within five minutes after the match ends. If a team Captain is not at the Referee Area within five minutes to sign and confirm the results and has not requested an appeal, it is deemed that the team agrees with the match results.

The referee will not entertain any request for appeals on match results between rounds of an individual match.

Once a team Captain has signed and confirmed the results, no further appeals can be made.

5. Competition Rules



Any penalty issued before the start of a competition will be executed after the competition officially starts.

To ensure the fairness of the competition and uphold discipline in the competition, participating teams and robots are required to adhere strictly to the Competition Rules. The Head Referee and Side Referees will issue the appropriate penalty against any violation of rules.

Serious violations and appeals in the competition will be publicized.

5.1 Penalty System

Each robot starts a round with 9 points. If a robot triggers a Level 1 Warning, 2 points will be deducted from it. If it triggers a Level 3 Warning, 4 points will be deducted from it.

- When a robot has no more than 5 points, a yellow exclamation point will be displayed on the robot's avatar on the robot server client interface
- When a robot has no more than 2 points, a red exclamation point will be displayed on the robot's avatar on the robot server client interface
- When a robot has 0 points, the robot will be ejected from the round

The details of penalty system for the RM2020 Robotics Competition are as follows:

Table 5-1 Penalty System

Penalty	Description
Verbal Warning	The referee will give an indication and warning on the violation of a team member or robot.
Warning Indication (Level 1 Warning)	When a warning is issued, the operation interface of all Operators from the offending team will be blocked for one second
HP Deduction (Level 2 Warning)	<ul style="list-style-type: none">● The operation interface of all Operators from the offending team will be blocked for five seconds● The Referee System will automatically deduct 5% of the current maximum HP from all surviving robots (except the Base and Aerial) of the offending team. The HP deducted will be counted as the enemy's HP Deduction● The offending robot will lose 2 points.
HP Deduction (Level 3 Warning)	<ul style="list-style-type: none">● The operation interface of the offending Operator will be blocked for ten seconds, and that of other Operators in the offending team will be blocked for five seconds

Penalty	Description
	<ul style="list-style-type: none"> The current maximum HP of the offending robot will be deducted by 50%, and those of other surviving robots (except the Base and Aerial) will be deducted by 5%. The HP deducted will be counted as the enemy's HP Deduction The offending robot will lose 4 points.
Ejection (Level 4 Warning)	<ul style="list-style-type: none"> The offending robot is ejected: In the round of the match, ground robots are immediately defeated by the Referee System (all HP deducted), and the Aerial will have its Launching Mechanism (including the loading mechanism and friction wheel) and video downlink powered off and its Video Transmitter Module disconnected. The Aerial must immediately land on the Landing Pad. Robots that are ejected cannot be revived. HP deducted from the ejection will be counted as the enemy's HP Deduction The Operator or other team members are ejected: Members ejected by the referee must immediately leave the Competition Area and no substitute Operators or 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 at the start of all rounds of the current match. HP deducted from the ejection will be counted as the enemy's HP Deduction
Forfeiture (Level 5 Warning)	<ul style="list-style-type: none"> If a Forfeiture is issued before a match (not including the 3-minute Setup Period), all the Pit Crew of the offending team must leave the Competition Area. The offending team's Base and Outpost HP are deducted to zero, and all their robots' HP remain full. The opposing team's Base and Outpost HP and their robots' HP remain full If a Forfeiture is issued during a match (including the 3-minute Setup Period), the round ends immediately. The offending team's Base and Outpost HP are deducted to zero, and all their robots maintain their HP level at the end of the round. The opposing team's Base and Outpost HP and their robots' HP remain at the level when the round ended If a Forfeiture is issued after a match (due to an appeal for arbitration), the offending team's Base and Outpost HP are deducted to zero, and all their robots maintain their HP level from the end of the round. The opposing team's Base and Outpost HP and their robots' HP remain at the amount when the round ended

Some violations will directly trigger a Level 4 or Level 5 Warning, while the penalties for some violations will increase gradually from a Verbal Warning. A Verbal Warning, Level 1 Warning, Level 2 Warning, Level 3 Warning or Level 4 Warning cannot be used by any team as the basis for an appeal. The Chief Referee will reject an appeal

immediately if it is made by any team on this basis.

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.

5.2 Rules

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

5.2.1 Personnel Rules

5.2.1.1 Participating Teams/Personnel

R1 Participating teams must adhere to the following rules when forming their teams:

R1.1 A participating team must be attached to a university or college, and must meet the role, number and identity requirements for personnel stated in the Chapter 3 of the RoboMaster 2020 Robotics Competition Participant Manual.

R1.2 In principle, only one team per university or college is eligible to participate in the competition. Institutions having multiple campuses in different cities, making it difficult for certain students to compete as a team, are allowed to have a team with members from different campuses provided it has been verified by the RMOC. Teams must obtain authorization from their university or college to participate in the competition and submit the proof to the registration system. Refer to the registration system for the authorization letter template. The first precondition for a team's registration for the competition is to obtain a stamped authorization from its university or college (or its campus). The applicant must ensure that its registration information is complete and accurate, and that it will undertake the corresponding responsibilities. The applicant must bear all consequences caused by any missing or inaccurate information. For special circumstances, the applicant may contact the RMOC, which will handle the case based on actual circumstances. The RMOC reserves the right of final interpretation.

R1.3 The team name must be in the format of "XXX-Team" ("-" is only a separator and should not appear in the actual team name), in which "XXX" is the personalized name of the team. The total length of the team name should not exceed 16 character units (each Chinese character is considered 2 character units, while each English letter is 1 character unit). The team name must not include the university/college name or its abbreviation in Chinese/English, or such Chinese characters as “队”, “团队” and “战队” (which

mean "team" in English) or other special symbols such as "*-/+". The team name must reflect the proactive spirit and motivation of the team and comply with relevant national laws and regulations.

R1.4 Two to five universities or colleges that do not have their own individual teams can form an Intercollegiate Team.

- A. Before establishing an Intercollegiate Team, members must consider all their respective circumstances and communicate with each other thoroughly about team planning. Any operating and R&D costs, personnel arrangements or disputes arising therefrom must be handled by the Intercollegiate Team itself, for which the RMOC bears no responsibility.
- B. After an Intercollegiate Team has been established, it can only participate in the RoboMaster 2020 Robotics Competition in the name of the Intercollegiate Team. If an Intercollegiate Team is disbanded after passing the Technical Proposal stage, the team will be deemed to have voluntarily dropped out of the competition.
- C. The registered team name shall be "Intercollegiate Team" instead of "Team". An Intercollegiate Team Statement must be issued by the universities or colleges represented by the Intercollegiate Team, and must be submitted to the registration system. Refer to the registration system for the template of the Intercollegiate Team Statement.
- D. For an Intercollegiate Team consisting of Hong Kong, Macau, Taiwan and overseas team members, if more than 50% of the total number of regular team members are formal team members from Hong Kong, Macau, Taiwan and overseas, the Intercollegiate Team shall be categorized as a Hong Kong, Macau, Taiwan and Overseas team and must participate in the International Regional Competition. Otherwise, the Intercollegiate Team shall be categorized as a Mainland China team and must participate in the China Regional Competition.

R1.5 Any official regular team member can only belong to one participating team during the RM2020 Robotics Competition.

Penalties:

- The RMOC will reject the registration of any team that does not meet any of R1.1-R1.4. The registration can be resubmitted after the team has amended it to meet the requirements.
- If any member of a team does not meet the identity requirements stated in R1.1, a Verbal Warning will be given to the team. If the Verbal Warning is ineffective, the highest penalty that can be given to the offending team, according to the seriousness of the situation, is a Forfeiture of the match.
- If R1.5 is not met, the highest penalty that can be given to the offending team member and 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).

Penalties: The highest penalty that can be given to the offending team is disqualification.

R3 Except for Radar, 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.

Penalties: Verbal Warning. If the Verbal Warning is ineffective, personnel of the offending team shall be ordered to leave the Competition Area.

R4 Except for emergencies, teams must be at the Inspection Area at least 60 minutes before the start of a match to carry out the Pre-Match Inspection.

Penalties: Forfeiture of the match.

R5 Team members must wear goggles when entering zones designated by the RMOC such as the Preparation Area, Staging Area and Competition Area.

Penalties: Offending personnel are ordered to leave the relevant area.

R6 Except for emergencies, team Captains must sign the Staging Area Statement 10 minutes before the start of each match.

Penalties: Forfeiture of the match.

R7 Team members must not turn on the power and debug or repair their robots in the Staging Area.

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

R8 Except for Pit Crew Members that are about to start the next match, other team members are not allowed to enter Competition Zones such as the Staging Area and Competition Area.

Penalties: Verbal Warning. If the Verbal Warning is ineffective, the offending team member shall be disqualified.

R9 Teams must not bring their own projectiles into the Inspection Area, Staging Area or Competition Area, and must not take official projectiles away from the Competition Area.

Penalties: The staff confiscate the projectiles.

R10 Teams must not damage any official equipment (including but not limited to equipment in the Competition Area, Staging Area, Repair Area and Inspection Area).

Penalties: Verbal Warning, and the offending team is required to pay compensation as per the price.

R11 Team members are not allowed to leave the Staging Area or Competition Area without permission.

Penalties: Offending team members are forbidden from entering the Competition Area.

R12 Team members are not allowed bring wireless headsets into the Operator Room.

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

R13 During the 3-minute Setup Period, team members may debug Aerial near the Landing Pad but must not start its propellers. They can only launch projectiles into the projectile storage bag.

Penalties: Verbal Warning. If the Verbal Warning is ineffective, the offending team shall be issued a Level 2 Warning.

R14 During 3-minute 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.

Penalties: The offending team must bear the relevant responsibility.

R15 Members from both teams must power off all their robots and remove them from the Competition Area after the match is over. Teams are required to empty all projectiles from the robots at the Projectile Unloading Area.

Penalties: The offending robot is detained at the Projectile Unloading Area.

5.2.1.2 Pit Crew Members

R16 Each team can have up to 17 Pit Crew Members and one Supervisor in the Competition Area. The team Captain must enter the Competition Area as a Pit Crew Member.

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

R17 Pit Crew Members must meet the identity requirements.

Penalties: 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.

Penalties: The offending team member is issued a Level 4 Warning.

R19 Pit Crews entering the Competition Area must not communicate with the outside world. During the 3-minute Setup Period, the audience is allowed to give time reminders.

Penalties: 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 3-minute Setup Period or the final 20 seconds of a Team Technical Timeout,

Pit Crew Members must leave the Battlefield as quickly as possible.

Penalties: Verbal Warning. If the Verbal Warning is ineffective, the team shall be issued a Level 4 Warning. If the team does not obey the penalty order, it shall be issued a Forfeiture of the match.

R21 After the end of the 3-minute Setup Period, Pit Crew Members must return to the designated area outside the Battlefield.

Penalties: Level 4 Warning. If the team does not obey the penalty order, it shall be issued a Forfeiture of the match.

R22 Pit Crew Members may debug the fully automated Sentry using a remote controller before entering the Referee System Initialization Period.

Penalties: Forfeiture for the round.

R23 During the match, other Pit crew Members apart from the Operators must remain in the Pit Area of the Competition Area unless otherwise permitted by the referee.

Penalties: Verbal Warning. If the Verbal Warning is ineffective, the team shall be issued a Level 4 Warning. If the offending team does not obey the penalty order, it shall be issued a Forfeiture of the match.

5.2.1.3 Operator



An Operator can be substituted after each round.

R24 The number requirements for Operators stated in [Table 1-3](#) must be met.

Penalties: Forfeiture of the round.

R25 The use of one's own computers is prohibited in the Operator's Room.

Penalties: Forfeiture for the round.

R26 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.

Penalties: Verbal Warning. If the Verbal Warning is ineffective, the team shall be issued a Level 4 Warning. If the offending team does not obey the penalty order, it shall be issued a Forfeiture of the match.

R27 During the competition, an Operator must operate the relevant robots and wear a headset, equipped with at most one remote controller.

Penalties: Verbal Warning. If the Verbal Warning is ineffective, the offending team members and the robots operated by them shall be issued a Level 4 Warning. If the offending team does not obey the penalty order, it

shall be issued a Forfeiture of the round.

R28 The Pilot must wear a long-sleeved top, a safety helmet and pilot goggles.

Penalties: Forbidden from reloading projectiles for Aerial.



- The safety helmet and pilot goggles are placed in the Operator Room.
 - Since the helmet and headset cannot be worn at the same time, the Pilot needs to take off the headset before wearing the helmet.
-

R29 The Pilot can connect his phone to the remote controller to check the status of the Aerial, but he is not allowed to use the video transmitter function of the remote controller.

Penalties: Forfeiture of the round.

R30 The projectile supply reload time for a Pilot during competition cannot exceed 30 seconds.

Penalties: Verbal Warning, and the Pilot is required to return to the Pilot Operator's Room. If the Verbal Warning is ineffective, the team shall be issued a Level 4 Warning.

5.2.2 Robot Rules

5.2.2.1 General

R31 Robots entering a match must pass Pre-Match Inspection.

Penalties: Forfeiture of the round.

R32 At least four robots compete in the first round of a match.

Penalties: Forfeiture of the match.

R33 Robots must be attached with their corresponding stickers that meet the specifications.

Penalties: Before the start of the competition, offending robots are not allowed to enter the stage. During the competition, the highest penalty that can be given to the offending team, according to the seriousness of the situation, is a Level 4 Warning.

R34 Robots are not allowed to leave the Staging Area without permission.

Penalties: Verbal Warning. If a Verbal Warning is ineffective, the highest penalty that can be given to an offending robot is ejection.

R35 Robots 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.

Penalties: 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 Level 4 Warning shall be issued to the offending team member and the robot operated by him/her or the offending robot.

R36 During the 5-second countdown in the Referee System Initialization Period, robots are not allowed to transform beyond their Maximum Initial Size.

Penalties: After the start of the competition, the offending team is issued a Level 2 Warning.

R37 During the competition, robots are not allowed to disintegrate into sub-robots or sub-systems connected by multiple flexible cables, and must not cast or launch their own parts.

Penalties: The offending robot is issued a Level 4 Warning.

R38 During the competition, apart from projectile supply reloads and rescues, robots are not allowed to cover their Armor Modules through transformation or sticking to one another to avoid attacks by other robots.

Penalties: Based on the length of covering time or the purpose of sticking together, the offending team is issued a Level 3 Warning.

5.2.2.2 Ground Robots

R39 During the 3-minute Setup Period, Ground Robots in the Battlefield are not allowed to leave their team's Starting Zone.

Penalties: Based on their subjective intention, the offending team or robot is issued a Level 2 or Level 4 Warning.

R40 Except for robots with initial projectiles, other robots must empty their projectiles during the 3-minute Setup Period for each round until they are no longer able to launch any projectiles.

Penalties: If the competition has yet to start, the Pit Crew Members must empty the projectiles in compliance with the referee's instructions. Otherwise the offending robot will not be allowed to compete in the round. If it occurs during competition, the offending robot shall be issued a Level 4 Warning.

R41 During the 3-minute Setup Period of the first round, Sentry must empty its projectiles until it is no longer able to launch any projectiles, and then reload its initial projectiles.

Penalties: Pit Crew Members must empty the projectiles in compliance with the Referee's instructions. Otherwise, the offending robot will not be allowed to compete in the round.

R42 During the competition, Engineer is not allowed to use supplement lights except for procuring Projectile Containers.

Penalties: Verbal Warning. If the Verbal Warning is ineffective, the offending team shall be issued a Level 2 Warning.

R43 During the competition, no robot of the offending team is allowed to attack its enemy's Aerial.

Penalties: The offending robot is issued a Level 4 Warning.

5.2.2.3 Aerial

R44 During the 3-minute Setup Period of the first round, Aerial must empty its projectiles until it is no longer able to launch any projectiles, and then reload its initial projectiles.

Penalties: Pit Crew Members must empty the projectiles in compliance with the Referee's instructions. Otherwise, the offending robot will not be allowed to compete in the round.

R45 During the 3-minute Setup Period, Aerial is not allowed to start its propellers and leave the Landing Pad.

Penalties: The offending robot is ejected from the match, the Pit Crew Members must remove Aerial from the Battlefield, and its Pilot and Aerial Gimbal Operator must return to the Pit Area.

R46 The Safety Rope of Aerial must be hooked onto the rigid ring.

Penalties: The offending robot is not allowed to enter the round.

R47 During the match, the distance between the lowest point of Aerial and the lowest point of the Competition Area must not be less than 1500 mm, and the surface of the propellers must not exceed the highest point of the Perimeter Wall of the Flight Zone.

Penalties: The Head Referee or Pilot Referee issues a warning to the Pilot, reminding the Pilot to adjust the flight altitude. If a warning is ineffective, the offending robot shall be issued a Level 4 Warning and forbidden from entering any rounds in the same match.

R48 During the competition, Aerial is forbidden from flying outside the Competition Area.

Penalties: The offending robot is issued a Level 4 Warning and forbidden from entering any rounds in the same match.

R49 Except for launching projectile attacks, Aerial must not interfere with the normal operation of Ground Robots during their flight.

Penalties: The offending team is issued a Level 3 Warning.

R50 If Aerial experiences technical faults, or is damaged due to the unreasonable design of the propulsion system or power supply system during the competition, it must be checked by the technical referee and must be cleared by the Head Referee as hazard-free before it can be allowed to return to the match.

Penalties: The offending robot is not allowed to enter the other rounds in the same match.

5.2.3 Interaction Rules

5.2.3.1 Between Robots

R51 Standard or Hero must not engage in technical blocking against Engineer when it is procuring Projectile Containers.

R52 Engineer of one team is not allowed to interfere with the other team's Engineer when it is procuring Projectile Containers.

Penalties: Based on the length of the disturbance, the offending team is issued a warning from Level 1 to 4.

R53 Except for slowly pushing away a defeated robot that is obstructing the path, a robot must not use any of its structures to collide with the enemy's robots, regardless of whether the opposing robot has already been defeated.

Penalties: Based on their subjective intention and the degree of collision, the offending team or robot is issued a warning from Level 1 to 4.

R54 A robot must not stick itself to any enemy robot through active interference, blocking or collision.

Penalties: Based on the length of time of sticking together and its impact on the competition, the offending team is issued a warning from Level 1 to 5.

R55 A team's robots must not prevent an enemy robot from engage in rescue operations through acts such as blocking and collision.

Penalties: Based on the length of blocking time, the offending team is issued a warning from Level 2 to 4.

R56 A team's robots must not interfere with an enemy robot during a regular projectile supply reload, HP recovery or revival.

Penalties: Based on the degree of interference, the offending team is issued a warning from Level 3 to 5.

5.2.3.2 Robots and Battlefield Components

R57 Robots are not allowed to enter the Base or Launch Ramp Penalty Zone.

Penalties: Based on the length of time the robot was in the Penalty Zone, the offending team is issued a warning from Level 1 to 3.



If a team's robot is in the Launch Ramp Penalty Zone or a road trench, and an enemy robot collides severely with and damages the structure of the offending robot during its flight, the offending team shall bear the relevant consequences. If the enemy robot suffers serious structural damage, the referee shall issue the offending robot a Level 4 Warning.

R58 A team's robots must not enter a Supplier Penalty Zone or any part to gain contact with the opposing side's Official Projectile Supplier.

Penalties: Based on the length of time the robot was in the penalty zone and how it was in contact with the Official Projectile Supplier, the offending team is issued a warning from Level 1 to 5.

R59 Robots must not place any Projectile Containers in the Launch Ramp Penalty Zone.

Penalties: The offending team is issued a Level 2 Warning.

R60 During any match in RM2020, participating robots can only use projectiles supplied by the RMOC.

Penalties: Verbal Warning.

R61 Robots are not allowed to procure projectiles directly or indirectly from their own team's Sentry or Aerial.

Penalties: The offending robot is issued a Level 4 Warning.

R62 Robots are not allowed to procure directly projectiles that have fallen to the ground.

Penalties: The offending robot is issued a Level 4 Warning.

R63 Standard and Hero are not allowed to procure projectiles from Projectile Containers on the Resource Island.

Penalties: The offending robot is issued a Level 4 Warning.

R64 Engineer is not allowed to grab more than one Projectile Container once or procure projectiles from more than one Projectile Container. Only when one Projectile Container has completely left the groove of the Resource Island can the next Projectile Container be taken.

Penalties: The offending robot is issued a Level 4 Warning.

R65 Engineer must not use adhesive materials to collect or place any projectile or Projectile Container.

Penalties: The offending robot is issued a Level 4 Warning.

R66 During the competition, the movements of robots must not cause any damage to the core components of the Competition Area.

Penalties: If the fault has been confirmed, the round ends and the offending team is issued a Forfeiture for the round.

5.3 Serious Violations

The following actions are considered serious violations of rules. Any serious violation by an individual or a team will lead to a maximum penalty of disqualification from the competition. The team will be prohibited from participating in the current competition season and receiving any awards. The match results of this team will still be documented as reference for the other teams' advancement in the competition.

Table 5-2 Categories of Serious Violations

Rule	Type
1.	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.
2.	Situations have occurred in the Competition Area that violate Pre-Match Inspection requirements
3.	Causing delays deliberately or refusing to immediately leave the Competition Area after a match has ended, thereby disrupting the schedule of the competition
4.	Installing explosives or other prohibited materials on robots
5.	Team members using robots to collide with or attack other people deliberately, putting themselves and other people at risk of injury
6.	Team members deliberately damaging the opponent's robots, Battlefield Components and related equipment.
7.	Serious verbal or physical conflicts between team members and the staff of the RMOC, opponent, audience, etc.
8.	Team members do not cooperate in inspections or cause delays deliberately when the RMOC is handling an appeal
9.	Other serious actions that disrupt the competition's schedule and violate the spirit of fair competition will be penalized accordingly by the Head Referee and Chief Referee based on to the actual acts of violation
10.	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
11.	Tampering with or damaging the Referee System, or interfering with any detecting function of the Referee System through technical means.

Rule	Type
12.	Any other behavior that seriously violates the spirit of competition or has been determined by the Chief Referee as a serious violation

5.4 Conditions for Winning

The conditions for winning a single round are as shown below:

1. When the Base of one team is destroyed, the round ends immediately and the team with the surviving Base wins.
2. If a round has ended and the Bases of both teams have not been destroyed, the team with the higher remaining Base HP is the winner.
3. If a round has ended and the remaining Base HP of both teams are the same and the Outposts of both teams have been destroyed, the team with the higher Remaining Sentry HP is the winner.
4. If a round has ended, and the remaining Base HP of both teams are the same, the team with the higher remaining Outpost HP is the winner.
5. If a round has ended and the Bases of both teams have not been destroyed and the remaining Outpost HP of both teams are the same, the team with the higher HP Deduction is the winner.
6. If a round has ended and the Bases of both teams have not been destroyed, the remaining Base, Outpost and Sentry HP of both teams are the same, and the total HP Deduction of both teams is the same, the team with the higher total Robot Remaining HP is the winner.

If the winning team is unable to be determined based on these criteria, the round is considered a draw. A draw in the Knockout Stage will lead to an immediate tie-breaker round until a team wins.

Group Stage

Depending on the competition system, both teams may compete in two, three or five rounds in a match. They are called BO2, BO3 and BO5, respectively, according to the general competition system descriptions of competitive games. The official matches of RM2020 consist of the Group Stage and the Knockout Stage. The competition system for the Group Stage is BO2. Except for the Semifinals and the Championship Match which are BO5, the competition system for all other Knockout Stages is BO3.

Table 5-3 Scoring for Group Stage

Competition System	Competition Result	Points
BO2	2:0	Winner of two rounds gains 3 points

Competition System	Competition Result	Points
	1:1	One point for each team
	0:2	Loser of two rounds gains 0 point
	1:0	(draw for one Round): The team winning one round gains 1 point, and the team losing one round gains 0 point
	0:0	(draw for two rounds): Each team gains 0 point

The ranking for the Group Stage is determined by the total points for each match. Teams are ranked based on the following order from 1 to 3, in descending order of priority:

1. The team with the higher total match points ranks higher.
2. If the total match points of teams are the same, the team with the higher total Net Base HP from all rounds ranks higher.
3. If the total Net Base HP of teams are the same, the team with the higher total Outpost HP from all rounds ranks higher.
4. If the total Outpost HP of teams are the same, the team with the higher total HP Deduction from all rounds ranks higher.

If two or more teams are still tied for the same place according to these criteria, the RMOC will arrange a playoff match on the basis of two extra rounds.



- HP Deduction: The total damage accrued by a team at the end of each round from successfully hitting the Armor Modules of enemy robots leading to HP deductions in the enemy robots or Base.
 - HP deducted as a result of exceeding the Initial Firing Speed limit, Barrel Heat limit and Maximum Chassis Power Consumption and of the Referee System going offline are not counted as HP Deduction.
 - HP deducted as a result of penalties executed by a referee for a Level 2 to 5 Warning will be counted as the enemy's HP Deduction.
 - Net Base HP: The remaining HP of a team's Base subtracted by the remaining HP of the enemy's Base at the end of a round.
 - Net Outpost HP: The remaining HP of a team's Outpost subtracted from the remaining HP of the enemy's Outpost at the end of a round.
 - Total Remaining HP: The total value of the remaining HP of a team's surviving robots at the end of a round.
-

Knockout Stage

A team wins the Knockout Stage if it has won the most number of rounds: B03 requires the winning of two rounds while B05 requires the winning of three rounds.

6. Technical Fault or Exception

6.1 Technical Fault

The faults that will trigger an Official Technical Timeout during the 3-minute Setup Period are set out as follows:

Table 6-1 Descriptions of Technical Fault

Rule	Description
1	The official equipment inside the Operator's Room malfunctions.
2	During the 3-minute 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's Room normally or connect to the Referee System server.
3	Structural damage or malfunctions of key Battlefield Components, for example: where a Base cannot open its shield normally; a Base Armor Module shifts, drops off or cannot detect hit damage; a Power Rune cannot be hit and triggered normally; the Aerial Safety Rope breaks or is worn out; the Official Projectile Supplier is unable to supply projectiles normally.
4	Other situations determined by the Head Referee as requiring an Official Technical Timeout.

If the malfunction referred to in Rule 2 occurs during a 3-minute Setup Period between rounds or during a 7-minute match, 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 the robot's mechanical or electrical system designs, or robot combat from previous matches. Regular battle damage will not trigger an Official Technical Timeout. Technical Referees will provide backup Referee System modules. Teams can request for a Team Technical Timeout to repair their robots.

6.2 Exception

Any exception that occurs during the competition should be handled as follows:

- When a robot safety hazard or exception in a robot has occurred on the Battlefield, such as battery explosion, Aerial flying towards the Audience Area after breaking an Aerial Safety Rope, stadium power outage, explosion of a compressed gas cylinder, or interpersonal conflict), the Head Referee will notify both teams through the Operator's Room Referees after discovering and confirming the emergency, and kill 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 the general Battlefield Components are damaged during a match (damage to the ground rubber surface, ground lighting, or Base lighting), the match will proceed as usual. In the event of structural damage or a malfunction of a key Battlefield Component, for example: where a Base Armor Module shifts, drops off or cannot detect hit damage; a Power Rune cannot be hit and triggered normally; the Aerial Safety Rope breaks or is worn out, the Head Referee will notify both teams through the Operator Room Referee after discovering and confirming the emergency, and kill all robots through the Referee System. The result of the round will be invalidated. The Technical Referees will enter the Battlefield to perform repairs. The round will restart once the Battlefield Component resumes its normal function.
- If an Official Projectile Supplier malfunctions, the Head Referee will evaluate whether it affects the fairness of the match. If it does, the Head Referee will notify both teams through the Operator's Room Referees and kill all robots through the Referee System. The round ends immediately and its result is invalidated. The round will restart after the issue has been solved.
- If certain Battlefield Components experience logical or structural faults that are not caused by participants in the process of the match, for example where no bonus is gained after a Power Rune is hit or a Base cannot open its shield normally, the Referee will solve the problem manually through the Referee System. If the problem cannot be solved manually through the Referee System and after determining that the issue cannot be eliminated, the Referee will notify both teams through the Operator Room Referee and kill all robots through the Referee System. The round ends immediately and its result is invalidated. The round will restart after the issue has been solved.



Resolving issues manually will cause delays, and the RMOC will not be responsible for any resulting consequences.

- 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 Head Referee did not confirm the situation and end the game in time, causing a Round that should have been ended to continue and thereby produce a winner, the result of the Round will be deemed invalid once confirmed by the Chief Referee, and one rematch will be given.
- If a serious violation has taken place that clearly warrants a Level 5 Warning but the Head Referee did not confirm the situation and did not issue a Level 5 Warning in a timely manner, the original match result will be deemed invalid once confirmed by the Head Referee or an appeal has been allowed after the match, and the offending team will be given a Level 5 Warning and penalty.
- If an issue has occurred during the competition that affects the fairness of the competition, the Chief Referee will make a determination according to the actual situation.

7. Appeal

Each team has the right to one appeal during the China Regional Competition, Wild Card Competition, International Regional Competition, and Final Tournament. However, opportunities to appeal cannot be accumulated 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 Head Referee and heads of the RMOC. The Arbitration Commission has the final right of interpretation on all appeal decisions.

If a rematch has occurred for a round due to an arbitration decision requiring a “Rematch between Both Teams”, both teams can appeal again after the rematch. In this scenario, if the original appealing team appeals again (known as a “Continued Appeal”), the team’s opportunity to appeal will be exhausted regardless of whether the appeal is successful. As a continued appeal will cause serious delays to the competition schedule, the continued appeal must be initiated together by both the team Captain and supervisor within five minutes after the match ends (both signing on the Appeal Form at the same time). The process for a continued appeal will also be condensed. The time for submission of evidence and materials is shortened to within 30 minutes of making the appeal. The RMOC will announce the outcome of the appeal on the Appeal Form within 60 minutes of the continued appeal being made.

7.1 Appeal Process

Teams filing an appeal must follow the procedure below:

1. Within five minutes after a match ends, the appealing team’s Captain submits an appeal request and signs an Appeal Form at the Referee Area. If the reason for the appeal is related to the robots of any team in the competition, the appealing party needs to propose that the relevant robots be isolated and tested, which will be implemented after being confirmed by the Arbitration Commission. By signing, the appealing party confirms that it is initiating the appeal process, and the Appeal Form cannot be modified after it has been signed. Any appeal made five minutes after a match has ended will be deemed invalid. No appeals are allowed before and during the competition.
2. The Captains of both teams will be brought by the staff to the Arbitration Room. The Arbitration Commission will determine whether the appeal request can be accepted.
3. If either team needs to collect evidence or defense materials, the period of time granted is one hour. The materials collected will need to be submitted to the Arbitration Commission, which will further communicate with the team members involved in the appeal. If neither side needs to collect evidence or defense materials, proceed to the next step.

4. After the Head Referee has accepted the appeal request, the staff will invite the Captain of both teams to meet in the Arbitration Room. Each team can only send three members to the Arbitration Room, and one they must be the Captain, Project Manager, key team members or the supervisor. The presence of either the Captain or the Project Manager is mandatory.
5. The Arbitration Commission will make a final decision, and the Captain of both teams will sign the Appeal Form to confirm the decision. Once signed, both teams cannot question the appeal decision any further.

7.2 Appeal Validity

Teams must file their appeal within the validity period. Below are the appeal validity periods for different stages:

- Validity period for appeal requests: Appeals must be made within five minutes after the end of a match and recorded on the Appeal Form. The Arbitration Commission will not accept any appeal request that has exceeded the validity period.
- Validity period for both teams to meet at the Arbitration Room: Within 30 minutes of being notified by the Arbitration Commission. If a team is absent during the validity period for both teams to meet at the Arbitration, the absent team is deemed to have given up its right to the arbitration. If more than three members of a team are present at the Arbitration Room or the attendees do not meet the specified identity requirements, the team is also deemed to have given up its right to the arbitration.
- Validity period for submission of evidence or defense materials: Within 60 minutes of making an appeal. The Arbitration Commission will not accept any new materials beyond this 60-minute limit.

7.3 Appeal Material

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 - the organizing committee will not provide any videos in order to stay impartial) and the text files for the appeal should be placed according to the directory.
- Material format: Each video cannot exceed one minute in length or 500MB in size. The name of the video must indicate the specific Round of the match and the time it was taken. Videos should be compatible with the latest version of Windows Media Player, photos must be in JPG format, and text documents must be in MS Word 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 not be isolated for more than three hours and will be returned to the teams latest when the arbitration decision is announced.

7.4 Appeal Decision

The Arbitration Commission will provide its final arbitration decision on the Appeal Form, which both team Captains must sign within an hour of the decision has been announced. If a team does not sign the Appeal Form, it is deemed to have accepted the appeal decision. The arbitration decisions that can be made include: Maintaining the original match results; a forfeiture issued against the respondent; a rematch between both teams. Neither team may appeal against the final decision of the Arbitration Commission.

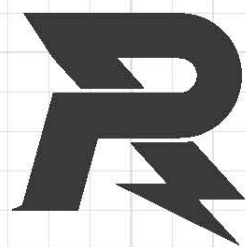
If the Arbitration Commission requires both teams to hold a rematch, the Organizing Committee will inform both teams of the rematch time when the arbitration decision is announced. If both teams refuse to hold a rematch, the appeal is deemed invalidated and the original match results are maintained, with both teams retaining their rights to appeal. If only one team refuses the rematch, the refusing team is deemed to have forfeited and lost the round.

Appendix 1 Safety Instruction

Every team member participating in the RoboMaster 2020 must fully understand and accept that safety is the most important issue for the sustainable development of the RoboMaster Competition. In order to protect the rights and interests of all team members and the event organizers, and according to relevant laws and regulations, all team members who have registered for RM2020 will be deemed to have acknowledged and agreed to abide by the following safety terms:

1. All team members who have registered to take part in the RoboMaster 2020 Competition confirm that they possess the full capacity for civil conduct and can independently create and operate robots. All team members further confirm that, before using any products of the competition organizer SZ DJI Technology Co., Ltd., to create any robots, they will read in detail the RoboMaster 2020 Competition registration guide, competition regulations, and other important documents containing rules and regulations related to the competition.
2. During the competition, all team members should make sure that their actions including the creation, testing, and use of robots will not cause any injury or damage to his or her teammates, members of the opposing teams, Referees, competition staff, audience, equipment, or the Competition Area.
3. All teams must ensure that the structural design of their robots will not hinder safety inspection during Pre-Match Inspection, and agree to fully cooperate in the Pre-Match Inspection carried out by RoboMaster's organizers.
4. All teams guarantee that they will not use any internal combustion engines, explosives, or high-pressure gas as working gas, or any dangerous materials.
5. During any stage of the R&D, preparation or competition period, all team members must be fully aware of any potential safety issues, and the team's Supervisor is responsible for instructing and supervising the team on safety issues.
6. All teams must guarantee the safety of all robots. This includes ensuring the projectile launchers installed on robots are safe, and that they will not cause any harm either directly or indirectly to any Operator, referee, staff member or audience member.
7. All teams will take sufficient and necessary safety measures during the R&D, training and competition periods regarding any hazardous situations that may occur. These include but are not limited to: preventing the control system from becoming unstable; anticipating every operation step prior to execution to avoid errors or collisions between team members or between robots and team members; prohibiting team members from engaging in solo training and making sure personnel are available as emergency responders to any situation; wearing goggles and helmets; applying the spotlight lock function and adding an emergency stop function other measures in a robot during debugging.

8. Teams will be held responsible for all accidents and losses resulting from the technical faults of robots, loss of control of UAVs or any other unexpected circumstances.
9. The materials bought from or provided by the organizer SZ DJI Technology Co., Ltd., such as batteries and the Referee System, must be used in accordance with their instructions. SZ DJI Technology Co., Ltd. will not be held responsible for any injuries that arise from improper use of these materials. Teams will be held responsible for any injuries caused to their own members or any third party and for any property loss arising from creating and operating any robots.
10. All team members must remain in strict compliance with the laws and regulations of the country or region. All team members pledge that their robots will only be used for the RoboMaster competitions and that their robots will not be illegally modified or used for any illicit purpose.



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