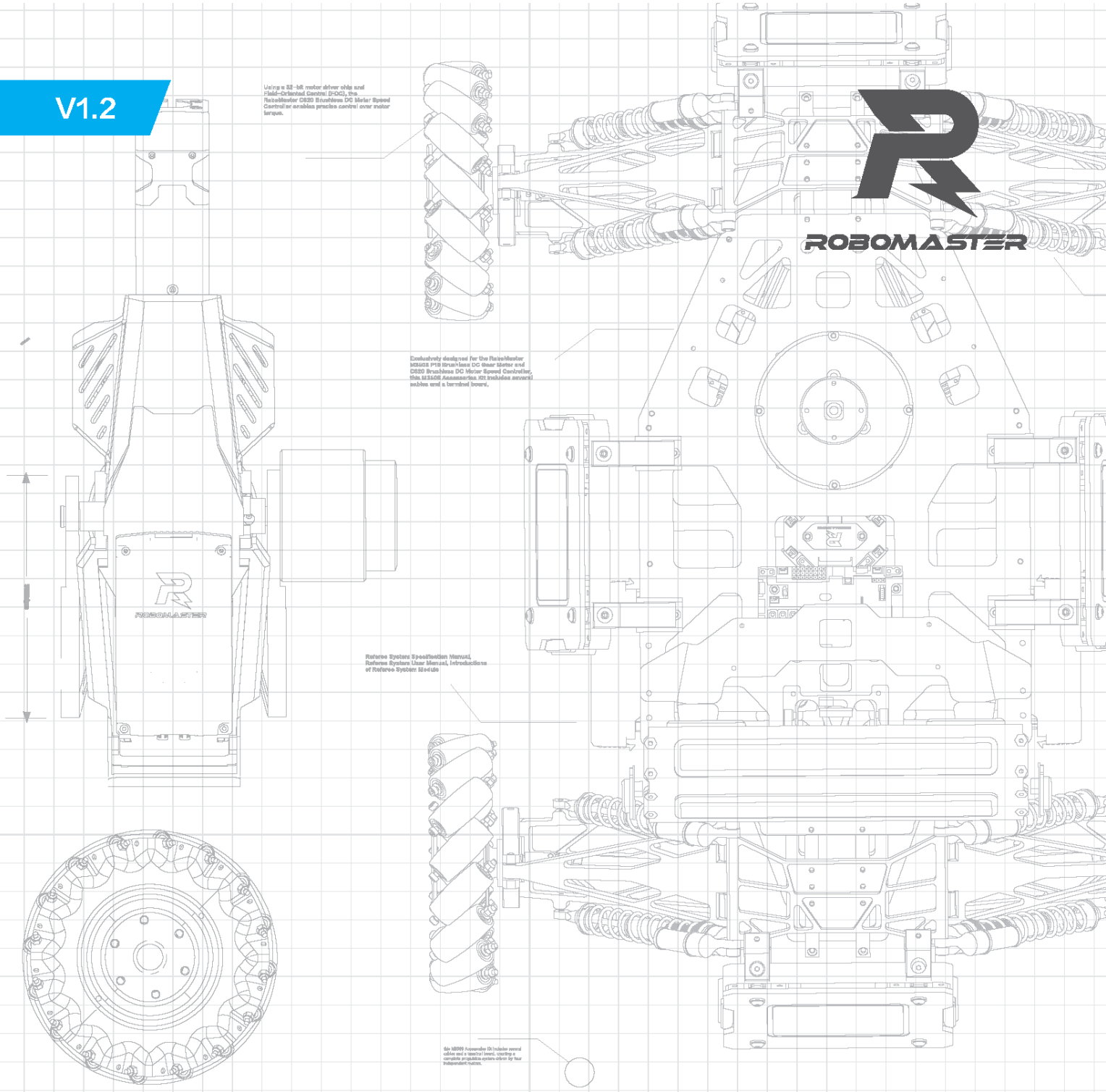
V1.2



ROBOMASTER 2020
ROBOTICS COMPETITION

RULES MANUAL

Prepared by the RoboMaster Organizing Committee
Released on May, 2020

Intellectual Property Statement

The RoboMaster Organizing Committee (hereinafter referred to as “the RMOC”) encourages and advocates for technological innovation and open source technology and respects the intellectual property of participating teams. All rights related to the intellectual property developed during the competition are owned by the individual teams. The RMOC will not be involved in the handling of intellectual property disputes within teams. The participating teams must properly handle all aspects of intellectual property rights among internal school members, company members and other members of the team.

While using the RoboMaster Referee System and other supporting materials provided by the RMOC, teams should respect the owners of all intellectual property. Teams are also prohibited from engaging in any behavior that violates intellectual property rights, including but not limited to reverse engineering, replication or translation.

With regard to any behavior that may infringe upon the intellectual property rights relating to educational materials provided for the competition by the RMOC or co-organizers, the intellectual property rights owners are entitled to hold the infringing parties responsible in accordance with law.

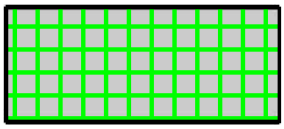
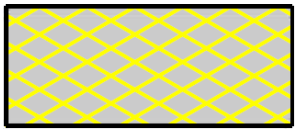
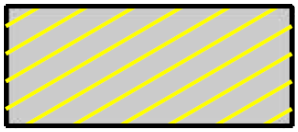
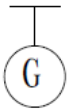
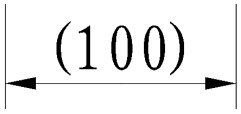
Relevant suggestions for open source materials can be found in this link: https://bbs.robomaster.com/thread-7026-1-1.html.

Using this Manual

Legend

Penalty zone	Important notes	Hints and tips	Definitions and references

Legend for Battlefield Drawings

		
Buff point for both sides	Buff point for one side	Penalty zone for both sides
		
Penalty zone for one side	The plane on which the battlefield is located is its lowest plane	Dimensions are for reference only

Release Notes

Date	Version	Changes
2020.5.27	V1.2	1. Cancelling the China Regional Competition and International Regional Competition due to the epidemic. 2. Adjusting the full team lineup size for Standard to 2. 3. Adding the Pilot Assessment component. 4. Updating the descriptions of the light effects of the Dart Launching Station. 5. Updating site diagrams and changing some site features. 6. Adding descriptions for the determination of Aerial status. 7. Adding relevant information for the Dart Detection Module. 8. Adding the site localization tag. 9. Updating the competition mechanism. 10. Adding the Hero Sniper Point buff mechanism. 11. Adding Pit Crew roles: tactical coach 12. Updating violation and penalty information. 13. Updating the appeal processes and materials required for appeals.
2019.12.31	V1.1	1. Adding image explanations, and updating competition site descriptions and drawings. 2. Updating the competition mechanism. 3. Updating the penalty system and competition rules.
2019.10.15	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

- Adding Dart System and Radar and update robot lineup and numbering
- Updating basic information such as robot parameters
- Adjusting 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
- Adding new mechanism related to Outpost
- Adding a mobile 17mm Launching Mechanism.

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, Final Tournament
Engineer	2	1	

Type	Numbering	Full Team Size (Units)	Competition Stage
Standard	3/4	2	
Aerial	6	1	
Sentry	7	1	
Dart System	8	1	
Radar	9	1	

Minimum lineup for the first round of 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

Robot Type	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	0	For details relating to the current levels and performance levels of robots, please refer to “Table 3-9 - Hero Robot Levels” and “Table 3-10 - Hero Robot Performance Upgrade”. For details on the buffer energy relating to the Maximum Chassis Power Consumption (W), please refer to “3.2.2 - Exceeding Barrel Heat Limit and Cooling”.							For details please refer to “3.2.2 - Exceeding Barrel Heat Limit and Cooling”	Starting Zone

Robot Type	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
Engineer	0	No limits	500	500	For details please refer to "Table 1-4 - Mobile 17mm Launching Mechanism".			5	For details please refer to "3.2.2 - Exceeding Barrel Heat Limit and Cooling"	Starting Zone
Standard	0	For details relating to the current levels and performance levels of robots, please refer to "Table 3-7 - Standard Robot Levels" and "Table 3-8 - Standard Robot Performance Upgrade" For the buffer energy correlated to the maximum chassis power consumption, refer to "3.2.3 - Exceeding Chassis Power Consumption Limit".							For details please refer to "3.2.2 - Exceeding Barrel Heat Limit and Cooling".	Starting Zone
Aerial	No limits	-	-	-	30	-	-	-	No limits	Landing Pad

Robot Type	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
Sentry	No limits	30	600	600	30	320	100	7.5	For details please refer to "3.2.2 - Exceeding Barrel Heat Limit and Cooling".	Sentry Rail
Dart System	-	-	-	-	18	-	-	-	-	Dart Launching Station
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: The speed detected by the relevant modules of Referee System after a projectile or dart has completed its acceleration. The initial firing speed of a dart can be measured based on the time interval of the dart passing through the speed detection device installed on the Dart Launching Station.
- Initial projectile quantity: The quantity of projectiles that a Pit Crew Member can load into the magazines of a robot before the start of a round.

1.2.3 Operator Lineup

- An operator must be an official member of a team in the current season.

- An Operator can be substituted after each round.
- A pilot can operate an Aerial Robot in the competition only after passing the Pilot Assessment by the RMOC. For details on the Pilot Assessment, please refer to the RoboMaster 2020 Robotics Competition Participant Manual.

Pilot Assessment: The Pilot Assessment includes the Pilot Theory Exam and Pilot Video Assessment.

The Operator lineup is as follows:

Table 1-3 Operator Lineup

Robot Type	Robot Operated	Full Team Lineup Size
Ground Robot Operator	Hero	1
	Standard	2
	Engineer Robots	1
Aerial Gimbal Operator	Aerial, Dart System, Radar	1
Pilot	Aerial Robot	1

Ground Robots: Hero, Engineer and Standard, collectively.

1.2.4 Tactical Coach

Each team is allowed to have a tactical coach, who can enter the operator room during the 3-Minute Setup Period to set up tactical arrangements with the operator. The tactical coach must leave the operator room before the end of the 3-Minute Setup Period.

The tactical coach can be any participating member in the team (apart from reserve members).

1.2.5 Mobile 17mm Launching Mechanism

A mobile 17mm Launching Mechanism can be mounted on any Ground Robot. 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 mobile 17mm Launching Mechanism shall be calculated separately from the existing Launching Mechanism. Its Initial Firing Speed limit shall be consistent in level with that of the existing Launching Mechanism. If the mobile 17mm Launching Mechanism is mounted on Standard, except Initial Firing Speed limit, the Barrel Heat limit and Barrel Cooling Value per Second shall be consistent with those of the existing Launching Mechanism.

For example, a participating team mounts the mobile 17mm Launching Mechanism on Hero. According to "3.8.1 - Experience System", when a Hero Robot reaches 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 mobile 17mm Launching Mechanism to 22 m/s, its barrel heat to 180, and Barrel Cooling Value per Second to 30. The Initial Firing Speed limit of a 42mm Launching Mechanism will be increased to 14 m/s, its barrel heat to 300, and Barrel Cooling Value per Second to 40.

Table 1-4 Mobile 17mm Launching Mechanism

Robot Type	Initial Firing Speed Limit (m/s)	Barrel Heat Limit	Barrel Cooling Value per Second
Hero	See "Table 3-8 - Standard Robot Performance Upgrade".	See "Table 1-5 - Barrel Heat Attributes of Mobile 17mm Launching Mechanisms Installed on Hero Robots".	
Standard		See "Table 3-7 - Standard Robot Levels".	
Engineer	15	150	25

Table 1-5 Barrel Heat Attributes of Mobile 17mm Launching Mechanisms Installed on Hero

Hero Level	Barrel Heat Limit	Barrel Cooling Value per Second
1	120	20
2	180	30
3	240	40

1.3 Overview of Competition Process

Before each match begins, all robots need to pass the Pre-match Inspection performed by the RMOC, which is to ensure that all robots fulfill the technical specifications set by the RMOC for fairness. After completing the Inspection, team members need to go to the Staging Area with their robots to sign the Staging Area Statement, and wait to enter the Competition Area for the match.

Before the start of each match, all teams must be guided by staff to enter the Competition Area from the Staging Area. Each round consists of a Three-Minute Setup Period and a Seven-Minute Round. Between the two periods, there is a 20-Second Referee System Initialization Period.

By the end of each match, teams must clean up projectiles left in the magazine and Launching Mechanism of each robot, return them to the designated area and leave the Competition Area. For detailed descriptions of the competition process, please refer to “4 - Competition Process”.

2. Competition Area

2.1 Overview

- The error margin for the dimensions of all battlefield components described in the document is ±5%. The unit for the size parameters on the site drawings is mm.
- A buff point is an area where robots can receive buffs of a certain nature. Please refer to "3.6 - Battlefield Buff Mechanism" for details on the buff point mechanism for the relevant areas mentioned in this chapter.
- A penalty zone is an area that designated robots are forbidden from entering. Please refer to "5.2.3.2 - Interaction between Robots and Battlefield Components" for the penalty zone debuff rules for the relevant areas mentioned in this chapter.

The core competition area of the RM2020 Robotics Competition is called the "Battlefield". The Battlefield is 28 meters long and 15 meters wide, and consists of the Base Zone, Elevated Ground, Resource Island Zone, Supplier Zone and Flight Zone. On the perimeter of the Battlefield is a black steel Perimeter Wall with a height of 2.4 m from its upper edge to the Battlefield ground surface.

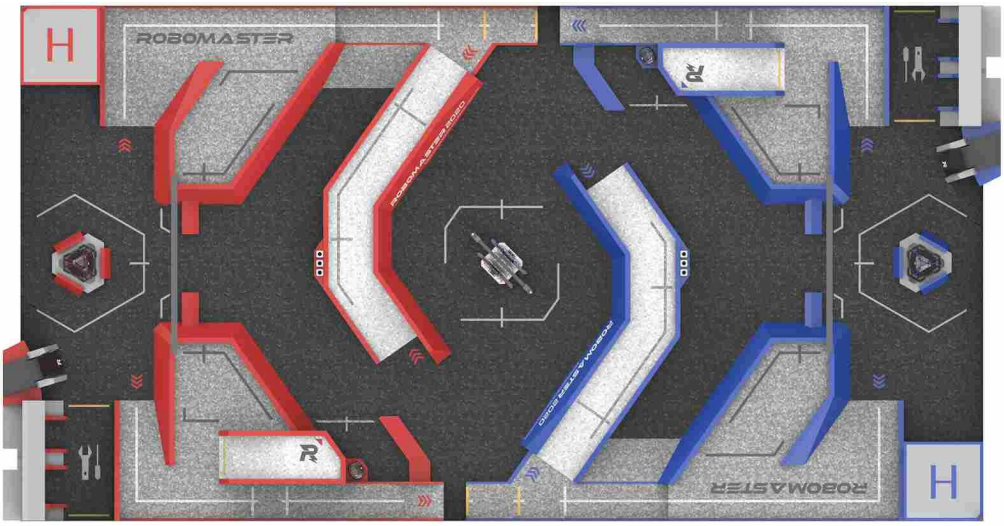


Figure 2-1 Top-view rendering of the Battlefield

Figure 2-2 Oblique-view rendering of the Battlefield

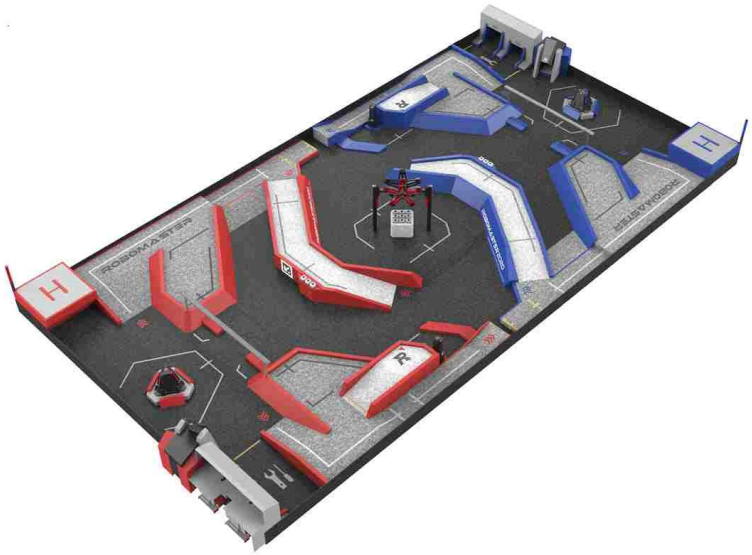
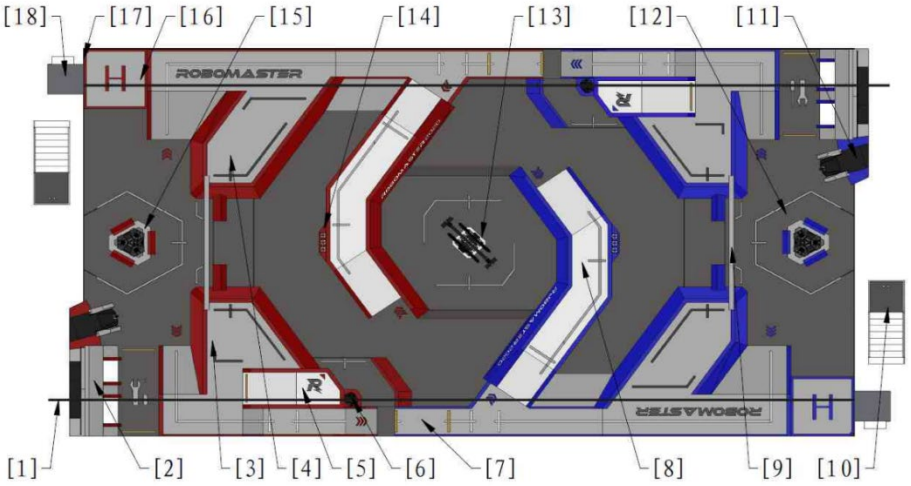


Figure 2-3 Axonometric rendering of the Battlefield



[1]	Aerial Safety Rope	[2]	Supplier Zone	[3]	Trapezoid-shaped elevated ground	[4]	Diamond-shaped elevated ground
[5]	Power Rune Activation Point	[6]	Outpost Zone	[7]	Road Zone	[8]	Ring-shaped elevated ground
[9]	Sentry Rail	[10]	Radar Base	[11]	Dart Launching Station	[12]	Starting Zone
[13]	Resource Island Zone	[14]	Small Resource Island	[15]	Base Zone	[16]	Landing Pad
[17]	Aerial projectile reload window	[18]	Pilot Room				

Figure 2-4 Battlefield modules

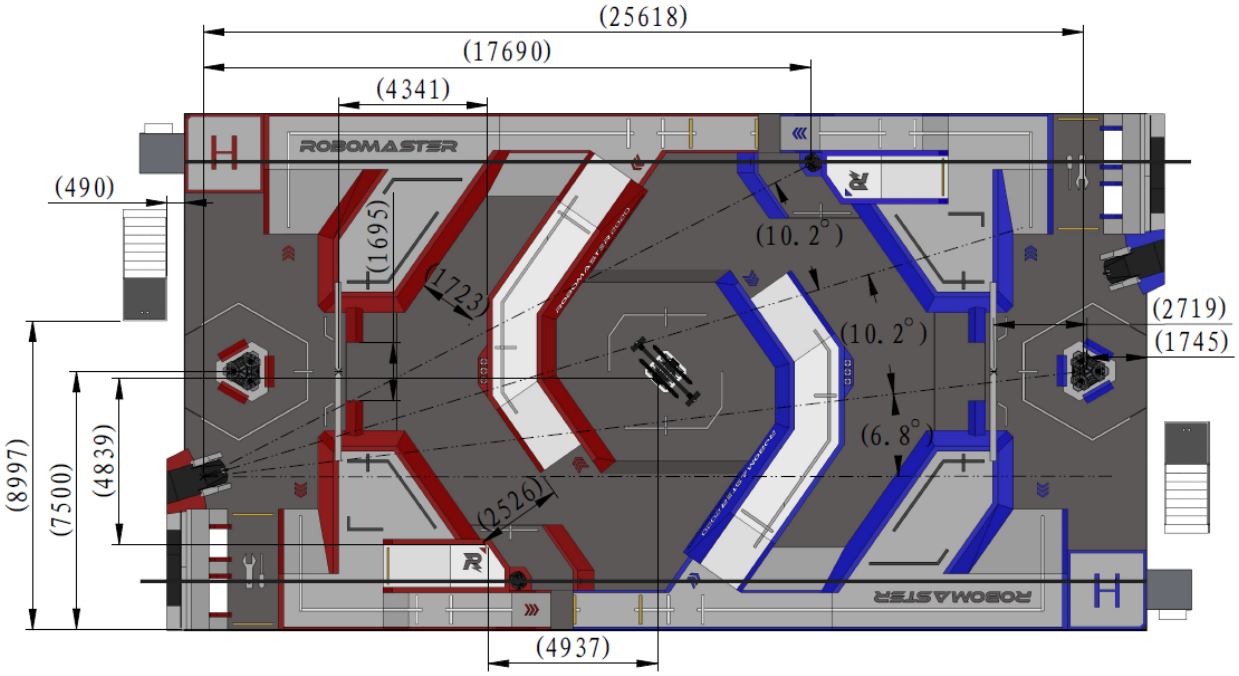
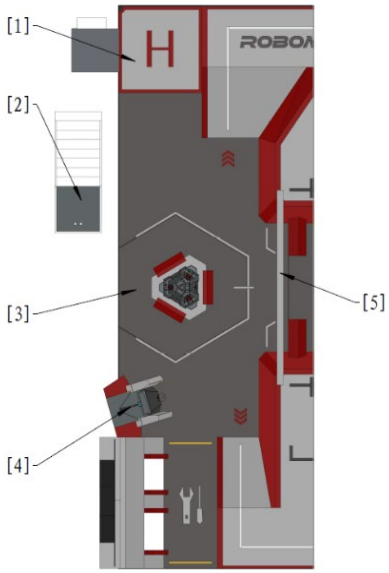


Figure 2-5 Localization dimensions for battlefield modules

2.2 Robot Initialization Area

The Robot Initialization Area is where robots are placed before a match, which includes the Landing Pad, Starting Zone, Radar Base, Dart Launching Station and Sentry Rail. The Starting Zone is the hexagonal area near the base, while the Landing Pad, Radar Base, Dart Launching Station and Sentry Rail are located around the Starting Zone.

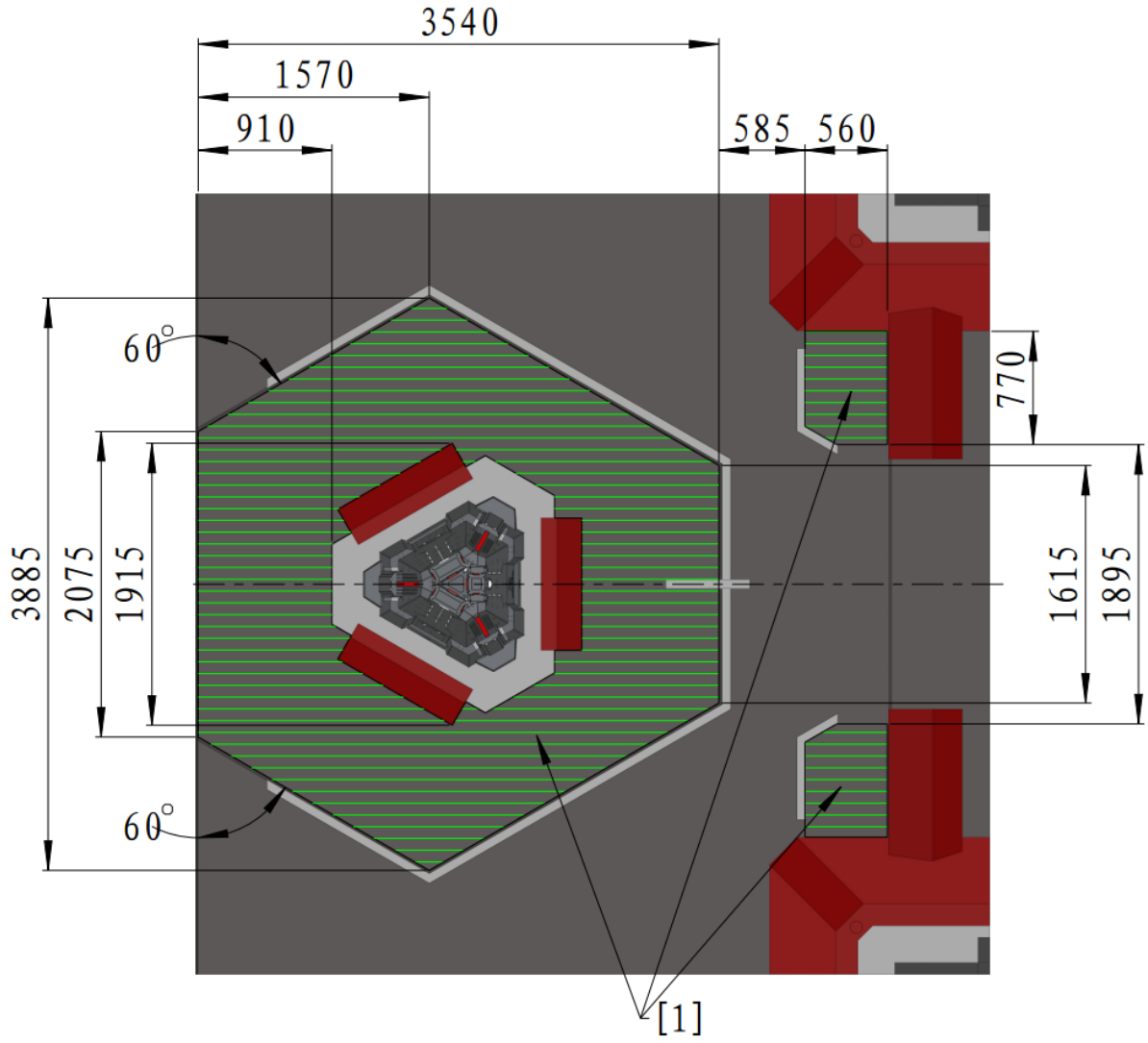


[1] Landing Pad [2] Radar Base [3] Starting Zone [4] Dart Launching Station [5] Sentry Rail

Figure 2-6 Robot Initialization Area

2.2.1 Starting Zone

The Starting Zone is the hexagonal area near the base, where robots are placed before the start of a match. The plane of the Starting Zone is about 15 mm from the Battlefield ground.



[1] Base Buff Point

Figure 2-7 Robot Starting Zone

2.2.1.1 Base Buff Point

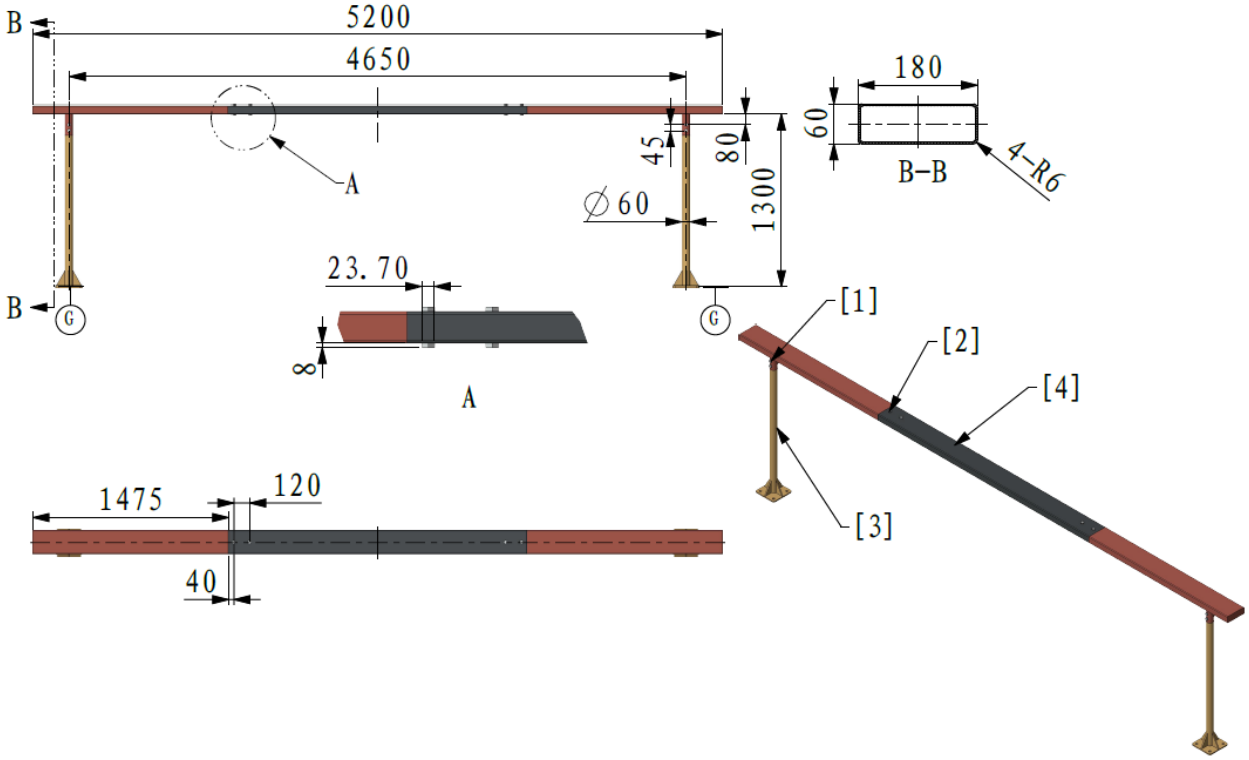
The Base Zone Buff Point consists of three locations including the hexagonal area near the base and the area behind the lower bunker of the Sentry Rail.

2.2.2 Sentry Rail

- The parts in the same colour represent the same component. Connection and height gaps exist in the assemblage of different components.
- The hexagonal angles of the bolt head are not definite and are for reference only.

The sentry rail is the only area where a Sentry can be active. It is located near the Starting Zone, including the body

of the rail and its supporting structure, the surface of which is painted. The distance between the lower surface of the Sentry Rail and the Battlefield ground should be 1300 mm. However, due to the weight of the rail, a certain height difference will exist between the middle and the ends of the Sentry Rail. Therefore the actual distance between the lower surface of the rail and the Battlefield ground should be 1250-1300 mm.



[1] M8 Bolt [2] M16 Bolt [3] Rail Support [4] Main Body of the Rail

Figure 2-8 Sentry Rail

2.2.3 Dart Launching Station

A Dart Launching Station is where a Dart Launcher is placed.

The Dart Launching Station consists of the body of the station, the gliding platform and the gate. The material of the gliding platform within an area of 600*1000mm is iron (which is magnetic).

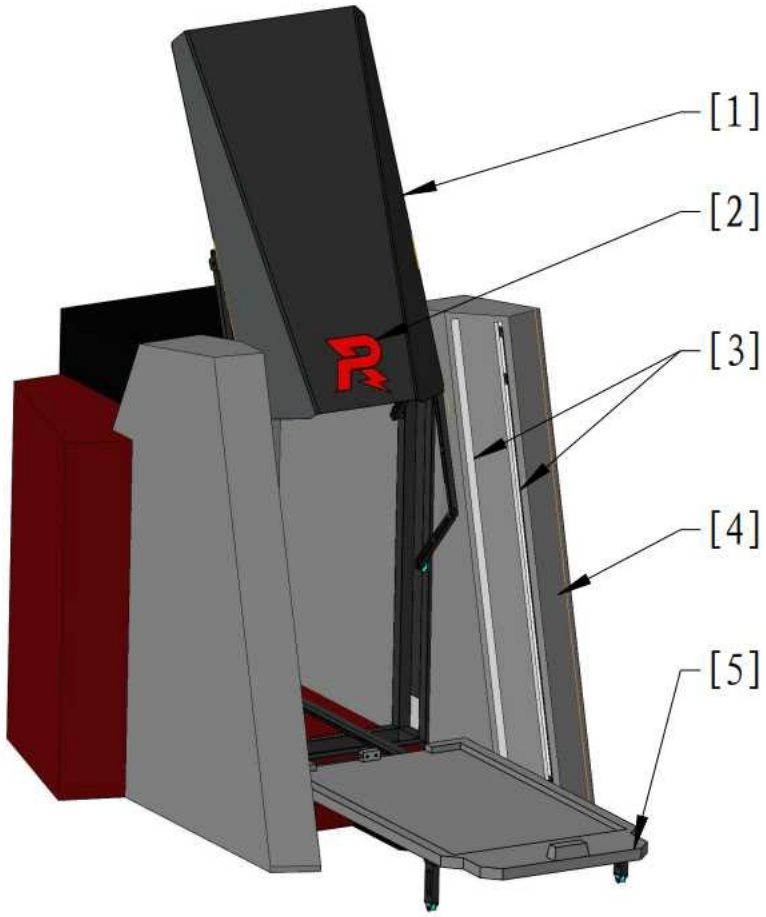
The body of the Dart Launching Station is installed with a speed detection device which can measure the initial firing speed of a dart based on the interval time of it passing through the two parallel flat surfaces. The gliding platform can glide forward and backward for easy placing of a Dart Launcher. The gate is opened and closed using motor power.

During the 3-Minute Setup Period, the gate of the Dart Launching Station is in the open position, and the Pit Crew Member needs to pull out the gliding platform and place the Dart Launching Station in the square area of the gliding platform. If the Dart Launching Station has not established any regular connection with the server, the “R” indicator on the gate is off, otherwise a white light will flash on the indicator at a frequency of 2 Hz. After confirming the

dart launching system is operating normally, the Pit Crew Member needs to push the gliding platform back into the body of the Launching Station until the gliding platform reaches the end. The gliding platform will lock itself automatically after it is in place, and the constant white light of the indicator will turn on. If the gliding platform is not properly in place, the indicator will flash at a frequency of 2 Hz. Before the start of a match, the gate will close automatically.

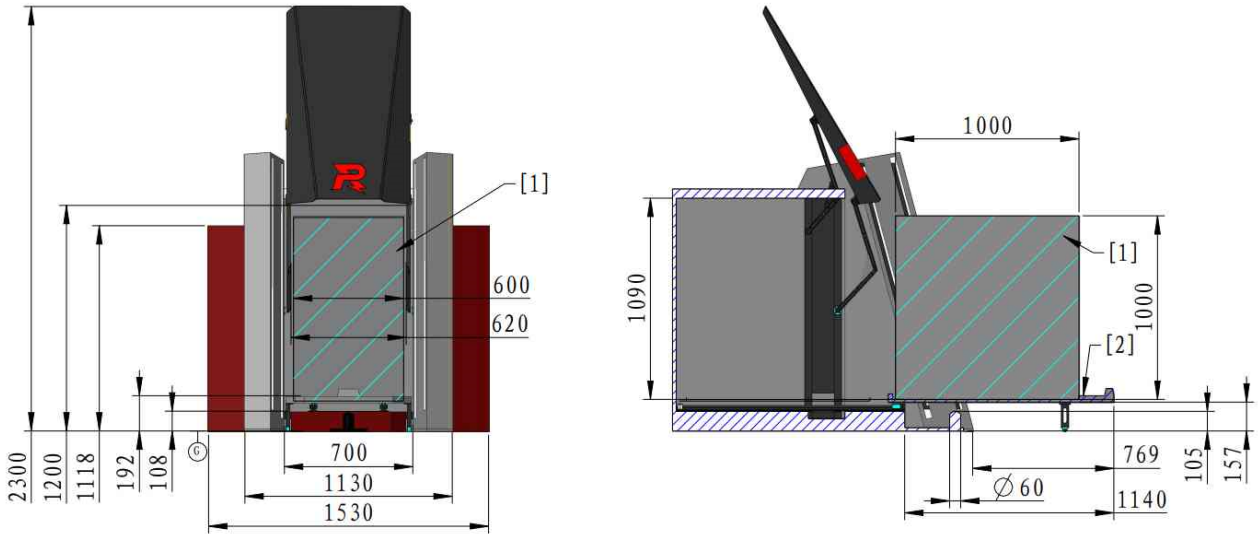
After the start of a match, the operator will use the keyboard and mouse on the client to control the opening and closing of the gate and the launching of darts.

It takes 5 seconds for the gate to open fully. The window period for launching darts is 15 seconds after the gate is fully opened. Darts can be launched during the window period, at the end of which the gate will close automatically.



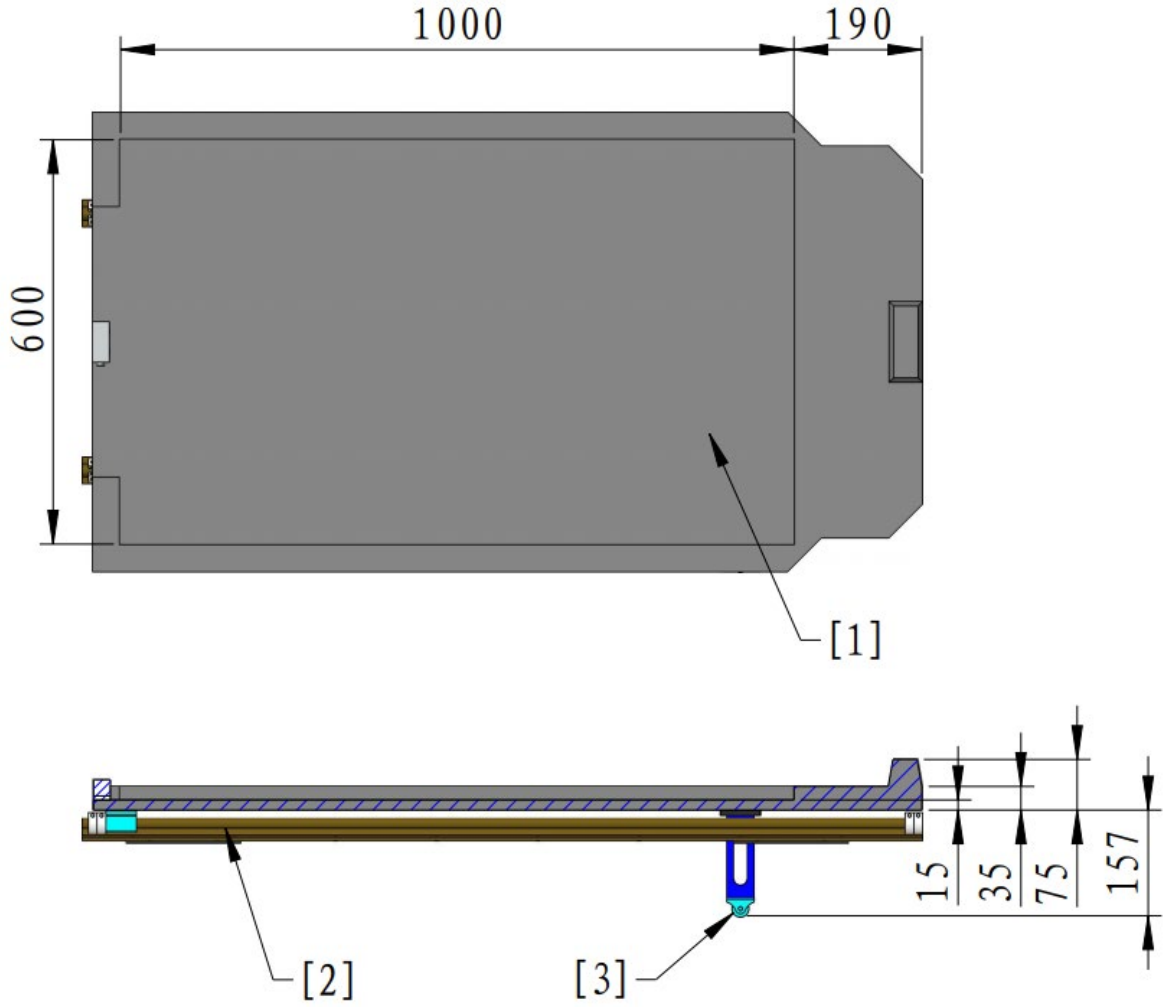
[1] Gate [2] Status Light [3] Speed detection device [4] Main Body of Launching Station [5] Gliding Platform

Figure 2-9 Dart Launching Station



[1] Setting Position of Dart Launcher [2] Gliding Platform

Figure 2-10 Gliding Platform Slides Out

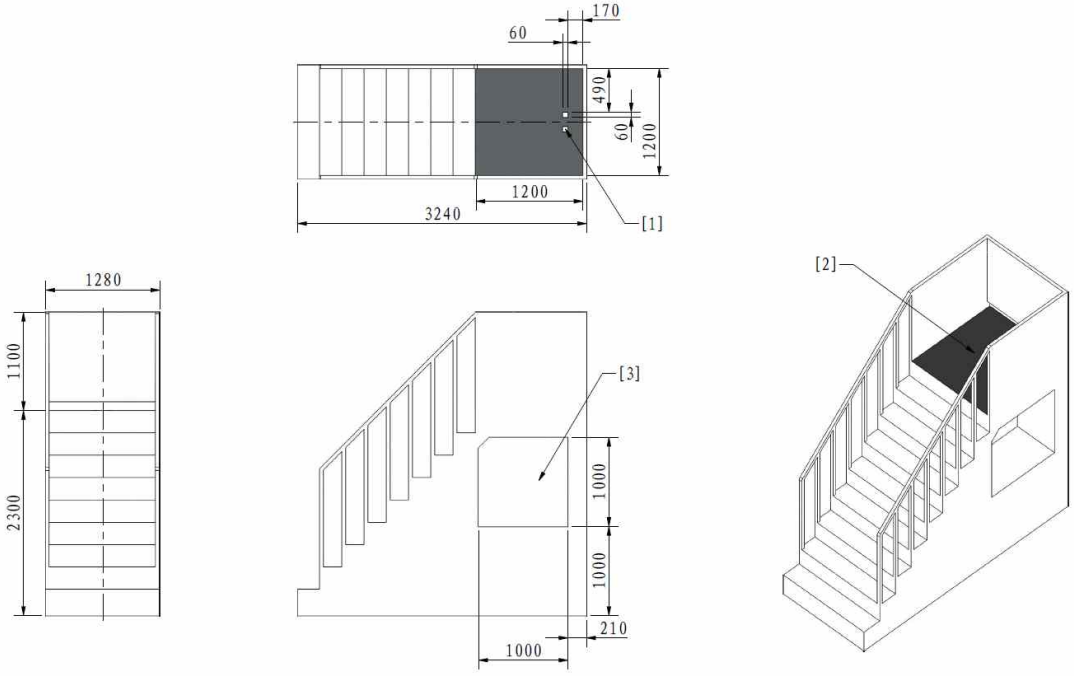


[1] Flat surface for placing Dart Launcher [2] Gliding Platform Rail [3] Supporting wheel

Figure 2-11 Dimensions for Gliding Platform

2.2.4 Radar Base

A Radar Base is the platform for placing a radar sensor. At its top is a platform with a surface area 1200*1200 mm, made of iron panel material (which is magnetic). The distance from the plane of the platform to the battlefield ground should be 2000 mm, with a non-transparent perimeter wall around that is 1100 mm high. Two cable grooves are on the platform, to be used as required by the conditions of the actual site.



[1] Sensor data cable slot [2] Iron panel material [3] Platform for placing the Radar computing end

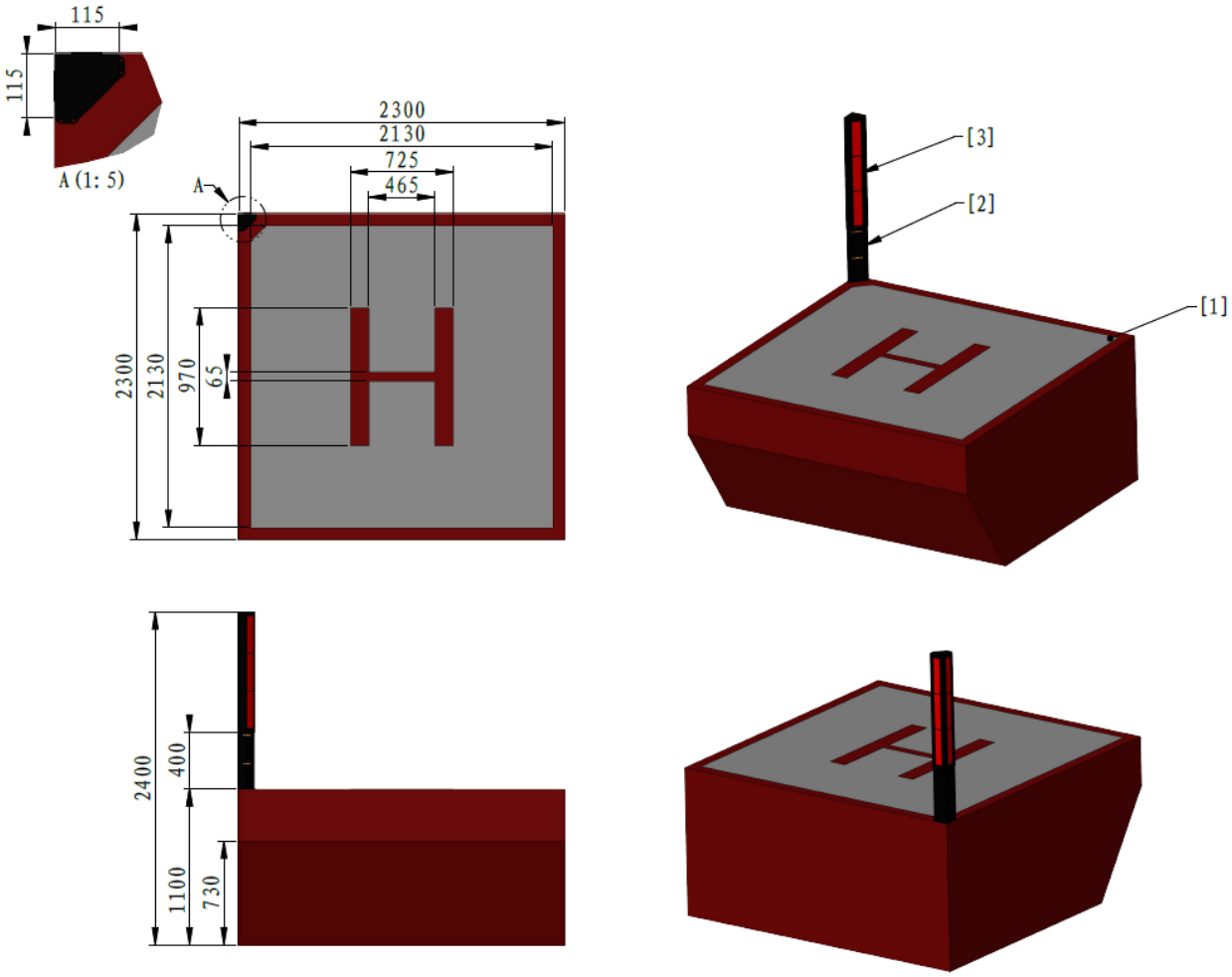
Figure 2-12 Radar Base

2.2.5 Landing Pad

The Landing Pad is the initialization zone for Aerial Robots, consisting of a Launching Pad platform, Aerial Robot detection device and Aerial Robot energy bar.

Before the start of a match, an Aerial Robot must be placed on a Launching Pad platform and connected to an Aerial Safety Rope according to requirements.

As shown below, the detection device of the Aerial should be placed at one corner of the Landing Pad near the perimeter wall of the battlefield, in which two LiDAR devices at different heights are installed. The LiDAR devices are used to detect the flight and landing status of an Aerial. When the two LiDAR devices detect an Aerial for longer than 2 seconds, the Aerial is deemed as having landed. The energy bar of the Aerial is placed at the top of its detection device, to display the real-time energy (E) growth of the Aerial. The length of the energy bar indicator light of an Aerial Robot increases with the energy (E) level of the Aerial Robot. When E<300, the indicator flashes at a breathing rate; when E>=300, the indicator flashes at a rapid rate, as shown below:

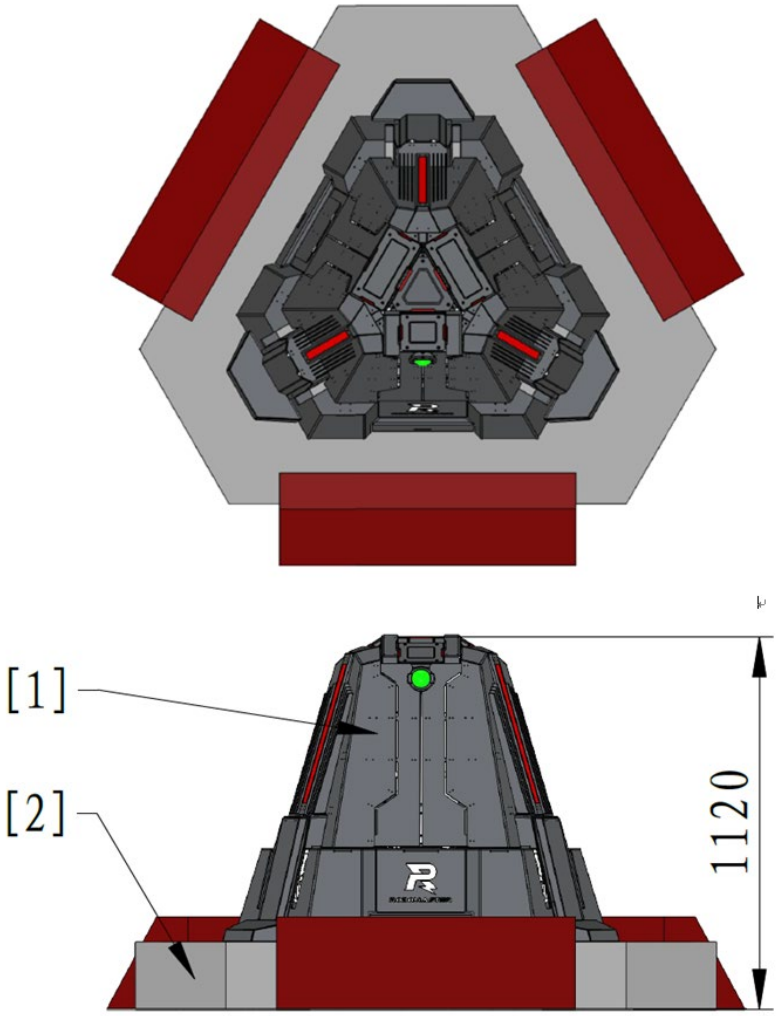


[1] Landing pad platform [2] Aerial robot's detection device [3] Aerial robot's energy column

Figure 2-13 Landing Pad

2.3 Base Zone

A Base Zone is where the Base Foundation is placed, and is located in the center of the Starting Zone.

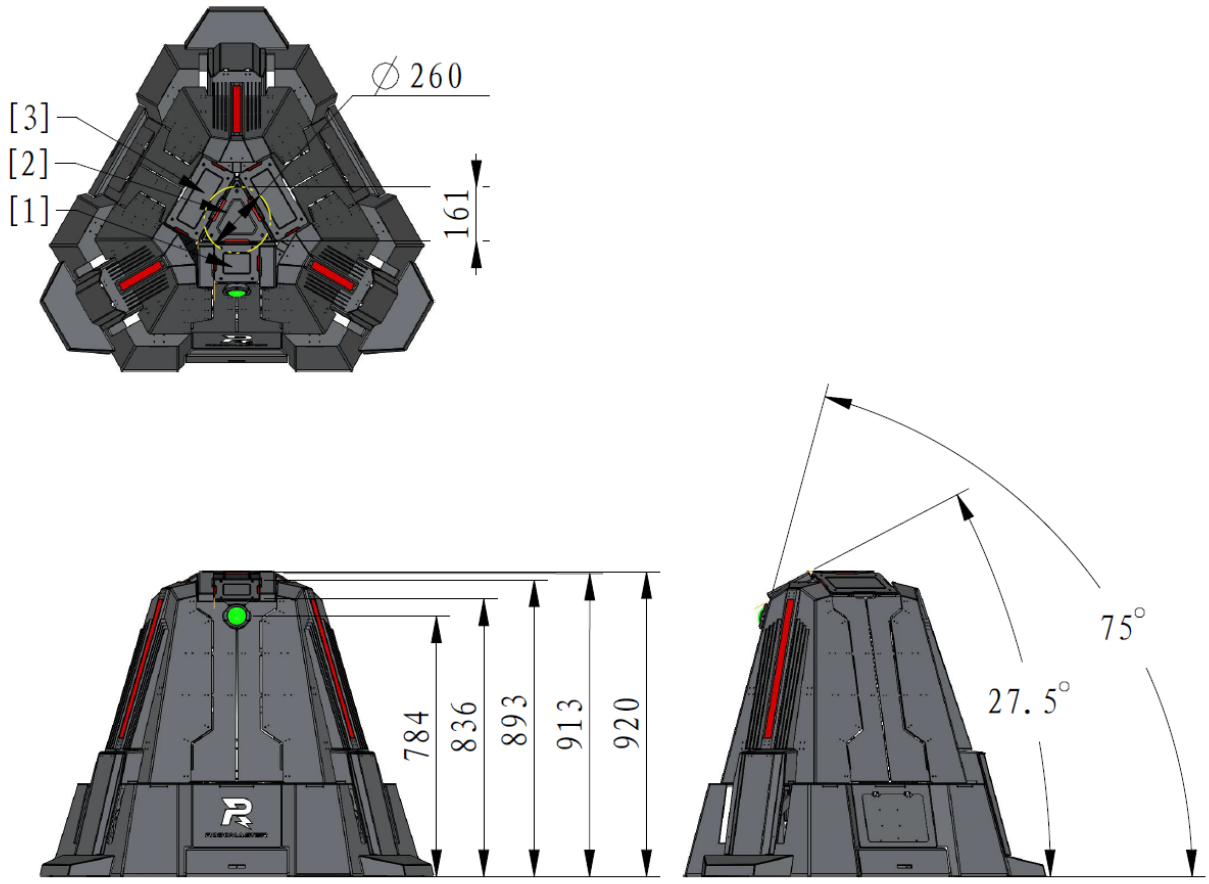


[1] Base [2] Base Foundation

Figure 2-14 Base Zone

2.3.1 Base

A base is the central tool in the competition and the offensive and defensive core of both sides. It is placed on the base foundation in the Base Zones of both teams. A base consists of the body of the base, armor modules, Dart Detection Module, Base Protective Armor, etc. The Base Protective Armor can either be in a closed or expanded state.



[1] Dart Detection Module [2] Triangular Armor Module [3] Large Armor Module

Figure 2-15 Closed state of Base Protective Armor

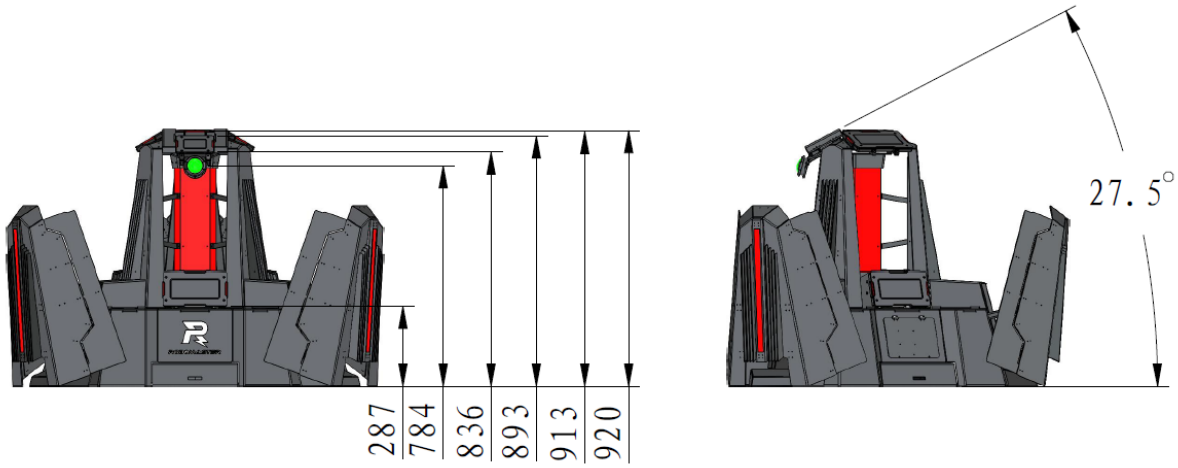
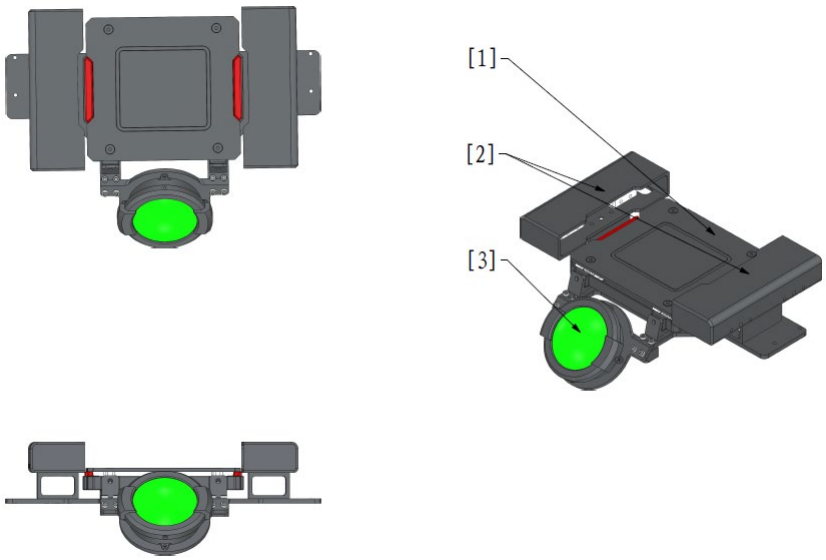


Figure 2-16 Expanded state of Base Protective Armor

The Dart Detection Module is located on the top of the Base and Outpost, consisting of a Small Armor Module, Dart Detection Sensor and dart guiding light.

The Armor Module can detect attacks by darts and 42mm projectiles. The Dart Detection Sensor can detect the infrared light emitted by a dart trigger device. When a Dart Detection Module detects infrared light and an attack

simultaneously, the module shall be deemed as having been hit by a dart. When only an attack is detected, the module shall be deemed as having been hit by a 42mm projectile. The dart guiding light emits a visible green light within a frequency band of 520 nm. Its power is about 2W and the diameter of the luminous part is 55mm. It is used to guide the dart in attacking its target.

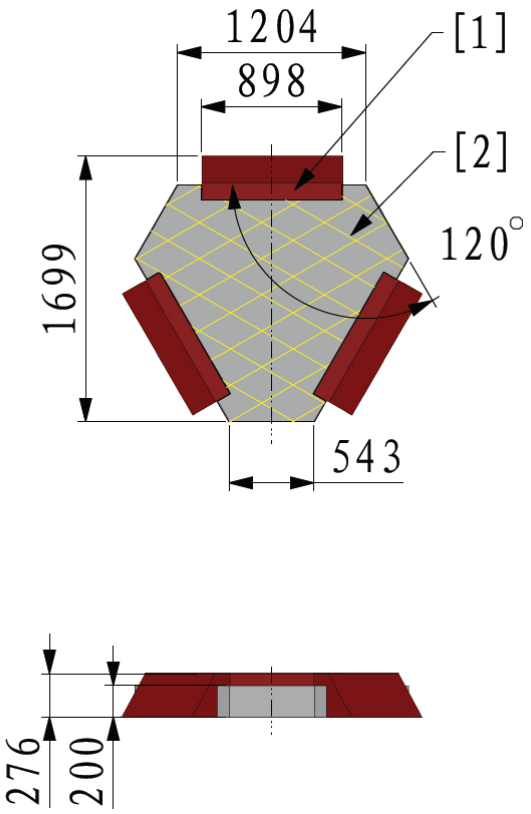


[1] Small Armor Module [2] Dart Detection Sensor [3] Dart guiding light

Figure 2-17 Dart Detection Module

2.3.2 Base Foundation

The Base Foundation is where the base is placed, and is located in the Base Zone. The area above the Base Foundation is a Base Penalty Zone.



[1] Base Foundation [2] Base Penalty Zone

Figure 2-18 Base Foundation

2.4 Supplier Zone

Due to the large size of the Projectile Outlet, teams are advised to enlarge the Projectile Loading Port and pad the internal wall of the Projectile Magazine with buffer materials, to prevent projectiles from falling in the process of loading them into the magazine.

A Supplier Zone is an important area for the reloading of projectiles, revival of defeated robots and recovery of HP.

A Supplier Zone consists of the Restoration Zone and Official Projectile Supplier.

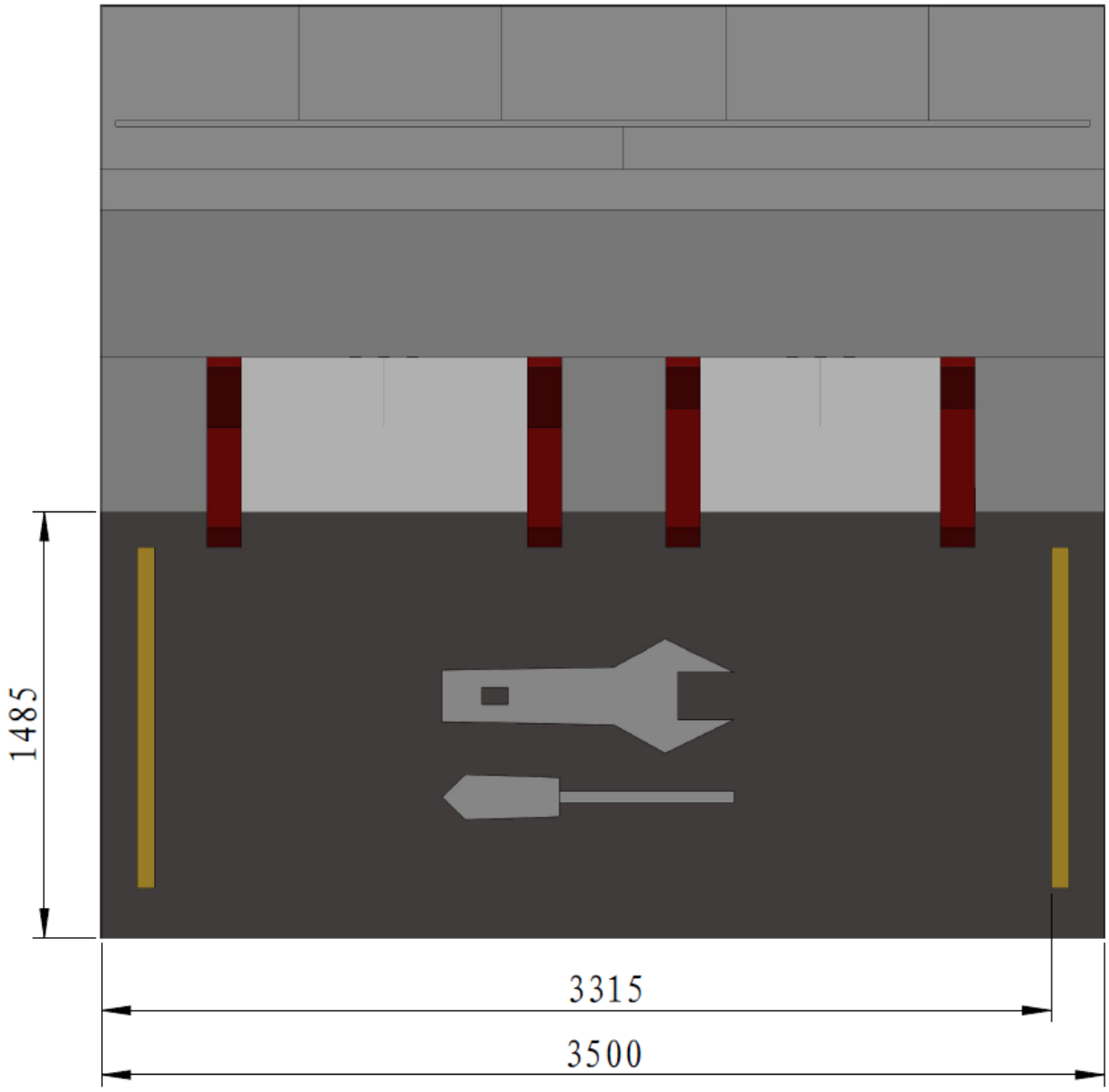
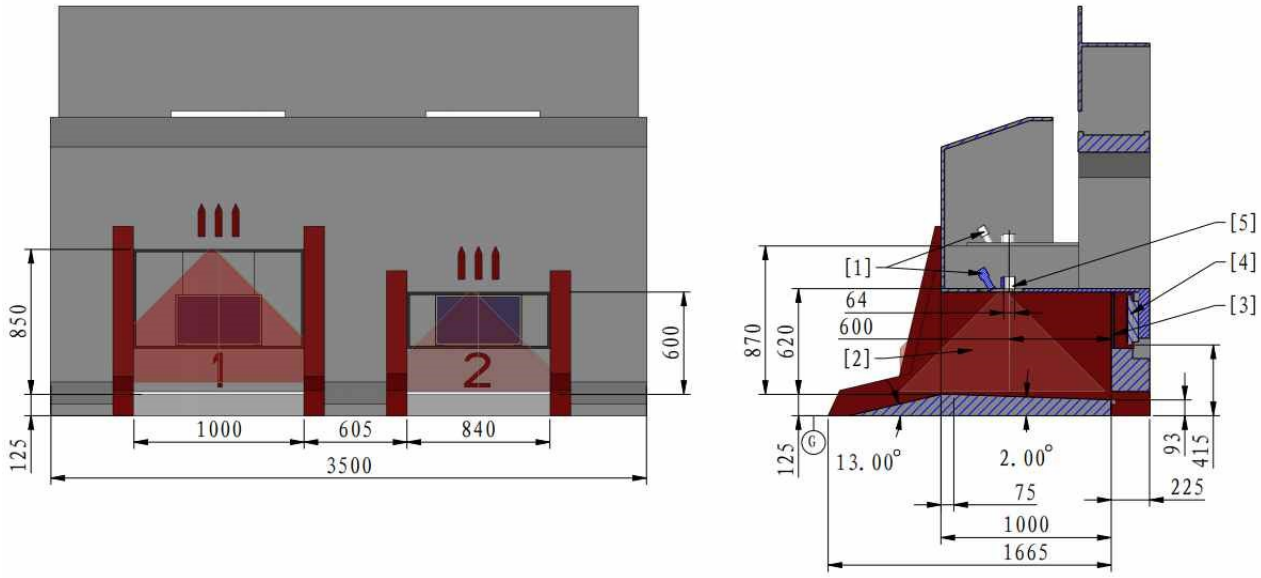


Figure 2-19 Supplier Zone

2.4.1 Official Projectile Supplier

Cross laser light: formed by two horizontal laser lights intersected at the center of the Projectile Outlet.

A Projectile Supplier provides 17mm projectiles during matches and consists of a Projectile Outlet, an auxiliary alignment laser sight, a camera and a monitor.



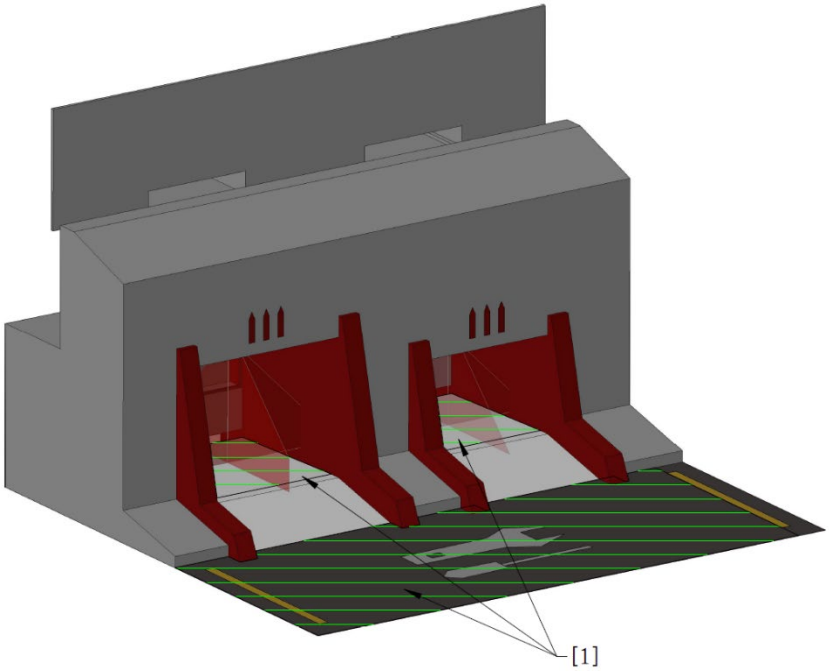
[1] Camera [2] Lase light path [3] Steel wire mesh [4] Monitor [5] Projectile Outlet

Figure 2-20 Official Projectile Supplier

The operator reloads projectile supply through the client interface using a keyboard and mouse. Robots can only reload projectile supply after a match round has started. The camera of the projectile outlet will capture real-time images of the robot's magazine and display them 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 to supply projectiles. If the operator decides to supply projectiles, he or she should press the "O" key on the keyboard. If a team has remaining projectiles and their robot has detected an RFID Interaction Module Card below the Supplier Zone, the projectile reload quantity can be selected directly on the reload panel to complete the reloading process. If a team has remaining projectiles but their robot has not detected any RFID Interaction Module Card below the Supplier Zone, projectiles can be reloaded by initiating the "force projectile reload" command.

2.4.2 Restoration Zone

A Supplier Zone consists of three Restoration Zones. The sizes of the Restoration Zones are 1485*3410 mm, 1000*925 mm and 840*925 mm.

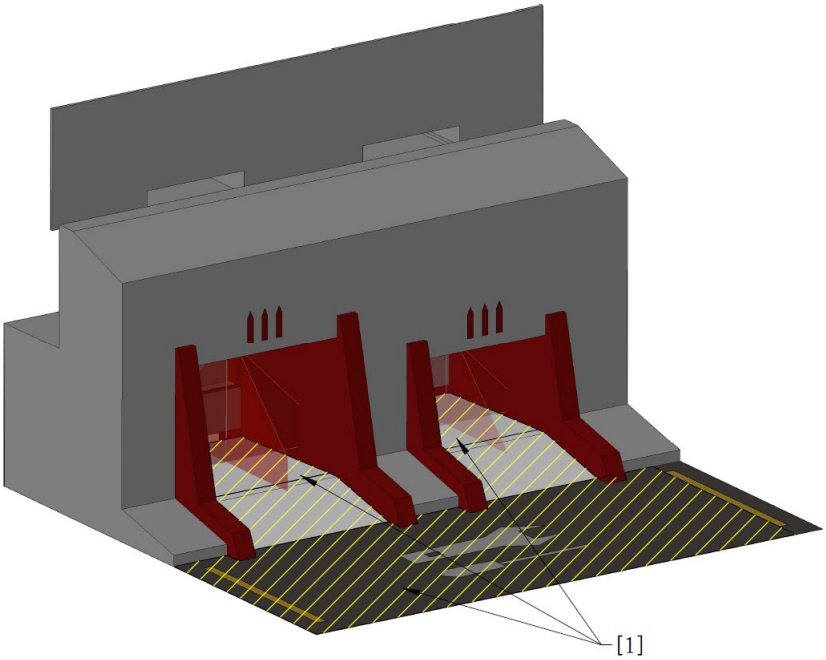


[1] Restoration Zone

Figure 2-21 Restoration Zone

2.4.3 Supplier Penalty Zone

The Supplier Penalty Zone is located within the Supplier Zone as shown below:



[1] Supplier Penalty Zone

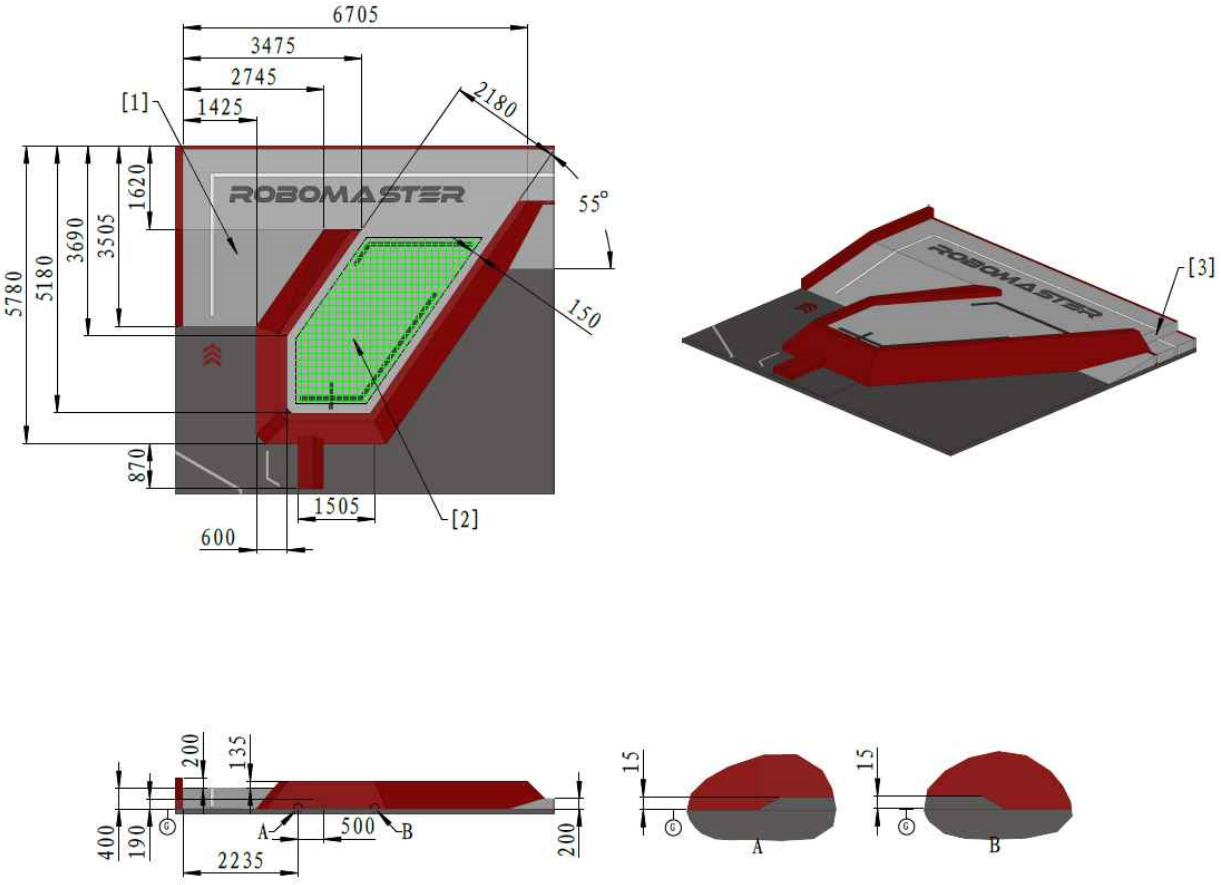
Figure 2-22 Supplier Penalty Zone

2.5 Elevated Ground

An elevated ground is an area higher than the flat ground of the Battlefield. Each side has three elevated grounds that divide the Battlefield into different zones and create a three-dimensional space for the Battlefield. Elevated grounds include the diamond, trapezoid and ring-shaped elevated grounds.

2.5.1 Diamond-shaped Elevated Ground

The diamond-shaped elevated ground is situated near the Landing Pad, at a height of 400 mm above ground, and the height of its perimeter walls is 135 mm.



[1] 12° slope [2] Elevated Ground Buff Point [3] 200 mm step

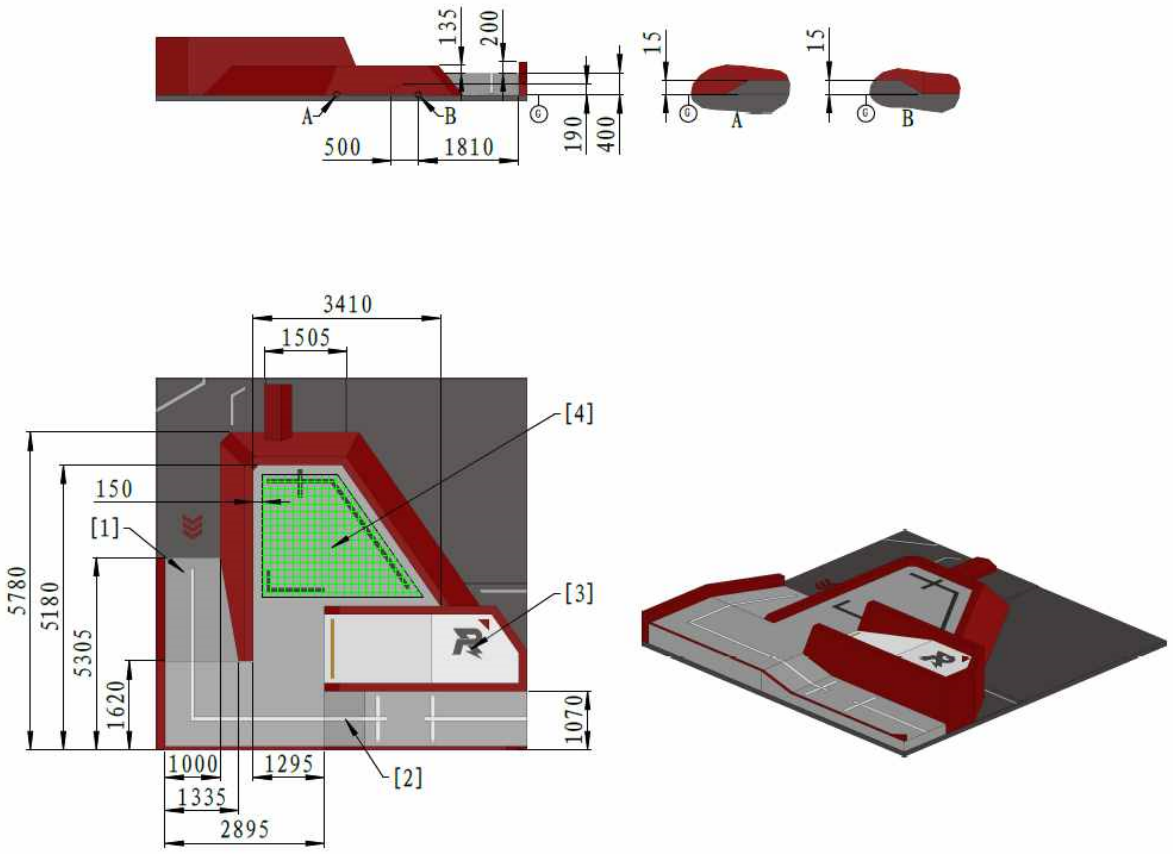
Figure 2-23Diamond-shaped elevated ground

2.5.1.1 Diamond-Shaped Elevated Ground Buff Point

A diamond-shaped elevated ground has one buff point.

2.5.2 Trapezoid-shaped Elevated Ground

The trapezoid-shaped elevated ground is located near the Supplier Zone, at a height of 400 mm above ground, and the height of the perimeter wall is 135 mm.



[1] 12° slope [2] 15° slope [3] Power Rune Activation Point [4] Elevated Ground Buff Point

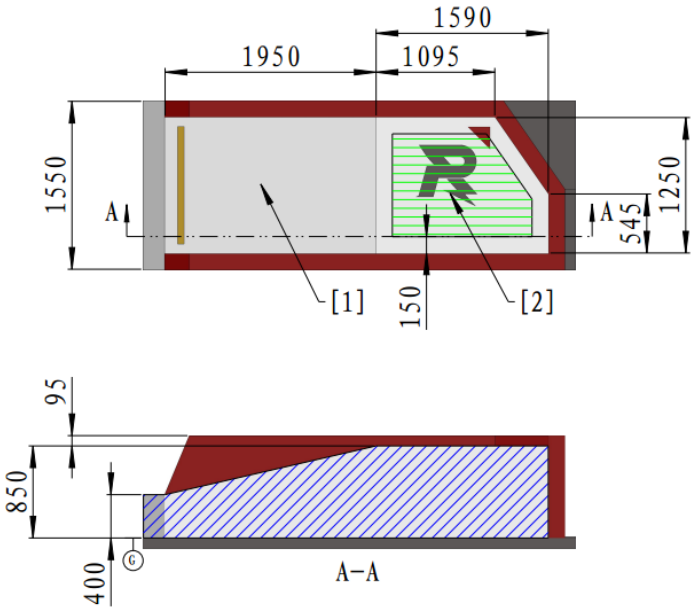
Figure 2-24 Trapezoid-shaped elevated ground

2.5.2.1 Trapezoid-Shaped Elevated Ground Buff Point

A trapezoid-shaped elevated ground has one buff point.

2.5.2.2 Power Rune Activation Point

The Power Rune Activation Point is where a robot hits to activate the Power Rune, and is located on the trapezoid-shaped elevated ground. The activation point is connected to the trapezoid-shaped elevated ground through the slope.

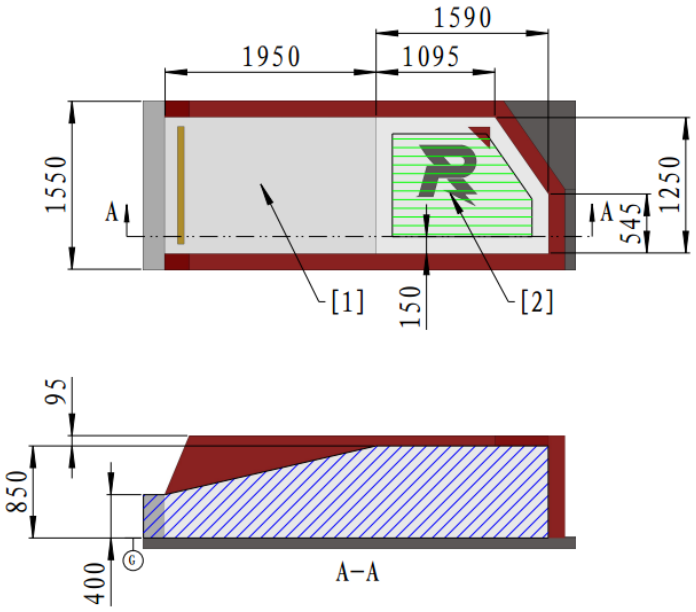


[1] 13° slope [2] Power Rune Activation Point

Figure 2-25 Power Rune Activation Point

2.5.2.3 Power Rune Activation Point Penalty Zone

The Power Rune Activation Point and the slope connecting the Power Rune Activation Point and trapezoid-shaped elevated ground are the Power Rune Activation Point Penalty Zone.



[1] Power Rune Activation Point Penalty Zone

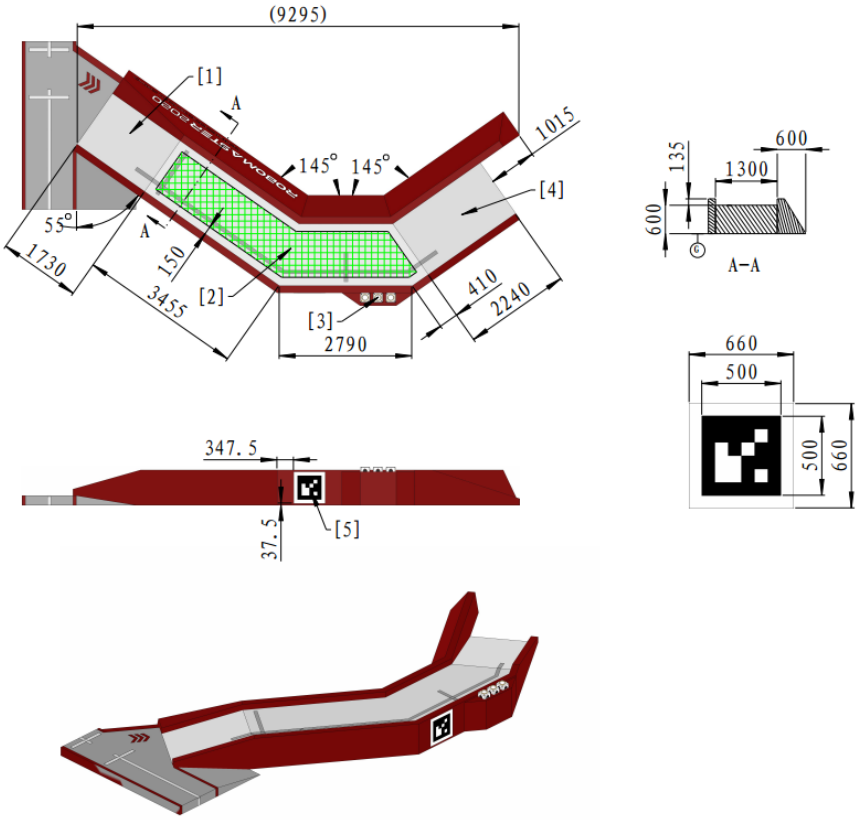
Figure 2-26 Power Rune Activation Point Penalty Zone

2.5.3 Ring-Shaped Elevated Ground

The ring-shaped elevated ground is located around the Resource Island Zone, with one end connected to the road

through the slope. The Small Resource Island is adjacent to the ring-shaped elevated ground, and is located outside the protective perimeter wall. The site localization tag is located near the Small Resource Island.

The code of the site localization tag is “AprilTags (Tag16h5)”. The site localization tag is placed on a vertical surface on the ring-shaped elevated ground near the Small Resource Island, as shown below. The team’s radar can obtain full-site location information through the site localization tag.



[1]	13° slope	[2]	Elevated Ground Buff Point	[3]	Small Resource Island	[4]	15° slope	[5]	Site localization tag

Figure 2-27 Ring-shaped elevated ground

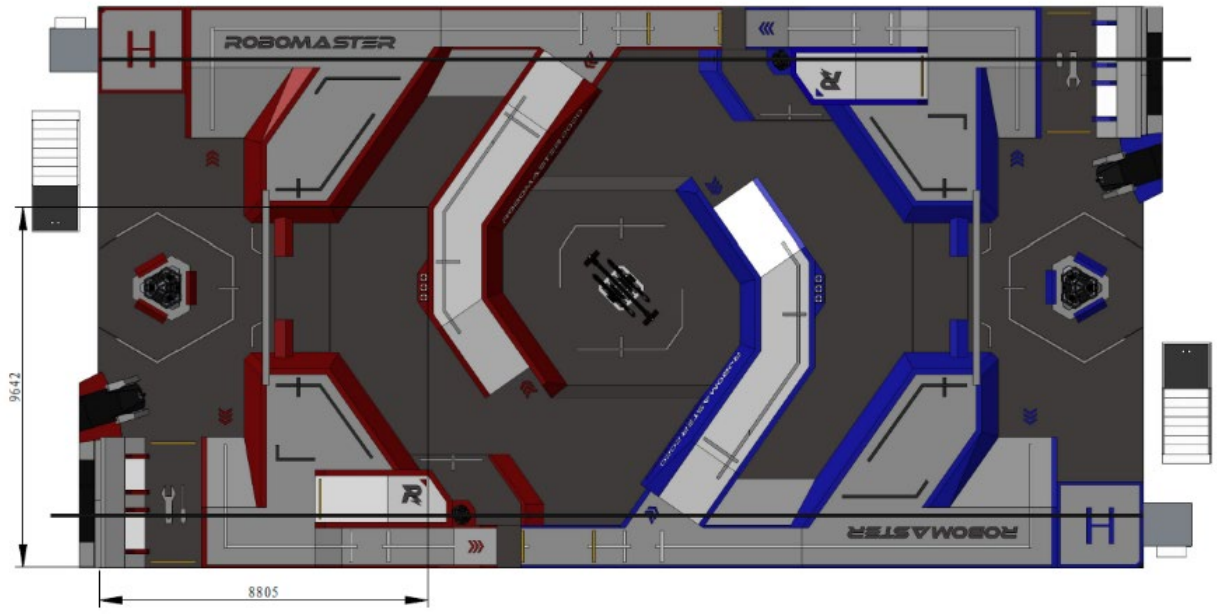


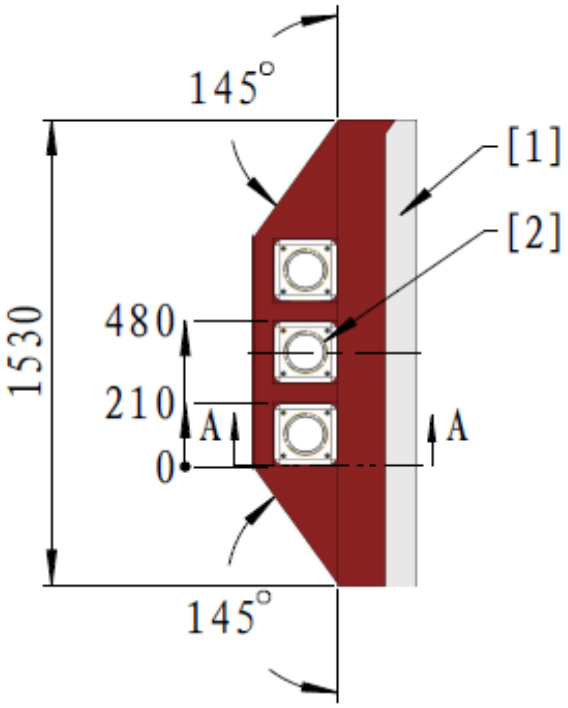
Figure 2-28 Ring-shaped elevated ground full-site locations

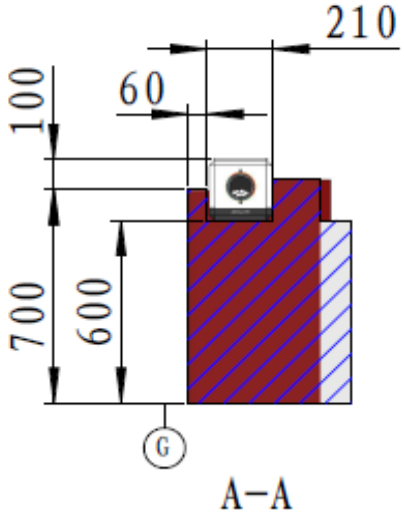
2.5.3.1 Ring-Shaped Elevated Ground Buff Point

A ring-shaped elevated ground has one buff point.

2.5.3.2 Small Resource Island

The Small Resource Island is adjacent to the ring-shaped elevated ground and located outside the protective perimeter wall. It has three grooves for Projectile Containers.



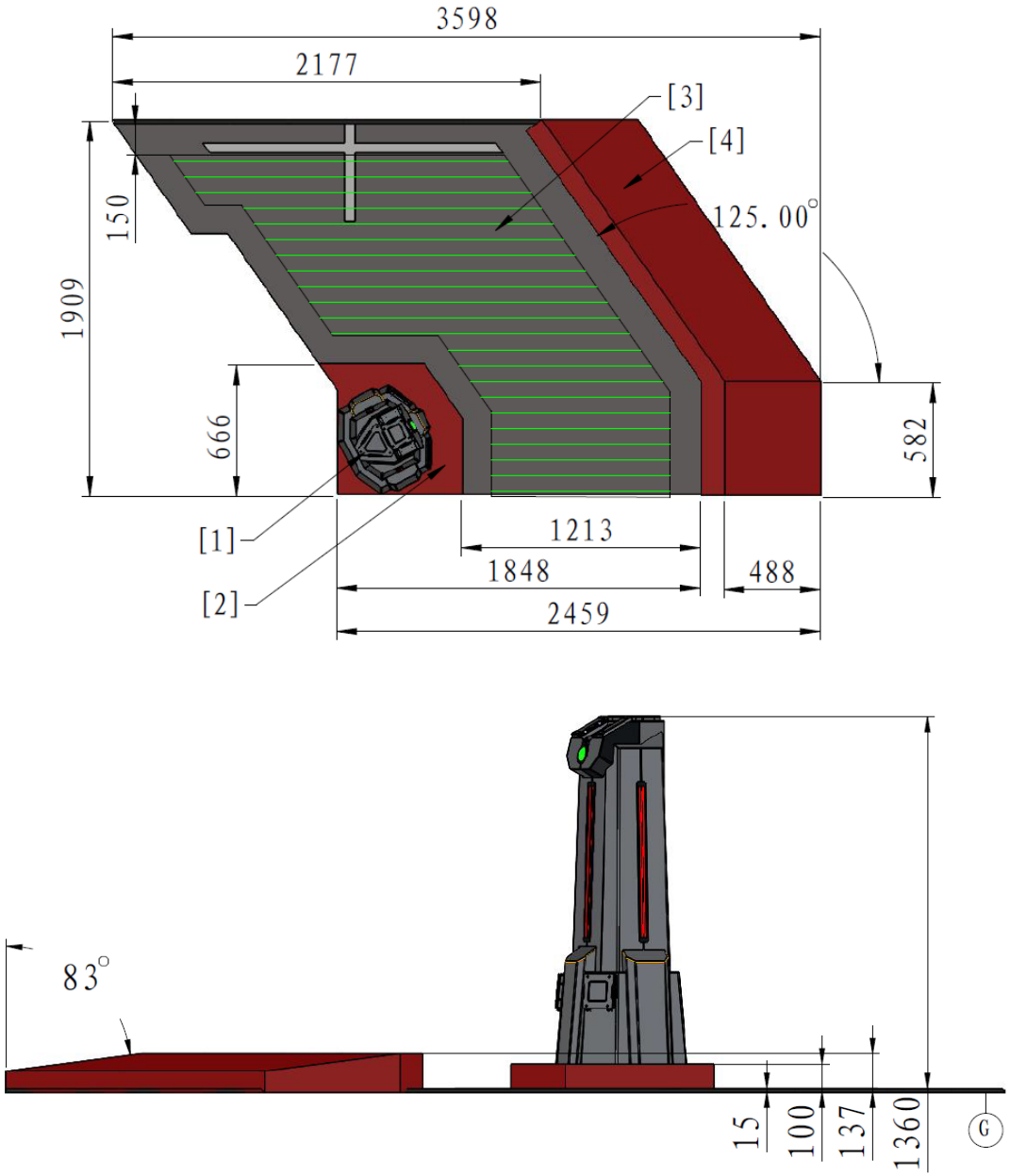


[1] Ring-shaped elevated ground [2] Small Resource Island Projectile Container

Figure 2-29 Small Resource Island

2.6 Outpost Zone

The Outpost Zone is located near the Resource Island Zone in the center of the Battlefield. It includes the Outpost, Outpost Base and Outpost Bunker.

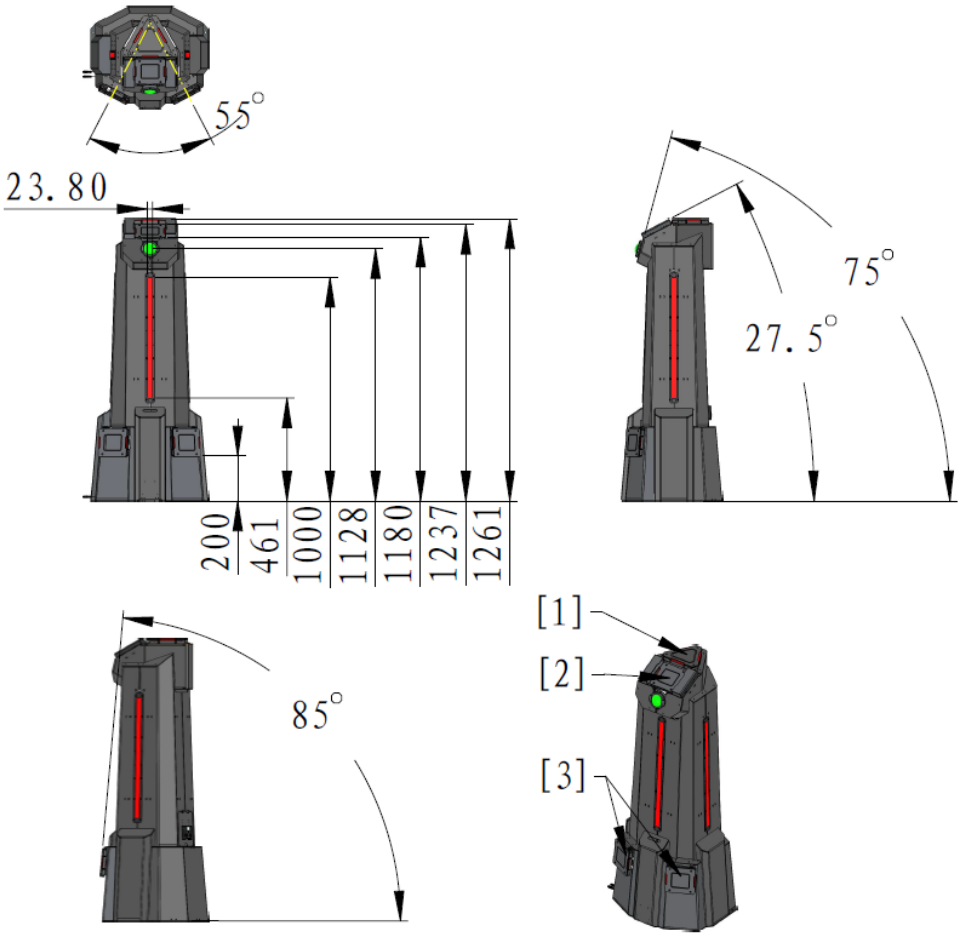


[1] Outpost [2] Outpost Base [3] Outpost Buff Point [4] Outpost Bunker

Figure 2-30 Outpost Zone

2.6.1 Outpost

The outpost is placed on the Outpost Base and is located on the edge of the Outpost Zone near the Launch Ramp on the road. The outpost consists of the body of the outpost, armor module, Dart Detection Module and other components. Please refer to “Figure 2-17- Dart Detection Module” for a drawing of the Dart Detection Module.



[1] Triangular Armor Module [2] Dart Detection Module [3] Small Armor Module

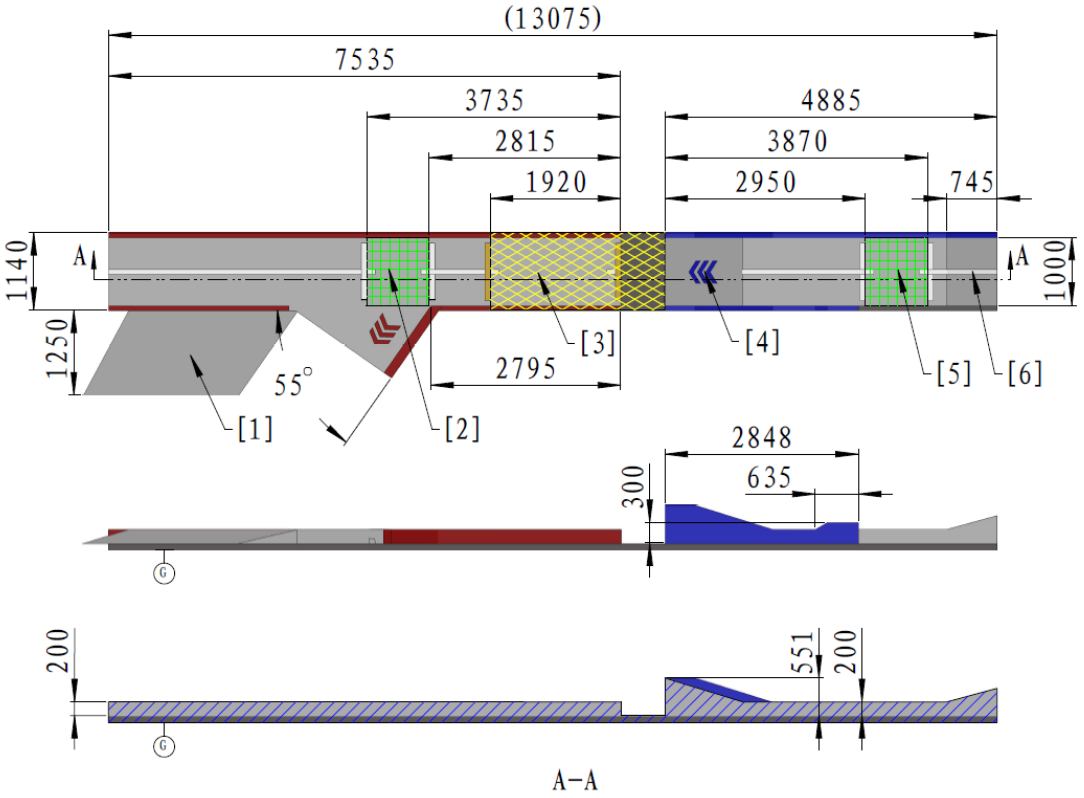
Figure 2-31 Outpost

2.6.2 Outpost Buff Point

The Outpost Buff Point is located behind the outpost bunker, and the buff point area is about 15 mm above the Battlefield ground.

2.7 Road Zone

The Road Zone connects the trapezoid-shaped elevated ground of one side and the diamond-shaped elevated ground of the other side. The Road Zone includes the road and the Launch Ramp.



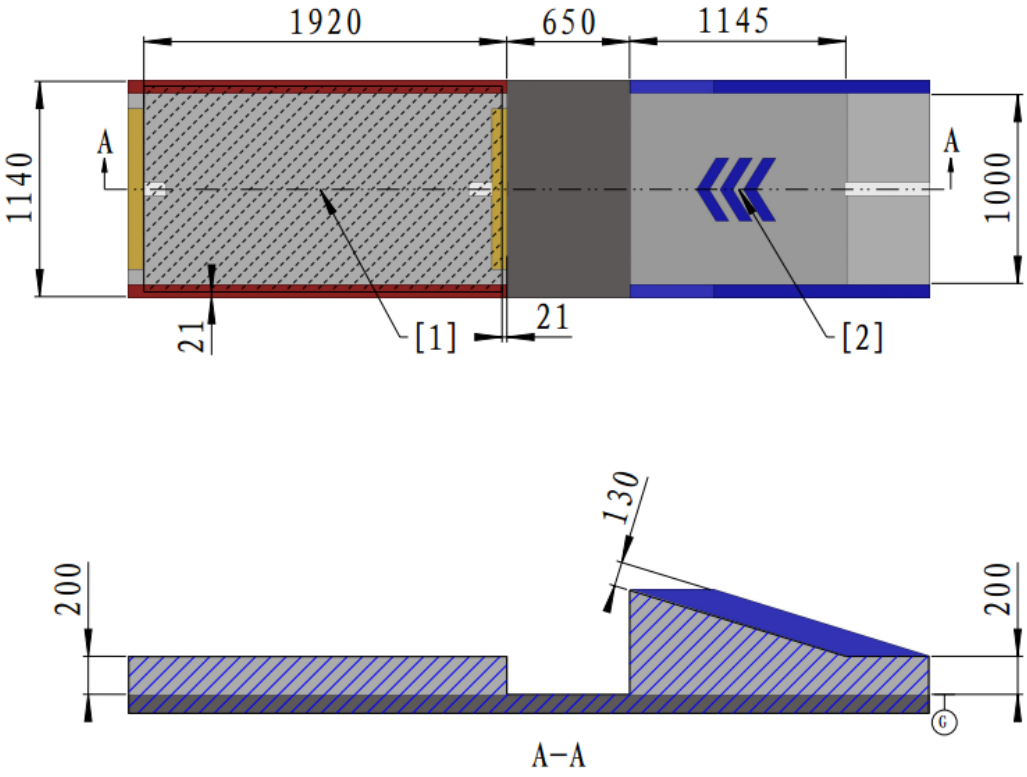
[1] 9° slope [2] Launch Ramp Buff Detection Point 1 [3] Road Penalty Zone

[4] 17° slope [5] Launch Ramp Buff Detection Point 2 [6] 15° slope

Figure 2-32 Road Zone

2.7.1 Launch Ramp

The Launch Ramp is located on the Road Zone, with which robots can fly over the ravine and reach the territory of the other team quickly. The Road Zone situated 1920 mm from the edge of the ravine is the Buffer Zone. EVA foam rubber with a thickness of 100 mm and hardness of 25 HC should be placed under the road surface.



[1] Buffer zone [2] 17° slope

Figure 2-33 Launch Ramp

2.7.2 Launch Ramp Buff Detection Point

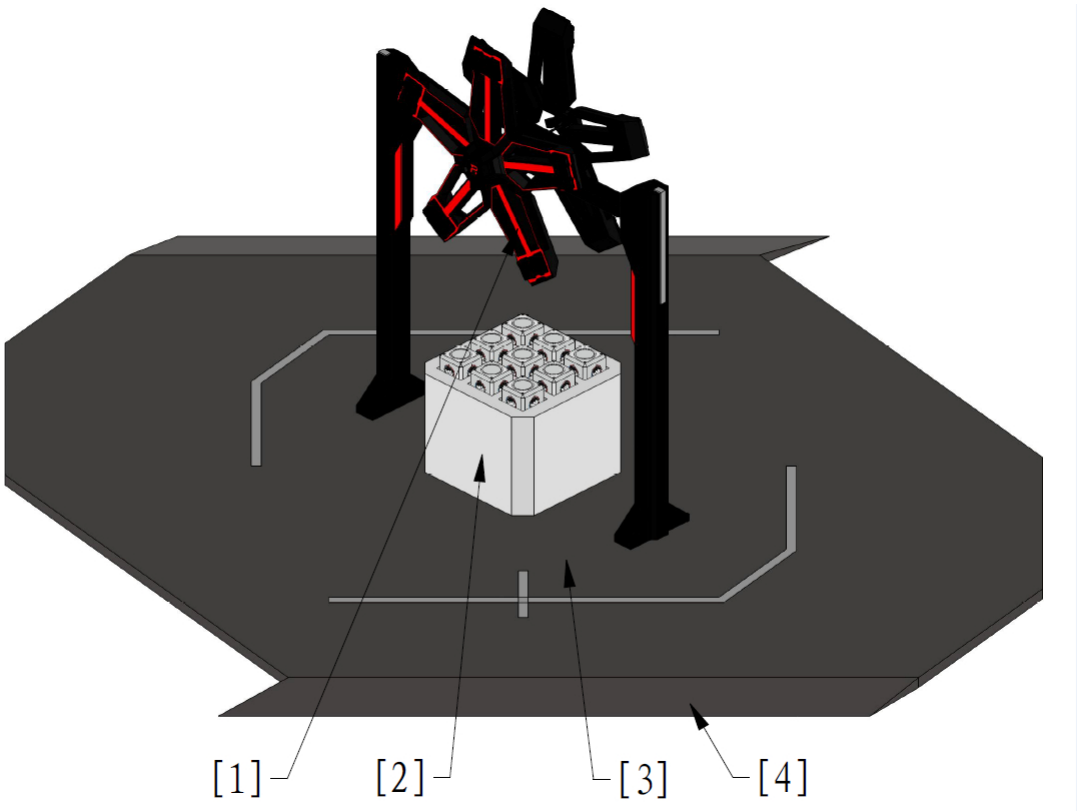
Each road has two Launch Ramp Detection Points, which are located respectively on the roads in front of and behind the Launch Ramp.

2.7.3 Road Penalty Zone

The Buffer Zone on the road and the ravine are the Road Penalty Zone. Except for using the Launch Ramp, the robots of both sides are forbidden from entering the zone.

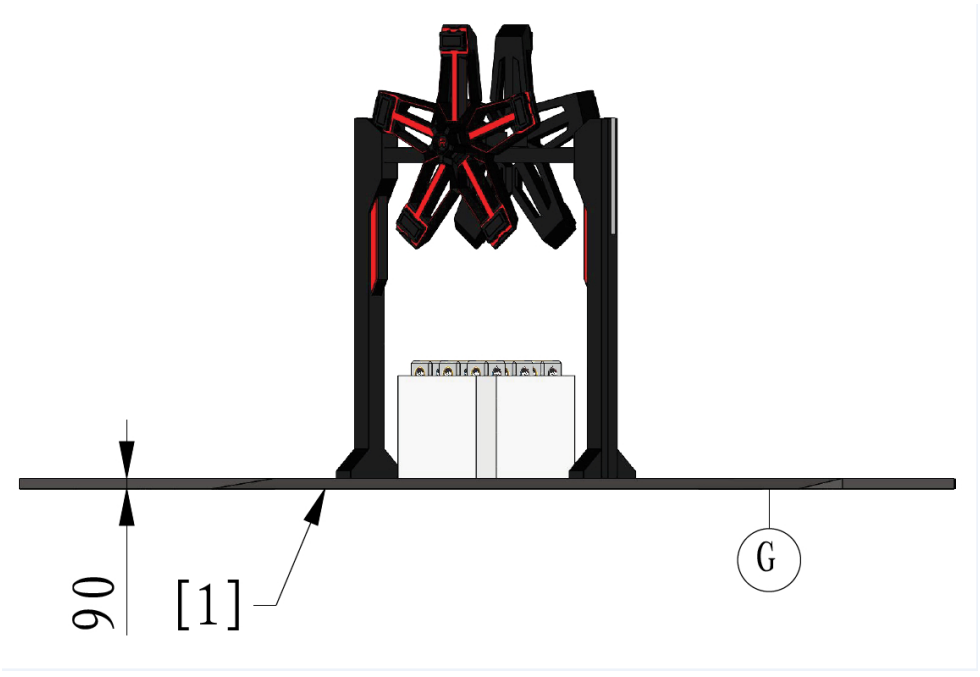
2.8 Resource Island Zone

The Resource Island Zone is located in the center of the Battlefield. The Resource Island Zone includes the Resource Island, Power Rune and Resource Island Buff Point.



[1] Power Rune [2] Resource Island [3] Resource Island Buff Point [4] 12° slope

Figure 2-34 Axonometric view of the Resource Island Zone



[1] 90mm platform ground

Figure 2-35 Main view of the Resource Island Zone

2.8.1 Resource Island

The Resource Island is located in the center of the Resource Island Zone and directly under the Power Rune. It has

nine grooves for Projectile Containers.

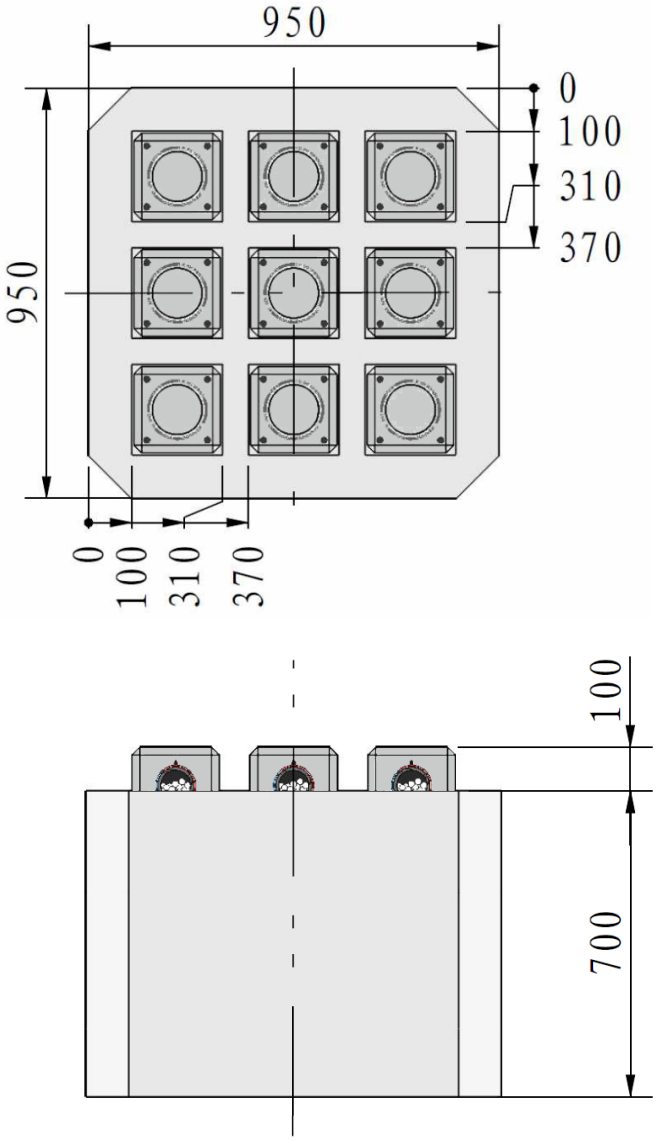


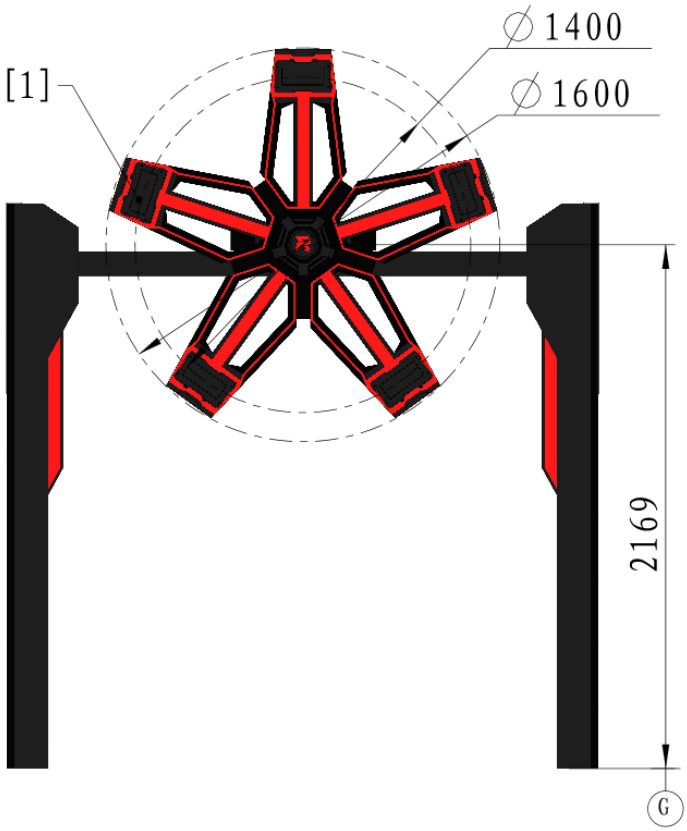
Figure 2-36 Dimensions of the Resource Island

2.8.2 Power Rune

- The Power Rune will have a slight dip in the middle due to its weight. The dip is around 0~50 mm.
- Due to the viewing angle and transmission gap, a team may see parts of the Power Rune of the other side when observing its own Power Rune.

The Power Rune is located directly above the Resource Island. The Power Rune is powered by the motor and rotates at a regular rhythm. A robot needs to occupy the Power Rune Activation Point to activate the Power Rune. The Power Rune of the red team is located one side and that of the blue team are located on the other. The Power Runes of both teams rotate on the same axis.

A Power Rune has five mounting brackets that are distributed evenly. The end of each mounting bracket is installed with a Large Armor Module. The specific location and dimensions of the Large Armor Module are as follows:



[1] Large Armor Module

Figure 2-37 Power Rune

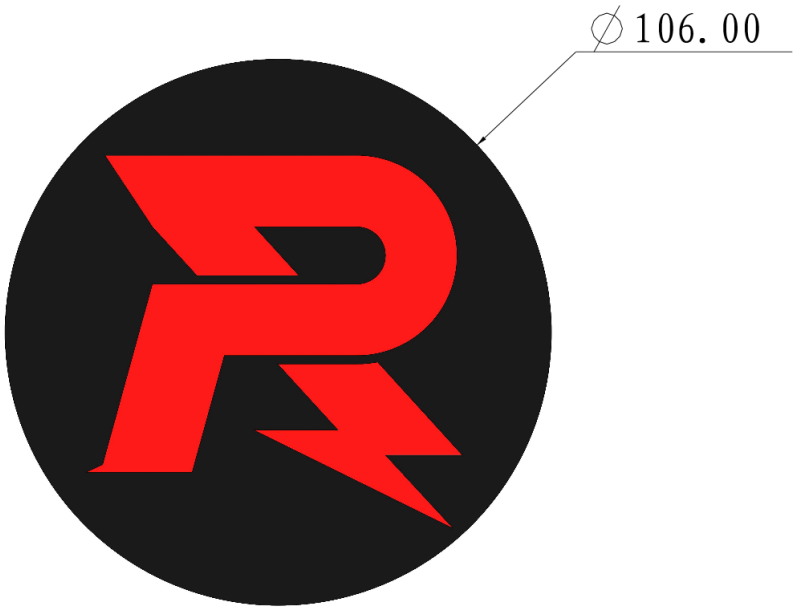
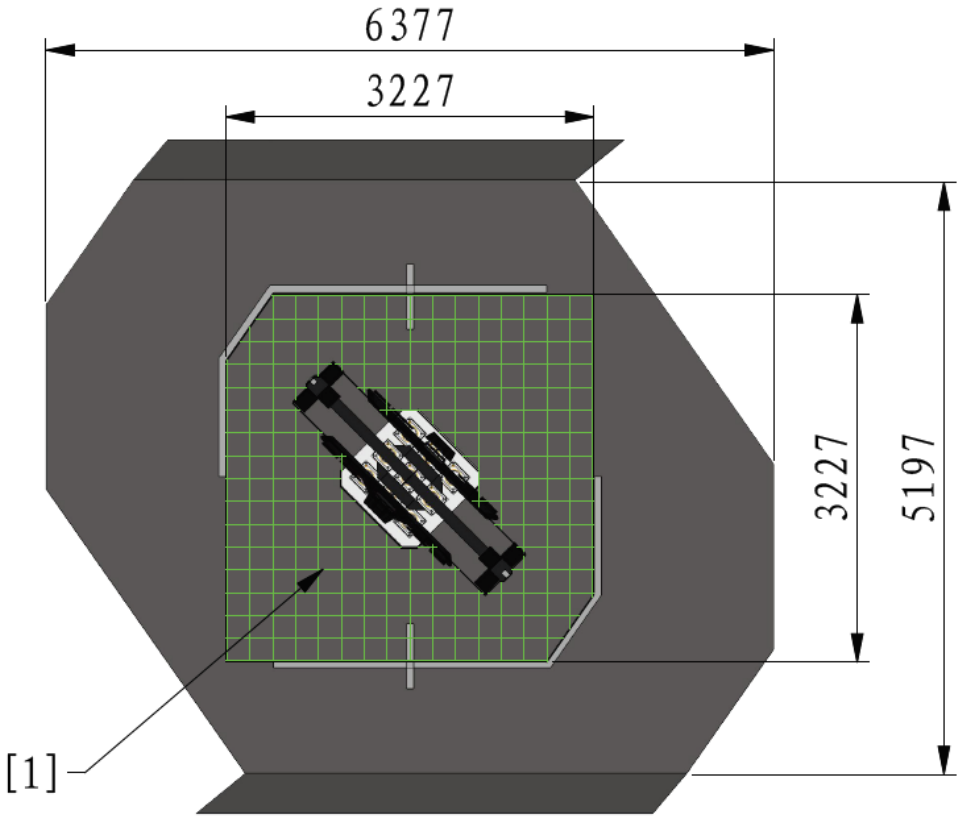


Figure 2-38 Central logo of the Power Rune

2.8.3 Resource Island Buff Point

The Resource Island Buff Point is located around the Resource Island



[1] Resource Island Buff Point

Figure 2-39 Resource Island Buff Point

2.9 Flight Zone

The Flight Zone is the flight area for Aerial Robots. It includes the Landing Pad and the air space above it as well as the air space above the road connected to the diamond-shaped elevated ground of one's team.

2.10 Aerial Safety Rope

An Aerial Robot must be attached with an Aerial Safety Rope during a match to ensure the robot's safety. The robot's flight distance is restricted by the snap ring of the Aerial Safety Rope. The maximum total travel distance is 16 m.

2.11 Miscellaneous

2.11.1 Projectiles

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

Robot Type	Appearance	Color	Size	Weight	Shore Hardness	Material	Scenarios of Use
42mm projectile	Similar to a golf ball	White	42.5 mm ± 0.5 mm	41 g ± 1 g	90 A	Plastic (TPE)	China Regional Competition
17mm projectile	Spherical	Yellow-green	16.8 mm ± 0.2 mm	3.2 g ± 0.1 g	90 A	Plastic (TPU)	Whole course of RM2020 Robotics Competition

2.11.2 Projectile Container

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

A Projectile Container is a cube of 200*200*200mm with beveled edges and made 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.

Projectile Containers on the Small Resource Island:

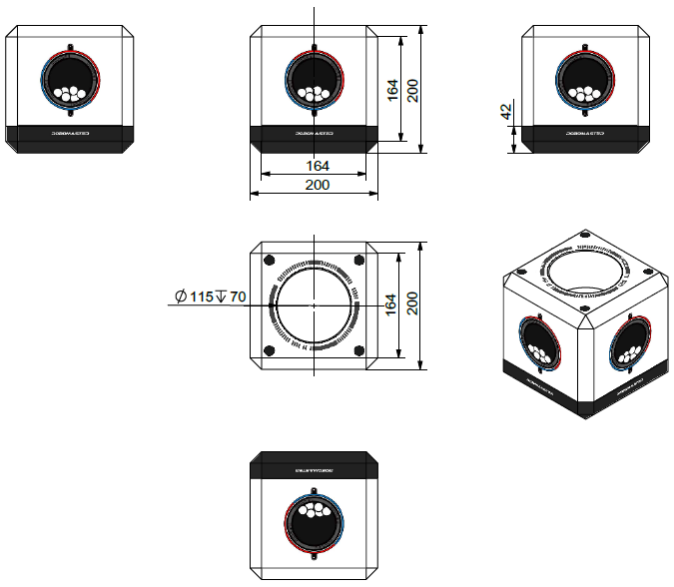


Figure 2-40 Projectile Containers on the Small Resource Island

Projectile Containers on the Resource Island:

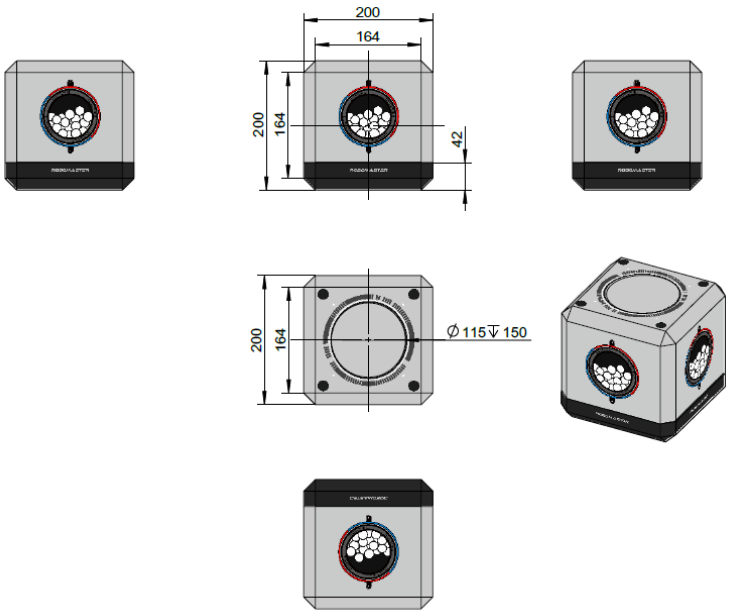


Figure 2-41 Projectile Containers on the Resource Island

2.11.3 Operator Room

Opperator Room lies outside the Battlefield and is an area for Operators during the competition. Operator Room consists of Main Operator Room and Pilot Room. 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. The Gimbal Operator is equipped with two displays, one showing the video-transmitted images from the Aerial Robot and the other showing the source images transmitted from the Radar. The Pilot Room is located in an area near the Landing Pad outside the Battlefield, as shown in “Figure 2-4 - Battlefield Modules”.

3. Competition Mechanism

3.1 Robot Status and Buff Types

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

Table 3-1 Robot Status

Status	Description
Survive	Robot's HP is not zero.
Defeated	Where a robot's HP drops to zero after its Armor Module has been attacked or hit, it has exceeded its chassis power consumption limit, initial firing speed limit or barrel heat limit, its Referee System module has gone offline, etc.
Ejected	Where a robot is ejected directly by the Referee System due to penalty of Level 4 Warning or the violation score has reached 9 points.
Destroyed Enemy	Where a robot attacks the Armor Module of an enemy robot until the latter's HP drops to zero. The destroy of a robot is determined in one of the following two ways: ● 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 destroy or ejection, then the last of the enemy robots to attack the defeated robot will be deemed the destroying robot

After a robot is defeated or ejected, the Referee System will cut off power input to the robot (apart from Mini PC).

Robots can earn buffs by completing specific missions. The types of buffs are as follows:

Table 3-2 Robot buffs

Robot Type	Description
Attack buff	Increases the damage caused by a projectile attack.
Defense buff	Reduces the damage suffered from a projectile attack or impact.

Robot Type	Description
	Defense buffs are not applicable to HP deductions caused by penalties, the Referee System going offline, exceeding limits, etc.
Barrel heat cooling buff	Increases the barrel heat cooling rate per second.
Buffer energy buff	Receives extra buffer energy for chassis power.
HP recovery buff	The robot restores its HP by a certain amount each second, until it reaches its Maximum HP.

3.2 HP Deduction Mechanism

The HP of ground robots and Sentry 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 strike; an important module of the Referee System goes offline; penalty for violation of rules; etc.

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

3.2.1 Initial Firing Speed Exceeds the Limit

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

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

Table 3-3 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%

3.2.2 Barrel Heat Exceeds the Limit and Cooling

Set the Barrel Heat limit as Q_0, the current barrel heat as Q_1, For each 17mm projectile detected by the Referee

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

A. When $Q_1 > Q_0$, the first-person-view (FPV) visibility 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:

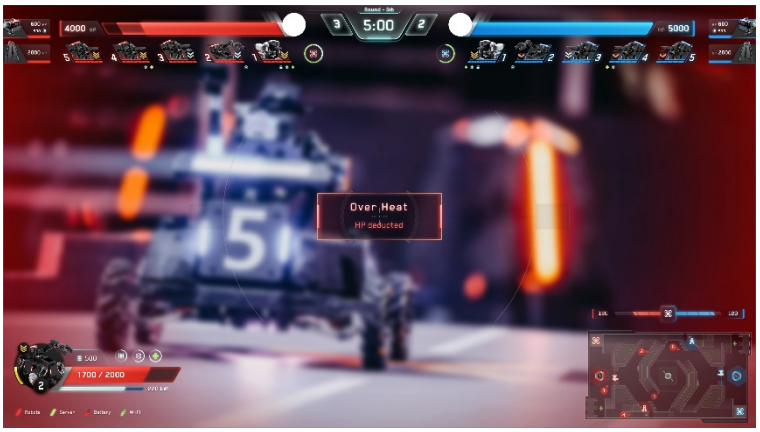


Figure 3-1 FPV of Client

B. When $2Q_0 > Q_1 > Q_0$, the deducted HP for every 100 ms = $((Q_1 - Q_0) / 250) / 10$ * Maximum HP. After the HP deduction, the barrel cooling will be calculated.

C. When $Q_1 \geq 2Q_0$, the immediate deducted HP = $(Q_1 - 2Q_0) / 250$ * Maximum HP. After deducting HP, set $Q_1 = 2Q_0$.

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

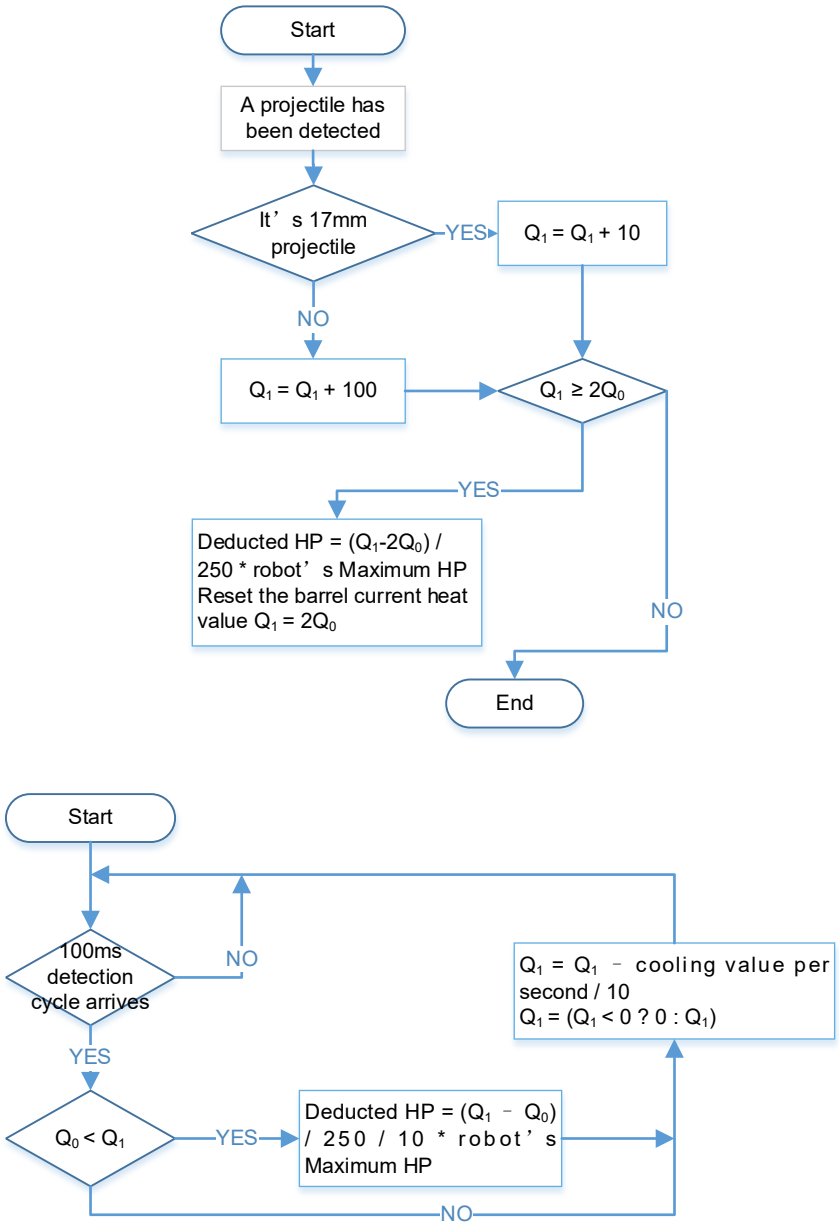


Figure 3-2 (Above) HP Deduction logic and (Below) cooling logic when Barrel Heat limit is exceeded

3.2.3 Exceeding Chassis Power Consumption Limit

The chassis power consumption of robots will be continuously monitored by the Referee System, and the robot chassis needs to run within the chassis power consumption limit. Considering it is difficult for a robot to control instantaneous output power when in motion, a buffer energy (Z) has been defined to avoid the consequent penalty.

The buffer energy (Z) of Sentry is 200J; while the Z values of Standard or Hero may differ according to these two scenarios:

- If Standard or Hero has not triggered the Launch Ramp Buff, its buffer energy limit is 60J.
- If Standard or Hero has triggered the Launch Ramp Buff, its buffer energy limit increases to 250J. If the buffer

energy reaches below 60J after subsequent consumption, it can be restored up to 60J. Refer to "3.6.3 - Launch Ramp Buff Mechanism" for details on the Launch Ramp buff mechanism.

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

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

Table 3-4 Penalty Mechanism for Exceeding Chassis Power Consumption Limit

K	N%
K ≤ 10%	10%
10% < K ≤ 20%	20%
K > 20%	40%

Standard and Hero:

After the exhaustion of buffer energy, when the Chassis Power Consumption of Standard or Hero exceeds the limit, in each detection cycle the deducted HP = Maximum HP * N% * 0.1.

> **For example: If the Maximum Chassis Power Consumption of Hero is upgraded to 80W, Maximum HP to 350, and it has a continuous power output of 140W under the situation that it has not triggered the Launch Ramp buff, then 60J of energy will be consumed after each second. The excess percentage that can be calculated in the next 100 ms detection cycle, K = (140 - 80) / 80 * 100% = 75%. Since K > 20%, the deducted HP = 350 * 40% * 0.1 = 14.**

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

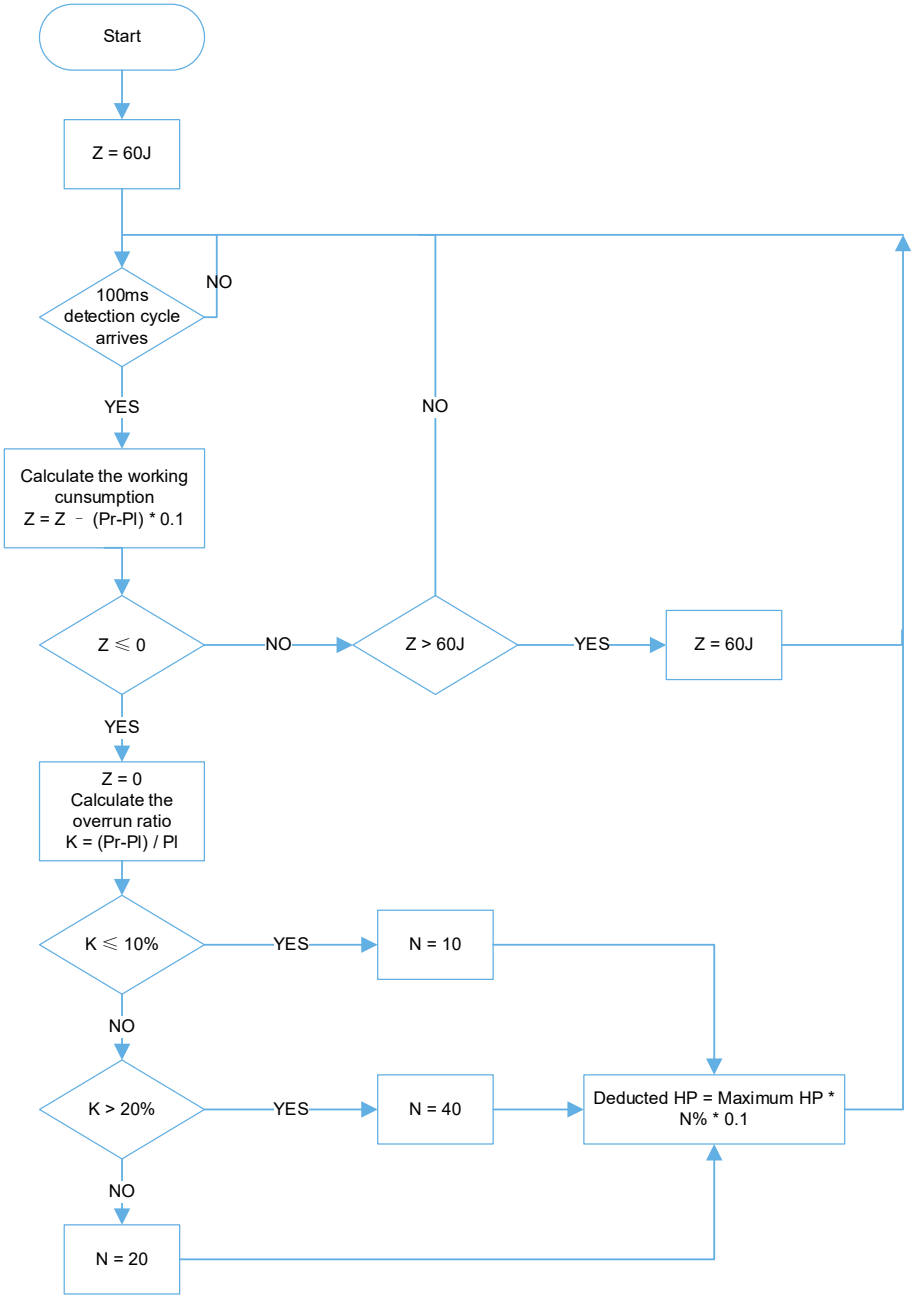


Figure 3-3 Chassis Power Consumption Detection and HP Deduction Logic of Standard and Hero

Sentry:

After the buffer energy is depleted, if the chassis power consumption of a Sentry Robot exceeds the limit, the Referee System will temporarily shut down the chassis' power output.

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

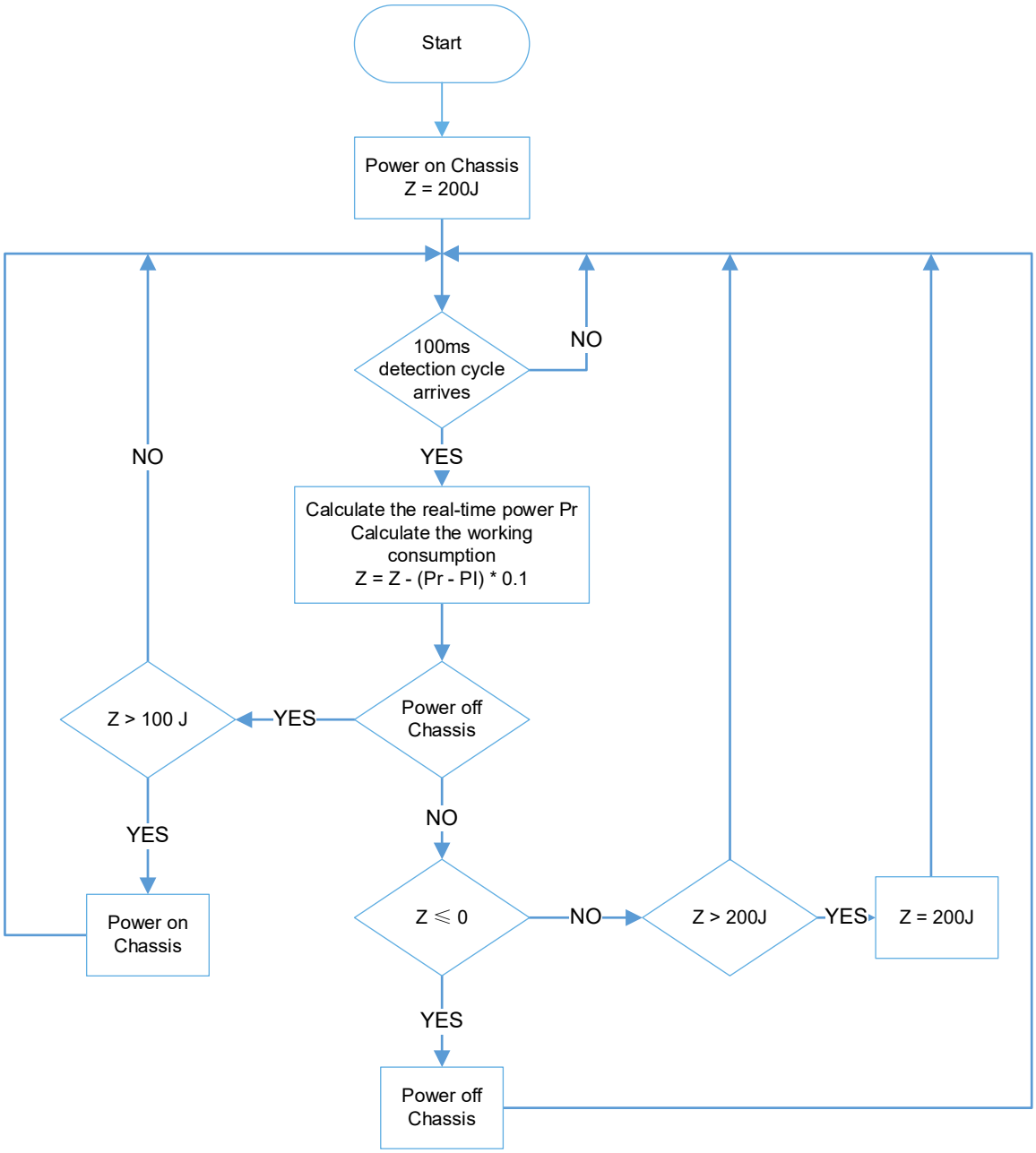


Figure 3-4 Chassis Power Consumption Detection and Chassis Power-off Logic of Sentry

3.2.4 Attack Damage

An Armor Module detects projectile attacks using the pressure sensor combined with the armor's vibration frequency. A Dart Target Module detects dart attacks using the Armor Module combined with the phototube. A Dart Detection Module can detect attacks from darts and 42mm projectiles. The time interval required for the detection of a dart attack by a Dart Detection Module is 1 second.

The shortest detection interval for an Armor Module is 50 ms (when hitting an Armor Module using a 42mm projectile, the detection interval can be extended to a maximum of 200 ms).

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

Table 3-5 Armor module's detection speed for different projectile types

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

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

A robot experiences damage when its Armor Module is struck. However, a robot is not allowed to 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 buff:

Table 3-6 HP Deduction Mechanism for Attack Damage

Damage Type	HP Damage Value
42mm projectile	● Robot's Armor Module: 100 ● Base and Outpost Armor Modules: 200 ● Triangle Armor Module of the Base and Outpost: 300
17mm projectile	● Robot's Armor Module: 10 ● Base and Outpost Armor Modules: 5
Collision	2
Darts	1/5 of the Maximum HP of Base or Outpost

3.2.5 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 modules, and each Referee System module must have a stable connection to its server throughout the competition. The Referee System server detects the connectivity of each module at a frequency of 2 Hz. If important Referee System modules 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 and Sentry will be deducted.

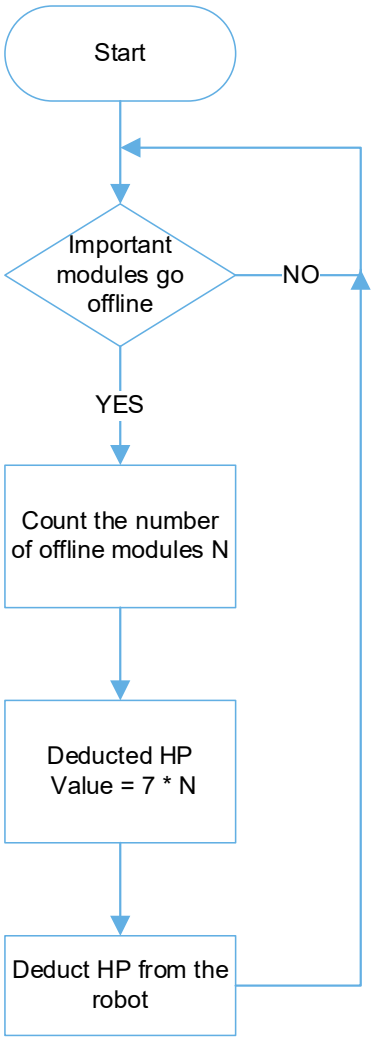


Figure 3-5 HP Deduction Mechanism for Important Referee System Modules Going Offline

3.3 Battlefield-related Mechanism

3.3.1 Base and Outpost HP

Base HP is 5000. Outpost HP is 2000.

3.3.2 Supply Strategies for Official Projectile Supplier

Robots can enter into the Official Projectile Supplier to reload 17mm projectiles during a match.

Both sides will have 200 rounds of launchable 17mm projectiles at the start of a match. For every 30 seconds after that 100 rounds of 17mm projectiles will be added until five and a half minutes after the start of the match (countdown at 1:29). Six minutes after the start of the match (countdown at 0:59), both sides will receive 200 additional rounds of 17mm projectiles.

3.3.3 Projectile Containers

⚠ When a Standard Robot strikes the Power Rune, the 17mm projectile may fall into the Projectile Containers in the Resource Island.

The Resource Island has nine fixed grooves for Projectile Containers, which are placed on the grooves. Each Projectile Container carries 20 rounds of 42mm projectiles. Each Small Resource Island has three fixed grooves for Projectile Containers, which are placed on the grooves. Each Projectile Container carries 5 rounds of 42mm projectiles. Engineer Robots can obtain projectiles from Projectile Containers that are completed raised.

The Projectile Containers in the Resource Island 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). At the first time, the five Projectile Containers aside from those in the four corners of the Resource Island are raised. The four Projectile Containers in the four corners of the Resource Island are raised at the second time. They are illustrated below:

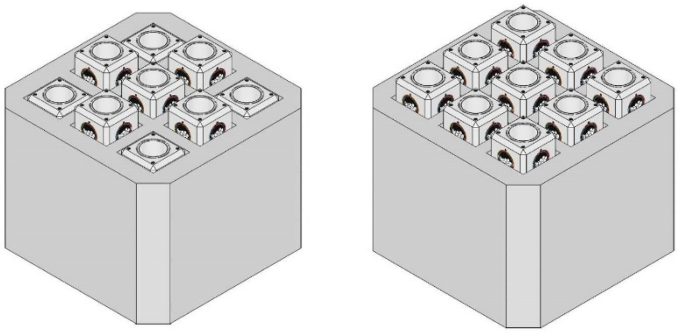


Figure 3-6 Raising and lowering of Projectile Containers in a Resource Island

The Projectile Containers in the Small Resource Island remain in a raised status.

3.3.4 Power Rune Mechanism

After successfully activating the Power Rune, the HP damage value of darts remains unchanged. See "Table 3-6 - Attack Damage HP Deduction Mechanism".

3.3.4.1 Mechanism Overview

The Power Rune is located in the center of the Battlefield. It can be activated by hitting it with a projectile. The whole team will receive a certain buff amount after successful activation.

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 unavailable.

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, all robots of the side gain a 1.5-time attack buff.
- 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, all robots of the side gain a double attack buff and 50% defense buff.

The duration of the Power Rune's buff effect is 45 seconds. After the buff effect of the Power Rune has lapsed, the Power Rune will enter into an unavailable state for 30 seconds. The unavailable state of a Small Power Rune after its buff effect has lapsed will not affect the Large Power Rune entering the available state.

3.3.4.2 Rotation Strategy

The Power Runes of both teams rotate on the same axis, i.e. the red team's Power Rune rotates in the clockwise direction while the blue team's Power Rune rotates in the counterclockwise direction (as per the rotation direction when facing the respective team's Power Rune). Before the start of a match, the Power Runes rotate in a random direction. During the match, the Power Runes rotate in a consistent direction.

The rotating speed of a Small Power Rune is set at 10 rpm.

The rotating speed of a Large Power Rune changes cyclically based on a trigonometric function. The target function for speed is: spd=0.785*sin(1.884*t)+1.305, where the unit of "spd" is rad/s, the unit for "t" is s, and "t" is

reset as 0 every time the Large Power Rune enters the available state.

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

3.3.4.3 Status

Power Runes can display four 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 fourth minute of the match (i.e. countdown at 3:59-3:00) and the 30 seconds after each lapse of the Power Rune buff effect, the Power Rune is unavailable as shown below:

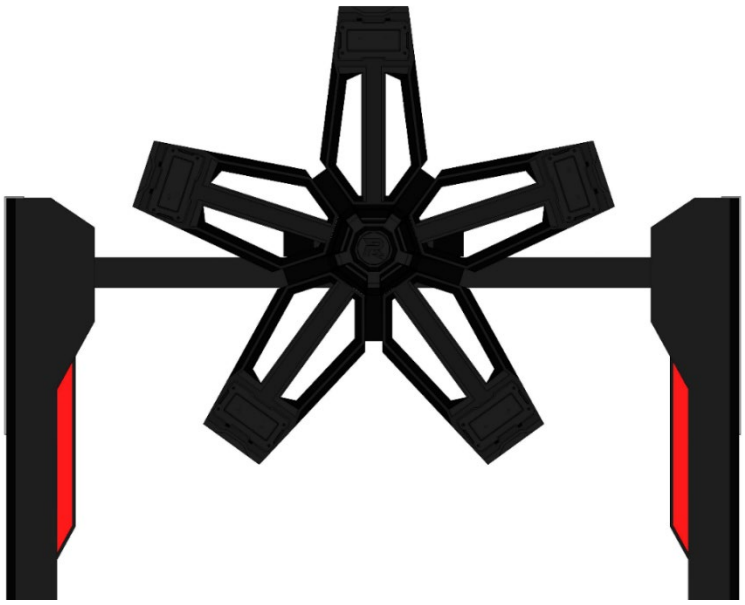


Figure 3-7 Power Rune When Unavailable

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:

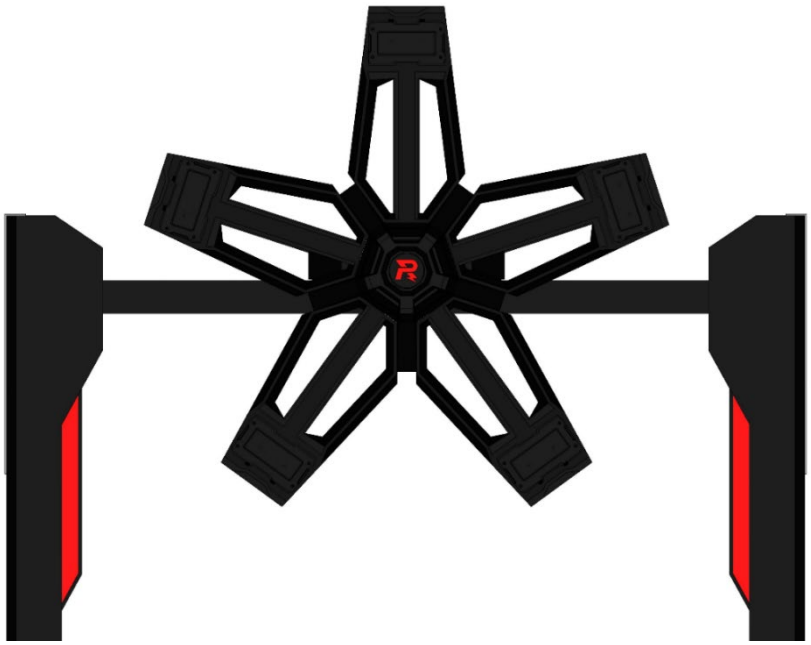


Figure 3-8 Power Rune When Available

3. Activating state

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, so on and so forth, as shown below:

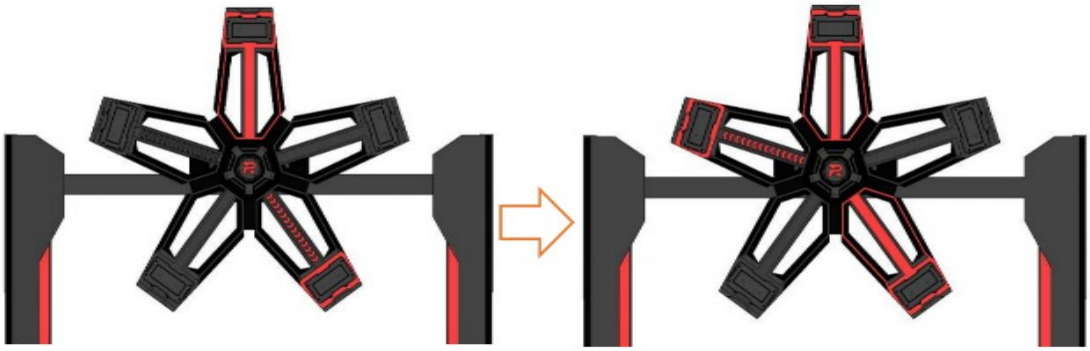


Figure 3-9 Power Rune in activating state

4. Activated

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

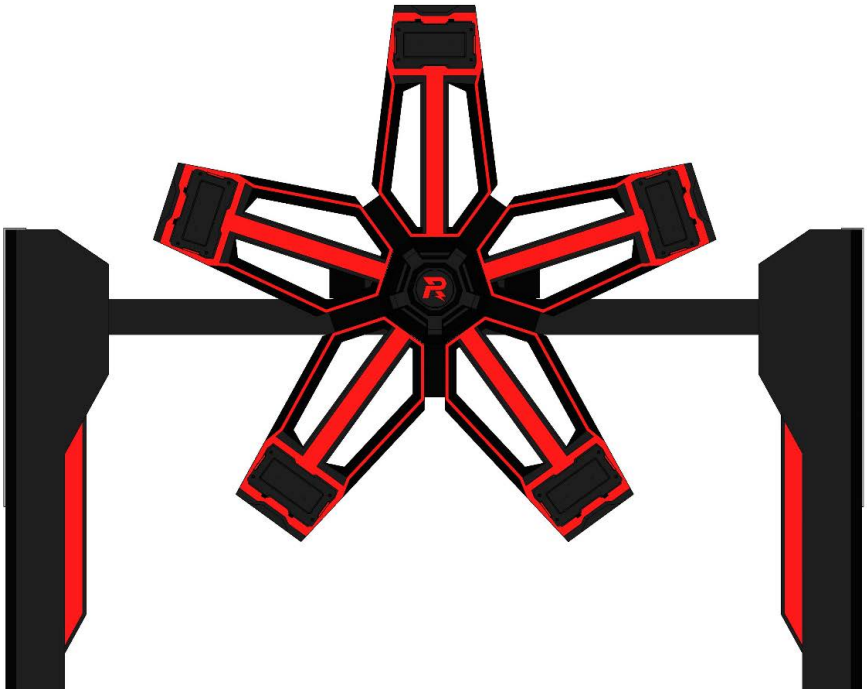


Figure 3-10 Power Rune When Activated

5. Activation Failed

If any of the following conditions occur during activation, 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

3.4 Relationships between Sentry, Outpost and Base

If the Outpost of one side has been destroyed, 100% of the defense buff 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 has not entered the Battlefield, been destroyed or ejected, the Armor of their Base will be expanded and the Virtual Shield will be disabled.

When an Outpost is intact, the dart guiding light on the Outpost is on, the dart guiding light on the Base is off. When the Outpost is destroyed, the dart guiding light on the Outpost is off, the dart guiding light on the Base is on

3.5 Virtual Shield Mechanism

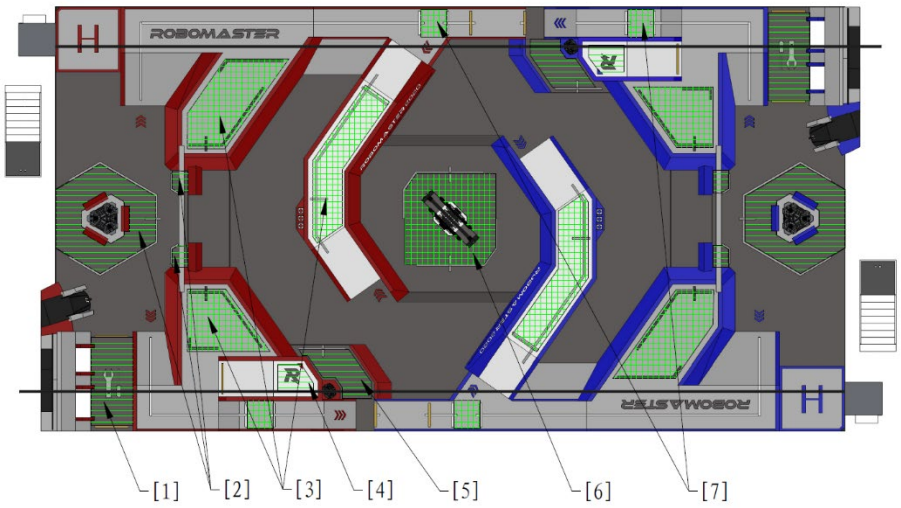
The HP of virtual protective shields cannot be restored, and the the HP deduction suffered by a virtual protective shield from being attacked will be included in the damage HP of the other team.

After the Invincible status of Base has been removed and Sentry of this side still survives, the Virtual Shield of the Base will be enabled and have 500 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.

3.6 Battlefield Buff Mechanism

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

All Buff Point areas in the Battlefield are shown below:



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

Figure 3-11 Battlefield Buff Point Area

All Buff Point areas are laid with multiple RFID Interaction Module Cards. A Buff Point area can be occupied at the same time by multiple robots. There may be a 2-second delay in the taking effect and expiration of occupation. If the occupying robot has been defeated, the buff gained will expire.

An Engineer Robot cannot receive any site buffs other than Restoration Zone buffs.

3.6.1 Base Buff Mechanism

Base Buff Points 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 team's Base will gain a 50% defense buff and 3-time barrel heat cooling Buff.
- Robots that occupy the area behind the Bunker under the Sentry Rail will gain a 5-time barrel heat cooling buff.

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

3.6.2 Elevated Ground Buff Mechanism

The occupied status of the Elevated Ground Buff Points of different zones are completely independent of and unrelated to one another.

Elevated Ground Buff Points are present on diamond, trapezoid and ring-shaped elevated grounds. A robot that occupies an Elevated Ground Buff Point receives a 5-time barrel heat cooling buff. If a robot of one side occupies an Elevated Ground Buff Point of one zone, no robots of the other side are allowed to occupy it at the same time.

3.6.3 Launch Ramp Buff Mechanism

There are two Launch Ramp Buff Detection Points on the respective roads for each team. A robot must detect the RFID Interaction Module Card of the two Launch Ramp Buff Detection Points of its team within 10 seconds, in order to trigger the buff from the Launch Ramp. A robot that triggers a buff from the Launch Ramp receives:

- 50% defense buff for 20 seconds
- 250J buff for buffer energy (please refer to "3.2.3 Exceeding Chassis Power Consumption Limit" for details on buffs for buffer energy).
- 3-time buff for barrel heat cooling rate per second lasting 20 seconds

3.6.4 Outpost Buff Mechanism

When a team's Outpost is intact, any robot occupying the Outpost Buff Zone of the team will receive a 5-time Barrel Heat cooling buff.

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

3.6.5 Resource Island Buff Mechanism

Resource Island Buff Points are inactive during the first minute of the competition (countdown at 7:00-6:00), and no robots can occupy them during this time.

At one minute into the competition (countdown at 5:59), the Resource Island Buff Points become active. Any robot that occupies a Resource Island Buff Point will earn 10 energy points for its team each second. The energy received by a team will be stored once every time 50 energy points are reached. Both teams can occupy the Resource Island Buff Points at the same time.

The energy received by any ground robot that is attacked while occupying a Resource Island Buff Point will be deducted: For every 17mm projectile detected, 2 energy points will be deducted, and for every 42mm projectile detected, 20 energy points will be deducted, until the team's unstored energy is reduced to zero.

> **For example, a robot has received 110 energy points after occupying a Resource Island Buff Point. It then gets hit by a 42mm projectile launched by the other team's Hero. Since 100 energy points have been stored, so only 10 energy points are deducted from the robot.**

If a robot has received 200 energy points from occupying a Resource Island Buff Point, the buff point will be immediately deactivated, and the Aerial of the team will receive 200 energy points. The other team will only retain the energy that has been stored. The deactivated status of the Resource Island Buff Point will last for 120 seconds. After 120 seconds, the Resource Island Buff Point will be reactivated.

If the team originally occupying a Resource Island Buff Point has ceased occupying it, the energy will stop accumulating, but any energy already received will be maintained. Once the team's robot reoccupies the Resource Island Buff Point, the energy will continue to accumulate.

> **For example, the red team's robot has received 170 energy points after occupying a Resource Island Buff Point, and the blue team has received 200 energy points, then the Aerial of the blue team receives 200 energy points. At this time the Resource Island Buff Point is deactivated, so the 20 energy points not stored by the red team will be deducted immediately, while its stored 150 energy points will be maintained, and can continue to accumulate the next time the team occupies a Resource Island Buff Point.**

3.6.6 Power Rune Buff Mechanism

When a team's Power Rune is in the available status, and any of its robots occupies its own Power Rune Activation Zone for 3 seconds, the Power Rune will enter the activating status (see Figure 3-9) and the robot occupying the zone will receive a 5-time buff for its barrel heat cooling rate.

3.6.7 Restoration Zone Mechanism

A robot that occupies its team's Restoration Zone can receive buffs for reviving defeated robots or recovering the HP of surviving robots. For the details of their implementation and values, please refer to "3.9 - HP Recovery and Revival Mechanism".

3.6.8 Hero Sniper Point Mechanism

The Power Rune Activation Point of a team can provide Hero Robot Sniper Point buffs to its own Hero Robot. When the Hero Robot of a team occupies the buff point, the damage value inflicted on the other team's Outpost and Base by the Hero Robot using a 42mm projectile will be boosted by 2.5 times.

> **For example: When a team has successfully activated the Large Power Rune, and the Hero Robot of the team fires a 42mm projectile from the Hero Robot Sniper Point and hits the triangle armor of the other team's Base, the damage inflicted is: 300*2*2.5=1500**

When the Base or Outpost of a team is attacked with a 42mm projectile by a Hero Robot occupying the sniper point, it will enter a 10-second defense period. During the defense period, the Outpost and Base of the team will receive a 100% defense buff for 42mm projectiles.

3.7 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.

3.8 Level Up Mechanism

3.8.1 Experience System

Assist: Where a robot (except the destroying robot) that inflicts damage on the destroyed robot or Outpost within 10 seconds before its destroy.

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 Experience Value of Outpost is 5.

The Level Up mechanism during a match works as follows:

- If a robot or Outpost from one side is destroyed 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. 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 or Outpost from one side has been destroyed and no destroying robot has been detected or the destroying robot is Engineer, Sentry or Aerial, the Value of Experience Points in the corresponding Experience Value of the defeated robot 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 destroyed,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 destroyed. Any excess Value of Experience Points after leveling up will be counted towards the next level.

3.8.2 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.

Performance points can be used to boost the performance of robots. Before the start of the competition, the performance points of Standards and Heroes are 0. After the start of the competition, the performance points of Standards and Heroes will increase to 3. When a Standard or Hero is upgraded to Level 2, 1 point will be added to its original performance point. When a Standard or Hero is upgraded to Level 3, 2 performance points will be added.

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 3 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 150 points. The Standard receives 1 Performance Point after upgrading to Level 2, and the Operator may choose to use 3 Performance Points to increase its Initial Firing Speed limit to Level 3 at 30 m/s.**

Table 3-7 Standard Level

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	120	20	3	3	2.5
2	240	40	4	6	5
3	360	60	6	/	7.5

Table 3- 8Standard Performance Upgrade

Performance Level	Maximum HP	Maximum Chassis Power Consumption (W)	Initial Firing Speed Limit (m/s)
0	100	50	15
1	150	60	18
2	200	70	22
3	300	100	30

During a match, when Standard's HP is less than 20% of Maximum HP, it gains a double barrel heat cooling buff.

Table 3-9 Hero Level

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	3	8	7.5
2	300	40	4	12	10
3	400	60	6	/	15

Table 3- 10 Hero Performance Upgrade

Performance Level	Maximum HP	Maximum Chassis Power Consumption (W)	Initial Firing Speed Limit (m/s)
0	150	60	10

Performance Level	Maximum HP	Maximum Chassis Power Consumption (W)	Initial Firing Speed Limit (m/s)
1	250	80	12
2	350	100	14
3	500	120	16

3.9 HP Recovery and Revival Mechanism

- If an Engineer is defeated or ejected, its RFID Interaction Module Card will be deactivated.
- If an Engineer Robot is detached from its RFID Interaction Module Card, the RFID Interaction Module Card will be deactivated in that round. The Engineer Robots of the red and blue teams are required to carry RFID Interaction Module Cards of their corresponding colors. The patterns of RFID Interaction Module Cards will be updated in the future.

Only the ground robot is qualified for HP recovery and revival, except for ejected robots.

3.9.1 HP Recovery Mechanism

- Engineer Robots: If an Engineer is not damaged for 30 seconds or after being revived from a defeat during a match, it will receive an HP recovery buff at 2% per second.
- Ground Robots: If an RFID Interaction Module Card of one's own team is detected at the Restoration Zone, the robot will receive an HP recovery buff of 5% per second.
- If an Engineer is not installed with a mobile 17mm Launching Mechanism, and a Standard or Hero detects an RFID Interaction Module Card carried by the Engineer of its team, the Standard or Hero will receive an HP recovery buff of 10% per second. During this period, if an Engineer or a robot recovering its HP from an Engineer is attacked, the RFID Interaction Module Card carried by the Engineer loses its recovery function for 5 seconds.

3.9.2 Revival Mechanism

Defeated ground robots must complete the revival process to achieve revival. Different robots execute their revival process in different ways:

- If a ground robot detects an RFID Interaction Module Card at the Restoration Zone, the revival progress increases by 2 points per second.
- If a Standard or Hero detects an RFID Interaction Module Card carried by its own team's Engineer, the revival progress increases by 1 point per second.
- During the automatic revival of an Engineer (without detecting any RFID Interaction Module Card), the revival progress increases automatically by 1 point per second.

The length of revival processes for different robots on their first defeat are shown as follows:

Table 3-11 The length of revival processes for different robots on their first defeat

Robot Type	Revival process length
Standard	10
Hero	20
Engineer	20

The revival process length for the same robot increases by 10 after each defeat.

A revived robot will maintain its level, performance points and experience points from before its defeat, and its HP will be restored to 20% of the Maximum HP. A revived robot will receive a 100% defense buff lasting for 10 seconds.

3.10 Mechanism Related to Sentry

3.10.1 HP Gain Mechanism

Sentry will receive HP Gain, which is calculated in real-time, from attacking ground robots of the enemy side. HP Gain for Sentry = HP Deduction caused by Sentry * 0.2.

3.10.2 Projectile Launching

The barrel heat of Sentry's two 17mm Launching Mechanisms shall be calculated separately. When the total number of projectiles launched by two Launching Mechanisms has reached 500, the Launching Mechanism will be powered off.

3.11 Aerial-Related Mechanisms

3.11.1 Energy Mechanism

Aerial is required to accumulate energy to exchange attack opportunities. If any important module of Referee System of Aerial goes offline, energy accumulation process suspends.

3.11.1.1 Energy Accumulation

Aerial may accumulate energy through the following methods:

- When Aerial lands stably on the Landing Pad, it gains one point of natural increase energy per second. If Aerial leaves the Landing Pad, natural increase energy will be paused but its accumulated energy will not be cleared to zero. Aerial continues to accumulate natural increase energy when it has returned and landed stably on the Landing Pad.
- When a robot of one team occupies the Resource Island Buff Point and triggers buff effect, its Aerial will gain the corresponding occupying buff energy. For details please refer to "3.6.5 - Resource Island Buff Point Mechanism".
- If robot of one's own side is destroyed by the enemy, Aerial of the destroyed side will gain destroy buff energy. Aerial's Destroy Buff Energy = Value of Experience Points of the destroyed robot * 5. The destroy buff energy shall be rounded off to the closest integer.

3.11.1.2 Projectile Launching

At the start of the match, Aerial's energy 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, 300 energy will be consumed and Aerial gains 30 secondsof 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. When the 30-second attack time is used up or the quantity of projectiles launched reaches its limit, the Launching Mechanism will be powered off. When an Aerial Robot activates its Launching Mechanism for the first time, the maximum quantity for projectiles launched is 250; after that, when Launching Mechanism is activated, the maximum quantity for projectiles launched is 500.

For example: After the start of a match, the Aerial of the red team lands on the Landing Pad and takes off after 85 seconds. At this time E = 85. During the match, a Level-2 Standard of the red team is defeated by the other team, at which point the energy of the red team's Aerial becomes: E = 85 + 5 * 5 = 110. Subsequently, the red team occupies the Resource Island and

triggers the buff effect. The energy of the red team's Aerial becomes: E = 110 + 200 = 310. The Aerial Gimbal Operator decides to power up the Launching Mechanism of the Aerial. The energy of the red team's Aerial is now: E = 10.

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

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

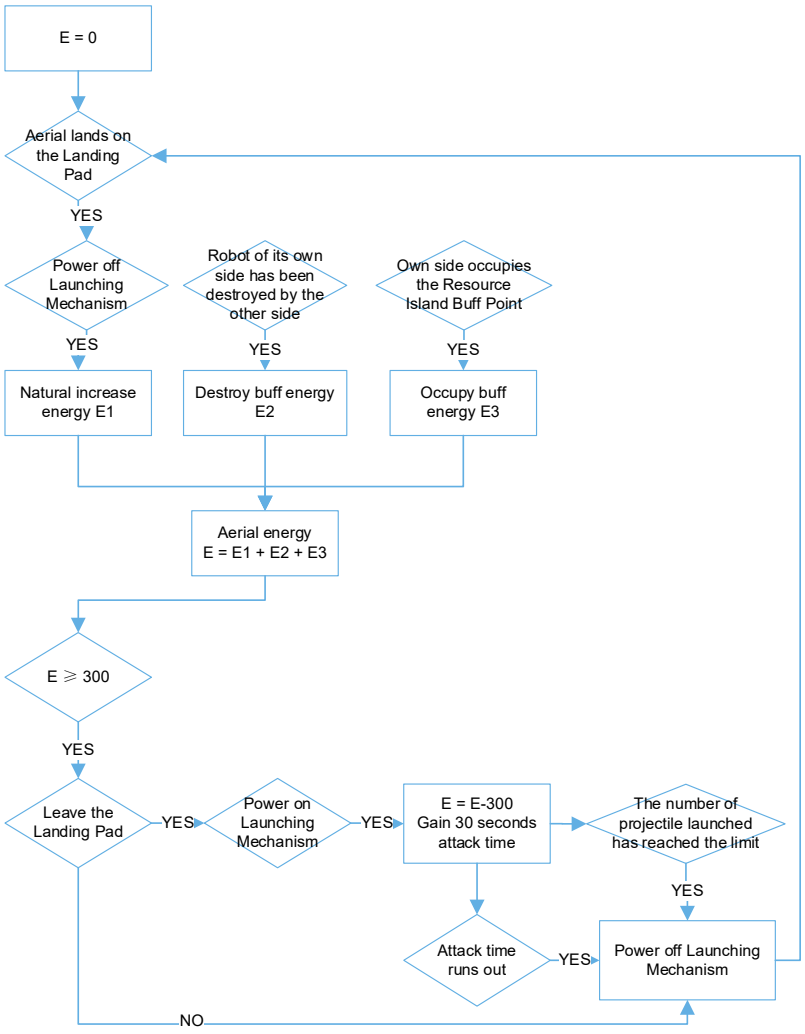


Figure 3- 12 Energy Mechanism

3.11.2 Attack Deductions

3.11.2.1 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 its Initial Firing Speed V_1 exceeds 30 m/s, the Aerial's attack time will be reduced by: $t = 0.5（V_1 - 30）^2$s, keeping the integer.

3.11.2.2 Modules Going Offline

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

3.12Dart Launching Mechanism

During each round, the gate of a Dart Launching Station has two opening opportunities, which the Aerial Gimbal Operator can choose when to use.

If the Aerial Gimbal Operator opens the gate of the Dart Launching Station, the Station's light indicator will light up when the gate is fully opened and a prompt will appear on the client interface of the Referee System. The Aerial Gimbal Operator can then launch darts by controlling the Dart Launcher. The gate of a Dart Launching Station stays fully open for 15 seconds. When the gate of the Dart Launching Station is closed, the light indicator will go off and a prompt will appear on the client interface of the Referee System. The Aerial Gimbal Operator will no longer be able to launch darts. When a gate closes for the first time, the Dart Launching Station will enter a 15-second cooling period. The gate can only open for the second time after the end of the cooling period.

3.12.1 Detection Window Period

When the Dart Launching Station of one team detects a dart, the Dart Detection Module on the outpost or base of the other team will update the detection window period, for a period of 5 seconds. The launched dart needs to hit the Dart Detection Module within the detection window period, or the attack will be void.

3.12.2 Invalid Attacks

During the same open period of a gate, if the initial firing speed of a dart exceeds its limit, then all darts that have not hit their targets during this open period will not be able to inflict any effective damage.

For example: When an Aerial Gimbal Operator opens the gate of the Dart Launching Station 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.

3.13 Logic of Mechanism Overlap

When a robot gains more than one buff of the same type, the maximum buff effect will be recorded. Buffs include attack, defense, HP recovery, and barrel heat cooling.

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.

3.14 Winning Criteria

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.

The following are the criteria for winning in a single round:

1. When the Base of one team is destroyed, the round ends immediately and the team with the surviving Base wins.
2. When the duration of a round has elapsed and if the Bases of both teams have survived, the team with the higher Remaining 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.
7. If neither team fulfills these criteria, the round is considered a draw. A draw in the Knockout Stage leads to an immediate tie-breaker round until a team wins.

3.14.1 Group Stage

The below shows the points for Group Stage:

Table 3-12 Points for Group Stage

Competition Format	Competition Result	Points	Remarks
BO2	2:0	3:0	Winner of two rounds gains 3 points
	1:1	1:1	One point for each team
	1:0	1:0	(draw for one round): The team winning one round gains 1 point
	0:0	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, 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 Net Outpost HP from all rounds ranks higher.
4. If the total Net Outpost HP of teams are the same, the team with the higher total Net Sentry HP from all rounds ranks higher.
5. If the total Net Sentry HP are the same, the team with the higher total HP Deduction ranks higher.
6. 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 or Base, Base Virtual Shield leading to HP deductions in the enemy robots, Base or Virtual Shield.
  - 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 from violations and penalties (Level 2 to 5 Warnings) as executed by the referee

will be counted as the enemy's HP Deduction.

- The amount of HP deducted from a Virtual Shield from attacks 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.
- Net Sentry HP: The remaining HP of a team's Sentry subtracted from the remaining HP of the enemy's Sentry 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.

3.14.2 Knockout Stage

A team wins the Knockout Stage if it has won the most number of rounds: BO3 requires the winning of two rounds while BO5 requires the winning of three rounds.

4. Competition Process

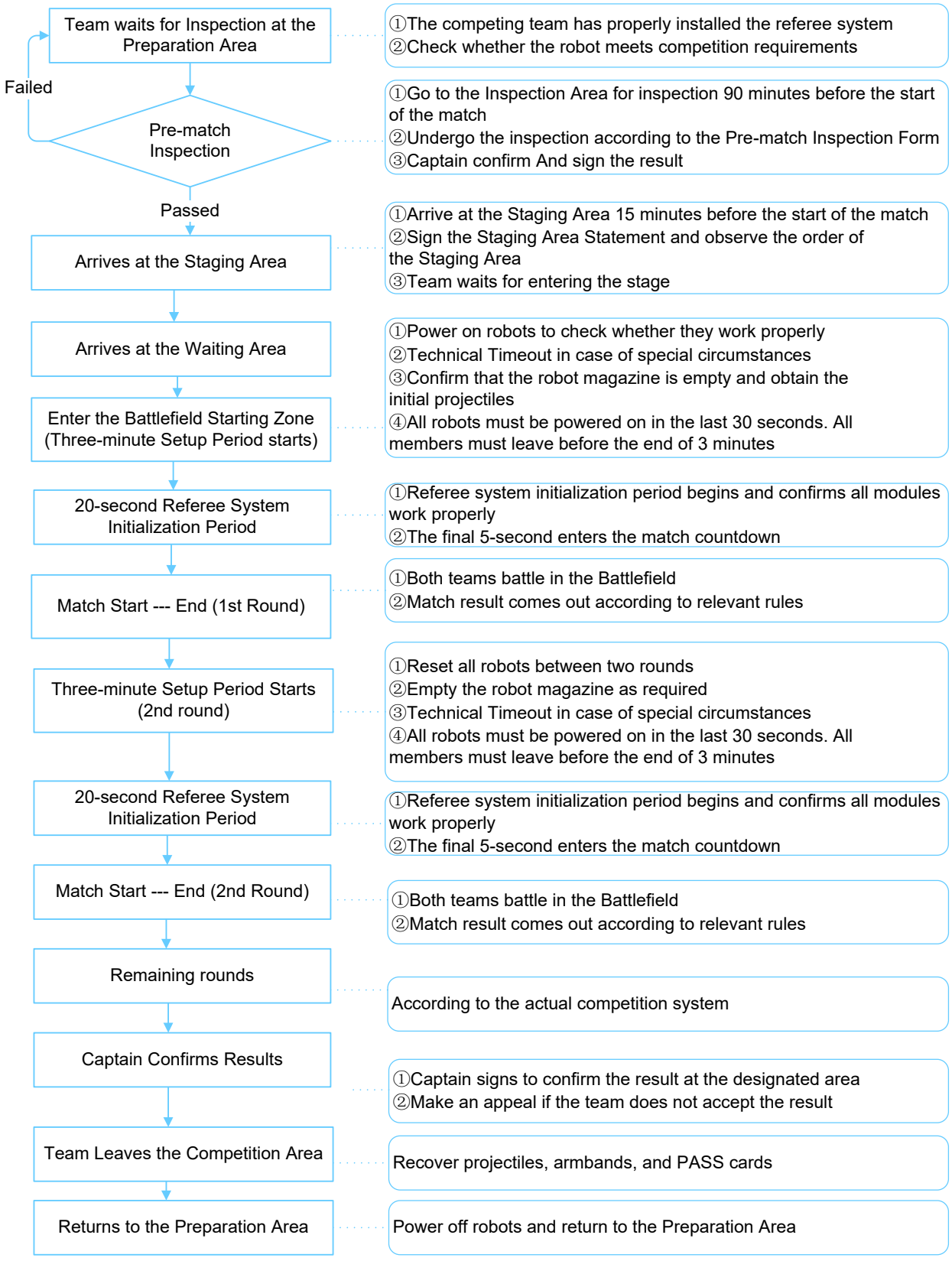


Figure 4-1 Process of A Single Match

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 90 minutes before the start of each match. For the requirements for Pre-Match Inspection, please refer to the RoboMaster 2020 Robot Building Specification Manual.

Except for each Standard brought into the Inspection Area by one team member, each of the other robots must 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 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 (one backup Dart Launcher is seen as one backup robot) for each match. A maximum of 4 backup darts are allowed in the BO2 and BO3 Competition Systems, while a maximum of 8 backup darts are allowed for the BO5 Competition System. Team members are required to declare the types of backup robots they are carrying during Pre-match Inspection. Backup Hero, Standard and Engineer must be attached with armor stickers in the Inspection Area. If a backup Standard Robot is needed on the field, a Pit Crew Member must obtain the corresponding armor sticker promptly from the referee. The attachment of armor stickers must follow the requirements stated in the RoboMaster 2020 Robot Building Specification Manual.

After passing the Pre-match Inspection, backup robots cannot be replaced without permission. In the Mock Inspection stage, the RMOC 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 its competitions 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. Staff at the Staging Area will check the status of the participating robots and the information of the Pit Crew. The team needs to sign the Staging Area Statement after confirmation.

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. Only when staff at the Staging Area has removed the Pass Card on the robot and the Staging Area Statement originally signed become invalidated can a robot leave the Staging Area for repair. When repair is finished, the robot needs to be brought back to the Inspection Area for another Pre-Match Inspection before re-entering the Staging Area, and the team Captain must sign a new 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 participating teams will enter the waiting area of the Competition Area to place their robots. When the previous match has ended and with the permission of the referee, the next pair of participating teams will wait at the entrance of the Battlefield with their robots for further instructions. After the referee has confirmed that both teams are ready, he or she will open the door and lead the team members into the Competition Area. The countdown for the 3-Minute Setup Period will begin when the door opens.

4.3 3-Minute Setup Period

After the end of the second and fourth round of a BO5 match, both teams have ten minutes to work on their robots. When ten minutes run out, the 3-Minute Setup Period of the next round begins.

During the 3-Minute Setup Period, the Pit Crew will place robots on their respective initialization locations, check whether the Referee System is operating normally, load the Aerial and Sentry Robots with initial projectiles, load darts into the Dart Launcher, and mount the Radar on the Radar Base.

In the last 1 minute and 30 seconds of the Setup Period, the Operator should preferably be in the Operator Room to complete debugging for the keyboard and mouse (which can be brought by the team itself), and double-check that the robot controls and official equipment are operating normally.

The robot’s control 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, referee will not announce technical timeout. The tactical coach can make tactical deployments in the operator room before a match, but is not allowed to enter the Battlefield, and must leave the operator room before the end of the 3-Minute Setup Period. Besides the operator and tactical coach, no other Pit Crew Members are allowed to enter the operator room.

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. Pit Crew Members must place the commissioning remote controllers

for Sentry Robots, darts and radars in the designated area at the Battlefield entrance.

4.3.1 Official Technical Timeout

During the 3-Minute Setup Period, if the Referee System, equipment inside the Operator Room or other modules related to the Referee System experience any faults (for details see “Table 4-1 - Faults”), the Head Referee can announce an Official Technical Timeout and pause the setup countdown.

During an Official Technical Timeout, team members can only work with the staff in eliminating the relevant faults of the Referee System or other official equipment, and are not allowed to repair other faults. When the relevant fault of the of the Referee System or official equipment has been eliminated and the Head Referee has resumed the countdown, Pit Crew Members are required to follow the set procedures for the 3-Minute Setup Period and leave the Battlefield within the specified time.

Table 4-1 Descriptions of Technical Fault

Rule	Description
1	A fault occurs with the official equipment in the operator room, and any key competition component in the Battlefield experiences structural damage or functional irregularity.
2	During the 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	Other situations determined by the Head Referee as requiring an Official Technical Timeout.

If the malfunction referred to in Rule 2 occurs during the 3-Minute Setup Period between rounds or during the 7-Minute Round, it will be categorized as “regular battle damage”, as it cannot be determined whether the malfunction was caused by the Referee System Module, a flaw in a robot’s circuit or structural design, or robot combat from a previous match. Regular battle damage will not trigger an Official Technical Timeout. Referees will provide backup Referee System modules. Teams can request for a Team Technical Timeout to repair their robots.

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 may enter the

Battlefield to repair robots, while the members of both teams can only inspect, repair and commission their own robots in the initialization zones for the robots.

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 in each 3-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 Team Technical Timeout opportunities once they have been used up. The Team Technical Timeout arrangements for different competition stages are as follows:

Table 4-2 Team Technical Timeout Arrangement

Competition	Arrangement
China Regional Competition and Final Tournament	● Group Stage: Two Technical Timeouts for 2 minutes each ● Knockout Stage: One Technical Timeout for 3 minutes Technical Timeout opportunities not used in the Group Stage can be carried over to the Knockout Stage

4.4 Referee System Initialization Period

After the 3-Minute Setup Period, the match enters a 20-second Referee System Initialization Period. During theInitialization Period, the competition server will automatically detect the connection status of the client, the Referee System module status of the robot, the status of Battlefield Components and restore the HP of all robots, ensuring their HP are full when the match officially begins.

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

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

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, an Aerial gains one opportunity to reload 500 rounds of projectiles for every energy unit spent. The Pilot can request for projectile 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-second projectile reloading period is calculated from when the Pilot opens the projectile reload window.

4.6 End of Competition

A round ends either when time has elapsed 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. Please refer to “3.14 - Winning Criteria” for details on the winning criteria. The match is over when the winner has been determined or all rounds are ended.

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.

A team Captain must confirm the match results by signing at the Referee Area within five minutes after a 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. Please refer to “7 - Appeal” for details on the appeal process.

5. Violations and Penalties

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

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. Referee will issue the appropriate penalty against any violation of rules.

Serious violations and all appeals in the competition will be publicized.

5.1 Penalty System

Before the start of each round of match, the violation score of each robot will be clear to zero. During the match, robot will be recored 2 scores when receives a Level 2 Warning and 4 scores for Level 3 Warning.

- When a robot has 4 violation scores, a yellow exclamation point will be displayed on the robot's avatar on the robot server client interface
- When a robot has 7 violation scores, a red exclamation point will be displayed on the robot's avatar on the robot server client interface
- When a robot has 9 violation scores, the robot is ejected for this round of match

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

Table 5-1 Penalty System

Penalty Level	Description
Level 1 Warning	When a warning is issued, the operation interface of all Operators from the offending team will be blocked for one second
Level 2 Warning	● The operation interface of the offending Operator will be blocked for 3 seconds, while the operation interfaces of other Operators in the offending team will be blocked for 2 seconds. ● The Referee System will automatically deduct 5% of the current maximum HP from all surviving robots of the offending team ● The offending robot will be recorded with 2 violation scores

Penalty Level	Description
Level 3 Warning	● The operation interface of the offending Operator will be blocked for 8 seconds, while the operation interfaces of other Operators in the offending team will be blocked for 3 seconds. ● The current maximum HP of the offending robot will be deducted by 50%, and those of other surviving robots will be deducted by 5% ● The offending robot will be recorded with 4 violation scores
Level 4 Warning (Ejection)	● The offending robot is ejected: In the round of the match, ground robots and Sentry are immediately ejected by the Referee System (deduct all HP). Aerial will have its Launching Mechanism (including the loading mechanism and friction wheel) powered off and its VTM disconnected and must immediately land on the Landing Pad. ● Ejection of Pit Crew Members: Members ejected by the referee must immediately leave the Competition Area and no substitute Pit Crew Members are allowed in the remaining rounds of the match. The robot operated by the ejected Operator will be ejected for this round, and will not be allowed to enter or be substituted by other robots in all other rounds of the current match.
Level 5 Warning (Forfeiture)	● If a Forfeiture is issued before the start of the 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, Outpost and Sentry HP will be deducted to zero, and the HP of all the offending team's robots will be 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, Outpost and Sentry 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, Outpost and Sentry 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 level 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.

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

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.

If any incident has occurred during the competition that affects the fairness of the competition but does not trigger any penalty rule or amount to a serious violation, the Head Referee shall issue a penalty based on the circumstances.

5.2 Penalty

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

5.2.1.1 Participating Teams/Personnel

R1 Teams are required to meet the requirements in Chapter 3 of the RoboMaster 2020 Robotics Competition Participant Manual.

Penalties: The maximum penalty that can be given to an 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 maximum penalty that can be given to an offending team is disqualification.

R3 Except for emergencies, teams must be at the Inspection Area at least 90 minutes before the start of a match to undergo the Pre-Match Inspection.

Penalties: The offending team is issued a Forfeiture of the match.

R4 Team members must wear protective goggles when entering official designated areas such as the Preparation Area, Staging Area and Competition Area.

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

R5 Except for emergencies, team Captains must sign the Staging Area Statement 10 minutes before the start of each match.

Penalties: The offending team is issued a Forfeiture of the match.

R6 Team members must not turn on the power and commission 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.

R7 Except the Pit Crew Members that are about to start the next match, other team members are not allowed to enter the Staging Area and Competition Area without special reasons.

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

R8 Except projectiles preset in the Inspection Area, teams must not bring their own projectiles into the Inspection Area, Staging Area or Competition Area, and also must not take official projectiles away from the Competition Area.

Penalties: The staff confiscates the projectiles.

R9 Teams must not damage any official equipment (including but not limited to equipment in the Competition Area, Staging Area, Preparation Area and Inspection Area).

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

R10 Team members are not allowed to leave the Staging Area or Competition Area without permission.

Penalties: Offender is forbidden from entering the Competition Area.

R11 After a match is over, members from both teams must power off all their robots, remove them from the Competition Area and empty all projectiles inside the robots at the Projectile Unloading Area.

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

5.2.1.2 Pit Crew Members

- Pit Crew Members: Official members, Supervisors and Advisors that have been registered on the registration system and can enter the Staging Area and Competition Area, where only the Advisor is allowed to be the tactical coach.
- Captain Armband: Any regular member that wears the 'Captain' armband performs the Captain role during the match. The Captain is responsible for managing and controlling the team's participation in the competition process, confirming results, and requesting for Technical Timeouts, appeals, etc.

R12 Each team can have a maximum of 19 Pit Crew Members enter the Competition Area, of which 17 must be official team members (not including the tactical coach), along with a Supervisor and a tactical coach. One Pit

Crew Member should wear the “Captain” armband and undertake the Captain’s role.

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

R13 Pit Crew Members must meet identity requirements.

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

R14 Pit Crews must wear armbands which must not be covered. The “Captain” sign of the Captain's armband must face the front.

Penalties: Verbal Warning.

R15 Except for the Radar, team members are not allowed to power their self-prepared 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, offender shall be ejected from the Competition Area.

R16 Pit Crew Members entering the Competition Area must not communicate with anyone from the outside.

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

R17 Apart from the tactical coach and operator, other Pit Crew Members are not allowed to enter the operator room.

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

R18 The tactical coach must leave the operator room before the end of the 3-Minute Setup Period.

Penalties: Verbal Warning. If the Verbal Warning is ineffective, the maximum penalty that can be given to the offender is disqualification.

R19 After the end of the 3-Minute Setup Period, Pit Crew Members must return to the designated area outside the Battlefield. During the competition, Pit Crew Members are not allowed to leave the area without the permission of the referee.

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

R20 The Pit Crew may commission the Sentry Robot, Radar and Dart System using a remote controller before entering the Referee System Initialization Period.

Penalties: Forfeiture of the round.

R21 Pit Crew Members are not allowed to 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.

R22 During the 3-Minute Setup Period, Pit Crew Members may Commission the Aerial Robot 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 party shall be issued a Level 2 Warning.

R23 During the 3-Minute Setup Period, Pit Crew 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 party must bear the relevant responsibility.

R24 During an Official Technical Timeout, Pit Crew Members are not allowed to fix faults other than those in modules related to the Referee System.

Penalties: Verbal Warning. If the Verbal Warning is ineffective, the offender shall be issued a Level 4 Warning.

5.2.1.3 Operator

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

Penalties: Forfeiture of the round.

R26 During the Referee System Initialization Period and the 7-minute Match, Operators must remain in the relevant Operator's Room to operate the relevant computers, and remain in position after a match has started, unless otherwise permitted by the referee.

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

R27 During the competition, each Operator must wear a headset and be equipped with not more than one remote controller.

Penalties: Verbal Warning. If the Verbal Warning is ineffective, the offender and the robots operated by the offender shall be issued a Level 4 Warning. If the offender does not obey the penalty order, the offending team shall be issued a Forfeiture of the round.

R28 A Pilot that operates an Aerial Root must pass the Pilot Assessment.

Penalties: Forfeiture of the round.

R29 The Pilot must wear a long-sleeved top, a safety helmet and pilot goggles.

Penalties: Forbidden from supplying projectiles for Aerial during the match.

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

R30 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.

R31 A single projectile supply time for Pilot during the match cannot exceed 30 seconds.

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

5.2.2 Robot

5.2.2.1 General

R32 Robots entering a match must pass Pre-match Inspection.

Penalties: Forfeiture of the round.

R33 In the first round of a match, the robots must meet the minimum battle team size.

Penalties: Forfeiture of the current match.

R34 Robots must be attached with armor stickers that meet the inspection specifications.

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

R35 When waiting in the Staging Area, team members are not allowed to bring robots out of the Staging Area without permission.

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

R36 Robots must not carry or present safety issues including but not limited to short circuits, crashing, and falling to the ground. If a safety issue is present or has arisen, team members must execute the relevant operations in accordance with the referee's instructions.

Penalties: If it is before the start of a match, the Pit Crew need to resolve the safety issue as required by the referee, otherwise the offending robot will not be allowed onto the Battlefield. If it is during the competition,

a Verbal Warning shall be issued. If the Verbal Warning is ineffective, a Level-4 Warning shall be issued against the offending team member or robot. Any incident involving serious safety hazards shall be handled by the Head Referee in accordance with "6 - Irregularities".

R37 During the 5-second countdown in the Referee System Initialization Period, no robots are allowed to transform beyond their Maximum Initial Size.

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

R38 During the 3-Minute Setup Period and the Referee System Initialization Period, robots in the Battlefield are not allowed to leave their corresponding initialization zones.

Penalties: If it is during the 3-Minute Setup Period, a Verbal Warning shall be issued. If the Verbal Warning is ineffective, a maximum Level-4 Warning may be issued against the offending team. If it is during the Referee System Initialization Period, the Head Referee shall issue a Level-2 or Level-4 Warning against the offending team, as judged by the offending team's subjective intention and the impact of its violation on the competition.

R39 During the competition, the robot is not allowed to disintegrate into sub-robots or sub-systems connected by multiple flexible cables, and must not cast or launch their own parts.

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

R40 Except for reloading projectiles and rescuing other robots, a robot is not allowed to cover its armor modules during a match by transforming to deflect the attacks from other robots. Robots are also not allowed to transform beyond the Maximum Expansion Size during a match.

- Any action that meets the following criteria constitutes a rescue.
  - The robot being rescued has been defeated.
  - The mechanisms of the rescuing robot and the robot being rescued must be connected, i.e. the rescuing robot remains connected to the robot being rescued whichever direction the rescuing robot moves towards.
  - The rescuing robot and the robot being rescued are moving towards their team's Restoration Zone (through the shortest route on the Battlefield)

  Any action other than the above is not considered a rescue. The act of pushing by any robot is not considered a rescue.
- A rescuing robot that is moving towards its team's Restoration Zone during a rescue has priority passage and cannot be blocked.

Penalties: An X-level warning will be issued against the violating team according to the length of time (T seconds) of its robot's blockage or transformation beyond the Maximum Expansion Size.

Table 5-2 Penalties for Blockage or Transformation

T Second(s)	Level X Warning
3 < T ≤ 10	2
10 < T ≤ 30	3
T > 30	4

5.2.2.2 Ground Robots

R41 During the 3-Minute Setup Period for each round, ground robots must empty their projectiles until they are no longer able to launch any projectiles. Engineer robots are required to clear their 42mm and 17mm projectiles completely. If an Engineer Robot is installed with a 17mm Launching Mechanism, its projectiles shall be cleared until no projectiles can be fired.

Penalties: If the competition has yet to start, the Pit Crew 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.

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 party shall be issued a Level 2 Warning.

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

Penalties: The offending robot is issued a Level 4 Warning. If the consequence is serious, a Level-5 Warning may be issued.

R44 During a match, each team can have not more than one robot installed with a mobile 17mm Launching Mechanism.

Penalties: During the 3-Minute Setup Period, if any team in the Battlefield has multiple robots installed with mobile 17mm Launching Mechanisms, the Pit Crew Members must remove the excess robots from the Battlefield as required by the rules. If the Initialization Period has commenced, the Referee System shall automatically retain the robot with the smallest serial number while issuing a Level-4 Warning against all the remaining offending robots.

> **For example, if a team's Hero and Engineer are found to be installed with a mobile 17mm Launching Mechanism during the Initialization Period, the Referee System's server will eject the Engineer**

5.2.2.3 Aerial

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 must remove the Aerial Robot from the Battlefield, and its Pilot and Aerial Gimbal Operator must return to the Pit Area.

If the team's Dart Launching System or Radar enters the stage, the Aerial Gimbal Operator can stay in the Operator Room.

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

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

R47 During the competition, the distance between the lowest point of an Aerial Robot and the Battlefield ground must not be less than 1500 mm, and no part of the 17mm Speed Detection Module carried by the Aerial Robot's gimbal Launching Mechanism can exceed the highest point of the Perimeter Wall of the Flight Zone

Penalties: A warning shall be issued against the Pilot to remind the Pilot to adjust its 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 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 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

5.2.3.1 Interaction between Robots

R50 Engineer of one team is not allowed to interfere with the other team's Engineer when it is procuring Projectile Containers within the Resource Island Buff Point.

Penalties: Based on the degree of interference, the offending party is issued a warning from Level 2 to 4.

Table 5-3 Penalties for Interference

Violation Level	Description
Level 2	Minor collision
Level 3	High-speed collision, or active pushing causing the other team's Engineer to move
Level 4	Repeated high-speed collision, or active pushing causing the other team's Engineer Robot to move across a longer distance

R51 Except for slowly pushing away a destroyed robot that is obstructing the path, a robot must not use any of its structures to collide with the enemy's robots.

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

Table 5-4 Penalties for Collision

Violation Level	Description
Level 1	Actively causing front collision
Level 2	Actively causing high-speed front collision, active pushing causing the other team's robot to move, or impeding the normal movement of the other team's robot
Level 3	Actively causing high-speed and repeated frontal collision, active pushing causing the other team's robot to move across a longer distance, or impeding the normal movement of the other team's robot for a long period of time
Level 4	Actively causing high-speed, repeated and intense front collision, or engaging in active high-speed collision for a long period of time causing the robot to move across a longer distance

R52 If Aerial collides with a ground robot when flying, the referee will consider Aerial a malicious collision.

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

R53 To ensure that Sentry is fully capable of moving along its Rail, any part of a robot that attacks the opposing team's Sentry, either intentionally or unintentionally, will be deemed as violation.

Penalties: Refer to the penalty levels for robot collision. See "Table 5-4 - Collision Penalty Levels".

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

Penalties: An X-level warning will be issued against the offending party according to the length of time of sticking together T second(s) and the impact on the competition.

Table 5-5 Penalties for Sticking Together

T Second(s)	Level X Warning
T ≤ 10	1
10 < T ≤ 30	2
30 < T ≤ 60	3
60 < T ≤ 90	4
T > 90	5

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

A penalty shall be issued according to the actual consequences.

Penalties: An X-level warning will be issued against the offending party according to the length of blocking time T second(s).

Table 5-6 Penalties for Blocking Rescue

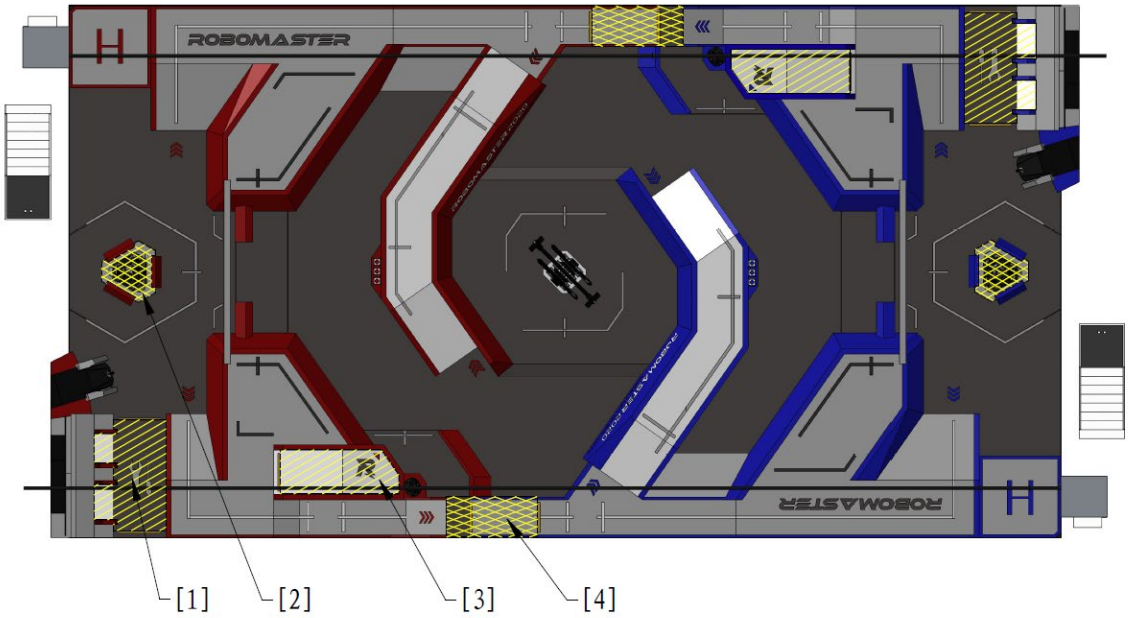
T Second(s)	Level X Warning
3 < T ≤ 10	2
10 < T ≤ 30	3
T > 30	4

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

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

5.2.3.2 Interaction between Robots and Battlefield Components

In order to ensure the fairness of the competition and that robots in the Battlefield are able to receive buffs or reloads effectively, multiple penalty zones have been set up in the Battlefield where the robots of one or both teams are forbidden from entering, as shown below.



[1] Supplier Penalty Zone [2] Base Penalty Zone [3] Power Rune Activation Point Penalty Zone [4] Road Penalty Zone

Figure 5-1 Base Penalty Zone

R57 Robots are forbidden from entering the Base Penalty Zone or Launch Ramp Penalty Zone.

Penalties: Based on the length of time the robot was in the Penalty Zone, the offending party is issued a warning from Level 2 to 3.

Table 5-7 Penalties for Staying

T Second(s)	Level X Warning
3 < T ≤ 10	2
T > 10	3

⚠ If a team's robot is in the Launch Ramp Penalty Zone, 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 Robots are not allowed to place Projectile Containers in the Supplier Penalty Zone and Power Rune Activation Point Penalty Zone.

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

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

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

R60 The robots of one team are forbidden from entering the Supplier Penalty Zone and Power Rune Activation Point Penalty Zone, and must not cause any interference with or hindrance to the entry of the other team's robots into the Supplier Penalty Zone and Power Rune Activation Point Penalty Zone.

Penalties: Based on the length of time the robot was in the Penalty Zone, the situation of gaining contact with the Official Projectile Supplier and the degree of blocking, the offending party is issued a warning from Level 2 to 5.

Table 5-8 Penalties for Stay, Contact and Blocking

T Second(s)	Level X Warning
T ≤ 3	2
3 < T ≤ 10	3
10 < T ≤ 30	4
T > 30	5

R61 Participating robots are only allowed to use projectiles provided officially by the RMOC.

Penalties: Verbal Warning. If the Verbal Warning is ineffective, according to the seriousness of the situation, the highest penalty that can be given to the offending party is disqualification.

R62 Robots may not obtain projectiles from Sentry or Aerial of its own side.

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

R63 Robots are not allowed to procure projectiles that have fallen to the ground.

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

R64 Standard and Hero are not allowed to directly procure projectiles from Projectile Containers on the Resource Island.

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

R65 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.

R66 An Engineer Robot is not allowed to grab any Projectile Container that has not completely left the groove of

the Resource Island or procure its projectiles.

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

R67 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.

R68 Robot of one side is not allowed to actively attack the Dart Launcher of the other side.

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

R69 During the competition, the moving mechanisms of robots must not actively cause any damage to the core components of the Competition Area.

Penalties: The staff shall check the fault, and may issue a maximum penalty of Forfeiture of the match against the offending team based on the circumstances.

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 disqualified from the current competition season and its awards. The match results of this team will still be kept on record as reference for other teams in their advancement in the competition.

Table 5-9 Categories of Serious Violations

Rule	Robot 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.	A situation has occurred in the Competition Area that violates 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.	A team member using robots to collide into or attack other people deliberately, putting themselves and other people at risk of injury
6.	A team member 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, other participating teams, audience, etc.

Rule	Robot Type
8.	A team member's refusal to cooperate, deliberate delay or provision of false materials and information during the RMCO's handling of an appeal request.
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 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.
12.	Any other behavior that seriously violates the spirit of the competition or has been determined by the Chief Referee as a serious violation

6. Irregularities

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

If any of the following anomalies occur during the competition, it shall be handled according to the corresponding process, to which both teams cannot object. The handling process is as follows:

- When a robot safety hazard or irregularity in a robot has occurred on the Battlefield, such as battery explosion, Aerial breaking an Aerial Safety Rope, stadium power outage, explosion of a compressed gas cylinder, or interpersonal conflict), the Head Referee will notify both teams' Operators after discovering and confirming the emergency, and eject all robots through the Referee System. The result of the round will be invalidated. The round will restart after the safety hazard or exception has been eliminated.
- If 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 or Outpost Armor Module shifts, drops off or cannot detect hit damage; a Power Rune cannot be hit and triggered normally; Official Projectile Supplier cannot supply projectiles normally; the Aerial Safety Rope breaks or is worn out, the Head Referee will notify both teams' Operators after discovering and confirming the emergency, and eject all robots through the Referee System. The result of the round will be invalidated. Referees will enter the Battlefield to perform repairs. The round will restart once the Battlefield Component resumes its normal function.
- 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' Operators and eject 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.
- 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 producing 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.

7. Appeal

Each team has the right to one appeal during the China Regional Competitions 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.

7.1 Appeal Process

Teams filing an appeal must follow the procedure below:

1. Within five minutes after the end of a match, the losing team may appeal on all its lost rounds in the match. Within five minutes after a match ends, the appealing team's Captain submits an appeal request to the referee and completes and signs an Appeal Form. If the reason for the appeal is related to the robots of any team in the competition, the appealing party shall propose that the relevant robots be isolated and tested, which will be implemented after confirmation 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 Captains of both teams to meet in the Arbitration Room. Each team can only send three members to the Arbitration Room, and they must be regular 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.
6. 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).

7. 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.

7.2 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 when both teams meet in the Arbitration Room, the absent team is deemed to have given up its right to the arbitration. If more than three members of a team are present in 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 (30 minutes of making a Continued Appeal). The Arbitration Commission will not accept any new materials beyond this 60-minute limit.

7.3 Appeal Materials

Appeal materials submitted by teams must follow the below specifications:

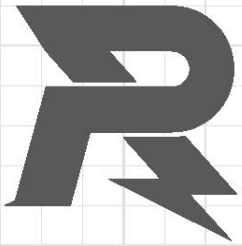
- Material type: Only materials stored on a USB flash drive and the robots themselves will be accepted as appeal materials. Materials submitted in other forms will not be accepted by the Arbitration Committee.
- USB flash drives: The edited video (the video materials should be prepared by the team itself) and the text files for the appeal should be placed according to the directory.
- Material format: No video can 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 Committee 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 at the latest when the arbitration decision itself is announced.

7.4 Appeal Decision

The Arbitration Committee will provide its final arbitration decision on the Appeal Form, which both team Captains must sign within an hour after 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 Committee.

If the Arbitration Committee 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 failed and the original match results are maintained. If only one team refuses the rematch, the refusing team is deemed to have forfeited and lost the round.



E-mail: robomaster@dji.com
Forum: bbs.robomaster.com
Website: www.robomaster.com
Tel: +86 (0)755 36383255 (GTC+8, 10:30AM–7:30PM, Monday to Friday)
Address: Room 202, Floor 2, Integrated Circuit Design & Application Industrial Park, No. 1089, Chaguang Road, Xili County, Nanshan District, Shenzhen City, Guangdong Province, China