RoboMaster 2018

Rules Manual

2018.06

V 2.1

The RoboMaster Organizing Committee (RMOC) reserves the right to revise these rules and has the final say on their interpretation.

Versions and Updates

Date	Version	Changes
9/26/2017	1.0	Release
12/1/2017	1.1	1. Decreased the air pressure value of the compressed gas source. 2. Reduced the number of Standard robots. 3. Adjusted the maximum speed of projectiles to 30m/s. 4. Updated the self-recovery parameters of Engineer robots. 5. Adjusted the frequency for calculating barrel heat to 10Hz. 6. Improved the robot experience system. 7. Updated the technical drawings and specifications of the Base Zone, Sentry Rail, projectile containers, airfield, and Power Rune. 8. Adjusted the kinds of robots that can request rescue and treatment. 9. Increased the number of times that deductions can be made and 50% discount rewards can be applied during different stages of the technical evaluation. 10. Added a Pre-match Inspection Form. 11. Adjusted the damage value of 17mm projectiles to 50. 12. Limited the number of projectile containers that Engineer robots and Hero robots can catch at the same time. 13. Specified the inspection frequency for the armor module.
4/4/2018	1.2	1. Added FAQs from December 27, 2017, January 23rd, 2018, and February 1st, 2018. 2. Added enemy sentry robots are powered off for 60 s once a team achieves First Blood 3. Adjusted the official number of projectiles in each match. 4. Limited the flight range of the aerial robots. 5. Completed form content and added a BOM form. 6. Established the bonuses provided by bunkers, bridge platforms, and side passages. 7. Added base and armor board sticker diagrams. 8. Damage from collisions adjusted to 25 HPs. 9. Updated the formula for calculating barrel heat and the relevant parameters and diagrams. 10. Updated the experience points needed for leveling up robots. 11. Standardized the referee system. 12. Updated the Pre-match Inspection Form. 13. Updated the diagrams of the different zones. 14. Updated the RM2018 official projectile color and material. 15. Updated the positioning module as an important module of the referee system 16. The distance between the lower edges of the armor of engineer robots cannot exceed 100 mm. 17. Refined the rules of optical mode.

		18. Added Assistance Column penalty area. **19. Updated Definitions of RoboMaster Terminology.** **20. Clarified the number and duration of "Competing Team's Technical Timeouts".**
06/15/2018	**2.0**	**1. Added FAQs up to 05/01/2018.** **2. Values of the Standards' HP, heat limit, cool-down rate, experience value in every level were changed.** **3. Values of the Hero's HP, heat limit, cool-down rate, experience value in every level were changed.** **4. Updated the revival procedure for the Standard, the Hero and the Engineer Robots.** **5. Added a penalty for unauthorized wireless gadgets used between team members.** **6. Added regulations for backup robots and relevant penalties.** **7. The penalty system changed from 4 levels to 5 levels.** **8. Added a penalty for robot false start.** **9. Changed regulations on unloading projectiles for the Sentry and the Aerial.** **10. Changed the Base defense mechanism.** **11. Added health restoration mechanism for the Sentry. Removed the penalty for the Sentry launching projectiles during the Setup Period.** **12. Updated the size limit for the Sentry.** **13. Video transmission from the Aerial will be cut off when the Aerial has 0 HP.** **14. Changed values of heat limit, cool-down rate of the Sentry and the Aerial. Changed the power off time of the Sentry.** **15. Changed the Engineer's restoration effect cool-down time.** **16. Added a mechanism that gives the Standard fast cool-down rate when HP is low.** **17. Changed HP deduction value for violations of 42mm projectile speed limit.** **18. Deleted extra experience value for the first blood effect.** **19. Updated the Battlefield related figures.** **20. Changed the number of 42mm projectiles in mixed projectile containers** **21. Updated violations and penalties in the Resource Island.** **22. Removed small armors of the Base. Removed the logo ball above the Base.** **23. Changed the value of defense bonus from Resource Islands and Bunkers.** **24. Updated the penalty for putting projectile containers on Resource Islands.** **25. Added further explanation on ejected team members.** **26. Added one more winning criteria: remaining total HP.** **27. Added rules for the pilot and the gimbal operator when the Aerial is absent from the competition.** **28. Changed robot requirements in the second round or later rounds.**

		29. Updated regulations and penalties for unloading projectiles for robots. **30. Updated rules for Team's Technical Timeouts.** **31. Changed the design of number stickers.** **32. Added a painting requirement for the Engineer Robot.**
06/20/2018	**2.1**	**Fixed typos and format bugs**

Contents

Organization

SZ DJI Technology Co., Ltd.

Competition Background

Robotics is currently one of the most cutting-edge technologies in the world and is now entering a new era after over 50 years of development. The next three to five years will see a massive upsurge in the global robotics industry. With this in mind, the RoboMaster competition was created to keep up with these developments and hone the skills required by today's modern robotics industry.

The RoboMaster tournament encourages innovation in robotics automation and intelligent technology while placing robot competition at its core. Previous competitions have seen robots designed and developed by young engineers - most of whom were university students. RoboMaster competitions highlight the importance of both engineering capabilities and teamwork skills, which are essential in developing the innovative abilities, technical skills, and communication capabilities of young engineers.

All participants in RoboMaster 2018 must follow the competition rules and guidelines as set out in the relevant documents. These documents are the *RoboMaster 2018 Rules Manual, RoboMaster 2018 Competition Manual*, and *RoboMaster 2018 Referee System Specification Manual*.

Please note that only the latest versions of the three of the previously-described documents issued by the RoboMaster Organizing Committee are valid.

This document (the *RoboMaster 2018 Rules Manual*) and all the rules contained within it are literal in meaning. Participants should not infer or twist any interpretation of the rules expressed in this manual; refer to regulations from previous competitions; or base the design of their robots on any rules, Battlefield sizes, or projectile specifications that were stated in previous manuals.

Objectives

Raising Awareness of the Robotics Industry

The tournament draws attention to the robotics industry through its intense competition, strict scientific standards, and innovative event scheduling.

Promoting A Practical Approach to Education

This competition is designed to promote and develop practical teaching methods within higher education establishments. Our core philosophy is that students learn best from hands on experience, and from testing their designs in a competitive environment where they must adapt on the fly. Robomaster strives to build the skills of teaching staff who work in the robotics field and to encourage undergraduate students, graduate students, and Ph. D students to combine their ongoing studies and research with real world competition. By building units an testing them in the field, we hope students can better apply their scientific research theories in practice. In this way, we hope to cultivate a group of outstanding scientists and engineers, as well as promote the transformation of scientific and technological achievement. As student teams grow their school clubs, we hope these can become functional teaching centers and open, creative technology labs.

Encouraging Participation from the Public

Robomaster was designed from the beginning to appeal to a broad audience and to make complex technology into a entertaining spectator sport. Over 26 million people watched the tournament online last year, and more than 40,000 attended the event in person. During the Robomaster tournament, the area around the stadium becomes a carnival focused on robotics, innovation, and STEM education. Robomaster partners with other high tech companies to offer the public an interactive experience that highlight scutting-edge scientific and technological achievements. This event is intended for all ages, with plenty of activities suitable for adults and children.

Fostering Academic Collaboration

In addition to the competition, this event also focuses on bringing schools from around the world together to share their ideas, experience, and technological achievements. At the Talented Engineer Conference, a half day long event held at coference center, faculty and students from Robomaster teams can interact with one another and with engineers from Robomaster and DJI. The goal is to encourage the exchange of ideas, similar to an event like Apple’s World Wide Developer Conferece.

Chapter 1: Introduction

The core theme of the RoboMaster competition is a game of battle tag, featuring robots equipped with projectile launchers and a referee system that can sense projectile hits. Each team must design and build an team of robots that meet all rules and regulations of the competition and enter into battle against robots from other teams. These robots can either be remotely operated or fully-automated, and they should be able to independently collect projectiles placed in the Competition Area and use them to attack the opposing team's robots and Base Zone to win matches.

We think tag is the best analogy, because it's a fun game that involves physical contact (which is critical to robotics technology) by does not condone violence. RoboMaster does not allow teams to build robots that can cause structural damage to one another and discourages players from crashing their robots into one another.

A number of changes have been made to this year's RoboMaster competition. This includes improving the limitation mechanism for the speed and frequency at which projectiles can be fired, redesigning the tasks of the Hero and Engineer robots, adding a new robot model called Sentry to the Battlefield, and enhancing the strategic positioning of the Aerial robot. Bases have also been changed to become a crucial Battlefield element and will be provided by the RoboMaster Organizing Committee. Finally, Resource Islands on the Battlefield have been modified and two Bunker Areas are added.

1.1 Schedule

Every team must accurately fill in the registration form on the official RoboMaster registration website. Please go *to* *https://www.robomaster.com/en-US/user/login* and make sure you complete all of the requirements for each stage before the specified deadlines. Teams will be admitted and allowed to start their research and development for the competition after successfully passing the Rules Quiz. They will then be qualified to attend Regional Competitions after meeting the Technical Assessment requirements and passing the Referee System Examination. Teams are only eligible to participate in the Final Tournament if they attain good results in the Regional Competition or Wild Card Competition.

Notice:

It is recommended that teams draft a 2018 Season Schedule to evaluate their personnel and funding requirements. Teams are also advised to calculate a budget for making their robots to avoid wasting funds at the beginning of the preparation stage.

The following dates for RoboMaster 2018 are provided for reference.

Dates	Item	Location	Applicable to	Content
Sep. 01, 2017	Season starts			
Sep. 25, 2017 - Nov. 20, 2017	Official Website Registration	Online	Domestic Teams (Mandatory)	Log in to the RoboMaster official website and complete the registration process.
Sep. 25, 2017 - Nov. 20, 2017	Official Website Registration	Online	Invited Teams (Mandatory)	
Oct. 2017	Competition Rules Quiz	Online	Domestic Teams (Mandatory) Invited Teams (Optional)	After passing the Competition Rules Quiz, teams will receive discount coupons for educational materials or products related to the competition. They can also submit their Season Schedule and Project Proposal.
Oct. 2017 - Dec. 2017	Season Plan	Online	Optional	After passing an evaluation by the RoboMaster Organizing Committee, teams will receive discount coupons for educational materials related to the competition.
November 6, 2017 - May 15, 2018	Project Proposal	Online	Domestic Teams (Mandatory)	After passing an evaluation by the RoboMaster Organizing Committee, teams will receive discount coupons for educational materials related to the competition and obtain complete submission authorizations.
Batch 1: March 15, 2018 - March 23, 2018 **Batch 2: March 24, 2018 - April 6, 2018**	Robot Assessment Video	Online	Domestic Teams (Mandatory)	After passing an evaluation by the RoboMaster Organizing Committee, teams also receive discount coupons for educational materials related to the competition. They are also eligible for the Referee System Examination.
By April 7, 2018	Referee System Examination	Online	Domestic Teams (Mandatory)	After passing an evaluation by the RoboMaster Organizing

Dates	Item	Location	Applicable to	Content
				Committee, teams will receive discount coupons for educational materials related to the competition. They can also access the Referee System and attend Regional Competitions.
By Friday, April 27, 2018	Project Proposal Robot Assessment Video	Online	Invited Teams (Mandatory)	After passing an evaluation by the RoboMaster Organizing Committee, teams will receive discount coupons for educational materials related to the competition. They can also access the Referee System and attend International Regional Competitions.
May 8, 2018 - May 13, 2018	Southern Regional Competition	Foshan	Domestic Team	Teams from Mainland China can either select their region independently or accept the selection made by the RoboMaster Organizing Committee. The ability to choose a region depends on the score received during the Technical Assessment.
May 15, 2018 - May 20, 2018	Central Regional Competition	Nanjing		
May 22, 2018 - May 27, 2018	Northern Regional Competition	Beijing		
July 18, 2018, July 22, 2018	International Regional Competition	Shenzhen	Invited Team	After passing the Technical Report assessment, teams can attend the International Regional Competitions.
July 18, 2018 - July 23, 2018	Wild Card Competition	Shenzhen	Domestic Team	Teams that come in second in the Regional Competitions can attend the Wild Card Competition.
July 21, 2018 - July 29, 2018	Final Tournament	Shenzhen	Domestic Teams and Invited Teams	Teams that come first in the Regional Competitions or win the Advanced Award in the Wild Card Competition can attend the Final Tournament.
August 31, 2018	Season ends			

1.2 Prizes

1.2.1 Final Tournament

Award	Ranking	Qty.	Reward
Grand Prize	Champion	1	Championship Trophy Championship Medals Grand Prize Certificate Certificate of Honor Approx. $79660 USD (pre-tax)
	First Runner-up	1	Regional First Runner-up Trophy First Runner-up Medals Grand Prize Certificate Certificate of Honor Approx. $47,800USD (pre-tax)
	Second Runner-up	1	Regional Second Runner-up Trophy Second Runner-Up Medals Grand Prize Certificate Certificate of Honor Approx. $16,000 USD (pre-tax)
	4th Place	1	Grand Prize Certificate Certificate of Honor Approx. $16,000 USD (pre-tax)
	5th to 8th Place	4	Grand Prize Certificate Certificate of Honor Approx. $8,000 USD (pre-tax)
Second Prize	9th to 16th Place	8	Second Prize Certificate Certificate of Honor Approx. $4800 USD (pre-tax)
Third Prize	17th to 32nd Place	16	Third Prize Certificate Certificate of Honor

Remark: The exact name of awards will be slightly adjusted.

1.2.2 Wild Card Competition

Award	Ranking	Qty.	Reward
Wild Card Competition Advanced Award	1st to 4th	4	Qualification for the Final Tournament

Remark: The exact name of awards will be slightly adjusted.

1.2.3 Regional Competitions

Award	Ranking	Qty.	Reward
Regional Competition - Grand Prize	Regional Champion	1/region	Regional Champion Trophy Regional Grand Prize Certificate Certificate of Honor Approx. $4800 USD (pre-tax)
	Regional First Runner-up	1/region	Regional First Runner-up Trophy Regional Grand Prize Certificate Certificate of Honor Approx. $4800 USD (pre-tax)
	Regional Second Runner-up	1/region	Regional Second Runner-up Trophy Regional Grand Prize Certificate Certificate of Honor Approx. $4800 USD (pre-tax)
	Teams that come 4th to 8th in each region. Quotas are set according to the respective number of teams in each region	16	Regional Grand Prize Certificate Certificate of Honor Approx. $4800 USD (pre-tax)
Regional Competition - Second Prize	Teams who get a high score in each region (except teams that go straight through to the Final Tournament). Quotas are set according to the respective number of teams in each region	4	Regional Second Prize Certificate Certificate of Honor
Regional Competition - Third Prize	Teams that do not don't receive a first or second prize in Regional Competitions	Several	Regional Third Prize Certificate Certificate of Honor

Remark: International Regional Competition is classified as one of Regional Competitions.

1.2.4 Outstanding Contribution Awards

Award	Remarks	Qty.	Reward
Outstanding Supervisor	Outstanding Supervisor in the Final Tournament	4	Certificate of Honor Approx. $3,200 USD (pre-tax)
	Outstanding Supervisor in the Regional Competitions	4	Certificate of Honor Approx. $800 USD (pre-tax)
Outstanding Captain	Outstanding Captain in the Final Tournament	4	Certificate of Honor Approx. $800 USD (pre-tax)
	Outstanding Captain in the Regional Competitions	4	Certificate of Honor Approx. $320 (pre-tax)
Outstanding	Outstanding Advisor in the Final	4	Certificate of Honor

Award	Remarks	Qty.	Reward
Advisor	Tournament		Approx. $800 USD (pre-tax)
	Outstanding Advisor in the Regional Competitions	4	Certificate of Honor Approx. $320 (pre-tax)
Outstanding Volunteer	Outstanding Volunteer in the Final Tournament	10	Certificate of Honor Approx. $480 USD (pre-tax)
	Outstanding Volunteer in the Regional Competitions	4	Certificate of Honor Approx. $160 USD (pre-tax)
Outstanding Project Manager	Outstanding Project Manager in the Final Tournament	4	Certificate of Honor Approx. $480 USD (pre-tax)
	Outstanding Project Manager in the Regional Competitions	4	Certificate of Honor Approx. $160 USD (pre-tax)
Outstanding PR Manager	Outstanding PR Manager in the Final Tournament	4	Certificate of Honor Approx. $480 USD (pre-tax)
	Outstanding PR Manager in the Regional Competitions	4	Certificate of Honor Approx. $160 USD (pre-tax)
Outstanding Technical Report		10	Certificate of Honor
Most Creative Robot Design		4	Certificate of Honor

1.2.5 Open-Source Technology Awards

Award	Remarks	Amount	Reward
Open-Source Technology - Grand Prize	During RoboMaster 2018 season (Sep 01, 2017 to Aug 31, 2018), teams can make their core technology available as open-source on the RoboMaster online forum or official website to advance the RoboMaster competition and carry forward the spirit and culture of engineering.	Several	Certificate of Honor Approx. $16,000 (pre-tax)
Open-Source Technology - Second Prize		Several	Certificate of Honor Approx. $8,000 (pre-tax)
Open-Source Technology - Third Prize		Several	Certificate of Honor Approx. $4,800 USD (pre-tax)

1.3 Intellectual Property Statement

Teams own all the intellectual property they developed during this competition. The RoboMaster Organizing Committee respects the intellectual property created by all teams. The RoboMaster Organizing Committee encourages and advocates technical innovation and open-source movement. The RoboMaster Organizing Committee will not get involved in dealing with intellectual property disputes between team members. All teams should appropriately manage the ownership of the intellectual property created by its members from

educational institutions, companies, and other entities.

While using the RoboMaster Referee System and other supporting materials provided by the RoboMaster Organizing Committee, teams should respect the ownership 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, copying, or translation.

1.4 Updates to the Rules and FAQs

RoboMaster 2018 Rules Manual will be updated to reflect the conditions of this year's event. The changes will include follows:

1. Minor adjustments to specifications (such as the number of projectiles allowed, power limits, etc.) to provide a more even playing field.
2. Modifications to rules that allowed teams to gain an unfair advantage through non-technical means.
3. Additional penalties for actions that result in an unfair advantage during competition.

To ensure a fair and engaging competition, the RoboMaster Organizing Committee will issue *RoboMaster 2018 Rules Manual Supplement&Amendment Notice* (otherwise known as Amendment Notice) to explain and update changes to game rules during important competitions.

Amendment Notice usually comes in two forms:

1. Extracts of rules from the latest edition of the *RoboMaster 2018 Rules Manual* and amendments to the original rules as supplementary instructions.
2. The addition of new rules, descriptions, and penalties.

When interpreting the rules, *Amendment Notices* take precedence over the latest version of the *RoboMaster 2018 Rules Manual*. Rules and regulations that are not mentioned in the Amendment Notice should be interpreted based on the latest version of the *RoboMaster 2018 Rules Manual*. The revised rules in the Amendment Notice will be updated into the Rules Manual, and thereafter, the amendment statement will be invalid.

Platforms for Communication and FAQs Regarding Game Rules	
Platform	**bbs.robomaster.com**
Telephone	0755-36383255
Official Email	robomaster@dji. com

Chapter 2: Team Requirements

2.1 Participants

The RoboMaster competition advocates the spirit of teamwork. To encourage all team members to play an equally important role in their team, the RoboMaster Organizing Committee rewards team members who contribute the most throughout the various stages of the RoboMaster competition, and selects the most outstanding team members to receive rewards such as Outstanding Captain, Outstanding Supervisor, etc.

Every team must have different team members serving in the following roles:

Team Member	Role	Qty.	Potential Candidates
Supervisor	A professional representative from a higher education institution who mentors the team throughout the competition.	1-5	An instructor, professor, or any other member of faculty teaching staff from a higher education institution who is qualified to perform scientific research and teaching.
Advisor	Senior team members or professional engineers who guide the team in strategy, technology, and/or management.	0-5	Current full-time college or university students, undergraduate students, postgraduate students, or Ph. D. students enrolled in a higher education institution; or engineers, scientists, or researchers working in an enterprise, research institute, or acting as freelancers.
Captain	The student leader of the team to direct all technological and strategic aspects; also serves as the main contact person for the team.	5-35	Full-time college or university students, undergraduate students, postgraduate students, or Ph. D. students enrolled in a higher education institution before August 2018.
PR Manager	The PR Manager leads the promotion of the robotics team and other competition-related projects.		
Project Manager	Oversees the entire project.		
Team Member	Team Members are separated into groups that serve in technical or operational roles. The technical groups may include mechanical group, electrical & control group, or algorithm & computer vision group.		

The responsibilities of each role are as follows:

Supervisor

As the team's professional mentor, the Supervisor serves as a leader and guardian who is responsible for building and managing the team. The Supervisor's responsibilities include:

- The safety of team members and their property.
- Directing and managing team expenses during the contest.
- Ensuring that the Captain and Project Managers report project progress and other issues to the RoboMaster Organizing Committee.
- Instructing the team in drafting plans, solving R&D issues, and completing Technical Reports on time.
- Helping the team to complete the contest successfully.
- Actively cooperating with the RoboMaster Organizing Committee throughout the competition.

The Supervisor cannot also serve as an operator, Project Manager, PR Manager, or Advisor at the same time.

Advisor

A person who is not a current student or instructor in the team's school (including people designated by sponsors, professional engineers, scientists, or researchers working in an enterprise or scientific research institution) can join the team as an Advisor. Advisors can be involved with tasks such as the manufacturing of robots and other competition affairs, but cannot also serve as a Supervisor, Captain, Operator, Project Manager, or PR Manager at the same time.

Captain

The Captain is responsible for the team's technology and strategies. The Captain's responsibilities include:

- The division of work, central planning, as well as the arrangement and modification of strategies.
- Attending pre-match meetings.
- Representing the team to confirm the results of each match.
- Representing the team during the appeals process and any subsequent hearings.

The Captain can also serve as an operator; however, they may not also hold the post of Project Manager, PR Manager, or Advisor at the same time.

Project Manager

The Project Manager oversees the entire project. The Project Manager's responsibilities include:

- Managing the project's overall progress.
- Comprehensively considering R&D costs, work safety, and other issues.
- Making overall management decisions including those related to project targets (e. g. progress, outcomes, costs, etc.).

The Project Manager can also serve as the PR Manager at the same time.

PR Manager

The PR Manager serves as the lead role for all public relations to support the team throughout the competition. The PR Manager's responsibilities include:

- Integrating the team's promotional materials and establishing a comprehensive promotional system.
- Planning and organizing promotional activities via multiple platforms to increase the team's exposure.
- Find sponsors for the team.

The PR Manager can also serve as the Project Manager at the same time.

Team Members

Team members are usually divided into the following groups, with each group having specific responsibilities:

- Technical Groups - Overseeing the R&D of robotics design and manufacturing.
- Operations Group - Promotion, organizing, and planning of the competition.
- Operator Group - Operating robots during matches throughout the competition.

2.2 Team Regulations

1. A team must have the backing of a higher education institution. The team's Supervisor must also be an instructor, professor, or other teaching staff member from that institution who is qualified to perform scientific research and teaching.

Violations:

Registration is rejected.

2. A single educational institution may only enter one team into the competition. Institutions that have multiple campuses and therefore make it difficult for students to work together may be allowed to have more than one team. However, this must first be verified by the RoboMaster Organizing Committee. Teams must also receive authorization from their school to enter the competition and submit proof of this during the registration process. For the authorization letter template, check the registration system.

Violations:

Registration is rejected.

3. Each team shall be named "Team (team name), (university name)". Teams may abbreviate their

university name if preferred. The total length of the team name should not exceed 16 English letters or 8 Chinese characters. The team name must be positive and inoffensive, as well as comply with all related regulations and laws (e. g. copyright laws). The RoboMaster Organizing Committee reserves the right to use all or part of a team's name to facilitate live competition broadcasts. If a team must use its full team name due to a requirement of sponsors or their school, a statement must be submitted to the RoboMaster Organizing Committee.

Violations:

Registration is rejected until the team name meets the aforementioned requirements.

4. Members from two or more schools can form a Joint Team. Before the establishment of a Joint Team, members must sufficiently communicate with each other about establishing the team. Once confirmed, the Joint Team cannot be separated and is only allowed to attend RoboMaster 2018 as a joint effort. The team itself must deal with any operating and R&D costs, personnel distribution, or disputes that may arise within a Joint Team. The RoboMaster Organizing Committee assumes no responsibility for any of these issues. The school names of the team members in the Joint Team must also be abbreviated. The registered team name (as seen in Point 3) is "Joint Team" instead of "Team". The Joint Team must also submit a joint team statement during the registration process. For the joint team letter template, check the registration system.

Violations:

Registration is rejected until the team name meets the aforementioned requirements. If a Joint Team disbands after passing the Technical Report stage, they are viewed as having voluntarily dropped out of the competition.

5. Each team must have between 5 and 35 members (excluding Supervisors and Advisors.)

Violations:

Registration is rejected until the number of team members meets the aforementioned requirement.

6. Each team must have one Captain, one Project Manager, and one PR Manager.

Violations:

Registration is rejected until the team member information meets the aforementioned requirement.

7. Each team must have at least one, but no more than five Supervisors.

Violations:

Registration is rejected until the number of Supervisors meets the aforementioned requirement.

8. Teams may have up to five Advisors (however Advisors are not a mandatory requirement.)

Violations:

Registration is rejected until the number of Advisors meets the aforementioned requirement.

9. No team member (including the Supervisor, Captain, PR Manager, or other team members) may be part of multiple teams during the RoboMaster 2018 competition.

Violations:

Once the Chief Referee has confirmed the situation, the offending participant and every team he/she is part of is regarded as cheating.

2.3 Types of Teams

Domestic Team: A team from Mainland China that passes the registration evaluation and technical evaluation within the required timeframes and meets all the requirements to participate in the competition.

Rights: Eligible to enter formal competitions to qualify for subsequent rounds; can receive awards as set out in the award rules.

Invited Team: Teams who receive an invitation to compete from the RoboMaster Organizing Committee. After accepting the invitation, the team must pass the registration and technical evaluations within the required timeframes and meet all the requirements to participate in the competition.

Entry Requirements: Invited Teams are usually teams from educational institutions outside of Mainland China. As education systems differ around the world, Invited Teams are not subject to the same educational requirements as Domestic Teams.

Rights: Eligible to enter formal competitions to qualify for subsequent rounds; can receive awards as set out in the award rules.

Wild Card Team: A team that registers within the required timeframe but does not meet the requirements of the technical evaluation and is nevertheless still invited to compete by the RoboMaster Organizing

Committee.

Rights: Eligible to enter the competition, however cannot qualify for subsequent rounds or receive awards as set out in the award rules.

2.4 Sponsorship Regulations

In order to find financial, material, and other assistance, teams are encouraged to seek sponsorships independently. To attract potential sponsors, teams can not only promote their university but also leverage the brand image of the RoboMaster competition as well. However, teams must follow the guidance of the RoboMaster Organizing Committee, and teams should make it clear to their sponsors that sponsoring a team is not the same as sponsoring the entire RoboMaster competition. Please refer to the *RoboMaster 2018 Competition Manual* for further details.

Violations:

Any behavior that damages the RoboMaster brand, trademark, or its intellectual property will be investigated and affixed legal liability according to law.

Chapter 3: Robot Technical Specifications

All teams are expected to develop and build robots through independent research, learning, and effort. Teams can purchase the robotic components and modules necessary for building robots from SZ DJI Technology Co., Ltd. or other manufacturers. Please refer to the *RoboMaster 2018 Instructions for Offline Purchase of Materials* on the official RoboMaster website for further details on DJI's product categories and purchasing methods.

All robots must follow the specifications defined in these instructions, otherwise they may fail the pre-match inspection and are disqualified from competing.

The RoboMaster Organizing Committee provides the following advice regarding robot system design:

- Choose off-shelf products and modules from reputable manufacturers to ensure the reliability of all robots.
- Carefully read all robot specifications and review your designs accordingly to ensure that your robot meets all of the competition's Technical Specification requirements.
- Read the *RoboMaster 2018 Referee System Specification Manual* carefully. Referee System modules must be installed correctly in order to pass the pre-match inspection.
- Create detailed development and budget plans.
- Test robots thoroughly to make sure they can endure multiple matches, transportation, and unforeseen accidents.
- Reduce manufacturing costs and difficulties by making components modular to fit on multiple robots. And make modular parts to facilitate maintenance and replacement.

3.1 General Technical Specifications

To ensure a fair and safe competition, robots must be designed and engineered in strict compliance with the following technical specifications:

Category	Technical Specifications
Energy Requirements	Robots may only use electrical or pneumatic power. Fuel-powered engines, explosive substances, and hazardous chemical materials are prohibited. **Power Supply** The power supply must consist of dry cell batteries from recognized manufactures and/or

Category	Technical Specifications
	smart batteries manufactured by SZ DJI Technology Co., Ltd (For instance, TB47). The total power capacity of each Aerial robot shall not exceed 300Wh. The total power capacity of every other robot shall not exceed 200Wh. The supply voltage of every robot shall not exceed 30V. In the Competition Area, there are battery explosion proof boxes next to the entrance of the Battlefield. If a battery has potential explosion risks, Battlefield Technician will put the battery into a box until the risk disappears. **Violations:** Robots with batteries violating these specifications fail the pre-match inspection. For safety incidents caused by non-compliant batteries, violators shall be liable for the legal repercussions as stipulated by law. **Pneumatic Devices** If a gas-powered firing mechanism is used, pressure in the compressed gas container may not exceed 20MPa (international unit, commonly used for the pressure units mentioned below. If team uses other units, please convert units to make sure gas pressure comply with the rules). The compressed gas container must be certified to safely withstand 30MPa. A regulator valve must be used together with the compressed gas container, along with at least two pressure gauges on both sides of the regulator valve. Output pressure from the regulator may not exceed 1MPa. Additionally, any robots using gas-powered mechanisms with a pressure higher than 0. 8 MPa must meet the following requirements: 1. The gas used should NOT be flammable, e. g. air, nitrogen, and carbon dioxide. 2. The gas cylinder must be designed and manufactured to handle the pressure conditions under which it will be put, and it must be certified by an officially recognized certification agency of its country of origin. A qualifying certificate shall be obtained for the cylinder body, and the certificate shall be displayed in an easily visible way. 3. The pressure regulator must be installed on or at container's main outlet valve. 4. The compressed gas container must be adequately protected from rollovers, impacts, and stress resulting from mechanical faults. 5. All pneumatic tubes, valves, and compressed gas containers must be concealed

Category	Technical Specifications
	and installed away from the outer surface of the robot. No part of the pneumatic system should contact the ground at any time; 6. Containers must be mounted on the robots' frame in a safe manner. There must be at least two fixed mounting points, or at least 1/5 the container's length must be fixed to the frame; 7. Containers must be insulated from potential heat sources such as batteries. Recommended thermal insulation materials are carbon fiber board and aluminum board. 8. All tubes, valves, and pneumatic components must be qualified to withstand pressure in the compressed gas container; 9. Robots using gas as the propellant for projectiles must NOT have an acceleration length (defined as the straight length of the barrel that can provide acceleration to projectiles) exceeding 20cm. Pneumatic devices with a pressure less than or equal to 0.8 MPa only need to meet the following requirements: 1. The gas used should NOT be flammable, e. g. air, nitrogen, and carbon dioxide. 2. Pneumatic energy sources must be fitted with an MPa gauge at the main outlet valve of the pressure source. The MPa gauge is not required when using plastic bottles as compressed air storage. 3. Compressed air storage bottles must be protected against abrasion and wear. 4. All pneumatic tubes, valves, and compressed gas containers must be concealed and installed away from the outer surface of the robot. No part of the pneumatic system should contact the ground at any time; 5. All tubes, valves, and pneumatic components must be qualified to withstand pressure in the compressed gas container; 6. Containers must be mounted on the robots' frame in a safe manner. The open end of a container must point to horizontal direction or point to the ground. There must be at least two fixed points, or at least 1/5 the container's length must be fixed to the frame; In the Competition Area, using air compressor that needs external power supply is prohibited. Teams can use air compressors that do not need external power supply. Teams can charge their air compressors in the Staging Area. **Violations:**

Category	Technical Specifications
	1. Robots that violate these gas-power specifications fail the pre-match inspection. Furthermore, if a referee determines that an unauthorized gas-power source is being used, this is deemed as cheating. Teams will be held liable for any danger caused that is a result of using gas-power sources that do not meet these specifications. 2. **During a match, if pneumatic devices malfunction (gas container has explosion risk, mount damages). Then robot must be move away from the Competition Area until pneumatic devices are fixed.**
Wireless	**Remote Controls** Remote control technology used by robots during the competition must be produced by SZ DJI Technology Co., Ltd. The Sentry Robot must be fully automated during matches, but can be controlled remotely during the setup period (the three minutes before the start of each round). After the Sentry is been setup, team members must submit the remote controller of the Sentry to Operator Room Referee. During the official match, the Sentry's remote controller must be placed in the designated area of the operator room. The Standard, Engineer, and Hero can each use one remote controller during each match. The Aerial Robot can use 2 remote controller during the match. 1 for the pilot and the other for the gimbal operator. **Violations:** 1. Using non-SZ DJI Technology Co., Ltd. remote controllers will result in robots failing the pre-match inspection. 2. If it is discovered that a remote controller has been used for the Sentry Robot during a round at any point, with the Chief Referee's confirmation this behavior will be treated as cheating. In all rounds in which cheating happens, the offending team lose the rounds. **Wireless Communications** In addition to the use of remote controls, Video Transmission Modules, and UWB positioning devices, teams can also develop their own Wi-Fi link for wireless

Category	Technical Specifications
	communication between different robots. This link can be used to establish data transfers between the operator and the Operator Room. The Wi-Fi access points used must be mounted on team robots, and the RoboMaster Organizing Committee will not provide an external power source. During a match, both sides can use a Wi-Fi frequency of 2. 412-2. 472GHz or 5. 725-5. 850GHz. Frequency hopping is allowed anytime within either frequency band, but the upper limit of occupation bandwidth for each side is 40MHz. Due to environmental factors such as live streaming devices and audience members' personal devices, there will be many unknown Wi-Fi signals around the Competition Area. The RoboMaster Organizing Committee therefore cannot guarantee the stability of Wi-Fi connections built by the competing teams. **Notices:** 1. During the setup period before each round, teams can build their own Wi-Fi network. We recommend choosing robust and reliable Wi-Fi solutions. 2. Computers or tablets used to access self-established Wi-Fi networks can only be placed inside the Operator Room. Placing such devices in the audience areas or other areas is regarded as cheating. After competition round starts, team members cannot adjust these devices. 3. This Wi-Fi network can only be used for communication between robots or transmitting data to robot operators. Transmitting video feeds from cameras is prohibited. 4. Team members cannot use any wireless communication device such as walkie-talkie in any competition related areas (the Preparation Area, the Staging Area and the Competition Area). **Violations:** 1. Any team found to be using illegal frequency bands for communication will result in an immediate team loss. 2. Any team found to be using Wi-Fi to communicate with team members outside of the Operator Room or with and robots currently on the Battlefield will result in an immediate team loss. 3. Any team found to be deliberately using a Wi-Fi network to interfere with the Referee System or normal functioning of enemy robots will be treated as cheating. 4. Any team found to use wireless communication devices between team members will receive verbal warning. If the wireless communication devices interfere communications among referee system components, team will be treated as cheating.

Category	Technical Specifications
Optical Light Devices	Laser sights used on robots must be red, have a power lower than 35mW, and have a projecting angle narrower than 5°. Only the Hero, Standard, Sentry, and Aerial with a firing mechanism can have laser sights installed. Each firing mechanism can only use one laser sight. In addition to laser sights, the Engineer and the Hero robots can also be equipped with optical light assistance for specific tasks such as LED lights when the robots land on a Resource Island. To facilitate operation, the Aerial can be equipped with up to six moderately bright LED indicators (with a maximum of three LED units per indicator and each LED unit not exceeding 5000 Lux from 1 m away) to serve as a visual indicator of the current flight status. Mounting high-power LED lights that can illuminate the Battlefield is prohibited. Light-emitting mechanisms are prohibited on all ground-based robots as they can interfere with the visual appearance of armor modules of the Referee System. Optical elements used by robots must not cause harm to participants, referees, staff, or audience members. **Violations:** 1. Non-red laser sights or those with excessive power outputs fail the pre-match inspection. 2. Robots equipped with optical light devices that do not conform to the rules fail the pre-match inspection. 3. Teams whose robots cause harm to participants, referees, staff, or audience members will be affixed legal liability. 4. When the Engineer or the Hero are not boarding a Resource Island or acquiring projectile containers and the referee warns the violating robot to turn off its LED light, non-compliance will result in a level two warning. If a level two warning is given and the LED light remains on for a long period, the violating robot will be given a level three warning.
Computer Vision	As there are clear optical effects (lights) on both sides of the Referee System's armor modules, it is suggested that teams develop a vision-based object detection algorithm for faster object recognition. A robots' sensors (such as LIDAR, camera, ultrasonic, or infrared technology) should be

Category	Technical Specifications
	mounted in a suitable location, and sensors must avoid blocking or casting light on the Referee System modules. The Competition Area and its environment are complex and teams should consider it when developing vision algorithms to better adapt to the changing illumination and other interferences that may be experienced from around the Competition Area. The RoboMaster Organizing Committee cannot guarantee that visual features and effects in the Battlefield will not cause interference to a robot's vision systems. The area covered by the light bar on both sides of the speed monitor module of the Referee System must not exceed 1/5 of the effective area of the light bar. **Violations:** 1. Robots equipped with illegal sensors will fail the pre-match inspection. 2. Robots illegally blocking or projecting light onto armor modules will fail the pre-match inspection. 3. Robots with blocked speed monitor modules will fail the pre-match inspection.
Robot Numbers	During the pre-match inspection and competition, the inspector of the RoboMaster Organizing Committee will give obvious designated stickers to team members. Team members should put stickers on corresponding robots' armor plates. Stickers contain numbers or clean visual features. The participating robots are marked as red 1/blue 1 Standard Robot, red 2/blue 2 Hero Robot, Red 3/Blue Engineer Robot 3, Red 4/Blue 4 Standard Robot, Red 5/Blue 5 Standard Robot, Red 6/Blue 6 Aerial Robot (no stickers), Red 7/Blue 7 Sentry Robot (stickers do not show numbers). Stickers must align with the armor plates. There should be no air bubbles under the stickers. Except for these stickers applied by the RoboMaster Organizing Committee, teams are prohibited from affixing similar stickers on the armor modules or any other parts of their robots. Decorative stickers containing numbers or similar visual features are also prohibited. Schematic reference for robot stickers is in **Appendix 5 - Reference Pictures**. **Violations:** 1. Robots with unauthorized stickers will fail the pre-match inspection. 2. Before a round, any robot that has bad sticker installation (sticker does not align with

Category	Technical Specifications
	the armor plate, sticker has underlying bubbles) cannot enter the Battlefield. 3. Any robot that is found to have unauthorized stickers on its body during a round will be treated as cheating.
Robot Painting	To make the Hero and the Engineer distinguishable, in the Wild Card Competition and the Final Tournament, the Engineer must have yellow painting in order to be qualified to compete. The painting spray will be provided by inspectors in the Inspection Area. The staff from the RoboMaster Organizing Committee will help the painting process, team members must follow the instruction of staff to do the painting.

3.2 Robot Specifications

RoboMaster requires robots to fight together as a team. Collaboration among robots is therefore critical to win matches. Robots are divided into two types: compulsory and optional robots, with each type of robot having different technical specification requirements. Before each match, at least one of each compulsory type of robot must attend and pass the pre-match inspection so that the team can be qualified to enter the competition. Before the first round of a match, all compulsory robots must present on the Battlefield. After the first round of the match, since robots may get damaged from competing, the number of compulsory robots has no limitation

Notice:

Teams can build backup robots for any character. Before each match, each team can bring at most 2 backup robots along with other robots to the pre-match inspection. All backup robots must pass pre-match inspection as well. Except for the backup robot of the Standard, other backup robots must have armor stickers installed. For the backup robot of the Standard, since its sticker number cannot be determined during pre-match inspection, teams can stick the sticker in the Competition Area during the match. Team member must make sure the stickers on backup robots comply with the rules to avoid corresponding penalties.

Please refer to the RoboMaster 2018 Inspection Form found in **Appendix 4 - Pre-Match Inspection Form** for the full list of technical requirements.

If an optional robot is not participating in the match, the robot's HP is displayed as 0 on the operator UI of the Referee System.

Category	Amount	Type	Eligible Competitions
Standard	1-3	Compulsory	International Regional Competitions, Wild Card Competitions, and the Final Tournament
	1-2	Compulsory	Regional Competition
Sentry	0-1	Optional	Regional competitions, International Regional Competitions, Wild Card Competitions, and the Final Tournament
Hero	1	Compulsory	Regional competitions, International Regional Competitions, Wild Card Competitions, and the Final Tournament
Aerial	0-1	Optional	Regional competitions, International Regional Competitions, Wild Card Competitions, and the Final Tournament
Engineers	1	Compulsory	Regional competitions, International Regional Competitions, Wild Card Competitions, and the Final Tournament
Suppliers	0-1	Optional	Regional competitions, International Regional Competitions, Wild Card Competitions, and the Final Tournament

Violations:

1. If any of a team's compulsory robots (Hero, Engineer, and Standard robots) fail to pass the pre-match inspection, the team is considered to be disqualified and lose the match.
2. After the pre-match inspection, team who changes backup robots, adds new backup robots, or modifies backup robots, with the chief referee's confirmation, will be treated as cheating.

3.2.1 Standard

During the International Regional Competition, the Wild Card Competition, and the Final Tournament, each team can have 1-3 standard robots enter the Battlefield.

Standard Robot begins at Level 1 at the beginning of each match round.

The armor module is a critical component of the Referee System. Any robot design that prevents the armor module from being hit by projectiles is prohibited. Otherwise the robot cannot pass the pre-match inspection. The armor modules on a Standard robot must be attached rigidly to the robot chassis. Actuated movement of any armor module relevant to the robot chassis during the match round is prohibited and is considered cheating.

Notice:

Robot chassis refers to the structure that bears the robot's main controller and other important hardware. This is also where the robot's power system and other associated components are installed. Wheels, legs, and suspension systems are not considered to be part of the chassis.

Standard Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
Target Robots	non-Aerial robots	-	-Robots that the Standard Robot can launch projectiles at
RoboMaster Referee System	4 small armor modules, (17 mm projectiles) speed monitor module, video transmission module, RFID interaction module, positioning module, main control module	Robots that do not meet the installation requirements of the Referee System shall not pass the pre-match inspection.	Install small armor modules on all four sides of the robot. The distance from the lower edge of the armor modules to the ground must be between 60-150mm. The RFID interaction module should be installed under the chassis. **Notice:** For more information, please refer to the detailed installation requirements in the *RoboMaster 2018 Referee System Specification Manual.*
Initial HP	1000	-	-
Operating Mode	No limits	-	-
Launching Mechanism	17 mm projectile	-	-
Initial Projectiles	0	-	All projectiles need to be removed before the start of each match round.
Projectile Resupply Allowed	Only projectiles	-	-
Maximum Velocity of Projectiles Launched (m/s)	30	HP deduction	-
Maximum Weight (kg)	20	Robots that do not meet the weight requirements shall not pass the pre-match inspection	Includes the battery weight, but not the weight of the Referee System.
Robot Chassis Power Consumption Limit (W)	80	HP Deduction	-
Maximum Initial Dimensions (mm)	600 x 600 x 500 (width x depth x height)	Robots that do not meet the size requirements shall not pass the pre-match inspection	1. The height of the robot should not exceed 500 mm, while the orthographic projection on the ground should be within a 600 x 600mm area.

Standard Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
			2. During the Setup Period, the size of the robot must be within the initial dimensions.
Maximum Dimensions During a Match (mm)	700 x 700 x 600 (width x depth x height)	Robots that do not meet the size requirements shall not pass the pre-match inspection	The height of the robot should not exceed 600 mm, while the orthographic projection on the ground should be within a 700 x 700 mm square area.
Movement Areas	Within the bounds of the Battlefield, except for the opponent's Base Zone and the opponent's Penalty Zone.	-	-
Activation Requirements	Movement in the Starting Zone is allowed during the Setup Period, however launching projectiles is only permitted after the match round begins.	See 5.5.1 Setup Period for violation penalties.	-

Level Up Mechanism

Robot Level	Max HP	Barrel Heat Limit	Barrel Cool-Down Rate (per second)	Experience Value
Level 1	1000	120	18	2.5
Level 2	1250	240	36	5
Level 3	1500	480	72	7.5

3.2.2 Sentry

Each team is allowed to have none or one Sentry Robot on the Battlefield at a match round.

During the Setup Period, the Sentry should be installed on the Sentry Rail. Team members must make sure the Sentry's installation is firm and reliable. If the installation is not stable so that the Sentry may fall from the rail, after the match round starts the Sentry will be ejected from the competition. The Sentry can either move freely or remain still after the match round starts autonomously.

The presence of the Sentry Robot affects the defense mechanism of the Base. At the beginning of a match

round, the Base has 100% defense bonus. And the protection shields of the Base are engaged.

If a team has the Sentry robot. During each match round, when the first non-Sentry robot death (Death may due to projectile hits, collision, Referee System module offline penalty or ejection) of this team happens, the power to this team's Sentry robot chassis will be cut off for **40** seconds. At the same time, the defense bonus of the Base reduced to 50%.

If a team has the Sentry Robot, when the Sentry is destroyed, then the Base has no defense bonus, and the protection shields of the Base open.

If a team does NOT have the Sentry robot. During each match round, when the first robot death (Death may due to projectile hits, collision, Referee System module offline penalty or ejection) of this team happens, the defense bonus of the Base reduced to 50%. And 120 seconds after the match round starts, the defense bonus disappears, and the protection shields of the Base open.

When the Sentry slays arbitrary enemy robot (the server of the Referee System will analyze log data to determine the source of the shooter), it can restore certain amount of HP, which equals to the experience value of the destroyed robot times 200. For example, if the Sentry destroys a level 1 Standard,

The armor module is a critical component of the Referee System. Any robot design that prevents the armor module from being hit by projectiles is prohibited. Otherwise the robot cannot pass the pre-match inspection.

Sentry Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
Target Robots	non-Aerial robots	-	-
RoboMaster Referee System	2 large armor modules, 17mm speed monitor module, positioning module, main control module	Robots that do not meet the installation requirements of the Referee System shall not pass the pre-match inspection.	The two large armor modules are mounted on the front and back. The distance between the upper side of the large armor modules and the Sentry Rail surface should be less than 100mm. The surface of the armor plate is at a 75-degree included angle with the floor of the competition area, but the height of the armor plate relative to the rail plane should not be changed; horizontal movement of the armor modules relative to the structure used to mount the robot to the rail is also not allowed.

Sentry Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
			The maximum distance between the lowest point on the Sentry robot and the upper surface of its rail shall not be over 450mm at any given time. The maximum distance between the highest point on the Sentry robot and the upper surface of its rail shall not be over 150mm at any given time. The main control module must locates on one side of the rail. The size limitation does not include the size of the main control module and the positioning module of the Referee System. **Notice:** For more information, please refer to the detailed installation requirements in the *RoboMaster 2018 Referee System Specification Manual.*
Initial HP and Maximum HP	3000	-	-
Operating Mode	Fully Autonomous	-	-
Launching Mechanism	17 mm projectile	-	-
Initial Projectiles	500	-	All projectiles must be removed from the robot at the beginning of the first match round. Starting from the second match round, the Sentry does not need to remove projectiles. Before each round, each team can ask referees for 200 more projectiles.
Projectile Resupply Allowed	Able to receive but cannot distribute	-	Any operation that delivers projectiles to other robots is prohibited.
Maximum Velocity of Projectiles Launched (m/s)	30	HP deduction	-
Barrel Heat Limit	480	HP deduction	-
Barrel Cool-Down Rate	160	-	-

Sentry Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
Maximum Weight (kg)	10	Robots that do not meet the weight requirements of the Referee System shall not pass the pre-match inspection.	Includes the battery weight, but not the weight of the Referee System.
Maximum Initial Dimensions (mm)	400 x 400 x 400 (width x depth x height)	Robots that do not meet the size requirements of the Referee System shall not pass the pre-match inspection.	-
Maximum Dimensions During a Match (mm)	500 x 500 x 500 (width x depth x height)	Robots that do not meet the size requirements of the Referee System shall not pass the pre-match inspection.	-
Movement Areas	Sentry Rail	If a Sentry robot leaves its rail at any point during a match, a Level 4 Penalty is issued	-
Activation Requirements	Movement on the Sentry Rail is allowed during the Setup Period, however launching projectiles is only permitted after the match round begins.	During the Setup Period, launching projectiles will receive a verbal warning. If the launched projectiles cause physical harm to on-site personnel. The team loses the current match round.	-

3.2.3 Hero

Every team must have one Hero Robot on the Battlefield during each match round.

The Hero Robot begins at Level 1 at the beginning of each match round.

The armor module is a critical component of the Referee System. Any robot design that prevents the armor module from being hit by projectiles is prohibited. Otherwise the robot cannot pass the pre-match inspection. The Hero is allowed to change its shape, but changing the shape of its chassis to avoid projectile hits is prohibited. During a match round, the horizontal position of the geometric central point of the four armor modules and the horizontal position for the center-of-mass of a projectile launching mechanism must keep their relative positions.

Notice:

A launching mechanism is any mechanism that makes a projectile move away from the robot traveling in a certain direction and cause damage to another robot. This definition is applicable to all launching mechanisms mentioned in this manual.

A Hero robot can only be equipped with one grabbing mechanism for grabbing projectile containers. This grabbing mechanism can only grab one projectile container at a time. The grabbing mechanism cannot damage battlefield elements. In particular, it cannot use needles or sharp-edged structures to interact with projectile containers.

Violations:

1. If the Hero changes its shape and relative positions between armor modules and projectile launching mechanism change, the robot will be ejected.
2. If the Hero robot's grabbing mechanism does not meet requirements, the Hero robot shall not pass the pre-match inspection.
3. During a match round, if a Hero's grabbing mechanism damages a projectile container with a needle or sharp-edged structure and irreversibly damages it, it will be ejected.

Hero Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
Target Robots	non-Aerial robots	-	-
RoboMaster Referee System	Four large armor modules, 17mm and 42mm projectile speed monitor modules, video transmission module, RFID interaction module, positioning module, main control module	Robots that do not meet the installation requirements of the referee system shall not pass the pre-match inspection.	The four large armor modules on all sides of the Hero Robot. The length between the ground and the bottom edge of any of the armor modules should not exceed 400mm. The RFID interaction module should be installed under the chassis. For more information, please

Hero Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
			refer to the detailed installation requirements in the *RoboMaster 2018 Referee System Specification Manual.*
Initial HP	2000	-	-
Operating Mode	No limits	-	-
Launching Mechanism	17 mm and 42 mm projectiles	-	-
Initial Projectiles	0	-	All projectiles need to be removed before the start of each match round.
Projectile Resupply Allowed	Can receive from other robots and give to other robots	-	-
Maximum Weight (kg)	35	Robots that do not meet the weight requirements shall not pass the pre-match inspection	Includes the battery weight, but not the weight of the Referee System.
Robot Chassis Power Consumption Limit (W)	120	HP deduction	
Maximum Initial Dimensions (mm)	800 x 800 x 800 (width x depth x height)	Robots that do not meet the size requirements shall not pass the pre-match inspection	1. The height of the robot must not exceed 800 mm, and the orthographic projection area should be within an 800 x 800 mm square area on the ground. 2. During the Setup Period, the size of robots must be within the initial dimensions
The maximum extension size during competition and the maximum extension size during transformation (mm)	1200 x 1200 x 1200 (width x depth x height)	Robots that do not meet the size requirements shall not pass the pre-match inspection	The height shall not exceed 1200 mm, and the orthographic projection area should be within a 1200 x 1200 mm square area on the ground.
Movement Areas	Within the bounds of the battlefield, except for the	-	

Hero Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
	opponent's Base Zone and Penalty Zone		
Activation Requirements	Movement in the Starting Zone is allowed during the Setup Period, however launching projectiles is only permitted after the match round begins.	See 5.5.1 Setup Period for violation penalties.	-

Projectile Specifications			
Item	**Limit**		**Penalty for exceeding limit**
	17 mm projectile	**42 mm projectile**	
Maximum Velocity of Projectiles Launched (m/s)	30	16. 5	HP deduction

Level Up Mechanism

Robot Level	Max HP	17 mm Barrel Heat Limit	17 mm Barrel Cool-Down Rate	42 mm Barrel Heat Limit	42 mm Barrel Cool-Down Rate	Experience Value
Level 1	2000	120	18	80	20	7.5
Level 2	2500	240	36	120	40	10
Level 3	3500	480	72	200	60	15

3.2.4 Aerial

Each team is allowed to have none or one Aerial Robot on the Battlefield at a match round.

The Aerial Robot can only fly within a restricted area, and they can carry a 17 mm projectile launching mechanism. The Referee System restricts an Aerials launching speed and barrel heat. The Aerial Robot cannot be attacked by other robots, but it still have HP for receiving HP deduction penalties. When the HP is reduced to zero, the Referee System cuts off the power supply to the Aerial robot's launching mechanism (at least cutting off power to the friction wheels of its launching mechanism) and the gimbal operator's video transmission feed. The pilot of the Aerial Robot must land the Aerial on its Landing Pad immediately. During the competition, no part of the aerial robot's barrel may be higher than the top of the Battlefield fence.

One Aerial Robot has two people controlling it: the pilot controls its flight path while the gimbal operator controls the launching mechanism. The Aerial sends FPV video feed to the gimbal operator in the Operator Room to offer an aerial perspective, while the pilot stays in a separate Pilot Room and controls the flight path without access to an FPV video. The gimbal operator can send voice commands to the pilot using

communication devices provided by the RoboMaster Organizing Committee, but the pilot cannot reply.

To ensure safety on the Battlefield, neither side is allowed to attack enemy Aerial robot. Aerial Robots must have fully enclosed propeller guards. These propeller guards should be able to fully protect the propellers. For example, if the Aerial Robot crashes into a tall cylindrical object, the propeller guards should protect the propellers from making direct contact with the object, and the propeller guards should be strong enough to avoid serious damage. The guards should also be strong enough to bear the weight of the entire robot. To test this, place the Aerial Robot on the ground resting directly on any part of a propeller guard and check for signs of the guard becoming warped or damaged.

There are safety ropes consist of steel cables, sliding pulleys, and safety lines above the Battlefield. Teams are required to mount a vertical safety rod that is 350 mm above the level of the propeller's rotation plane on their Aerial Robots. This vertical safety rod must be securely fastened to the Aerial Robot and have a bead ring on the top so that it can be attached to a safety line using a carabiner. This safety line secures the Aerial robot from crash accidentally. The vertical safety rod and the bead ring must be strong enough to support the weight of the Aerial robot without becoming warped or damaged.

The Aerial robot is prohibited from directly passing projectiles to other robots in the team.

To reduce safety hazards and avoid potential accidents, team should assess and test whether an Aerial Robots' propulsion and power systems are reliable enough to carry a large payload. During a match round, if an Aerial fails to work properly or becomes damaged due to the poor design of its propulsion or power systems, it must land and undergo a safety inspection conducted by referees before the next round. This robot can only return to the Battlefield after it has been confirmed by the Head Referee that no safety concerns are present. Otherwise, this robot will be ejected from the remaining rounds of the match.

Notice:

During a match round, if the Aerial crashes or lands inside the Battlefield, and the pilot is unable to restart the Aerial. Then the Aerial will be ejected. Then Battlefield technicians will lift the safety rope to life the Aerial Robot above the ground.

Aerial Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
Target Robots	non-Aerial robots	-	
RoboMaster Referee System	Speed monitor module (17mm projectile), video transmission module, positioning module, main	Robots that do not meet the installation requirements of the Referee System shall not	The total weight of all components of the Aerial Robot Referee System is

Aerial Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
	control module	pass the pre-match inspection.	approximately 0.65 kg.
Operating Mode	No limits	-	-
Launching Mechanism	17 mm	-	
Initial Projectiles	200	-	All projectiles must be removed from the robot at the beginning of the first match round. Starting from the second match round, the Sentry does not need to remove projectiles. Before each round, each team can ask referees for 200 more projectiles.
Projectile Resupply Allowed	Able to receive but cannot give away		
Maximum Weight (kg)	6.5	Robot that do not meet the weight requirements shall not pass the pre-match inspection	Includes the battery weight but not the weight of the Referee System.
Maximum Initial Dimensions (mm)	1000 x 1000 x 800 (width x depth x height)	Robot that do not meet the size requirements shall not pass the pre-match inspection	
Maximum Dimensions During a Match (mm)	1000 x 1000 x 800 (width x depth x height)		The height shall not exceed 800 mm, and the orthographic projection area should be within a 1000 x 1000 mm square area on the ground.
Maximum Projectiles Carried	No limits	-	-
Movement Areas	Flight range is restricted by the safety rope. No part of the barrel may exceed the top of the fence. The distance between the lowest point of the robot and the ground shall not be less than 1300 mm.	-	-
Take Off/Landing Location	Excluding emergencies, Aerial robots can only take off or land on	-	-

Aerial Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
	a Landing Pad		
Maximum Barrel Heat	480		
Heat Cooling Value (seconds)	160		
Maximum Velocity of Projectiles Launched (m/s)	30		
Initial HP and Maximum HP	1000		
Activation Requirements	During the Setup Period, the Aerial can move within the landing pad. Projectiles can be fired only after the match round starts and the Aerial robot is in the air.	See 5.5.1 Setup Period for violation penalties.	

3.2.5 Engineer

Teams must have one Engineer Robot on the Battlefield during every match round.

The armor module is a critical component of the Referee System. Any robot design that prevents the armor module from being hit by projectiles is prohibited. Otherwise the robot cannot pass the pre-match inspection. The armor modules on an Engineer robot must be attached rigidly to the robot chassis. Actuated movement of any armor module relevant to the robot chassis during the match round is prohibited and is considered cheating.

Engineer Robot restores 1% of its maximum HP per second if it avoids damage for at least 30 seconds (restoration cool-down time) during a match round (including damage due to collisions, the Referee System module offline, etc.).

Engineer Robot can use a special Regeneration Card to restore the HP of the Hero and the Standard Robots (up to a maximum of 1% of their max HP per second).

An Engineer Robot can only be equipped with one grabbing mechanism for grabbing projectile containers. This grabbing mechanism can only grab one projectile container at a time. The grabbing mechanism cannot damage battlefield elements. In particular, it cannot use needle or sharp-edged structures to interact with projectile containers.

Before a match round begins, the Regeneration Card must be carried by the Engineer Robot (The Engineer Robot must contain a card slot where the Regeneration Card can be installed in a secure way). During the match round, the Engineer Robot can place the Regeneration Card on the ground, but the card can only be picked up or moved again by the Engineer Robot. Other robots cannot carry a Regeneration Card. During the pre-match inspection, the inspector makes sure the Regeneration Card is working properly. Once the Team Captain has signed the inspection form, the Regeneration Card is regarded as working normally. The RoboMaster Organizing Committee will not take responsibility for the exchange and repair of the card after the inspection. Teams must assume responsibility for any damage caused to their Regeneration Card during the match. The RoboMaster Organizing Committee does not provide replacements for broken Regeneration Cards. Between match rounds, teams can apply to replace their broken Regeneration Card with a backup one during the Setup Period. However, since time is limited and no testing can be performed, the RoboMaster Organizing Committee cannot guarantee the reliability of backup Regeneration Cards.

Violations:

1. Grabbing mechanisms that do not meet requirements will fail to pass the pre-match inspection
2. During competition, if an Engineer Robot's grabbing mechanism damages a projectile container with a needle or sharp-edged structures and irreversibly damages it, the robot will be ejected.

Engineer Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
Target Robots	Robots in the team	-	-
RoboMaster Referee System	4 small armor modules, video transmission module, RFID interaction module, positioning module, main control module	Robots that do not meet the installation requirements of the referee system shall not pass the pre-match inspection.	Install small armor modules on all four sides of the robot. The distance from the lower edge of the armor modules to the ground must be between 50-400mm. The distance between armor lower edges along the Z-axis shall not exceed 100 mm. For installation specifications, see *RoboMaster 2018 Referee System Specification Manual*.
Initial HP and Maximum HP	5000	-	-
Operating Mode	No limits	-	-
Launching Mechanism	N/A	-	-
Initial Projectiles	0	-	All projectiles need to be removed before the start of each match.
Projectile Resupply	Can receive projectiles	-	

Engineer Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
Allowed	from other robots and give projectiles to other robots		
Maximum Weight (kg)	35	Robots that do not meet the weight requirements shall not pass the pre-match inspection	Includes the battery weight, but not the weight of the Referee System.
Robot Chassis Power Consumption Limit (W)	No limits	-	
Maximum Initial Dimensions (mm)	800 x 800 x 800 (width x depth x height)	Robots that do not meet the size requirements shall not pass the pre-match inspection	1. The height of the robot must not exceed 800 mm, and the orthographic projection area should be within an 800 x 800 mm square area on the ground. During the Setup Period, the size of robots must be within the initial dimensions
The maximum extension size during competition and the maximum extension size during transformation (mm)	1200 x 1200 x 1200 (width x depth x height)	Robots that do not meet the size requirements shall not pass the pre-match inspection	The height shall not exceed 1200 mm, and the orthographic projection area should be within a 1200 x 1200 mm square area on the ground.
Movement Areas	Within the bounds of the battlefield, except for the opponent's Base Zone and Penalty Zone	-	
Activation Requirements	Movement in the Starting Zone is allowed during the Setup Period. Can only leave the Starting Zone after the match round starts.	See 5.5.1 Setup Period for violation penalties.	-

3.2.6 Supplier

Each team can choose whether to have a fully-automated Supplier Robot in the Supply Zone.

A Supplier Robot must not possess any projectiles at the start of a round. When the round starts, an external projectile supply tube delivers 200 17 mm projectiles to the Supplier Robot. Following this initial

distribution, 150 17 mm projectiles will be delivered to the Supplier Robot every minute.

The Supplier must stay in the Supply Zone and cannot move. Adhesive tape or other sticky substances cannot be used to fix the Supplier to the Battlefield.

The Supplier can be stabilized by weighting it with heavy objects, such as sandbags. These objects are considered part of the robot's body. The Supplier Robot and any additional objects attached to it must remain in the Supply Zone before the start of a round. Team cannot use objects contain water or sand to stabilize the Supplier, otherwise the robot cannot pass the pre-match inspection.

Supplier Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
Target Robots	Robots in the team	-	-
RoboMaster Referee System	N/A	-	No Referee System installed
Initial HP	N/A	-	-
Operating Mode	Full autonomous	-	-
Launching Mechanism	N/A	The robot fails to pass the pre-match inspection	No launching mechanism can be installed
Initial Projectiles	-	-	All projectiles need to be removed before the start of each match round.
Projectile Resupply Allowed	Can receive and give projectiles	-	
Maximum Weight (kg)	No limits	-	
Robot Chassis Power Consumption Limit (W)	N/A	-	
Maximum Initial Dimensions (mm)	1000 x 1000 x 1000	Robots that do not meet the size requirements shall not pass the pre-match inspection	
Maximum Dimensions During a Match (mm)	1000 x 1000 x 1000	Robots that do not meet the size requirements shall not pass the pre-match inspection	

Supplier Robot Specifications			
Item	**Regulations**	**Violations**	**Remarks**
Movement Areas	Supply Zone	-	Cannot move
Activation Requirements	N/A	-	-

3.3 Referee System Mechanisms

Participating robots must install a corresponding Referee System in accordance with the latest version of the *RoboMaster 2018 Referee System Specification Manual*. All robot actions throughout a match round are monitored by this Referee System.

3.3.1 Health Point (HP) Deductions

Normally, the Armor module of the Referee System takes projectile hits or collisions and convert them into HP deductions.

During a match round, robots will be penalized through a deduction of Health Points (HP) when a projectile launching mechanism's barrel overheats, the projectile firing speed exceeds the set limit, a robot chassis' power consumption exceeds the maximum limit, important modules come offline, or other penalties for violations are imposed (see 5.5.3.1 Types of Penalties).

3.3.1.1 Barrel Heat

Each robot has different barrel heat limits and cool-down rates for their projectile launching mechanisms based on their characters. When a match round starts, the initial barrel heat value for every projectile launching mechanism is 0 and the Standard and the Hero robots are at level 1. When a robot's experience level is upgraded, the barrel heat limit and cool-down rate (measured per second) are also increased. When a robot's barrel heat exceeds the preset limits, the UI screen of the corresponding operator displays a warning symbol and FPV visibility is reduced.

The barrel heat limits and cool-down rates for different robots are as follows:

Robot Types	Level	Maximum Launching Speed (m/s)	17 mm Projectiles Maximum Heat	42 mm Projectiles Maximum Heat	17 mm barrel heat Cool-down Rate (Per Second)	42 mm barrel heat Cool-down Rate (Per Second)
Standard	Level 1	30	120	/	18	/
	Level 2		240	/	36	/
	Level 3		480	/	72	/

Sentry	Regular	30	480	/	160	/
Hero	Level 1	17 mm: 30 42 mm: 16.5	120	80	18	20
	Level 2		240	120	36	40
	Level 3		480	200	72	60
Aerial	Regular	30	480	/	160	/

Whenever the HP of a Standard Robot is below 20% of its max HP, its cool-down rate doubles. If the HP restores above 20% of max HP, then the cool-down rate changes back to listed value.

When a match round starts, the initial barrel heat value for every projectile launching mechanism is 0. As projectiles are launched, the barrel heat increases. When the barrel heat is greater than 0, it is cooled using a frequency of 10Hz. Each time a 17 mm projectile with a speed of V (m/s) is launched, the barrel heat of the robot increases by **V**; Each time a 42 mm projectile is launched, barrel heat value increases by **40**.

Notice:

For the Hero Robot, different projectile launching mechanisms (17 mm and 42 mm) calculate barrel heat separately. The speed monitor module can only be installed at the end of the launching mechanism, and the value measured must be the value after the projectile has reached its maximum acceleration. For example, the Standard robot's projectile has a speed limit of 30 m/s. This refers to the time when the acceleration of the projectile has been completed and the speed monitor module has measured that the projectile's speed is less than or equal to 30 m/s.

These calculations are performed as follows:

The set current barrel heat Q_1, the heat limit is Q_0, the current projectile launch speed is V_1 (m/s), and the projectile launch speed upper limit is V_0 (m/s).

1. When $Q_1 - Q_0 > 0$, the visibility of the robot operator's FPV screen is reduced. When $Q_1 < Q_0$, the first person view will return to normal. The UI of operator FPV screen is as follows:

2. The calculation of barrel heat is performed using two different into two methods:

2.1. Each time the Referee System detects a 17mm projectile with a speed of V_1:

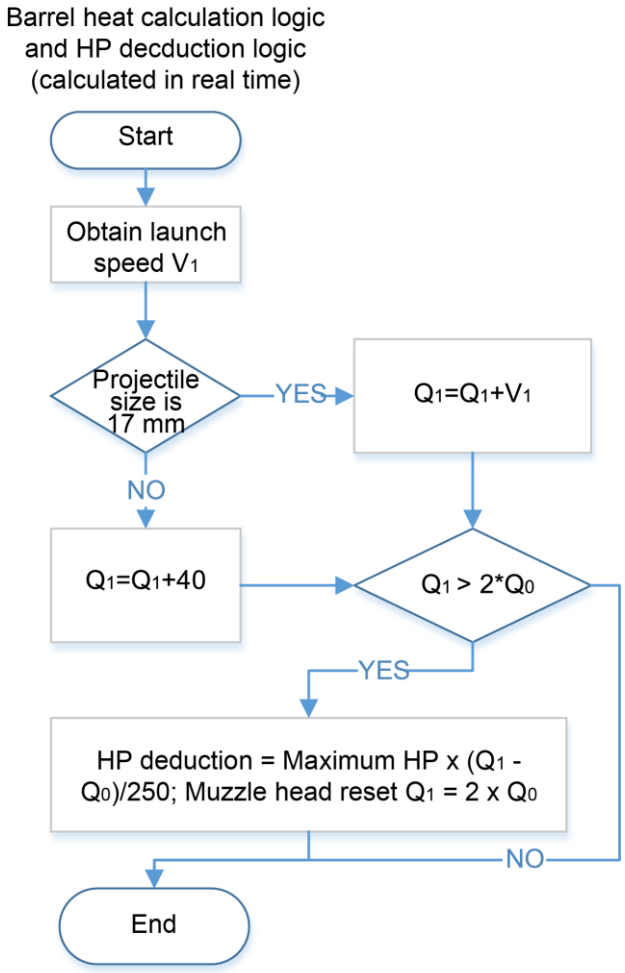
2.1.1. When $V_1 < = V_0$, heat increases by V_1; If $Q_1 > = 2Q_0$, an immediate deduction of (Q_1 - 2 x Q_0)/250 x the upper HP limit is made, resulting in $Q_1 = 2Q_0$.

2.1.2. When $5 > V_1-V_0 > 0$, health is reduced by 10% of the maximum HP level.

2.1.3. When $10 > V_1-V_0 > = 5$, health is reduced by 50% of the maximum HP level.

2.1.4. When $V_1-V_0 > = 10$, health is reduced by 100% of the maximum HP level.

The logic for the deduction of barrel heat calculations exceeding the upper limit of HP is as follows:

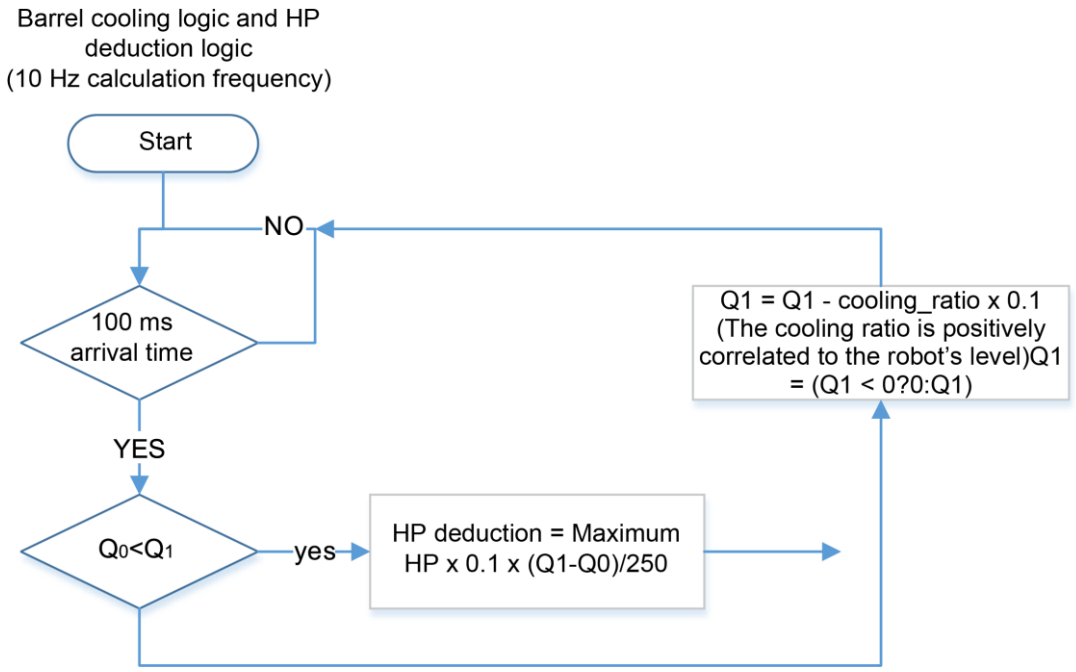


2.2. 10Hz periodic cool down method:

2.2.1. When $2 \times Q_0 > Q_1 > Q_0$, each cycle is penalized by a HP deduction of $((Q_1-Q_0) / 250) / 10 \times$ maximum HP. The cooling value per second is then/10.

2.2.2. When $Q_1 <= Q_0$, each time heat is cooled it is calculated using the cool-down rate/10.

The logic for barrel heat cooling is as follows:



3. When launching a 42mm projectile, the overall mechanism is similar to that of a 17mm projectile. Each time the Referee System detects a 42mm projectile, barrel heat is increased by 40 (without taking into consideration the launching speed of the 42mm projectile).

   3.1. When $V_0 < V_1 <= 1.1 \times V_0$, each time a 42 mm projectile is detected by the Referee System, 10% of the robot's maximum HP value is deducted.

   3.2. When $1.1 \times V_0 < V_1 <= 1.2 \times V_0$, each time a 42 mm projectile is detected by the Referee System, 20% of the robot's maximum HP value is deducted.

   3.3. When $1.2 \times V_0 < V_1$, each time a 42 mm projectile is detected by the Referee System, 50% of the robot's maximum HP value is deducted.

3.3.1.2 Robot Chassis Power Consumption Limits

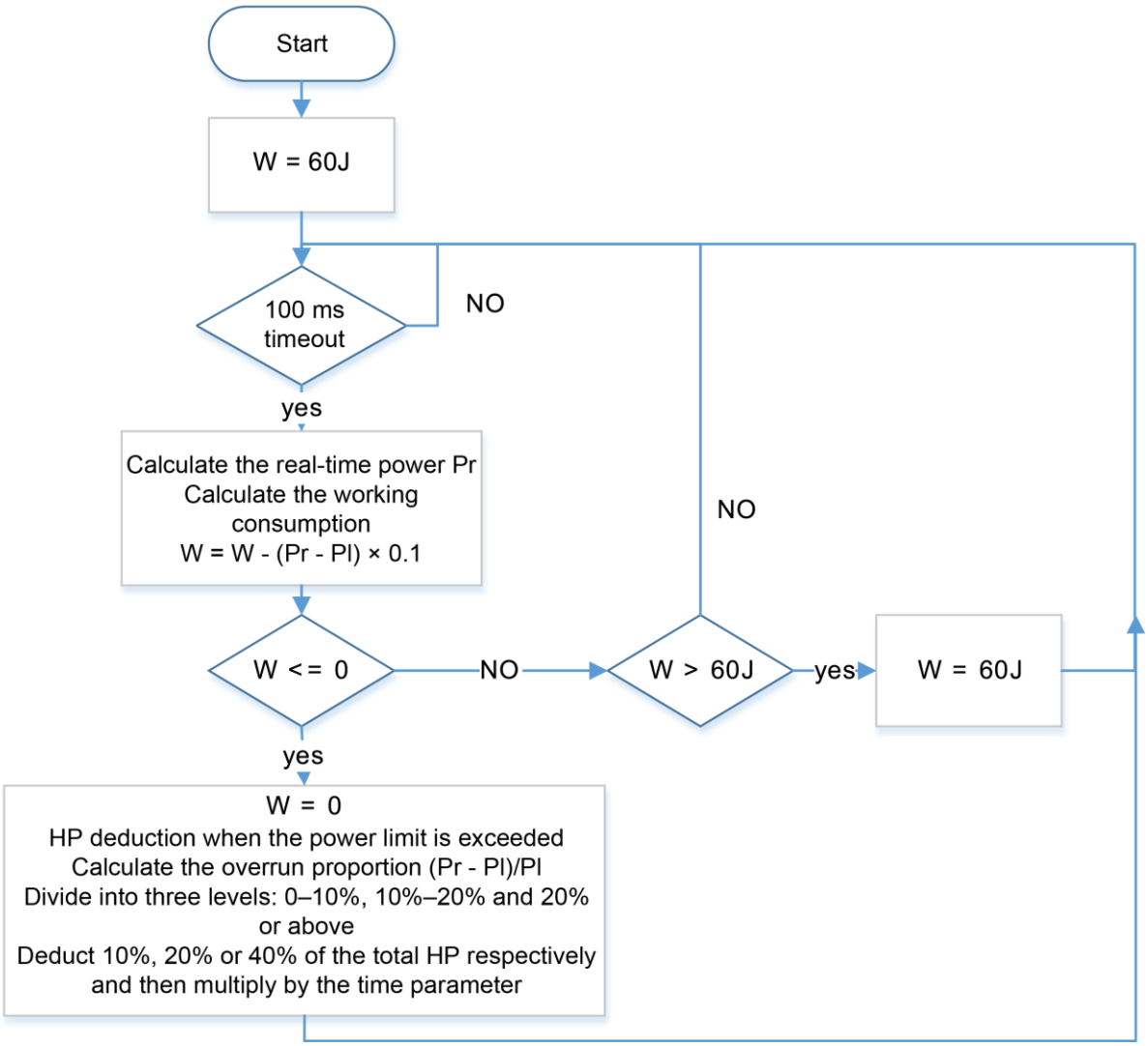
A robot's chassis is the mechanism that carries the power system and accessories that actuates itself to generate horizontal movements. However, it does not include actuators that are used for performing special tasks, such as the functional movement of the upper mechanical structure. The power consumption mechanism is described in the *RoboMaster 2018 Referee System Specification Manual*.

Robot Types	Power Consumption Limit
Standard	80
Sentry	No limit, but the chassis must be connected to the Referee System
Hero	120
Aerial	No limit
Engineers	No limit

Violations:

The number of HP deducted due to exceeding chassis power consumption limits depends on the amount of exceed power. An overrun ratio is calculated to represent the amount. The formula to calculate this overrun ratio is: (Pr - Pl) / Pl, with Pr representing the instantaneous chassis power output and Pl representing the defined power limits as detailed in the table above. If the ratio is 0 to 10%, then up to 10% of max HP is deducted from the robot. If the ration is more than 10% but not more than 20% then up to 20% of max HP is deducted from the robot; if the ratio is more than 20%, then up to 40% of max HP is deducted from the robot.

As it is difficult to achieve instantaneous power output control when a robot is moving, the Referee System has set a buffer energy limit W, which is equal to 60 joules. The detection frequency used by the Referee System to identify chassis power is 10Hz. The entire logic process of detection and the deduction of the HP from the robot is shown below:



Using a Standard robot with an 80W power limit as an example, if the robot has 140 W of power output, 1

second later it will consume 60 J of energy. In the next 100 ms detection cycle, the calculated overrun ratio is (140 - 80)/80 = 75%, which is more than 20%; therefore, the HP to deduct is 1500 x 40% x 0.1 = 60. This happens at 10Hz, so after another second robot will lose 600 HP.

3.3.1.3 Attacking the Armor

The armor module detects damage sources basing on its pressure sensor measurement and the measurement frequency. Damage sources are divided into projectile damage and collision damage. Different types of damage will cause a different amount of deduction of robot's HP. The measurement frequency of the armor module is 20 Hz.

Launching projectiles at an enemy robot's armor modules is the only permitted attacking method. Collisions with other robots and throwing objects or robot components to other robots are prohibited. The 17 mm and 42 mm projectiles also deal different amounts of damage. The HP deductions for the different projectile sizes are listed in the table following this paragraph. Please note that situation during the actual competition may vary, and the results are subject to the determination of the Referee System.

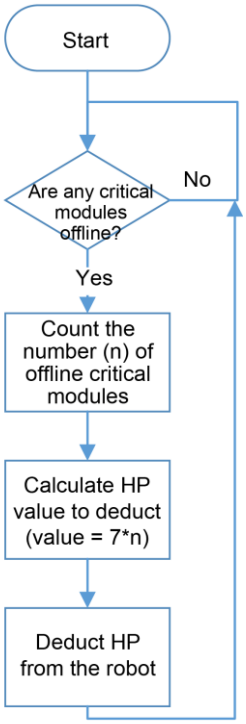
Each time the armor module is subjected to an impact (due to a collision with any part of another robot's body, its own structure hitting a venue prop, etc.), the robot suffers 25 damage.

Attack types	Speed (m/s)
42 mm projectile	500
17 mm projectile	50
Collisions	25

3.3.1.4 Referee System Module Offline

Teams must install a complete set of Referee System modules on each robot according to the *RoboMaster 2018 Referee System Specification Manual* and ensure that their robots maintain a stable connection between their Referee System modules and the server of the Referee System. The Referee System server detects whether the Referee System modules are connected every half second. When important modules such as the speed monitor module, positioning modules or armor modules go offline due to a problem caused by the design or structure of a robot, a corresponding amount of HP will be deducted.

Module initialization flow chart



3.3.2 Leveling Up

When a match round begins, all the robots start with 0 experience points. The Hero and the Standard robots start at Level 1. The Hero and the Standard robots level-up by earning experience points from the destruction of enemy robots. After leveling up, the robot's experience points are reset to 0. When experience points overflow (e. g. a robot only needs 20 experience point to level-up but it receives 50), any extra experience points are carried over towards achieving the next level.

During a seven-minute match round, each Standard robot gains one experience point per minute on the Battlefield, while each Hero robot gains two experience points per minute. When a robot is destroyed, its experience points remain the same and do not increase.

The experience point requirements for leveling-up Hero and Standard robots are as follows:

Robot Type	Level 1 - Level 2	Level 2 - Level 3	Experience Points Gained Per Minute
Standard	3	6	1
Hero	8	12	2

A robot is destroyed when its HP is reduced to 0.

During competition match round, robots can destroy different types of enemy robots to gain experience points (The server of the Referee System records and analyzes these situations).

There are two situations when an enemy robot is considered to have been destroyed:

1. A team's robot makes a fatal shoot that destroys an enemy robot.
2. A robot is destroyed due to friendly fire or exceeding its power limits or barrel heat limits. In this case, if an enemy robot attacked this specific robot within the last 10 seconds, this robot is considered to be destroyed by the enemy robot that made the last hit.

The experience points gained by destroying different enemy units are as follows:

Destroyed Robot	Status	Experience Points Gained
Standard	Level 1	2.5
	Level 2	5
	Level 3	7.5
Hero	Level 1	7.5
	Level 2	10
	Level 3	15
Engineer	Regular	5

Sentry	Regular	7.5

After a robot levels up, its barrel heat limit, heat cool-down rate, experience value, and maximum HP all increase.

The amount of HP gained at each level are as follows:

HP Gained By A Standard Robot When Leveling Up		
Level-Up Type	**HP Gained**	**Max HP**
Level 1 - Level 2	250	1250
Level 2 - Level 3	250	1500
HP Gained By A Hero Robot When Leveling Up		
Level-Up Type	**HP Gained**	**Max HP**
Level 1 - Level 2	500	2500
Level 2 - Level 3	1000	3500

3.3.3 Revival/Recovery Procedures

Revival Procedures

When a team's robot is in a destroyed state, after staying at the Regeneration Point for a certain amount of time (revival cool-down time) it can then be revived. However, robots that have been ejected by a Level 4 Penalty cannot be revived.

A robot can transport a destroyed robot to the Regeneration Point of its team's Restoration Zone, and when the dead robot detects the regeneration point using its RFID interaction module and stays there until the revival cool-down time passes, it revives. Revived robots maintain the level and experience points they had before they were destroyed and 20% of their maximum HP is restored as well. The robot is also invincible for 10 seconds after it revives.

The revival cool-down time of different robot types are shown below:

Robot Types	**Revival Cool-Down Time**
Standard	First destroyed, the cool-down time is 5 seconds. Then each death will add 10 seconds to the cool-down time.
Hero	First destroyed, the cool-down time is 10 seconds.

	Then each death will add 10 seconds to the cool-down time.
Engineers	First destroyed, the cool-down time is 20 seconds. Then each death will add 10 seconds to the cool-down time.
Sentry	Unrevivable
Aerial	Unrevivable

Recovery Procedure

When a robot is at the Regeneration Point with its RFID interaction module detects underlying signal generator, it will recover health at an amount equal to 5% of its maximum HP per second until its HP restores to the maximum amount.

3.3.4 Referee System Installation Specification

The Referee System is provided by the RoboMaster Organizing Committee. It records a robot's status, such as the number of projectiles it has been struck by, its HP, projectile firing speed, and chassis power consumption. The Referee System sends status updates to the Referee System server to determine the result of each round and ensure fair play. And operator can view some status from the UIs of their FPV screens.

Every team must assemble the mechanical and electrical interfaces of their robots correctly and ensure that the Referee System can be installed. **Robots that do not meet the Referee System installation requirements will fail the pre-match inspection and cannot enter the competition.**

The RoboMaster 2018 Referee System consists of following components:

Module	Purpose
Video Transmission Module	Captures live video from the camera and displays it on the operator's FPV screen in the Operator Room.
Speed Monitor Module	Detects the firing speed of the projectile launching mechanism and deducts HP from a firing robot if its firing speed is above the predetermined limits.
Armor Modules	Comprised of armor plates and sensors, this module detects projectile impacts to deduct HP accordingly.
RFID Interaction Module	The RFID interaction module detects functional mechanisms around the Battlefield.
Positioning Module	The positioning module determines the robots' location on the Battlefield.
Main Control	The main control module controls the battery power supply and calculates power

Module	Purpose
Module	consumption. It also indicates the amount of HP remaining using the strength of its LED light bar. The color of the LED bar is used to distinguish between the red and blue teams, as well as the status of the robots. The main module cuts the power supply when a robot's HP reaches 0. The main control module connects to the Referee System server to upload robot status.

Please refer to the *RoboMaster 2018 Referee System Specification Manual* for installation instructions and detailed explanations of the functions of the Referee System.

Chapter 4: Competition Area

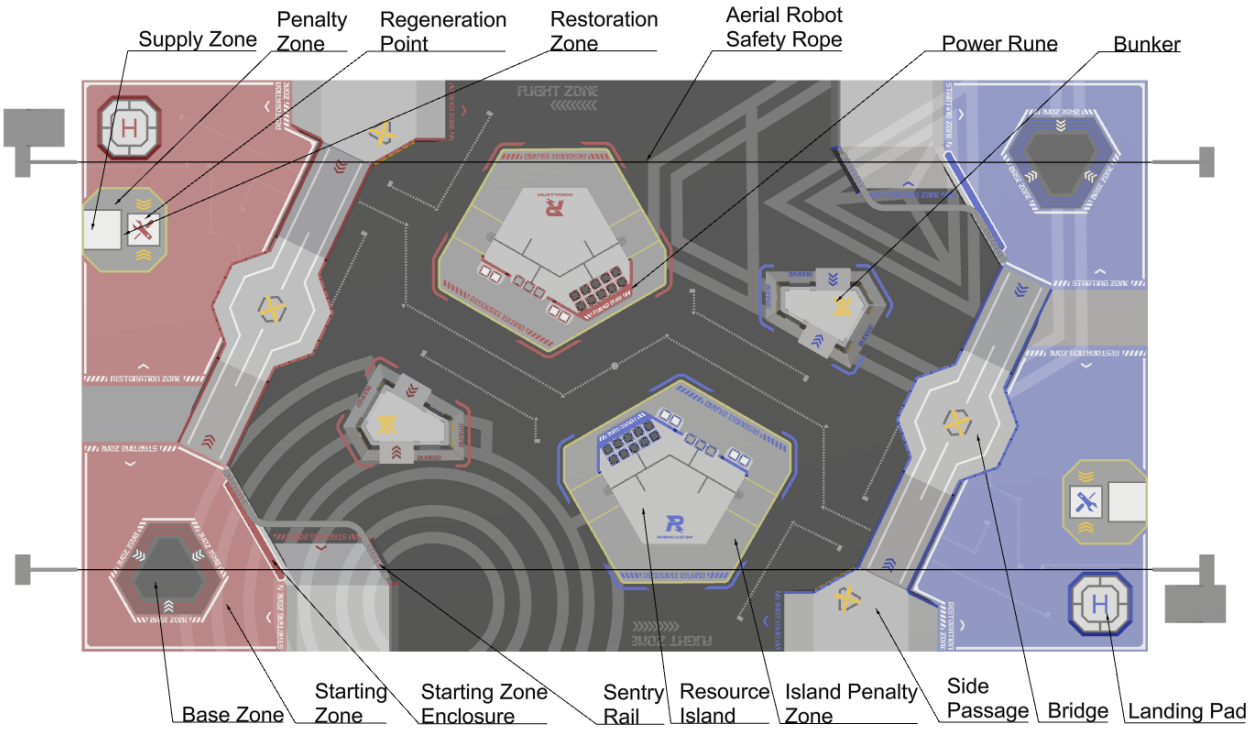
4.1 Battlefield Overview

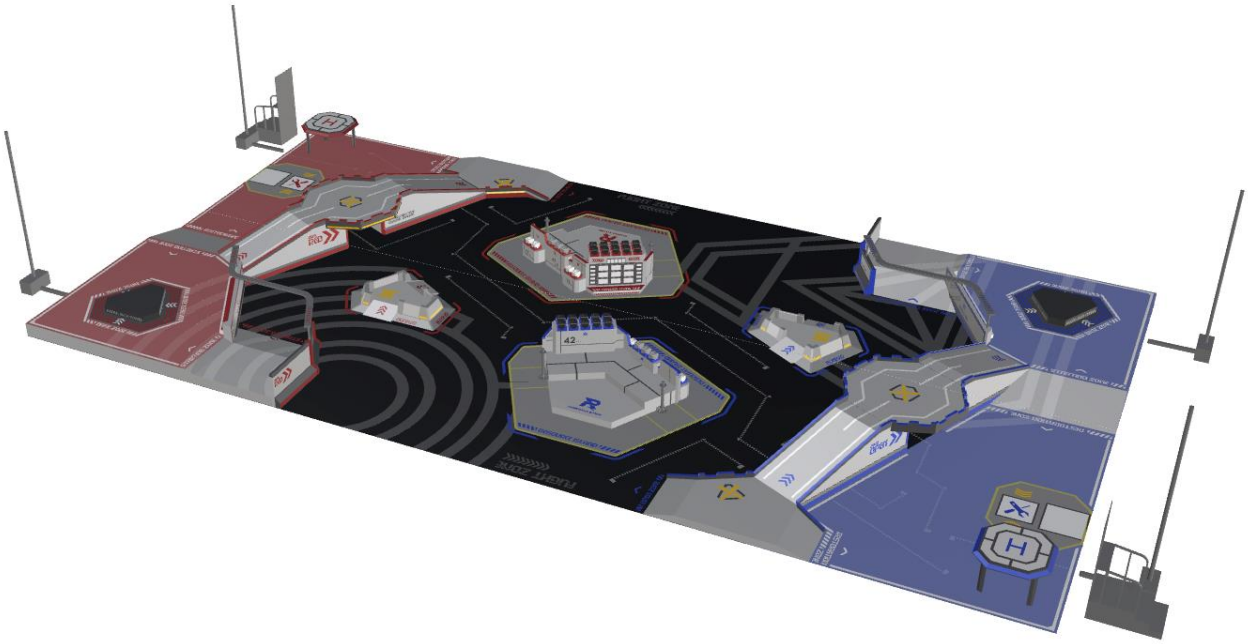
The core area of the RoboMaster 2018 Competition Area is called the Battlefield. It is 28m long and 15m wide, and consists of Starting Zones, Restoration Zones, Bridges, Open Zone, Resource Islands, and other elements.

Notice:

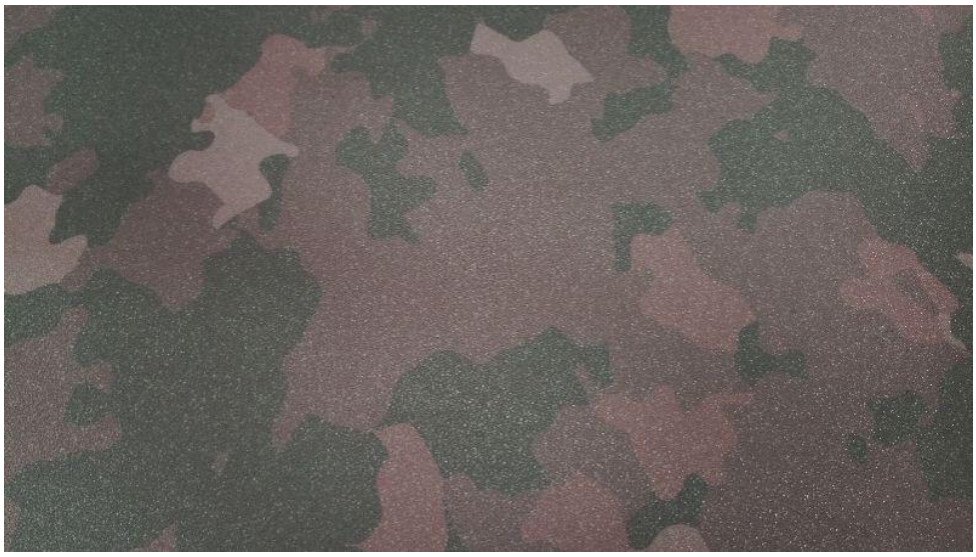
There is a ± 5% margin of error for all object dimensions in this chapter.

The Battlefield is shown in the figures below:





The Battlefield is laid with granulated PVC with a thickness of 3 mm or 4.5 mm. The surface of the floor is shown in the following figure:



Notice:

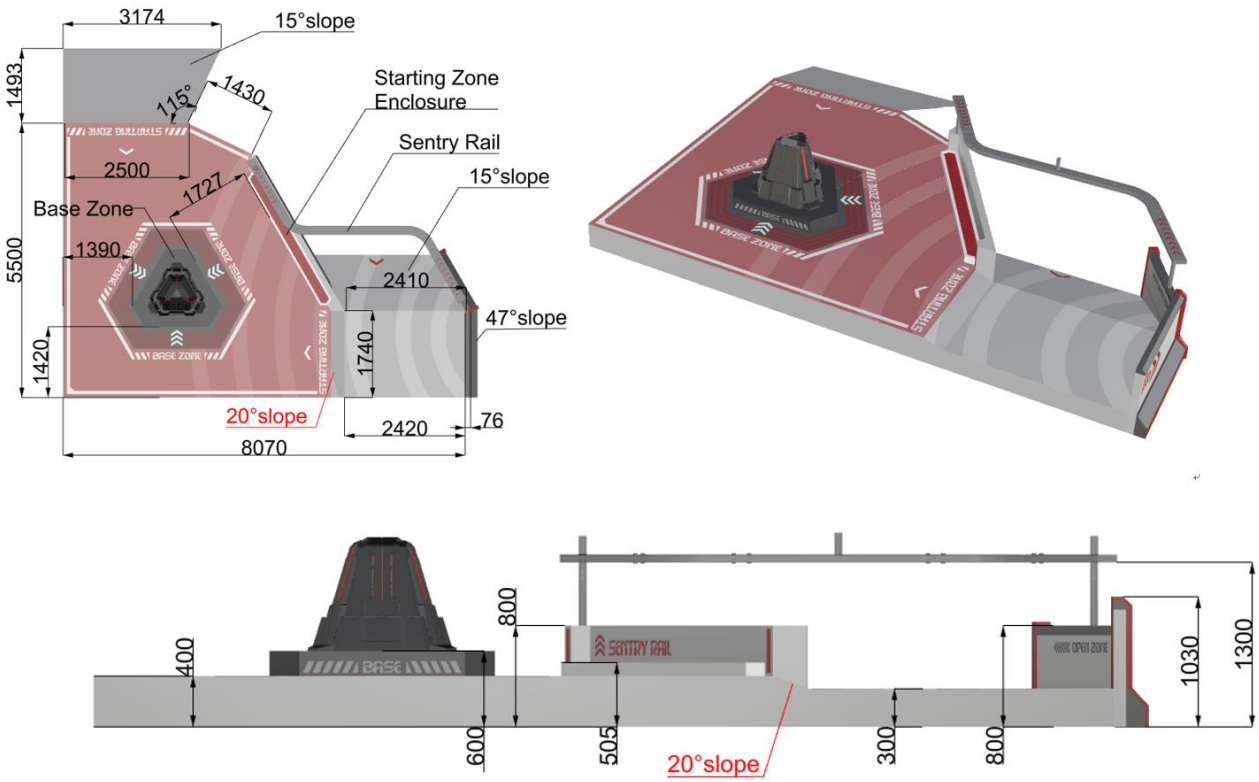
The color in the figure is for illustration only.

4.2 Starting Zone

Zone Description

The Starting Zone is where a team sets up its ground robots during the Setup Period. This zone includes the Base Zone, Sentry Rail, and the team's Base.

The layout of the Starting Zone is as follows:

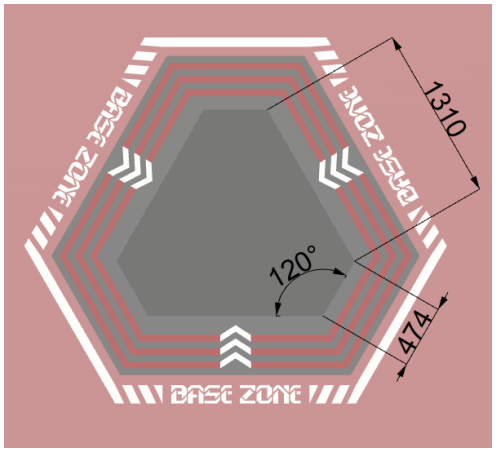


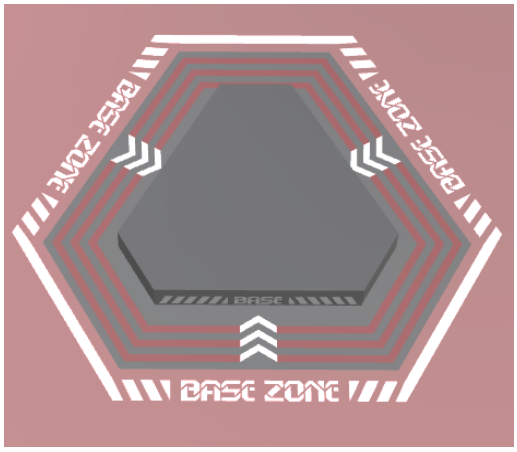
4.2.1 Base Zone

Zone Description

The Base Zone is a hexagonal platform in the middle of the Starting Zone. The height difference between the surface of the Base Zone and the ground of the Starting Zone is 200mm.

The Base Zone is shown in the following figures:



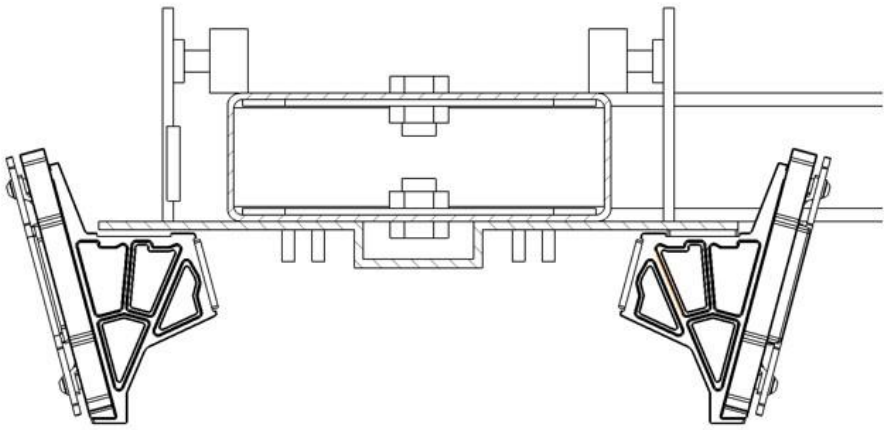


4.2.2 Sentry Rail

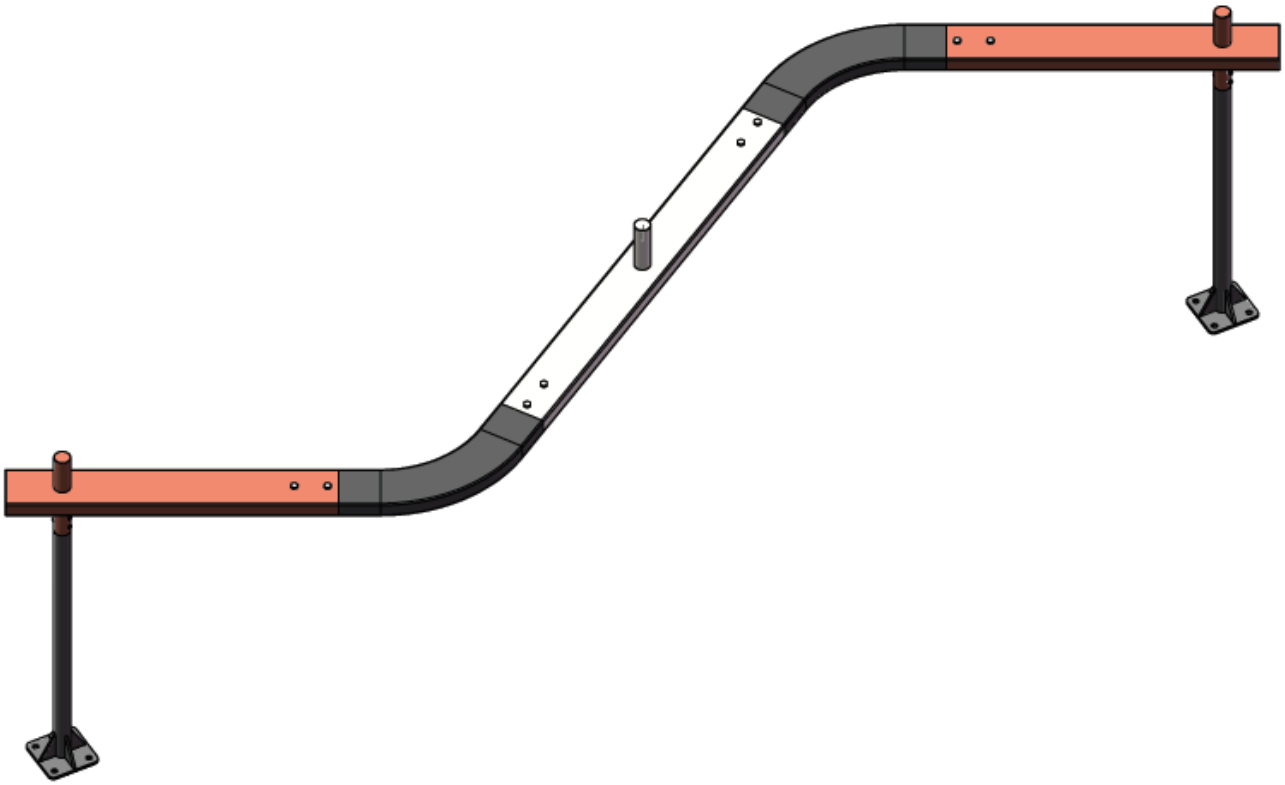
Element Description

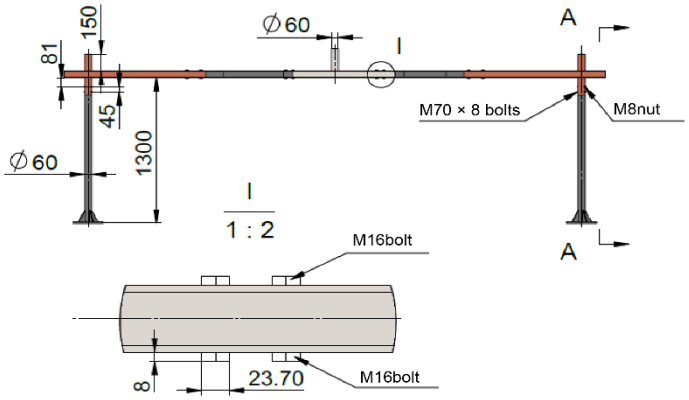
The Sentry Rail consists of two parts: the main rail and its supporting frame. The Sentry Rail is the only place on which a Sentry robot can move and operate. The three cylindrical pillars on the rail can be used for robot localization. Welded structures exist at points of contact between the pillars and the top surface of the Sentry Rail. The bottom surface of the Sentry Rail is designed to be 1300mm above the Battlefield. Due to the weight of the rail and other factors, the height of the middle part will differ from the height on both sides. Therefore, the distance between the bottom of the rail and the Battlefield is allowed to be within 1250-1300mm.

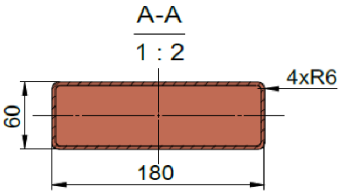
A Sentry Robot hangs on the rail and can move, stop, and launch 17mm projectiles using automated programs. When a Sentry is hung on the straight portion of the Sentry Rail, the long side of the large armor modules on the Sentry shall remain parallel to the rail. For the side facing the Base Zone, the sentry should be equipped with armor ID 0 and the other side with armor ID 1. Shown in the figure below:

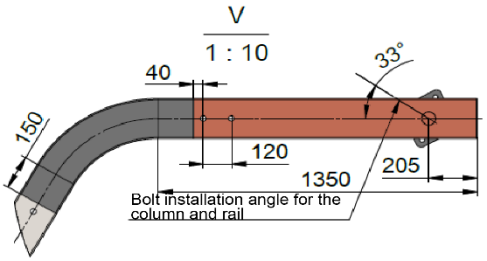


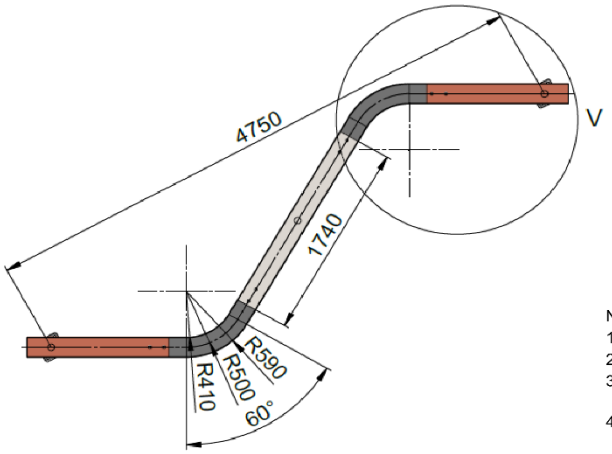
The surface of the rail is polished. The dimensions of the Sentry Rail are as follows:

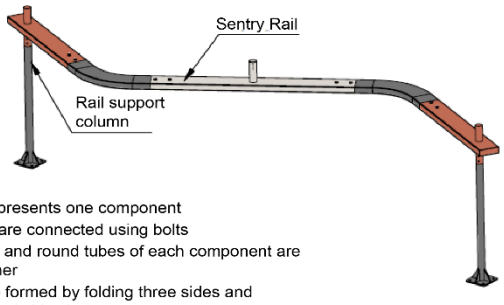












Note:

1. Each color represents one component
2. Components are connected using bolts
3. The flat tubes and round tubes of each component are welded together
4. Flat tubes are formed by folding three sides and welding the final side shut
5. The angle of the hexagonal bolt after it is tightly screwed is uncertain. The drawing is for illustration purpose only.

4.2.3 Base

There are two Bases for each team in the Battlefield. The total HP of a Base is 10,000. Bases are equipped with 3 large armor modules at the top, 3 large armor modules on the sides of its inner core. All armor modules has stickers to indicate their positions. Please refer to section **Appendix 5 - Reference Pictures** for more details.

Base Zones are penalty zones for opposing team's robots. The space inside and above the boundary of the Base Zone is restricted. Robots must not enter the opponent's Base Zone. Please refer to section **Combat Rules** for more details.

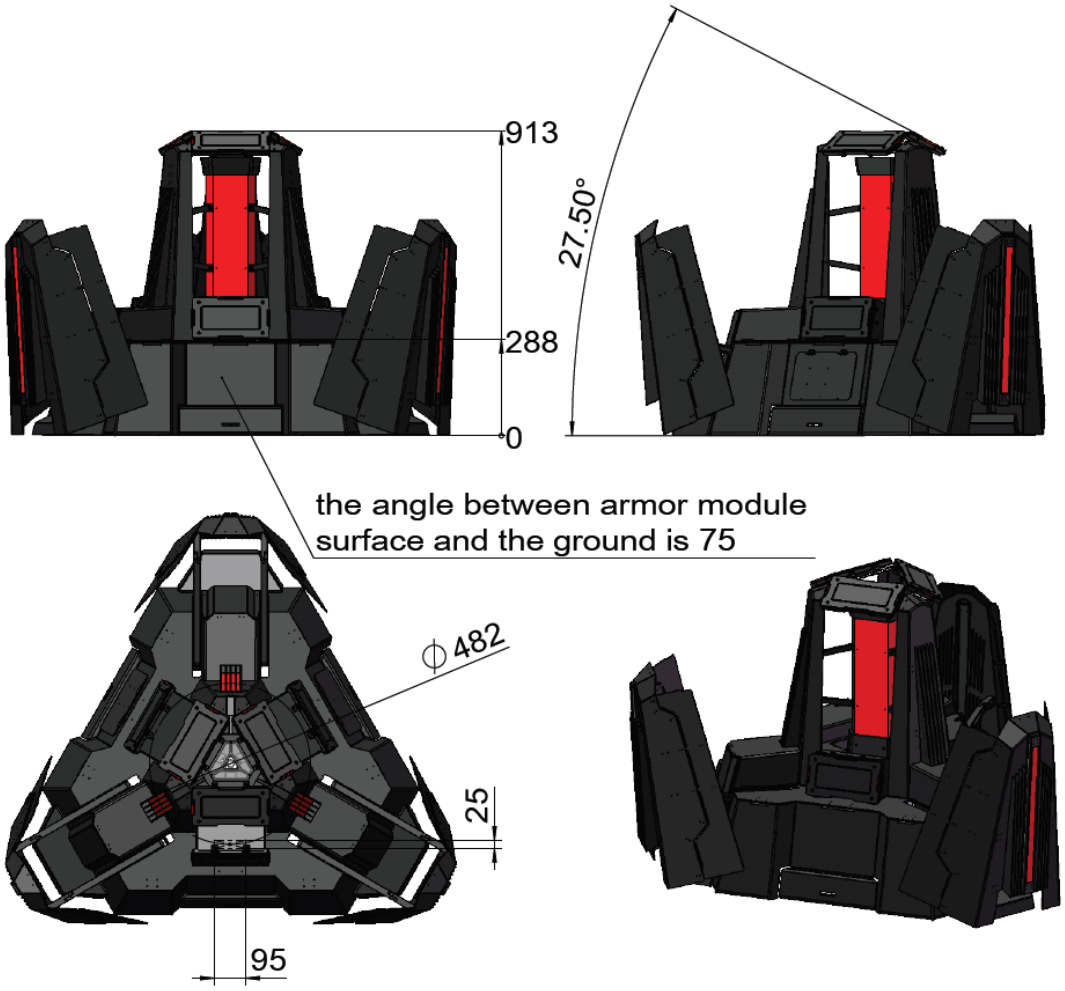
At the beginning of a match round, the Base has 100% defense bonus. And the protection shields of the Base are engaged.

If a team has the Sentry robot. During each match round, when the first non-Sentry robot death (Death may due to projectile hits, collision, Referee System module offline penalty or ejection) of this team happens, the power to this team's Sentry robot chassis will be cut off for **40** seconds. At the same time, the defense bonus of the Base reduced to 50%.

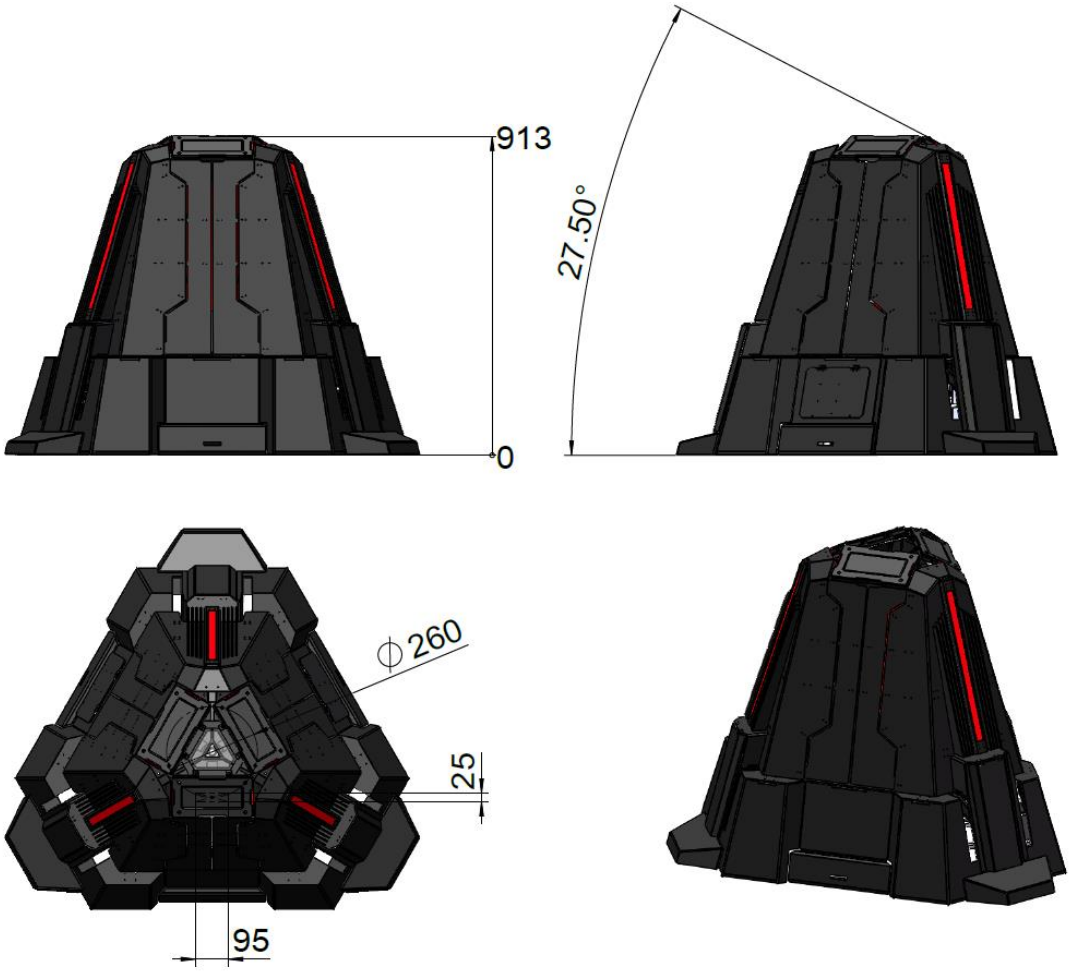
If a team has the Sentry Robot, when the Sentry is destroyed, then the Base has no defense bonus, and the protection shields of the Base open.

If a team does NOT have the Sentry robot. During each match round, when the first robot death (Death may due to projectile hits, collision, Referee System module offline penalty or ejection) of this team happens, the defense bonus of the Base reduced to 50%. And 120 seconds after the match round starts, the defense bonus disappears, and the protection shields of the Base open.

The following are diagrams of the Base:



Base with open protection shields

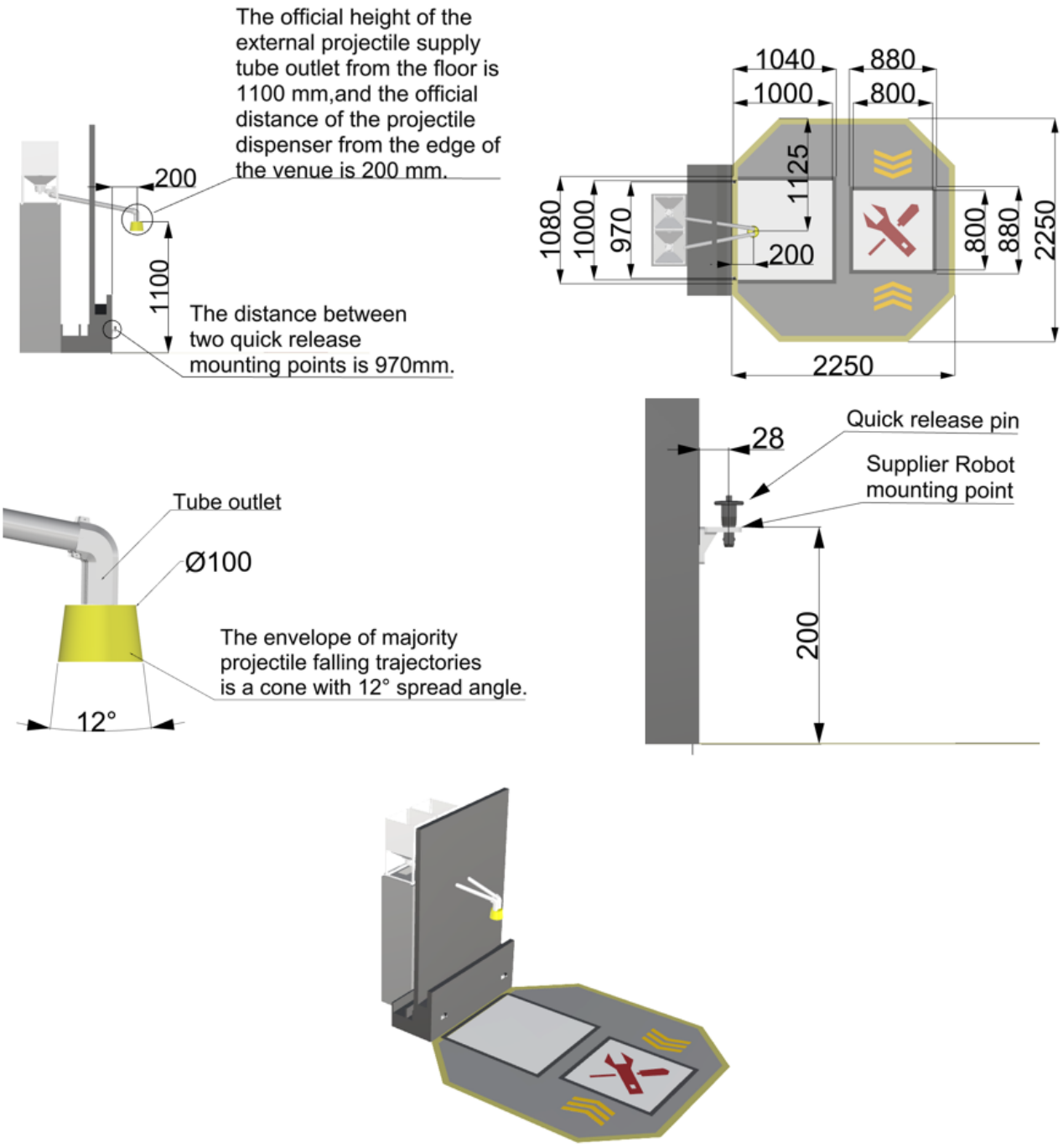


Base with protection shields engaged

4.3 Restoration Zone

Zone Description

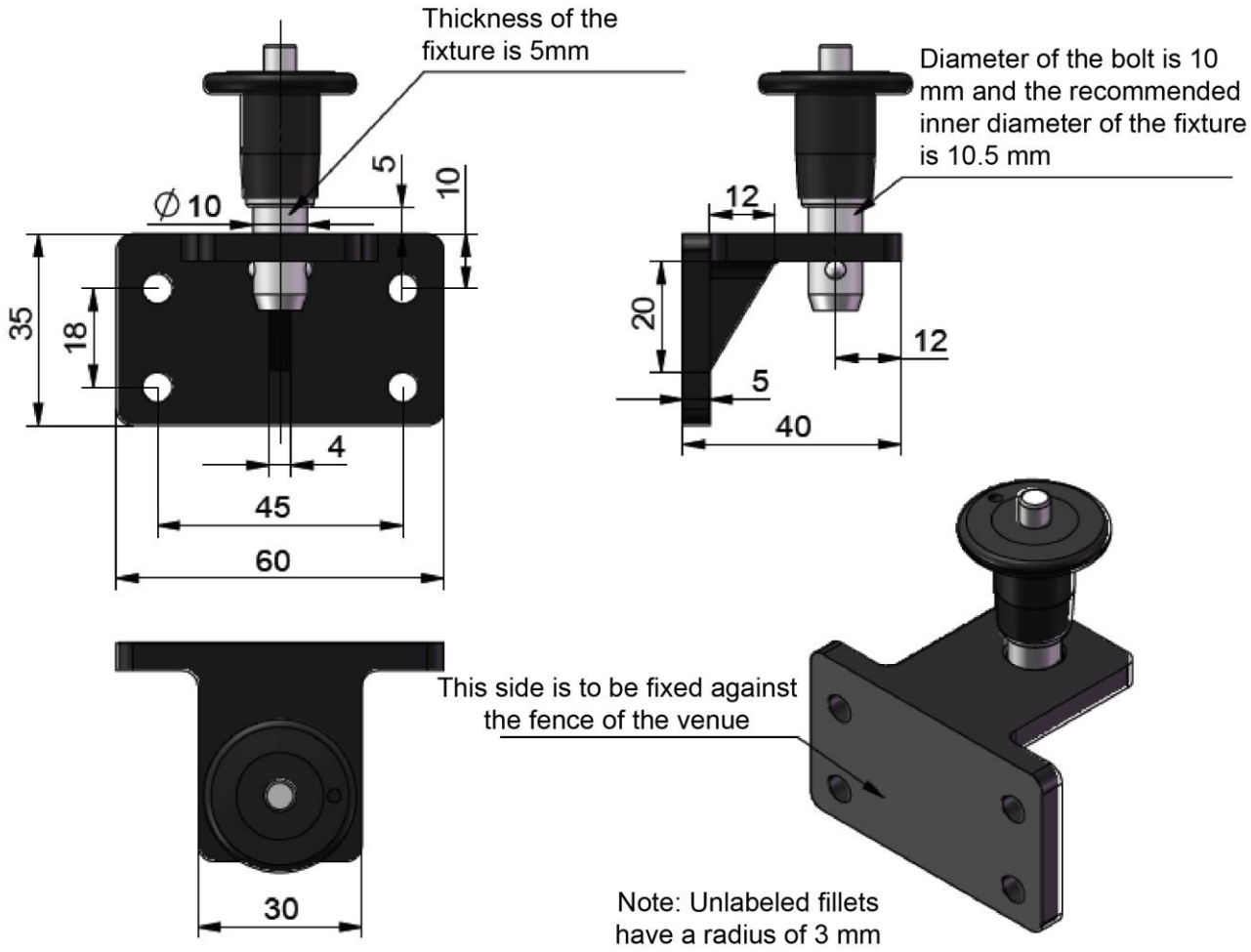
The zone adjacent to the Starting Zone is quite important. This zone contains a team's Supply Zone, Regeneration Point, and external projectile supply tube. Robots can reload projectiles, restore HP, and revive in this zone. Images and dimensions of the Supply Zone are as follows:



The external projectile supply tube outlet has a wide spreading angle. Team should design a wide entrance on the Supplier Robot to better receive projectile supply.

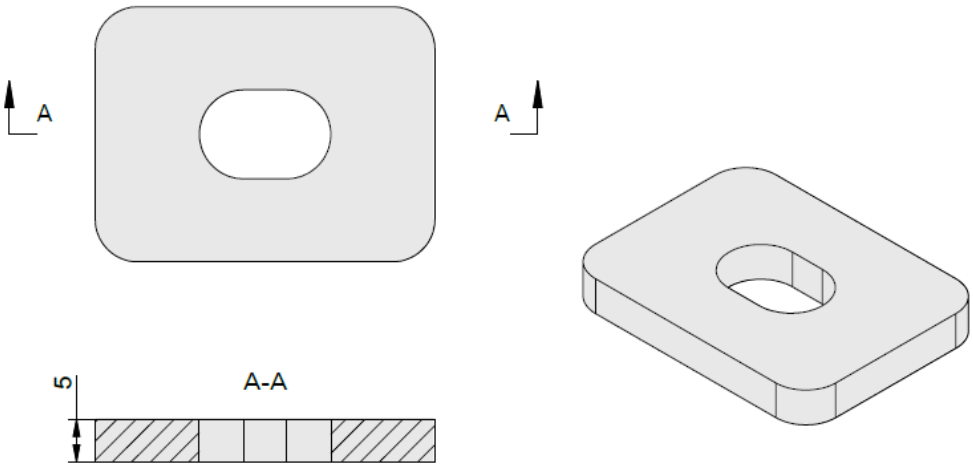
In match rounds, Supplier robots can be easily moved by collisions. In order to help teams stabilize their Supplier Robots, two quick release mounting points are added in the Supply Zone. Teams may use the mounting points to fix the position of Supplier Robots, preventing them from moving during a collision.

The quick release mounting points for the Supplier Robot are shown as follows:



Notices:

1. The external projectile supply tube is easily knocked out of place by collisions and other external forces. The pit crew members cannot touch the external projectile supply tube when moving robots in this zone.
2. Team should consider the locations of the mounting points for the Supplier Robot when designing it to avoid the Supplier Robot from not being able to latch onto the mounting points. For example, use slot instead of hole to give screw more clearance as shown in the following figure:



4.3.1 Supply Zone

Zone Description

The 1000 mm x 1000 mm Supply Zone is where a team's external projectile supply tube outlet is located, and is also the home of team's Supplier Robot. The Supplier Robot cannot leave the Supply Zone at any point during a match round.

The height of the external projectile supply tube outlet from the ground is 1100 mm. The extended horizontal distance of the supply tube outlet is 200 mm. The diameter of the outlet of the external projectile supply tube is 50 mm;

The Supplier Robot's projectiles must be unloaded before every round. During one round, extra projectiles are supplied to the Supplier Robot through the external projectile supply tube. The tube distributes 200 x 17 mm projectiles at the beginning of each round, and distributes a further **150** x 17 mm projectiles each minute thereafter.

4.3.2 Regeneration Point

Element Description

It is an 800 x 800 mm square area with several RFID cards under its surface. When the RFID interaction module on a robot communicates with RFID cards, the robot restores HP or starts to revive. For specific mechanism, see **3.3.3 Revival/Recovery Procedures**.

4.3.3 Penalty Zone

Zone Description

A team's Supply Zone and its surrounding Penalty Zone has strict access rules for opposing team's robots.

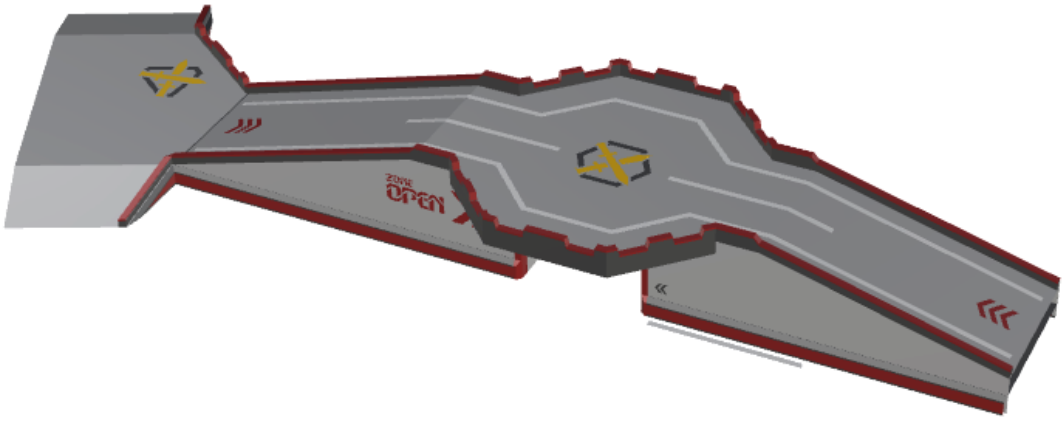
In general opposing robots are forbidden to enter the space within and above the 2000 x 2000 mm boundary of the Penalty Zone. Please refer to **Combat Rules** for specific violation and penalty details.

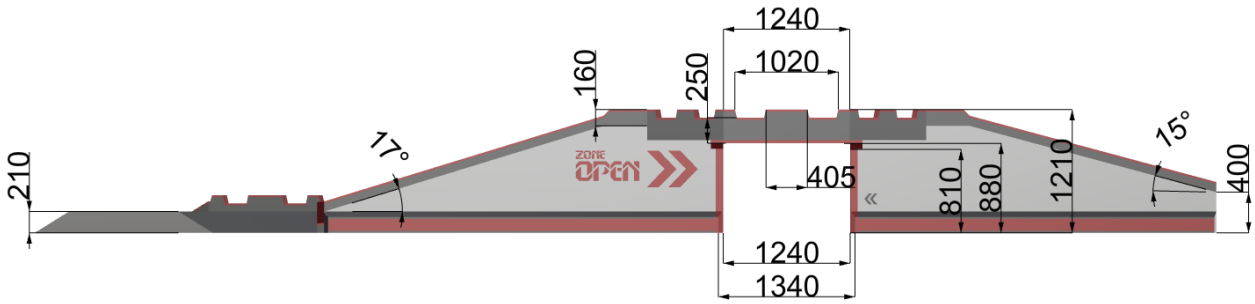
4.4 Bridge

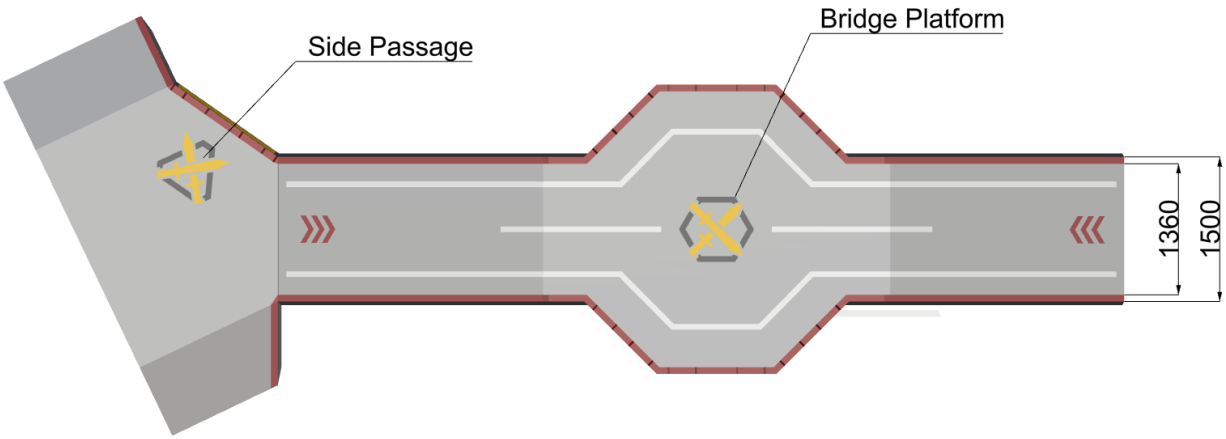
Element Description

A Bridge connects the Open Zone and Starting Zone. It is the shortest path to enter an opposing team's Base Zone. A Bridge contains a bridge platform and a side passage, both of which are strategical locations.

Images and dimensions of the bridge are as follows:





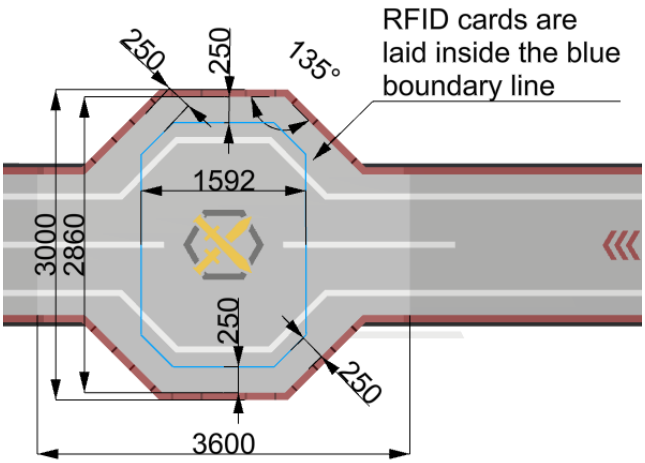


4.4.1 Bridge Platform

Element Description

The top surface of bridges are called bridge platforms. A number of RFID cards are laid under the surface of the bridge platforms. When a robot occupies a bridge platform by using its RFID interaction module to read RFID cards, the cool-down rate of its barrel heat is five times faster than normal. If more than two robots enter the same bridge platform, only the robot that first occupies the bridge platform gains this bonus.

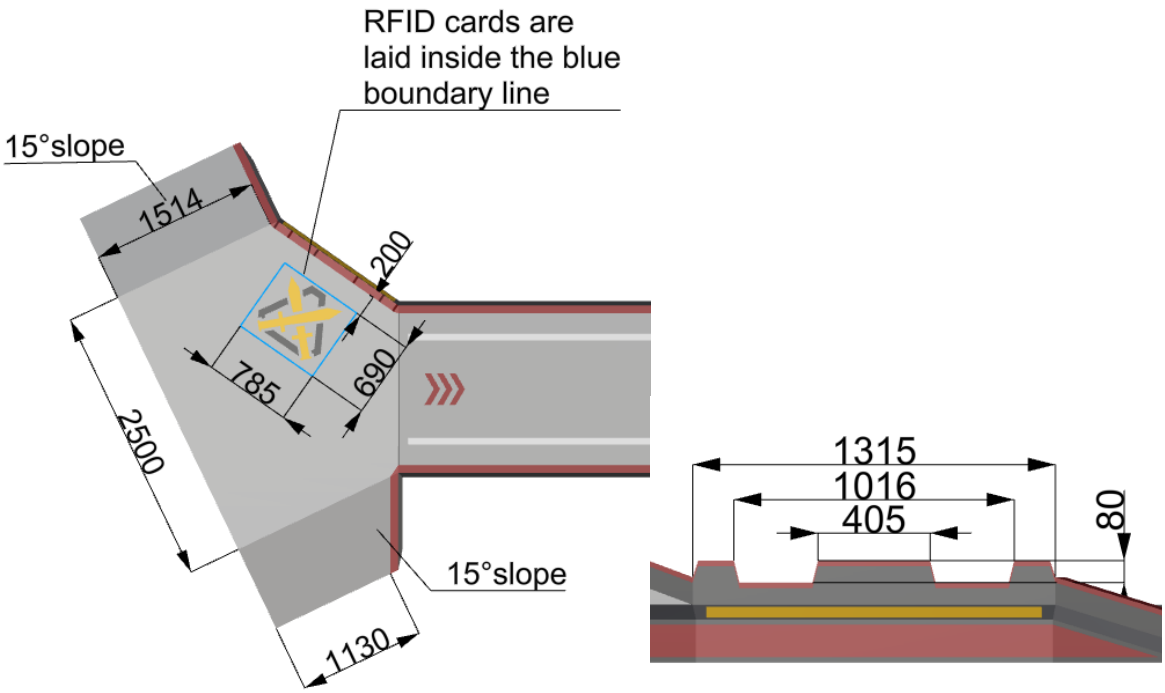
The dimensions of a bridge platform are as follows:



4.4.2 Side Passage

Element Description

A Side passage locates at the end of a bridge. It contains several RFID cards, making it an important strategic location. When a robot occupies a side passage by using its RFID interaction module to read RFID cards, the cool-down rate of its barrel heat is five times faster than normal. If more than two robots enter the same side passage, only the robot that first occupies the side passage gains this bonus.



4.5 Open Zone

Zone Description

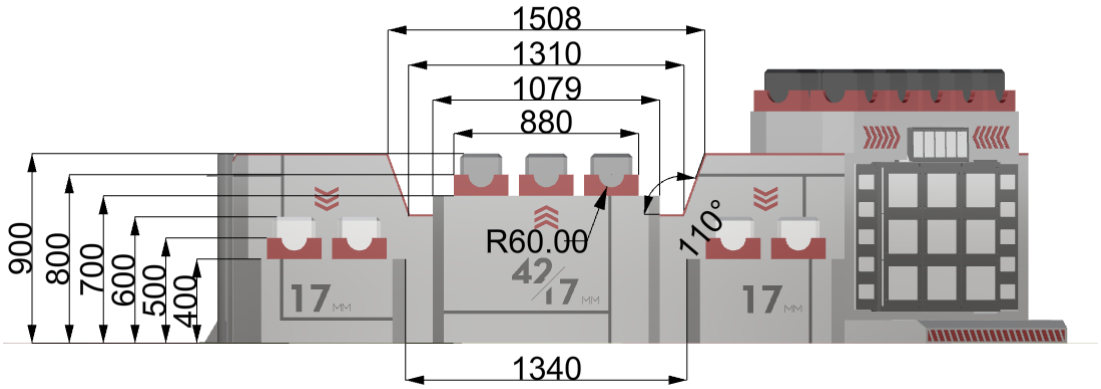
The center of the Battlefield is called the Open Zone. This is an important zone where a majority of the projectile launching, maneuvering, and robot destruction events occur. This zone contains Resource Islands and Bunkers.

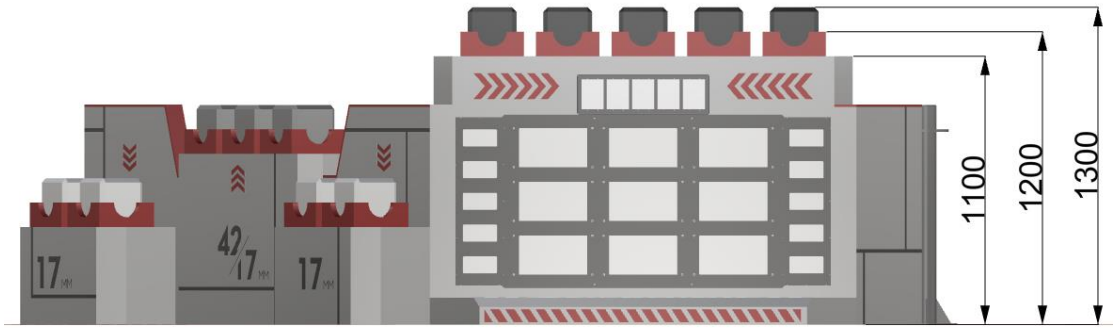
4.5.1 Resource Island

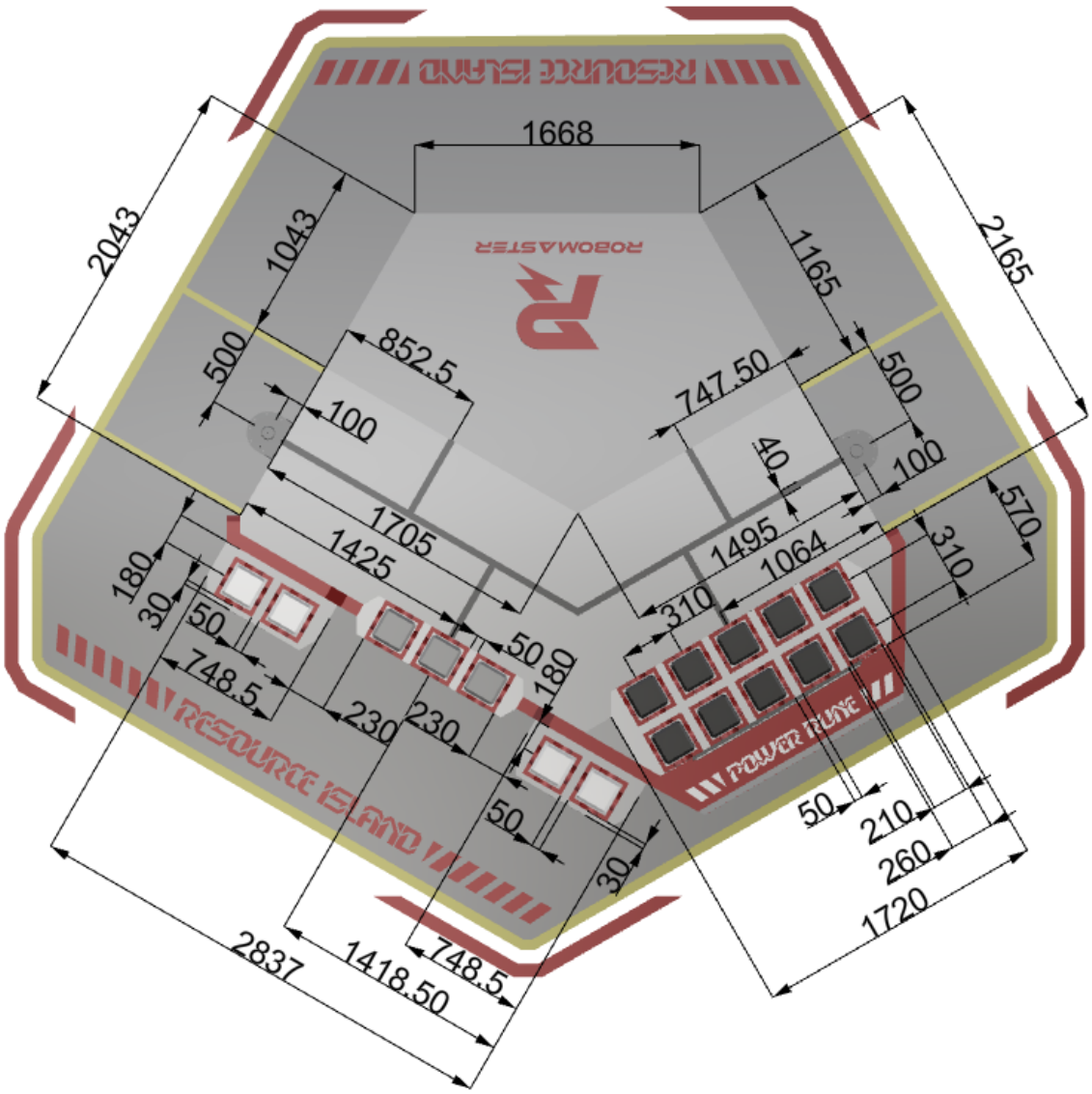
Element Description

The Resource Island is a large hexagonal elevated platform located in the middle of the Battlefield. There are two Resource Islands for both teams. They include Projectile Containers, Power Runes, and Assistance Columns. Both teams can access both islands to collect Projectile Containers. These islands are critical for the competition.

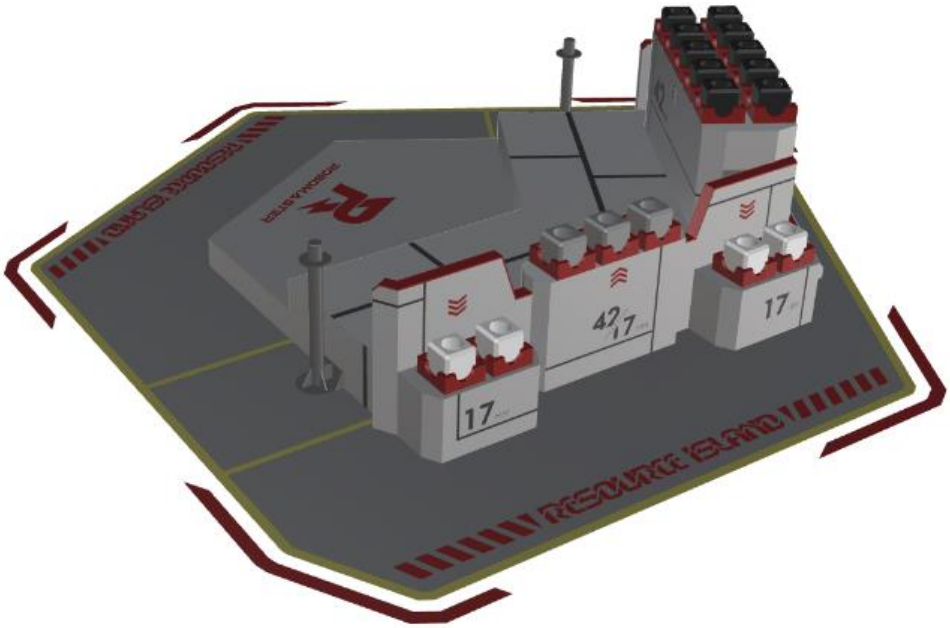

42 MM
400
200


1508
1310
1079
880
900
800
700
600
500
400
R60.00
110°
42/17 MM
17 MM
17 MM
1340

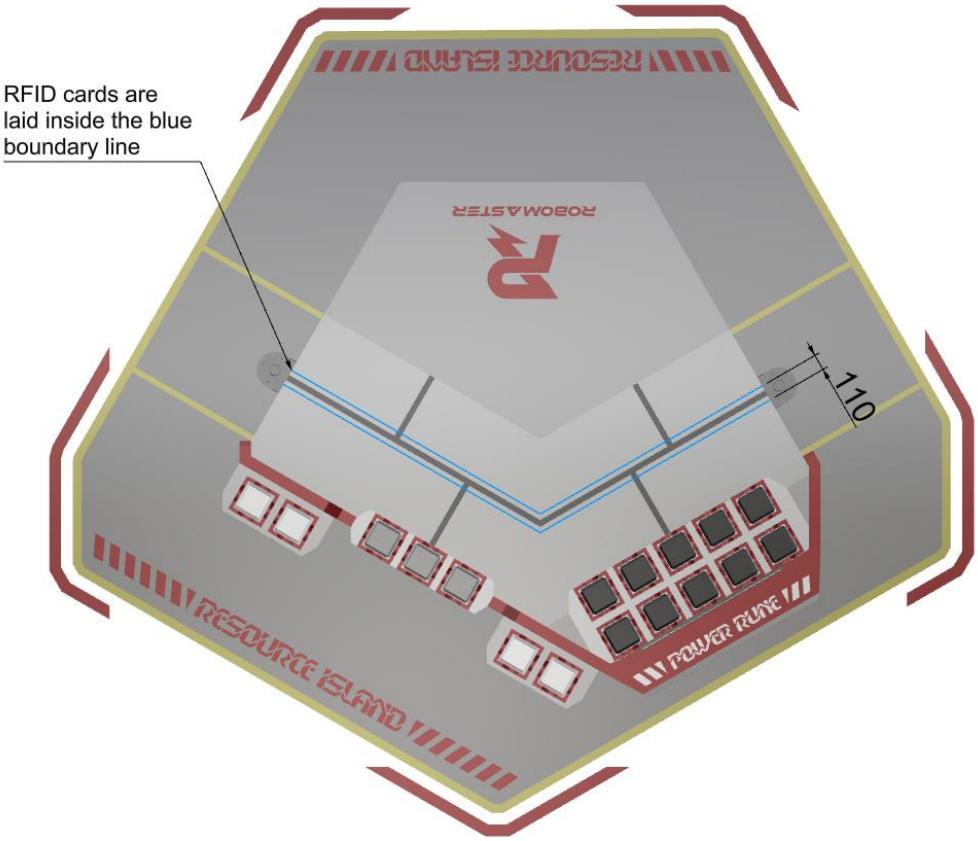

1100
1200
1300
42/17 MM
17 MM
17 MM



There is a line of RFID cards located along the top of both sides of the Resource Island's top platform. When a robot detects one of these cards with its RFID interaction module, it receives an 80% defense bonus for 20 seconds. When this defense bonus expires, the robot can return to the edge of the top platform to obtain another 80% defense bonus.



The specific drawings and dimensions are as follows:



Island Penalty Zone

The Island Penalty Zone is a 20-mm-thick wooden platform that encloses the Resource Island. The resource island platform's two steps is 200 mm and 400 mm higher than the surface of the Penalty Zone (± 5% accuracy). Hero Robots and Engineer Robots can land on Resource Islands, and other robots are not allowed to land on Resource Islands in any way.

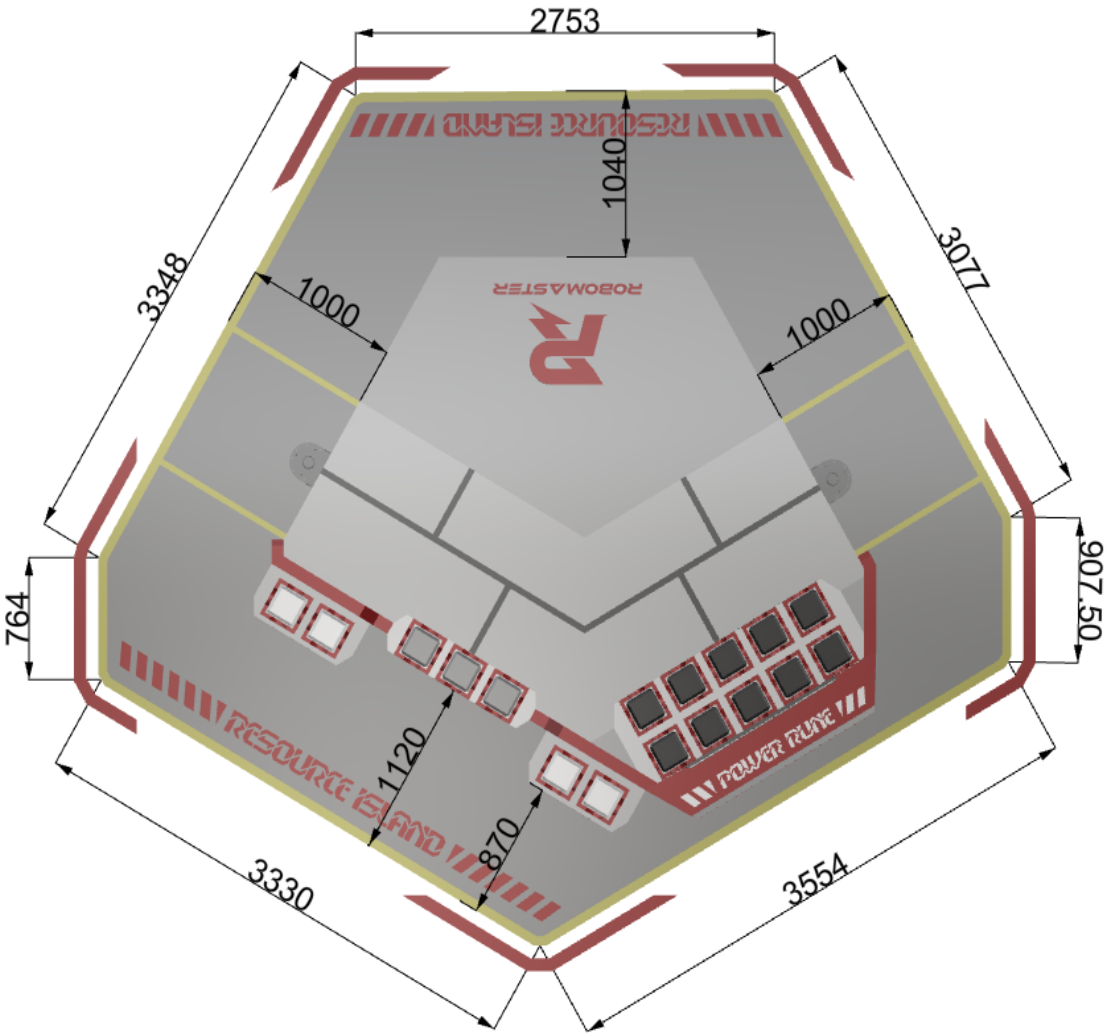
The Penalty Zone is shown in the following figure:

Hero and Engineer Robots have priority in the Penalty Zones around Resource Islands. Standard robots are prohibited from blocking the landing area and the Projectile Container pickup area of Resource Islands. Standard robots from any team shall not disrupt Hero or Engineer robots who are trying to land or leave the island, or are picking up Projectile Containers. Otherwise, the violating robot will be penalized.

Engineer and Hero Robots from any team shall not disrupt Engineer and Hero Robots from the other team trying to land or leave the island, or are picking up Projectile Containers. Violating robots will be penalized.

Violations:

Regulations	Penalty Standards
1	If a Standard robot disrupts a Hero or Engineer Robot from the opposing team that is landing or leaving a Resource Island or picking up Projectile Containers for a short period of time (less than 3 seconds), the referee will give a Level 1 penalty to the violating robot;



Regulations	Penalty Standards
2	If a Standard robot disrupts a Hero or Engineer Robot from the opposing team that is landing or leaving a Resource Island or picking up Projectile Containers, for a significant period of time (between 3-10 seconds), the referee will give a Level 2 penalty to the violating robot and the robot must leave the Resource Island;
3	If a Standard robot disrupts a Hero or Engineer Robot from the opposing team that is landing or leaving a Resource Island or obtaining Projectile Containers for a long period of time (10 seconds or above), the referee will give a Level 3 penalty to the violating robot;
4	If a Standard robot stays in a Resource Island's Penalty Zone or upper platform for a long period of time, blocking a Hero or Engineer Robot from the opposing team from landing or leaving a Resource Island or picking up Projectile Containers, and clashes with a robot from the opposing team causing the robot to malfunction, the referee will give a Level 4 penalty to the violating robot.

Regulations	Penalty Standards
1	If a Hero or an Engineer Robot disrupts a Hero or Engineer Robot from the opposing team that is landing or leaving a Resource Island or picking up Projectile Containers for a short period of time (less than 3 seconds), the referee will give a Level 1 penalty to the violating robot;
2	If a Hero or an Engineer Robot disrupts a Hero or Engineer Robot from the opposing team that is landing or leaving a Resource Island or picking up Projectile Containers, for a significant period of time (between 3-10 seconds), the referee will give a Level 2 penalty to the violating robot and the robot must leave the Resource Island;
3	If a Hero or an Engineer Robot disrupts a Hero or Engineer Robot from the opposing team that is landing or leaving a Resource Island or obtaining Projectile Containers for a long period of time (10 seconds or above), the referee will give a Level 3 penalty to the violating robot;
4	If a Hero or an Engineer Robot stays in a Resource Island's Penalty Zone or upper platform for a long period of time, blocking a Hero or Engineer Robot from the opposing team from landing or leaving a Resource Island or picking up Projectile Containers, and clashes with a robot from the opposing team causing the robot to malfunction, the referee will give a Level 4 penalty to the violating robot.

Properties and Roles

A Resource Island has 17 Projectile Container grooves, which are grouped into dedicated areas for 42 mm projectiles, mixed projectiles, and 17mm projectiles.

Loaded Projectile Containers are placed on the Projectile Container grooves. Before each round begins, referees and volunteers will place projectiles in the containers, and then place the containers in their appropriate positions on the Resource Islands. The Engineer and the Hero Robots can move them to obtain projectiles.

Projectile Container

Projectile Containers are 200 x 200 x 200 mm cube made of EVA. All of its six faces are chamfered. There is a hole on one side of the cube. The diameter of the hole is 115mm, but the depth of the hole varies on different types of Projectile Container:

- 42mm Projectile Container depth: 150 mm
- 17 mm Projectile Container depth: 80 mm
- mixed projectile container depth: 100 mm

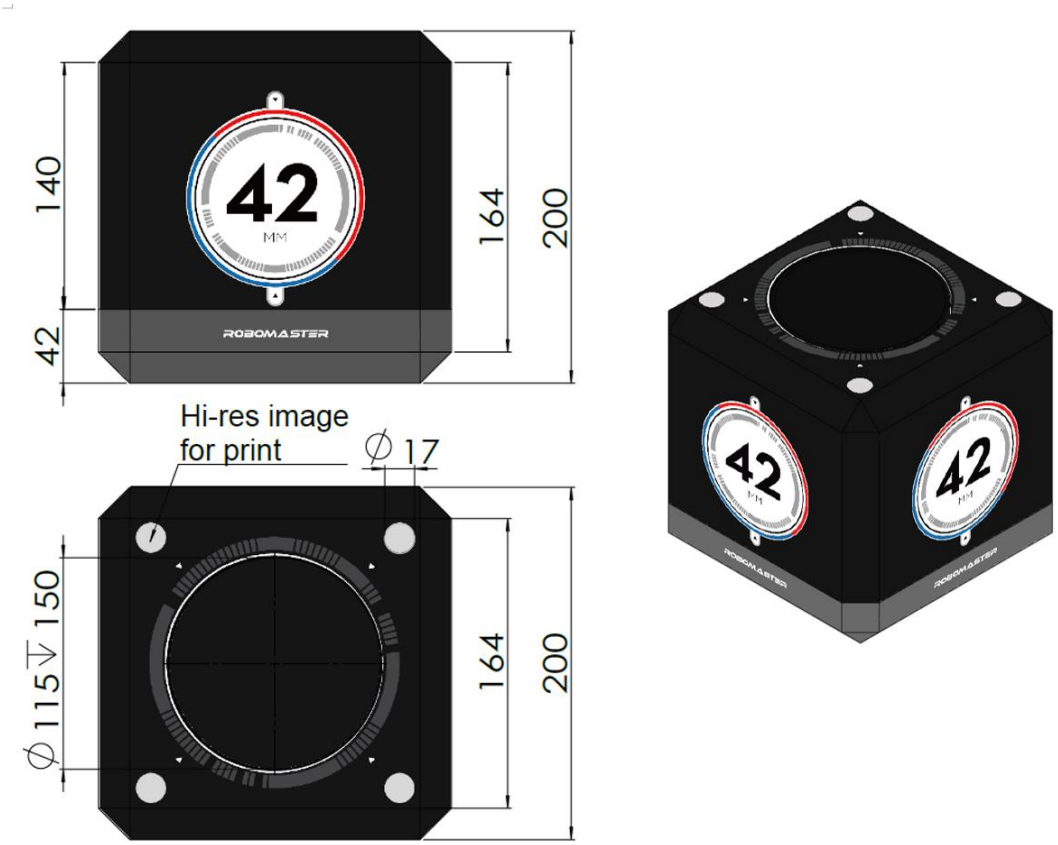
1. There are ten 42 mm Projectile Containers in the 42 mm Projectile Container area. Each of these projectile containers contains twenty 42 mm projectiles.
2. There are three mixed Projectile Containers in the mixed Projectile Container area. Each of these containers contains five 42 mm projectiles and about 180 17 mm projectiles. The top of projectiles are the same height as the top edge of the Projectile Container.
3. There are four 17 mm Projectile Containers in the 17 mm Projectile Container area. Each of these containers are filled with projectiles to a level where the tops of the projectiles are at the same height as the top edge of the container.

During a match round, robots can use Projectile Containers as obstacles but are forbidden from placing Projectile Containers on the platform of a Resource Island.

Violations:

Any robot below a Resource Island attempting to place a Projectile Container on the platform of a Resource Island will receive a Level 2 penalty.

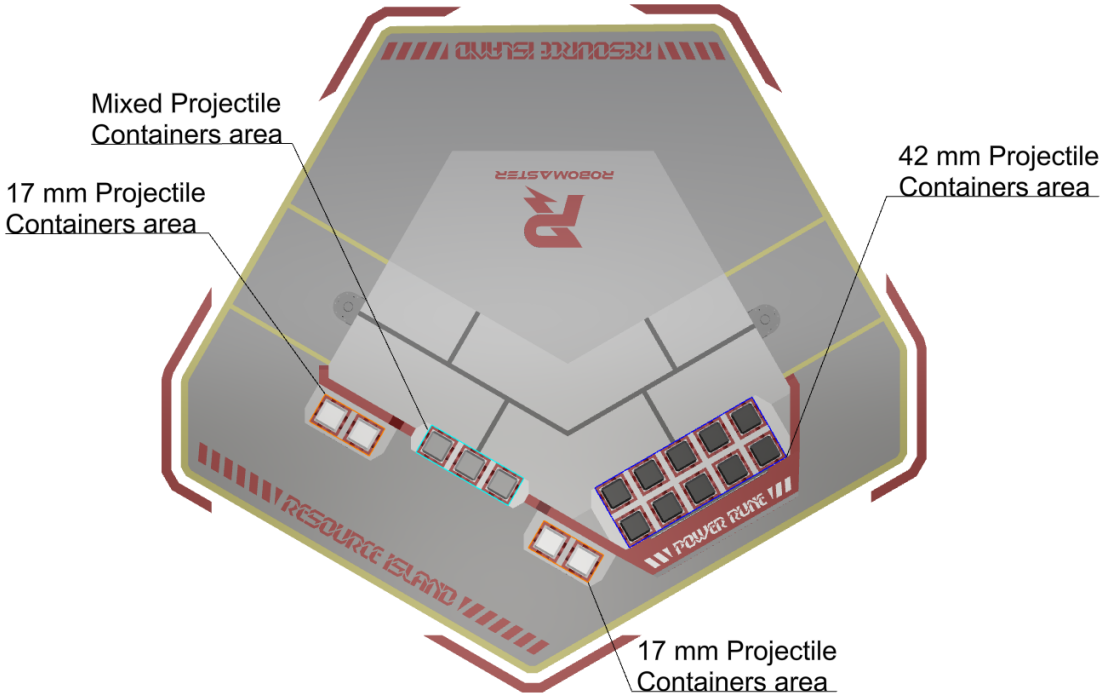
The Projectile Container is shown in the following figure:



Notice:

The color in the figure is for illustration only. The color of actual containers may differ from it.

The layout of Projectile Containers is shown in the following diagram:



Assistance Columns

There are two Assistance Columns on both sides of a Resource Island that are made of Q235 steel with a matt surface. Teams can let their Hero Robots and Engineer Robots to utilize these Assistance Columns to access Resource Islands to obtain projectiles.

During a match round, no robot shall place Projectile Containers on the Assistance Columns or place Project Containers in the Island Penalty Zones.

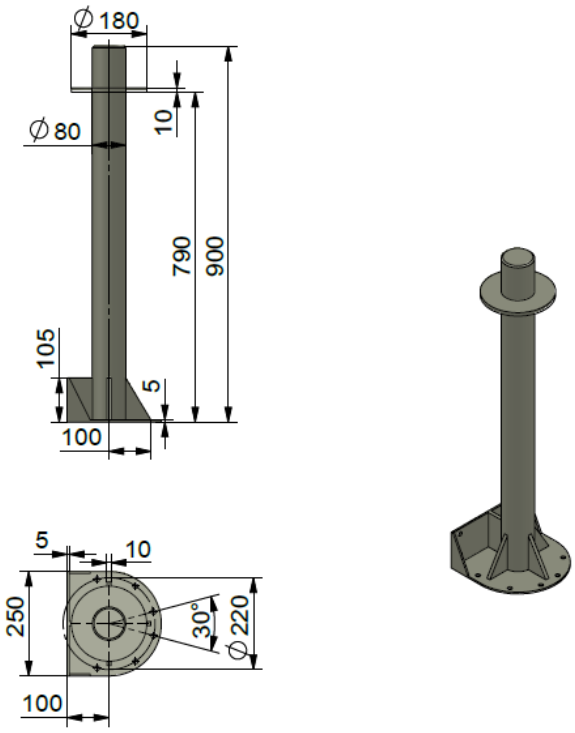
Violations:

1. During a match round, any robot attempting to place Projectile Containers in the Island Penalty Zones of a Resource Island will receive a Level 2 penalty. If the robot or another robot from the same team attempts the same behavior after it has received a Level 2 penalty, a Level 3 penalty will be given.
2. During a match round, a team will be penalized with a Level 3 penalty if any of its robots sets a Projectile Container on any Assistance Column.

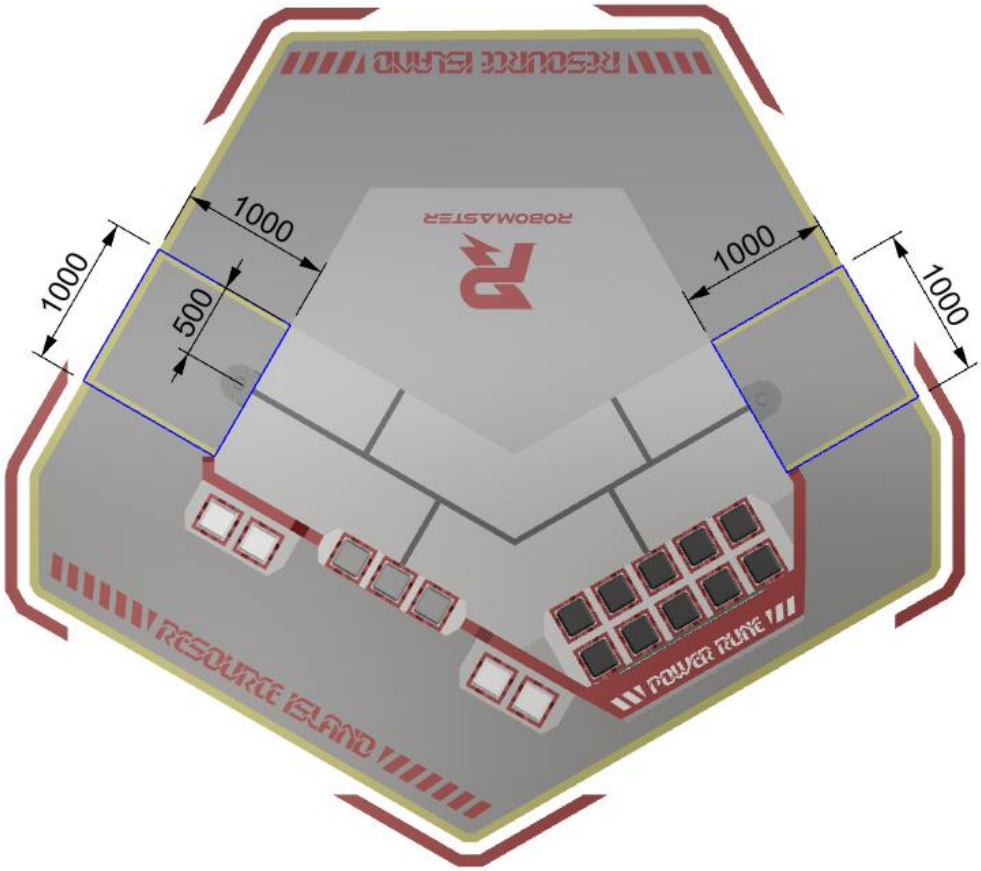
Notices:

1. The surface of Assistance Columns will be inevitably scratched from repeated use so the mechanical structures of robots should be designed to take this phenomenon into consideration.
2. Consider the possible impact to robots if there is a Projectile Container on the platform of a Resource Island and prepare appropriate solutions;
3. Hero robots and Engineer robots can use the Assistance Columns to land on the island, and their mechanical structures will have direct contact with columns. Teams should take this into consideration when designing the robots so as to avoid damaging the column.

4. There may be welding spots and painted surfaces where the upper platform of the Assistance Columns and their support tubing intersect. The dimensions of a Assistance Column is shown in the following diagram:



The Island Penalty Zones are shown in the blue boxes below:

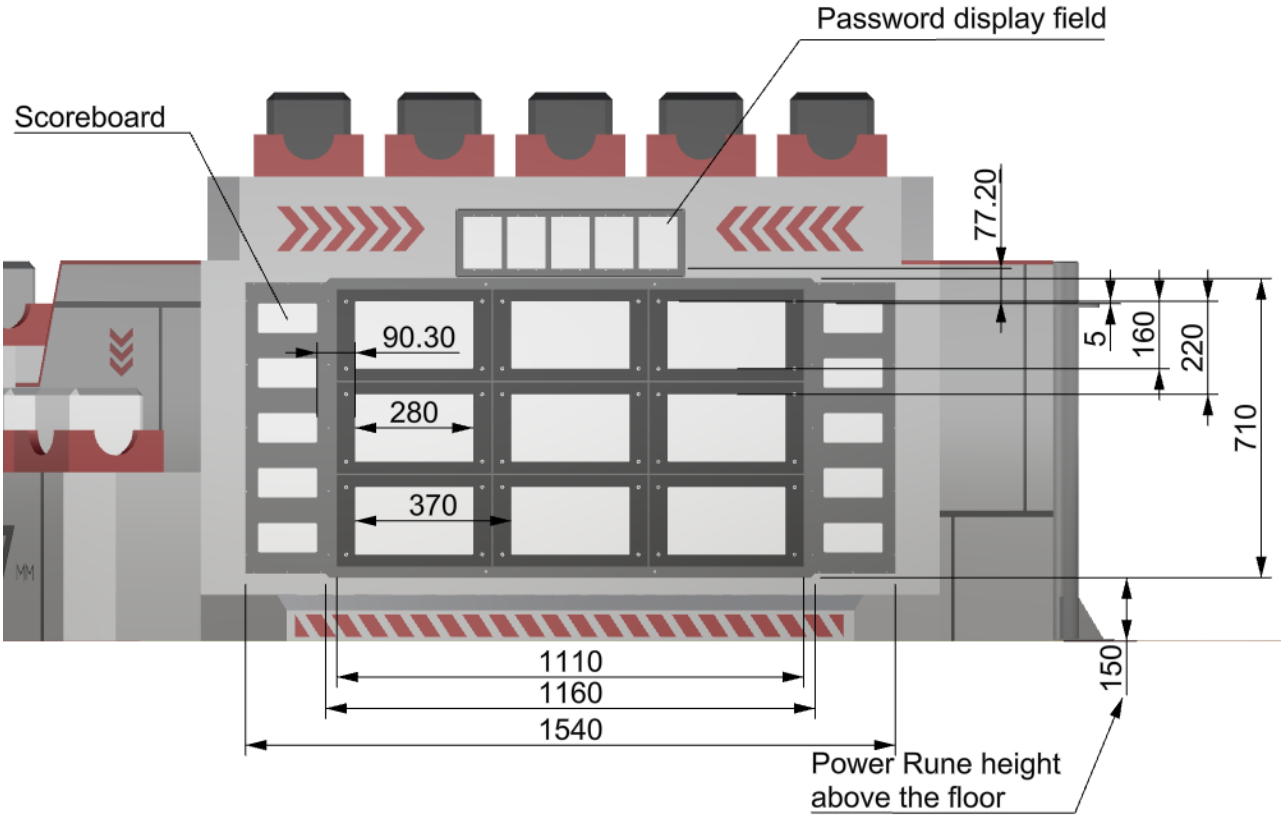


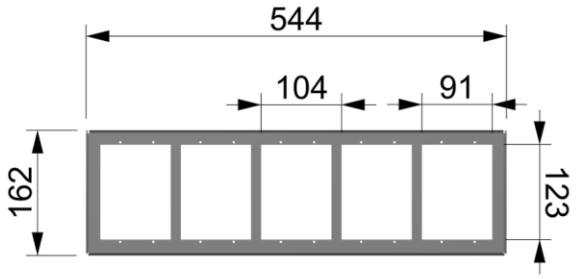
Power Runes

There is a screen installed on the side of each Resource Island in the Battlefield. A panel consists of nine squares is displayed on the screen and each square in the panel displays a number. Above the screen is a password display field, which displays a randomly generated password contains 5 non-repetitive numbers. The scoreboard is displayed on both sides of the screen. When a robot hits the correct number on the panel in the correct order of the password, the scoreboard light is lit from the bottom up. When the scoreboard reaches 5, the Power Rune is activated, and its bonus will boost the team that has the same color as the Power Rune.

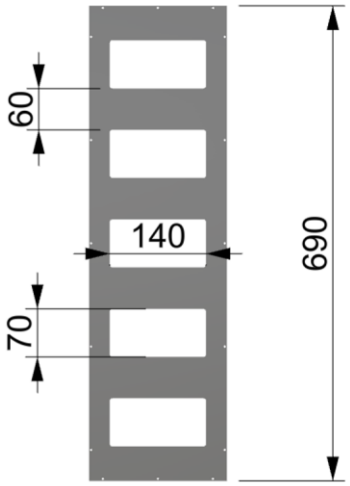
There is a barrier in front of the screen of the Power Rune to protect the screen from collisions.

Schematic diagrams of the Power Runes are as follows:

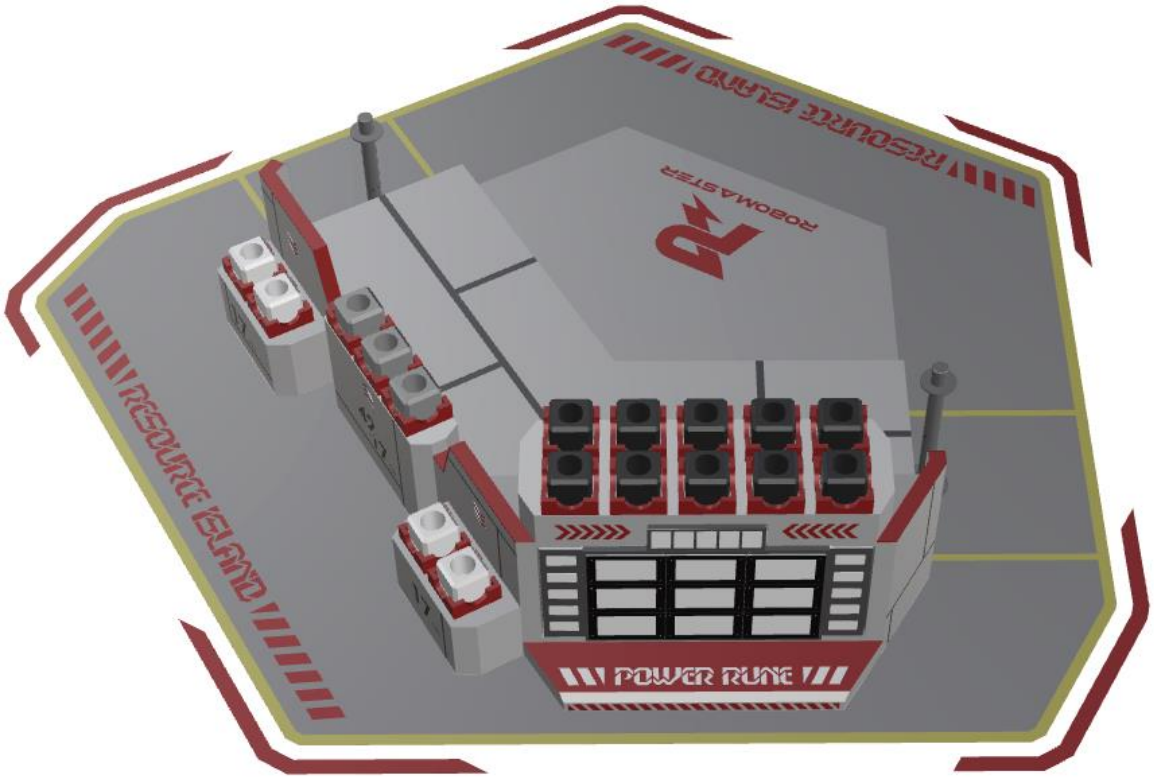




Password display field



Scoreboard



There are red and blue Power Runes. Red Power Rune is on the red Resource Island while the blue Power Rune is on the blue Resource Island.

In each round, after the round begins, the small Power Runes are in the stand-by mode immediately. Once the small Power Runes for red or blue team is activated, the damage per hit launched by robots in the corresponding team increases by 1.5 times and the bonus lasts for 1 minute (the bonus also applies to robots revived during this period). When round countdown timer reaches "4: 00", the large Power Rune replaces the small Power Rune and the screen enters stand-by mode for the large Power Rune. The bonus of the large Power Rune is double damage for all robots for 45 seconds.

Notices:

1. The two types of bonus do not stack. When the large Power Rune is activated, the existing small Power Rune bonus will be replaced.
2. When the countdown timer reaches "4: 00", no matter what the status of the Power Rune screen is, the Referee System will refresh the status of the Power Rune and switch to the large Power Rune immediately.

Principle of the Small Power Rune

When the round starts, the small Power Rune is in stand-by mode. When any projectile hits any square in the panel, the Power Rune turns into activatable mode. In this mode, the 5-digit password is displayed in the password display field. At the same time, the panel starts to refresh random configuration of 1-9 non-repeating handwritten numbers on its squares. The activatable state lasts for 4.5 seconds. If no consequent correct hits happen in 4.5 seconds, the password display field and the panel will stop displaying numbers, which means the Power Rune switches back to the stand-by mode.

In the activatable mode, the password display field refreshes new password every 1.5 seconds (refresh interval). Within this 1.5 seconds, the robot that triggers the activatable mode should analyze password and start to hit correct number according to the first password digit. The panel will refresh a new random configuration of handwritten numbers. Then the robot should use the second password digit as its target number and hit it on the panel. 1 point is obtained for hitting the square on the panel displaying the target number. The small Power Rune is activated when 5 points are obtained consecutively.

Refreshing mechanism for the panel and password display field of small Power Runes are as follows:

(1) If the robot hits the correct target number within 1.5 seconds, the configuration on the panel changes immediately, but the password in the password display field remains unchanged;

(2) If the robot hits the incorrect number within 1. 5 seconds, both the panel configuration and the password in the password display field change immediately;

(3) If the robot does not hit any number within 1.5 seconds, both the number sequence and the password in the password display field change after this 1.5 seconds;

(4) If the robot does not hit any number in the panel within 4.5 seconds, the panels return to stand-by mode, and the password display field and the panels stop displaying numbers;

(5) If the 5-digit password is hit correctly in sequence, then the small Power Rune is activated.

Example figures for the handwritten "2"s to activate the small Power Runes is as follows:

Principle of the Large Power Rune

When the countdown timer reaches "4: 00", the large Power Runes is in stand-by mode. The only differences of the large Power Rune and the small Power Rune are:

1. The numbers displayed in the squares of the panel are flaming numbers.
2. The refresh interval for the large Power Rune is 1.3 seconds.

Notice:

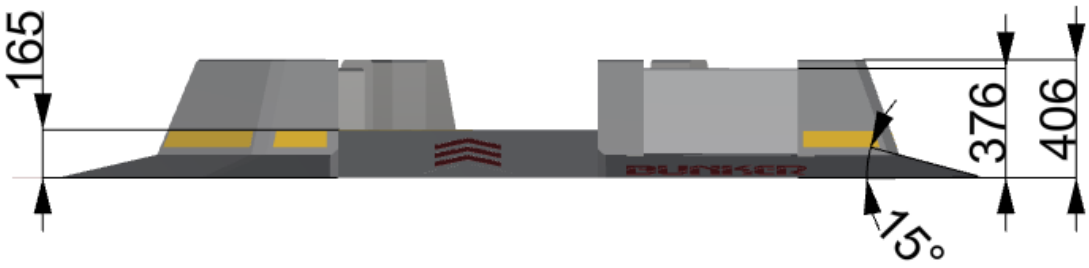
For example pictures of flaming numbers, refer to **Appendix 5 - Reference Pictures**.

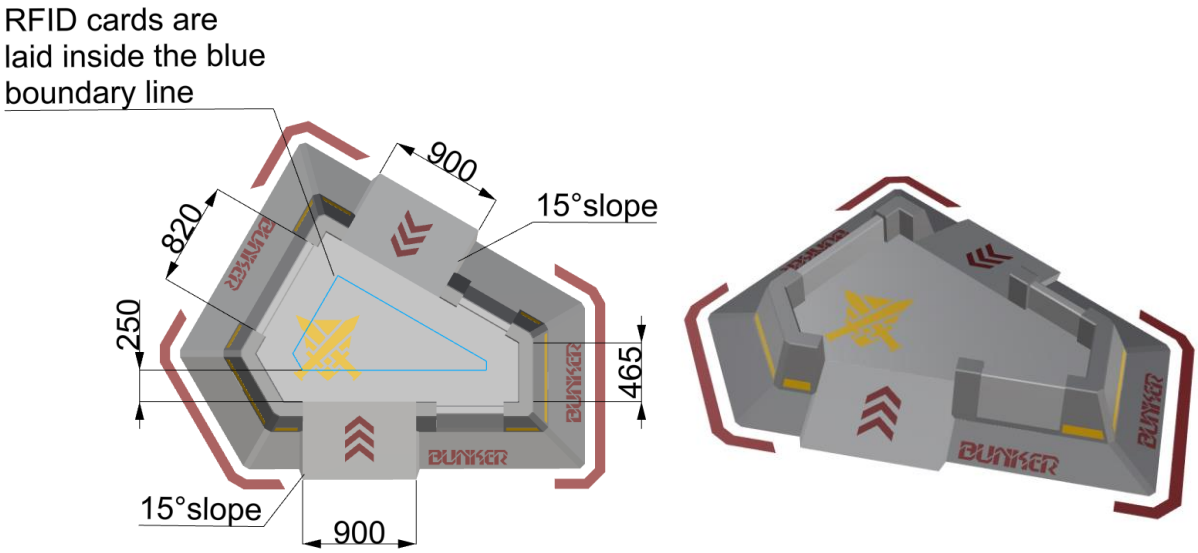
4.5.2 Bunker

Element Description

The Open Zone contains two bunkers. When a robot occupies a bunker by using its RFID interaction module to scan the surface of the bunker, it receives an 80% defense bonus and the barrel cool-down rate is increased five times. If more than two robots enter the same bunker, only the robot that first occupies the bunker gains this bonus.

The bunker is shown in the following figure:





4.6 Flight Zone

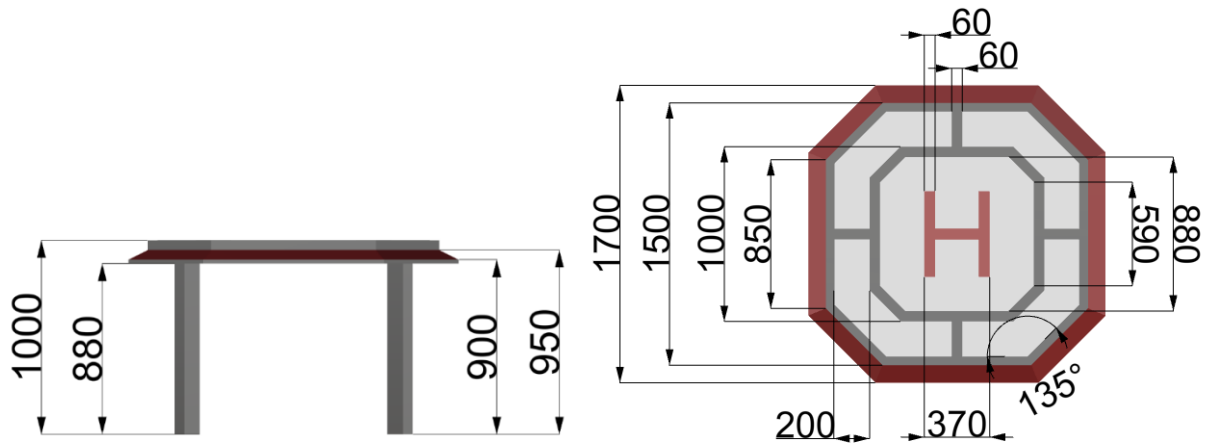
Zone description

This is the zone where an Aerial robot is permitted to operate. This zone includes a Landing Pad and a safety rope.

4.6.1 Landing Pad

A Landing Pads is where the Aerial robot take off and land. There are two Landing Pads in the Battlefield. Each team must place the Aerial robot on their Landing Pad before the start of each round.

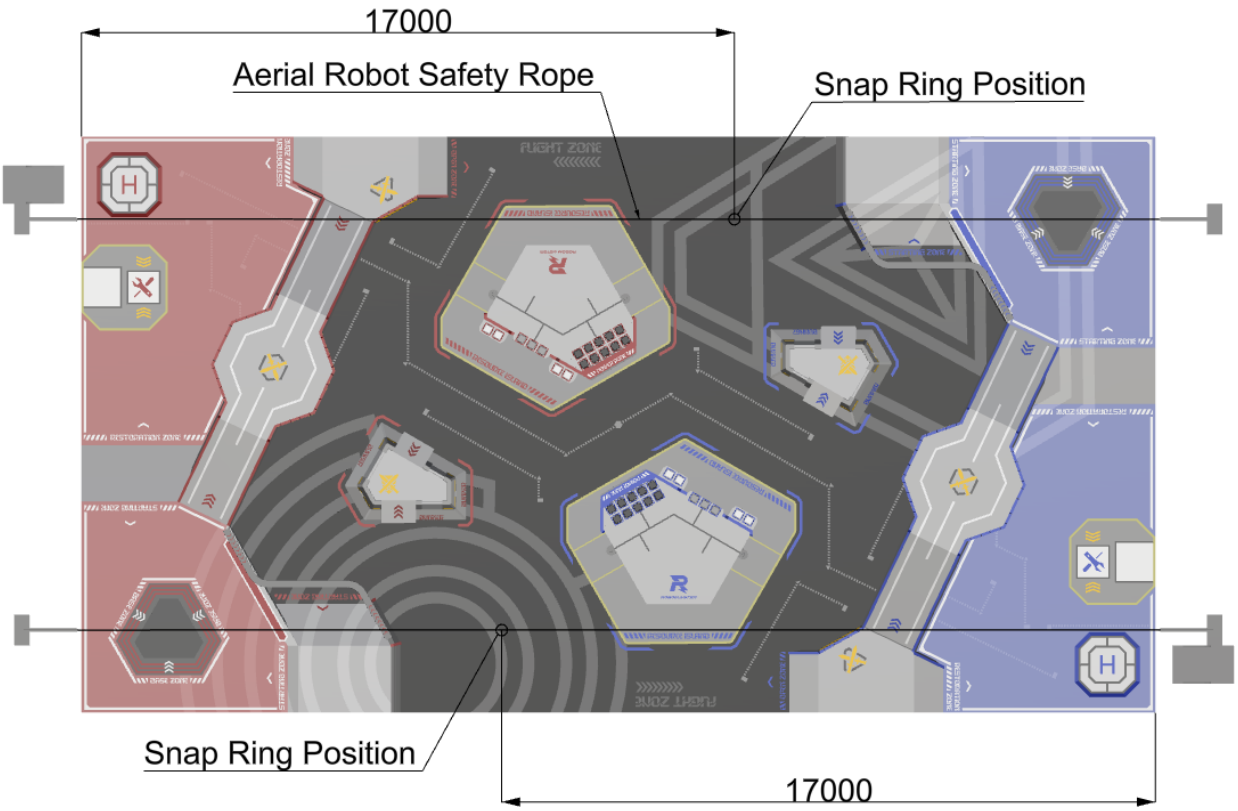
The dimensions of a Landing Pad are shown below:



4.6.2 Safety Rope

Safety Rope is attached to a pulley, which slides on a fixed horizontal steel cable over the Battlefield. This cable is 4m above the ground, and the Safety Rope is 3m long. There are two sets of Safety Ropes in the Battlefield, one for each team.

The Safety Rope is shown in the following figure:



To limit the flight range and protect the Battlefield, each team must connect their Aerial robot to the Safety Rope using the wire loop or bead ring on top of the Aerial robot's vertical safety rod before each round. The maximum horizontal flight distance of an Aerial robot is 17 meters from the Landing Pad, with a snap ring mechanism on the steel cable to prevent the robot from flying outside this distance.

During the match round, the distance between the lowest point of the aerial robot and the floor shall not be less than 1300 mm. No part of the aerial robot's barrel may exceed the top of the Battlefield fence (2 m away above the Open Zone ground).

Violations:

If any part of an Aerial robot's launching mechanism exceeds the maximum altitude, referees in the Pilot Room will warn the operator to decrease the altitude of the robot. If the operator disobeys this warning, their Aerial robot will be ejected from the Battlefield, and the team is not be allowed to use it for the remainder of the match.

4.7 Operator Room

Area Description

The Operator Room is the only place where operators can control their robots (except for the Aerial robot) during the competition. Each Operator Room contains computers display UI and FPV video stream that helps operators control their robots. Also there are headsets and referee communication equipment for operators receiving notifications from the Head Referee.

Properties and Roles

The Operator Room includes six computers for operating robots that come with, mice, keyboards, USB hubs, communication headsets, and other official equipment. As some equipment, such as mice and keyboards, may suffer from performance degradation over time, operators are recommended to bring their own mice and keyboards. However, all operators are responsible for setting up their own equipment during the Setup Period. There is no power supply in the Operator Room. Operators must therefore bring their own power supply for their equipment if necessary.

The ground robot operators and Aerial gimbal operator must stay in the Operator Room. The number of

operators must be the same as the number of robots that need to be operated. One operator can only control one robot and its corresponding computer, and positions of operators cannot be switched after a round begins.

The pilot of the Aerial robot can only operate the Aerial robot in the Pilot Room. If a team does not have the Aerial robot, then the pilot and the Aerial gimbal operator must stay in the Crew Member Resting Area instead of the Operator Room and the Pilot Room.

There are also referees and technicians present in Operator Rooms and Pilot Rooms. The referees are responsible for maintaining order during the match and assisting the operator room technicians to solve any problems. The operator room technicians ensure normal operation of the official equipment during the Setup Period.

All operators in the operator room must wear the headsets provided by the RoboMaster Organizing Committee for receiving instructions from the Head Referee. Aerial gimbal operators are also equipped with a similar microphone for communicating with the pilot. Operators, aerial gimbal operators, and pilots cannot leave their post without a referee's permission.

Violations:

1. The use of an unauthorized power supply in the Operator Room will get a Level 5 penalty.
2. Operators, Aerial gimbal operators, and pilots who leave their post without permission will receive a verbal warning. Failing to comply with this warning results in their team receiving a Level 5 penalty.
3. Operators, Aerial gimbal operators, and pilots who do not wear their headsets will receive a verbal warning. Failing to comply with this warning results in operators and their robots being ejected from the round. And the team and send backup operators to replace ejected operators.

4.8 Projectiles

Launching projectiles is the only acceptable method for attacking other robots. Robots must use projectiles to hit the armor modules of enemy robots, thereby causing damage to enemy robots' HP and finally destroying them. Both 17 mm and 42 mm projectiles are used during a match. Their specifications are as follows:

Type	Appearance	Color	Size	Weight	Shore Hardness	Material
42 mm projectile	Similar to a golf ball	White	42.5 mm (±0.5 mm)	42.2 g (±0.2 g)	90 A	Plastic (TPE)
17 mm projectile	Round		16.9 (±0.1 mm)	2.9 g (±0.1 g)	90 A	Plastic (TPU)

42 mm illuminating projectile	Similar to a golf ball	White	42.5 mm (±0.5 mm)	40. 7 g (±0.2 g)	90 A	Plastic (TPE)
17 mm illuminating projectile	Round		16.9 (±0.1 mm)	3.4 g (±0.1 g)	90 A	Plastic (TPE)

Notices:

1. The official 17 mm projectiles for the RM2018 season are white and made from the same material as the gray 17 mm projectiles sold to contestants. Compared with the official 17 mm projectiles of RM2017 season, there is a clear difference in color, the surface wear resistance is improved, and it does not deform easily during high-speed launch.
2. Special illuminating projectiles are used in matches for eight winners during the Final Tournament.
3. Official RM2018 projectiles must be used in all RM2018 matches.

Chapter 5: Competition Rundown and Rules

This chapter consists of the core competition rundown, regulations, and rules of the Regional Competition, International Regional Competition, Wild Card Competition, and Final Tournament of RoboMaster 2018. During the official matches of RoboMaster 2018, each team will prepare for the matches in the Preparation Area, reach the Inspection Area for pre-match inspection of robots, wait for the match in the Staging Area, and finally enter the Competition Area to compete in matches. Each team is required to leave the Competition Area and return to the Preparation Area at the end of the match.

Details for these areas and a corresponding map will be provided in the *RoboMaster 2018 Competition Manual.*

5.1 General Competition Rundown

The RoboMaster 2018 competition consists of qualification matches and the quarterfinals. In qualification matches, points are awarded to teams for each match, and the teams are then ranked based on their total number of points. In the quarterfinals, double-elimination games are played.

Before each match begins, all robots need to pass a pre-match inspection performed by the RoboMaster Organizing Committee. This inspection is to ensure that all robots fulfill the technical specifications set by the RoboMaster Organizing Committee for a fair competition. Teams must also follow the instructions from referees and volunteers when entering the Competition Area. At the end of each match, teams must clean up the projectiles left in the firing mechanism of each robot and return them to the designated areas.

Each match may have two, three, or five rounds depending on the stage of the competition. Each round mainly consists of a **three-minute Setup Period** and a **seven-minute round period**. There is also a **twenty-second initialization period** for the Referee System between the Setup Period and the round period.

During the Setup Period, team members can enter the Battlefield to initialize and set up their robots. 1 minute and 30 seconds after the Setup Period starts, referee will remind team members enter the Operator Room and the Pilot Room to set up controllers. In the last 30 seconds of the Setup Period, all team members MUST leave the Battlefield and return to the Operator Room, Pilot Room, or Pit Crew Member Resting Area. When the Setup Period ends, the match round immediately enters the initialization period for the Referee System.

During the last five seconds of the initialization period, operators will hear a countdown alert sound and see a countdown timer on their FPV screens. The round starts immediately after the countdown finishes.

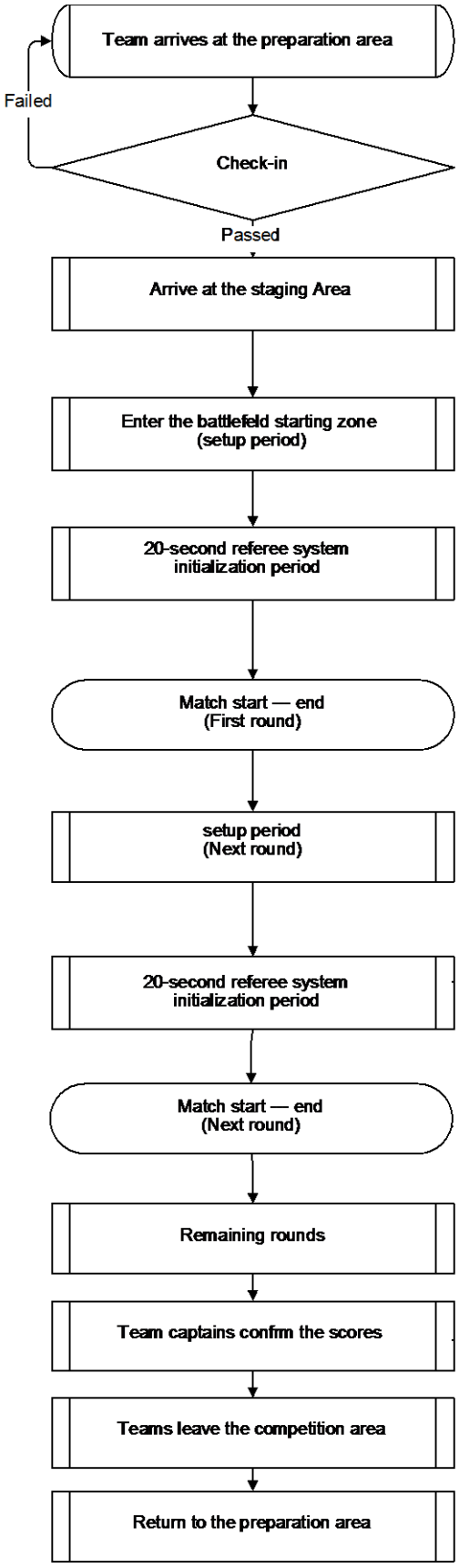
A round ends when either the seven minutes are up or one team fulfills the criteria to win the round. When one round ends, the match immediately enters the Setup Period for the second round or later rounds. The match ends when all rounds have been completed.

During one round, robots from both teams will compete on the Battlefield. All robots must have the RoboMaster Organizing Committee's Referee System installed for recording projectile hits, monitoring the projectile launching mechanism, and measuring chassis power consumption. The Referee System cuts off a robot's power supply when its HP reach zero. During a round, the real-time status of all robots is transmitted to both the operators' FPV screens and the Referee System server. The Referee System server determines the outcomes of all rounds automatically. During the rounds, human referees will issue penalties for rules violations by robots, operators, Aerial Robot gimbal operators, and pilots.

Notice:

If a match has 5 rounds, then after the second round and the fourth round, team will have extra 10 minutes to maintain their robots. The Setup Period of the third round and the fifth round starts after the extra 10 minutes run out.

The flow chart for a single match is shown below:



① The competing team has properly installed the referee system
② Check whether the robot meets competition requirements

① Make all inspections according to the Pre-Competition Robot Inspection Form
② Team captain confrms and signs (offcials are not responsible for maintenance once the team leaves the inspection area)
③ Competitors who have not arrived at the inspection area 60 minutes before the start of the competition are automatically disqualifed.

① Teams await to enter the arena (robots cannot be powered on and commissioned at this time)

① Check whether the robot's offcial image transmission and Wi-Fi are normal
② Call for a technical timeout in special circumstances
③ Check whether the robot's projectile magazine is empty and obtain starting projectiles
④ All robots must be powered on in the last 30 seconds. Before 3 minutes elapses, all competitors must leave the premises.

① Teams prepare for battle
② After the setup period elapses, the referee system initialization period begins, after which is the 5-second countdown to the start of the battle.
(Robots that did not start their referee systems in time are disqualifed.)

Case 1: The base of either side is destroyed
Case 2: HP calculation after time runs out

① Reset the robot in-between matches
② Empty all projectiles from the robots (including aerial robots)
③ Call for a technical timeout in special circumstances
④ All robots must be powered on in the last 30 seconds. Before 3 minutes elapses, all competitors must leave the premises.

① Teams prepare for battle
② After the setup period elapses, the referee system initialization period begins, after which is the 5-second countdown to the start of the battle.
(Robots that did not start their referee systems in time are disqualifed.)

Case 1: The base of either side is destroyed
Case 2: HP calculation after time runs out

According to competition arrangements

If you do not sign to confrm your score or appeal the score within 10 minutes, you are deemed to have accepted the score.

Recover projectiles, armbands, and pass cards

Power off robots

5.2 Criteria Required To Win

Criteria for winning a match

A match may consist of two, three, or five rounds, which are traditionally called BO2, BO3, and BO5 respectively. A match can end in one of the following outcomes:

Match Format	Qualification Matches	Quarterfinals
BO2	2: 0: Winning team obtains 3 match points, 1: 1: Each team obtains 1 match point, 0: 2: Losing team obtains 0 match point, 1:0 (one draw round): Winning team obtains 1 match point, losing team obtains 0 match point, 0:0 (two draw rounds): Each team obtains 0 match point	N/A
BO3	N/A	Team that wins 2 rounds is crowned the winner
BO5	N/A	Team that wins 3 rounds is crowned the winner

Criteria for Winning an Individual Round

1. The round ends immediately when the Base of one team is destroyed, giving the opposing team a win.
2. When the entire seven minutes of a round are up, if Bases of both teams have survived, the team with higher Base HP is the winner.
3. When the entire seven minutes of a round are up, if Bases of both teams have survived and both Bases have the same remaining HP, the team with higher Damage Output wins.
4. When the entire seven minutes of a round are up. If Bases of both teams have survived, both Bases have the same remaining HP, and both teams have the same Damage Outputs, then the team with higher Total Remaining HP wins.

If winner cannot be determined, the round is considered a draw. If a draw round happens in quarterfinals, a follow-up round immediately added to determine a clear winner.

Rankings for Qualification Matches

The following are the criteria used to determine rankings in qualification matches:

1. The team with higher amount of match points is ranked higher.
2. If the total match points are the same, the team with higher amount of total Base Winning HP is ranked

higher.

3. If the total Base Winning HPs are the same, the team with the higher Damage Output is ranked higher.

If two or more teams share the same ranking, the RoboMaster Organizing Committee will arrange rematches for the teams two at a time.

The definitions for some previously-described critical terms are as follows:

1. Damage Output: The total damage accrued by the end of each round from successfully hitting the armor modules of an opposing team's robots and Base. **The HP lost due to penalties imposed on the opposing team by referee is also count into Damage Output.**
2. Base Winning HP: When a match round ends, team's Base HP minus the opposing team's Base HP is the Base Winning HP. Thus a team's total Base Winning HP is the sum of Base Winning HPs from all round this team has played.
3. Total Remaining HP: When a match round ends, the sum of HP of surviving robots is Total Remaining HP.

5.3 Competition Area Staff

5.3.1 Team Member Standards for the Competition Area

1. The team members who are allowed to enter the Staging Area and the Competition Area are all called pit crew members. During each match, up to TWELVE pit crew members per team can enter these areas (including the team's Captain, Operators, Supervisor, and Advisors).

Violations:

The referee will give a verbal warning to any team that sends more than twelve pit crew members into the Staging Area or Competition Area. The extra pit crew members must leave these areas. If the team does not obey this rule after the referee has given several verbal warnings, the team receives a Level 5 penalty for all rounds in the match.

2. During each round, operators must stay in their respective Operator Rooms. The other pit crew members must stay in the audience area outside of the Battlefield. Pit crew members are prohibited from leaving the area they are stationed in without receiving approval from a referee.

Violations:

Pit crew members who leave designated areas for them without a referee's permission will be given a verbal warning by the referee. If the violating pit crew member does not comply with the warning, that member will be ejected from the Competition Area. And the team cannot send backup team member to replace ejected member. If the ejected pit crew members do not obey a referee's order to leave the Competition Area, their team loses that round.

3. During each round, operators and pilots must wear the headsets provided by the RoboMaster Organizing Committee for receiving commands from the Head Referee.

Violations:

Operators who do not wear the provided headsets will receive a verbal warning. Operators who continue to disregard the referee's instructions will have Level 4 penalties assessed to all of the operator's robots in use (ejected from the round).

4. During each round, each operator can only control one robot. For example, if there are four ground-based robots on the Battlefield, only four operators can be in the Operator Room.

Violations:

Non-operators entering the operator room will receive a verbal warning from the referee to leave the operator room. Non-compliance will result in the violator being ejected from the Competition Area. And the team cannot send backup team member to replace ejected member. If an ejected violator does not obey a referee's order to leave the Competition Area, their team loses that round.

5.3.2 Competition Staff

Competing teams will be guided by volunteers and staff members from the RoboMaster Organizing Committee throughout the competition. During the competition, the Chief Referee has the final right of interpretation regarding competition rules. Teams can only approach the Chief Referee if they have queries regarding the competition rules.

Competition Staff	Duties
Head Inspector	Oversees all pre-match inspections. Has the final decision on whether a team passes their pre-match inspection.
Inspector	Assists with pre-match inspections. Cannot be involved with or assist in the maintenance of robots in any way.
Chief Referee	Has the final decision and right of interpretation regarding competition rules. Issues

Competition Staff	Duties
	penalties for severe violations of the rules (for example, disqualification from the competition). Has the right to issue additional penalties following an appeal.
Head Referee	Responsible for controlling match progress. Issues official Technical Timeouts, receives and confirms Technical Timeouts from the teams, and confirms the validity of match results. During the match, the Head Referee receives information from Side Referees and Operator Room Referees, and confirms and issues Level 1-5 Penalties for violations.
Side Referee	Executes competition procedures and leads the competitors in and out of the battlefield. Reports a robot's violation to the head referee during matches. Reports any rule violations to the Head Referee, receives the application for a Technical Timeout from teams, and reports to the Head Referee for confirmation.
Operator Room Referee	Executes competition procedures. Guides the pit crew members to enter and exit the Operator Rooms. Reports any rule violations to the Head Referee, receives the application for a Technical Timeout from teams, and reports to the Head Referee for confirmation.
Field Technician	Maintains the Battlefield. Assists pit crew members in solving technical problems with the Referee System during the setup period. Can apply for official Technical Timeouts, but cannot assist crew members in repairing and maintaining their robots.
Operator Room Technician	Assists operators in solving technical problems with the Operator Room's equipment. Can apply for official Technical Timeouts, but cannot assist pit crew members in repairing the mouse and keyboard.

5.4 Pre-Match Procedures

5.4.1 Inspection Regulations

To ensure that robots meet the required specifications, each team must undergo a pre-match inspection in the Inspection Area. Please refer to **Appendix 4 - Pre-Match Inspection Form** for a full list of these requirements.

1. Each team must reach the Inspection Area to start the pre-match inspection at least 60 minutes before the match begins.

Violations:

Unless there is an emergency, teams will forfeit and be credited a loss if they do not arrive at the Inspection Area on time. The Head Inspector and Chief Referee have the final say, and their decision is final.

2. A maximum of 12 team members can enter the Inspection Area. The Standard, the Sentry and the Aerial robots must be brought into the Inspection Area by one team member. The Hero, the Engineer, and the Supplier robots require two members each. One team member must also oversee the pre-

match inspection work. Team members are prohibited from entering the Inspection Area without permission before their robots arrive.

Violations:

Extra team members who are not participating in the pre-match inspection must leave the Inspection Area.

3. During the pre-match inspection, inspectors will place a "Pass Card" on robots that pass the inspection. Only robots with a "Pass Card" can enter the Staging Area and the Competition Area. Teams can only modify their robots in the Preparation Area before their robots receive a pass card.

Violations:

Robots without a "Pass Card" cannot enter the Staging Area and the Competition Area.

4. After the pre-match inspection, robot malfunctions and damages discovered in the Staging Area and the Competition Area are deemed as incidental damage and the competition will continue. After the first round of the match, if any robot has serve problems, even it is compulsory, robot should leave the Battlefield to ensure safety.

Violations:

N/A

5. Teams must have one Hero, one Engineer, and one Standard robot that passes the pre-match inspection to enter a match. When the inspection is complete, Team Captains must sign the inspection form to confirm that they agree with the inspection results.

Violations:

1. If one or more of a team's Hero, Engineer, or Standard robots fail the pre-match inspection, the team forfeits and is credited a loss.
2. Once a Team Captain has signed the inspection form, teams will be deemed as cheating if any robot that failed the pre-match inspection are found inside the Staging Area and the Competition Area. Any rounds of the match these robots compete are also be forfeited.

5.4.2 Staging Area Regulations

When the pre-match inspection is complete, the teams must arrive at the Staging Area at least ten minutes before their match begins. All robots and team members must be re-checked at the Staging Area.

1. At least 5 minutes before every match begins, team Captains must sign a *Staging Area Statement* to confirm that the match can take place.

Violations:

Unless an emergency arises, any team whose captain does not sign the *Staging Area Statement* five minutes before the start of a match will lose their right to compete and be assessed a loss. The staff within the Staging Area and the Chief Referee have the final say.

2. All robots in the Staging Area must prove that their robots received a pre-match inspection and have "Pass Cards" placed on them.

Violations:

Robot without a "Pass Card" will be refused entry to the Competition Area.

3. The total number of pit crew members in the Staging Area cannot exceed 12 per team.

Violations:

Any additional crew members will be asked to leave the Staging Area.

4. Robots cannot be powered on or undergo maintenance in the Staging Area, as their Wi-Fi and video transmission signals can interfere with active matches in the Competition Area.

Violations:

1. The first time a team powers on one of their robots, they will receive a verbal warning from Staging Area staff. If the team receives multiple verbal warnings, yet continues to not comply, they will forfeit the match. The staff within the Staging Area and the Chief Referee have the final say.
2. If robots require maintenance after entering the Staging Area, the team must first inform the Staging Area staff. The "Pass Card" on the robot must then be removed, and the signed the *Staging Area Statement* becomes invalid. The team can then take their robots back to the Preparation Area to carry

out repairs. When they have finished, the team must bring their robots back to the Inspection Area to undergo another pre-match inspection to reenter the Staging Area and their team Captain must sign another *Staging Area Statement*.

5.5 Match Procedures

The RoboMaster competition has a tight schedule, and the event is livestream. Any accidents or interruptions can cause delays that result in a negative impact on our competitors and a global audience of millions of people. To ensure our event is the best it can possibly be, all participants must adhere to the pre-arranged schedules, instructions, and guidelines provided by the RoboMaster Organization Committee, its officials, and its volunteers. All participants are expected to abide by the rules and regulations as outlined in the *RoboMaster 2018 Rules Manual* and the *Staging Area Statement*. **Participants who violate these rules face individual and/or team penalties. Severe violations will lead to disqualification from the RoboMaster competition for the entire season.**

Competing teams enter the Competition Area after leaving the Staging Area. They must then wait outside the Battlefield for any ongoing matches to end. When the previous match ends, staffs start to clean the Battlefield and the side referee will allow the next pair of competing teams to take their robots to the entrance of the Battlefield and wait for further instructions. After the Battlefield is cleaned, the side referee will instruct the teams to enter the Battlefield for their Setup Period. As soon as teams enter the Battlefield, timer for the Setup Period starts.

5.5.1 Setup Period

Before the Setup Period begins, both teams must be ready and waiting at the side of the Battlefield. The side referees will check that both teams are prepared and then inform the Head Referee. The Head Referee will announce that both teams can enter the Battlefield and the side referees will open the gates to allow the teams to enter. When the gates open, a three-minute countdown begins for the teams to prepare their robots.

All penalties for violations occurring during the Setup Period will be executed after the start of the match round.

1. The number of pit crew members for each team cannot exceed 12.

Violations:

The referee will give a verbal warning to any team that sends more than twelve pit crew members into the Competition Area. The extra pit crew members must leave. If the team does not obey this rule after the referee has given several verbal warnings, the team receives a Level 5 penalty for all rounds of the match.

2. Crew members from both teams place their robots in the Starting Zone and check that the Referee System on each robot is working correctly. Teams can only test their Hero, Standard, Sentry, and Engineer robots in their own Starting Zones. Other than Supplier robots who are placed in the Restoration Zone, they cannot test their robots in any other area.

Violations:

Teams will receive a verbal warning if they test their robots in areas other than the Starting Zone, and any offending robots must be returned to the Starting Zone. Any robot that fail to comply with repeated warnings will be ejected from the round.

3. Aerial robots cannot be commissioned (propellers rotating) and projectiles can only be launched into the projectile bag.

Violations:

1. If an aerial robot's propellers are rotating while on the landing pad, it will be regarded as a violation and the referee will give a verbal warning to stop the propellers. Non-compliance will result in a Level 2 penalty for the offending party;
2. If an aerial robot flies away from the landing pad, the referee will eject the violating robot;
3. If the launching of an aerial robot's projectile or early start-up result in any bodily harm to on-site personnel, once the violation is verified, the violation party will be assessed a loss for the current round.

4. Except for the Aerial and the Sentry after the first round, other robots must make sure they exhaust projectiles before the start of every match round. (The definition of “exhaust” here is either robot does not contain any projectile, or robot can have a few projectiles but it cannot launch them since projectiles are too few to push each other into the launching barrel.)

Violations:

1. Before each round, robot loaded with large amount of projectiles will be ejected from the round.
2. If the Supplier robot has projectiles unloaded, the team will forfeit and be credited a loss for the current match round.

5. Pit crew members cannot pick up projectiles found on the ground and insert them into their robots.

Violations:

1. If a pit crew member picks up a projectile on the Battlefield, the referee will give a verbal warning. Non-compliance with the warning will result in a Level 2 penalty;
2. If a pit crew member picks up projectiles and loads a robot, the referee will eject the robot.
3. Teams that using unofficial projectiles are consider as cheating.

6. Aerial robots must be placed on the Landing Pad and attached to the Safety Rope according to competition instructions. A referee will pass 200 17mm projectiles to the pilot every round. Team can choose to load these projectiles into their Aerial robot on their own.

Violations:

Aerial robots that do not have the Safety Rope properly connected will be ejected from the match round.

7. Pit crew members must ensure that their robots are working safely when carrying out testing in the Starting Zone. The team must also ensure that their fully-automated robots do not injure anyone in the Battlefield.

Violations:

Teams are assessed as a loss for the current round if their automated robots cause injury to any participants or staff member on the Battlefield during the Setup Period.

8. During the last 30 seconds of the setup period, all robots on the Battlefield must be powered on. Referees will also instruct pit crew members to leave the Battlefield.

Violations:

Pit crew members will receive verbal reminders if they do not power on their robots and leave the Battlefield.

9. At the end of the Setup Period, pit crew members from both teams must return to their appointed areas outside the Battlefield.

Violations:

Pit crew members who fail to leave the Battlefield at the end of the Setup Period will be ejected. And team cannot send backup members to replace these ejected members. If these pit crew members continue to

disobey orders to leave and remain on the Battlefield, their team will be assessed as a loss for that round.

10. Ground-based robots cannot leave their Starting Zone before the round begins. The size of these robots cannot be transformed to exceed their initial maximum dimensions. During the last 5 seconds of the Referee System Initialization Period, the control input of robots will temporarily locked to prevent robots from false start. If robots move outside the Starting Zone or transform just before this period of time, team will definitely receive penalties after the round starts.

Violations:

Regulations	Penalty Standards
1	Ground robots that move outside the Starting Zone or transform their sizes during the Setup Period will receive verbal warning from the referee
2	If robots continue to disobey the referee's order, the referee will issue a Level 2 penalty.
3	If a robot move to places far from the Starting Zone and disobey the referee's order, the referee will issue a Level 4 penalty to eject the robot.
4	If robots move or launch projectiles to cause physical harm to people around the Battlefield and the Competition Area, the team will forfeit and are assessed as a loss for the current match round.

5.5.1.1 Technical Timeouts

Official Technical Timeout

The Head Referee can announce an Official Technical Timeout during the Setup Period if the Referee System, operator equipment, or other modules related to the Referee System malfunction. Examples of malfunctions include:

Regulations	Description
1	A robot cannot connect to the server of the Referee System during the Setup Period of the first round.
2	A robot cannot transmit FPV video to the Operator Room during the Setup Period of the first round.
3	The official equipment (except for keyboard and mouse) inside the Operator Room malfunctions.
4	A robot's onboard Referee System modules malfunction during the Setup Period of the first round.
5	A Battlefield component malfunctions.
6	Any other situation determined to require an Official Technical Timeout by the Head Referee.

An Official Technical Timeout may only be implemented after an Operator Room Technician or Field Technician reports to the Head Referee. Pit crew members cannot request an Official Technical Timeout.

If cases 1, 2, or 4 occur during the Setup Period of the second round or later rounds, the damage will be considered as normal incident and an Official Technical Timeout will not be permitted, since in these situations, it is too hard to determine whether the malfunctions were caused by the Referee System modules, or a failure in the robot's mechanical or electrical system design, or operational mistakes made in previous rounds. Nevertheless, a Field Technician will provide backup Referee System modules, and the team can request a Competing Team's Technical Timeout to repair their robots.

During an Official Technical Timeout, pit crew members can work with Field Technicians to solve the malfunctions with the Referee System. Pit crew members can also enter the Battlefield to repair other robots. However, they must leave the Battlefield when the Referee System has been repaired.

Competing Team's Technical Timeouts

Teams can also request a Competition Team's Technical Timeout from the Head Referee during the Setup Period for their current round. This timeout can be requested if a robot's systems or control equipment (such as keyboards and mice) break down during the previous round. Pit crew members can use the timeout to enter the Battlefield and repair their robots. Members may repair their robots only in their respective Starting Zones or Restoration Zones.

During RM2018 regional competition, each team has one 1-minute technical timeout, one 2-minute technical timeout, and one 3-minute technical timeout.

During RM2018 wild card competition, each team has one 1-minute technical timeout and one 2-minute technical timeout.

During RM2018 final tournament, each team has one 1-minute technical timeout, one 2-minute technical timeout, and one 3-minute technical timeout.

Once all Competing Team's Technical Timeout chances are used up, the team can no longer request a technical timeout.

Notices:

1. Any request for a Competing Team's Technical Timeout must be submitted by a Team Captain to a Side Referee or Operator Room Referee, with the length of the timeout requested being clearly stated. The Head Referee announces the technical timeout after confirming with other referees. Then when the Setup Period countdown reaches last 30 seconds, it will be paused and the timeout will be counted by the Head Referee After the timeout finishes, Setup Period countdown resumes.

Violations:

The Head Referee will not accept requests for technical timeouts raised by team members other than the

Team Captain.

2. The Head Referee will inform both teams of the Competing Team's Technical Timeout regardless of which team requested the timeout. All 24 pit crew members from both teams can enter the Battlefield to repair their robots during this time. But only team who made the request consumes their timeout chances. During the last 20 seconds of the timeout, referees remind team members to leave the field. When the technical timeout expires, all pit crew members must leave the Battlefield.

Violations:

Pit crew members who do not leave the Battlefield at the end of a timeout will be ejected. And team cannot send backup members to replace ejected members. If ejected pit crew members fail to comply with this penalty and remain on the Battlefield, their team is immediately assessed as a loss for the round.

3. Each approved technical timeout uses up one of the technical timeouts allotted to each team, regardless of the time spent or the purpose of the timeout. For example, if a team is granted a two-minute Competing Team's Technical Timeout but only uses 40 seconds of this time, the full two-minute Competing Team's Technical Timeout is deducted. Additionally, if a team is granted a Competing Team's Technical Timeout but does not enter the Battlefield, they will still use up one of their timeouts.
4. Team must request the Competing Team's Technical Timeout during the first 2 minutes and 45 seconds of the Setup Period. The last 15 seconds of the Setup Period and the Referee System Initialization Period do not response to timeout requests from team.
5. To ensure that subsequent matches begin on time, only one Competing Team's Technical Timeout is allowed per setup period. This timeout is granted to the team that successfully places a request first. Technical Timeout usage is recorded in the *Match Record Form*. The type of Technical Timeout is determined by the Head Referee based on the request of the team. The team Captain cannot dispute the type of Technical Timeout when signing and the Technical Timeout process may not be used as a basis for appeals after the match.

5.5.2 Referee System Initialization Period

After the Setup Period, the match round enters the Referee System Initialization Period. During the last 5 seconds, a countdown timer will be displayed and an audio alert will play. The round begins at the end of the Referee System Initialization Period. **Any robot that cannot connect to the Referee System server by the end of the Referee System Initialization Period is automatically ejected from the round.**

If there is an error with the Referee System server, the system automatically pauses the countdown. Only staff from the RoboMaster Organizing Committee and one pit crew member from each team can enter the

Battlefield to check what the problem is.

Teams cannot request a technical timeout during the Referee System Initialization Period.

5.5.3 A 7-minute Round

All operators and pilots from both teams must stay in their Operator and Pilot Rooms, with all other pit crew members from both teams remaining in the Crew Member Resting Area outside the Battlefield when a round begins. All the other team members must watch the match from the audience area.

All robots are continuously monitored by the Referee System. The Head Referee and Side Referees at the Referee Area will announce rule violations and subsequent penalties, as well as address any emergencies that occur.

The Chief Referee and Head Referee will penalize teams if they violate the rules both during and after the match. The RoboMaster Organizing Committee announce important penalties to all teams every day.

5.5.3.1 Types of Penalties

Type	Penalty Standards
Warning (Level 1 Penalty)	The screen of all operators of the violating team is blacked out for three seconds upon receiving a warning. Referees may also verbally alert the operator or their team members.
HP Deduction (Level 2 Penalty)	The screen of all operators of the violating team is blacked out for five seconds. The violating robot loses 2 credits. The Referee System will also automatically deduct 5% HP (of max HP) from all remaining robots of the violating team (excludes the Base). The deducted HP will count toward opposing team's Damage Output.
HP Deduction (Level 3 Penalty)	The violating robot loses 4 credits. The screen of the operator correspond to the violating robot is blacked out for ten seconds, while the blackout time for other team members' screens is five seconds. The violating robot gets 50% HP (of max HP) deduction until it reaches 1 HP. Other remaining robots get 5% HP deduction. The deducted HP will count toward opposing team's Damage Output.
Ejection (Level 4 Penalty)	Ejected robots: In one round, ground and Sentry robots are immediately disabled by the Referee System. Aerial robot will have its launching mechanism (including the loading mechanism and friction wheels) powered off, video stream transmission disconnection, and must immediately land on its Landing Pad. Ejected operators or other team members: A referee requests the team members to leave the Competition Area. During the rest rounds in the match, team cannot send backup members to replace ejected members. The robots belong to ejected operators will be ejected during rest rounds as well. And the HP deduction due to robot ejections will count towards opposing team's Damage Output.

	Robots that are ejected in one round cannot be revived for the duration of the current round.
Round Loss (Level 5 Penalty)	When Level 5 penalty is issued before the Setup Period of a round starts, then all team members and robots must leave the Battlefield immediately. For this round or all rounds this penalty affected, the violating team Base HP becomes 0 and opposing team Base HP is full. When Level 5 penalty is issued during a match round, the Head Referee immediately eliminates all of a team's robots via the Referee System and the team is assessed a loss for that round. The Base HP value of the losing team is also set to 0, while the opposing team's Base HP value remains at the amount it was prior to the round being terminated. Teams must move all robots outside the Battlefield. If a team receives this penalty after the round due to an appeal, the Base HP value for the losing team is set at 0, and the opposing team's value is the value recorded at the end of the match.

The penalty system used throughout the competition consists of the five penalties described in the previous table. A team may receive a Level 4 or Level 5 Penalty immediately after severely breaking the rules, whereas some penalties may be the result of gradually being upgraded from a Level 1 Penalty.

All robot have a credit system that can trigger Level 4 penalty automatically. At the beginning of a round, every robot has 9 credits. Each Level 2 penalty deducts 2 credits, while each Level 3 penalty deducts 4 credits. When a robot has 0 or less credits, the latest penalty will automatically rise to Level 4 penalty.

The UI of operator’s FPV screen will indicate a yellow exclamation mark on robot’s profile photo when robot has less than 5 credits. And a red exclamation mark for robot with less than 2 credits.

For example, if a team's robot crashes into their opponent's Supplier robot at high speed, it will immediately receive a Level 4 Penalty. Repeating the same violation within a round can also result in the severity of a penalty being escalated. For example, if a team repeats a Level 1 penalty multiple times in the same round, the Referee can assess a Level 2 or Level 3 Penalty, even if the robot does not fulfill the penalty requirements for a Level 2 or Level 3 Penalty.

During a match, before issuing Level 4 and Level 5 warnings, the head referee will announce the penalty through the headset to the participating operators. After the announcement (about 10 seconds), the Head Referee sends the ejection order of the robot through the Referee System or terminates the round. The Head Referee will not consider the status and location of robots before issuing the penalty.

Crew members must obey all Level 4-5 penalties issued during any match round. After the match, teams

cannot appeal Level 1-4 penalties.

5.5.3.2 Projectile Collection

1. Robots may not obtain projectiles from the Sentry or the Aerial robot.

Violations:

Robots that obtain projectiles from a Sentry or an Aerial robot will be ejected from the round.

2. Robots may not collect projectiles from the ground.

Violations:

Robots that collect projectiles from the ground will be ejected from the round.

3. All robots must use official RM2018 projectiles and cannot use any unofficial projectiles.

Violations:

Any team found to be using unofficial projectiles will be regarded as cheating.

4. Standard Robots cannot directly collect Projectile Containers from a Resource Island.

Violations:

Standard Robots collecting Projectile Containers will be given a Level 4 penalty.

5. The Hero or the Engineer can only be grab one Projectile Container at a time.

Violations:

A team whose Hero or Engineer robots grabbing more than one Projectile Container at a time will be given a Level 2 penalty for the first violation. After given a Level 2 penalty, if the team makes the same violation again, they will be given a Level 4 penalty.

5.5.3.3 Combat Rules

1. Crash Violations

A robot may not use any part of its structure to collide with enemy robots, regardless of whether the

opposing robots are alive or have already been destroyed. When a Battlefield element leaves the field with a robot, it is considered a part of the structure of the robot.

Teams can fire projectiles at the opposing team's ground robots within the projectile speed limits previously stated in the rules. If this causes damage to any structure, the video transmission module, or circuits on a robot, this will be considered incidental damage and will not be considered a violation of the rules. Nevertheless, if a Referee System module is damaged, a technician will provide backup modules during the Setup Period of the next round. Additionally, teams can request a technical timeout during the Setup Period to repair their robots.

To ensure that Sentry robots are able to move on Sentry Rails, any robot that crashes a Sentry robot (including those destroyed) either intentionally or unintentionally will be penalized.

Violations:

Regulations	Penalty Standards
1	If a robot intentionally crashes into an opposing robot by moving forward, the referee will issue a Level 1 penalty.
2	If a robot intentionally and repeatedly crashes into an opposing team's robot by moving forward or disturbs the normal movement of their opponent, the referee will issue a Level 2 penalty.
3	If a robot intentionally and repeatedly crashes into an opposing team's robot by moving forward with high speed, or a robot pushes an opposing team's robot for a long distance, or a robot disturbs the normal movement of their opponent for a long time, the referee will issue a Level 3 penalty.
4	If a robot intentionally and repeatedly crashes into an opposing team's robot with very fast movement, or pushes an opposing robot excessively for a long distance so that the opposing robot cannot normally perform its task or moving, the referee will issue a Level 4 penalty.
5	If a robot intentionally and repeatedly crashes into an opposing team's robot by moving forward with high speed and causes damage to the robot(including damage to the wires, sensors, or cameras), making the opposing robot unable to demonstrate basic mobility or controllability, the referee will issue a Level 5 penalty. And a Level 5 penalty may also be added after the match is over with the Chief Referee's confirmation.

Notice:

For robots that crash into an opposing team's destroyed robot, referee will issue Level 1-4 penalties as well according to previous table.

2. Restoration Zone Violations

Robots cannot enter the opposing team's Restoration Zone.

Violations:

Regulations	Penalty Standards
1	If a robot enters or flies above the opposing team's Restoration Zone for less than three seconds, the referee will issue a Level 1 penalty.
2	If a robot enters or flies above the opposing team's Restoration Zone for three to ten seconds, or if any part of the robot touches the enemy's supplier robot, the referee will issue a Level 2 penalty and the robot must immediately leave the opposing team's Restoration Zone.
3	If a robot enters or flies above the opposing team's Restoration Zone for three to ten seconds, and any part of the robot touches the enemy's supplier robot, the referee will issue a Level 3 penalty and the robot must immediately leave the opposing team's Restoration Zone.
4	If a robot enters or flies above the opposing team's Restoration Zone for more than ten seconds, or makes physical contact with the opposing team's Supplier robot that causes it to move from its current position, the referee will issue that robot a Level 4 penalty.
5	If a robot makes physical contact with an opposing team's Supplier robot in a way that prevents the Supplier robot from obtaining projectiles from the external projectile supply tube, or an ejected robot prevents opposing team from entering their Supplier robot to collect projectiles, the referee will issue that team a Level 5 penalty.

3. Aerial Robot Related Violations

Robots cannot launch projectiles at their opponent's Aerial robot.

Violations:

A robot that deliberately shoots at an Aerial robot will be ejected from the round.

4. Base Zone Violations

Robots may not enter the opposing team's Base Zone.

Violations:

Regulations	Penalty Standards
1	If any part of a Hero, Sentry, or Engineer Robot enters an opposing team's Base Zone for 3 seconds or less, the referee will issue a Level 1 penalty.
2	If any part of a Hero, Standard, or Engineer robot enters an opposing team's Base Zone for 3-10 seconds, the referee will issue a Level 2 penalty and the robot must leave the area immediately.
3	If any part of a Hero, Standard, or Engineer robot enters an opposing team's Base Zone for more than 10 seconds, the referee will issue the robot a Level 3 penalty.
4	If a Hero, Standard, or Engineer robot causes damage to the structure of the Base such that it no longer operates normally or robot prevents the Base from opening, the referee will issue the violating team a Level 5 penalty.

5. Contact Violations

Regardless of a robot's design or function, no part of it can make physical contact with and attach to an

opposing robot.

Violations:

Regulations	Penalty Standards
1	If a robot makes physical attachment that blocks the movement of an opposing team's robots for 10 seconds or less, the referee will issue that robot a Level 1 penalty.
2	If a robot makes attachment that blocks the movement of an opposing team's robots for 10-30 seconds, the referee will issue a Level 2 penalty, and that robot must move to a location away from the robot it is blocking.
3	If a robot makes attachment that blocks the movement of an opposing team's robots for 30-60 seconds, the referee will issue that robot a Level 3 penalty.
4	If a robot makes attachment that blocks the movement of an opposing team's robots for more than 60 seconds, the referee will issue that robot a Level 4 penalty.
5	If the Level 4 Penalty does not result in the violating robot moving out the opposing robot's path and/or causes damage, the referee will issue a Level 5 penalty.

Notices:

1. During a match round, the Head Referee will instruct operators to solve attachments, operators should follow the instruction of the Head Referee.

2. If robots attach to opposing team’s destroyed robots, the referee will issue Level 1-4 penalties according to the previous table.

5.5.3.4 Transformation

1. During a match, components can fall off of or break free from a robot as long as they are not essential components, and their components do not provide the team with a non-technical advantage. However, robots are prohibited from intentionally separating into smaller robots or systems. Robots cannot intentionally cast off or launch their own parts.

Violations:

A robot that separates into smaller robots or intentionally casts off its own parts will receive a Level 4 penalty.

2. A robot's transformation cannot block its own armor modules or armor modules for its team members to prevent projectile hits.

Violations:

A robot that blocks its own armor modules or those of a teammate will receive one of the following penalties:

- Level 1 Penalty: blocking duration of 3 seconds or less
- Level 2 Penalty: blocking duration of 3-10 seconds
- Level-3 Penalty: blocking duration greater than 10 seconds

3. Robots cannot cover each other's Referee System armor modules by linking together or blocking each other to avoid incoming attacks. The only exception to this rule is when robots are collecting projectiles or rescuing a destroyed robot.

Violations:

A robot that violates this rule will receive one of the following penalties:

- Level 1 Penalty: blocking duration of 3 seconds or less
- Level 2 Penalty: blocking duration of 3-10 seconds
- Level 3 Penalty: blocking duration greater than 10 seconds

4. When rescuing or restoring other friendly robots, robots are allowed to shield at most three armor modules for each other. When receiving projectile supply from the Suppliers, up to four armor modules of the robots can be shielded.

Violations:

When rescuing or restoring other friendly robots and the rescue robot and the rescued robot are connected, the time allowed for one robot to shield more than one armor side of the other robot is determined by the Head Referee, and they may give Level 1 (less than 3 seconds), Level 2 (between 3-10 seconds), or Level 3 (10 seconds or above) penalties based on the circumstances.

5. Robots are prohibited from using adhesive materials and substances (e. g. duct tape) on its projectile grabbing mechanism.

Violations:

1. A robot equipped with a sticking mechanism, such as 3M adhesive, cannot pass the pre-match inspection;
2. The use of 3M adhesives and other sticky materials for picking up and dropping projectiles during a match will be considered cheating, and all rounds in which the violating robot participated will all be assessed as loses.

6. Any of the robot's moving mechanisms cannot cause damage to the core Battlefield elements / mechanisms (Bases, Power Runes, Assistance Columns, and Sentry Rails) on the Battlefield.

Violations:

Once a robot causes damage to the Battlefield elements / mechanisms, the referee confirm the damage and end the match, assessing a Level 5 penalty for the violating team.

7. Sentry robots can only move along the Sentry Rail.

Violations:

Once a Sentry robot leaves the Sentry Rail, it will be issued a Level 4 penalty.

5.5.3.5 Rescue and Revival

1. Team can rescue a destroyed robot by bringing it to team's Regeneration Point to be revived. A destroyed robot that has completed the revival process at its team's Regeneration Point will automatically be revived. During the rescue and revival process, opposing robots may launch projectiles at the robots performing the rescue, but they cannot crash into these robots.

Violations:

Regulations	Penalty Standards
1	If any part of a robot crashes into robots involved in a rescue or revival process and briefly interrupts the process, the referee will issue a Level 2 penalty.
2	If any part of a robot briefly crashes into robots involved in a rescue or revival process with fast forwarding speed and interrupts the process, the referee will issue a Level 3 penalty.
3	If any part of a robot crashes into robots involved in a rescue or revival process with fast forwarding speed and interrupts the process, the referee will issue a Level 4 penalty.
4	If any part of a robot crashes into robots involved in a rescue or revival process and interrupts the process, blocks their path, and causes the opposing robot cannot demonstrate basic mobility or controllability or cannot perform rescue task again, the referee will issue a Level 5 penalty.

2. When the robots from either team are rescuing or restoring other friendly robots, do not grab any Referee System module from the rescued/restored robot.

Violations:

Robots which do not meet the installation requirements of the Referee System will not be able to pass the pre-match inspection.

5.5.3.6 Emergency Cases

1. When safety risks arise on the Battlefield, such as an exploded battery, the Aerial robot's safety line breaking and causing it to fly towards the audience area, a power outage, the explosion of a compressed gas canister, or an injury to a team or staff member, the Head Referee will end the round immediately by informing operators and destroying all the robots. The current round result will not be recorded. Technicians will then enter the Battlefield to carry out repairs. When the repair work is complete, the round will restart.

2. The match will continue if ordinary Battlefield elements are damaged (Base armor module LED goes off, etc.). However, the Head Referee will end the round immediately by informing operators and destroying all the robots if any important element is confirmed to be structurally damaged or malfunctioning (Base protection shield cannot open, Base armor modules are damaged and cannot sense projectile hits, the Power Rune cannot be triggered normally, etc.). The current round result will not be recorded. Technicians will enter the Battlefield to carry out repairs. When the repair work is complete, the round restarts.
3. If the external projectile supply tube becomes damaged, the Head Referee will evaluate whether this affects the fairness of the match round. If it does, the Head Referee will end the round immediately by informing operators and destroying all the robots. The current round result will not be recorded. Technicians will enter the Battlefield to carry out repairs. When the repair work is complete, the round restarts.
4. If a key mechanism of the Battlefield has minor logical errors and the problem was not caused by a competing team (for example, the Power Rune cannot be triggered after team successfully hits correct number sequence), the Head Referee will manually trigger the mechanism for the team. This process may have delays, and the Head Referee will not be held responsibility for the impact of these delays. If the error cannot be resolved manually, the Head Referee will end the round immediately by informing operators and destroying all the robots. The current round result will not be recorded. Technicians will enter the Battlefield to carry out repairs. When the repair work is complete, the round restarts.
5. During a match round, if there are abnormal functioning of or structural damage to key Battlefield elements / mechanisms that affect the fairness of the match round and the Head Referee did not confirm and end the game in time, resulting in the game that should have ended resulting in a win and loss for the teams, after verification of the Chief Referee, the result of the round is deemed invalid and there will be a rematch.
6. During a match round, there may be a serious violation that obviously deserves a Level 5 penalty but the Head Referee did not confirm and execute the penalty in a timely manner. After the match round, the Chief Referee has the right to further verify the round result and issue additional Level 5 penalty.

5.5.4 Severe Violations of the Rules and Cheating

To ensure fairness and proper regulation of the competition, any cheating or severe violations of the rules by an individual or team will lead to their disqualification from the competition. This results in the team being unable to participate or receive any awards. The results of any matches participated in by this team are documented for their opponents' reference.

The following actions are considered cheating:

Regulations	Cheating
1	Changing or damaging the Referee System, concealing power consumption measurements

	through technical tricks, and/or damaging measuring systems.
2	A robot's behavior is different from that exhibited during the pre-match inspection (such as changes in size and Referee System installation positions.)
3	Operators are not team members; robots are not made by the team.
4	Manually operating a fully-automated robot.
5	Use of unofficial projectiles.
6	Other behavior that the Chief Referee determines to be serious misconduct.

The following actions are considered a severe violation of the rules:

Regulations	Types of severe violation of rules
1	Refusal to accept penalties and conform to the results for any violation of the rules mentioned in this document.
2	Refusing to leave the Competition Area after the match ends.
3	Installing explosives or other prohibited items on robots.
4	Team members using robots to crash into or attack people.
5	Team members purposely damaging an opponent's robots, battlefield items, or the Competition Area.
6	Team members engaging in a physical confrontation with a referee, their opponents, or the audience.
7	Team members not cooperating when the RoboMaster Organizing Committee is hearing an appeal.
8	Other severe actions that go against the guidelines and spirit of the competition, as determined by the Chief Referee.
9	Violation of local laws and regulations inside the Competition Area, audience area, or accommodation. In addition to being disqualified from the competition, the RoboMaster Organizing Committee will fully cooperate with the relevant authorities to pursue appropriate legal action against the offender.

5.6 Post-Match Procedures

Members from both teams must turn off the power supply for all their robots and remove them from the Competition Area when the match is finished. Teams are required to remove all the projectiles from the robots before returning to the Preparation Area.

Violations:

Once the match is over, if a robot has not unloaded all its projectiles, the robot will be detained in the unloading area.

5.6.1 Results Confirmation

During each match, an assistant referee records the results of each round, which includes the remaining HP (at both the team's Base and the total value) for both teams and key penalties, on a *Match Record Form*.

Team Captains must go to the Referee Area to confirm the results at the end of a match. The referee will not accept appeal requests between the rounds of an ongoing match.

Both teams must confirm the match results by signing the *Match Record Form* in the Referee Area **within five minutes after the match**. If a Team Captain does not turn up at the referee area to sign the *Match Record Form* or request an appeal, it is deemed that their team agrees with the match result written on the *Match Record Form*.

Once the Team Captain has signed the *Match Record Form*, all rights to an appeal are forfeited.

5.6.2 Appeals

Every team has the right to appeal once during each Regional Competition, Wild Card Competition, and the Final Tournament. However, appealing chances cannot be accumulated across different competition periods. If an appeal is successful, a team can appeal again in future matches. If an appeal is not successful, the RoboMaster Organizing Committee will not accept further appeals from the team in that competition period. When processing an appeal, an Appeals Panel will be formed that is made up of Chief Referees. **The appeal panel makes the final decision on all appeals**.

If the result of an appeal is "Result determined by a re-match", both teams can appeal again after the re-match. In this scenario, if the previous team that made the initial appeal wants to appeal again (known as a "continued appeal"), this will consume the team's appeal chance regardless of the appeal results. Due to potential delays to the competition schedule, this "continued appeal" must be initiated by both the Team Captain and Team Supervisor within five minutes after the match ends. The appeal process for a "continued appeal" is also simplified, with the time for the submission of evidence and materials being shortened. The time for the submission of evidence and materials being shortened to within 30 minutes after the match ends. The RoboMaster Organizing Committee will announce the result of the appeal in the appeal form within one hour after the match ends. In the following section, we only discuss normal appeals.

5.6.2.1 Appeals Process

1. Within five minutes after a match ends, the Team Captain submits an appeal to the Chief Referee on duty in the Referee Area and signs an Appeal Form. The RoboMaster Organizing Committee will not accept any appeals five minutes after a match ends. They will also not accept any appeals received either before or during the match.

2. The Chief Referee checks whether the appeal can be processed.

3. After the Chief Referee has accepted the appeal, RoboMaster staff will invite Team Captains from both teams to meet in the Arbitration Room. If the team that made the appeal requests a robot inspection, the Appeals Panel will transfer all robots from both teams to the Arbitration Room for immediate inspection. Each team can only send three members into the Arbitration Room, and one must be either the Team Captain or Project Manager.

4. Members of both teams can collect evidence and materials to submit to the Appeals Panel.

5. The Appeals Panel will conduct further communication with both teams inside the Arbitration Room after evidence and materials have been submitted.

6. The Appeals Panel makes a final decision and both Team Captains sign the Appeal Form to confirm the result. Once signed, both teams cannot question the appeal results any further.

5.6.2.2 Appeal Validity

1. Appeal Request Validity Period: Appeals must be made within five minutes of the end of each match and recorded on the Appeal Form. The Appeals Panel will not accept any appeal requests five minutes after the stated Appeal Request Validity Period.

2. Arrival at the Arbitration Room: Both teams must arrive at the Arbitration Room within 30 minutes of receiving a notification from the Appeals Panel. An absent team is deemed to have forfeited their right to an appeal and must accept any decision made by the Appeals Panel. If more than three members of a team enter the Arbitration Room or the attendees do not belong to the related team, the team is also considered to have forfeited their right to an appeal.

3. Submission of Evidence and Materials: A team must submit evidence and materials within 60 minutes of requesting an appeal, and the Appeals Panel will not accept any new materials beyond this 60-minute limit.

5.6.2.3 Appeal Materials

1. Types: The Appeals Panel only accepts materials stored on a USB drive or on a competing robot.

2. USB Drive Requirements: The team must prepare videos extracts and other document files as materials used in their appeal. The RoboMaster Organizing Committee will not assist in the collection

of videos to maintain neutrality throughout the process.

3. Materials Requirements: Each video cannot exceed 1 minute in length or be over 500 MB 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 .txt format and not exceed 1000 words in length.

4. Materials Name: The name of each video and photo must contain less than 30 characters.

5. Text Requirements: Each text document can only refer to one video or photo and must clearly state the name of the video or photo being referred to. The text document only needs to reflect the specific rules violation in support of the photo/video/robot(s).

6. Robot Evidence: The Appeals Panel has the authority to isolate any relevant robots from both teams after an appeal has been made. These robots will not be isolated for more than three hours, and the latest time they will be returned to teams is at the same time as the outcome of the appeal.

5.6.2.4 Appeal Decisions

The Appeals Panel will release their final decision in the Appeal Form within three hours of the appeal being made. This decision has one of three possible outcomes: Original Result Upheld, Original Result Reversed, or Result Determined by a Re-match.

Neither team may argue against the outcome of an appeal. If the Appeals Panel requests both teams to have a rematch, they will inform both teams of the time of this re-match. If both teams refuse to have a re-match, this appeal is discarded and both teams retain their right to appeal during the remainder of the competition period. A team that refuses a re-match is considered to have forfeited the match and lost.

Appendix 1 – RoboMaster Safety Instructions

Every team and all its members must fully understand and accept that safety is of paramount importance when competing at the RoboMaster competition. To protect the rights and interests of all those who participate in the competition, as well as the rights and interests of the event organizers, everyone who enters the RoboMaster competition must make the following commitments, uphold and abide by the following safety clauses in accordance with applicable laws and regulations:

1. All team members who register to take part in the RoboMaster competition state that they are fully capable of civil conduct and can independently manufacture and operate robots. Prior to manufacturing robots, all team members will use materials provided by SZ DJI Technology Co., Ltd., carefully read registration rules, competition regulations, and other important documents containing rules and regulations related to the competition.
2. During the competition, all team members will ensure that their actions including the manufacturing, testing, and use of robots will not cause any injury or damage to his or her teammates, members of the opposing teams, referees, competition personnel, audience members, equipment, or the Competition Area.
3. The team must ensure that the structural design of its robots will not hinder the safety inspections that take place prior to the commencement of the competition, and agrees to cooperate fully with the pre-competition safety inspections carried out by the RoboMaster Organizing Committee.
4. The team guarantees that it will not use any internal combustion engines, explosives, high-pressure air products, or Energetic Materials
5. Throughout the R&D stage as well as the competition stages of the event, all team members must pay full attention to potential safety issues, and the team's Advisors must be responsible for instructing and supervising the team on safety issues.
6. The team must guarantee the safety of all the robots it enters into the competition. This includes ensuring the projectile launchers installed on the robots are safe, and that the projectiles will not cause any harm (either directly or indirectly) to any operator, referee, competition personnel, or audience member.
7. The team will take sufficient and necessary safety measures during R&D, training, and competition stages of the event regarding any hazardous situations that may occur. This includes but is not limited to: preventing the control systems from becoming unstable; anticipating every potential operation prior to carrying out the operation to avoid wrongful operation or a collision between team members or between robots and team members; prohibiting team members from engaging in solo training; making sure that one or more persons have been appointed as an emergency responder; wearing goggles and

helmets; properly applying the lock function in the robots control system before engaging in debugging or adjustments; and including an emergency stop function on all robots.

8. The team will be held responsible for all accidents and losses that occur as a result from robots breaking down, autonomous airborne robots losing control, and any other unexpected circumstances.
9. The materials bought from or provided by the organizer of this competition (SZ DJI Technology Co., Ltd.) such as batteries and the Referee System must be used in accordance with the information contained in their user manuals. SZ DJI Technology Co., Ltd. will not be held responsible for any injuries that arise from the improper use of these materials. The team will be held responsible for any injuries caused to its own members or any other persons, as well as for damage caused to property arising from the production and operation of its robots.

All team members must remain in strict compliance with the laws and regulations of the People's Republic of China. All team members must also pledge that their robots will only be used for the RoboMaster competition and that their robots will not be illegally modified or used for any illicit purpose(s).

Appendix 2 - Definitions of RoboMaster Terminology

Terms	Definition
Competition Names	
Warm-up Competition	A voluntary competition held in Shenzhen for teams to practice on the actual RoboMaster 2018 Battlefield.
Regional Competition	The number and location of Domestic Teams determines where the competition will be hosted. Based on the results of the competition, teams qualify for the Wild Card Competition and Final Tournament.
International Regional Competition	The number and location of Invited Teams determines where the competition will be hosted. Based on the results of the competition, teams qualify for the Wild Card Competition and Final Tournament.
Wild Card Competition	Competition for the last spots in the Final Tournament among teams that performed strongly, but did not qualify during Regional Competitions.
Final Tournament	A weeklong tournament for teams that qualified in the Regional Competition or Wild Card Competition to determine the final champion of RoboMaster 2018.
Robot Types	
Sentry	Autonomous robots that protect a team's Base.
Hero	The main robot of the competition.
Standard	Robots with multiple uses throughout the competition.
Aerial	A robot that provides an aerial view of the Battlefield and can fire 17mm projectiles.
Engineers	A robot built to provide assistance throughout the competition. One is required for each team.
Suppliers	A robot that supplies projectiles to a team's robots.
Staff Responsibilities	
Supervisor	A professional representative of the university who mentors the team throughout the season.
Advisor	Senior team members or professional engineers who guide the team in strategy, technology, and/or management.
Registered Captain	A student leader of the team to direct all technological and strategic aspects. Also serves as the team's contact person for the RoboMaster Organizing Committee.
Project Manager	Oversees the RoboMaster project by managing project schedules, budgets, and personal safety.
PR Manager	Leads promotion of the robotics team and other competition-related projects.
Team Member	Team Members are separated into groups that serve in technical or operational

Terms	Definition
	roles. The technical group is further separated into mechanical, electric control, or vision sub-groups.
Operator	A team member who controls a robot. Operators are categorized into those that operate ground robots, and those that fly airborne robots. Two operators are required to control airborne robots, an Aerial Gimbal Operator who controls the gimbal-mounted firing mechanism and a Pilot who manages the flight path.
Pit Crew Member	Team members who enter the Staging and Competition Areas.
Head Inspector	An inspector who oversees all the pre-match inspections and makes the final decision on whether the team passes the pre-match inspection or not.
Inspector	Assists with pre-match inspections.
Chief Referee	Has the final decision and right of interpretation regarding competition rules. Issues penalties for severe violations of the rules. Has the right to issue additional penalties following an appeal.
Head Referee	The main person responsible for controlling competition procedures and penalties.
Side Referee	Executes competition procedures and penalties from their position around the perimeter of the Battlefield.
Operator Room Referee	Executes competition procedures and penalties from their position in the Operator Room.
Field Technician	Maintains the Battlefield by repairing it and other related elements. In addition, solves technical issues related to the Referee System.
Operator Room Technician	Fixes communication issues between the Referee System and the competing robots from their position in the Operator Room.
Technical Review Stage	
Rules Quiz	An evaluation that tests the understanding and the ability to interpret the content of the RoboMaster 2018 Rules Manual.
Season Plan	A technical evaluation that checks the team's realistic scientific abilities to prepare for the competition including its culture, project analysis, team structure, knowledge sharing ability, auditing systems, resource management, and business plan.
Project Proposal	A technical evaluation that looks at how the team will design and develop their robots while conforming to the requirements, structural design, programming logic, ergonomics, scientific design, scientific practice improvement, innovation, and aesthetic design.
Robot Assessment Video	A comprehensive look at whether the team's robots meet all the minimum specifications required to show readiness for the competition.
Referee System Examination	A test based on the *RoboMaster 2018 Referee System Specification Manual* to check understanding of the ability to install and use the Referee System.
Participating Teams	
Domestic Team	A team that is qualified to participate in the competition after passing the registration technical evaluation stages. These teams are typically from universities in Mainland China.

Terms	Definition
Invited Team	A team that received a special invitation from the RoboMaster Organizing Committee (RMOC) and qualified for the competition by successfully passing the registration and technical evaluations. These teams are typically from universities outside of Mainland China.
Wild Card Team	A team that successfully registers in the required timeframe, however, does not pass the technical evaluation stage. These teams receive special invitations from the RoboMaster Organizing Committee.
Technical Specifications	
Operating Air Pressure	The air pressure required for the main parts and gas pipes on a robot to work.
Energy Source	Robots can be powered by electricity and air pressure.
Optical Measures	Robots taking action to reach goals by using different power and different colors at different visible wavelengths during a match.
Visual Feature	Images used to assist robots.
HP (HP)	
Initial HP	The HP of each robot set by the Referee System at the beginning of every round.
Current HP	A real-time HP measurement of robots during a match.
Max HP	The maximum HP available for each robot.
Damage Output	Damage caused by enemy projectiles that hit a robot's armor modules. The HP lost due to penalties imposed on the opposing team by referee is also count into Damage Output.
Base Winning HP	The difference between the remaining HP of the Base of both teams.
HP Gained	Robots that are rewarded with additional HP by triggering core gears on the Battlefield or leveling up.
Referee System	
Video Transmission Module	Captures live video from the camera and displays it on the operator's monitor in the Operator Room.
Speed Monitor Modules	Detects the firing speed of the firing mechanism and deducts HP from a firing robot if its firing speed is above the predetermined limits.
Armor Modules	Comprised of armor plates and sensors this module Protects the internal workings of robots and detects projectile impacts to deduct HP accordingly.
RFID Interaction Module	Communicates with RFID-enabled Battlefield elements (such as the Revival/Recovery Zone) to activate predetermined functions.
Positioning Module	Obtains the location of each robot on the Battlefield.
Main Control Module	Control the power supply of the robot and gauges chassis power. When the power limit is exceeded, the system will deduct the robot's HP. When HP is zero, it will automatically cut off the power supply.
Functional Areas	

Terms	Definition
Preparation Area	Includes the Inspection Area, Maintenance Area, and a rest area.
Staging Area	Where qualified robots and participants prepare for a match.
Competition Area	The formal tournament area that includes different functional areas, such as the competition field (also known as the Battlefield), referee area, stage, projectile management area, Operator Room, audience area, unloading area, and Arbitration Room.
Competition Field (Battlefield)	The main competition site for participating robots. Includes a Starting Zone, Base Zone, Resource Islands, Landing Pads, and Restoration Zone.
Inspection Area	Where the participating robots undergo an inspection before competing.
Maintenance Area	The only area where the robots can be repaired.
Rest Area	The only area for players and robots to rest outside matches.
Referee Area	Where the Head and Chief Referees implement competition procedures, confirm participant's performance, process appeal requests, and carry out other official duties.
Red/Blue Operator Room	A room for robot and Aerial Gimbal Operators to control their robots during the competition.
Pilot Room	An area for pilots to see and control the Aerial robot during the competition.
Red/Blue Spectator Area	The only area where non-operating pit crew members may sit and observe matches.
Unloading Area	An area to unload projectiles from all robots after a match finishes.
Arbitration Room	A room for representatives of the RoboMaster Organizing Committee and Chief Referee to deal with appeal requests.
Red/Blue Entrance (Exit)	The pathway for participants to enter and exit the Competition Area.
Battlefield	
Starting Zone	The only area where all ground robots (except the Supply robot) have a three-minute setup period. This area includes the Base Zone and Sentry Rail.
Base Zone	Where each team's Base is located.
Base	The area that has core tools with 10,000 HP, and is the main factor that determines which team wins.
Sentry Rail	The only area the Sentry robot can access. Includes a sliding rail and support frame.
Bridge Platform	Located at the top plane of the bridge with barriers on both sides to prevent robots from falling off the bridge platform. Robots occupying the bridge platform can receive accelerated barrel heat cool-downs and additional defensive capabilities.
Side Passage	Located at one of the exits of the bridges. These are areas where occupying robots can get double the rate of barrel heat cool-downs.
Bridge	Robots can occupy higher spots on the bridges for attack advantages, including the

Terms	Definition
	bridge platform that has the highest point and the side passages. The bridge connects the Base Zone on one side and a side passage on the other.
Bunker	The key location in the main Battlefield where the barrel heat cool-down rate and defensive capabilities of occupying robots will be improved.
Projectile Container - 17 mm	A container for projectiles that is located in the lowest area of the projectile depot on Resource Islands. Contains 17 mm projectiles.
Projectile Container - Mixed	A container for projectiles that is located in the projectile depot on Resource Islands. Contains a mix of 17 mm and 42 mm projectiles.
Projectile Container - 42 mm	A container for projectiles that is located in the highest area of the projectile depot on Resource Islands. Contains 42 mm projectiles.
Projectile Container	An area on the edges of Resource Islands that contains Projectile Containers. The types and quantities of projectiles vary in each area.
Resource Islands	The most essential part of the Battlefield that consists of the projectile bank, Power Rune, and Assistance Column. The robot can get different quantities and different types of projectiles from the different projectile containers by ascending the Resource Island platform.
Power Runes	The large screen on the side of the Resource Island is divided into a 9x9 grid. There are lights on both sides showing the number of times a robot has hit the 9x9 grid. If solved correctly, the challenge will activate the Power Rune to benefit the team.
Assistance Column	Fixed columns located on both sides of the Resource Islands. Robots can use the Assistance Columns to ascend to Resource Island and get projectiles from the Projectile Container.
Supply Zone	The 1000 mm x 1000 mm Supply Zone is where a team's External Projectile Supply Tube outlet is located, and is also the home of its Supplier Robot.
Penalty Zone	A 2000 mm^2 area that is off-limits to opposing teams. A team entering the opposing team's Penalty Zone will receive penalties.
Regeneration Point	Each team can use the Regeneration Points to initiate the recovery and revival of any of their robots that have exhausted their HP. Destroyed robots can also be brought here to be revived.
Landing Pad	This is where the Aerial robots of each team take off and land.
Open Zone	Located at various points around the Battlefield, these are designed to test the power capabilities of a robot's chassis.
Safety Rope	The safety line is fixed to a steel cable and connected through pulleys that limit the Aerial robots flight range. All Aerials robots must be attached to a Safety Line via a slip ring before each match begins.
Regeneration Card	Interacts with Regeneration Points to restore the HP values of Hero and Standard robots.
Judging	
Setup Period	This period provides three minutes before a match for teams to enter the

Terms	Definition
	Competition Area and test their robots and equipment.
Round	A seven-minute period for teams to compete on the Battlefield.
Referee System Initialization Period	A twenty-second period provided between the setup period and a round for connecting and checking the Referee System.
Pass Card	Indicates that a robot has passed the pre-match Inspection. Only robots with a Pass Card can enter the Staging and Competition Areas.
Official Technical Timeout	During the setup period of the first round, technicians can request that the Chief Referee provide a technical timeout when the Referee System or other equipment in the Operator Rooms malfunction, or functional problems occur with critical equipment in the Battlefield.
Team's Technical Timeout	A pause in the competition that teams may request during the setup period to address specific needs. Teams are required to confirm the timeout with signatures before a Technical Timeout is accepted.
Safety Hazards	On-site safety inspectors will handle possible safety hazards and problems that may occur during the competition.
Robot Projectile Unloading	Robots are required to unload all projectiles during the setup period to ensure that both teams have the same number of projectiles and the competition remains fair.
Rescue	After a robot dies on one team, a teammate can carry the dead robot to the Regeneration Point to resurrect the robot. After a certain amount of time, the dead robot will come back to life with full HP. This is called robot rescue.
Violations	If a team member violates any rule stated in the rulebook, he/she will receive different level of penalties from referees.
Level 1 Penalty	A light obstruction of the rules occurs. The screen of the operator will be blacked out for three seconds.
Level 2 Penalty	An obvious obstruction of the rules occurs. The screen of the operator will be blacked out for five seconds. The Referee System will deduct 5% of the maximum HP of all the team's active robots (except robots in bases) automatically.
Level 3 Penalty	A competing team exhibits serious misconduct, and is applied directly to the offending robot. This penalty sends an eject command to a robot and reduces its HP to 0.
Level 4 Penalty	A competing team exhibits very serious misconduct. This penalty results in a team being automatically declared the loser of the current match.
Crash	An occasion during a match when two team's robots collide with each other because of poor control by their operators. Referees will decide the penalty for the culprit of such an occasion based on the actual contact that takes place and the impact the crash has on the match.
Attachment	An occasion in a match when one team's robot cannot avoid the other team's robot. Referees will decide the penalty for the culprit of such an occasion based on the actual contact that takes place and the impact the crash has on the match.
Operator Ejection	If an Aerial operator or a ground robot operator leaves their Operator Room without permission, he or she will be penalized by the referee accordingly.

Terms	Definition
Round Loss	A competing team will lose the round if they engage in an extremely serious violation of the rules or other forms of cheating. The referee determines this penalty in accordance with the rules that state it is applicable.
Cheating	Forms of cheating are clearly set out in the rules. Referees will usually punish cheating by declaring the current round to have been lost by the offending team, with more serious forms of cheating leading to disqualification from the competition and its awards.
Appeal	If any of the competing teams hold different opinions regarding the results of a game, they can request for an appeal from the competition's RoboMaster Organizing Committee to within a designated period. The number of appeals available to each team is subject to the stipulations set out in the rules. The team making the appeal must hand in supportive materials to the Appeals Panel, and members from the Appeals Panel as well as the Team Captains from both teams need to gather in the Arbitration Room to discuss the issue and come to a conclusion.
Result Confirmation	Team Captains from both teams must go to the Referee Area to confirm they have no objections to the result of a match by signing off on the results within a designated period after each match.

Appendix 3 - Technical Assessment Specifications

Technical Assessment Introduction

All teams that compete in the RoboMaster 2018 Competition must complete a Technical Assessment in accordance with the requirements of the RoboMaster Organizing Committee and within the time specified. The purpose of the Technical Assessment is to demonstrate the technical skills of a team, better prepare the team for the competition, and help them in their future development. During the Technical Assessment, the RoboMaster Organizing Committee encourages teams to be innovative and not stick to a rigid structure. Teams should also ensure that their report is clear and contains sufficient data. The RoboMaster Organizing Committee does not accept Technical Assessments that are overly rigid and or those that contain inaccuracies.

Only after completing the Technical Assessment within the specified deadline may teams move on to the next step of the assessment and become eligible for Warm-up, Regional, International Regional, and Wild Card Competitions, followed by the Final Tournament. Teams that are commended by the judging panel for their Project Proposal, Robot Assessment Video, Season Report, and Open-Source Report and that also share their experience, making their content open-source on the official RoboMaster online discussion forums, will receive a 50%-off discount on RoboMaster online educational materials. They will also receive a discount on educational competition resources from the competition's RoboMaster Organizing Committee.

The schedule for the RoboMaster 2018 Technical Assessment is as follows:

Schedule	Item	Format	Details	Benefits
Oct. 2017	Rules Quiz	Online	Domestic Teams (Mandatory) Invited Teams (Optional)	20% discount on RoboMaster online educational materials. Apply for RoboMaster online proxy permission. Obtain permission to submit a Season Plan and Project Proposal.
Oct. 2017 - Dec. 2017	Season Plan	Online	Optional	30% discount on RoboMaster online educational materials.
November 6, 2017 - May 15, 2018	Project Proposal	Online	Domestic Teams (Mandatory)	40% discount on RoboMaster online educational materials.

Schedule	Item	Format	Details	Benefits
				Obtain full submission permission.
Batch 1: March 15, 2018 - March 23, 2018 **Batch 2: March 24, 2018 - April 6, 2018**	Robot Assessment Video	Online	Domestic Teams (Mandatory)	Authority to submit a Referee System Examination.
By April 7, 2018	Referee System Examination	Online	Domestic Teams (Mandatory)	Authority to access the Referee System and attend Regional Competitions.
By Friday, April 27, 2018	Project Proposal Robot Assessment Video	Online	Invited Teams (Mandatory)	Authority to access the Referee System and attend International Regional Competitions.
May 2018 - Sep. 2018	6. Season Summary	Document	Optional	50% discount on RoboMaster online educational materials.
Throughout the competition	Open-Source Report	Document	Optional	50% discount on RoboMaster online educational materials.
Throughout the competition	Any Season Plan, Project Proposal, Robot Assessment Video, Season Summary, or Open-Source Report that is deemed outstanding and comes with shared experiences and open-source content on the official RoboMaster online discussion forum.	Optional	50% discount on RoboMaster online educational materials.	50% discount on RoboMaster online educational materials.

The recommended components list for all robots is as follows:

Robot Type	Qty	M3508	C620	RM Dev Board	M3508 Accessories Package	TB47D	M100
Standard	3	4	4	1	1	2	0
Hero	1	6	6	1	2	2	0
Sentry	1	2	2	1	0	2	0
Engineers	1	6	6	1	1	2	0
Suppliers	1	1	1	1	0	1	0
Aerial	1	0	0	0	0	2	1
Total		27	27	7	6	15	1

Note:

Pass the Season Schedule and Project Proposal stages with good ratings and get 50% off for RM online

products (limited to the number of robots in the full lineup). The 50% Education Discount Vouchers are not counted towards the sales limit of the full season.

The details of the Technical Assessments are as follows:

1. Competition Rules Evaluation

Format: Multiple-choice questions randomly selected from the RoboMaster database. The quiz can be taken, submitted, and retaken an unlimited number of times within 24 hours of the start of the evaluation period.

Score Ranking: Based on the score and time of the most recent submission. Totals are first ranked by score, and if the scores are the same, they are then ranked by submission time.

Rewards: Teams who finish in the top ten and share an evaluation of their experience will earn a 50% discount on all RoboMaster educational materials available online.

2. Season Plan

Format: Word document

Font: Microsoft YaHei or Times New Roman (size 10)

File Size: Max. 5,000 words including diagrams (flowcharts, forms, etc.)

Filename: College Name + Team Name + Registration Number + First/Second Season Plan

Submission Opportunities: 2 (The score of a second submission will receive a five-point deduction; i.e., a second submission that receives a score of 90 will have five points deducted to give a final score of 85 points.)

Rewards: Teams passing the Season Plan evaluation receive a 30% discount on RoboMaster online educational materials. Teams that are commended by the judging panel for their Season Plan and that also share their experience, making their content open-source on the official RoboMaster online discussion forums, will receive a 50%-off discount on RoboMaster online educational materials.

Evaluation Requirements: The Season Plan includes seven modules. Each of these modules has its own

requirements, scoring criteria, and score. The RoboMaster Organizing Committee will assess all modules.

The details and requirements for the four modules of the Season Summary are as follows:

Module	Content	Scoring Criteria	Score
Competition Culture	RM competition details and culture Core team culture	Clarity and accuracy	5
Project Analysis	The structure of each robot, all the other components that need to be finished (deadlines for actions), the capital and human resource requirements for each part.	Content breadth and depth Logical clarity and accuracy Data clarity and accuracy	25
Team Structure	Team's management structure Recruitment direction Responsibilities of each role	Reasonable structure Cooperativeness Clarity of duties	10
Knowledge Sharing	Open source forum materials, material manuals, knowledge sharing platforms, procedures, document management software applications, training and self-learning processes.	Abundance of materials Usability of shared software Study plan arrangements	20
Auditing System	Task proposal, allocation, verification, evaluation, and progress tracking Results acceptance system	Rationale processes that are easily executable	15
Resource Management	Investigation of resource status (budgeting, materials, and manufacturing resources) Work arrangements that take into consideration both schoolwork and competition requirements	Thoroughness of investigation Planning Resource allocation	10
Business Plan	Acquisition of resources and materials needed throughout the season Team sponsorship and promotional plan	Clarity and quality of plan	15
Total:			100

3. Project Proposal

Format: Word document

Font: Microsoft YaHei or Times New Roman (size 10)

File Size: Max. 8000 words including diagrams (flowcharts, forms, etc.)

Content Requirements: Graphs and flowcharts that include adequate data, focus on key points, and demonstrate sound logic.

File Name: College Name + Team Name + Registration Number + First/Second/Third Project Proposal

Submission Opportunities: 3 (The score of a second submission will receive a five-point deduction, and the score of a third submission will receive a ten-point deduction; i.e., a second submission that receives a score of 90 will have five points deducted to give a final score of 80 points.)

Rewards: Teams passing the Project Proposal evaluation receive a 40% discount on RoboMaster online educational materials.

Teams that are commended by the judging panel for their Project Proposal and that also share their experience, making their content open-source on the official RoboMaster online discussion forums, will receive a 50%-off discount on RoboMaster online educational materials.

Evaluation Requirements: The Project Proposal includes eight modules. Each of these modules has its own requirements, scoring criteria, and score. The RoboMaster Organizing Committee will assess all modules.

The details and requirements for the four modules of the Season Summary are as follows:

Module	Content	Scoring Criteria	Score
Requirements Confirmation	From the rules and their conditions, find out task priorities and key indicators for winning matches.	Clarity and quality of indexes and technical points	15
Structural Design	A robot's or component Project Proposal attached in the document appendix	Analysis of the quality, requirements, performance analysis, material applications, selection of components, and manufacturing techniques	20
Programming Logic	An example program logic diagram for one of the robots	Logical accuracy Degree of modularity Ability to meet requirements	10
Ergonomics	Analysis of classic examples of ergonomics being applied to a robot's capabilities	Intuitiveness of design Optimization of user-robot interaction Quality and maintainability of robot layout and wiring	10
Scientific Design	Analysis of classic examples of a robot's typical simulation and practical capabilities	Demonstration of theory guiding practice Contrastive analysis of simulation results and practice	15
Scientific Practice Improvements	Analysis of classic examples of practical improvement methods being applied to robots	Science behind experiment Quality of data and cause analysis Demonstration of improvement	15

		being effective Application of debugging software and tools	
Innovation	Analysis of classic examples of innovative methods being applied to robots	New technology and creativity that leads to better end results	10
Aesthetic Design	Demonstration of a robot's aesthetic design	Consistency, attractiveness, and expressiveness of style	5
Total:			100

The Robot Structural Design section uses the components required for a certain function as an example and can report on the following five modules:

Item	Content	Scoring Criteria	Score
Requirements Analysis	Mechanisms, performance indexes and analysis under different working conditions, sensors, and propulsion selection parameters	Quality of analysis Simulation of dynamics	30
Design Drawings	Taking one component as an example and showing the engineering diagram (with STEP file)	Complete diagrams that show: 2D and 3D drawings, dimensions, tolerance levels, fonts, label positions, materials, surface treatment, etc.	20
Materials and Manufacturing Processes	Lists the materials selection, manufacturing techniques/cost, and plan to reduce costs for different batches	Selection of materials and accessories Labor cost calculations Rationale of manufacturing processes and costs, costs reduction plan	20
Finite Element Analysis	An LEM report for a certain component that includes: 1. Loading Condition 2. Meshing 3. Results Analysis 4. Optimization	Meshing and optimization method Topological optimization registration	30
Total:			100

4. Robot Assessment Video

Format: Video + BOM

Video Requirements:

1. A title must be displayed at the beginning of the video that includes the college name and date/place of the recording.

2. Sufficient lighting is recommended to best display every operation and movement.
3. Every process must include captions or display board and the video commentator must clearly explain every process shown in the video.
4. The video must be concise and the length cannot exceed three minutes. Ensure the video is compact and well put together to save on assessment time.
5. Editing is allowed, however it must not be used to demonstrate fraudulent operations.
6. Videos must have a resolution of 720p or higher.

BOM: In order to encourage the team to manage the project well, control costs, and clarify the structure and material of each robot, research and development of the robot as well as subsequent iterations well, and add a BOM.

Standards: The BOM is chosen for the project and is filled in according to the template.

Rewards: Teams that are commended by the judging panel for their BOM and that also share their experience, making their content open-source on the official RoboMaster online discussion forums, will receive a 50%-off discount on RoboMaster online educational materials.

Submission Opportunities: 3 (All items must reach the required standards.)

Submission Method: Upload the video to youku.com as a private video with an access password, and then submit the video URL and password to the RoboMaster registration system. Assessment Requirements: The Season Completion Form includes six modules. Each of these modules has its own requirements, scoring criteria, and score. The RoboMaster Organizing Committee will assess all modules.

The details and requirements for the four modules of the Season Summary are as follows:

Item	Content
Suppliers	Supplier robots automatically replenish more than 50 rounds of projectile for any two robots each time
Engineers	Demonstrate full movement capabilities, demonstrate the installation position reserved for the Referee System, and that the installation holes conform to the requirements stipulated in the rules
Hero	Demonstrate full movement capabilities, launch projectiles to hit targets 1, 3, and 5 m away, and be able to calculate the hit ratio Demonstrate the installation position reserved for the referee system and that the installation holes conform to the requirements stipulated in the rules

Item	Content
Standard	Continuously fire 50 rounds of projectiles from the magazine to hit targets that are 1, 3, and 5 m away, and is able to calculate the hit ratio While not exceeding power consumption limit, Standard robots must be able to climb a 20 degree slope and display real-time power data Demonstrate the installation position reserved for the referee system and that the installation holes conform to the requirements stipulated in the rules
Full lineup display	Show a photo of all complete robots and all participating players from the team

5. Referee System Assessment

Format: Multiple-choice questions randomly selected from the RoboMaster database. The quiz can be taken, submitted, and retaken an unlimited number of times within 24 hours of the start of the evaluation period.

Score Ranking: Based on the score and time of the most recent submission. Totals are first ranked by score, and if the scores are the same, they are then ranked by submission time.

6. Season Summary

Format: Word document

Font: Microsoft YaHei or Times New Roman (size 10)

File Size: Max. 8,000 words

Content Requirements: Graphs and flowcharts that include adequate data, focus on key points, and demonstrate sound logic.

Teams passing the Season Summary evaluation receive a 50% discount on RoboMaster online educational materials.

Evaluation Requirements: The Season Summary includes four modules. Each of these modules has its own requirements, scoring criteria, and score. The RoboMaster Organizing Committee will assess all modules.

The details and requirements for the four modules of the Season Summary are as follows:

Module	Content	Scoring Criteria	Score
Academic Innovation	All competition-related patents, academic articles, and open-source documents	The quality and quantity of patents, articles and open-source documents	30
Competition Analysis	Analyzes problems that arise in each match, and then finds a cause and solution	Comprehensiveness of analysis Adequacy of data Helpfulness of the summary	10
Team Development	Summary of problems and challenges encountered throughout the season, plan to improve and develop the team		25
Project Manager	Causes, data, and results of each improvement and iteration		35
Total:			100

Appendix 4 - Pre-Match Inspection Form

Category	Inspection Item	Description
Size & Mass	Initial Dimensions (width x depth x height)	Standard: 600 x 600 x 500 mm Sentry: 400 x 400 x 400 mm (excluding the main control module and the positioning module) Hero: 800 x 800 x 800 mm Aerial: 1000 x 1000 x 800 mm Engineer: 800 x 800 x 800 mm Supply: 1000 x 1000 x 1000 mm
	Dimensions During the Match (width x depth x height)	Standard: 700 x 700 x 600 mm Sentry: 500 x 500 x 500 mm Hero: 1200 x 1200 x 1200 mm Aerial: 1000 x 1000 x 800 mm Engineer: 1200 x 1200 x 1200 mm
	Mass	Standard: 20kg (subtract the 3.4kg of the Referee System) Sentry: 10kg (subtract the 2.5kg of the Referee System) Hero: 35kg (subtract the 4.6 kg of the Referee System) Aerial: 6.5kg (subtract the 0.65kg of the Referee System) Engineer: 35kg (subtract the 3.2 kg of the Referee System)
Referee System	Integrity	The Referee System modules should be complete and unmodified.
	Safety Modules	1. The Vertical Safety Rod of the Aerial should be 350 mm higher than the top of the propeller and rigidly coupled to the robot body. The wire loop attached to the rod is firm and steady; 2. The Vertical Safety Rod and the wire loop should be capable of withstanding the robot's static force without significant deformation or damage; 3. The Propeller Guard should not leave the propeller exposed, and must be capable of withstanding the robot's weight while also protecting the propeller; 4. The propeller should not contact a cylinder of any diameter when flying horizontally at this cylinder; 5. The Aerial's signal indicator lights should not be so bright as to interfere with the competition process, and there should not be more than 6 indicator light effects (including the arm and tail lights). 6. The Aerial's loading mechanism and friction wheel must be connected to the referee system's main control module.
	Armor Modules	1. Only official mounts are allowed. They should not be modified or damaged; 2. The imaginary connection lines between the X-axis armor and Y-axis armor should be perpendicular to each other and run through the

Category	Inspection Item	Description
		geometric center of a robot. X-axis and Y-axis armor modules allow a ±50 mm deviation from the geometric center; 3. The height difference between the lower edges of any two pieces armor on a Hero should not exceed 50 mm, for an Engineer it should not exceed 100 mm; 4. The hitting surface and the mounts of the armor module must be securely connected. Two screws must be installed for each bracket. 5. An frustum with spread angle of 145° and indefinite height whose top plane is the armor module hitting surface must not contain structures, so the robot can lose HP by projectile hits in more cases; 6. For a Standard, the height of the lower edge of the armor before and after transformation must fall within 60-150 mm; for an Engineer, the height of the lower edge of the armor before and after transformation must fall within 50-400 mm; for a Hero, it must be higher than 400 mm; 7. The projected vectors of the normal vectors of the armor module's stress-bearing surface in the XY plane must be equal to the positive/negative X axis and Y axis in the body coordinate system, respectively; 8. The top sideline of a Sentry's armor should be within ±100 mm from the upper surface of the rail. The hitting surface should be at a 75 degree angle from the Battlefield ground plane; the maximum size below the upper surface of the Sentry Rail is 450 mm, the Main Control Module LED bar should be installed above the rail
	Robot Firmware Updates	1. Robot modules should be updated to their latest versions.
	Power Tests	1. The power band should be normal; 2. A chassis should stop moving when its power supply is cut off;
	RFID Interaction Module	1. The RF card on the bottom should flash normally when being read; 2. Only an Engineer with a slot may be provided with an IC card unit;
	Speed Monitor Modules	1. The launching speed and rate should be capable of being displayed (each robot must be capable of using a remote control to launch a projectile for the convenience of inspection); 2. Only a Hero may be provided with 1 17mm launching mechanism and 1 42mm launching mechanism; 3. Light effects on both sides of the Speed Monitor Module should only be blocked by at most 20%; 4. Re-calibration should be completed each time it leaves the Inspection Area;
	Positioning Module	1. The positioning Module should be installed horizontally with its top surface facing up. Its front should be aligned with the front of the robot;

Category	Inspection Item	Description
		2. The imaginary line connecting the positioning Module and a base station should not be blocked during movement; 3. Except for the bottom face, at least a sphere with 10 cm radius around the five other faces should not be blocked; 4. The LINK indicator should flash green and the SYS indicator should flash red;
	Video Transmission Module	1. A robot should transmit pictures back normally; 2. The Aerial's transmission channels should be set properly;
Pneumatics		1. A high-pressure gas cylinder should be provided with a certificate which matches the steel seal on the cylinder body. The steel seal on the cylinder body should be visible during inspection; 2. A pressure gauge (in MPa) should be set at the pressure source outlet. The air pressure for non-launching power should not exceed 0. 8MPa, and should not exceed 20MPa for launching power. In addition, the nominal withstand pressure of the gas cylinder should not be more than 30MPa and a dual-gauge constant pressure valve should be provided at the gas cylinder outlet (in MPa, other pressure unit must be converted to SI units to ensure safety). 3. The gas cylinder should be protected from being cut and installed firmly inside a robot. The gas cylinder should not contact the ground when a robot rolls in any direction; 4. Only incombustible gas may be used, such as air, nitrogen and CO2; 5. A constant pressure valve should be set directly on the gas cylinder/tank.
Others		1. A DJI-supplied Li-Po battery or dry cell battery from recognized manufacturers should be used, total power capacity of each Aerial robot shall not exceed 300Wh. The total power capacity of every other robot shall not exceed 200Wh. 2. The supply voltage should not be higher than 30V and there should be no risk of short circuit; 3. Each operator should have no more than 1 remote control that is supplied by DJI; 4. Materials that may contaminate the battlefield such as water or sand should not be used as counterweights in the Suppliers; 5. Only a Wi-Fi wireless data link of 2. 412-2. 472GHz or 5. 725-5. 850GHz may be used and should be reported for filing; 6. No more than 1 red laser sight with power lower than 35mW may be provided for each barrel; 7. A ground robot should not be retrofitted with unofficial light effect devices; 8. A robot should not possess any devices that may damage the Battlefield; 9. A robot should not possess any mechanisms that can attach itself to other robots; 10. Red or blue colors or large amounts of reflective materials should not

Category	Inspection Item	Description
		be used for robot decoration. 11. A single hero or engineer robot can only be equipped with one grabbing mechanism for grabbing projectile containers. This grabbing mechanism can only grab one projectile container at a time. The grabbing mechanism cannot damage battlefield elements. In particular, it cannot use serrated or sharp-edged structures to interact with projectile containers, irreversibly damaging it. 12. The Engineer has clear and distinguishable painting.
Report a wireless spectrum		

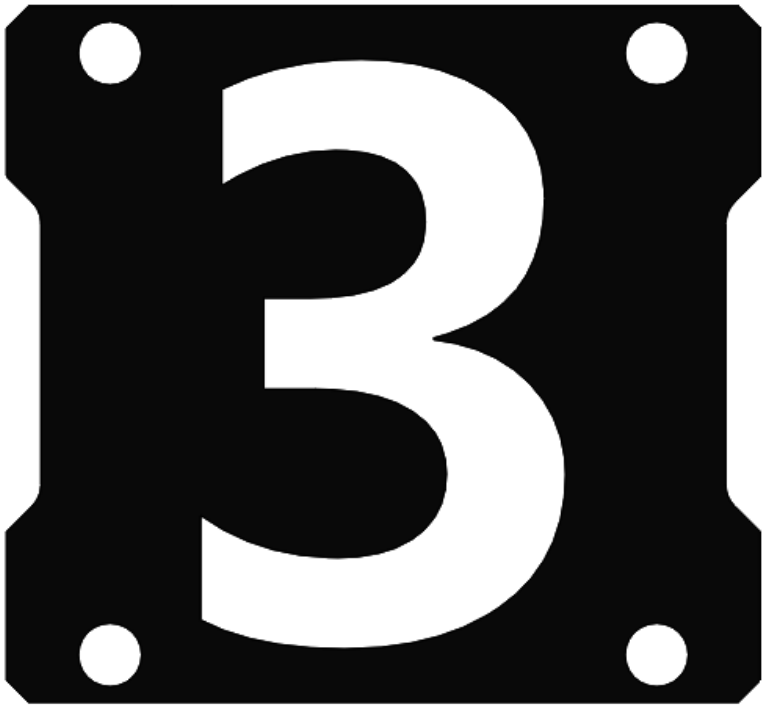
Appendix 5 - Reference Pictures

1. Armor plate stickers

Standard digital sticker 1:

Hero digital sticker 2:

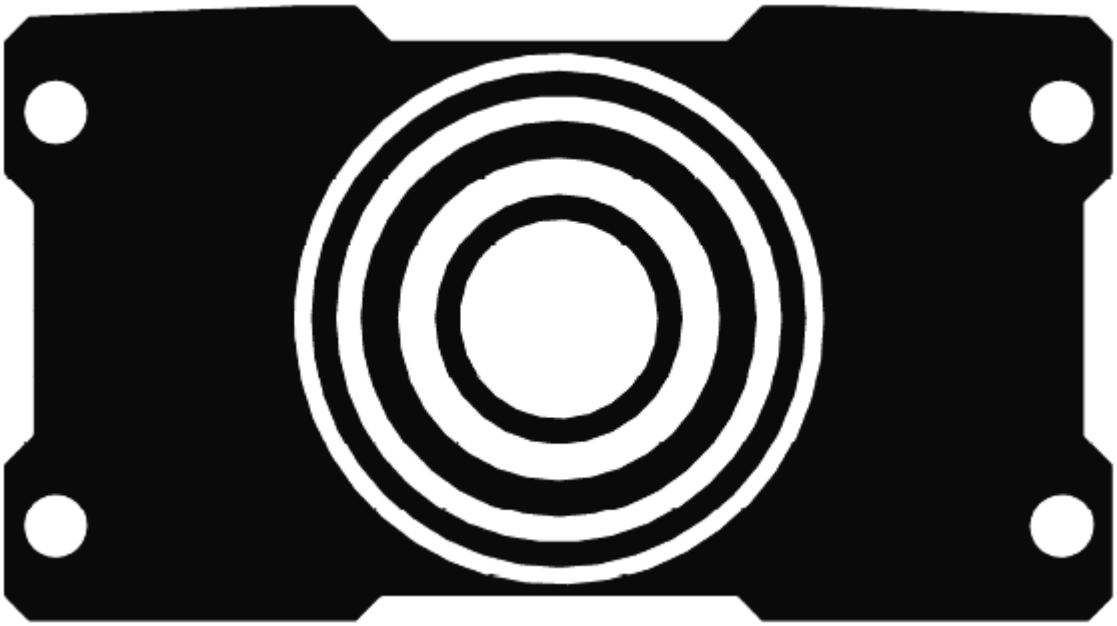
Engineer digital sticker 3:



Standard digital sticker 4:

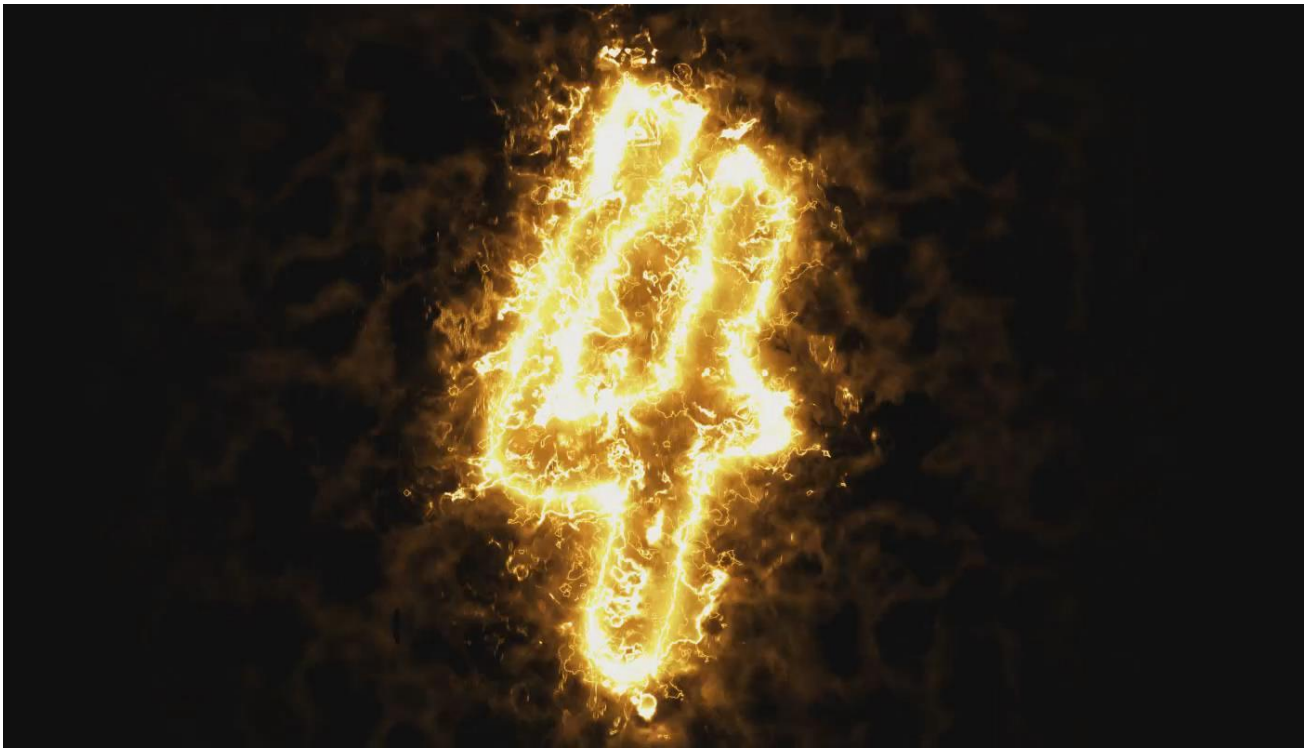
Standard digital sticker 5:

Sentry sticker:



Base sticker:

2. **Example pictures for the flaming numbers "1-9" to activate the large Power Runes:**



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