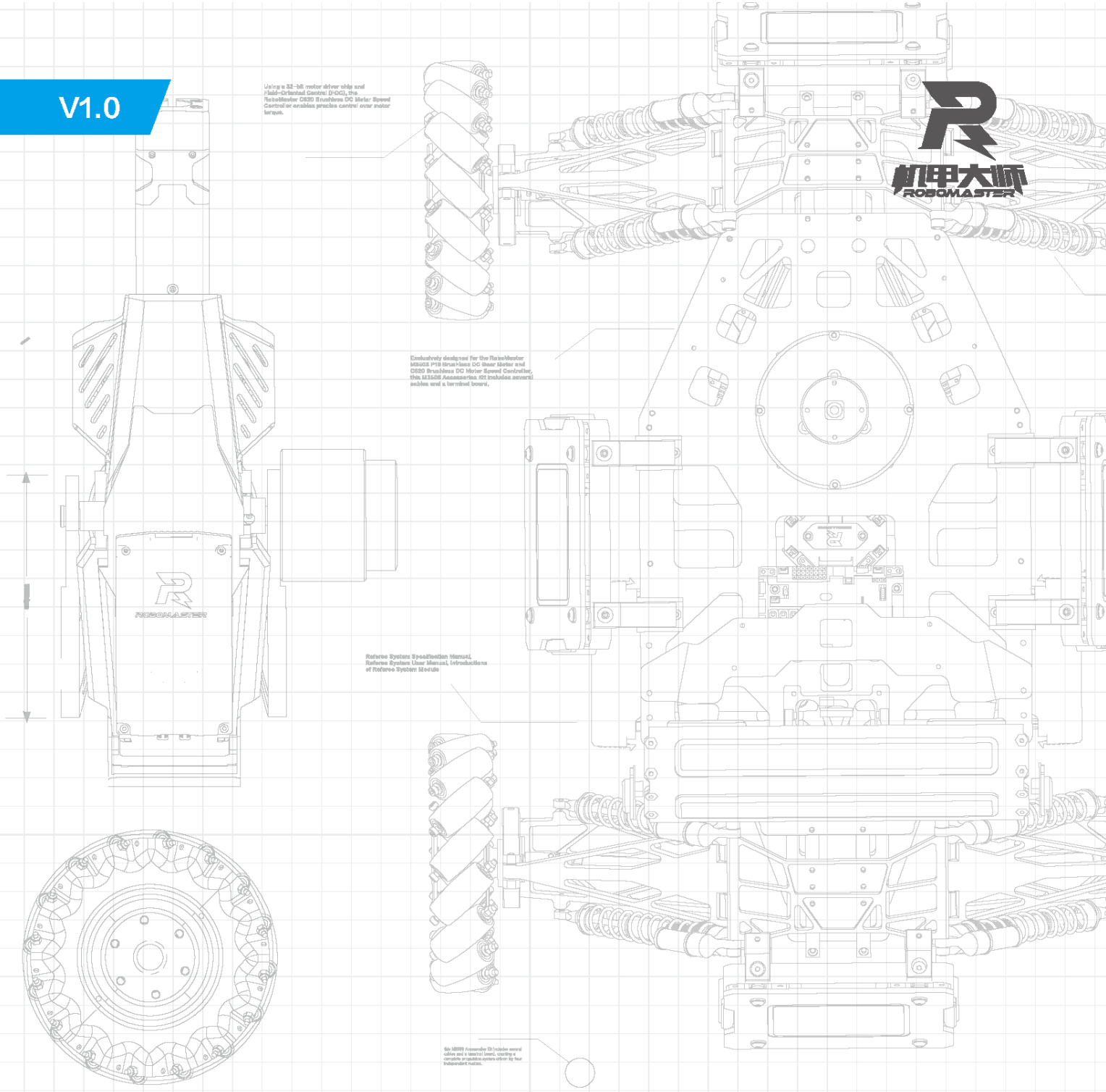
V1.0



ROBOMASTER 2022

UNIVERSITY LEAGUE (NORTH AMERICA)

RULES MANUAL

Prepared by the RoboMaster Organizing Committee
Released on November 2021

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.

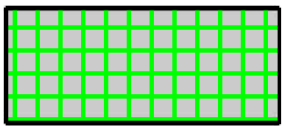
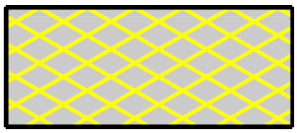
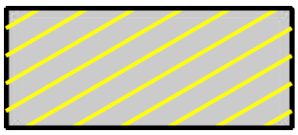
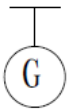
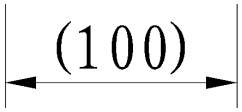
Relevant suggestions for open source materials can be found in this link: https://bbs.robomaster.com/thread-7026-1-1.html.

Using this Manual

Legend

Prohibitions	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
Oct. 15, 2021	V1.0	First release

Table of Contents

Tables Directory

Figures Directory

1. Introduction

RoboMaster University League (RMUL), organized by local academic institutions and universities, engaging in nearby universities, is dedicated to promote regional university robotic technology exchange, cultivate a strong academic atmosphere, and assist the development of regional technology innovation. The participating teams can advance to the RoboMaster University Championship (RMUC) through the Scoring and Ranking System.

Scores are only calculated for teams participating in 3V3 Confrontation.

The RMUL 2022 season consists of 3V3 Confrontation and Standard Confrontation.

During 3V3 Confrontation, both teams need to independently develop their own Standard, Hero, and Sentry Robots, conduct tactical confrontations on the designated battlefield, and command the robots to attack enemy robots and bases by launching projectiles. The winner at the end of the Confrontation shall be the team with the higher remaining Base HP.

During Standard Confrontation, both teams operate independently developed Standard Robots for 1V1 confrontation on the battlefield. There are two groups: Auto Standard group (only for Auto Standard robots) and Manual Standard group (only for regular standard robots and Balancing Standard robots), which respectively require corresponding qualifications. The winner at the end of the Confrontation shall be the team with the higher Sentry remaining HP.

1.1 Main Changes to New Competition Season

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

Events:

- There are two groups in Standard Confrontation: Auto Standard group and Manual Standard group

Competition Site:

- Re-designed the Battlefield

Robots:

- Adjusted the Armor Module of the Balancing Standard Robot
- Added Radar to the Auto Standard group of Standard Confrontation

Mechanism:

- Added a new economic system
- Changed the winning criteria for Standard Confrontation
- Adjusted the performance parameters of the robots

- Adjusted HP Recovery Mechanism

1.2 Robot and Operator

RMUL 2022 emphasizes the participation of robots as teams and requires balanced cooperation between robots. Building specifications for robots can be found in the "RoboMaster 2022 University Series Robot Building Specifications Manual".

1.2.1 Robot Line-up

Robot Line-up information is shown below.

Table 1-1 Robot Line-up

Type	Numbering	Qty (set)	Event
Hero Robot	1	0-1	3V3 Confrontation
Standard Robot	3/4	0-2	
Sentry Robot	7	0-1	
Standard Robot	5	1	Standard Confrontation
Radar	9	0-1	

- When there are no special classification instructions, Standard robots include regular Standard robots, Auto Standard robots, and Balancing Standard robots, but other types can be included when there are such instructions.

- Participating teams that have not participated in the RMUC/RMUT/RMUL 2021 competitions can play at most one RoboMaster Type-A Assembly Robot.
- During 3V3 Confrontation, the total number of Hero and Standard Robots is less than 2. In the first round of each match, the number of line-up robots is greater than 2.

- In the Standard Confrontation, the Radar is available only when the Auto Standard robot is playing.
- In the Standard Confrontation, the armor sticker of the Standard can only be 3/4/5.

1.2.2 Basic Robot Information

Basic robot information is shown below.

Table 1-2 Basic Robot Information

Item	3V3 Confrontation			Standard Confrontation			
Type	Hero	Standard	Sentry	Regular Standard	Auto Standard	Balancing Standard	Radar
Maximum Chassis Power Consumption (W)	Note[1]	Note[1]	30	120	120	150	-
Initial HP	Note[1]	Note[1]	600	200	200	200	-
Maximum HP	Note[1]	Note[1]	600	200	200	200	-
Initial Launching Speed Limit (m/s)	Note[1]	Note[1]	30	18	18	18	-
Barrel Heat Limit	Note[1]	Note[1]	320	280	280	280	-
Barrel Cooling Value per Second	Note[1]	Note[1]	100	25	25	50	-
Value of Experience Points	Note[1]	Note[1]	7.5	-	-	-	-
Projectile Launch Speed (round/s)	Note[2]	Note[2]	Note[2]	-	-	-	-
Initial Position	Starting Zone	Starting Zone	Sentry Rail	Starting Zone	Starting Zone	Starting Zone	Radar Base

Note[1]:

About the robot level, please refer to "3.2.6 Level Up Mechanism" for details.

For the buffer energy correlated to the maximum chassis power consumption, refer to “2.2.3 Exceeding Chassis Power Consumption Limit”.

Note[2]:

For details, please refer to “2.2.1 Exceeding the Initial Launching Speed Limit”.

A Radar provides vision and warnings to all robots of the team. The Radar is situated outside the Battlefield. The Aerial Gimbal Operator is able to view the Radar images, while the Radar can also relay information to the team’s robots through the inter-robot communication function. The Radar’s computing system shall be connected to a 220V utility power supply.

- Robot chassis: A mechanism that carries a robot propulsion system and its accessories.
- Chassis Power Consumption: The power propulsion system that enables a robot to move horizontally, not including the power used for special tasks (e.g., power consumption for functional movements such as moving the upper mechanical structure).
- Initial Launching Speed: The speed detected by the relevant modules of the Referee System after a projectile or dart has completed its acceleration.
- Initial projectile quantity: The quantity of projectiles that a Pit Crew Member can load into the magazines of a robot before the start of a round.
- Barrel Heat: A mechanism for limiting the continuous Launching of projectiles by robots. For more details, please refer to "2.2.2 Barrel Overheating and Cooling".

1.2.3 Operator Line-up

- An operator must be a Regular Member of a team in the current season.
- After the end of each round, the Operator can be replaced by a Pit Crew Member.
- An Auto Standard Robot does not have an operator. The Aerial Gimbal Operator can issue commands to an Auto Standard Robot through the small map.

The operator line-up is as follows:

Table 1-3 Operator Line-up

Type	Robot Operated	Maximum Number of Operators
Robot Operator	Hero Robot	1 Operator/Robot
	Standard Robot	1 Operator/Robot
	Sentry Robot	0 Operator/Robot
	Radar	1 Operator/Robot

Ground Robots: Hero robot and standard robot are generally referred to as ground robots.

1.3 Overview of Competition Process

All robots entering the stage must first pass the Pre-match Inspection to ensure they meet the technical specifications set by the RMOC for the fairness of the competition. After completing the Inspection, team members need to go to the Staging Area with their robots 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 Setup Period and Round Period. Between the two periods, there is a 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 “5 - Competition Process”.

2. General Competition Mechanism

2.1 Robot Status and Buff Types

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

Table 2-1 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 Launching 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 as a penalty after being issued with a Red Card or having accumulated 8 violation points.
Offline	Where a robot is disconnected from the server.

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

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

Table 2-2 Robot buffs

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

2.2 HP Deduction Mechanism

The HP of ground robots and Sentry Robots will be deducted in any of the following situations: the Barrel Heat limit, Initial Launching Speed limit or Maximum Chassis Power Consumption of a Launching Mechanism is exceeded; an Armor Module is 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.

2.2.1 Exceeding the Initial Launching Speed Limit

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

When $V_1 > V_0$, if it's 17 mm 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 2-3 Penalty Mechanism for Exceeding Initial Launching Speed Limit

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

2.2.2 Barrel Overheating and Cooling

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

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

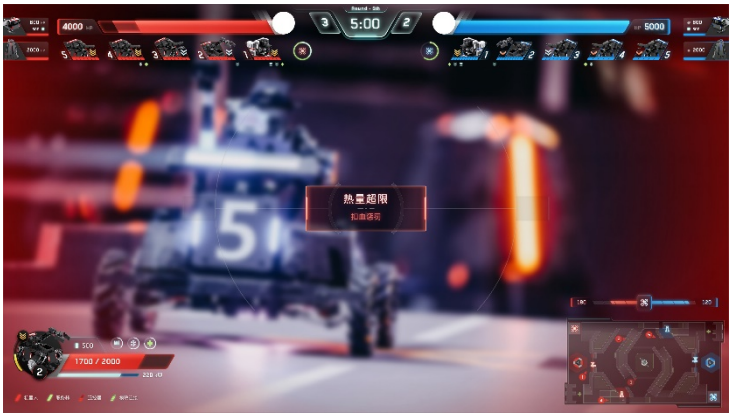
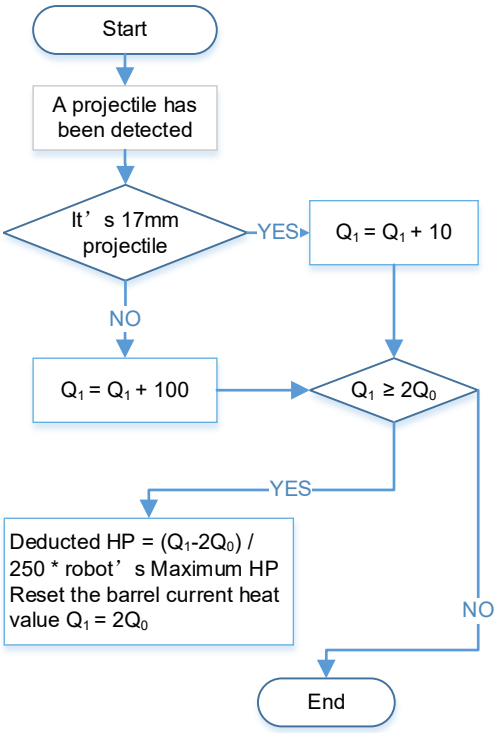


Figure 2-1 FPV of Client

B. When 2Q0 > Q1 > Q0, the deducted HP for every 100 ms = ((Q1 - Q0) / 250) / 10 * Maximum HP. After the HP deduction, the barrel cooling will be calculated.

C. When Q1 ≥ 2Q0, the immediate deducted HP = (Q1 - 2Q0) / 250 * Maximum HP. After deducting HP, set Q1 = 2Q0.

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



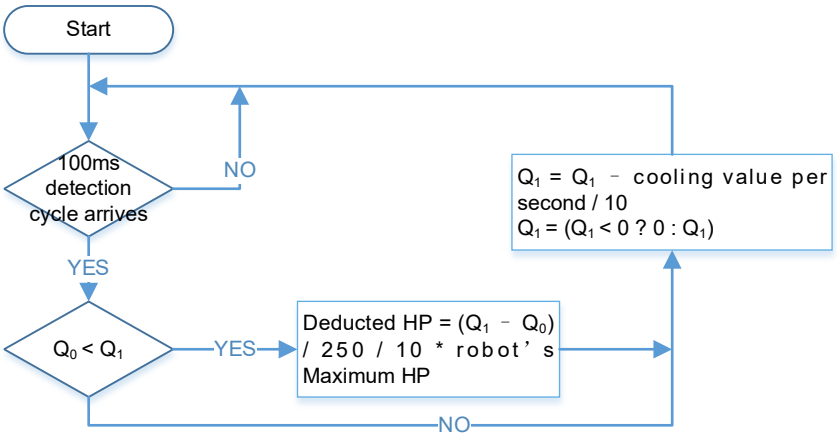


Figure 2-2 (Above) HP Deduction logic and (Below) cooling logic when Barrel Heat limit is exceeded

2.2.3 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 robot is 200J; while the Z values of Standard and Hero are set as 60J.

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

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

Table 2-4 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:

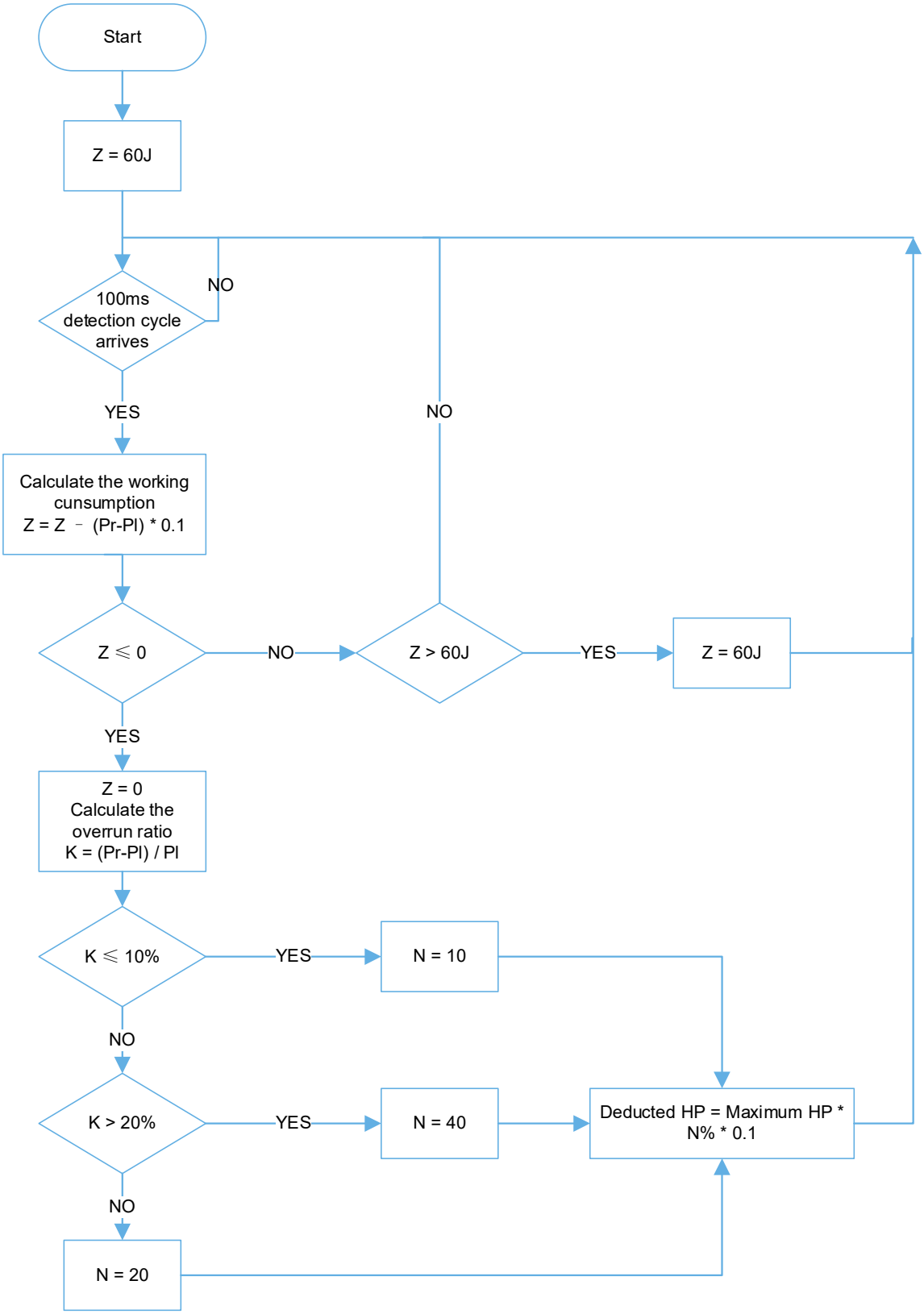


Figure 2-3 Chassis Power Consumption Detection and HP Deduction Logic of Standard and Hero

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:

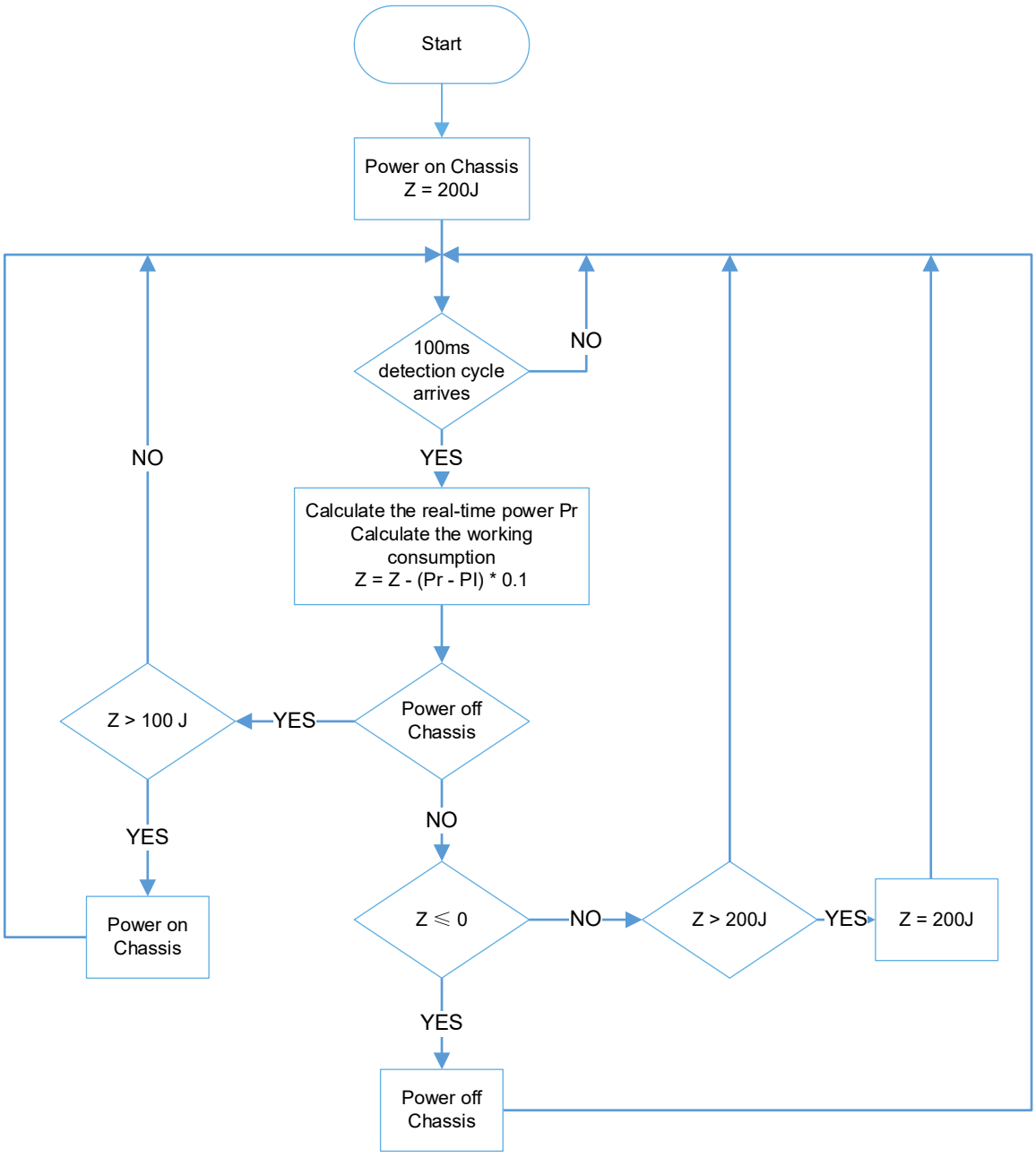


Figure 2-4 Chassis Power Consumption Detection and Chassis Power-off Logic of Sentry

2.2.4 Attack Damage

An Armor Module detects projectile attacks using the pressure sensor and the vibration frequency of the Armor.

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 2-5 An armor module's detection speed for different projectile types

Armor Module	17 mm projectile	42 mm projectile
Large Armor Module, Small Armor Module	Higher than 12m/s	Higher than 8m/s

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

A robot 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).

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

Table 2-6 HP Deduction Mechanism for Attack Damage

Damage Type	HP Damage Value
42 mm projectile	Robot Armor Module: 100 Base Armor Module: 200
17 mm projectile	Robot Armor Module: 10 Base Armor Module: 5
Collision	2

2.2.5 Referee System Going Offline

In accordance with the latest version of the "RoboMaster 2022 University Series Robot-Building Specifications Manual", robots must be mounted with their corresponding Referee System Modules, and each Referee System Module must have a stable connection to its server throughout the competition. The Referee System server detects

the connectivity of each module at a frequency of 2 Hz. If important Referee System modules 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.

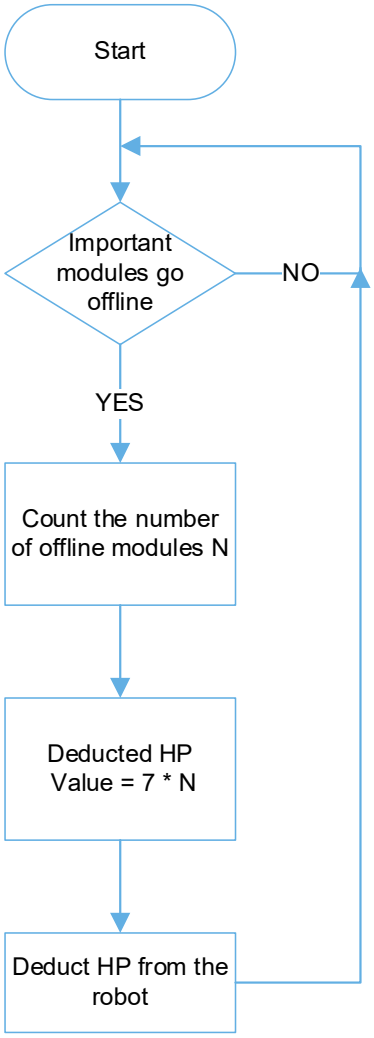


Figure 2-5 HP Deduction Mechanism for Important Referee System Modules Going Offline

2.2.6 Irregular Offline Status

During the competition, if a robot enters an “irregular offline” status:

- For less than or equal to 30 seconds: It can reconnect back to the competition and its experience and levels will still be counted during the offline period.
- For more than 30 seconds: It cannot reconnect back to the competition and be revived for that round of the match.

Table 2-7 Consequences of irregular offline status

Robot Type	Consequences of irregular offline status
Ground Robots	● When the power supply to the Launching Mechanism and Chassis is cut off, 5% of the Maximum HP is deducted for each second passed by until it drops to zero. ● The RFID Interaction Module is disabled. ● The robot no longer detects any damage caused by collision or projectile attacks. ● Revival process pauses
Sentry Robot	● When the power supply to the Launching Mechanism and Chassis is cut off, 5% of the Maximum HP is deducted for each second passed by until it drops to zero. ● The robot no longer detects any damage caused by collision or projectile attacks.

The HP deduction caused by a robot's "irregular offline" status does not count towards the other team's damage HP.

3. 3V3 Confrontation

During the five-minute match, robots from red and blue teams must attack each other's Base and Sentry to win the match. Robots from both teams conduct shooting confrontation on the "Battlefield", the core competition field.

3.1 Competition Area

3.1.1 Overview

- The error margin for the dimensions of all Battlefield Components described in the document is ±10%. The unit for the size parameters on the site drawings is mm. The impact of the robot on the field during the game, which caused the battlefield or components to shift and increased error, cannot be used as a basis for appeal.
- The Battlefield has a symmetrical layout with a central line. All descriptions and illustrations of Battlefield modules in this text will be based on the Red Team as an example but will apply equally to the Blue Team.
- A Buff Point is an area where robots can gain buffs for a certain property. Please refer to "3.2.4.3 - Central Buff Point Mechanism" for the details on the buff point mechanism of the relevant areas mentioned in this chapter.
- Penalty Zone is a zone from which the designated robot shall keep away.
- The site material and structure of different sites may vary slightly.
- There may be static electricity at the site, so contestants need to protect themselves.

The core competition area of the 3V3 Confrontation is called the "Battlefield". The Battlefield is 12m x 8m in size. There're Starting, Supplier and Buff Zones for both teams on the battlefield, which has a grid ground.

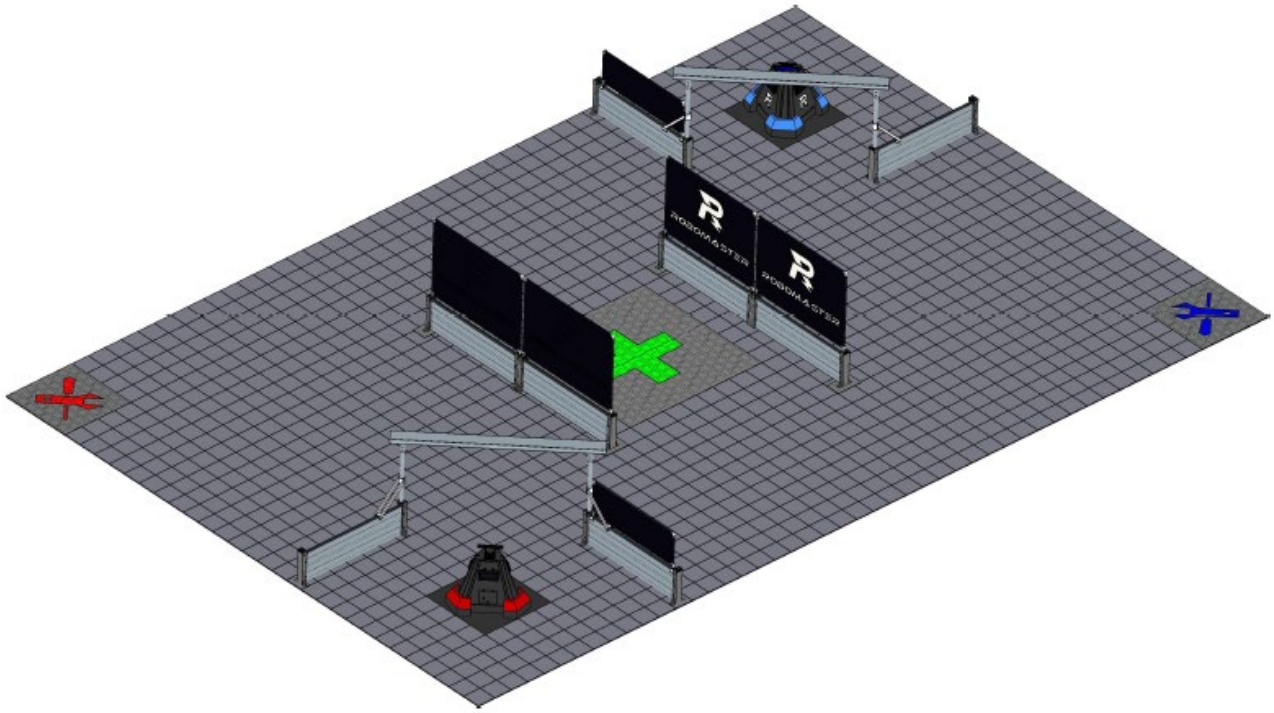
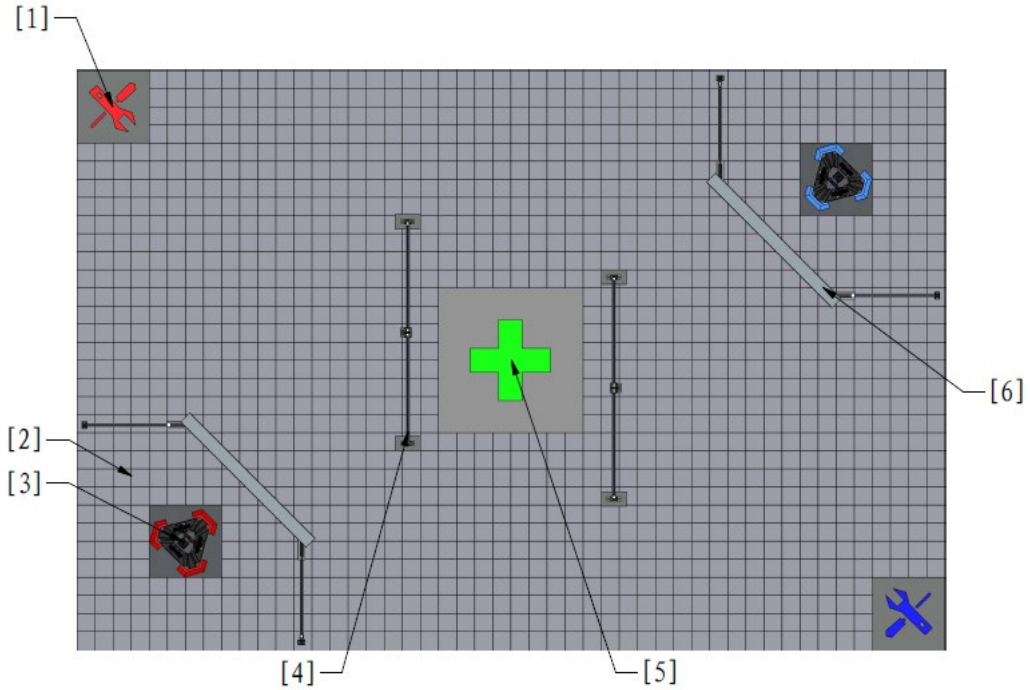


Figure3-1 Axonometric View of 3V3 Confrontation Battlefield



[1]	Projectile Supply Zone	[2]	Starting Zone	[3]	Base	[4]	Bunker	[5]	Central Buff Point
[6]	Sentry Rail								

Figure 3-2 3V3 Confrontation Battlefield

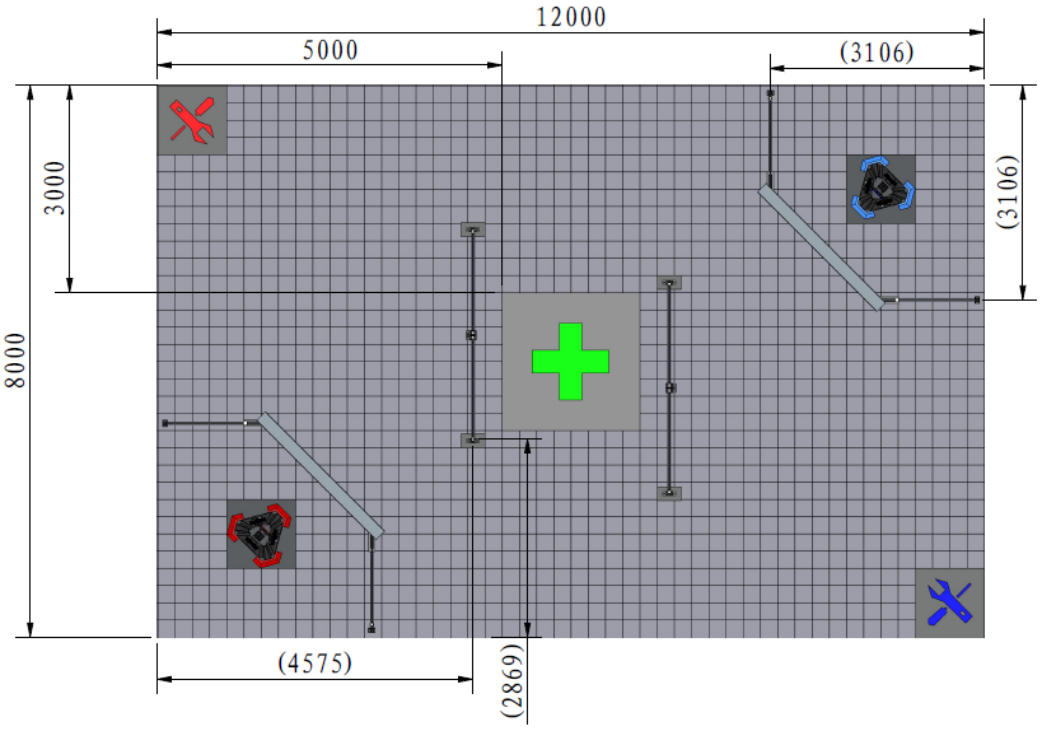
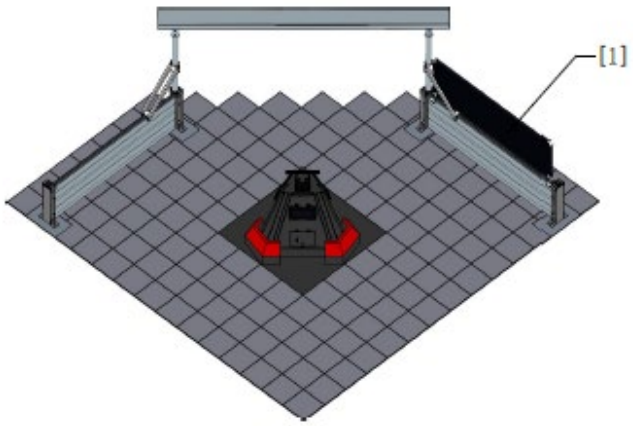


Figure 3-3 3V3 Confrontation Battlefield Dimensions

3.1.2 Starting Zone

The Starting Zone is the robots placement area before a match, mainly including the Base and Sentry Rail.



[1] The Start Zone is blocked by gauze

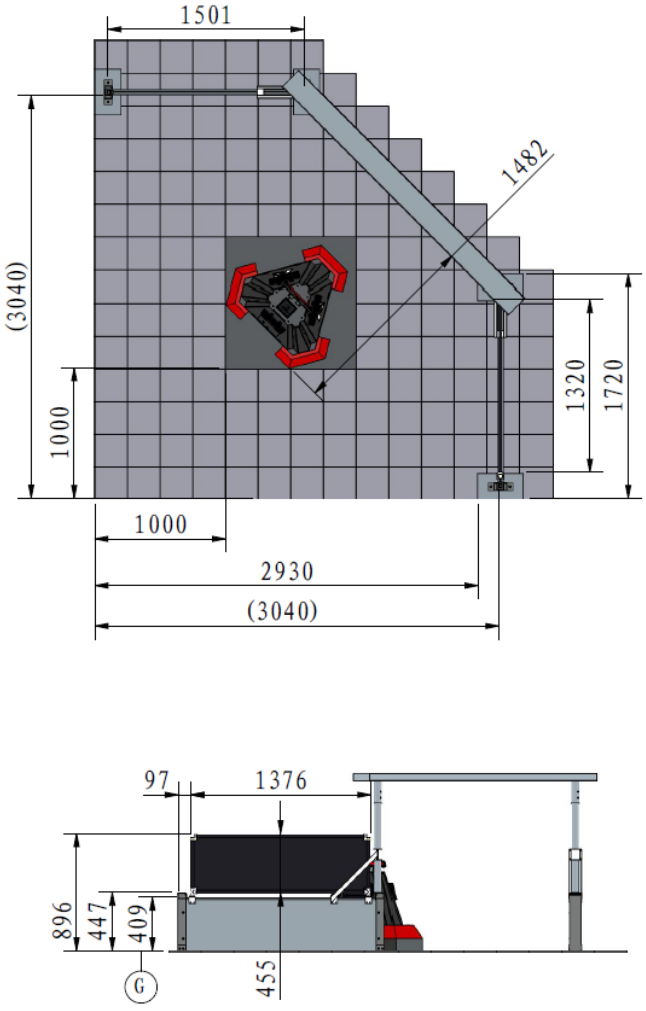
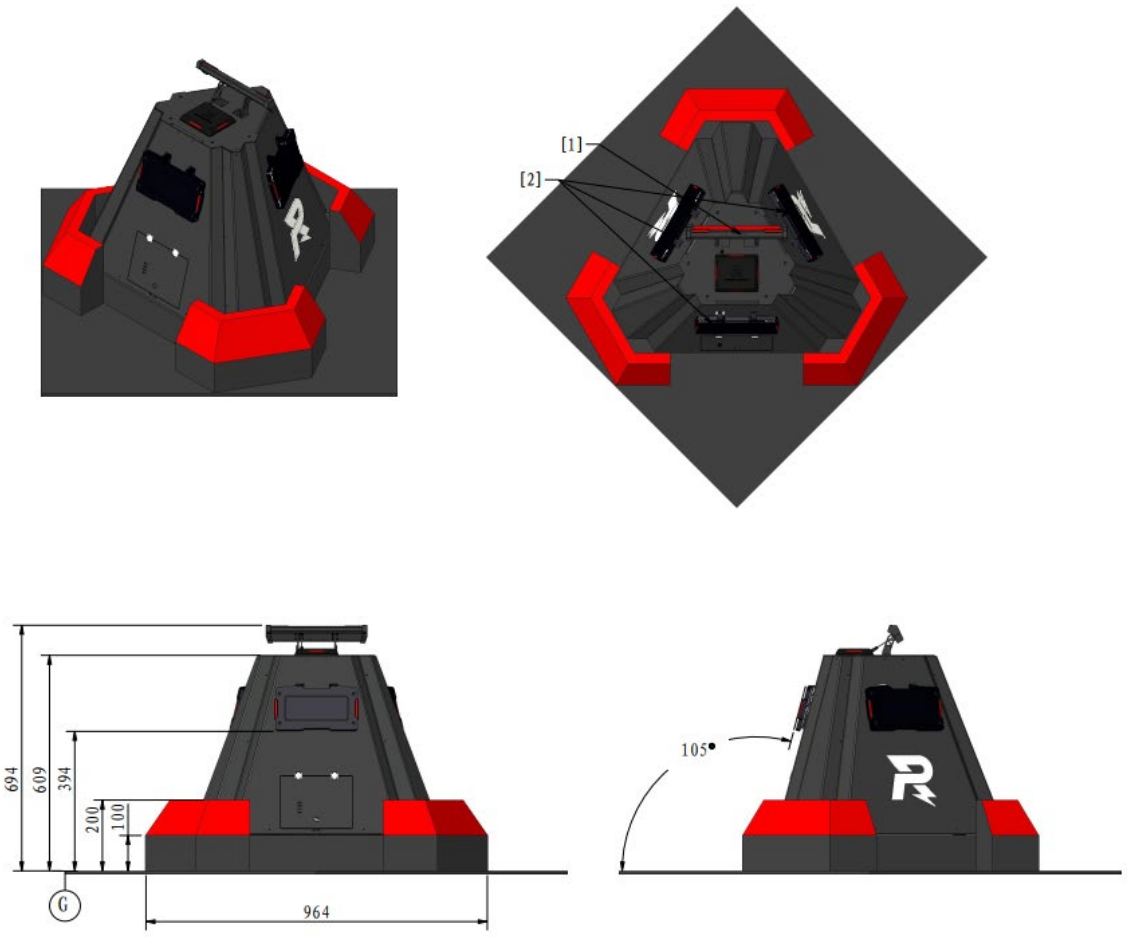


Figure 3-4 Diagram of Starting Zone

3.1.2.1 Base

The total HP of a Base is 2000. The Red Team and Blue Team each have a Base. The Base is equipped with several Armor Modules with stickers attached.



[1] Light Indicator Module [2] Armor Module

Figure 3-5 Base

3.1.2.2 Sentry Rail

The Sentry Rail is the only area where a Sentry Robot can be active. It is located in the Starting Zone, consisting of the Rail body and its mounting bracket, with a painted surface. 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 1,250-1,300 mm.

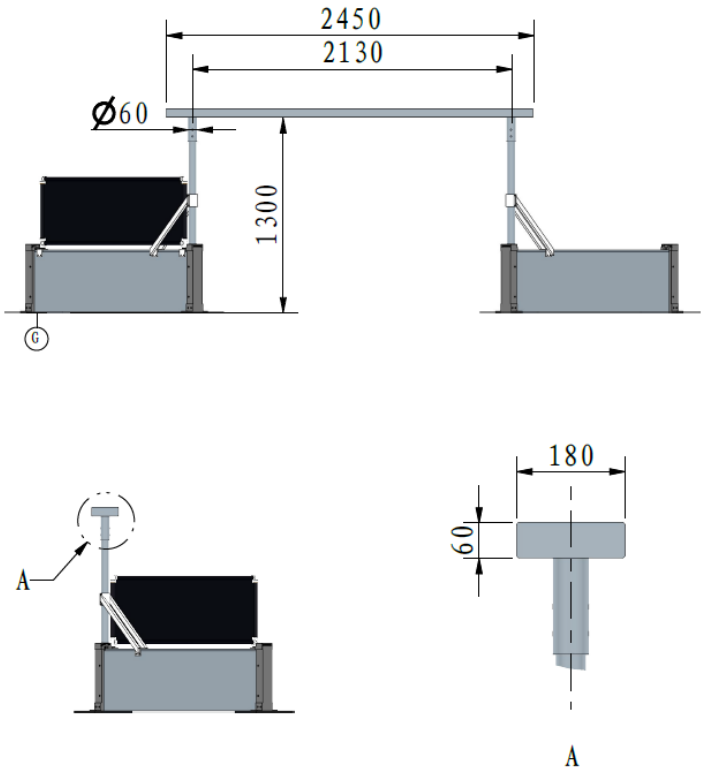


Figure 3-6 Sentry Rail

3.1.3 Projectile Supply Zone

Supply Zone is an important area for robots to replenish projectile and reset HP.

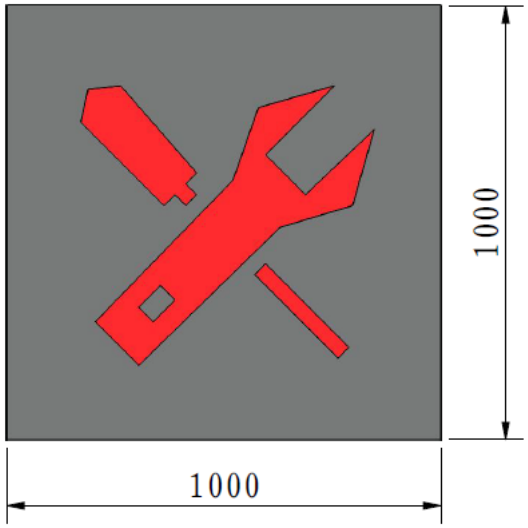


Figure 3-7 Restoration Zone

3.1.3.1 Supplier Penalty Zone

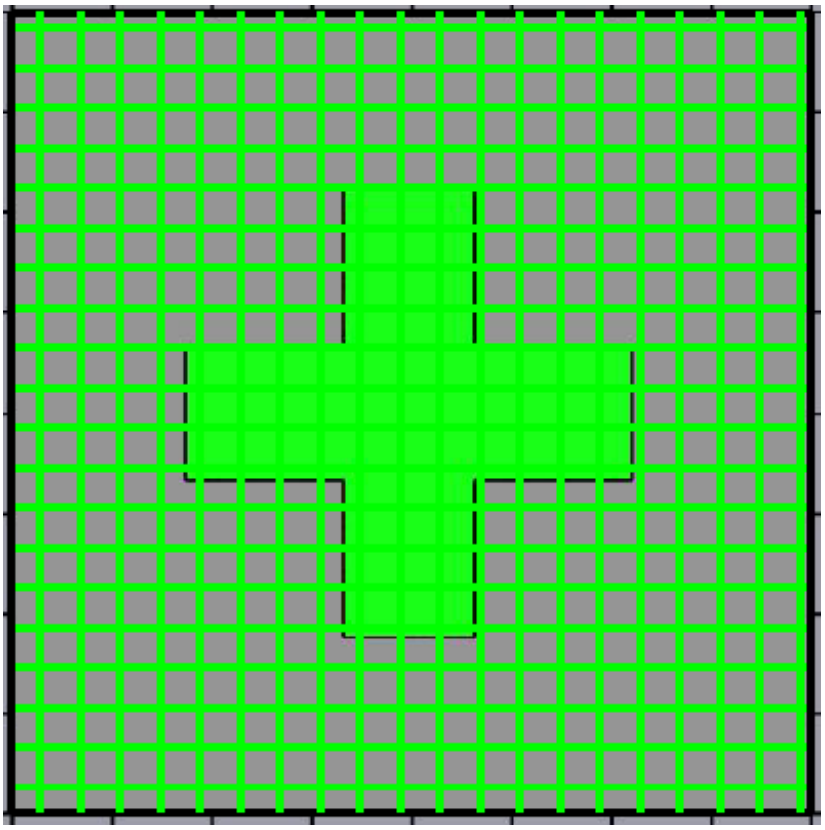
The Supplier Zone of one side is the Supplier Penalty Zone for the robots of the other side.

Size: 1m*1m

Figure 3-8 Supplier Penalty Zone

3.1.4 Central Buff Point

Central Buff Point is located at the center of the battlefield.



Size: 2m*2m

Figure 3-9 Central Buff Point

3.1.5 Miscellaneous

3.1.5.1 Bunker

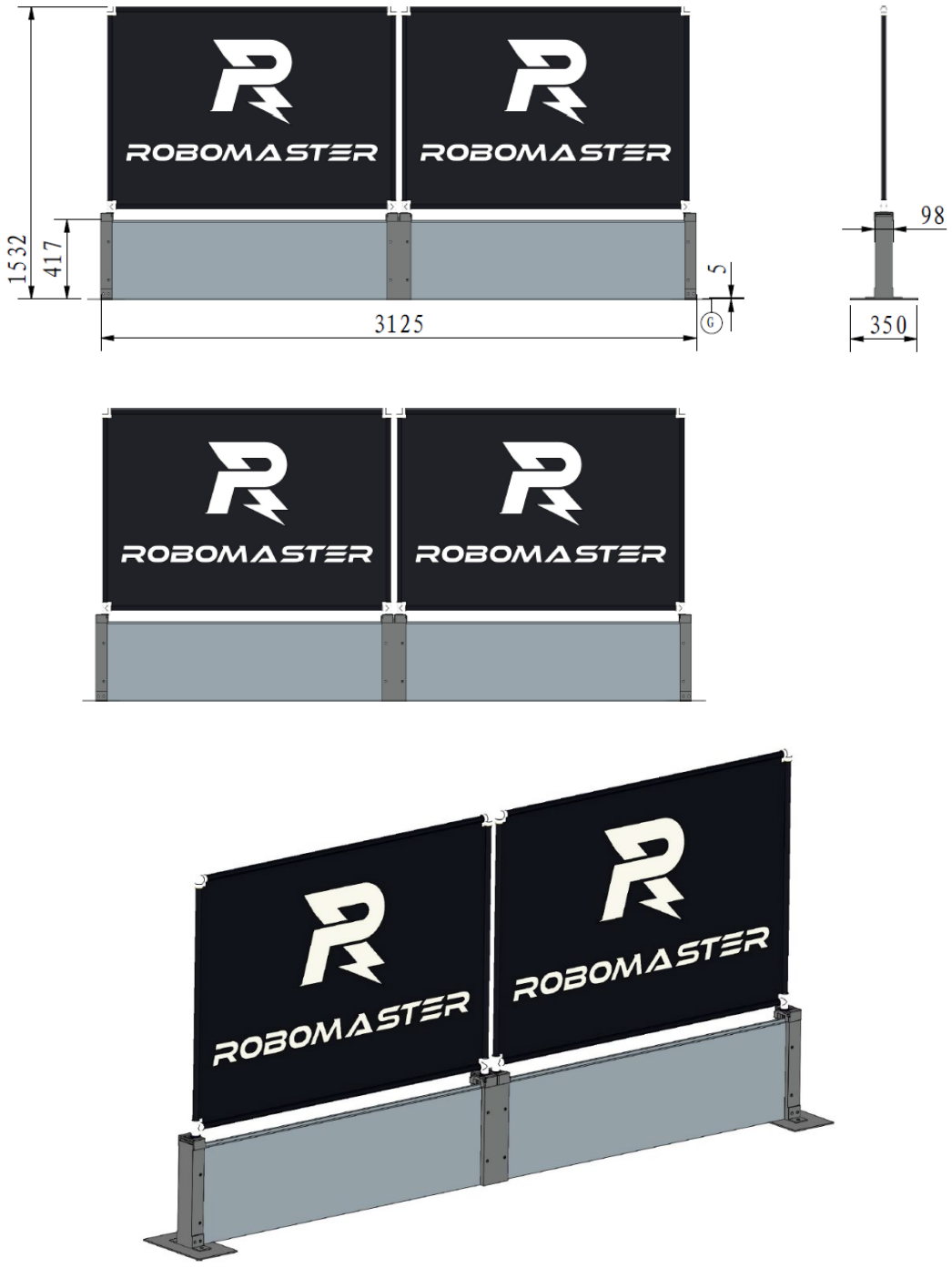


Figure 3-10 Bunker

3.1.5.2 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 3-1 Projectile Parameters and Scenarios of Use

Type	Appearance	Color	Size	Weight	Shore Hardness	Material	Scenarios
42 mm projectile	Similar to a golf ball	White	42.5 mm ± 0.5 mm	41 g ± 1 g	90 A	Plastic (TPE)	3V3 Con-frontation
17 mm projectile	Spherical	Yellow-green	16.8 mm ± 0.2 mm	3.2 g ± 0.1 g	90 A	Plastic (TPU)	All RMUL Events

3.1.5.3 Operator Room

Operator Room lies outside the Battlefield and is an area for Operators during the competition. Each Operator Room must be equipped with a corresponding number of computers with official equipment such as monitor, mouse, keyboard and USB hub.

The aerial gimbal operator is equipped with a display that shows images from the radar.

3.2 Competition Mechanism

3.2.1 Mobile 17mm Launching Mechanism

A Mobile 17mm Launching Mechanism can be mounted on either a Standard or a Hero Robots, provided that it meets the technical specifications of all robots. All Launching Mechanisms must meet the relevant requirements for Initial Launching Speed Limit for Projectiles. Each Launching Mechanism can be mounted with a laser sight.

> **Example: A Standard Robot can be equipped with one 17mm launching mechanism. A team can mount a mobile 17mm Launching Mechanism on a Standard Robot as needed. The Robot will then have two 17mm Launching Mechanisms.**

The Barrel Heat of a Mobile 17mm Launching Mechanism is calculated separately from a Fixed Launching Mechanism. At the start of a match, the operator must select the type of Launching Mechanism for the Mobile 17mm Launching Mechanism.

Sentry equipped with the 17 mm mobile launching mechanism is not allowed to participate in the Standard Confrontation.

3.2.2 HP Recovery and Revival Mechanism

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

3.2.2.1 HP Recovery Mechanism

HP Bag: Allow robot HP recovery at a maximum speed of 10% per second within 5 seconds.

Each team has 3 HP Bags when the match begins. When there is one or more HP Bags, the operator can press the "Y" key to consume an HP Bag after the robot has occupied its own supply point. For the same robot, the next HP Bag can only be used after the previous one is completed (namely, 5 seconds after it takes effect).

Both teams can acquire more HP Bags by occupying the Central Buff Point. For detailed acquisition methods, please refer to “3.2.4.3Central Buff Point Mechanism.”

3.2.2.2 Revival Mechanism

- Defeated ground robots must complete the revival progress bar in order to be automatically revived.
- During the auto revival of ground robots, the revival process bar progresses 2 points automatically per second.

- The launching mechanism will be powered off after the robot is resurrected, so it needs to occupy its Restoration Zone to unlock the launching mechanism.

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

Table 3-2 The length of revival processes for different robots on their first defeat

Type	Revival process length
Standard Robot	10
Hero Robot	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.

3.2.3 Projectile supplies

In each round, the robot can enter its Supplier Zone at any time. The projectiles supplying operator outside the Battlefield feeds the projectiles to the robot with official supplying equipment.

Except when supplying the projectiles with the official supplying equipment, the projectiles supplying operator must not touch the robot.

3.2.4 Battlefield-related Mechanism

3.2.4.1 Base HP

Base HP is 2,000.

3.2.4.2 Virtual Shield Mechanism

The HP of Virtual Shields cannot be restored, and the HP deduction suffered by a Virtual Shield from being attacked will be included in the damage HP of the other team.

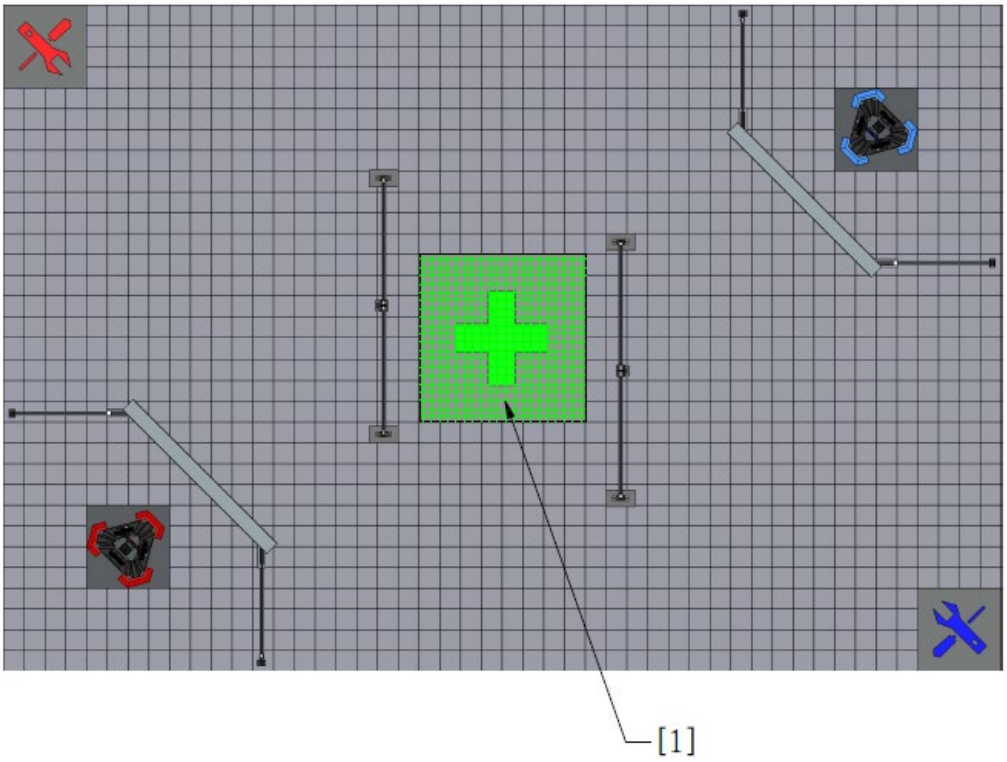
When the ground robots of one team are destroyed, the “Invincible Status of its base is lifted, and Virtual Shield takes effect, which has 1000 HP. When a robot attacks the enemy’s Base, the HP of its Virtual Shield will first be deducted. If the Virtual Shield's HP has reduced to zero, the Base's HP will be deducted.

A team’s Invincible Status and Virtual Shield become ineffective when its Sentry is destroyed or ejected.

The Sentry is deemed to be defeated when it has not entered the Battlefield after 1 minute after the match begins, Sentry is deemed to be defeated if it has not entered the Battlefield.

3.2.4.3 Central Buff Point Mechanism

The position of Central Buff Point is shown below:



[1] Central Buff Point

Figure 3-11 Central Buff Point

Within the first minute of the match, Central Buff Point is not activated, and no robot can occupy the Zone.

By the end of the first minute of the competition (that is, the countdown at 3:59), Central Buff Point become active. Any robot that occupies a Central Buff Point will gain 10 energy points for its team per second. Both teams can occupy Central Buff Point simultaneously, and the deactivation of Occupied Status is delayed by 2 seconds.

The energy received by any ground robot that is attacked while occupying a Central 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 energy is reduced to zero.

When a team occupying Central Buff Point has gained 100 energy points, the Zone becomes deactivated immediately. The occupying team gains 2 HP Bags, and both teams' occupation energy becomes zero. The deactivated status of Central Buff Point will last for 90 seconds. Central Buff Point becomes activated again after 90 seconds.

3.2.5 Mechanism Related to Sentry

The barrel heat of Sentry's two 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.

3.2.6 Level-Up Mechanism

3.2.6.1 Experience System

- Assist: Inflicting damage on a robot within 10 seconds before its complete defeat besides the destroying robot.
- Destruction: A robot is deemed "destroyed" if its Armor Module is attacked by an enemy robot until its HP drops to zero.
- Experience value: The existing value of the robot; the robot's experience value increases with the robot's level.
- Experience points: The accumulated points needed for the robot to upgrade itself, which can be obtained through natural growth or destroying or assisting in the attack of other robots.

After the match starts, Standard and Hero are both at Level 1. They can upgrade themselves by gaining experience points.

During the competition, a robot can earn experience points through natural growth or destroying or assisting in the attack of other robots. The upgrading mechanism is as follows:

- If a Hero or Standard Robot is the destroying robot, it will receive the experience points corresponding to the value of experience points of the destroyed robot; otherwise, the latter's experience points will be distributed evenly among the surviving Hero and Standard Robots of the opposing team. The average is rounded up and shall be accurate to one decimal place.
- The Hero or Standard Robot assisting in the attack will receive 25% of the experience points corresponding to the value of experience points of the destroyed robot.
- 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.

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.

⚠ In RMUL, since there is no robot positioning system in the field, all kills are calculated based on the undetected destroyers and assists. The value of experience points of the destroyed are evenly distributed to the surviving Hero and Standard of the opponent.

- In addition, a Standard gains 0.2 experience point every 12 seconds, and a Hero gains 0.4 experience point 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.

Table 3-3 Levels and Experience Points for Standard, Hero, and Sentry Robots

Robot Type	Grade	Value of Experience Points	Value of Experience Points Required for Leveling Up
Standard Robot	1	2.5	3
	2	5	6
	3	7.5	-
Hero Robot	1	7.5	8
	2	10	12
	3	15	-
Sentry Robot	-	7.5	-

3.2.6.2 Performance System

After the start of a match, the operators of the Standard and Hero Robots may select the types of chassis and Launching Mechanism for the robots. If a Standard or Hero Robot is to be installed with a Mobile 17mm Launching Mechanism, the type of Launching Mechanism will also need to be selected. A robot's chassis and Launching Mechanism, once selected, cannot be changed during a competition round.

Table 3-4 Types of Chassis and Launching Mechanisms

Robot Type	Chassis Type	Launching Mechanism Type
Standard Robot	HP-focused	Burst-focused
	Power-focused	Cooling-focused
	Balancing chassis	Projectile speed-focused

Hero Robot	HP-focused Power-focused	Burst-focused Projectile speed-focused

Table 3-2 Attributes of Standard Robot Chassis

Chassis Type	Grade	Maximum HP	Maximum Chassis Power Consumption (W)	Miscellaneous	Remarks
Initial Status	-	100	40	-	-
Power-focused	1	150	60	-	-
	2	200	80	-	-
	3	250	100	-	-
HP-focused	1	200	45	-	-
	2	300	50	-	-
	3	400	55	-	-
Balancing chassis	1	300	60	Note[1]	Note[2]
	2	400	80	Note[1]	Note[2]
	3	500	100	Note[1]	Note[2]

Note[1]:

Barrel cooling rate per second is increased by 50%.

Note[2]:

This can only be selected if the robot meets the definition of a Balancing Standard Robot.

Table 3-3 Attributes of Hero Robot Chassis

Chassis Type	Grade	Maximum HP	Maximum Chassis Power Consumption (W)
Initial Status	0	150	50
Power-focused	1	200	70
	2	250	90
	3	300	120
HP-focused	1	250	55
	2	350	60

Chassis Type	Grade	Maximum HP	Maximum Chassis Power Consumption (W)
	3	450	65

Table 3-4 Attributes of 17mm Launching Mechanisms

Launching Mechanism Type	Grade	Barrel Heat Limit	Barrel Cooling Value per Second	Initial Launching Speed Limit (m/s)
Initial Status	0	50	10	15
Burst-focused	1	150	15	15
	2	280	25	15
	3	400	35	15
Cooling-focused	1	50	40	15
	2	100	60	18
	3	150	80	18
Projectile speed-focused	1	75	15	30
	2	150	25	30
	3	200	35	30

Table 3-5 Attributes of 42mm Launching Mechanisms

Launching Mechanism Type	Grade	Barrel Heat Limit	Barrel Cooling Value per Second	Initial Launching Speed Limit (m/s)
Initial Status	0	100	20	10
Burst-focused	1	200	40	10
	2	350	80	10
	3	500	120	10
Projectile speed-focused	1	100	20	16
	2	200	60	16
	3	300	100	16

3.2.7 Economic System

During the game, both sides will receive gold coins regularly. In addition, the player whose virtual shield fails will get an extra 100 gold coins. Gold coins can be used to exchange projectiles.

Each team has 200 coins at the start of the match. For every minute afterwards, 200 gold coins will be given to each team until the second minute (when countdown is at 2:59). In the third minute (when countdown is at 1:59) and fourth minute (when countdown is at 0:59) of the game, both sides can get 300 gold coins again.

Table 3-6 Rules for Exchange

Redemption item	Redemption ratio
17 mm projectile	50 coins/50 rounds
42 mm projectile	75 coins/5 rounds

When the game starts, every time the referee system detects a 17mm or 42mm projectile, the ground robot that fires it will lose a corresponding projectile. When the projectile of the robot is exhausted, the Launching Mechanism will be powered off.

The ground robot can exchange 17mm or 42mm projectiles with gold coins at any time in the Supplier Zone. The operator reloads projectiles through the client interface using a keyboard and mouse. Projectiles can be reloaded on ground robots after the match starts. If the standard operator decides to supply projectiles, he or she should press the “O” key on the keyboard. The hero operator can directly select the number of projectiles in the exchange panel by pressing "I" to complete the exchange if there are gold coins remaining.

- The robot can be pre-loaded. Ground robots can be refilled by the off-site projectiles supplying operator of Supplier Zone during the competition.
- Gold coins can only be used to exchange projectiles.
- When the available projectiles are exhausted, the launching mechanism will be powered off.
- During the period when power to the Hero Robot’s Launching Mechanism is disconnected, the Referee System will enable protection on the armors of all enemy robots and the base against attacks from 42 mm projectiles.

3.2.8 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.

3.2.9 Winning Criteria

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, the team with the higher remaining Sentry HP is the winner.
4. If a round has ended, and the remaining Base HP and Sentry HP of both teams are the same, the team that inflicted more damage to other team is the winner.

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.

3.2.10 Competition Format

3V3 Confrontation consists two parts: the Group Stage and the Knockout Stage. The competition system of Group Stage is BO2; the system of Knockout Stage is all BO3.

3.2.10.1 Group Stage

Table 3-7Points for Group Stage

Competition Format	Competition Result	Points
BO2	2:0	The team winning two rounds gains 3 points, while the team losing two rounds gains 0 point
	1:1	One point for each team
	1:0	(draw for one round): The team winning one round gains 1 point, and the team losing one round gains 0 point
	0:0	(draw for two rounds): Each team gains 0 point

The ranking for the Group Stage is determined by the total points for each match. Teams are ranked based on the following order, 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 Sentry HP from all rounds ranks higher.
4. If the total Net Sentry HP are the same, the team with the higher total HP Deduction ranks higher.

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

- HP Deduction: The HP deduction (consumption) of the robot and props caused by attacking another team.

  Exceptions are shown below:

  - The HP Deduction as a result of the penalty issued by the Referee is added to the other team's Damage HP.
  - The HP Deduction caused by a robot's "irregular offline" status is not added to the other team's Damage HP.
  - HP Deducted as a result of exceeding the Initial Launching Speed limit, Barrel Heat limit and Maximum Chassis Power Consumption and of the Referee System going offline are not added to the other team's Damage HP.
  - The HP deduction as a result of Armor Module under collision is not included into the other team's Damage HP.

- 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 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.

3.2.10.2 Knockout Stage

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

4. Standard Confrontation

During every two-minute match, robots from both teams will conduct shooting confrontation on the Battlefield.

- During the Standard Confrontation, Standard Robot will have no experience and level changes.
- During the Standard Confrontation, the mobile 17 mm launching mechanism cannot be mounted on Standard Robot.

4.1 Competition Area

The Competition Area for Standard Confrontation is 5m*5m in size.

The Standard Robot can fire up to 200 rounds of 17mm projectiles. During the two-minute match, Standard Robots from Red and Blue Teams start from their respective Starting Zone and engage in 1V1 confrontation on the battlefield.

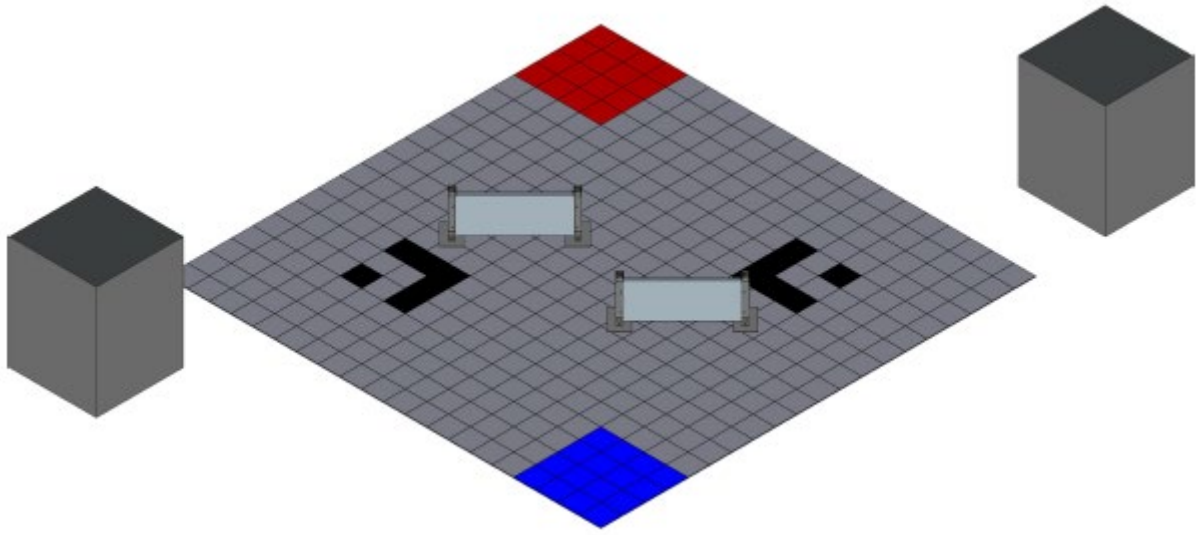
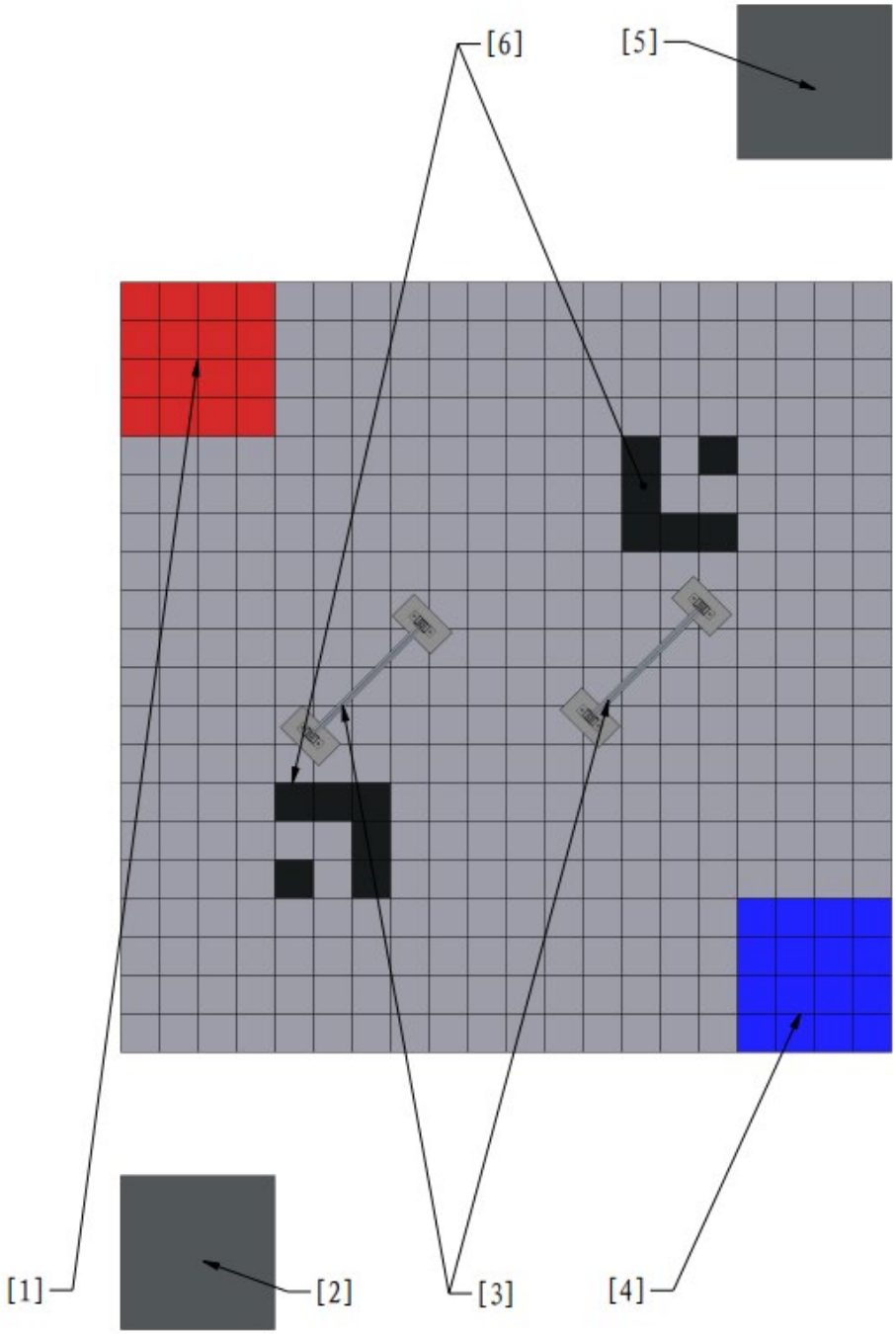


Figure 3-12 Axonometric View of Competition Area for Standard Confrontation



[1]	Red Team's Starting Zone	[2]	Blue Team's Radar Base	[3]	Bunker	[4]	Blue Team's Starting Zone	[5]	Red Team's Radar Base

[6] Visual tag

Figure 3-13 Bird's Eye View of Competition Area for Standard Confrontation

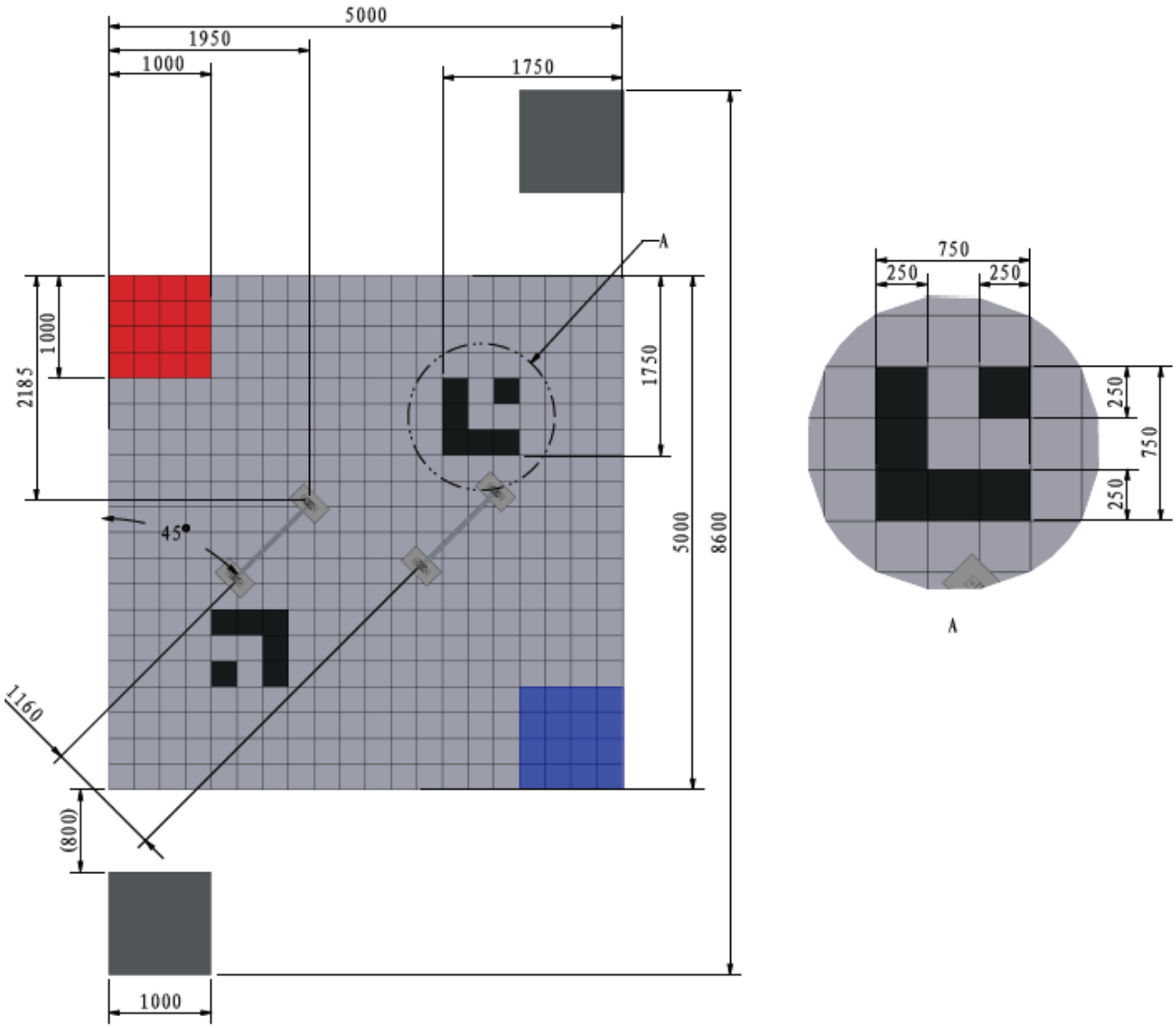


Figure 3-14 Dimensions of Competition Area for Standard Confrontation

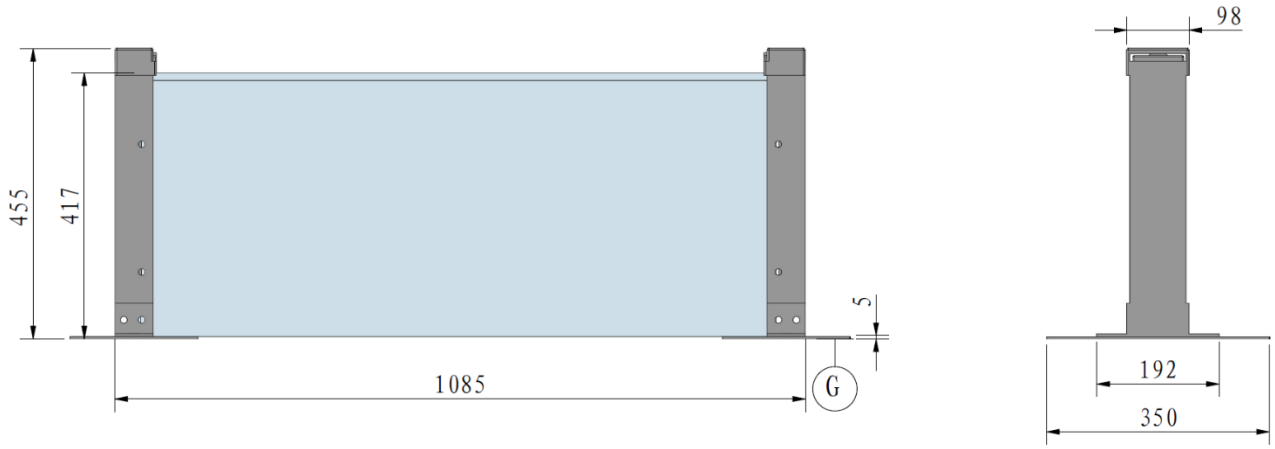


Figure 3-15 Bunker

4.1.1 Radar Base

A Radar Base is the platform to place a radar sensor. At its top is a platform with a surface area 1000*1000 mm, made of iron panel (which is magnetic). The platform, which is 1300mm from the ground of the battlefield, is used according to the actual situation during the game.

The Radar's data will be displayed on a monitor with an HDMI port in the Operator's Room. A socket for powering radar and other official equipment will be placed on the platform of the Radar's computer.

The above equipment is placed on the platform and cannot be moved.

4.2 Winning Criteria

1. Where a robot attacks the Armor Module of an enemy robot until the latter's HP drops to zero.

2. When the time of a round is exhausted, if neither team has a zero remaining HP, the team with higher remaining HP wins.

3. When the time of a round is exhausted, if neither team has a zero HP and their remaining HP are the same, the robot with less weight wins.

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.

4.3 Competition Format

Standard Confrontation consists of two parts: the Group Stage and the Knockout Stage. The competition system of Group Stage is BO2; the system of Knockout Stage is all BO3.

4.3.1 Group Stage

Table 3-8Points for Group Stage

Competition Format	Competition Result	Points
BO2	2:0	The team winning two rounds gains 3 points, while the team losing two rounds gains 0 point
	1:1	One point for each team
	1:0	(draw for one round): The team winning one round gains 1 point, and the team losing one round gains 0 point
	0:0	(draw for two rounds): Each team gains 0 point

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

1. The team with the higher total match points ranks higher.
2. If two teams have equal points, the winner of the two in the group match will be ranked higher.
3. If there are three teams with equal points or two teams with equal points are tied, the one with highest net Sentry HP after all games will be ranked higher.

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

4.3.2 Knockout Stage

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

5. Competition Process

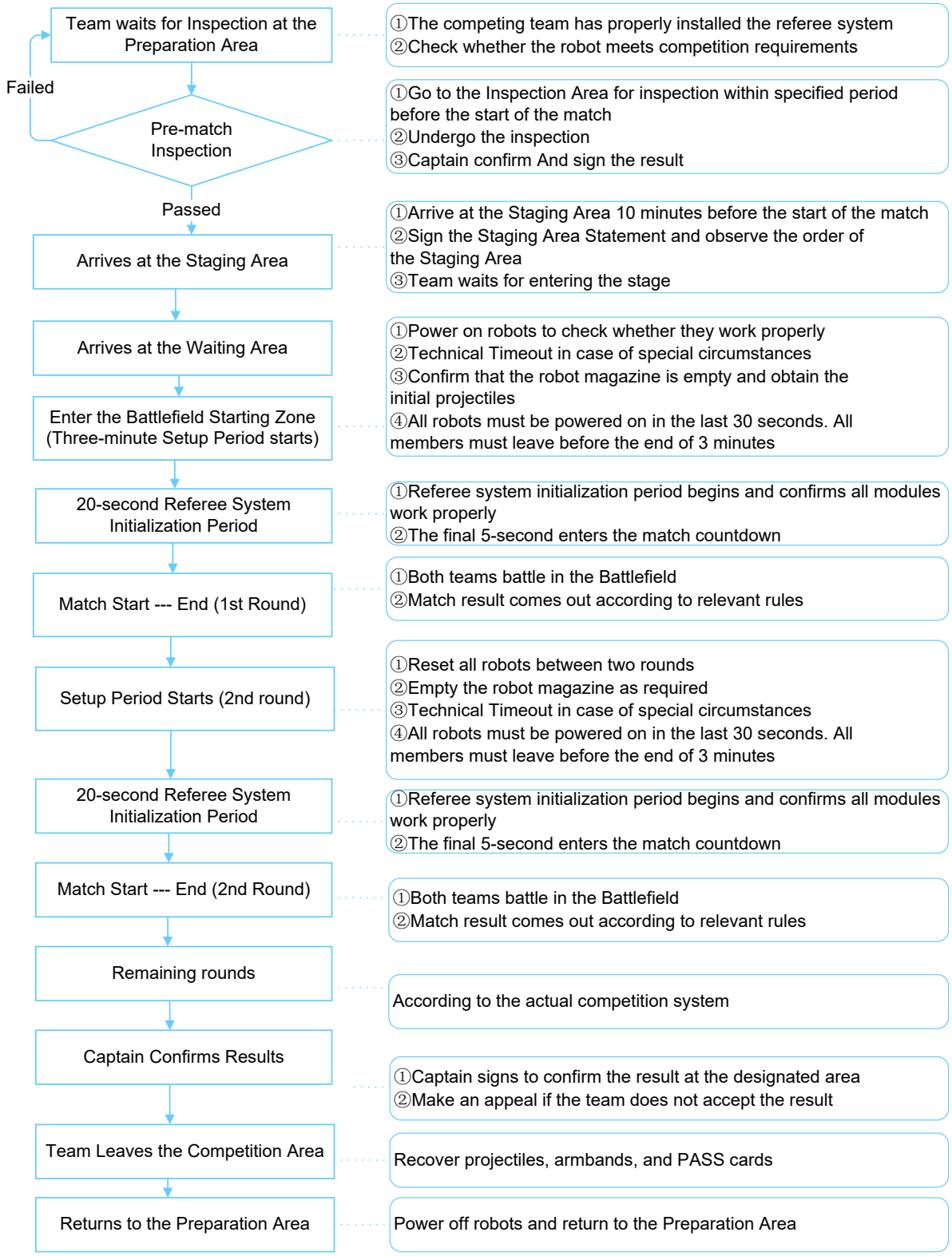


Figure 5-1 Process of a single match

5.1 Pre-Match Inspection

In order to make sure that the robots manufactured by all teams conform to unique manufacturing specifications, 3V3 and Standard Confrontation teams must arrive at the Inspection Area 60 and 40 minutes in advance, respectively, for Pre-match Inspection. For the requirements of the Pre-Match Inspection, please refer to the "RoboMaster 2022 University Series Robot-Building Specifications Manual". The inspection process is as follows:

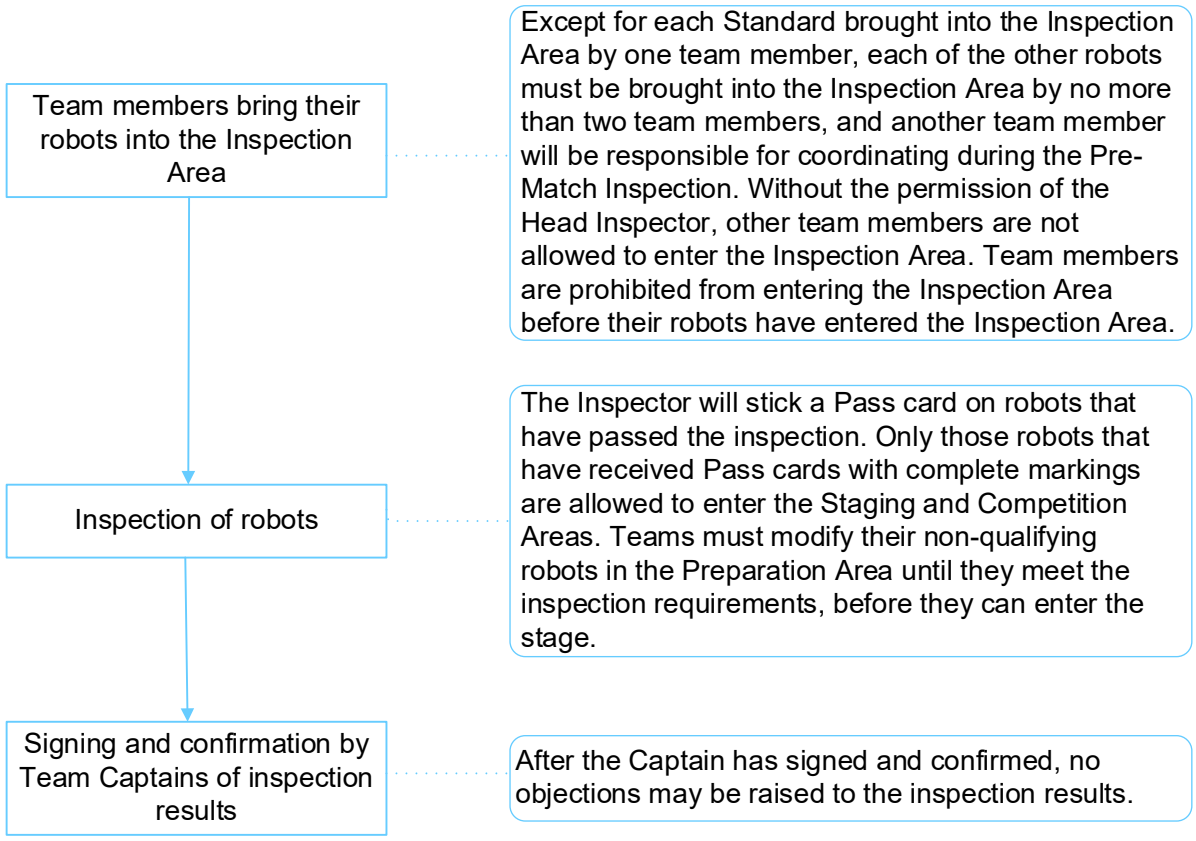


Figure 5-2 Pre-match Inspection Process

The rules regarding backup robots are as follows:

- During each round, each team can carry no more than one backup robot.
- Team members are required to declare the types of backup robots they are carrying during Pre-match Inspection. Backup Hero and Sentry must be attached with armor stickers in the Pre-match 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 2022 University Series Robot-Building Specifications Manual".

After passing the Pre-match Inspection, backup robots cannot be replaced without permission. During Mock Inspection, the RMOC will issue Referee Systems to backup robots that have passed Mock Inspection. For all RMUL events, each team can borrow at most one backup robot's Referee Systems.

5.2 Staging Area

After the pre-match inspection, the teams should arrive at the Staging Area at least 10 minutes before the start of each round. The staff at the Staging Area will check the status of the participating robots and the Crew Members' information.

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

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

5.3 Setup Period

The Setup Period for all RMUL events lasts for 2 minutes. During the Setup Period, Pit Crew Members place robots on their respective initial positions, check whether Referee Systems operate normally, load the Standard Robots with initial projectiles, and place the Radar on the Radar Base. Pit Crew Members may repair robots or replace equivalent parts, while Referees may initiate temporary inspection on these robots anytime.

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

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

Thirty seconds before the Setup Period ends, all robots on the Battlefield must be powered up, and the staff on the

Battlefield should leave the Competition Area in an orderly manner. The Pit Crew Members must place the debugging remote controller for the Sentry Robots, Radar and Auto Standard Robots in the designated area at the Battlefield entrance.

5.4 Official Technical Timeout

During the Setup Period, if the Referee System, equipment inside the Operator Room or other modules related to the Referee System malfunctions (for details see “Table 5-1 - 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 Referee System or official equipment has been eliminated and the Chief Referee has resumed the countdown, Pit Crew Members are required to follow the set procedures for the Setup Period and leave the Battlefield within the specified time.

Table 5-1 Descriptions of Technical Faults

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

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

5.5 Team Technical Timeout

If the mechanical structure of a robot, a software system, the keyboard or mouse in the Operator Room or other equipment experiences any faults, the Team Captain may make a request to the referee in the Battlefield or Operator Room for “Team Technical Timeout” before entering the final 15 seconds of the Setup Period, and indicate the requested timeout length and reasons for the request. Once a Team Technical Timeout request has been made and

conveyed to the Chief Referee, the Technical Timeout cannot be revoked or revised.

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 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 Chief Referee based on the request of the team. The team cannot dispute the type of Technical Timeout allowed, and the Technical Timeout process cannot be the basis for any appeal after the match.

A team cannot request for more Team Technical Timeout opportunities once they have been used up. During each event, each team has two technical timeout opportunities.

5.6 Referee System Initialization Period

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

If 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.

5.7 Competition Round

During the matches, the robots from both teams in 3V3 and Standard Confrontations compete tactically on the core competition area – the Battlefield.

5.8 End of Competition

A round ends either when the full time has elapsed or one team has fulfilled the conditions for winning. When a round ends, the match immediately enters the Setup Period for the next round. The match is over when a winner has emerged or all rounds have ended.

5.9 Match Results Confirmation

During a match, the referee will record on the Match Results Confirmation Form the penalties issued for each round, the key competition data at the end of the match, the winning teams, the use of Technical Timeout opportunities by the teams, and other relevant details. After the end of each match, team Captains need to be at the Referee Area to confirm the results.

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

6. Violations and Penalties

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

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

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

6.1 Penalty System

6.1.1 Forms of Penalties

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

Table 6-1 Forms of penalties

Forms of Penalties	Description
Automatic penalties by the Referee System	HP deductions as a result of a robot exceeding its parameter limits or a Referee System Module going offline. The HP deductions mentioned in “2.2 HP Deduction Mechanism”, except those caused by attacks, are all automatic penalties by the Referee System.
Manual penalties through the Referee System	Penalties issued by the referee through the server against participants and robots for violation of rules.
Manual Penalties	Used in situations where penalties cannot be issued through the Referee System, for example issuing a verbal warning or disqualifying a team.

6.1.2 Violation Scores

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

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

6.1.3 Types of penalties

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

Table 6-2 Types of penalties

Types of penalties	Description
Verbal Warning	A Verbal Warning is given to the offending party with no HP deducted.
Yellow Card	● One team receives a Yellow Card: ➢ The operation interface of the offending Operator will be blocked for 5 seconds, while the operation interfaces of other Operators in the offending team will be blocked for 2 seconds. ➢ The Referee System automatically deducts 15% of the robot's Maximum HP (except for Sentry Robots), while the other surviving robots' Maximum HP (except for Sentry Robots) is deducted by 5%. For each Yellow Card that is issued against the robot in the next 30 seconds, the deducted percentage will be twice that of the previous deduction for that robot, and 5% for the other surviving robots (except for Sentry Robots). **Example 1: An offending robot has a Maximum HP of 200 while the other robots in the team have a Maximum HP of 100. The offending robot is issued a Yellow Card each at the 15th, 25th and 58th second of a round. The HP deductions for the three Yellow Cards issued are as follows: The deducted HP for the offending robot are 30, 60 and 30. The deducted HP for the other robots are 5, 5 and 5.** **Example 2: An offending robot has a Maximum HP of 200 while the other robots in the team have a Maximum HP of 100. The offending robot is issued a Yellow Card each at the 15th, 25th and 40th second of a round. The HP deductions for the three Yellow Cards issued are as follows: The deducted HP for the offending robot are 30, 60 and 120. The deducted HP for the other robots are 5, 5 and 5.** ➢ The offending robot will receive 2 violation points.

Types of penalties	Description
	● Both teams receive a Yellow Card: ● The interface of all Operators is blocked for 2 seconds and the maximum HP of all robots (except Sentry) is deducted by 5%. No demerits recorded.
Red Card (Ejection)	● The offending robot is ejected: ➢ If it is before a match, the offending robot will be barred from the match and must leave the Battlefield ➢ If the Radar is ejected during the competition, the Radar image in the Operator's Room will be disconnected from the robots. ➢ If a robot other than a Radar is ejected during the competition, the robot's HP will be reduced to zero and the VTM image will become monochrome ● 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.
Forfeiture	● If a Forfeiture is issued before the start of the match (not including the Three-Minute Setup Period), all the Pit Crew of the offending team must leave the Competition Area. The offending team's Base, Outpost and Sentry's HP will be deducted to zero, and the HP of the team's other 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 Three-Minute Setup Period), the round will end immediately. The offending team's Base, Outpost and Sentry's HP are deducted to zero, and the team's other robots maintain their HP level at the end of the round. The HP of the opposing team's Base, Outpost and robots remain at the level when the round ended. ● If a Forfeiture is issued after a match, the offending team's Base, Outpost and Sentry's HP will be deducted to zero, and the team's other robots maintain their HP level from the end of the round. The HP of the opposing team's Base, Outpost and robots remain at the level when the round ended. ● If a Forfeiture is issued in a match (hereinafter referred to as "Match Forfeiture"), it applies to all rounds in the match, and the HP for each round shall be calculated according to the above descriptions.

Types of penalties	Description
Disqualification	● The team member is disqualified from the current competition season. ● The team is disqualified from the current competition season, but its results so far in this season will be maintained as a reference for other teams.

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

6.1.4 Miscellaneous

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

6.2 Penalty Rules

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

6.2.1 Staff

6.2.1.1 Participating Teams/Personnel

R1 The requirements stated in "RoboMaster 2022 University League Participant Manual" must be met.

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

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

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

R3 Except for emergency situations, teams must be present at the Inspection Area before the start of each match for Pre-match Inspection. The team must stand by at the Staging Area 10 minutes before each match.

Penalty: Forfeiture of the current match.

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

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

R5 Team members must not turn on the power and commission or repair their robots in the Staging Area.

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

R6 Apart from Pit Crew Members who have entered the Staging Area and Competition Area beforehand due to match-related reasons, no participants are allowed inside either area without special reasons.

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

R7 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.

Penalty: The staff will confiscate the projectiles and issue a verbal warning. If the warning does not work, the most serious penalty that can be imposed on the offending personnel is disqualification from the competition.

R8 Teams must not damage any official equipment (including but not limited to equipment in the Competition Area, Staging Area, Preparation Area and Inspection Area).

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

R9 Any participant who has entered the Staging Area and Competition Area for match-related reasons may not leave either area without permission.

Penalty: Offending personnel are not allowed to enter the Staging Area and Competition Area. The most serious penalty that can be imposed is disqualification from the competition.

R10 After the end of a match, participants must clear the projectiles loaded in the robots at the Projectile Unloading Area.

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

R11 During the competition, participants must not interfere with the arena in any manner.

Penalty: Verbal Warning The most serious penalty is Forfeiture if the player ignores the warning prompt.

6.2.1.2 Pit Crew Members

- Pit Crew Members: Regular Member and Supervisor who have registered for this Season and have been entered into the registration system, can walk into the Preparation Area and Competition Area.
- Captain Armband: Any Regular Member that wears the 'Captain' armband performs the Captain role during the match. 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 Pit Crew Members must meet the identity and quantity requirements of the corresponding challenge. For details, refer to "RoboMaster 2022 University League Participant Manual." One Pit Crew Member should wear the "Captain" armband and undertake the Captain's role.

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

R13 Pit Crew Members must meet identity requirements.

Penalty: 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" label of the Captain's armband must face the front.

Penalty: Verbal Warning

R15 Pit Crew Members are not allowed to power their equipment using the power supply for official equipment in the Competition Area. However, they may bring their own power supply.

Penalty: Verbal warning will be given; and if it does not work, the offending personnel will be issued a Red Card. The highest penalty that can be imposed on the offending party is disqualification.

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

Penalty: Verbal Warning The most serious penalty is Forfeiture if the player ignores the warning prompt.

R17 During the game, personnel other than operators are not allowed to communicate with operators in any way.

Penalty: Verbal Warning The most serious penalty is Forfeiture if the player ignores the warning prompt.

R18 Besides the operator, no other Pit Crew Members are allowed inside the Operator Room.

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

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

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

R20 Pit Crew Members are not allowed to debug the Sentry Robot with remote controller (RC) during the Referee System Initialization Period.

Penalty: Forfeiture of the round.

R21 Pit Crew Members are not allowed to bring headsets into the Operator Room.

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

R22 During the 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.

Penalty: The offending party must bear the relevant responsibility.

R23 During an Official Technical Timeout, Pit Crew Members are not allowed to fix faults other than those in modules related to the Referee System.

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

6.2.1.3 Operator

R24 The use of one's own computers is prohibited in the Operator's Room.

Penalty: Forfeiture of the round.

R25 Operators must remain in the relevant Operator's Room during the Referee System Initialization Period and the Match, to operate the relevant computers, and must remain in position after a match has started, unless otherwise permitted by the referee.

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

R26 During the competition, each operator is equipped with at most one remote controller.

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

6.2.2 Robots

6.2.2.1 General Rules

R27 The robot must meet the requirements of the corresponding manufacturing specifications.

Penalty: Verbal warning will be given; and if it is ineffective, the most serious penalty that can be imposed is disqualification from the competition.

The organizing committee will conduct spot check for the robots from time to time. The reporter must provide corresponding evidence if reporting that robots do not meet the production specifications.

R28 Robots entering a match must pass Pre-match Inspection.

The check result is only valid for the game it is aimed at.

Penalty: Forfeiture of the round.

R29 In the first round of a match, the robots must meet the minimum battle team size.

Penalty: Forfeiture of the current match.

R30 Robots must be attached with armor stickers that meet the inspection specifications.

Penalty: If the violation happens before the start of a match, the offending robot will be barred from the match. If the violation happens during a match, the highest penalty that can be imposed on the offending party is a Red Card, based on the seriousness of the situation.

R31 When waiting in the Staging Area, team members are not allowed to bring robots out of the Staging Area without permission.

Penalty: Verbal Warning If the verbal warning is ineffective, the offending team member and robot shall be issued a Red Card.

R32 Robots must not carry or present safety issues including but not limited to short circuits, crashing, creating fumes or lighting flames, 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.

Penalty: If it happens 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 to appear on the Battlefield. If it is during the competition, a Verbal Warning shall be issued. If the Verbal Warning is ineffective, a Red Card 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 "7 Irregularities".

R33 During the Setup Period and the Referee System Initialization Period, robots in the Battlefield are not allowed to leave their corresponding initialization zones.

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

R34 During the Setup Period, all projectile must be launched into the projectile clearance bag.

Penalty: Verbal Warning If the Verbal Warning does not work, the offending team member and robot shall be issued a Red Card.

R35 During the competition, the robot is not allowed to disintegrate into sub-robots or sub-systems connected by

multiple flexible cables, and must not cast or launch their own parts.

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

R36 During the competition, robots are not allowed to block any Armor Module with its body or transform beyond its maximum expansion size.

Penalty: Warnings shall be issued against the offending party as judged based on their subjective intention. If the blocking was intentional, a Yellow Card will be issued along with a Verbal Warning. If the Verbal Warning is ineffective, a Red Card shall be issued. If the blocking was passive in nature, the offender will be issued a Yellow Card.

R37 During the Setup Period, the replacement modules and parts used on robots must meet the requirements for "equivalent parts" as stated in "5.3Setup Period".

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

6.2.2.2 Ground Robots

R38 During 3V3 Confrontation, each team can have no more than one robot mounted with a motorized 17 mm Launching Mechanism.

Penalty: During the Setup Period, if any team in the Battlefield has multiple robots mounted with mobile 17 mm 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 Red Card against all the remaining offending robots.

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

R39 The Standard with Balancing Chassis shall satisfy the definition of Standard Robot under the Surviving Status; please refer to "RoboMaster 2022 University Series Robot Building Specifications Manual". This does not apply to Standard Robot under Non-surviving Status.

In the Supplier Zone, the Balancing Standard Robot are allowed temporarily not to meet relevant definitions.

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

6.2.3 Interaction

6.2.3.1 Interaction between Robots

R40 No robot may use any part of its body to strike an enemy robot, except where a destroyed robot is obstructing a path and needs to be slowly pushed away.

- This rule applies to the collision between Balancing Standard Robot and Auto Standard Robot
- In any collision between a Sentry Robot and Ground Robot, the Ground Robot will be deemed the offender.
- In any collision between two Ground Robots, the offender will be the robot deemed by the referee as the initiator.

Penalty: Warnings shall be issued against the offending party as judged based on their subjective intention and the degree of collision.

Table 6-3 Penalties for Collision

Violation Level	Description
Yellow Card	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
Red Card	Actively, maliciously and repeatedly causing high-speed front collision, active and prolonged pushing causing the other team's robot to move over a fairly long distance, seriously impeding the normal movement of the other team's robot, or securing a major advantage unfairly by means of aggressive collision.

R41 A robot must not stick itself to any enemy robot through active interference, blocking or collision.

Penalty: Warning prompt shall be given to the offending party based on the duration of the violation. If it exceeds 10 seconds, a first Yellow Card will be issued. Thereafter, each 20 seconds will incur a further Yellow Card. This carries on until the robot is ejected. Whether the offending robot is under the Surviving Status or not, if the violation goes on longer than 90 seconds, the offending team will be issued a Forfeiture for that round.

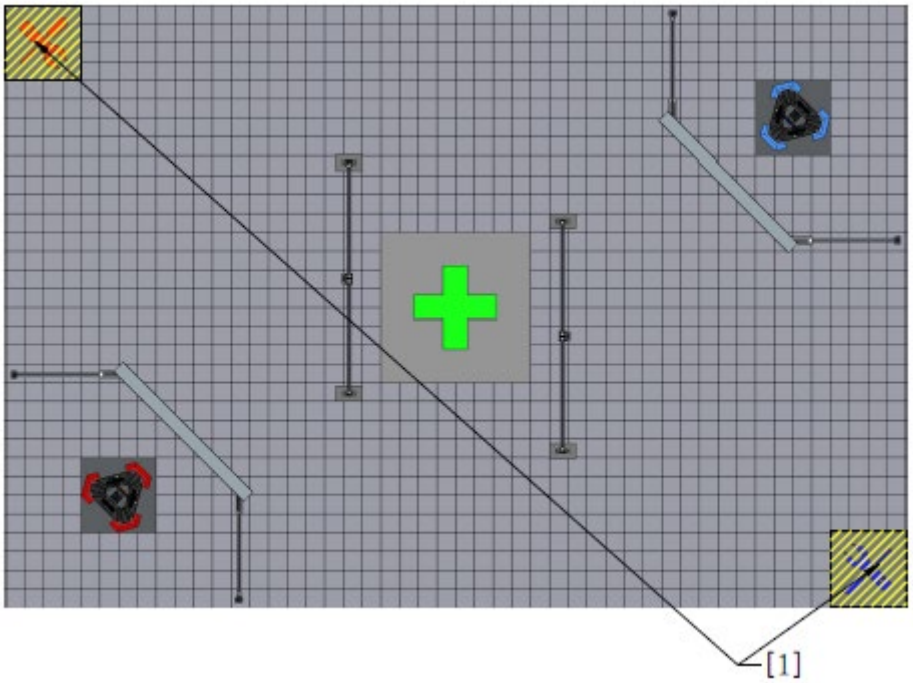
R42 No robot may interfere with the regular projectile reload, HP recovery or revival of an enemy robot.

Penalty: The offending team is issued a Yellow Card.

6.2.3.2 Interaction between Robots and Battlefield Components

To ensure the fairness of the competition and that robots in the Battlefield are able to receive buffs and reloads

effectively, Supplier Penalty Zones have been set up in the Battlefield where the robots of one or both teams are forbidden from entering, as shown below. The Supplier Zone of one team is the Supplier Penalty Zone for the other.



[1] Supplier Penalty Zone

Figure 6-1 Base Penalty Zone

R43 The robots of one team are forbidden from entering the Supplier 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.

Penalty: Warnings shall be issued against the offending party based on how long the robot remained in the Penalty Zone and the impact of the violation. If it exceeds 3 seconds, a first Yellow Card is issued. Thereafter, each 10 seconds will incur a further Yellow Card. This carries on until the robot is depleted. An offending robot that causes serious damage to an enemy robot by remaining in a Penalty Zone will be issued a Red Card.

R44 Participating robots are only allowed to use projectiles provided officially by the RMOC.

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

R45 During the match, the robots are only allowed to get projectiles from the Projectile Supplier Zones.

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

6.3 Serious Violations

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

Table 6-4 Categories of Serious Violations

Rule	Type
1	The participants are not members of the team, or the participating robots do not belong to the team.
2	Replacing backup robots without permission, or exceeding the maximum quantity limit for backup robots
3	Violating rules mentioned in this chapter and refusing to accept penalties, for example a Pit Crew Member interfering with the regular work process of a referee.
4	Tampering with or damaging the Referee System, or interfering with any detecting function of the Referee System through technical means.
5	Installing explosives or other prohibited materials on robots
6	A situation has occurred in the Competition Area that violates Pre-Match Inspection requirements
7	A team member deliberately damaging the opponent's robots, Battlefield Components and related equipment.
8	Causing delays deliberately or refusing to immediately leave the Competition Area after a match has ended, thereby disrupting the schedule of the competition
9	A team member using robots to collide into or attack other people deliberately, putting themselves and other people at risk of injury
10	Serious verbal or physical conflicts between team members and the staff of the RMOC, other participating teams, audience, etc.
11	A team member's refusal to cooperate, deliberate delay or provision of false materials and information during the RMCO's handling of an appeal request.
12	In respect of any violation of local laws and regulations occurring inside the Competition Area, Audience Area, dormitories or other relevant competition zones during the competition, the RMOC, apart from issuing the most severe penalty of "disqualification", will fully cooperate with the relevant authorities to pursue appropriate legal actions against the offenders.

Rule	Type
13	Any other violation that seriously affects the progress of the matches, goes against the spirit of fair competition, or is deemed as serious in nature by the Chief Referee.

7. Irregularities

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

If any of the following anomalies occur during the competition, it shall be handled 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 Chief 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 non-key Battlefield Components are damaged during a match (damage to the ground rubber surface, ground lighting, or Base lighting), which do not affect the fairness of the match, the match will proceed as usual.
- If key Battlefield Components experience logical or structural faults, for example where the network connections are disrupted causing a robot to go offline, no buff is gained after a Power Rune is hit, or a Battlefield Component does not operate normally, the referee will solve the problem manually through the Referee System. If the problem cannot be solved manually, the referee will notify the operators of both teams and eject all robots. The round of the match is ended immediately and its results are invalidated. The round will restart after the issue has been solved.
- During a match, if the fairness of a match has been affected by the malfunction or structural damage of a key Battlefield Component, and the Chief Referee did not confirm the situation and end the competition in time, causing a round that should have been ended to continue and thereby producing a winner, a rematch will be required and the results of the round will be invalidated, after an appeal has been made or the Chief Referee has made a determination to that effect after the end of the round.
- In the case of a serious violation that would clearly have triggered a penalty of forfeiture, and the Chief Referee did not confirm and execute it in time, the results of the round will be invalidated after an appeal has been made or the Chief Referee has made a determination to that effect after the end of the round, and the offending party will be issued a forfeiture.

8. Appeals

Each team has one opportunity to appeal during each event of each competition area during the RoboMaster 2022 University League, but the opportunity does not accumulate. If an appeal is successful, the team involved retains its right to appeal again in future matches. If it is unsuccessful, the team will have exhausted its one opportunity to appeal. When a team has exhausted its opportunity to appeal, the RMOC will no longer accept any appeal from the team. When processing an appeal, an Arbitration Commission will be formed by the Chief Referee and heads of the RMOC. The Arbitration Commission has the final right of interpretation on all appeal decisions.

8.1 Appeal Process

Teams lodging an appeal must follow the procedure below:

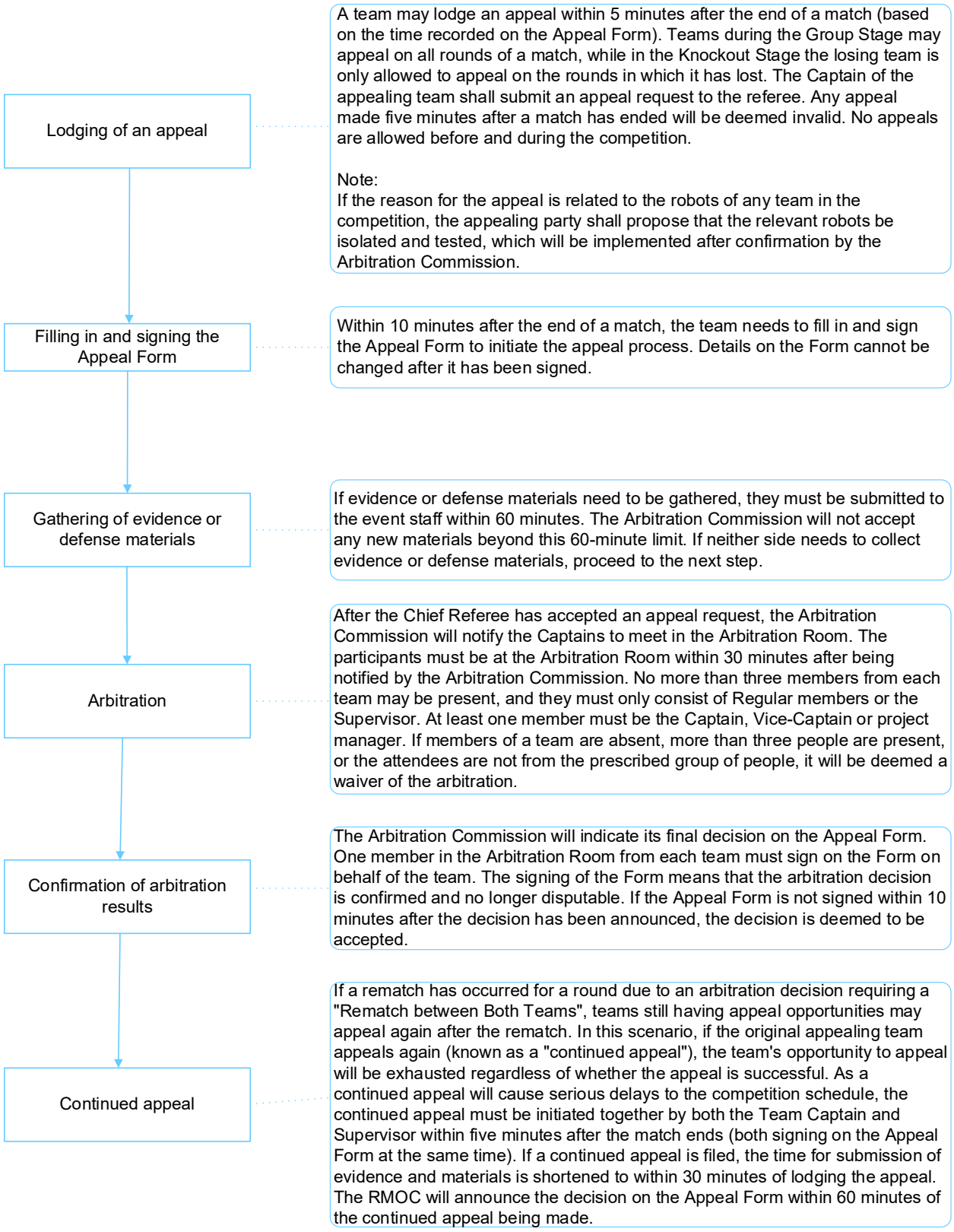


Figure 8-1 Appeal Process

8.2 Appeal Materials

Appeal materials submitted by teams must follow the below specifications:

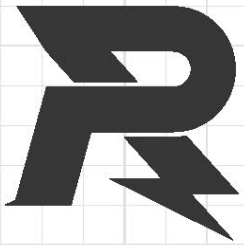
- Material type: Only materials stored on a USB flash drive and the robots themselves will be accepted as appeal materials. Materials submitted in other forms will not be accepted by the Arbitration Commission.
- USB flash drives: The edited video (the video materials should be prepared by the team itself)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

8.3 Appeal Decision

The arbitration decisions that can be made include: Maintaining the original match results; a forfeiture issued against the respondent; a rematch between both teams. Teams may not appeal against the decision made by the Arbitration Commission.

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.

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



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