

V1.0

Using a 55-bit motor driver cable and Field-Oriented Control (FOC), the RoboMaster C630 Brushless DC Motor Speed Controller enables precise control over motor torque.

Exclusively designed for the RoboMaster M6000 P18 Brushless DC Motor and C630 Brushless DC Motor Speed Controller, the M5500 Assembly Kit includes universal wheels and a terminal board.

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

The M6000 Assembly Kit includes universal wheels and a terminal board, ensuring a complete protection system when for your RoboMaster system.

ROBOMASTER 2020

TECHNICAL CHALLENGE

RULES MANUAL

Prepared by the RoboMaster Organizing Committee
Updated on October, 2019

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Using this Manual

Legend

 Prohibition	 Important	 Hints and Tips	 Reference
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Release Notes

Date	Version	Changes
2019.10.31	V1.0	First Release

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1. Introduction

RoboMaster 2020 Technical Challenge (hereinafter referred to as “RM2020 Technical Challenge”) has four challenges: Engineer Projectile Obtaining, Standard Racing and Smart Firing, 2V2 Confrontation and Dart Targeting.

1.1 Main Changes to New Competition Season

The following are the new changes made to the RM2020 Technical Challenge compared to RM2019:

Robot

- Cancel Hero
- Add Sentry

Competition Area

- Adjust Battlefield size parameters
- Add new Battlefield Component, Spinning Top

Challenge

- Change Standard Confrontation to 2V2 Confrontation
- Cancel Hero Remote Firing
- Add Dart Targeting

1.2 Robot and Operator

Building specifications for robots can be found in the RoboMaster 2020 Robot Building Specification Manual.

1.2.1 Robot Lineup

The robot lineup for the RM2020 Technical Challenge is as follows:

Table 1-1 Robot Lineup

Challenge	Qty. of Robot to Play	Standby Robot (optional)	Robot Numbering
Engineer Projectile Obtaining	1	Except for Dart Targeting, the total number of standby robots in other challenges should not exceed one As for Dart Targeting, each team can carry four standby Darts at most.	2
Standard Racing and Smart Firing	1		3
2V2 Confrontation	1-2		<ul style="list-style-type: none">● Standard: 3● Sentry: 7

Challenge	Qty. of Robot to Play	Standby Robot (optional)	Robot Numbering
Dart Targeting	1 (one Dart System consists of four Darts)		8

1.2.2 Basic Robot Information

The basic robot information for the RM2020 Technical Challenge is as follows:

Table 1-2 Basic Robot Information

Type	Initial Projectile (round)	Maximum Chassis Power Consumption (W)	Initial HP	Initial Firing Speed Limit (m/s)	Barrel Heat Limit	Barrel Cooling Value per Second	Projectile Launch Speed (round/s)	Initial Position
Engineer	-	No limits	500	-	-	-	-	Starting Zone
Standard	2V2 Confrontation: 100	120	200	30	360	60	Negatively correlated to initial velocity - refer to 3.3.2 Barrel Heat Exceeds the Limit and Cooling	Starting Zone
	Standard Racing and Smart Firing: 150	Buffer energy is 60J						
Sentry	2V2 Confrontation: 300	30 Buffer energy is 200J	400	30	360	60	Negatively correlated to initial velocity - refer to 3.3.2 Barrel Heat Exceeds the Limit and Cooling	Sentry Rail
Dart System	-	-	-	18	-	-	-	Dart Launching Station



- During a match, when Standard's HP is less than 20%, its 17mm barrel cooling value per second will double.
- Sentry in the Technical Challenge is recommended to have a magazine capacity of 500 rounds of projectiles, so as to be compatible with the Sentry's initial projectile requirement stated in the Robotics Competition.



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

1.2.3 Operator Lineup

The Operator lineup is as follows:

Table 1-3 Operator Lineup

Type	Robot Operated	Full Team Lineup Size
Ground Robot Operator	Standard	1
	Engineer	1
Aerial Gimbal Operator	Dart System	1



Ground Robots: Standard, Engineer and Sentry, collectively.

2. Operator Room and Projectile

2.1 Operator Room



Deterioration in performance is unavoidable from prolonged use of equipment.

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

An Operator Room is not provided with additional power supply.

2.2 Projectile

Robots attack the Armor Modules of enemy robots by launching projectiles, causing damage to their HP so as to ultimately defeat them. The parameters and scenarios of use for projectiles in the competition are as follows:

Table 2-1 Projectile Parameters and Scenarios of Use


Type	Appearance	Color	Size	Weight	Shore Hardness	Material	Scenarios of Use
42mm Projectile	Similar to a golf ball	White	42.5mm±0.5mm	41g±1g	90 A	Plastic (TPE)	Engineer Projectile Obtaining
17mm Fluorescent Projectile	Spherical	Yellow-green	16.8mm±0.2mm	3.2g±0.1g	90 A	Plastic (TPU)	2V2 Confrontation, Standard Racing and Smart Firing

3. Competition Mechanism

3.1 Overview

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

Table 3-1 Robot Status

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

3.2 Relationships between Sentry and Base

Below shows the relationship between Sentry and Base in the 2V2 Confrontation challenge:

- **If Sentry is playing:** When Sentry is destroyed, the team's Base 60% defense will be eliminated.
- **If Sentry is not playing:** Two minutes into the match, the Base 60% defense will be eliminated.

3.3 HP Deduction Mechanism

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

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

3.3.1 Initial Firing Speed Exceeds the Limit

Set the current barrel heat as Q_1 , the Barrel Heat limit as Q_0 , the current initial speed as $V_1(\text{m/s})$, and the Initial

Firing Speed limit as V_0 (m/s). Take Standard as an example: its Initial Firing Speed limit is $V_0 = 30$ m/s, and its barrel heat mechanism is described as follows:

When $V_1 > V_0$, each 17mm projectile with a speed of V_1 detected by the Referee System will result in a deduction, where the deducted HP = Maximum HP * L%. For each 42mm projectile detected, the deducted HP = Maximum HP * M%. The values of L% and M% are correlated to the margin of excess. The larger the margin of excess, the greater the values of L% and M%.

Table 3-2 Penalty Mechanism for Exceeding the Initial Firing Speed Limit

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

3.3.2 Barrel Heat Exceeds the Limit and Cooling

For each 17mm projectile with a speed of V_1 detected by the Referee System, the current barrel heat Q_1 is increased by V_1 . For each 42mm projectile detected, the current barrel heat Q_1 is increased by 100 (regardless of its initial speed). The barrel cools at a frequency of 10 Hz. The cooling value per detection cycle = cooling value per second / 10.

It is known that the Barrel Heat limit is Q_0 ,

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



Figure 3-1 FPV of Client

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

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

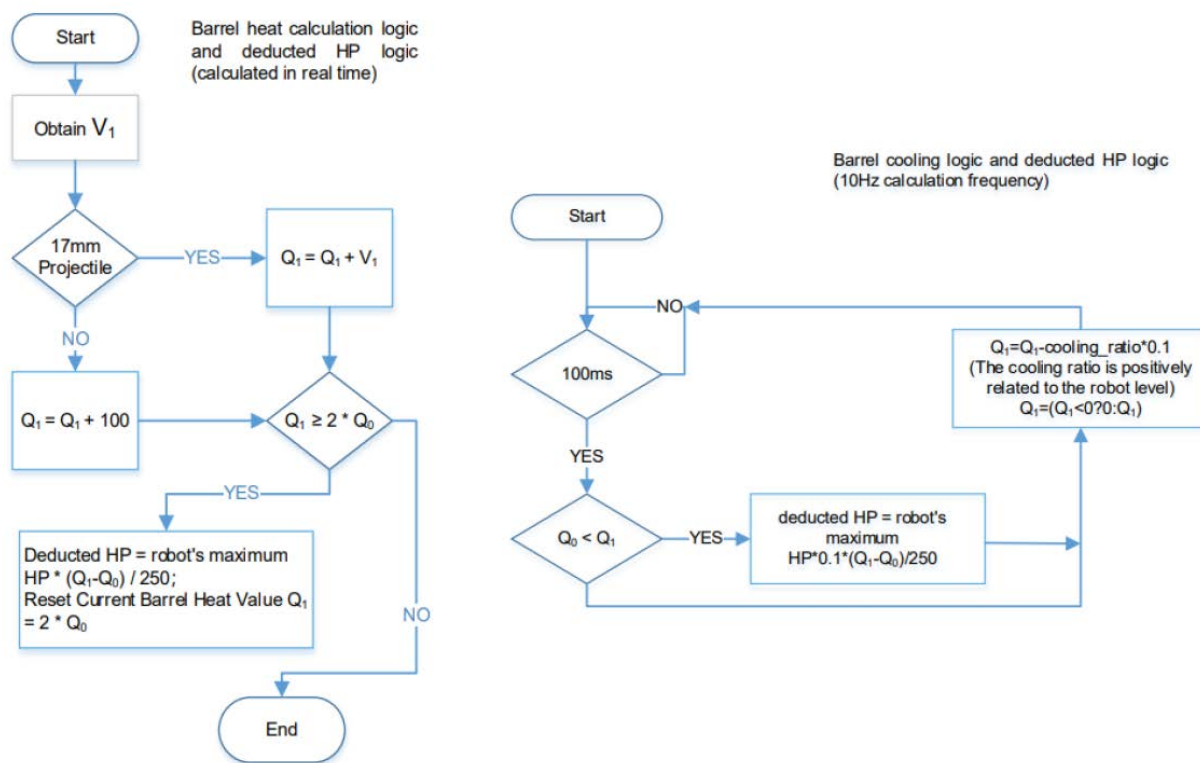


Figure 3-2 (L) HP Deduction logic Graph and (R) cooling logic Graph when Barrel Heat limit is exceeded

3.3.3 Chassis Power Consumption Exceeds the Limit

The chassis power consumption of robots will be continuously monitored by the Referee System, which will trigger the penalty mechanism when the chassis power consumption is exceeded. Different types of robots trigger different penalties. As it is difficult for a robot to control instantaneous output power when in motion, the RMOC has defined a buffer energy (W) in the Referee System server. For the W value of each robot, refer to [Table 1-2](#).

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

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

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

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

K	N%
$K > 20\%$	40%

Standard:

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

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

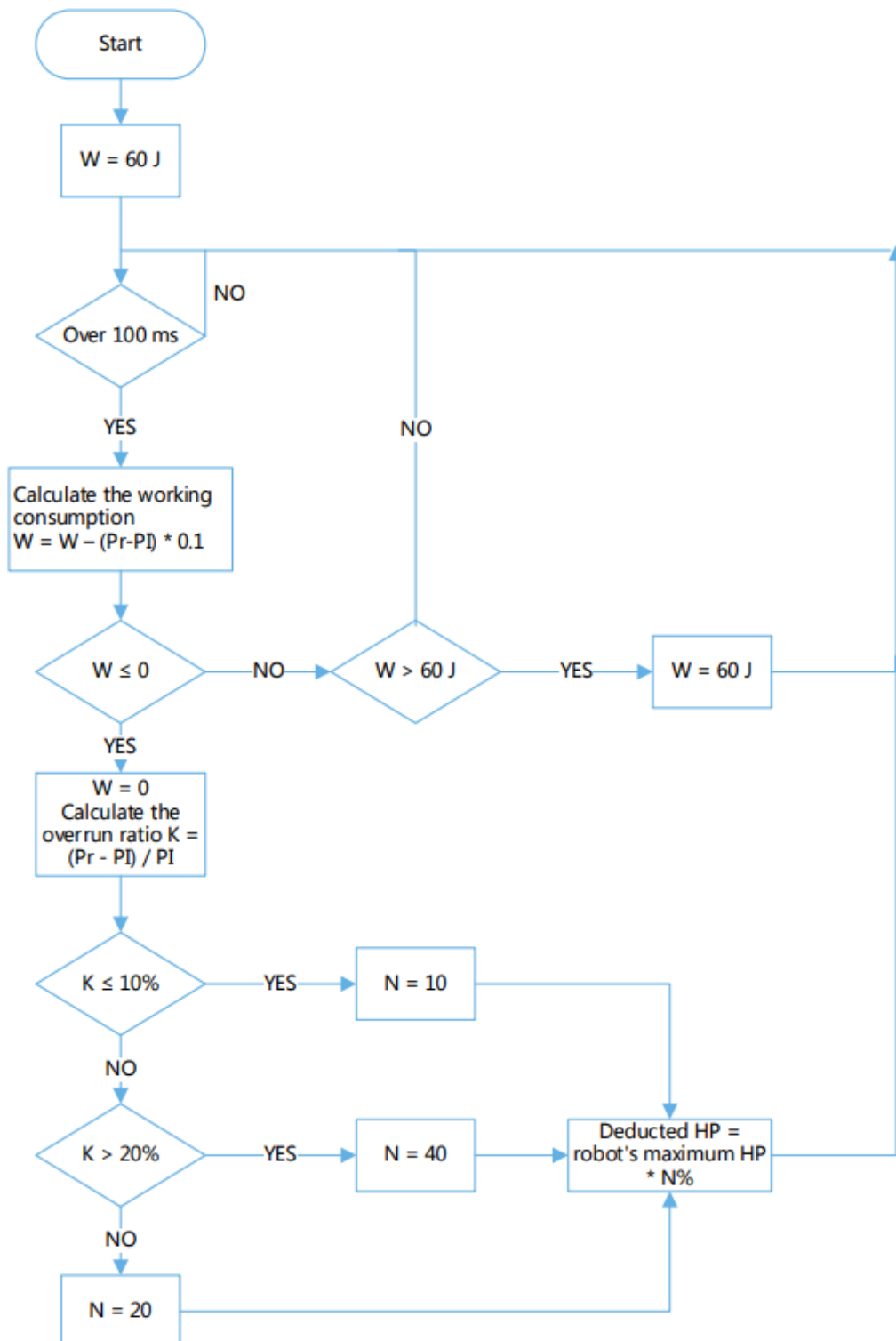


Figure 3-3 Logic Graph for Chassis Power Consumption Detection and HP Deduction

Sentry:

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

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

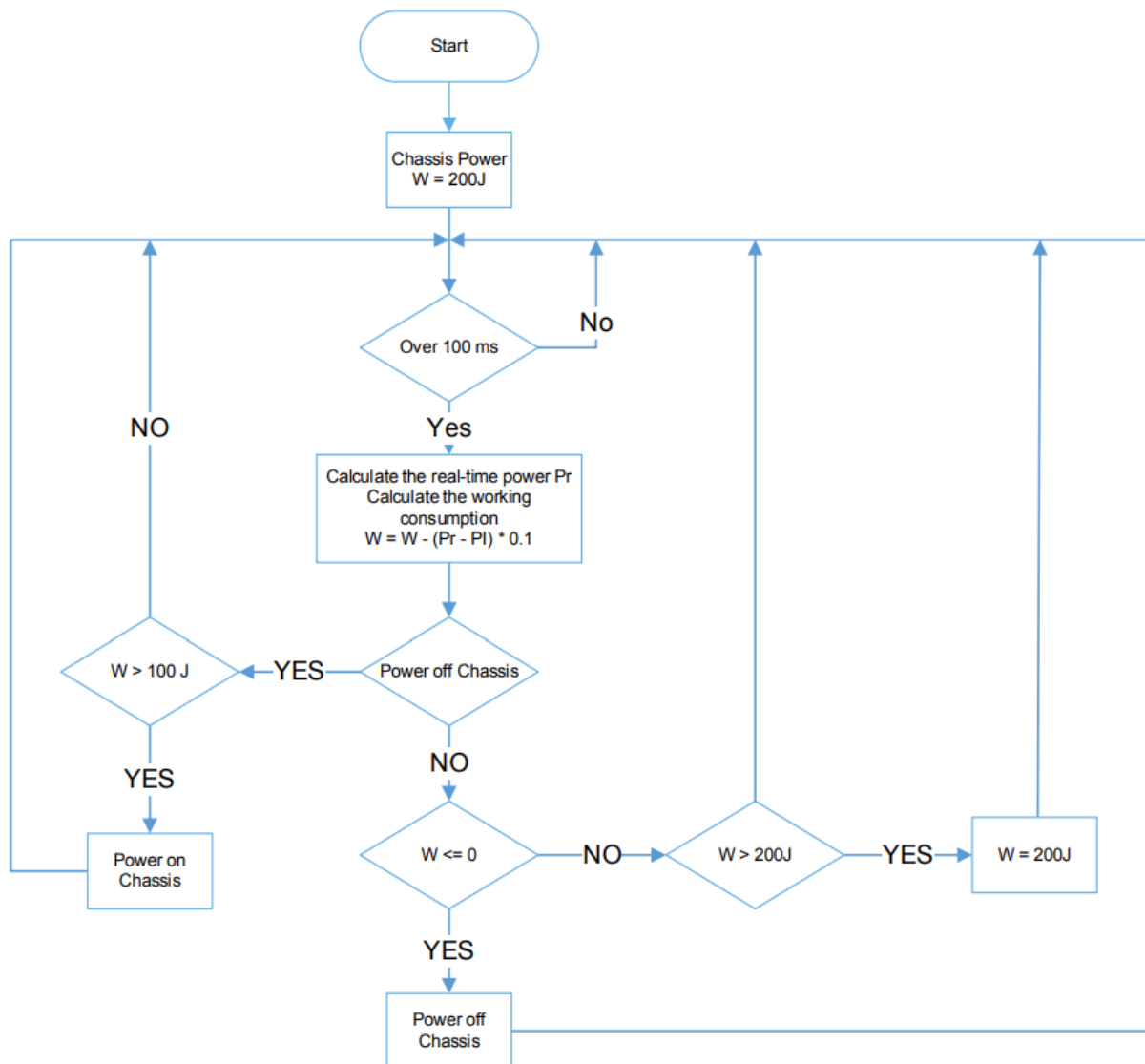


Figure 3-4 Logic Graph for Chassis Power Consumption Detection and Chassis Power-off

3.3.4 Attack Damage



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

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

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

A robot will also experience damage when its Armor Module is struck. However, a robot cannot cause HP damage

to the other side's robots through striking (including collision with the robots or launching objects).

Below are HP deductions in situations of no bonus gains:

Table 3-4 HP deduction Mechanism for Attack Damage

Damage Type	HP Damage Value
17mm projectile	10
Collision	2
Darts	1/5 of the Maximum HP of Base

3.3.5 Referee System Going Offline

According to the latest version of the RoboMaster 2020 Robot Building Specification Manual, robots must be mounted with their corresponding Referee System module, and each Referee System module must have a stable connection to its server throughout the competition. The Referee System server detects the connectivity of each module at a frequency of 2Hz. If important Referee System modules such as a Speed Monitor Module, Positioning System Module or Armor Module goes offline due to design or structural problems, then the HP of the corresponding Ground Robots will be deducted.

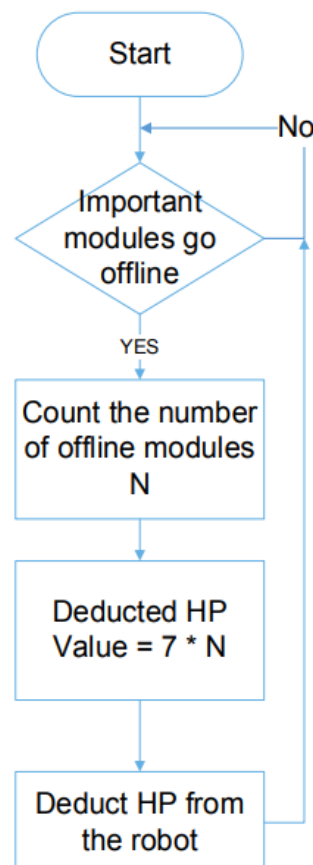


Figure 3-5 HP Deduction Mechanism for Important Referee System Modules Going Offline

3.4 HP Recovery and Revive Mechanism

HP Recovery Mechanism: If an RFID Interaction Module has been detected in one's own Restoration Zone, the robot will recover 5% of its Maximum HP per second until the Maximum HP is reached.

Revive Mechanism: Standard can be revived on any location in the Battlefield. After it is revived, it will maintain its Level before it was defeated, and it will recover its HP to 20% of the Maximum HP. The robot is at 100% of defense status within 5 seconds of revival. For definitions of the defensive status, please refer to [Table 3-1](#).

Time Required for Revive: If defeated for the first time, Standard needs to wait for 10 seconds before it can be revived. For every subsequent revival, the waiting time for Standard will increase by 10 seconds each time.

3.5 HP Gain Mechanism for Sentry

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

3.6 Logic of Mechanism Overlap

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

4. Challenge



The margins of error for all Battlefield Components described herein are within $\pm 5\%$. The unit for size parameters is mm.

Below shows the pre-match preparation period and competition time of a single round:

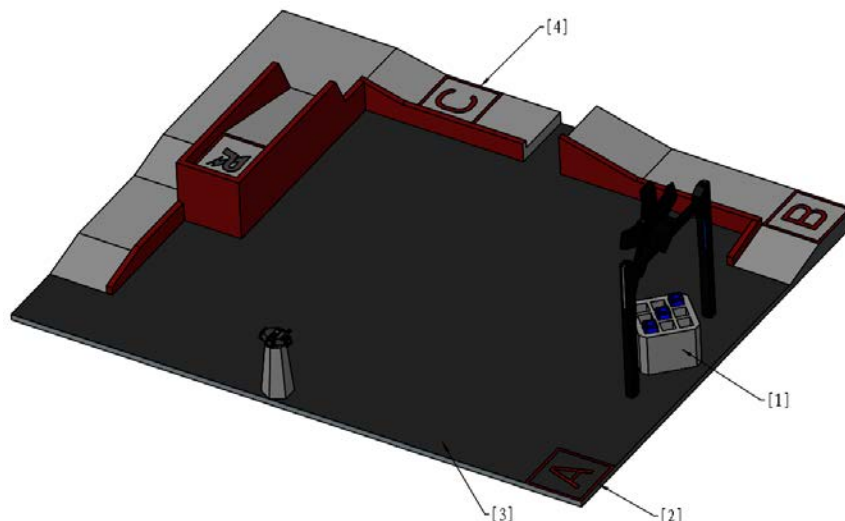
Table 4-1 Challenge Specification

Challenge	Pre-Match Preparation (min)	Time for a Round (min)
Engineer Projectile Obtaining	1	2
Standard Racing and Smart Firing	2	3
2V2 Confrontation	2	5
Dart Targeting	2	1

4.1 Engineer Projectile Obtaining

The Engineer Projectile Obtaining challenge and the Standard Racing and Smart Firing challenge share the same Battlefield.

4.1.1 Battlefield



[1] Resource Island [2] Starting Zone (Zone A) [3] Litchi texture rubber [4] Zone C

Figure 4-1 Engineer Projectile Obtaining Battlefield Graph

4.1.1.1 Resource Island

The Resource Island includes Projectile Depot and Power Rune. In the “Engineer Projectile Obtaining” challenge, the Engineer needs to obtain Projectile Containers at the Resource Island.

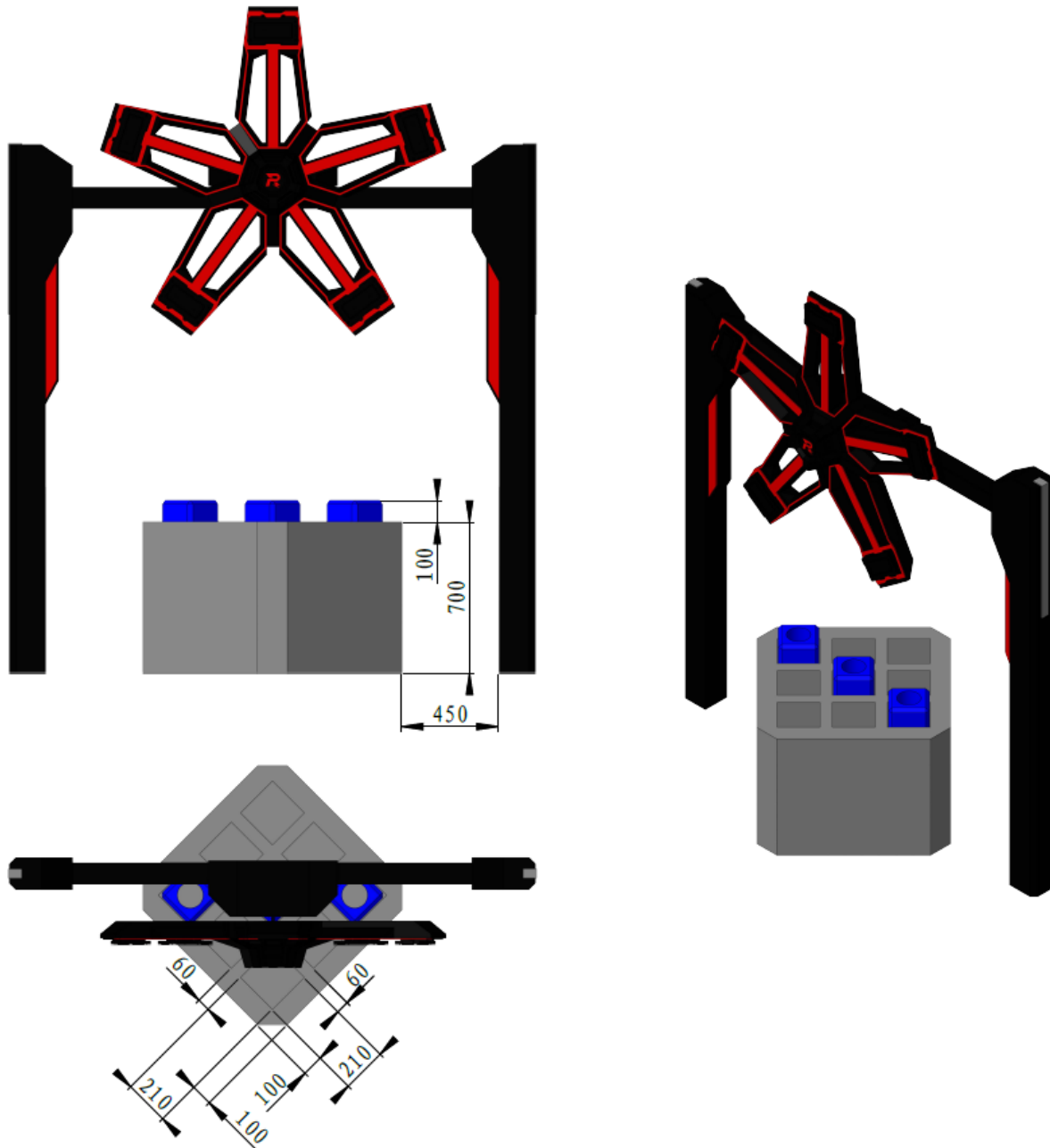


Figure 4-2 Resource Island Graph

4.1.1.2 Projectile Depot

The Resource Island is provided with nine fixed-position Projectile Container grooves, which holds full Projectile Containers.

Projectile Container In the Engineer Projectile Obtaining challenge, three Projectile Containers are placed on the Resource Island. For the position of Projectile Containers, refer to [Figure 4-2](#). In each of Projectile Container, there are twenty 42mm projectiles. Engineer can move or take away them to obtain projectiles.

Projectile Container



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

Projectile containers are 200 x 200 x 200 mm in size. Their six faces are chamfered, and they are made out of EVA materials. The top surface has a hole with a diameter of 115 mm. The hole depths of the Projectile Containers on the Resource Island is 150 mm.

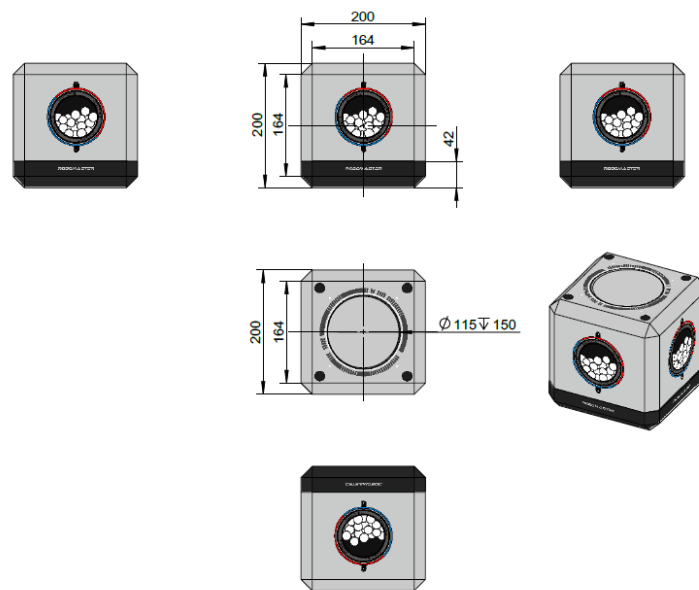


Figure 4-3 Graph of Projectile Containers of the Resource Island

4.1.2 Rules

4.1.2.1 Competition Rule

At the beginning of the competition, Engineer leaves the Zone A to retrieve projectiles in the Projectile Containers. After retrieving projectiles, Engineer needs to move to the Zone C to complete the challenge.

4.1.2.2 Scoring Rule

Engineer moves to Zone C to count the quantity of projectiles. It needs to put the obtained projectiles into a storage box held by the staff. Projectile needs to be obtained naturally from the projectile interacting mechanism of Engineer. One projectile gains five points.

If projectiles in the Projectile Containers on the Resource Island are all taken, and the game time is not over when Engineer moves to Zone C, one point will be added for each remaining second. The final score will be zero if Engineer fails to move to Zone C.

4.1.2.3 Ranking Rule

Below is the team ranking rule in Engineer Projectile Obtaining:

1. Each team can initiate two challenges and take the highest total score of the two challenges as the final score.
All teams will be ranked from high to low based on their total scores.
2. If the total scores of several teams are the same, the teams will be ranked based on the weight of their robots, with the lightest ranking higher.

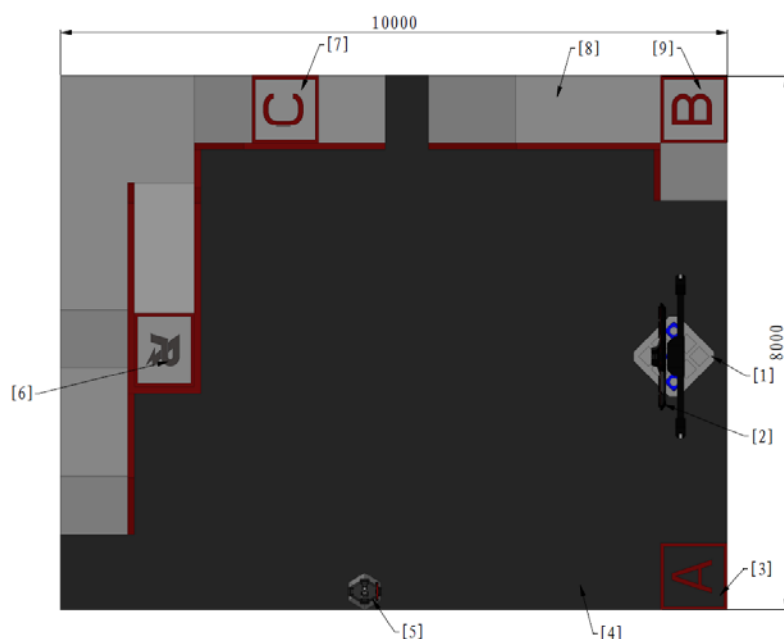
4.1.2.4 Eligibility

Engineer must successfully retrieve at least one round of projectile and move to Zone C in the schedule time.

4.2 Standard Racing and Smart Firing

The Standard Racing and Smart Firing challenge and the Engineer Projectile Obtaining challenge share the same Battlefield.

4.2.1 Battlefield



[1] Resource Island

[2] Power Rune

[3] Zone A

[4] Litchi texture rubber

- [5] Spinning Top [6] Power Rune Activation Point (Zone D) [7] Zone C [8] Road
- [9] Zone B

Figure 4-4 Top View of Standard Racing and Smart Firing Battlefield

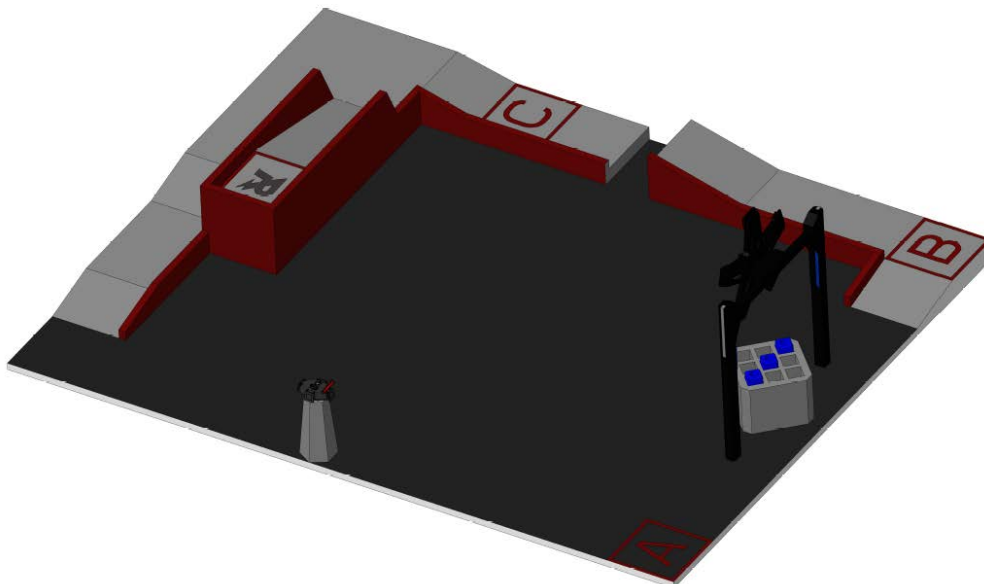
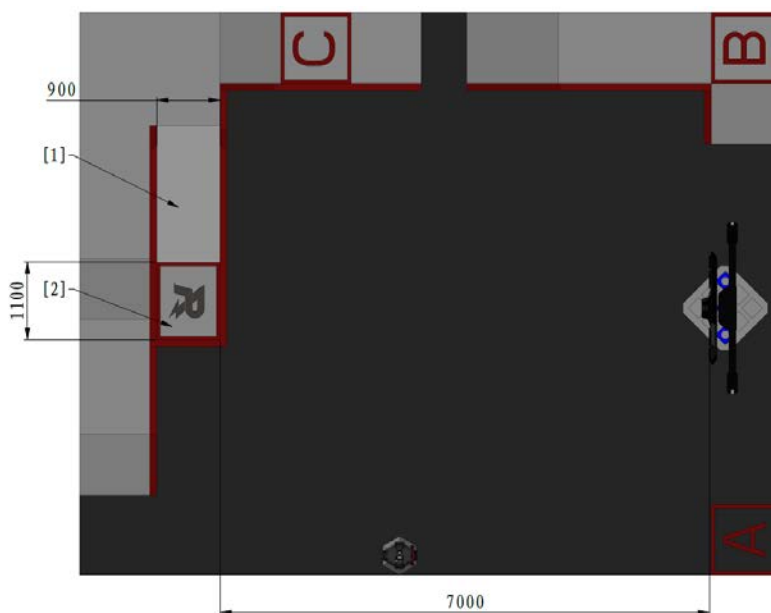


Figure 4-5 Axonometric View of Standard Racing and Smart Firing Battlefield

4.2.1.1 Power Rune Activation Point

Standard needs to strike Power Rune at the Power Rune Activation Point.



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

Figure 4-6 Power Rune Activation Point (Zone D) Graph

4.2.1.2 Road

When Standard reaches Zone B, it can choose to get access to Zone C quickly through the Launch Ramp.

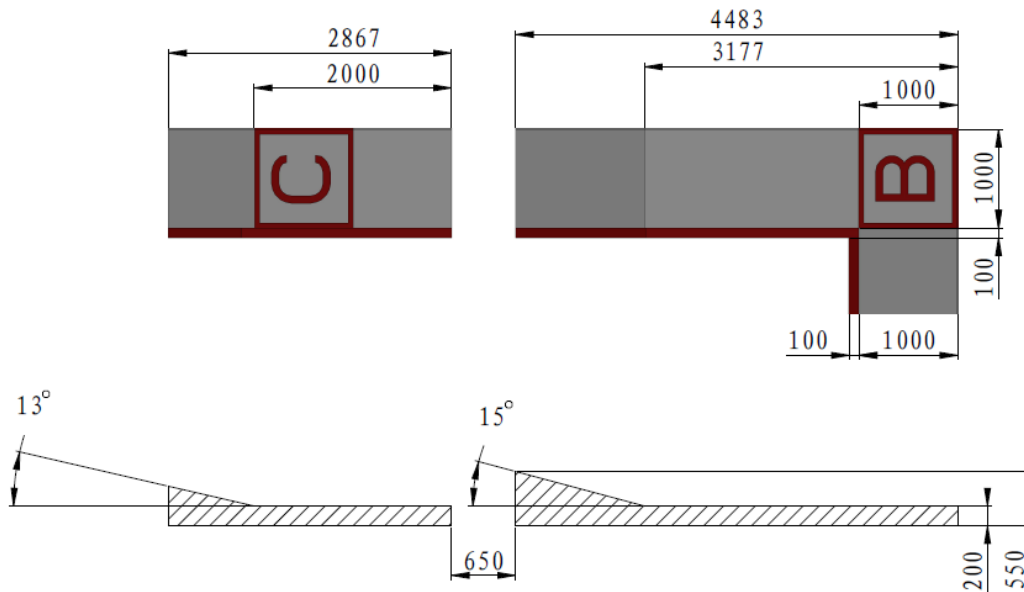


Figure4-7 Road Graph

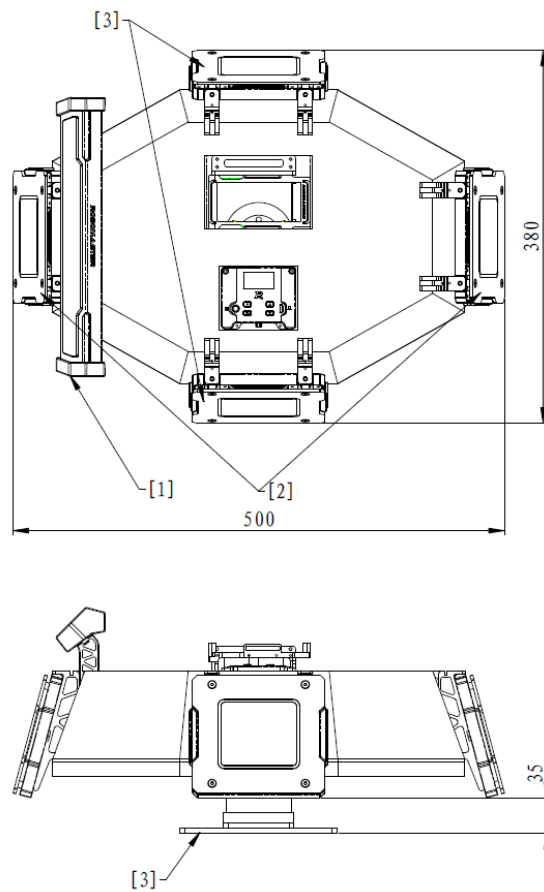
4.2.1.3 Spinning Top

The Spinning Top is mounted on a platform at an altitude of 900 mm, at a distance of 4000 mm from Zone D. Four small Armor Modules and a Light Indicator Module are mounted on the Spinning Top. The lowest altitude of the Armor Modules from their bottom to the site is 935 mm, and the Light Indicator Module is fixed on one of the Armor Modules. For the position of Armor Module, refer to [Figure 4-8](#).

On the Spinning Top, there are two valid Armor Modules with No.4 sticker attached, and two invalid Armor Modules without stickers. During the match, the indicator of valid Armor Modules displays red while that of invalid Modules is off.

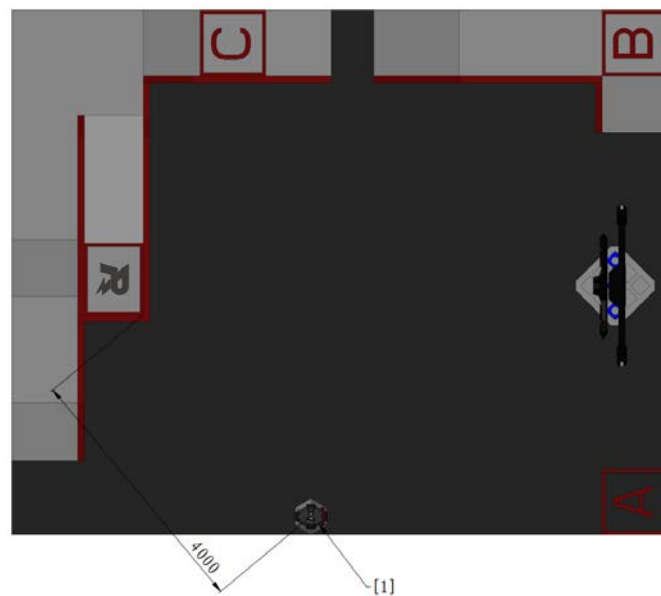
The rotation axis of Top is fixed on the base. Spinning Top only performs rotation motion.

The Spinning Top has a HP of 300.



[1] Light Indicator Module [2] Valid Armor Module [3] Invalid Armor Module

Figure 4-8 Spinning Top Graph



[1] Spinning Top

Figure 4-9 Relative Positional Relationship between Spinning Top Platform and Strike Point Zone D

Status

The Spinning Top will be in one of two states: active and inactive.

1. Active

At the start of the match, the Top performs a variable motion at the pace of $\omega = A * \sin\left(\frac{2\pi}{T} * t + \varphi\right) + B$.

Specifically speaking, Spinning Top performs a variable motion at the pace of sine wave. The variant period T is a random number ranging from 3 seconds to 7 seconds. This random number is generated randomly at the start of each round and T will remain unchanged before the end of the round. Variant gain is A 1.5. The largest rotational speed is 6.5rad/s (about 1.034r/s) and the smallest is 3.5 rad/s (about 0.557r/s).

ω : Angular velocity (unit: rad/s)

T : Variant period (unit: s)

A : Variant gain

2. Inactive

HP of the Spinning Top becomes zero and the Top stops spinning.

4.2.1.4 Power Rune

The rotate speed of Power Rune will change with the strike process. The specific mechanism will be updated subsequently.

4.2.2 Rules

4.2.2.1 Competition Rule

Standard is pre-loaded with 150 rounds of 17mm projectiles. During the competition round, Standard must complete the following missions:

1. Depart from Zone A, pass through Zone A, B and C on the site, eventually reaching Zone D. The barrel cooling value per second of Standard is now five times its original value.
2. Standard strikes the Spinning Top at Zone D to make it inactive. Striking the Top in other places will be invalid.
3. After the Spinning Top is inactive, Standard needs to continue occupying Zone D for the Power Rune to enter into the state of activating. If the robot leaves Zone D or has been defeated for longer than 2 seconds, any gains will be lost, and it will not be able to strike the Spinning Top or activate the Power Rune.
4. Standard can try to activate the Power Rune at Zone D multiple times. The round ends once the Power Rune is

activated completely.

The specific movement track of Standard is decided by the participant.

4.2.2.2 Scoring Rule

Record the time when each challenge is completed. If Standard is still unable to make the Spinning Top inactive after the round's countdown has ended, the challenge will be deemed as failed.

4.2.2.3 Ranking Rule

Each team can initiate two challenges and take the shortest time used as the final score.

Activated Power Rune:

1. The team that spends the least amount of time to finish the challenge ranks the highest.
2. If the time to finish the challenge is the same, the teams will be ranked based on the remaining HP values of their robots.
3. If the time and the remaining HP values are the same, the teams will be ranked based on the weight of their robots, with the lighter ranking higher.

Failed to activate Power Rune:

1. Take the highest strike rings of Power Rune as the final score, with the higher ranking higher.
2. In the case of two or more teams having the same number of strike rings, the team whose strike was achieved in the shortest time will be given the higher ranking (time is accurate to seconds).
3. If the time of achieving the highest strike rings of Power Rune is the same, robot with the higher remaining HP values ranks higher.
4. If the time and the remaining HP values are the same, the teams will be ranked based on the weight of their robots, with the lighter ranking higher.

4.2.2.4 Eligibility

Standard must make the Spinning Top inactive for the team to be shortlisted.

4.3 2V2 Confrontation

4.3.1 Participant

Participants qualify for 2V2 Confrontation are: teams that have never obtained or for the first time have obtained

the entry qualification in the RoboMaster 2018 Robotics Competition or RoboMaster 2019 Robotics Competition

The RMOC will determine whether participants of this challenge meet relevant requirements for team and conduct an on-site verification of participants' identity. If any team does not meet the requirements, the highest penalty that can be given to the offending personnel and offending team is a Forfeiture of the match.

4.3.2 Battlefield

The core Competition Area of 2V2 Confrontation is called the "Battlefield". The Battlefield is an area with the size of 8m x 6m. Within the area are the Base, Starting Zone, Sentry Rail, Supplier Zone and Buff Zone.

Ground of the Battlefield is non-smooth and its specific parameter will be updated subsequently.

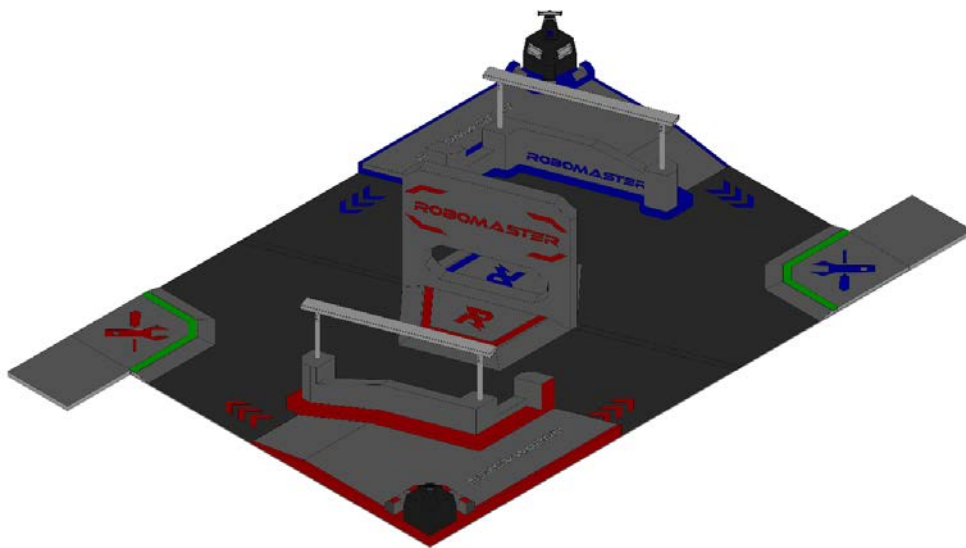
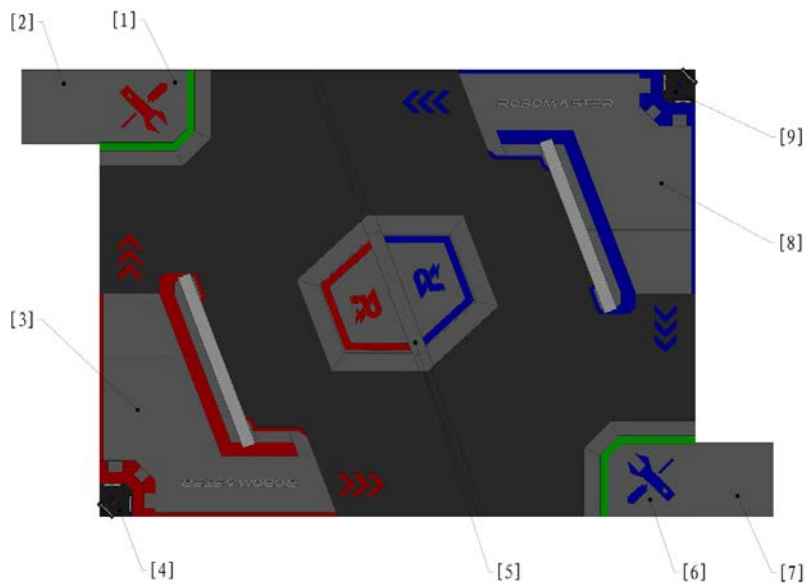


Figure 4-10 Axonometric View of 2V2 Confrontation Battlefield



- [1] Red Team Restoration [2] Red Team Supplier [3] Red Team Starting Zone

Zone		Zone	
[4] Red Team Base		[5] Red Team and Blue Team Buff Zone	[6] Blue Team Restoration Zone
[7] Blue Team Supplier Zone		[8] Blue Team Starting Zone	[9] Blue Team Base

Figure 4-11 Top View of 2V2 Confrontation Battlefield

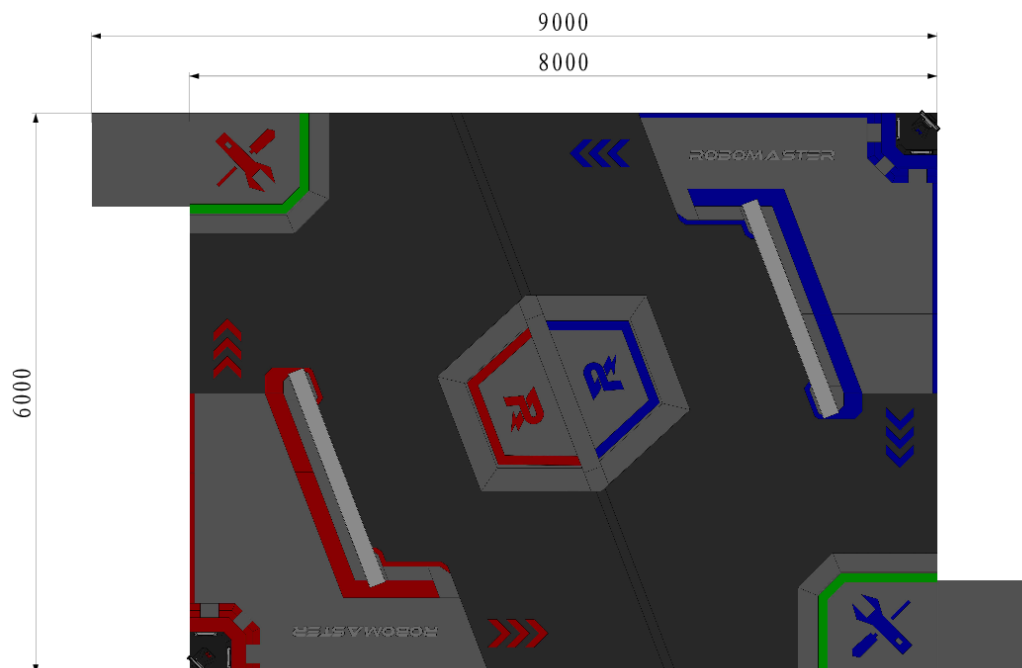


Figure 4-12 2V2 Confrontation Battlefield Size Graph

4.3.2.1 Starting Zone

The Starting Zone is the area where Standard is placed before a competition begins, which includes the Base, Base Zone and Sentry Rail.

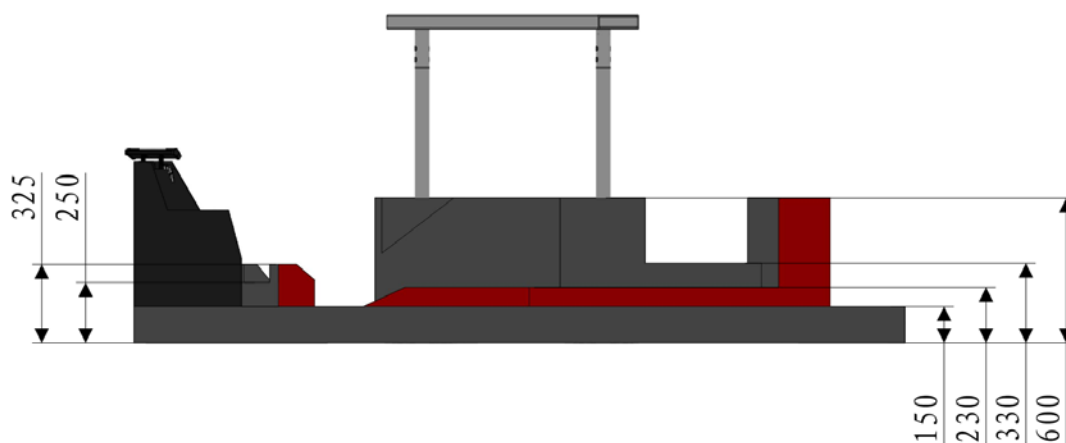
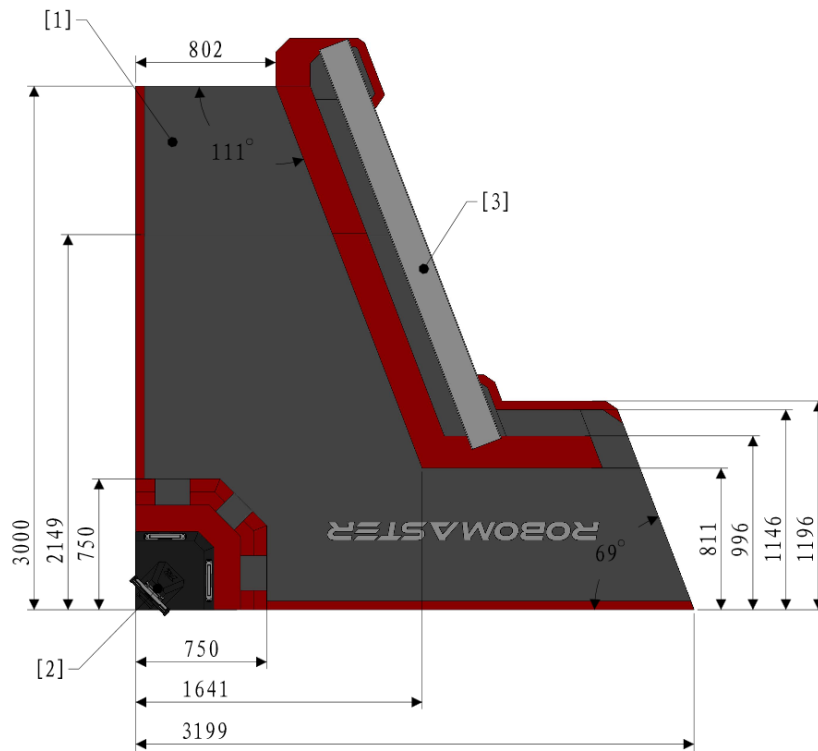


Figure 4-13 Front View of Starting Zone



[1] 10° slope [2] Base [3] Sentry Rail

Figure 4-14 Top View of Starting Zone

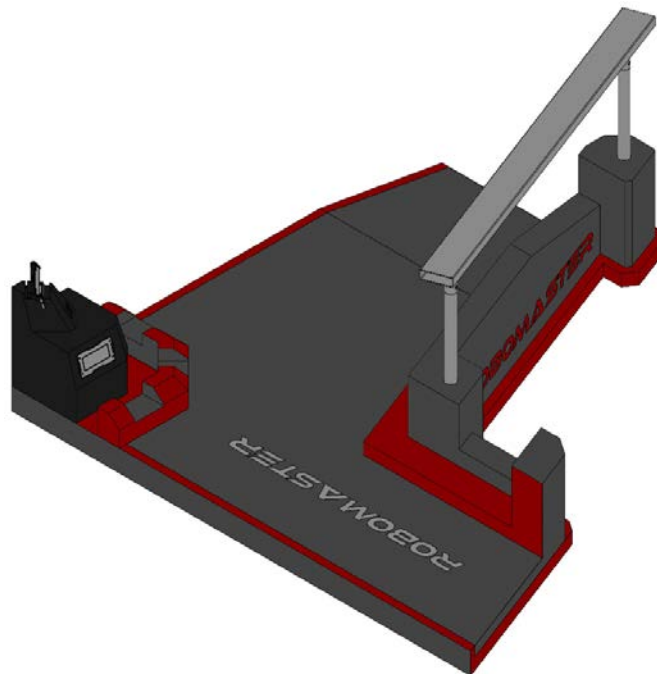
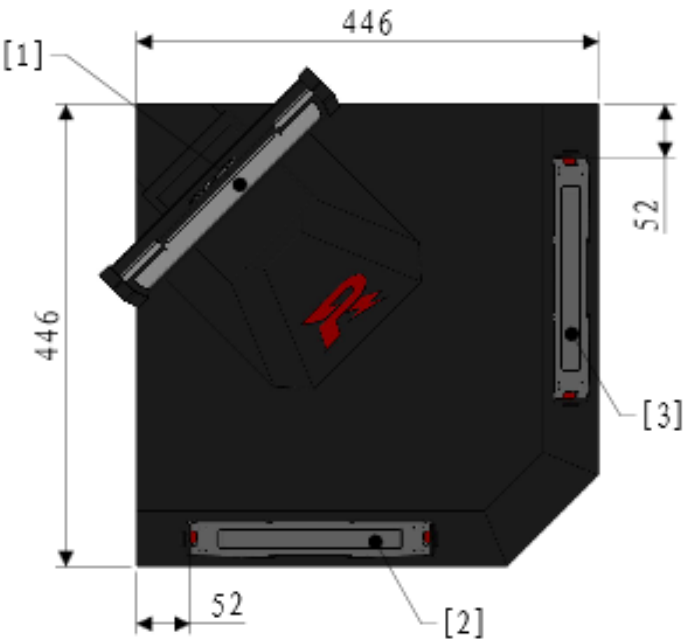


Figure 4-15 Axonometric View of Starting Zone

4.3.2.1.1 Base

The total HP of a Base is 1000. The Red Team and Blue Team each have a Base. Each Base is installed with two

large armors. A corresponding sticker is attached on the armor plate. Intersection angle between the large armor panel inside the Base with the ground is 75°.



[1] Light Indicator Module [2] Large Armor Module [3] Large Armor Module

Figure 4-16 Top View of Base

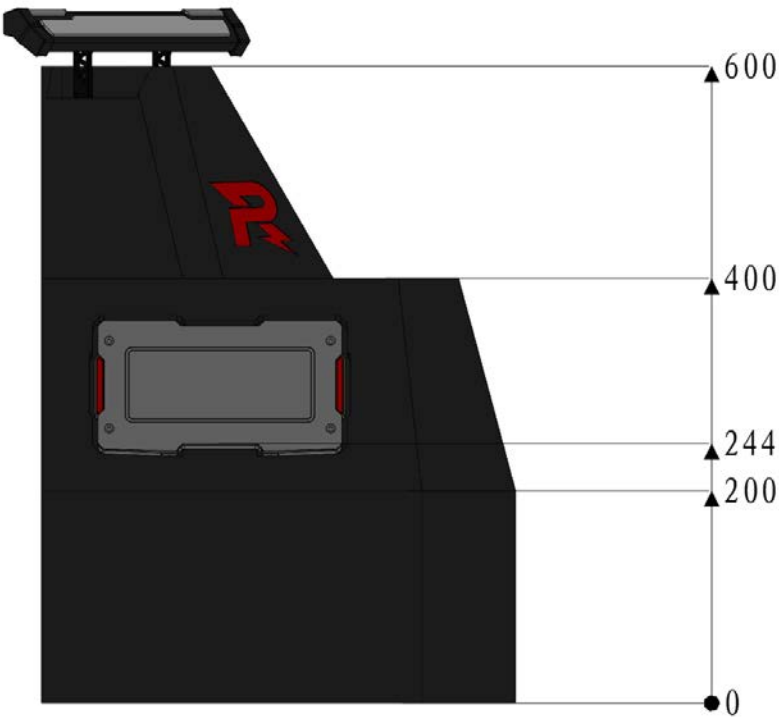


Figure 4-17 Side View of Base

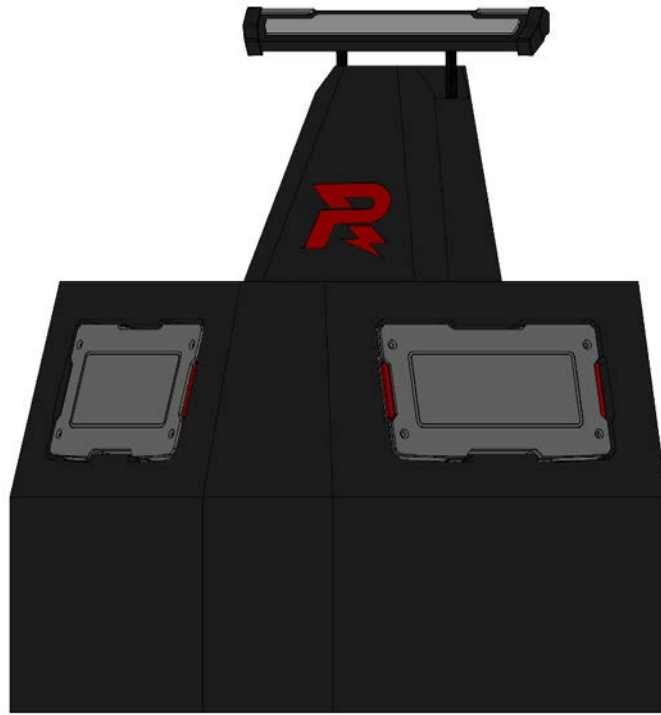


Figure 4-18 Axonometric View of Base

4.3.2.1.2 Sentry Rail

Sentry Rail consists of the main rail and its supporting frame. The main rail is the only area on which Sentry moves. The surface of the Sentry Rail is matte paint.

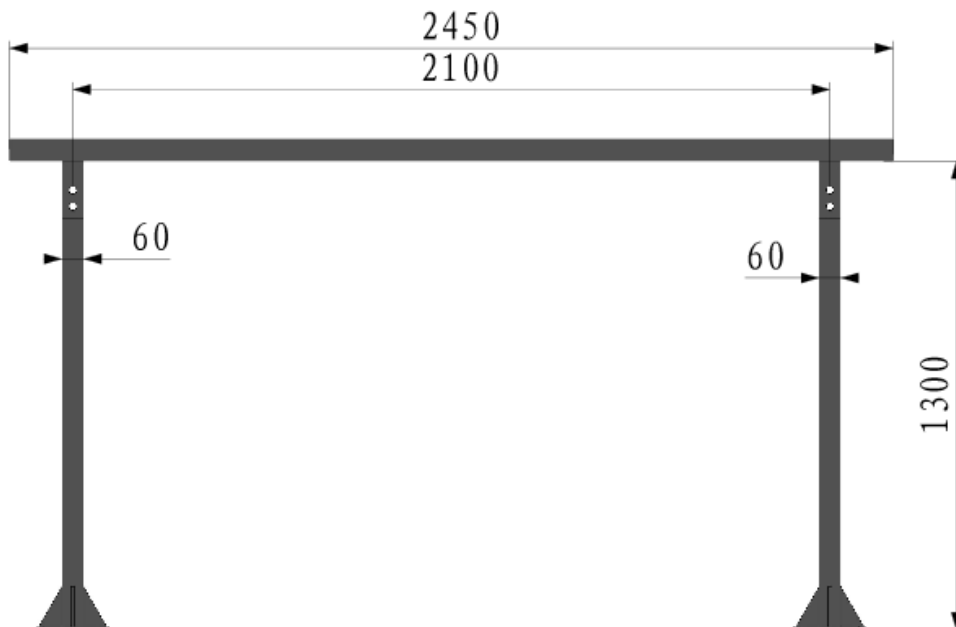


Figure 4-19 Front View of Sentry Rail

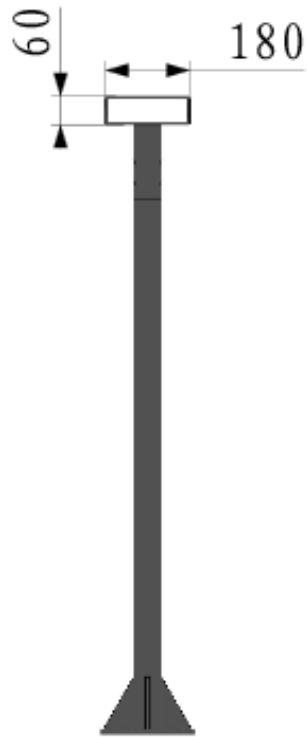


Figure 4-20 Side View of Sentry Rail

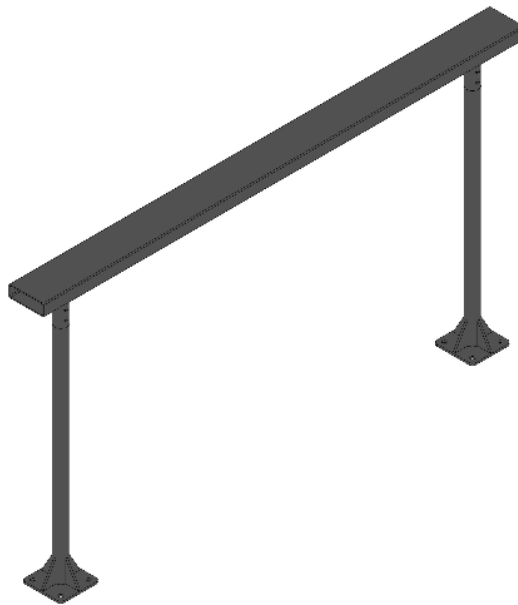


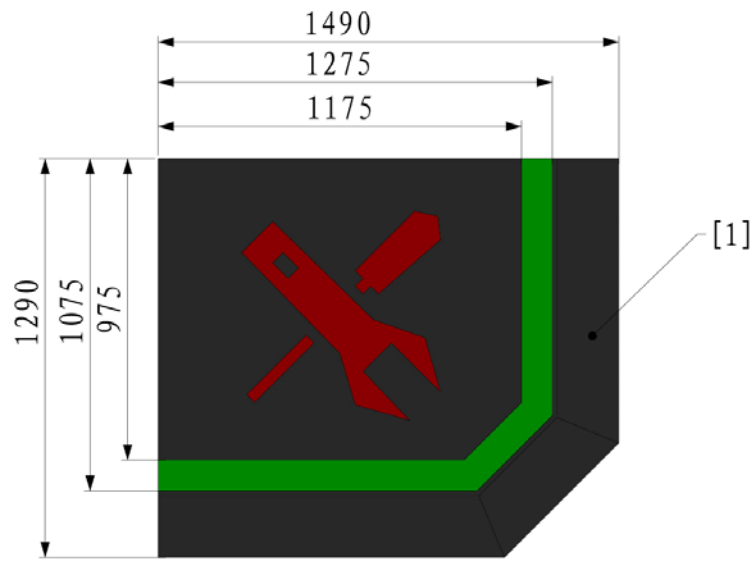
Figure 4-21 Sentry Rail Graph

4.3.2.2 Supplier Zone

The Supplier Zone is an important area for reloading the projectiles and restoring the HP of a robot. Each Supplier Zone consists of a Restoration Zone and Projectile Supplier Zone. Both Red and Blue Teams each have a Supplier Zone.

4.3.2.2.1 Restoration Zone

Each Supplier Zone has a Restoration Zone and the slope is 14°.



[1] 14° slope

Figure 4-22 Top View of Restoration Zone

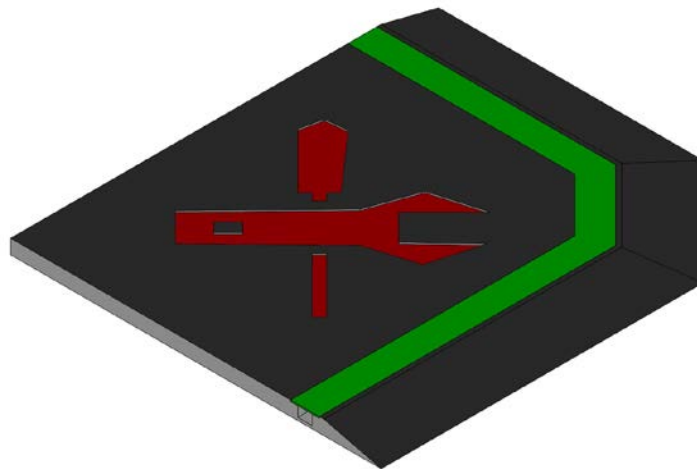


Figure 4-23 Axonometric View of Restoration Zone

When a surviving robot is at its own Restoration Zone and detects the RFID Interaction IC Card of the Zone (the valid detection area is within the yellow frame in the figure shown below), it will recover its HP at an amount equal to 5% of its maximum HP per second until its HP is fully restored.



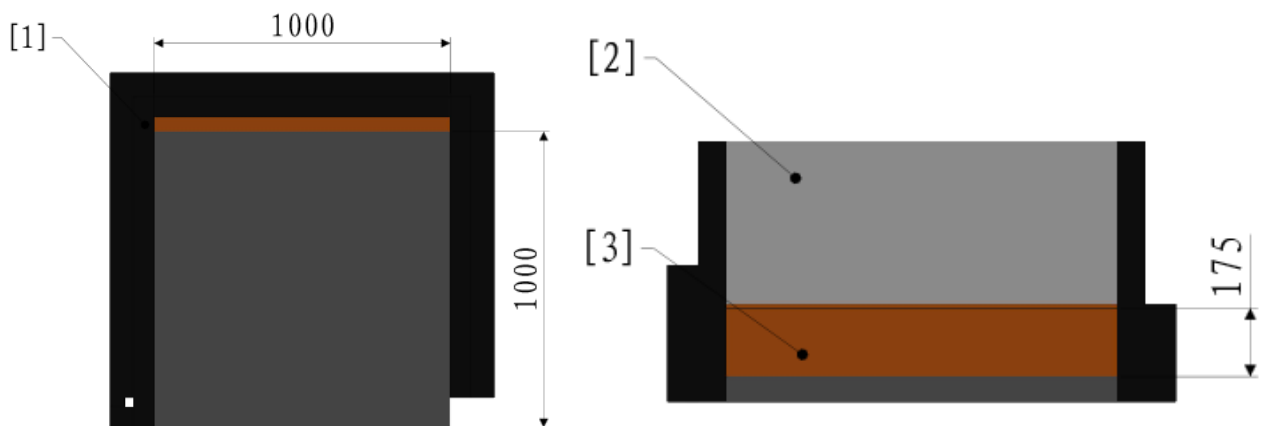
Figure 4-24 RFID Interaction IC Card Graph

4.3.2.2.2 Projectile SupplierZone

One of the sides of the Perimeter Wall of the Projectile Supplier Zone is mirror stainless steel.

In each round, a Supplier outside the Battlefield will supply 150 rounds 17mm projectiles for robots for twice. Operator needs to control the robot to the Projectile Supplier Zone, where he can observe the whole process of projectile supplying from the mirror reflection.

The projectile supply time is at the start of the first minute (countdown at 3:59) and at the start of the thirdminute (countdown at 1:59).



[1] Perimeter Wall [2] Mirror Material [3] EVA

Figure 4-25 Top View of Projectile Supplier Zone

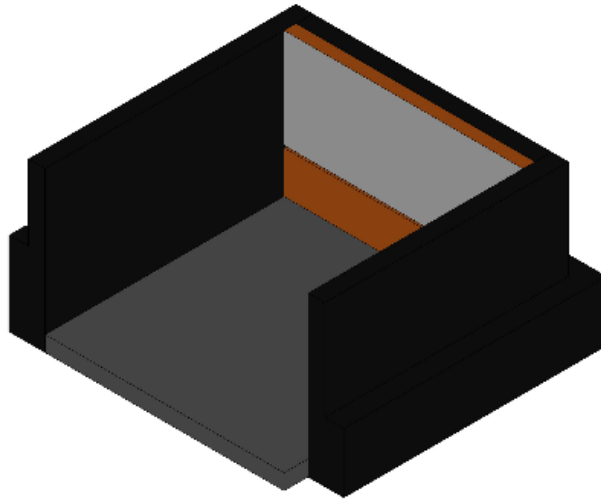


Figure 4-26 Axonometric View of Projectile Supplier Zone

4.3.2.2.3 Supplier Penalty Zone

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

4.3.2.3 Buff Zone

The Buff Zone is a hexagonal island zone located at the center of the Battlefield. The Buff Zone is divided into two sides by a Perimeter Wall, in the middle of which there is a feature area for observation (the actual effects will be based on conditions at the competition site). Both Red Team and Blue Team has its own Buff Zone. The slope for the Buff Zone is 22°.

Robot that occupies the Buff Zone of any side, in other words detects the RFID Interaction IC Card of the Zone (the valid detection area is within the yellow frame in the figure shown below), will receive a 50% defense and its barrel cooling value per second is increased to 5 times of its origin. Only robots of the first occupied team can gain this bonus. If the robot leaves this area for more than two seconds, the gain will be invalid.

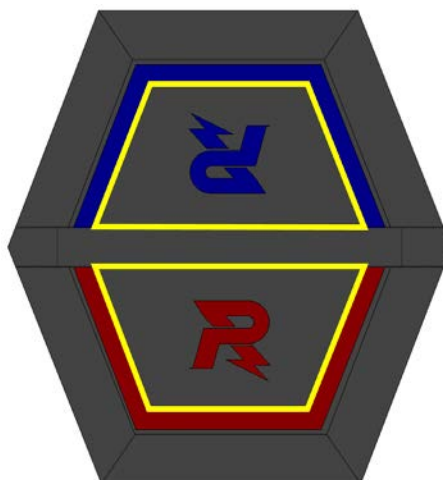


Figure 4-27 Top View of Buff Zone

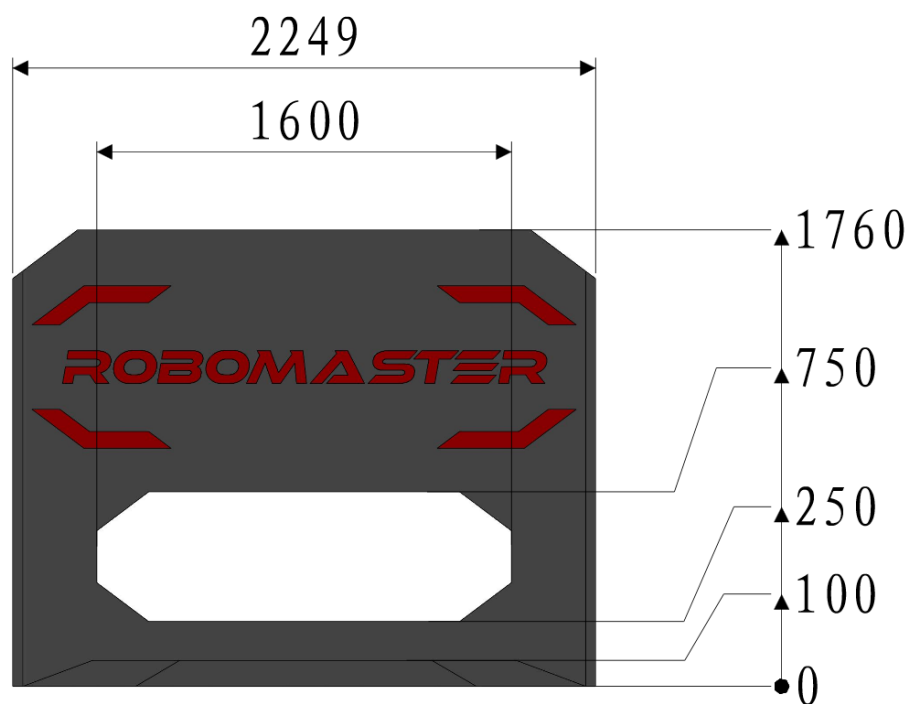


Figure 4-28 Front View of Buff Zone

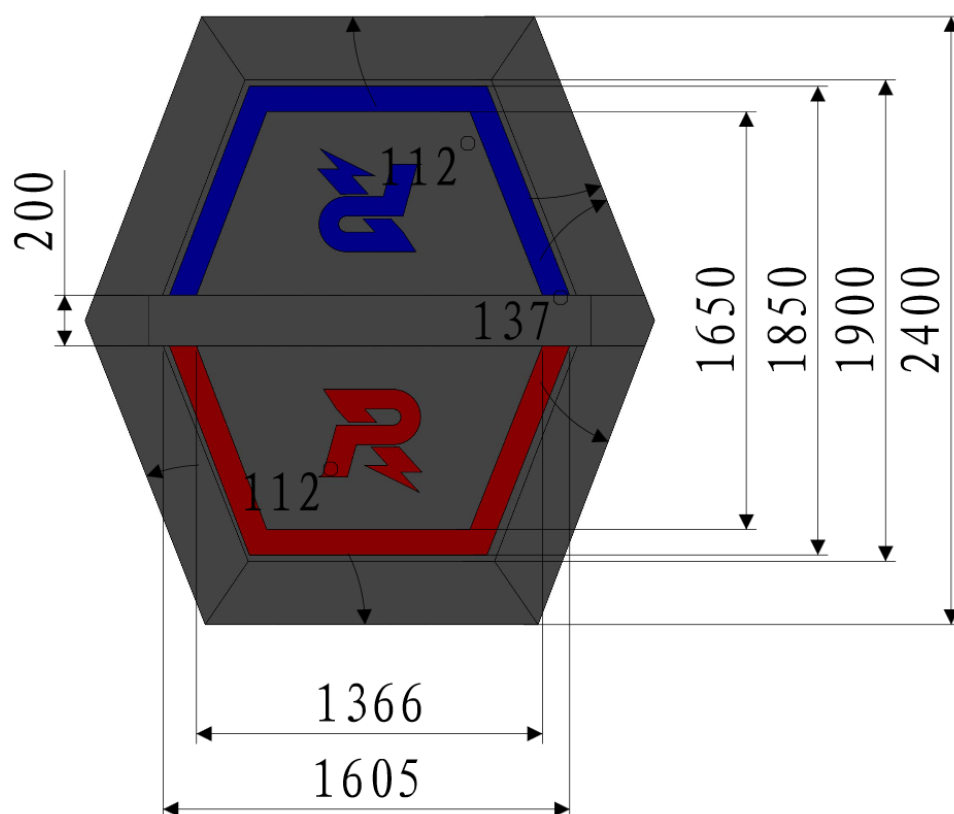


Figure 4-29 Buff Zone Size Graph

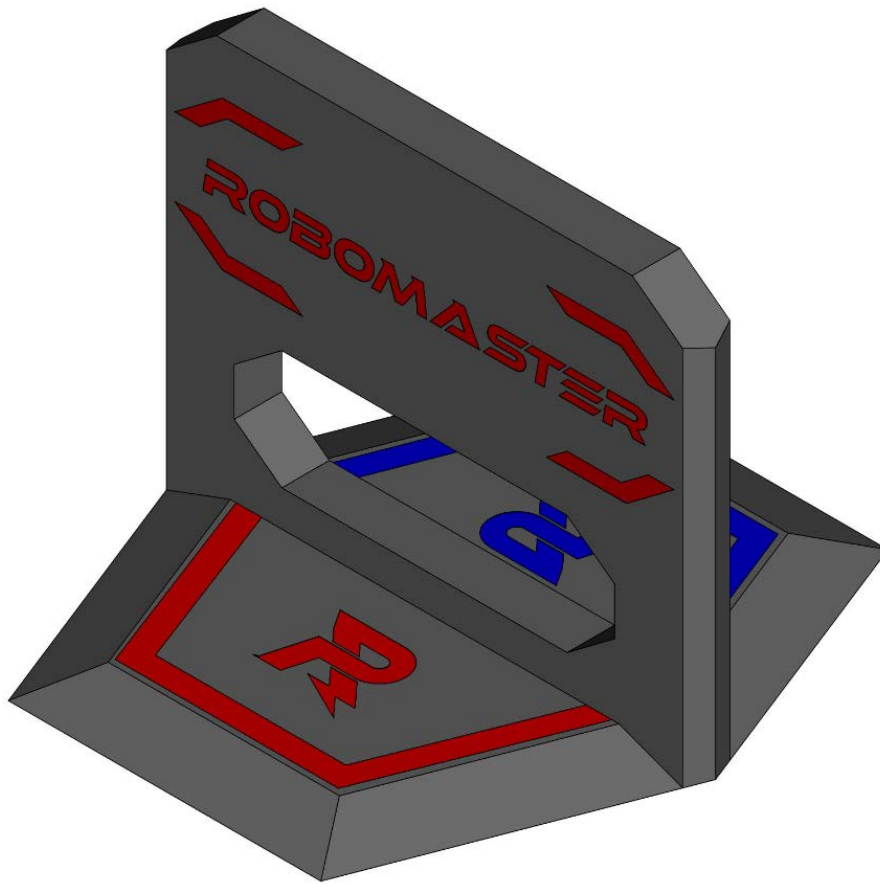


Figure 4-30 Axonometric View of Buff Zone

4.3.3 Rules

4.3.3.1 Competition Rule

During the competition round, Standard and Sentry of both sides engage in a 2V2 Confrontation in the Battlefield and attempt to shoot the Armor Modules in the opponent's Base.

4.3.3.2 Conditions for Winning

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

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

4. If a round has ended and the Bases of both teams have not been destroyed, the remaining Base HP of both teams are the same, and the total HP Deduction of both teams is the same, the team with the higher total Robot Remaining HP is the winner.

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

4.3.3.3 Group Stage

Depending on the competition system, both teams may compete in two or three rounds in a match. They are called BO2 and BO3 respectively, according to the general competition system descriptions of competitive games. 2V2 Confrontation consists of the Group Stage and the Knockout Stage. The competition system of Group Stage is BO2; the system of Knockout Stage is all BO3.

Table 4-2 Scoring for Group Stage

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

The ranking for the Group Stage is determined by the total points for each match. Teams are ranked based on the following order, 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 are the same, the team with the higher total HP Deduction ranks higher.
4. If the total HP Deduction of a team are the same, the team with the higher total Robot Remaining HP ranks higher.

If two or more teams are still tied for the same place according to these criteria, the RMOC will arrange a playoff

match on the basis of two extra rounds.



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

4.3.3.4 Knockout Stage

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

4.3.3.5 Eligibility

Awards are set in a certain proportion based on the scores.

4.4 Dart Targeting

4.4.1 Battlefield

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

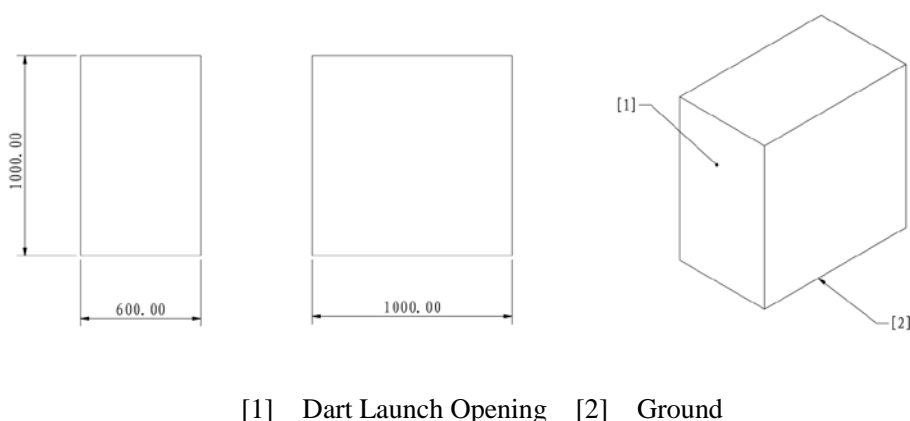


Figure 4-31 Internal Graph of Dart Launch Opening

4.4.2 Rules

4.4.2.1 Qualification

Each team must produce at least four Darts in order to participate.

4.4.2.2 Competition Rule

After the competition has begun, the team has a setup period of two minutes to adjust the Darts. Thereafter, the team must launch all the Darts within one minute.

4.4.2.3 Scoring Rule

Each successful hit at a subject by a Dart is counted as one valid hit.

4.4.2.4 Ranking Rule

Below is the team ranking rule in Dart Targeting:

1. Each team can initiate two challenges and take the highest total score of the two challenges as the final score. All teams will be ranked from high to low based on their total scores.
2. In the case of two or more teams having the same number of subject hits, the team whose last subject hit was achieved in the shortest time will be given the higher ranking (time is accurate to milliseconds and subject to server record time).

4.4.2.5 Eligibility

A team must have at least one valid subject hit to be shortlisted.

5. Competition Process

5.1 Pre-Match Inspection

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

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

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

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

Team members are required to declare the types of backup robots they are carrying during Pre-Match Inspection. Backup robots must be attached with armor stickers in the Inspection Area. The stickers must follow the requirements in the “Robot Production Specifications for RoboMaster 2020 Robotics Competition”.

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

5.2 Staging Area

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

If any team needs to repair its robots after entering the Staging Area, it must obtain the permission of the staff at the Staging Area. A robot of the applicant can only return to the Repair Area if a staff member at the Staging Area has removed the Pass Card on the robot and the Staging Area Statement originally signed is invalidated. When repair is

finished, the team must bring their robots back to the Inspection Area for another Pre-Match Inspection before reentering the Staging Area, and their team Captain must sign another Staging Area Statement. If a Staging Area Statement cannot be signed in time as a result of this delay, the robot will not be able to enter the match, and the team will bear its own consequences.

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

5.3 Setup Period

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

When the Setup Period is left with 30 seconds, the Operator should preferably be in the Operator Room to complete the debugging for the keyboard and mouse (which can be brought on your own), and double-check that the robot controls and official equipment are operating normally. If equipment in the Operator's Room cannot operate normally, the Operator must raise the issue before the Setup Period is left with 15 seconds. Otherwise, any request will not be entertained by the Technical Referee.

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

5.3.1 Official Technical Timeout

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

During an Official Technical Timeout, team members can only cooperate with the Technical Referee in eliminating the faults of the relevant Referee System modules and cannot repair other breakdowns. After the faults in the relevant Referee System modules have been eliminated and the Head Referee has resumed countdown, the team must comply with the specifications for the Setup Period and leave the Battlefield at the designated time.

5.3.2 Team Technical Timeout

If the mechanical structure of a robot, a software system, the keyboard or mouse in the Operator's Room or other equipment experiences any faults, the team Captain may make a request to the referee in the Battlefield or Operator's Room for "Team Technical Timeout" before the 15-second countdown in the Setup Period, and indicate the requested timeout length and reasons for the request. Once a Team Technical Timeout request has been made and conveyed to the Head Referee, the Technical Timeout cannot be revoked or revised.

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

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

To ensure that subsequent matches begin on time, only one Team Technical Timeout is allowed per the Setup Period on a first-come-first-served basis. After the match, the Match Results Confirmation Form will state whether Technical Timeout opportunities have been used during the match. The type of Technical Timeout allowed is determined by the Head Referee based on the request of the team. The team cannot dispute the type of Technical Timeout allowed, and the Technical Timeout process cannot be the basis for any appeal after the match.

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

Table 5-1 Team Technical Timeout Arrangement

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

5.4 Referee System Initialization Period

After the Setup Period, the match enters a 20-second Referee System Initialization Period. During the Initialization Period, the competition server will automatically detect the connection status of the client, the Referee System module status of the robot, Battlefield Component status, etc. If a robot of team experiences technical faults during the Initialization Period causing the initialization countdown to stop, a maximum of two Pit Crew Members for each

team are allowed to enter the Battlefield to check on the fault. After the fault has been rectified, the initialization countdown will resume, and the competition server will restore the HP of all robots, ensuring their HP are full when the match officially begins.

When the Referee System Initialization Period is left with 15 seconds, a clear countdown sound effect and live animation will be played. At this time, the keyboard connected to the computer in the Operator Room will be locked. The match starts immediately after the countdown finishes.

5.5 Competition Round

During the Round, robots from both teams will engage in tactical combat or complete the challenge on the Battlefield – the core Competition Area.

5.6 End of Competition

A round ends either when time has elapsed for the Round 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 the winner has been determined.

5.7 Match Results Confirmation

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

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

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

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

6. Competition Rules



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

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

Serious violations and appeals in the competition will be publicized.

6.1 Penalty System

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

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

The details of penalty system for the RM2020 Technical Challenge are as follows:

Table 6-1 Penalty System

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

Penalty	Description
	<ul style="list-style-type: none"> ● The current maximum HP of the offending robot will be deducted by 50%, and those of other surviving robots (except the Base) will be deducted by 5%. The HP deducted will be counted as the enemy's HP Deduction ● The offending robot will lose 4 points.
Ejection (Level 4 Warning)	<ul style="list-style-type: none"> ● The offending robot is ejected: In the round of the match, ground robots are immediately defeated by the Referee System (all HP deducted). Robots that are ejected cannot be revived. HP deducted from the ejection will be counted as the enemy's HP Deduction ● The Operator or other team members are ejected: Members ejected by the referee must immediately leave the Competition Area and no substitute Operators or Pit Crew Members are allowed in the remaining rounds of the match. The robot operated by the ejected Operator will be ejected for this round and at the start of all rounds of the current match. HP deducted from the ejection will be counted as the enemy's HP Deduction
Forfeiture (Level 5 Warning)	<ul style="list-style-type: none"> ● If a Forfeiture is issued before the match (not including the Setup Period) and the match has not yet started, the Pit Crew of the offending party must all leave the Competition Area. The offending party's Base HP is deducted to zero, and all the robots' HP of the offending party is full. The opposing team's Base HP and robots' HP remain their maximum. ● If a Forfeiture is issued during a match (including the setup period), the Head Referee directly kills all robots of the offending team via the Referee System, and the round is over. The offending party's Base HP is deducted to zero, and all the robots' HP of the offending party is based on the HP at the end of the match. The opposing team's Base HP and robots' HP remain at the amount when the round ends. ● If a Forfeiture is issued after the round due to an appeal, the offending party's Base HP is deducted to zero, and all the robots' HP of the offending party is based on the HP at the end of the match. The opposing team's Base HP and robots' HP remain at the amount when the round ends.

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

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

6.2 Rules

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

6.2.1 Personnel Rules

6.2.1.1 Participating Teams/Personnel

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

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

R1.2 For each institution of higher learning participating in the competition, only one team representing the institution is allowed to register for each challenge. In other words, multiple teams from one institution can register for four challenges, but they must follow the "Five Different Principles", which are different team name, different team members, different supervisors, different affiliated organizations (e.g. school of the college) and different participating robots.

R1.3 The team name must be in the format of "XXX-Team" ("-" is only a separator and should not appear in the actual team name), in which "XXX" is the personalized name of the team. The total length of the team name should not exceed 16 character units (each Chinese character is considered 2 character units, while each English letter is 1 character unit). The team name must not include the university/college name or its abbreviation in Chinese/English, or such Chinese characters as “队”, “团队” and “战队” (which mean "team" in English) or other special symbols such as "*/-+". The team name must reflect the proactive spirit and motivation of the team and comply with relevant national laws and regulations.

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

A. Before establishing an Intercollegiate Team, members must consider all their respective circumstances and communicate with each other thoroughly about team planning. Any operating and R&D costs, personnel arrangements or disputes arising therefrom must be handled by the Intercollegiate Team itself, for which the RMOC bears no responsibility.

- B. After an Intercollegiate Team has been established, it can only participate in the RoboMaster 2020 Technical Challenge in the name of the Intercollegiate Team. If an Intercollegiate Team is disbanded, the team will be deemed to have voluntarily dropped out of the competition.
- C. The registered team name shall be “Intercollegiate Team” instead of “Team”. An Intercollegiate Team Statement must be issued by the universities or colleges represented by the Intercollegiate Team, and must be submitted to the registration system. Refer to the registration system for the template of the Intercollegiate Team Statement.
- D. For an Intercollegiate Team consisting of Hong Kong, Macau, Taiwan and overseas team members, if more than 50% of the total number of regular team members are formal team members from Hong Kong, Macau, Taiwan and overseas, the Intercollegiate Team shall be categorized as a Hong Kong, Macau, Taiwan and Overseas team and directly participate in the Final Tournament. Otherwise, the Intercollegiate Team shall be categorized as a Mainland China team and must participate in the China Regional Competition.

R1.5 Any team member can only belong to one participating team during the RM2020 Technical Challenge.

Penalties:

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

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

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

R3 Team members are not allowed to power their equipment using the power supply for official equipment in the Competition Area. However, they may bring their own power supply.

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

R4 Except for emergencies, teams must be at the Inspection Area at least 30 minutes before the start of a match to

carry out the Pre-Match Inspection.

Penalties: Forfeiture of the match.

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

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

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

Penalties: Forfeiture of the match.

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

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

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

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

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

Penalties: The staff confiscate the projectiles.

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

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

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

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

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

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

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

Penalties: The offending team must bear the relevant responsibility.

- R14 Members from both teams must power off all their robots and remove them from the Competition Area after

the match is over. Teams are required to empty all projectiles from the robots at the Projectile Unloading Area.

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

6.2.1.2 Pit Crew Members

R15 Pit Crew Members must meet the identity and quantity requirements of the corresponding challenge. For details, refer to RoboMaster 2020 Technical Challenge Participant Manual.

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

R16 Pit Crews must wear armbands which must not be covered. The “Captain” sign of the Captain's armband must face the front.

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

R17 Pit Crews entering the Competition Area must not communicate with the outside world. During the Setup Period, the audience is allowed to give time reminders.

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

R18 During the final 30 seconds of the Setup Period or the final 20 seconds of a Team Technical Timeout, Pit Crew Members must leave the Battlefield as quickly as possible.

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

R19 After the end of the Setup Period, Pit Crew Members must return to the designated area outside the Battlefield.

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

R20 Pit Crew Members may debug the fully automated Sentry using a remote controller before entering the Referee System Initialization Period.

Penalties: Forfeiture of the round.

R21 During the match, other Pit crew Members apart from the Operators must remain in the Pit Area of the Competition Area unless otherwise permitted by the referee.

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

6.2.1.3 Operator



An Operator can be substituted after each round.

R22 The number requirements for Operators stated in [Table 1-3](#) must be met.

Penalties: Forfeiture of the round.

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

Penalties: Forfeiture of the round.

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

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

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

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

6.2.2 Robot Rules

6.2.2.1 General

R26 Robots entering a match must pass Pre-Match Inspection.

Penalties: Forfeiture of the round.

R27 In any challenge, the number of robot to play must meet the requirement stated in [Table 1-1](#).

Penalties: Forfeiture of the match.

R28 Robots must be attached with their corresponding stickers that meet the specifications.

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

R29 Robots are not allowed to leave the Staging Area without permission.

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

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

Penalties: Before the start of the competition, Pit Crew Members must resolve the safety issue as required by the referee. Otherwise the offending robot will not be allowed to enter the match, and the relevant Operator will not be allowed to enter the Operator's Room or must surrender its remote controller, and must return to the Pit Area. Verbal Warning given during the competition. If the Verbal Warning is ineffective, a Level 4 Warning shall be issued to the offending team member and the robot operated by him/her or the offending robot.

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

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

R32 During the competition, robots are not allowed to disintegrate into sub-robots or sub-systems connected by multiple flexible cables, and must not cast or launch their own parts.

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

R33 During the competition, apart from projectile supply reloads and rescues, robots are not allowed to cover their Armor Modules through transformation or sticking to one another to avoid attacks by other robots.

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

6.2.2.2 Ground Robots

R34 During the Setup Period, Ground Robots in the Battlefield are not allowed to leave their team's Starting Zone.

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

R35 Except for robots with initial projectiles, other robots must empty their projectiles during the Setup Period for each round until they are no longer able to launch any projectiles.

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

R36 During the Setup Period of the first round, Sentry must empty its projectiles until it is no longer able to launch

any projectiles, and then reload its initial projectiles.

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

R37 During the competition, Engineer is not allowed to use supplement lights except for procuring Projectile Containers.

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

6.2.3 Interaction Rules

6.2.3.1 Between Robots

R38 Except for slowly pushing away a defeated robot that is obstructing the path, a robot must not use any of its structures to collide with the enemy's robots, regardless of whether the opposing robot has already been defeated.

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

R39 A robot must not stick itself to any enemy robot through active interference, blocking or collision.

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

R40 A team's robots must not interfere with an enemy robot during a regular projectile supply reload, HP recovery or revival.

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

6.2.3.2 Robots and Battlefield Components

R41 Robots are not allowed to enter the Supplier Penalty Zone.

Penalties: Based on the length of time the robot was in the Penalty Zone, the offending team is issued a warning from Level 1 to 5.

R42 During any match in RM2020, participating robots can only use projectiles supplied by the RMOC.

Penalties: Verbal Warning

R43 Robots are not allowed to procure directly projectiles that have fallen to the ground.

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

R44 Standard is not allowed to procure projectiles from Projectile Containers on the Resource Island.

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

R45 Engineer is not allowed to grab more than one Projectile Container once or procure projectiles from more than one Projectile Container. Only when one Projectile Container has completely left the groove of the Resource Island can the next Projectile Container be taken.

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

R46 Engineer must not use adhesive materials to collect or place any projectile or Projectile Container.

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

R47 During the competition, the movements of robots must not cause any damage to the core components of the Competition Area.

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

6.3 Serious Violations

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

Table 6-2 Categories of Serious Violations

Rule	Type
1.	Violating rules mentioned in this chapter and refusing to accept penalties, for example a Pit Crew Member interfering with the regular work process of a referee.
2.	Situations have occurred in the Competition Area that violate Pre-Match Inspection requirements
3.	Causing delays deliberately or refusing to immediately leave the Competition Area after a match has ended, thereby disrupting the schedule of the competition
4.	Installing explosives or other prohibited materials on robots
5.	Team members using robots to collide with or attack other people deliberately, putting themselves and other people at risk of injury
6.	Team members deliberately damaging the opponent's robots, Battlefield Components and related equipment.

Rule	Type
7.	Serious verbal or physical conflicts between team members and the staff of the RMOC, opponent, audience, etc.
8.	Team members do not cooperate in inspections or cause delays deliberately when the RMOC is handling an appeal
9.	Other serious actions that disrupt the competition's schedule and violate the spirit of fair competition will be penalized accordingly by the Head Referee and Chief Referee based on to the actual acts of violation
10.	In respect of any violation of local laws and regulations occurring inside the Competition Area, Audience Area, dormitories or other relevant competition zones during the competition, the RMOC, apart from issuing the most severe penalty of "disqualification", will fully cooperate with the relevant authorities to pursue appropriate legal actions against the offenders
11.	Tampering with or damaging the Referee System, or interfering with any detecting function of the Referee System through technical means.
12.	Any other behavior that seriously violates the spirit of competition or has been determined by the Chief Referee as a serious violation

7. Technical Fault or Exception

7.1 Technical Fault

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

Table 7-1 Descriptions of Technical Fault

Rule	Description
1	The official equipment inside the Operator's Room malfunctions.
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	Structural damage or malfunctions of key Battlefield Components, for example: where a Base cannot open its shield normally; a Base Armor Module shifts, drops off or cannot detect hit damage; a Power Rune cannot be hit and triggered normally.
4	Other situations determined by the Head Referee as requiring an Official Technical Timeout.

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

7.2 Exception

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

- When a robot safety hazard or exception in a robot has occurred on the Battlefield, such as battery explosion, stadium power outage, explosion of a compressed gas cylinder, or interpersonal conflict), the Head Referee will notify both teams through the Operator's Room Referees after discovering and confirming the emergency, and kill all robots through the Referee System. The result of the round will be invalidated. The round will restart after the safety hazard or exception has been eliminated.
- If the general Battlefield Components are damaged during a match (damage to the ground rubber surface, ground lighting, or Base lighting), the match will proceed as usual. If there is structural damage or malfunction of key Battlefield Components (Base armor module shifts, drops or cannot detect hit damage, Power Rune cannot be triggered by normal hit), the Head Referee will notify both teams through the Operator Room

Referees after discovering and confirming the emergency, and kill all robots through the Referee System. The result of the round will be invalid. The Technical Referees will enter the Battlefield to perform repairs. The round will restart once the Battlefield Component resumes its normal function.

- If certain Battlefield Components experience logical or structural faults that are not caused by participants in the process of the match, for example where no bonus is gained after a Power Rune is hit or a Base cannot open its shield normally, the Referee will solve the problem manually through the Referee System. If the problem cannot be solved manually through the Referee System and after determining that the issue cannot be eliminated, the Referee will notify both teams through the Operator Room Referee and kill all robots through the Referee System. The round ends immediately and its result is invalidated. The round will restart after the issue has been solved.



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

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

8. Appeal

Each team has the right to one appeal during the China Regional Competition, Wild Card Competition, International Regional Competition, and Final Tournament. However, opportunities to appeal cannot be accumulated across competitions. If an appeal is successful, the team involved retains its right to appeal again in future matches. If it is unsuccessful, the team will have exhausted its one opportunity to appeal. When a team has exhausted its opportunity to appeal, the RMOC will no longer accept any appeal from the team. When processing an appeal, an Arbitration Commission will be formed by the Head Referee and heads of the RMOC. The Arbitration Commission has the final right of interpretation on all appeal decisions.

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

8.1 Appeal Process

Teams filing an appeal must follow the procedure below:

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

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

8.2 Appeal Validity

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

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

8.3 Appeal Material

Appeal materials submitted by teams must follow the below specifications:

- Material type: Only materials stored on a USB flash drive and the robots themselves will be accepted as appeal materials. Materials submitted in other forms will not be accepted by the Arbitration Commission.
- USB flash drives: The edited video (the video materials should be prepared by the team itself - the organizing committee will not provide any videos in order to stay impartial) and the text files for the appeal should be placed according to the directory.
- Material format: Each video cannot exceed one minute in length or 500MB in size. The name of the video must indicate the specific Round of the match and the time it was taken. Videos should be compatible with the latest version of Windows Media Player, photos must be in JPG format, and text documents must be in MS Word format and not exceed 1,000 words in length.
- Material naming: The file name of each video and photo must be within 30 Chinese characters.

- Text requirements: One text file can only correspond to one video or a photo, which must be indicated in the text. Text files only need to explain the violations reflected in the corresponding materials.
- Robot evidence: The Arbitration Commission has the authority to isolate any relevant robot from both teams after an appeal has been made. These robots will not be isolated for more than three hours and will be returned to the teams latest when the arbitration decision is announced.

8.4 Appeal Decision

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

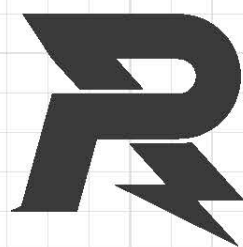
If the Arbitration Commission requires both teams to hold a rematch, the Organizing Committee will inform both teams of the rematch time when the arbitration decision is announced. If both teams refuse to hold a rematch, the appeal is deemed invalidated and the original match results are maintained,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

Appendix 1 Safety Instruction

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

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

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



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