

Using a 32-bit motor driver chip and Field-Oriented Control (FOC), the RoboMaster C20 Brushless DC Motor Speed Controller enables precise control over motor torque.



ROBOMASTER

Exclusively designed for the RoboMaster M3508 P15 Brushless DC Gear Motor and C20 Brushless DC Motor Speed Controller, this M3508 Accessories Kit includes several cables and a terminal board.

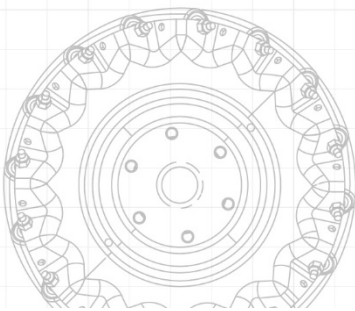
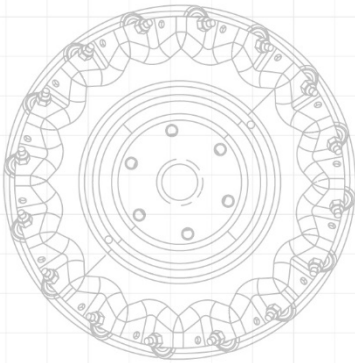
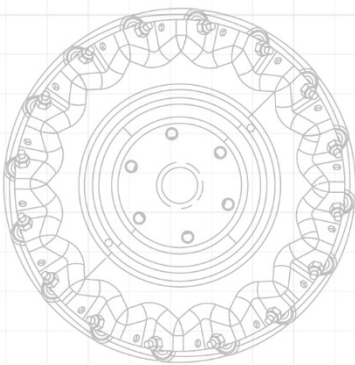
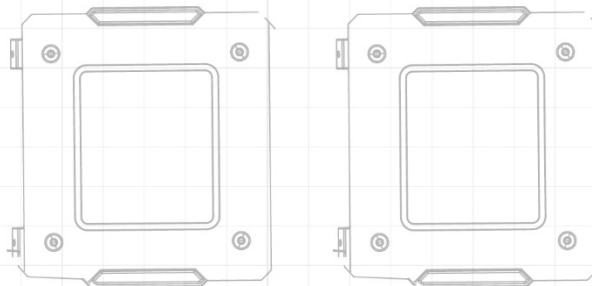
Refer to System Specification Manual, Referee System User Manual, introductions of Referee System Module.

This M3508 Accessories Kit includes several cables and a terminal board, designed to complete protection system driven by four independent motors.

ROBOMASTER 2019 TECHNICAL CHALLENGE





RULES MANUAL

Prepared by the *RoboMaster* Organizing Committee
Updated on April, 2018



Using This Manual

Legend

 Prohibition	 Important	 Hits and Tips	 Reference
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Release Notes

Date	Version	Changes
2018.12.10	V1.0	Release
2019.5.5	V1.1	<ol style="list-style-type: none">1. Update Season Schedule (including Final Robot Assessment Video, Referee System Exam, South China Regional Competition, North China Regional Competition and Final Tournament).2. Update awards quantity setting.3. Update post format of Rules Update and Q&A.4. Update participant requirement.5. Update Sponsor Sepcification.6. Update General Technical Specification (including Power Supply, Gas Source, Remote Controller, Optical Equipment, Robot Numbering, Aesthetic Design and Launching Mechanism).7. Update Robot Technical Specification.8. Update specification and referee weight of each robot.9. Add pre-match inspection requirement of chassis power of Standard and Hero.10. Update Armor attack inspection mechanism.11. Update Armor Module ID setting specification of participating teams.

Date	Version	Changes
		<p>12. Update Operator Room and Operator specification and projectile mass parameters.</p> <p>13. Update drawings and parameters of Hero Remote Firing challenge (including Battlefield, Bridge and Road).</p> <p>14. Update RFID card working mechanism of Bridge Top Platform.</p> <p>15. Update drawings and parameters of Engineer Island Climbing and Projectile Obtaining (including Battlefield, Resource Island, Projectile Container).</p> <p>16. Update Projectile Container specifications.</p> <p>17. Update challenge and scoring rules of Engineer Island Climbing and Projectile Obtaining.</p> <p>18. Update drawings and parameters of Standard Racing and Smart Firing (including Battlefield, Bridge, Road and Power Rune).</p> <p>19. Add Power Rune rotate direction, rotate mechanism and update the available time and status of Power Rune.</p> <p>20. Update challenge and scoring rules of Standard Racing and Smart Firing.</p> <p>21. Add drawings, parameters and violations and penalties of Standard Confrontation.</p> <p>22. Update Match Procedure specification.</p> <p>23. Update appeal process.</p>

Date	Version	Changes
		<p>24. Update violations and penalties (including participating specification, General Technical Specification, Robot Technical Specification, Operator Room Referee, participant specification, Assistive Column and Post-match Procedure).</p> <p>25. Add Appendix 2 Definition of RoboMaster Terminology.</p> <p>26. Update Appendix 3 Referee System Exam specification.</p> <p>27. Update Appendix 5 Pre-match Inspection Form (including referee system weight, Armor Module, power inspection, Speed Monitor Module, Positioning System Module, gas source, Standard strength, aesthetic design and miscellaneous).</p>

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1. Introduction

Robotics is currently one of the most mainstream cutting-edge technologies in the world. After more than 50 years of development, the robot industry is ushering in a new era. In the coming three to five years, there will be a massive upsurge in the global robotic industry, and China will be one of the major world markets. With this in mind, the RoboMaster Robotics Competition was created to keep up with the development and cultivate the talents required by today's modern robotics industry.

The RoboMaster Robotics Competition is among one of the four major national robot competitions for college students. It encourages innovation in robot mechanics, automation and electronic technology while placing robot battles at its core. The RoboMaster Robotics Competition also displays the beauty of engineering technology and robotic knowledge to the masses by balancing technical challenges and enjoyable viewing experiences.

The RoboMaster 2019 Technical Challenge (hereinafter referred to as the Technical Challenge) is derived from the RoboMaster 2019 Robotics Competition (hereinafter referred to as the Robotics Competition), focusing on academic researches in a certain field of robotics. The Technical Challenge aims to encourage participants to pursue in-depth technical solutions and build their robots to perfection.

In the Technical Challenge, participants only need one robot to complete a challenge, which means they can greatly reduce the cost of research and development, and concentrate their manpower and funding to seek breakthroughs. For young teams, the Technical Challenge is undoubtedly a good choice to show off their skills. The Technical Challenge has four challenges and each team is allowed to choose to participate in one or more challenges.

1.1 Season Schedule



The following is the RoboMaster 2019 Robotics Season Schedule for reference only. The specific time is subject to the latest announcement by the RMOC.

There are three types of team: teams from Mainland China, teams from Hong Kong, Macau, Taiwan and Overseas and Chinese and Foreign Joint Teams. The property and entry procedure of Chinese and Foreign Joint Teams depend on the college's location.

Teams that complete the registration and pass the Technical Assessment qualify for the Final Tournament. For details about the Technical Assessment, please refer to [Appendix 3 Technical Assessment Specification](#). Teams registering for the Technical Assessment can gain the corresponding number of RM Online Product Education Discount (hereinafter referred to as "Product Discount") provided by the RMOC. For online product of each type of robot, please refer to [Appendix 4 RM Online Product Education Discount](#).

Since the specifications of the RoboMaster Robotics Competition also apply to the RoboMaster Technical

Challenge, it is recommended that the teams who participate in both the RoboMaster 2019 Robotics Competition and the RoboMaster Technical Challenge should try to make the most use out of the robots for the RoboMaster Robotics Competition to avoid wasting money due to undeveloped ideas and excessive iterative robots in the early stage of the preparation period.

Below shows the RM2019 Season Schedule.

Table 1-1 Season Schedule

Schedule (Beijing Time)	Item	Property	Rights and Duties
December 10, 2018 – January 25, 2019	Registration on Official Website	Required for teams from Mainland China	Log in the RoboMaster website and complete the registration as required
		Required for teams from Hong Kong, Macau, Taiwan and Overseas	
January 23 – April 1, 2019	Technical Assessment –	Required for teams from Mainland China	Qualify for the Referee System Exam
March 1 – May 20, 2019	Final Robot Assessment Video	Required for teams from Hong Kong, Macau, Taiwan and Overseas	
January 23 – April 2, 2019	Technical Assessment –	Required for teams from Mainland China	Qualify for borrowing the full set of Referee System and participating in the Chinese Regional Competition.
March 1 – May 26, 2019	Referee System Exam	Required for teams from Hong Kong, Macau, Taiwan and Overseas	Qualify for borrowing the full set of Referee System and participating in the Final Tournament.

Schedule (Beijing Time)	Item	Property	Rights and Duties
May 13 – May 19, 2019	South China Regional Competition	Teams from Mainland China	The Mainland teams can choose to fill in the Competition Area for the RoboMaster Technical Challenge. If not, it is deemed that the team accepts the RMOC's arrangement. If you participate in both the RoboMaster Robotics Competition and the RoboMaster Technical Challenge at the same time, the Competition Area should be that of the RoboMaster Robotics Competition. The RMOC decides the priority for choosing Competition Areas based on the ranking of the technical assessment scores.
May 21 – May 26, 2019	Central China Regional Competition		
May 28 – June 2, 2019	North China Regional Competition		
August 3 – August 11, 2019	Final Tournament	Teams from Mainland China; Teams from Hong Kong, Macau, Taiwan and Overseas	<ul style="list-style-type: none"> Teams from Mainland China need to win the grand prize and first prize of the Chinese Regional Competition Teams from Hong Kong, Macau, Taiwan and Overseas can directly qualify for the Final Tournament

1.2 Awards

1.2.1 Final Tournament

Awards of each challenge of the Final Tournament are as follows:

Table 1-2 Standard Racing and Smart Firing Award

Prize	Qty.	Reward
Grand Prize	1	<ul style="list-style-type: none"> Grand prize trophy Grand Prize Certificate Cash prize of USD \$ 750 (pre-tax)
First Prize	Multiple	<ul style="list-style-type: none"> First Prize Certificate Cash prize of USD \$ 600 (pre-tax)
Second Prize	Multiple	Second Prize Certificate

Prize	Qty.	Reward
Third Prize	Multiple	Third Prize Certificate

Table 1-3 Hero Remote Firing Award

Prize	Qty.	Reward
Grand Prize	1	<ul style="list-style-type: none"> ● Grand prize trophy ● Grand Prize Certificate ● Cash prize of USD \$ 750 (pre-tax)
First Prize	Multiple	<ul style="list-style-type: none"> ● First Prize Certificate ● Cash prize of USD \$ 600 (pre-tax)
Second Prize	Multiple	Second Prize Certificate
Third Prize	Multiple	Third Prize Certificate

Table 1-4 Engineer Island Climbing and Projectile Obtaining Award

Prize	Qty.	Reward
Grand Prize	1	<ul style="list-style-type: none"> ● Grand prize trophy ● Grand Prize Certificate ● Cash prize of USD \$ 750 (pre-tax)
First Prize	Multiple	<ul style="list-style-type: none"> ● First Prize Certificate ● Cash prize of USD \$ 600 (pre-tax)
Second Prize	Multiple	Second Prize Certificate
Third Prize	Multiple	Third Prize Certificate

Table 1-5 Standard Confrontation Award

Prize	Qty.	Reward
Grand Prize	1	<ul style="list-style-type: none"> ● Grand prize trophy ● Grand Prize Certificate ● Cash prize of USD \$ 750 (pre-tax)
First Prize	Multiple	<ul style="list-style-type: none"> ● First Prize Certificate ● Cash prize of USD \$ 600 (pre-tax)
Second Prize	Multiple	Second Prize Certificate
Third Prize	Multiple	Third Prize Certificate



The number of prizes of each challenge is subjected to the actual number of qualified teams. The number of Grand Prize and First Prize is no more than the total participating teams in principle. For the actual number, please pay attention to the latest version of Rules Manual released by the RMOC.

1.2.2 Regional Competition

Awards of each challenge of the Regional Competition are as follows:

Table 1-6 Standard Racing and Smart Firing Award

Prize	Qty.	Reward
Regional Grand Prize	1	<ul style="list-style-type: none">● Grand prize trophy● Grand Prize Certificate● Cash prize of USD \$ 450 (pre-tax)
Regional First Prize	Multiple	<ul style="list-style-type: none">● First Prize Certificate● Cash prize of USD \$ 300 (pre-tax)
Regional Second Prize	Multiple	Second Prize Certificate
Regional Third Prize	Multiple	Third Prize Certificate

Table 1-7 Hero Remote Firing Award

Prize	Qty.	Reward
Regional Grand Prize	1	<ul style="list-style-type: none">● Grand prize trophy● Grand Prize Certificate● Cash prize of USD \$ 450 (pre-tax)
Regional First Prize	Multiple	<ul style="list-style-type: none">● First Prize Certificate● Cash prize of USD \$ 300 (pre-tax)
Regional Second Prize	Multiple	Second Prize Certificate
Regional Third Prize	Multiple	Third Prize Certificate

Table 1-8 Engineer Island Climbing and Projectile Obtaining Award

Prize	Qty.	Reward
Regional Grand Prize	1	<ul style="list-style-type: none"> ● Grand prize trophy ● Grand Prize Certificate ● Cash prize of USD \$ 450 (pre-tax)
Regional First Prize	Multiple	<ul style="list-style-type: none"> ● First Prize Certificate ● Cash prize of USD \$ 300 (pre-tax)
Regional Second Prize	Multiple	Second Prize Certificate
Regional Third Prize	Multiple	Third Prize Certificate

Table 1-9 Standard Confrontation Award

Prize	Qty.	Reward
Regional Grand Prize	1	<ul style="list-style-type: none"> ● Grand prize trophy ● Grand Prize Certificate ● Cash prize of USD \$ 450 (pre-tax)
Regional First Prize	Multiple	<ul style="list-style-type: none"> ● First Prize Certificate ● Cash prize of USD \$ 300 (pre-tax)
Regional Second Prize	Multiple	Second Prize Certificate
Regional Third Prize	Multiple	Third Prize Certificate



The number of prizes of each challenge is subjected to the actual number of qualified teams. The number of Grand Prize and First Prize is no more than the total participating teams in principle. For the actual number, please pay attention to the latest version of Rules Manual released by the RMOc.

1.2.3 Open Source Award

Open Source Award is as follows:

Table 1-10 Open Source Award

Prize	Qty.	Reward	Notes
Open Source Grand Prize	Multiple	<ul style="list-style-type: none"> ● Honor certificate 	

Prize	Qty.	Reward	Notes
		<ul style="list-style-type: none"> ● USD \$ 15,000 (pre-tax) 	In the RM 2019 Season (September 20, 2018 to August 31, 2019), teams share their core technology or operation management methods in the RoboMaster Forum and the official website, promoting the development of the RoboMaster Robotics Competition and the engineering culture and spirit.
Open Source First Prize	Multiple	<ul style="list-style-type: none"> ● Honor certificate ● USD \$ 7,500 (pre-tax) 	
Open Source Second Prize	Multiple	<ul style="list-style-type: none"> ● Honor certificate ● USD \$ 4,500 (pre-tax) 	
Open Source Third Prize	Multiple	<ul style="list-style-type: none"> ● Honor certificate ● USD \$ 1,500 (pre-tax) 	
Open Source Outstanding Prize	Multiple	<ul style="list-style-type: none"> ● Honor certificate ● Class A: USD \$ 750 (before tax) ● Class B: USD \$ 450 (before tax) ● Class C: USD \$ 300 (before tax) 	

1.3 Academic Philosophy and Intellectual Property Statement



If there are any violations to the intellectual property rights of the competition and education products provided by the RMOC and the Organizer DJI, the party which owns the rights will pursue compensation according to the law.

By using a series of RoboMaster robotics competitions, the RMOC joins forces with colleges and universities to promote the development of practical teaching with cutting-edge science and technology, and cultivate relevant teachers. Their participation also helps establish a teaching practice center and an open smart technology laboratory. The experiments and tests are carried out through robotics competitions, in an effort to catalyze the combination of scientific research work of universities and the actual robot programs, to train a group of outstanding scientific and technological engineers, and to promote the practical application of scientific and technological achievements. In addition to the competing process itself, the organizing committee also focuses on bringing together academic and technological achievements within the robotics field through events. The “RoboMaster 2019 Young Engineer Summit” fully demonstrates this. This conference serves as a platform for competing teams to share their new achievements in robotics research and development, and promote in-depth exchanges of research and ideas.

The RMOC encourages and advocates technological innovation and open source technology and

respects the intellectual property of the teams. All rights related to the intellectual property developed during the competition will be owned by the team. The RMOC will not participate in the process of handling intellectual property disputes among team members. The participating teams must properly handle all aspects of intellectual property rights among school members, company members and other members of the team.

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

1.4 Rules Update and Q&A

Based on the actual situation of the preparation and competition stage in the RM 2019 Season, RoboMaster 2019 Robotics Competition rules of the following aspects may be updated:

- Minor adjustments to balancing parameters (projectile capacity, power restriction, etc.)
- Modifications to the rules that participants can gain advantages through non-technical means
- Additional penalties or amendments to actions that lead to an unbalanced competition


To ensure a fair and just competition, the timeliness of rules update, and the healthy running of the competition, the RMOC will issue the Rules Hotfix Announcement (hereinafter referred to as "the Announcement") to explain and update rules, which is usually presented in two ways, one is to continue to use the latest version of the Rules Manual and replace the specific texts with modifications and updates; the other is to directly add new rules, regulations, and penalties.

The Announcement reserves a higher right of interpretation over the latest version of the Rules Manual. Rules and regulations that are not mentioned in the Announcement are subject to the latest version of the Rules Manual. Changes of the Announcement will be updated in the Rules Manual and later revoked. The Rules Manual will have a higher version number. All updates of the Rules Manual will be posted on the Events section of the [RoboMaster official forum](#), with the latest version number pinned to the top.

The RMOC provides many Q&A channels as shown below:

Table 1-11 Q&A Channel

Channel	Notes
Official Forum	<p>Questions about the competition rules can be posted on the Events section and about products can be posted on the Products section. The RMOC will reply to it within 2-5 working days.</p> <p>Post title should concentrate on the main points and be clear and concise. The</p>

Channel	Notes
	<p>title format is not required.</p> <p>Each week, posts related to rules and rules Q&A will be summarized in the same post, which is synchronized in the FAQ sub-section of the Competition section of the RoboMaster official forum.</p>
Telephone	0755-36383255
Official E-mail	robomaster@dji.com
Competition QQ Group	RoboMaster 2019 Robotics Competition Official Entry QQ Group: 791094259
Competition Enquiry Account	<p>QQ: 2355418059</p> <hr/> <p> Official notices and enquiry related to the competition are subject to the information and answers published via the official QQ number.</p>
WeChat	Account: rmsaiwu
WeChat Group	Add the WeChat account (rmsaiwu) and apply to join the corresponding group (the official competition WeChat group, PR Manager WeChat group, and Supervisor exchange group)

2. Team Requirement

2.1 Requirement for Participant

The RoboMaster Robotics Competition advocates teamwork spirit. To encourage team members to play important roles, the RMOC will reward those who contribute the most throughout the competition with rewards like Outstanding Captain, Outstanding Supervisor, etc. Below shows the requirement for participants.

Table 2-1 Requirement for Participant

Participant	Role	Number	Qualification	Duties
Supervisor	<ul style="list-style-type: none"> ● Head of the team, responsible for team building and management ● Cannot serve as Operator 	1-5	Faculties of the team's college or university who are qualified for teaching and scientific research.	<ul style="list-style-type: none"> ● Responsible for the safety of team members and their properties, guidance and management of the use of funds ● Instruct the team to develop project plan and solve R&D issues, helping the team to complete the competition successfully ● Actively cooperate with the RMOC and push Captain and OPM to regularly report project progress to the RMOC

Participant	Role	Number	Qualification	Duties
Advisor	<ul style="list-style-type: none"> ● Provide strategic, technical and management support and guidance to the team ● Cannot serve as Captain, Operator 	0-5	Full-time junior college students, undergraduates, postgraduates, and doctoral students in colleges and universities, as well as engineers, researchers and faculties working in enterprises, research institutions, or freelancers	Advisor can undertake tasks of manufacturing robots and other competition affairs
Captain (one person only)	<ul style="list-style-type: none"> ● Key member of the team, responsible for technology and tactics ● The major liaison for the RMOC 	The overall number should meet the requirement of Table 2-2	Full-time junior college students, undergraduates, postgraduates, and doctoral students in colleges and universities before August 2019	<ul style="list-style-type: none"> ● Responsible for division of labor, overall planning and tactics arrangement and adjustment ● Attend Captains Meeting, represent the team to confirm match results and participate in appeal processes and any subsequent hearings ● Responsible for the heritage and development of the team after the competition

Participant	Role	Number	Qualification	Duties
Organizational Project Management (OPM) (one person only)	Responsible for promotion			<ul style="list-style-type: none"> ● Oversees the entire project ● Comprehensively considers R&D costs, work safety and other issues ● Plays a decisive role in the project's general objective (e.g. progress, outcome, costs, etc.)
Team Member	Oversees the entire project			<ul style="list-style-type: none"> ● Technical Group: responsible for R&D work such as robot design and manufacturing and has technical directions such as machine, electronic control and vision. It is recommended that the group has an industrial designer who is in charge of the aesthetic design of robots ● Operation Group: responsible for promoting, organizing and planning the competition. It is recommended that the group has a team member who is in charge of attracting investment.

Participant	Role	Number	Qualification	Duties
				<ul style="list-style-type: none"> Operator Group: responsible for controlling robots during the competition

Table 2-2 The Number of Participants in Each Challenge

Challenge	Number of team members (including the Captain, and excluding Supervisor or Advisor)
Hero Remote Firing	1-8
Engineer Island Climbing and Projectile Obtaining	1-8
Standard Racing and Smart Firing	1-5
Standard Confrontation	1-5

2.2 Requirement for Team

Teams must following specifications as shown below:

1. The team must cooperate with a college or university and meet the requirements of role, number and qualification stated in [Table 2-1](#).
2. In principle, only one team per school is eligible to participate in the competition. Institutions that have multiple campuses in different cities, which makes it difficult for students to compete as a team, are allowed to have more than one team once verified by the Committee. Teams must obtain the entry authorization from their school and submit the proof to the registration system. For the entry authorization template, please refer to the registration system. For a team, the precondition to register for the competition is to obtain the stamped authorization from the college (or campus) it represents. Applicants must ensure that their registration information is complete and accurate, and will undertake the corresponding responsibilities. They must bear all consequences caused by missing any information or providing incorrect registration information. For special circumstances, applicants can contact the Committee to deal with the issue. The Committee reserves the right of final interpretation.
3. The team comes up with their own name, which must be in the format of "XXX-Team" ("- is only a separator, not in the actual team name) and the total length should not exceed 16 English characters or 8 Chinese characters. The team name cannot consist of the college name or its abbreviation in Chinese or English, or such Chinese characters as "队", "团队" and "战队" which mean "team" in

English, or special symbols like "*/-+". The team name must reflect the positive and pioneering spirit of the team and comply with relevant state laws and regulations.

4. Two or more schools that do not have their own teams to register for the competition can form an intercollegiate team.
 - A. Before the establishment of an intercollegiate team, members must fully communicate with each other based on the actual situation. The team itself must deal with issues of operating and R&D costs, staffing or disputes that may hence arise. RMOc assumes no responsibility for any of these issues.
 - B. Once established, the intercollegiate team shall not dissolve and may only participate in the RoboMaster 2019 Robotics Competition as that team. If the intercollegiate team that has passed the review of technical report dissolves, it shall be deemed as r its qualification for the competition.
 - C. The team name of an intercollegiate team should be "XXX Intercollegiate Team" instead of "XXX Team." It must also submit a statement provided by the team's school to the registration system. For the template of the intercollegiate team statement, please refer to the registration system.
5. Any team member (including Supervisor, Advisor, Captain, PR Manager, OPM and Team Members) may only participate in one team during the 2019 Season.

Violations and Penalties:


- If Item 1-4 have not been met, the RMOc will reject the application.
- If Item 5 has not been met, the violator and each team that he/she is part of is regarded as cheating once confirmed by the Chief Referee and the violator will be disqualified from the competition.

2.3 Team Type

Below shows the definition, rights and entry procedures for each type of team.

Table 2-3 Team Type

Teams from Mainland China	
Definition	Come from colleges in mainland China, pass the registration review and technical review within the specified time and meet the competition requirements.
Rights	Eligible for the competition and subsequent rounds. Qualify for awards as set out in Award Rules.
Entry Procedures	1. Implement the competition process in accordance with standards for teams from mainland China.

	 Event procedure includes policies of material granting, purchasing, and supporting services.
	<ol style="list-style-type: none"> Participate in the (Chinese) Regional Competition and outstanding performers qualify for the Final Tournament.
Teams from Hong Kong, Macau, Taiwan and Overseas	
Definition	Come from Hong Kong, Macau, Taiwan and Overseas, invited by the Committee to participate in the competition, pass the registration review and technical review within the specified time and meet the competition requirements.
Rights	<ul style="list-style-type: none"> Eligible for the competition and subsequent rounds. Qualify for awards as set out in Award Rules. Due to different education systems, education background of teams from Hong Kong, Macau, Taiwan and Overseas will not be restricted.
Entry Procedures	<ol style="list-style-type: none"> Implement the competition process in accordance with standards for teams from Hong Kong, Macau, Taiwan and Overseas. Directly qualify for the Final Tournament.
Chinese and Foreign Joint Teams	
Definition	Come from Chinese-foreign cooperatively-run colleges, pass the registration review and technical review within the specified time and meet the competition requirements.
Rights	Eligible for the competition and subsequent rounds. Qualify for awards as set out in Award Rules.
Entry Procedures	<ol style="list-style-type: none"> If the college is located in mainland China, its team is subject to standards for teams from mainland China. If the college is located in Hong Kong, Macau, Taiwan or overseas, its team is subject to standards for teams from Hong Kong, Macau, Taiwan and overseas. In the RoboMaster 2019 Season, teams are free to choose to follow the entry procedures for mainland China or the other. The entry procedure shall not be changed throughout the season once confirmed with the staff of the RMOC in the registration period.

2.4 Sponsor Specification

In order to obtain financial, material, and other assistance, teams are encouraged by the RMOC to seek

sponsorships independently. In the process of looking for sponsors, in order to protect the interests of each team and maintain the overall brand image of the competition, teams need to follow the investment guideline provided by the RMOC as shown below.

- The investment guideline is only subject to supporting services and sponsorship support of the teams, and does not involve the return and benefits related to the RoboMaster competition.
- Teams must follow the investment process to declare the rights of both parties to the RMOC for approval. Such "sponsorship" include ads placed on the robot body, title sponsors' appearances on the competition spectator system, etc. If the aforementioned process is not followed, the RMOC has the right not to cooperate in the implementation of relevant rights and interests of the competition. The logos of sponsors that fail to pass the declaration approval process cannot be revealed in the competition. This includes but is not limited to: A robot that displays undeclared sponsor information cannot pass the check, the team uniforms that display undeclared sponsor information cannot be revealed in the live broadcast, and the undeclared named sponsor cannot enjoy naming rights etc.
- The RMOC is only responsible to confirm whether the sponsors are acceptable partners and to decide whether to assist the team in implementing rights and interests of the competition. The RMOC is not responsible for any party of the sponsorship.

Violations and Penalties:

For actions that damage the brand of the RMOC and the Organizer DJI, and the trademark and intellectual property rights of sponsors, certain penalties such as disqualification from the competition and being subject to legal liability will be imposed on by the RMOC.

2.4.1 Naming rights

The participating team's named sponsor has the right to name the designated team (eg: XXX-team name, no more than 16 characters). The participating team's named sponsor is entitled to the naming rights of the designated team, granted by the RoboMaster organizing committee, and the corresponding naming method will be finalized in the Cooperative Sponsorship Agreement. Named sponsors can reveal the brand names of their channel through the team name, upon receiving competition notice from the organizing committee.

2.4.2 Participating Team Apparel Advertising Space

If the participating teams wear uniforms during the competition, their advertising space must conform to the specifications, as shown below. In the process of designing the team uniform of each team, the participating teams can independently design and produce the styles and materials of the costumes, as long as they do not violate the unified regulations of the competition.

Table 2-4 Participating Team Apparel Ads And Suggested Advertising Space

Element content	Suggested revealed location	Remarks
Named sponsor logos	Displayed directly on the chest, on the front of the costume	Permitted to invite investment
General sponsor logos	Displayed on the cuffs, clothing corners, etc.	Permitted to invite investment
Partner logos	Displayed on the back of the neck	Permitted to invite investment

2.4.3 Robot Body Advertising Space

The participating team can inkjet or paste the sponsor brand logo or product name on the robot body. See the [Decorative requirements](#) in [Table 3-1](#) for the advertising space decoration specifications.

If the participating team's investment results are outstanding, and there is a need to add advertising space on the basis of the price of the rights and interests guidance, they can apply for special approval from the organizing committee.

In order to ensure the fair competition of the game and the corresponding rules, the advertising space must meet the rules of the competition, such as not blocking the referee system and armor board, and not affect the visual recognition of the robot etc. In order to ensure aesthetic beauty, please make sure that the ads are pasted neatly. In order not to affect the robot's visual recognition functions, please do not use red, blue etc. in the advertising space. The inkjet or sticker cannot be illuminated and you should not choose fluorescent colors. The ruling on this regulation is subject to the results of the on-site check.

3. Technical Specification

Teams are expected to make and develop robots independently and can purchase basic components and modules from SZ DJI Technology Co., Ltd. with student discounts or from other manufacturers. For details of RoboMaster education products and purchasing, please refer to [RoboMaster 2019 Robotics Competition Instructions for Purchasing Materials](#) posted on the official website.

Robots must follow the specifications defined in this chapter, otherwise they shall fail the pre-match inspection.



It is recommended that participating teams consider the following aspects when designing robots:

- Plan and analyze the mechanical design before making robots, Use mature industrial products and modules to improve the reliability of mechanisms.
- Read this chapter carefully, plan well in advance, improve mechanism functions according to the rules and ensure that robots meet technical specifications.
- Read the [RoboMaster 2019 Robotics Competition Referee System Specification Manual](#) carefully, pay attention to the various installation specifications and usage methods of the referee system, in order to avoid failing the pre-match inspection due to improper installation.
- Evaluate manpower and fund demands in advance and make budgets and plans for robot making so as to avoid unnecessary iterations of robots during the preparation phase.
- Pay attention to the manufacturability of components to reduce costs and processing difficulty. Modularize components for easy replacement.
- Since robots will endure massive shootouts during the competition, good durability and maintainability are required.
- There will be certain manufacturing errors between the actual objects and the drawings. When designing the robot structure, consider the manufacturing errors of the Battlefield Components, and do not overly rely on the accuracy of the size measurements.
- During the process of robot design and structure production, try to add industrial design elements to improve the aesthetic extent. The aesthetic design should not interfere with the enemy with non-technical means. Robots installed with protective cases must satisfy the constraints specified in [Table 3-1](#) and [Appendix 5 Pre-match Inspection Form](#). You can also proceed to the official forum to check the related post: <https://bbs.robomaster.com/thread-7848-1-1.html>.


3.1 General Technical Specification


All robots must meet the following general technical specifications for energy source, wireless, optical equipment, visual feature and robot numbering.

Table 3-1 General Technical Specification of Robot



Type	Technical Specification
Energy Source	 <ul style="list-style-type: none"> ● An explosion-proof box will be placed at the entrance to each team in the Competition Area. During the competition, if a battery becomes a safety hazard, Technicians will put the hazardous battery into the explosion-proof box and will not return it to the participating team until the safety hazard is eliminated. ● It is forbidden to use air pumps that have to work with external power supplies in the Competition Area. Teams can bring low-pressure air pumps but they are not allowed to charge air pumps in the Competition Area. ● During the competition, if the gas cylinders are found to have safety hazards (such as damage to the external protection device, hidden dangers arising from aging, etc.), participants must follow the instructions of the referee to deal with safety hazards. Otherwise, the robot will not be allowed to play and must be removed from the Competition Area. The actual situation is determined by the Chief Referee.
	<p>Robots may only use electrical or pneumatic power. Internal combustion engines, explosive substances and hazardous chemical materials are prohibited.</p> <p>Gas Source:</p> <ul style="list-style-type: none"> ● Only use dry batteries such as No. 1, No. 5, and No. 7 produced by reputable manufacturers or specified by the RMOC. <hr/> <p> In the 2019 Season, battery that is specified by the RMOC is produced by DJI.</p> <hr/> <ul style="list-style-type: none"> ● The total battery capacity of Aerial should not exceed 600 Wh and that of other robots not exceed 200 Wh. ● The supply voltage should not be higher than 48 V and there should be no risk of short circuiting. <p>Violations and Penalties:</p> <p>Robots equipped with batteries of violation would fail the pre-match inspection. Violators will be held legally liable for safety incidents caused by such batteries.</p> <p>Gas Source:</p> <p>The compressed gas pressure must not exceed 20 Mpa. The cylinder used should have a nominal pressure of no less than 30 MPa. The working pressure must not exceed 0.8 Mpa. A double gauge constant pressure valve should be placed at the outlet of the cylinder.</p> <p>Robots using compressed gas for propulsion system must meet the following requirements:</p> <ul style="list-style-type: none"> ● Working gas: Working gas must be non-flammable and non-toxic, such as air, nitrogen or carbon dioxide.



Type	Technical Specification
	<ul style="list-style-type: none"> ● Cylinder: Cylinder must have a valid conformity certificate or a steel plate. The plate should be viewable during the pre-match inspection and the certificate should be easily viewable. ● Cylinder certification: Cylinder must be designed and manufactured for the pressure condition for usage, and certified by the officially recognized test organization of the country of origin. ● Pressure regulator: The constant pressure valve must be directly installed on the gas cylinder or gas tank. ● Protection measure: Gas cylinder and gas pipe must be protected to prevent damage caused by rollover, collision and rotation from any direction, and moving parts failures. The container opening shall not be exposed in order to prevent damage caused by projectiles. ● Location of gas cylinder and pipe: The gas cylinder should be installed in a way that it and the gas pipe will not touch the ground no matter how the robot rolls. ● Cylinder installation: The cylinder must be safely mounted on the frame and ensure the container opening remains either level or upward. To fix to the frame, the container must have at least two fixed points, or one fixed surface that is more than 1/5 of its length. ● Thermal insulation: The cylinder must be insulated from any possible heat sources by a barrier layer, such as a carbon fiber board or aluminum plate. ● Gas Pipes and fittings: Gas pipes and fittings must be able to handle the system's maximum possible working pressure. <p>Violations and Penalties:</p> <p>Robots that violate these gas-power specifications will fail the pre-match inspection. Furthermore, if a referee determines that an unauthorized gas-power source is being used, this shall be deemed as cheating. Teams will be held liable for any danger caused by using gas-power sources that do not meet these specifications.</p>
Wireless	<p>Remote Controller:</p> <ul style="list-style-type: none"> ● Each Operator can use atmost one remore controller and each remote controller can only be targeted to one receiver. ● Only use remoter controller that is specified by the RMOC.

Type	Technical Specification
	<p data-bbox="421 226 464 271"></p> <p data-bbox="507 210 1414 271">In the 2019 Season, remote controller that is specified by the RMOC is produced by DJI.</p> <hr data-bbox="397 286 1426 291"/> <p data-bbox="344 311 667 338">Violations and Penalties:</p> <ul data-bbox="344 371 1433 674" style="list-style-type: none"> <li data-bbox="344 371 1433 454">● Robots not equipped with specified remote controllers cannot pass the pre-match inspection. <li data-bbox="344 488 1433 674">● During the seven-minute match, if the remote controller used with robots is targeted to two or more receivers, the team will be considered cheating once confirmed by the Chief Referee or through investigation, and then it will be disqualified from the match. <p data-bbox="344 707 691 734">Wireless Communication:</p> <p data-bbox="344 768 1433 1010">Unofficial wireless networks may interfere with the operation of the equipment related to the official referee system or participating robots. Participants are forbidden from setting up wireless networks in the relevant areas (including but not limited to the Preparation Area, Inspection Area, Staging Area, and Competition Area), and using radios to communicate with each other.</p> <p data-bbox="344 1043 667 1070">Violations and Penalties:</p> <ul data-bbox="344 1104 1433 1406" style="list-style-type: none"> <li data-bbox="344 1104 1433 1245">● If participants are found to set up wireless networks, they will be considered cheating once confirmed by the chief referee or through investigation, and then they will be disqualified from the match. <li data-bbox="344 1279 1433 1406">● If participants are found to use radios to communicate and interfere with the normal process of the match, they will be considered cheating once confirmed by the chief referee or through investigation, and then they will be disqualified from the match.
<p data-bbox="161 1525 312 1608">Optical Equipment</p>	<ul data-bbox="344 1447 1433 1693" style="list-style-type: none"> <li data-bbox="344 1447 1433 1693">● The laser beam from the laser sight must be red and the optical power consumption of the laser beam is less than 35 mW. The projection angle of the laser sight must not exceed 5° (i.e. the diameter of the laser spot perpendicularly projected by the laser sight on a vertical wall with a horizontal distance of one meter is less than 9 cm).

Type	Technical Specification
	<ul style="list-style-type: none"> ● During the competition, Aerial can be equipped with indicator lights on its body to better implement visual function and indicate its current flight status. Indicator lights on the body can only be placed at six locations at most, the number of lights on each of these six locations must not exceed three and the luminance of each bulb cannot exceed 3500 Lux at 10 cm away). Indicator lights should not interfere with the competition on the Battlefield (high-power LED that directly illuminates the Battlefield is prohibited). <hr/> <div style="display: flex; align-items: center;">  <p>Reference data: The maximum illumination value of the flight status indicators for the latitude and Matrice 100 drone are 3200 Lux outside the distance of 10 cm.</p> </div> <hr/> <ul style="list-style-type: none"> ● In addition to the laser sight, Engineers can be equipped with a visible light emitting device, and a fill light can be used to enhance the visual recognition feature when going to an island or acquiring a Projectile Container. Other ground robots must not be equipped with other obvious visible light emitting equipment. ● Optical elements used by robots must not cause harm to participants, referees, staff or audience members. <p style="color: #00AEEF;">Violations and Penalties:</p> <ul style="list-style-type: none"> ● Any robot that uses illegitimate optical equipment will not pass the pre-match inspection. ● If any piece of optical equipment on the robot causes any physical injury to the participating team members, referees, staff or the audience, the offending party shall be investigated for legal liabilities.
<p>Visual Feature</p>	<p>The Referee System Armor Module is designed with clear lighting effects for the development of automatic identification and sighting algorithms. The environment in and around the Competition Area is relatively complicated. The computer vision algorithm should adapt to the changes of the lighting of the venue and other possible interferences around the venue. The RMOC cannot guarantee that the computer vision features of the Battlefield will not cause visual interference.</p> <p>When designing the robot's visual feature, teams should follow specifications as shown below:</p> <ul style="list-style-type: none"> ● Robot sensors (such as lidar, camera, ultrasonic sensor, infrared sensor, etc.) must be installed without blocking the armor and must not project light on the armor.

Type	Technical Specification
	<ul style="list-style-type: none"> Do not project light onto the armor and do not install any device that interferes with the computer vision feature identification of the Armor Module by reflecting or refracting the light on both sides of the armor on the robot. <p>Violations and Penalties:</p> <p>Robots that violate the rules will fail the pre-match inspection.</p>
<p>Robot Numbering</p>	<p>During the pre-match inspection and the competition, the RMOC staff will paste number stickers on robots that enter the competition and also the armor plates at the Base according to the robot numbering rules. The robot number is shown in Table 3-2 and for number stickers, please refer to Appendix 6 Reference Drawing.</p> <p>When applying stickers on robots, teams should follow specifications as shown below:</p> <ul style="list-style-type: none"> Stickers must be applied properly on the armor plates without bubbles, with one sticker on each side. Stickers shall be identical with the number of robots. Except for the designated number stickers provided by the RMOC, similar stickers may not be attached to the armor plates or other structures of the robot. Other decorative stickers on the robot shall not include distinct numbers. <p>Violations and Penalties:</p> <ul style="list-style-type: none"> Robots that have unqualified stickers will fail the pre-match inspection. During the competition, all robots are required to be pasted with their corresponding stickers; otherwise they are not allowed to play. In the competition, except for damages caused to stickers during a match, the robot will be deemed as cheating if any kind of unqualified sticker is found to be pasted on the robot. The offending team will receive a punitive forfeiture for any round of the challenge where it shows up with unqualified stickers.
<p>Aesthetic Design</p>	<p>In order to prevent the robot's protective case from affecting the shootouts on the Battlefield or the audience's viewing experience, teams must comply with the following requirements of aesthetic design:</p> <p>Basic requirements:</p> <ul style="list-style-type: none"> The lines of the robot are neat and not exposed. Exposure that is unavoidable requires line protection with materials such as drag chains and cable managers. There must be no materials that have an obvious influence on the appearance of the robot, such as washbasins, plastic bottles, corrugated paper, bed sheets, flesh-colored stockings, white foam boards, air cushion membranes, etc.

Type	Technical Specification
	<ul style="list-style-type: none"> ● Fish nets should not be used as aesthetic design materials, unless necessary functional requirements exist. <p style="color: #00AEEF;">Violations and Penalties:</p> <p style="color: #00AEEF;">Robots that do not meet the basic aesthetic design requirements will not pass the pre-match inspection.</p> <p>Glossiness:</p> <p>The protective case can be made of any material. In order to prevent the protective case from reflecting the light emitted by the referee system which may affect the computer visual recognition, the surface glossiness of the case is required to be no more than 15 Gs. During the pre-match inspection, the inspector will measure the glossiness of the case with a glossmeter.</p> <hr/> <ul style="list-style-type: none"> ●  Matte paint and stickers are provided at the Inspection Area. If a team fails to meet the requirements, it can implement matte treatment to the surface. ● The principle of glossmeter: A built-in light source emits a certain amount of light, which is projected onto the surface of the object to be detected. Then a built-in receiver receives the reflected light, and measures the glossiness of the surface according to the amount of reflected light. The glossmeter's measurement range is 0-101 Gs. It is known that the glossiness of a mirror surface is 101 Gs and that of a total diffuse reflection object is 0 Gs. <hr/> <p>Coating color (Engineer is not required):</p> <ul style="list-style-type: none"> ● The Red team robot's protective shell color can use red series, the blue team robot can use blue series, but the opposing team's color should not be used, to avoid confusion. Except for black and metallic colors, the number of other colors must not exceed two. ● It is recommended that the team's robots have a consistent aesthetic style. ● The robot must have two school badges or team badges from their own side (one for each perspective). The school badges or team badges must be in a prominent position across the robot. The school badges or team badges have no limitation on the number of colors. The school badges or team badges can be anti-white processed or preserve the original colors. <hr/> <ul style="list-style-type: none"> ●  It is recommended that teams use a large area of dark color (with texture) as the bottom color and use acceptable colors to outline and embellish the case. ● Textures such as camouflage, fiber texture, wood grain, metal wire drawing, etc. are processed as a single color. ● If there is a sponsor logo on the robot, it is recommended to use a black background and white color (that is, logo anti-white processing), and white shall not be limited by the number of colors; otherwise, the colors of the logo pattern must be accounted for in the color amount. If there

Type	Technical Specification
	<p>are special circumstances (such as special requirements of sponsors, etc.), the participating team must report to the organizing committee.</p> <ul style="list-style-type: none"> ● Special materials, such as boards and 3D printed parts, must meet the color amount standard. The transparent color of the materials must also be accounted for in the color amount. It is recommended to use materials with a unified black surface, such as black printed silk, cable ties, etc. <hr/> <p>Installation:</p> <p>The installation of the protective case needs to meet the normal inspection standards. For example, the armor panel cannot be blocked within 105° in the positive direction.</p> <hr/> <p> It is recommended that teams use tough materials that are not easily damaged for the protective case and at the same time implement confrontation and strike test on the case, so as to avoid violations resulting from damage caused in the Competition Area.</p> <hr/> <p>Decorative requirements:</p> <p>Each robot can be set with up to two advertising spaces for the display of sponsor information and the advertising space should be displayed on the left and right sides of the robot. The size of a single robot advertising space shall be no more than 10cm*10cm, and there are no more than two sponsor logos displayed.</p> <p>Display of sponsors must be reported to the RMOC for approval at least two weeks before the start of the competition. If the application is not approved, it cannot be revealed on the vehicle body and the robot cannot otherwise pass the pre-match inspection.</p> <p>Violations and Penalties:</p> <p>Robots that do not meet the aesthetic design requirements will fail the pre-match inspection.</p>
<p>Launching Mechanism</p>	<ul style="list-style-type: none"> ● Robots using compressed gas as the propellant for projectiles must not have an acceleration length (defined as the lineal length of the barrel that can provide acceleration to projectiles) exceeding 20 cm. <hr/> <p> Launching Mechanism: a mechanism that allows projectiles to leave the robot on a fixed trajectory to cause damage to other robots. (This definition is applicable to all instances of "Launching Mechanism" mentioned in this manual.)</p> <hr/> <ul style="list-style-type: none"> ● When the robot launches ten 17 mm projectiles or launches five 42 mm projectiles, the maximum speed difference detected by the speed measuring module shall not be more than 5 m/s. <p>Violations and Penalties:</p> <p>Robots that do not meet the launching mechanism requirements will fail the pre-match</p>

Type	Technical Specification
	inspection.

3.2 Robot Technical Specification

Participants who enter the Staging Area and Competition Area are called Pit Crew. In each challenge, the number of robots entering onto the Competition Area and Pit Crew limit are as follows:

Table 3-2 Robot Entrance Lineup and The Maximum Number of Pit Crew

Challenge	Qty. of Required Robot	Qty. of Standby Robot (Optional)	Robot Numbering	Maximum Number of Pit Crew
Hero Remote Firing	1	0-1	1	4
Engineer Island Climbing and Projectile Obtaining	1	0-1	2	4
Standard Racing and Smart Firing	1	0-1	3-5 (Optional)	3
Standard Confrontation	1	0-1		3

Robots must meet the corresponding technical specifications:

- Before each match, both required robots and standby robots must all pass the pre-match inspection so that teams can qualify for the match.
- Participants are required to declare the types of standby robots that they are carrying and that need to enter the stage during the pre-match inspection. Apart from standby Standard, other types of standby robots must be attached with armor stickers in the Inspection Area. When a standby Standard is required to enter the stage, team members must promptly get the corresponding sticker from the technicians and attach it in accordance with [Robot Numbering](#) stated in [Table 3-1](#). Only then can the robot enter the stage.
- Standby robots are not allowed to replace after passing the pre-match inspection. The RMOC will issue a referee system to the spare robots that have passed the check in the pre-checking section of the competition division. The participating teams that do not report in advance to carry the spare robots will not be able to borrow the referee system of the spare robots. The participating team will immediately recycle the referee system of the spare robot after finishing the competition in the competition division.

Violations and Penalties:

- Before each match, if any robot does not pass the pre-match inspection, the team is deemed as give up its qualification for the round of the match and lose the match.
- If a participating team replaces or adds a standby robot after passing the pre-match inspection or the standby robot does not pass the pre-match inspection, the team will be deemed as cheating and lose the match. The actual situation is determined by the Chief Referee.

3.2.1 Hero

Level 2 Hero needs to complete the Hero Remote Firing challenge, and below shows its specification:

Table 3-3 Level 2 Hero Specification

Item	Limit	Violations and Penalties	Notes
Initial HP	500	-	-
Maximum Total Power Supply Capacity (Wh)	200	Unable to pass the pre-match inspection	-
Maximum Power Supply Voltage (v)	30	Unable to pass the pre-match inspection	-
Maximum Chassis Power Consumption (W)	80	HP deduction	Buffer energy 60 joules
Launching Mechanism Type	<ul style="list-style-type: none"> ● 42 mm projectile (required) ● 17 mm projectile (optional) 	-	<ul style="list-style-type: none"> ● Each Launching Mechanism can only be equipped with one laser sight ● Even installed with a 17 mm Launching Mechanism, Hero can only fire 42 mm projectiles in Hero Remote Firing
Initial Firing Speed Limit for Projectiles (m/s)	16.5	HP deduction	42 mm projectile

Item	Limit	Violations and Penalties	Notes
Barrel Heat Limit	250	Refer to 4.2.1 Barrel Heat	
Barrel Cooling Value Per Second	40		
Maximum Weight (kg)	35	Unable to pass the pre-match inspection	Include the battery weight, but not the weight of the Referee System
Maximum Initial Size (mm)	800*800*800	Unable to pass the pre-match inspection	<ul style="list-style-type: none"> ● Height must not exceed 800 ● Its orthographic projection on the ground should not exceed a 800*800 square
Maximum Expansion Size (mm)	1200*1200*1200	Unable to pass the pre-match inspection	<ul style="list-style-type: none"> ● Height must not exceed 1200 ● Its orthographic projection on the ground should not exceed a 1200*1200

Item	Limit	Violations and Penalties	Notes
Referee System	Five large armor modules, Speed Monitor Module (42 mm projectiles), Video Transmission Module (VTM), RFID Interaction Module, Positioning System Module, Main Controller Module, Power Management Module, Light Indicator Module	Teams that fail to meet the installation requirement of Referee System will be unable to pass the pre-match inspection	Weight: 5.0 kg



- Initial firing speed limit: When the projectile has accelerated, the detected speed must be less than or equal to the limit. The limit of 17 mm projectile is 30 m/s and that of 42 mm projectile is 16.5 m/s.
- Maximum expansion size: It indicates that the size of the robot after deformation shall be less than or equal to the limit value during the game.
- Hero configured with two types of projectile Launching Mechanism will have barrel heat calculated separately for each type.

3.2.2 Engineer

Engineer needs to complete the Engineer Island Climbing and Projectile Obtaining challenge, and below shows its specification.

Table 3-4 Engineer Specification

Item	Limit	Violations and Penalties	Notes
Initial HP and Maximum HP	1000	-	-
Maximum Total Power Supply Capacity (Wh)	200	Unable to pass the pre-match inspection	-

Item	Limit	Violations and Penalties	Notes
Maximum Power Supply Voltage (v)	30	Unable to pass the pre-match inspection	-
Maximum Chassis Power Consumption (W)	No limits	-	-
Launching Mechanism Type	Not available	-	-
Maximum Weight (kg)	35	Unable to pass the pre-match inspection	Include the battery weight, but not the weight of the referee system
Maximum Initial Size (mm)	800*800*800	Unable to pass the pre-match inspection	<ul style="list-style-type: none"> ● Height must not exceed 800 ● Its orthographic projection on the ground should not exceed a 800*800 square
Maximum Expansion Size (mm)	1200*1200*1200	Unable to pass the pre-match inspection	<ul style="list-style-type: none"> ● Height must not exceed 1200 ● Its orthographic projection on the ground should not exceed a 1200*1200 square

Item	Limit	Violations and Penalties	Notes
Referee System	Four small armor modules, Video Transmission Module (VTM), RFID Interaction Module, Positioning System Module, Main Controller Module, Power Management Module, Light Indicator Module	Teams that fail to meet the installation requirement of Referee System will be unable to pass the pre-match inspection	Weight: 2.6 kg

Grabbing Mechanism

Engineer's Grabbing Mechanism should meet the following regulations:

- During the competition, only Engineer can install one Grabbing Mechanism for Projectile Containers.
- Engineer's Grabbing Mechanism is only allowed to grab one Projectile Container at a time.
- When the body of the projecting Grabbing Mechanism is in close contact with a vertical plane, the maximum horizontal distance between the Grabbing Mechanism and the vertical plane is 400 mm. In other words, no part of the Grabbing Mechanism can cross the midline of the projectile depot in the central area of the Resource Island.
- The Grabbing Mechanism cannot damage Battlefield Components. In particular, it cannot use serrated or sharp-edged structures to interact with projectile containers, which will cause irreversible damage.

Violations and Penalties:

- If the Engineer's Grabbing Mechanism does not meet requirements, it will fail the pre-match inspection.
- During a match, if the Engineer's Grabbing Mechanism is discovered to have serrated or sharp edges that cause irreversible deformation or severe damage to Projectile Containers, the violating robot will be ejected.

3.2.3 Standard

Level 2 Standard needs to complete the Standard Racing and Smart Firing challenge, and below shows

its specification:

Table 3-5 Level 2 Standard Specification

Item	Limit	Violations and Penalties	Notes
Initial HP	250	-	-
Maximum Total Power Supply Capacity (Wh)	200	Unable to pass the pre-match inspection	-
Maximum Power Supply Voltage (v)	30	Unable to pass the pre-match inspection	-
Maximum Chassis Power Consumption (W)	80	HP deduction	Buffer energy 60 joules
Launching Mechanism Type	17 mm projectile	-	Can install only one Launching Mechanism and one laser sight
Initial Firing Speed Limit for Projectiles (m/s)	30	HP deduction	-
Barrel Heat Limit	360	Refer to 4.2.1 Barrel Heat	-
Barrel Cooling Value Per Second	60		During a match, when Standard's HP is less than 20%, its 17 mm barrel cooling value per second will double.
Maximum Weight (kg)	20	Unable to pass the pre-match inspection	Include the battery weight, but not the weight of the Referee System
Maximum Initial Size (mm)	600*600*500	Unable to pass the pre-match inspection	<ul style="list-style-type: none"> Height must not exceed 500

Item	Limit	Violations and Penalties	Notes
			<ul style="list-style-type: none"> ● Its orthographic projection on the ground should not exceed a 600*600 square
Maximum Expansion Size (mm)	700*700*600	Unable to pass the pre-match inspection	<ul style="list-style-type: none"> ● Height must not exceed 600 ● Its orthographic projection on the ground should not exceed a 700*700 square
Referee System	Four small Armor Modules, one large Armor Module, Speed Monitor Module (17 mm projectile), Video Transmission Module Transmitter (VTM Transmitter), RFID Interaction Module, Positioning System Module, Main Controller Module, Power Management Module, Light Indicator Module	Teams that fail to meet the installation requirement of Referee System will be unable to pass the pre-match inspection	Weight: 3.7 kg



4. Referee System

4.1 Overview

The referee system is an electronic referee system that can automatically monitor the state of the robots and make a judgment - in other words, an “Intelligent Referee”. During the competition, the referee system provided by the RMOC monitors a robot's behaviors, such as HP, projectile initial firing speed, and chassis power consumption and then sends real-time information to the computer of the corresponding operator and the referee system server. It also automatically determines the outcome of the competition. When designing robots, teams must reserve mechanical and electrical interfaces to the referee system and install the system as required in the latest version of the [RoboMaster 2019 Robotics Competition Referee System Specification Manual](#). Otherwise, they will not pass the pre-match inspection. For details of the size and mounting interface of the referee system, please refer to the latest version of the [RoboMaster 2019 Robotics Competition Referee System Specification Manual](#).


The RoboMaster 2019 referee system consists of the following modules:

Table 4-1 Referee System Modules

Module	Function
Camera Video Transmitter Module	Capture real-time video feed from the camera and transmit the data to the operator's monitor in the operator room.
Speed Monitor Module	<p>Detect the projectile initial firing speed and if it overspeeds, the robot's HP will be deducted.</p> <hr/>  <ul style="list-style-type: none"> • The Speed Monitor Module can only be installed at the end of the Launching Mechanism, and the speed cannot be measured until the projectile has fully accelerated. • The installation position of the speed measuring module may be adjusted later and is subject to the latest version officially released by the RMOC.
Armor Module	<p>Detect the situation when the robot is hit, and deduct corresponding HP values.</p> <hr/>  <p>It is recommended that the participating teams increase the protection measures of the front armor to avoid impact on the armor board quick disassembly function after installation.</p>
RFID Interaction Module	Interact with the Function Zone of the Battlefield and realize corresponding functions.
Positioning System Module	Detect a robot's position on the Battlefield and authorize the robot to connect to the main server.
Main Controller Module	Monitor all referee system modules, send real-time status of a robot to the server wirelessly, and authorize the robot to connect to the main server.

Module	Function
Power Management Module	Control power to the chassis, gimbal, and the launching mechanism, detect the chassis power consumption, and automatically cut off power supply for propulsion when a robot's HP drops to zero.
Camera Video Transmitter Module	Indicate the level of HP with the health bar, and its color is used to distinguish between the red/blue teams and the status of the robot.

Table 4-2 Robot Status in the Monitor Process

Status	Definition
Defense	<p>The Armor Module reduces damage when it is hit or attacked by projectiles.</p> <hr/>  Defense does not apply to blood-deduction penalties caused by violations.
Defeat	HP drops to zero when its Armor Module is attacked, it gets hit, the chassis power consumption exceeds the limit, the projectile initial firing speed exceeds the limit, the referee system goes offline (including ejected by the server).
Slay	<p>A robot attacks the armor module of the enemy's robot till its HP drops to zero.</p> <p>A slain robot can be determined by the following two situations:</p> <ul style="list-style-type: none"> ● A robot defeats the enemy's robot with a critical hit. ● If a defeated robot has been attacked by one or multiple robots 10s before its death, the last attacking robot is deemed as the killer.

4.2 HP Deduction

Robot's HP will be deducted if such situation occurs: the barrel heat of the Launching Mechanism exceeds the limit; the initial speed exceeds the limit; the chassis power exceeds the limit; the armor module is hit; important modules go offline; and/or violation of rules.

When the referee system server calculates the HP, it rounds up the decimal point. For example, when an Engineer's Defense is at 80%, the HP deduction is $2 * (1 - 0.8) = 0.4$, which rounds up to 0.

4.2.1 Barrel Heat

Hero and Standard have different initial firing speed limits, heat limits, and cooling values per second according to their function and orientation. For more details, please refer to [3.2.1 Hero](#) and [3.2.3 Standard](#).

Set the current barrel heat as Q_1 , the barrel heat limit as Q_0 , the current initial speed as V_1 (m/s), and the initial firing speed limit as V_0 (m/s). Take Standard as an example: the limit for the Standard's initial firing speed is $V_0 = 30$ m/s, the barrel heat mechanism is as follows:

4.2.1.1 Exceeding the Initial Firing Speed Limit

When $V_1 > V_0$, each 17 mm projectile with a speed of V_1 detected by the referee system will cause deduction, and the deducted HP = maximum HP * L%. For each 42 mm standard projectile detected, the deducted HP = maximum HP * M%. Values of L% and M% is related to the exceeding range. The larger the exceeding range, the greater the values of L% and M%.

Table 4-3 Penalties for Exceeding the Initial Firing Speed Limit

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

4.2.1.2 Barrel Heat Exceeds the Limit and Barrel Heat Cooling

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

It is known that the barrel heat limit is Q_0 ,

- A. When $Q_1 > Q_0$, the First Person View (FPV) visibility of the robot operator's computer will be reduced. When $Q_1 < Q_0$, the FPV will return to normal. The FPV for the client is as follows:



Figure 4-1 Client FPV

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

HP deduction logic when the barrel heat exceeds the limit and barrel heat cooling logic:

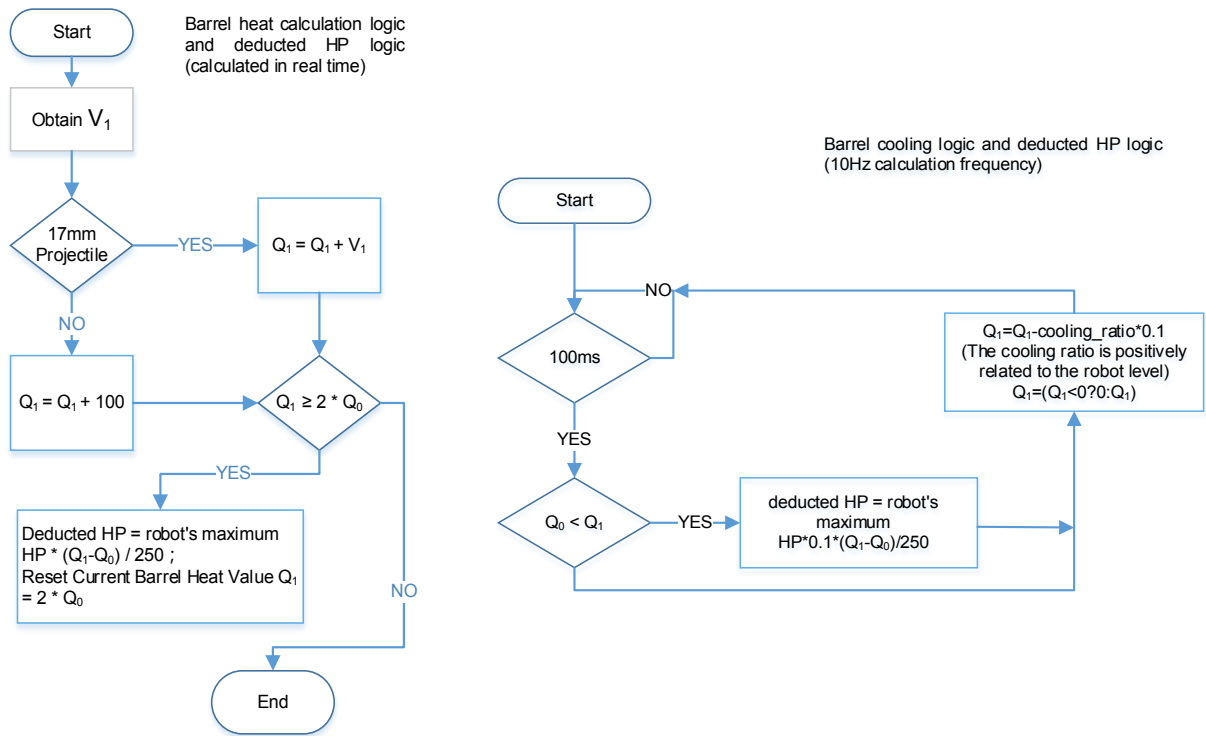


Figure 4-2 HP Deduction Logic When the Barrel Heat Exceeds the Limit (left) and Barrel Heat Cooling Logic (right)

4.2.2 Chassis Power Consumption

Different types of robots have the corresponding chassis power consumption limit according to their function and orientation.

Table 4-4 Robot Chassis Power Consumption Limit

Type	Power Consumption Limit (watts)
Standard	80
Hero	80
Sentry	20
Aerial	No limit
Engineer	No limit



- Robot's chassis: a mechanism that carries and installs the robot propulsion system and its accessories.
- Chassis power consumption: the power that enables the robot to move horizontally, excluding power used for special tasks (such as the power consumption for functional movements like moving the upper mechanical structure).

Pre-match Inspection Requirement

Standard or Hero faces and abuts the vertical rigid plane (such as the wall), the remote controller pushes to the maximum rod amount, the robot accelerates for 20 seconds, and there is no blood-deduction due to exceeding the limit throughout the whole process. There are no requirements for sentry robots.

Violations and Penalties:

Robots that do not meet the requirements cannot pass the pre-match inspection.

Chassis Power Consumption Exceeds the Limit

The chassis power consumption of the robot will be continuously monitored by the referee system. The system monitors the chassis power consumption at a frequency of 10Hz and triggers penalties when the power consumption exceeds the limit. Different types of robots trigger different penalties. Considering that it is difficult to control instantaneous output power when the robot is in motion, the competition defines a buffer energy (W) on the referee system server. The buffer energy (W) of Standard or Hero is 60 J.

Ratio of exceeding the limit: $K = (Pr - PI) / PI$, where Pr is the instantaneous chassis output power consumption and PI is the power consumption limit.

Table 4-5 Penalties for Chassis Power Consumption Exceeds the Limit

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

Standard or Hero:

When a Standard's or a Hero's chassis power consumption exceeds the limit, the deducted HP = maximum HP * N%.

For example, if the robot has a continuous power output of 140 W, 60 J of energy will be consumed after one second. In the next 100 ms detection period, the calculated overrun ratio $K = (140 - 80) / 80 = 75\%$. Since $K > 20\%$, the deducted HP = $300 * 40\% * 0.1 = 12$.

The logic diagram of chassis power consumption detection and HP deduction of Standard or Hero is shown below:

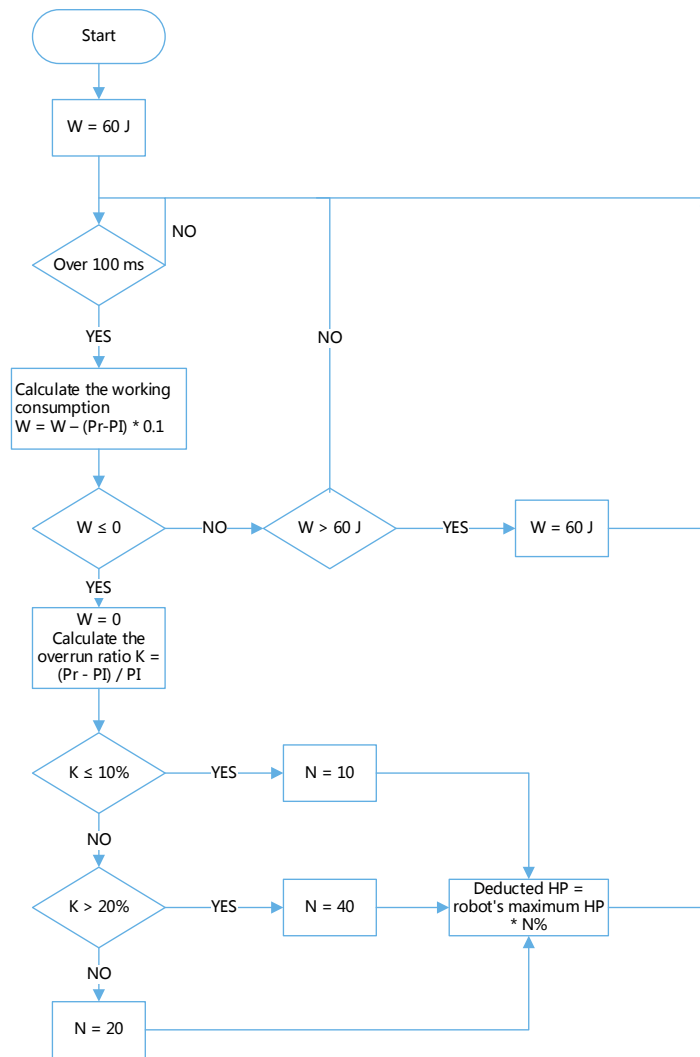


Figure 4-3 Chassis Power Consumption Detection and HP Deduction

4.2.3 Armor Attack

The Armor Module detects damage sources base on its pressure sensor feedback and the vibration frequency of the armor plate. Damage sources are divided into projectile attack and collision. Projectile is the only legal damage source. Collisions including crashing into other robots, throwing objects or robot's components hitting against the Battlefield are prohibited.

The highest frequency which the armor module can detect during a detection period of 50 ms is 20 Hz. When a 17 mm projectile and 42 mm projectile come into contact with the large Armor Module at speeds of 12 m/s and 8 m/s respectively, they can be effectively detected. The triangle Armor Module at the top of the Base can only detect 42 mm projectile. When a 42 mm projectile comes into contact with the triangle Armor Module at speed of 6 m/s, it can be effectively detected.

Below is the HP deduction under the situation of no attack gain in Hero Remote Firing challenge.

Table 4-6 HP Deduction of Armor Attack

Attack Type	HP Deduction
42 mm projectile	100
17 mm projectile	10
Collision	2



Please note that the actual HP Deduction may vary with the actual firing speed and firing distance, and the results are subject to the determination of the Referee System.

The damage of 42 mm projectile that is detected by the triangle Armor Module at the top of the Base is twice the large Armor Module. For example, under the situation that there is no attack gain and that the Base is defenseless, when Hero shoots 42 mm projectile to the top triangular Armor Module of the Base, the Base HP is deducted by 200.

In Standard Confrontation, for the scoring rule of hitting the armor plates in legal attack zones to receive the corresponding scores please refer to [Table 6-2](#).

4.2.4 Referee System Going Offline

Install referee systems of the corresponding modules as required in the [RoboMaster 2019 Robotics Competition Referee System Specification Manual](#). During the competition, the connection between each module and the server must be stable. The referee system server detects the connectivity of each module at a frequency of 2 Hz. If important modules, which are speed monitor module, positioning system module and armor module, go offline due to problems of design or structure, then a certain amount of HP will be deducted.

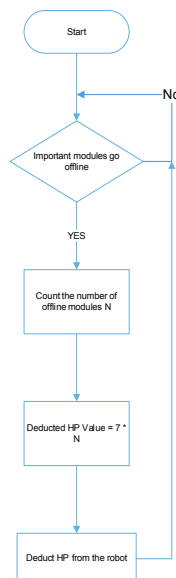
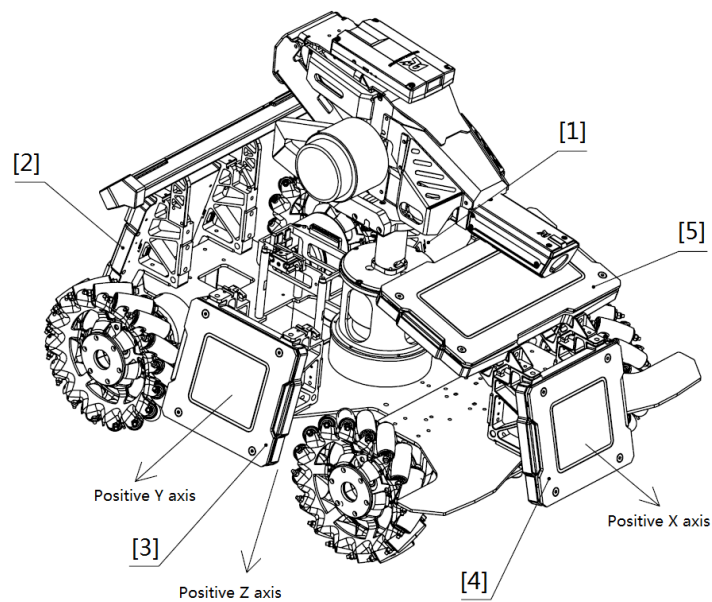


Figure 4-4 HP Deduction Mechanism of Referee System Important Module Going Offline

The Armor Module must be configured with the correct ID number before the pre-match inspection. The specific requirements are as follows:

Standard and Hero

According to the Robot Coordinate System established by the armor module installation requirements, set the armor module ID of the Positive X axis as 0, the Negative Y axis as 1, the Negative X axis as 2, the Positive Y axis as 3 and the Negative Z axis as 4. In other words, after entering the armor ID setting mode, tap the Positive X axis, the Negative Y axis, the Negative X axis, the Positive Y axis, and the Negative Z axis in turn to complete ID settings.



[1] Armor #1 [2] Armor #2 [3] Armor #3

[4] Armor #0 [5] Armor #4

Figure 4-5 Standard and Hero Armor Module ID Setting

Teams must set the Armor Module ID according to the above specification, so that the attack direction can be displayed accurately on the operator's operation page and at the same time, the correctness of the "real-time HP change information" produced by the Referee System can be guaranteed.

Engineer

Engineer has four pieces of armor. If a competition starts with an Engineer, the Video Transmitter Module faces towards the Positive X axis of the Robot Coordinate System. The Armor Module ID of the Positive X axis is set as 0, the Positive Y axis as 1, the Negative X axis as 2, the Negative Y axis as 3.

5. General Battlefield Components

5.1 Operator Room

On both sides of the Battlefield, there are Operator Room of the red team and blue team and Pilot Room, which are equipped with computers of the corresponding robot and communication devices for referees. The Operator Room is the only place where operators can control their robots in real time during the competition.

5.1.1 Facility



- The operator is not allowed to bring his own computer.
 - The participating team members are prohibited from using the official equipment power supply to supply power to their own equipment.
-

During the Regional Competition, the Operator Room includes five computers and each has mouse, keyboard and USB hub. As some equipment such as mouse and keyboard may suffer from performance degradation over time, it is recommended by the RMOC that operators bring their own equipment and set up during the pre-match preparation period.

There is no extra power supplied to the Operator Room. Operators must therefore bring their own power supply for their own equipment.

5.1.2 Operator

Operator can only operate on his corresponding computer and cannot change after a round has begun. Operator can be substituted after each round.

Standard, Hero, and Engineer can only have one Operator each.

5.1.3 Operator Room Referee

In the Operator Room, there are referees who are responsible for maintaining order, helping technicians to solve problems and ensuring the normal operation of official equipment during the pre-match preparation period. Operators cannot leave their post without referee's permission.

Violations and Penalties:

- The use of an unauthorized power supply in the Operator Room is regarded as damaging components.
- Operator who leaves his post will receive a verbal warning. If three verbal warnings are not heeded, the team with the member who does not comply with the warnings will be punished as lose for the challenge.

- Operator that changes his position after the start of a match will receive a verbal warning from the Operator Room Referee, and the Operator must return to his specified position. If three verbal warnings are not heeded, the member who does not comply with the warnings will be sent off, and the robot he operates will be ejected after the start of the match. The team is not allowed to have a substitute Operator enter the Operator Room. If the ejected team member does not comply, the entire team will be punished as lose for the challenge.

5.2 Projectile

Projectile is the only acceptable component to attack robots. Robots must use projectiles to hit the Armor Modules of the enemy robots, causing damage to their HP and defeat them. Both 17 mm and 42 mm projectiles are used during a match.

Table 5-1 Projectile Parameters

Type	Appearance	Color	Size	Weight	Shore Hardness	Material
42 mm Standard Projectile	Similar to the shape and size of a golf ball	White	42.5mm±0.5mm	41 g ± 1 g	90 A	Plastic (TPE)
17 mm Standard Projectile	Round		16.9mm±0.1mm	3.0 g ± 0.1 g	90 A	Plastic (TPU)

Violations and Penalties:

Robots must use official RM2019 projectiles and cannot use any unofficial projectiles. Any team being found to use unofficial projectiles will be regarded as cheating and disqualify once confirmed through investigation.

6. Challenge Introduction



The error margin of all Battlefield Components described in the chapter is within $\pm 5\%$ and the dimension unit is mm.

The Technical Challenge has four challenges: Hero Remote Firing, Engineer Island Climbing and Projectile Obtaining, Standard Racing and Smart Firing and Standard Confrontation.

- **Hero Remote Firing:** completed by Level 2 Hero (“Hero” for short). Hero fires at the Base remotely from different locations. Firing distance and number of hits are counted towards the final scores. Hero is the main attack robot on the Battlefield and fires 42 mm projectiles at the Base from a long distance.
- **Engineer Island Climbing and Projectile Obtaining:** completed by Engineer. Engineer climbs the Resource Island and obtains projectile containers. The number of projectiles obtained and the speed of obtaining will affect the final scores. Engineer is the supporting robot on the Battlefield.
- **Standard Racing and Smart Firing:** completed by Level 2 Standard (“Standard” for short). Standard should rush through complex terrain of the Battlefield and activate the Power Rune. It is the backbone on the Battlefield and can launch 17 mm projectiles to activate the Power Rune to obtain combat buffs.
- **Standard Confrontation:** completed by Level 2 Standard (“Standard” for short). It is a new challenge for the RM2019 Season. Standard of each team battles each other in the Battlefield, and whoever defeats its opponent wins the round.

Pre-match preparation period, competition time of a single match and initial projectile quantity of each challenge are as follows:

Table 6-1 Challenge Specification

Challenge	Pre-Match Preparation (min)	Time for a Single Match (min)	Initial Projectile Qty.	Projectile Type
Hero Remote Firing	2	3	20	42 mm projectile
Engineer Island Climbing and Projectile Obtaining	1	3	0	
Standard Racing and Smart Firing	1	3	50	17 mm projectile
Standard Confrontation	1	2	150	

6.1 Hero Remote Firing

The Hero Remote Firing challenge will be carried out on the Battlefield of the Robotics Competition.



[1] Zone A [2] Zone B [3] Zone C [4] The location of the armor plate is on the top of the Base

Figure 6-1 Battlefield Top View

6.1.1 Battlefield

The positional relationship between the three zones and the firing targets in the Battlefield:

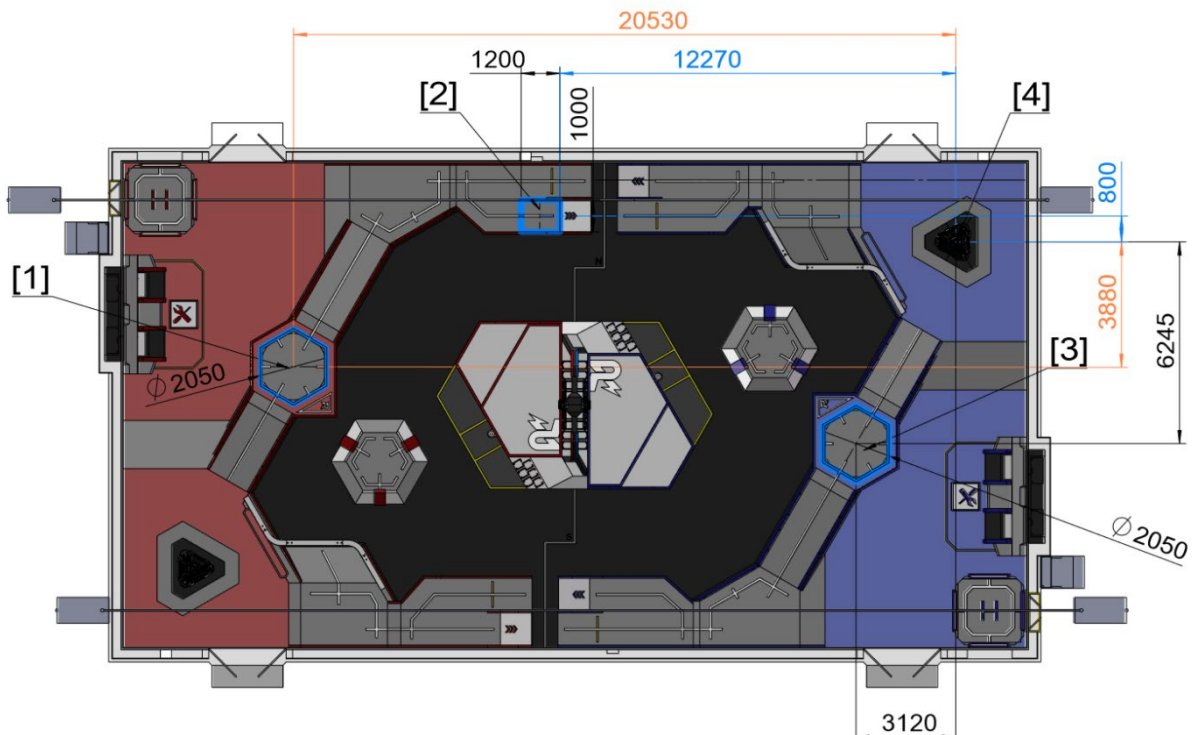
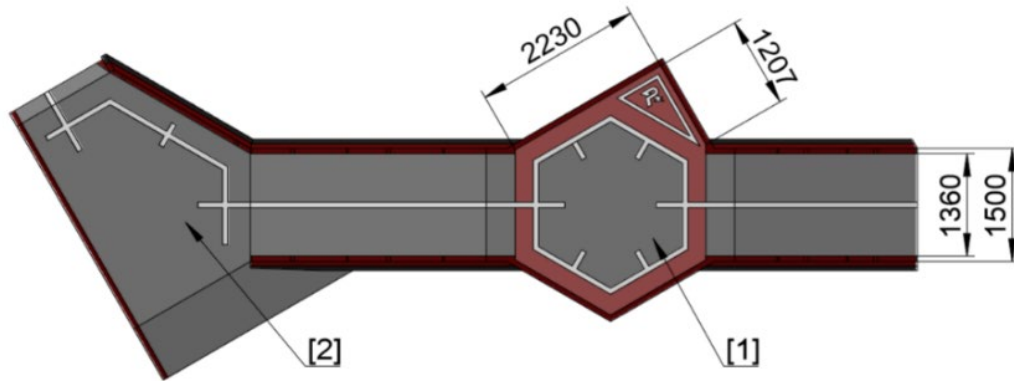


Figure 6-2 Positional Relationship Between the Three Zones and the Firing Targets in the Battlefield

6.1.1.1 Bridge

Bridge consists of the Bridge Top Platform and Bridge End Platform. The top surface of the Bridge is Bridge Top Platform and Zone A and Zone C lies in the Bridge Top Platform.



[1] Bridge Top Platform [2] Bridge End Platform

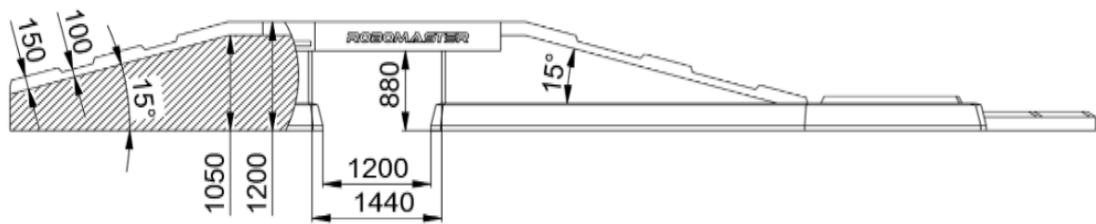
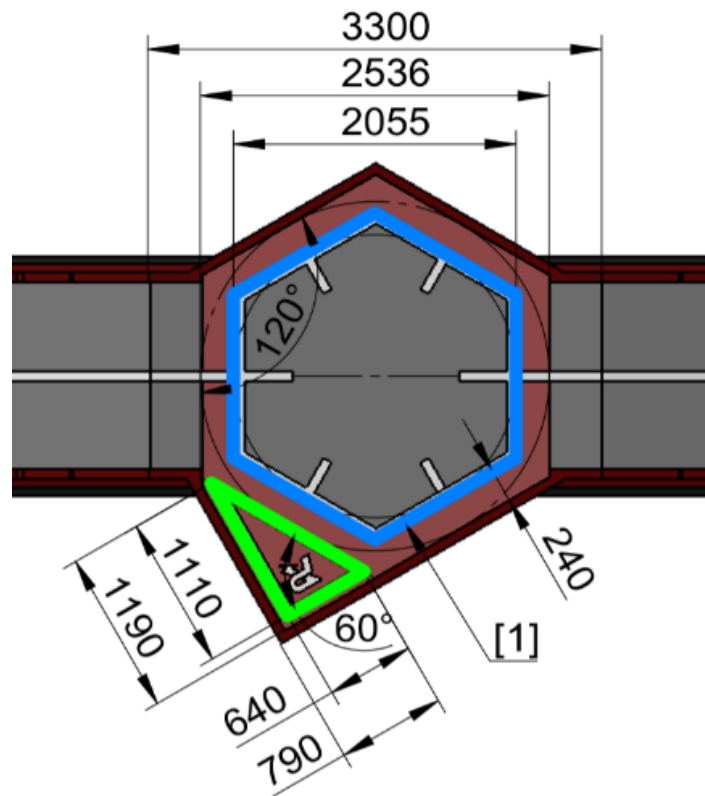


Figure 6-3 Bridge in Hero Remote Firing

Bridge Top Platform is laid with two kinds of RFID Interaction Module cards, one is distributed inside the blue frame as shown below and the other is in the green frame.

- If the robot reaches the blue frame area of its own side and stays for 3 seconds, the robot's barrel heat will be reduced 5 times faster per second. If the robot leaves the blue frame area of its side for more than two seconds, the gain will be invalid.
- After the start of the game, if the robot reaches the green frame area of its own side and stays for 3 seconds, the Power Rune on the Resource Island enters an activating state (see Figure 6-20) and the robot's barrel heat will be reduced five times faster than before occupying the Bridge Top Platform. If one side's Power Rune preferentially enters the activated state (see Figure 6-22), the other side's Power Rune cannot continue to be activated. If the robot leaves the green frame area of its own side for more than two seconds, the gain in barrel heat per second of cooling value will be invalid.

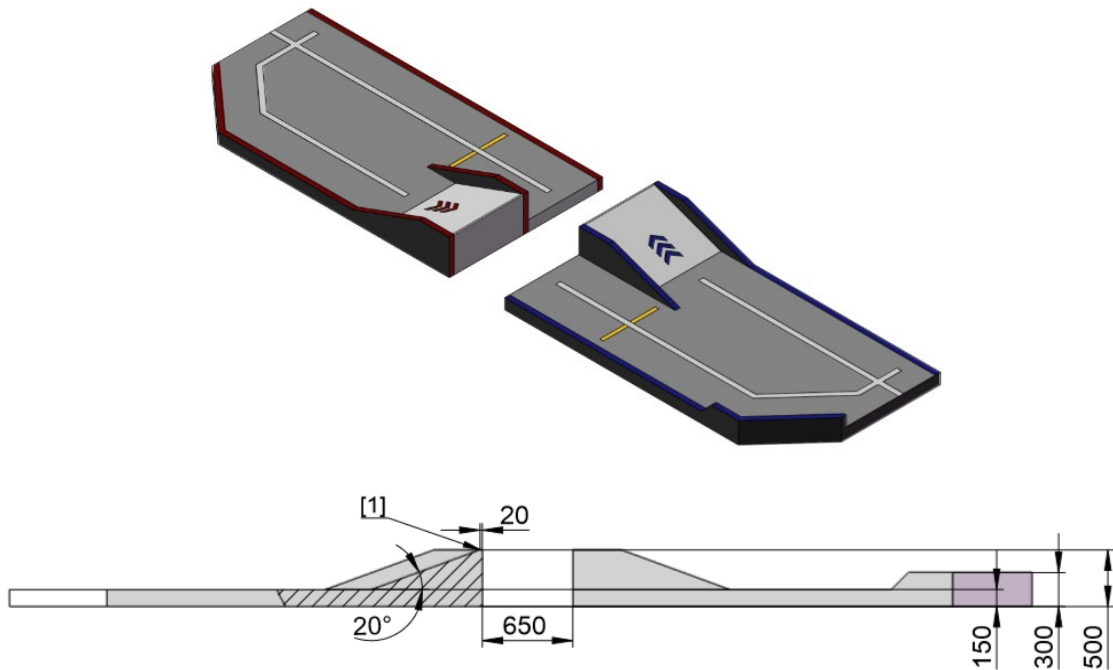


[1] RFID Interaction Module cards are laid inside the blue frame (same goes for green frame)

Figure 6-4 Bridge Top Platform in Hero Remote Firing

6.1.1.2 Road

Zone B is on one side of the road slope. There is a 650 mm gully in the middle of the road.



[1] Right angle corners are fitted with aluminum corner guards

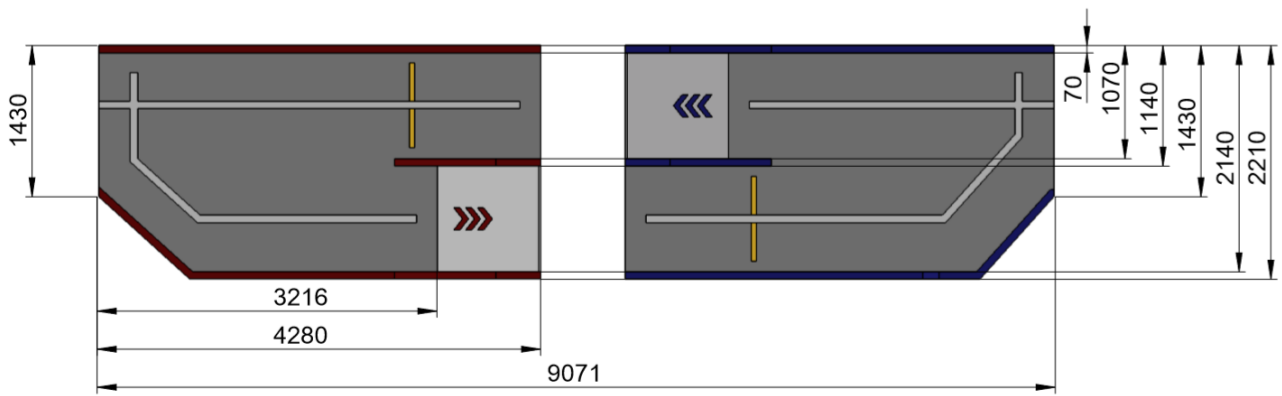
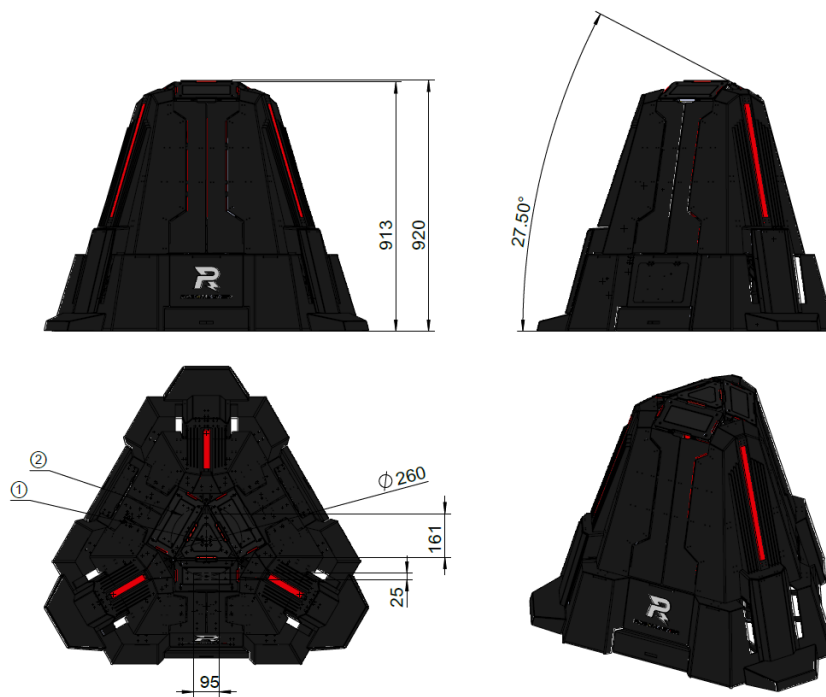


Figure 6-5 Road in Hero Remote Firing

6.1.1.3 Base

There are three large Armor Modules and one triangular Armor Module. In the middle of the interior, there are three large Armor Modules with the corresponding No.8 sticker attached. For details, please refer to [Appendix 6 Reference Drawing](#).



[1] Triangle Armor Module [2] Large Armor Module

Figure 6-6 Base in Hero Remote Firing

6.1.2 Rules

6.1.2.1 Challenge Rule

Hero is preloaded with twenty 42 mm projectiles. In a three-minute round, aHero leaves the Starting Zone and can move to any of the three legal attack zones in the Battlefield marked as Zone A, Zone B and Zone C (outlined with blue lines in the above figures). When Hero enters into such Zones, the RFID

Interaction Module will detect the corresponding card and prompt on the client. When prompted, the robot can start firing at the Armor Module on top of the Base, including three large Armor Modules and one triangle Armor Module. The round will come to an early closure when use up twenty projectiles. Otherwise, Hero can move to other legal zones until this 3-minute round is concluded.

6.1.2.2 Scoring Rule

Hit the armor plates in legal attack zones to receive the corresponding scores. After a round is concluded, a total score for a single challenge will be calculated according to the following rules.

Table 6-2 Hero Remote Firing Scoring Rule

Zone	Straight-line distance between the Zone and the Armor Module	A single hit on the triangle Armor Module	A single hit on the large Armor Module
A	21000	8	4
B	12400	4	2
C	7000	2	1

For example, in a three-minute round, Hero leaves the Starting Zone and hits one large armors once from Zone A. Then it moves to Zone B and hits one large armor five times and the triangle armor twice. Later, Hero makes an attempt to advance to Zone C but fails before the countdown. Therefore, the team's score from this challenge is $1 * 4 + 5 * 2 + 2 * 4 = 22$.

6.1.2.3 Ranking Rule

Below is the team ranking rule in Hero Remote Firing:

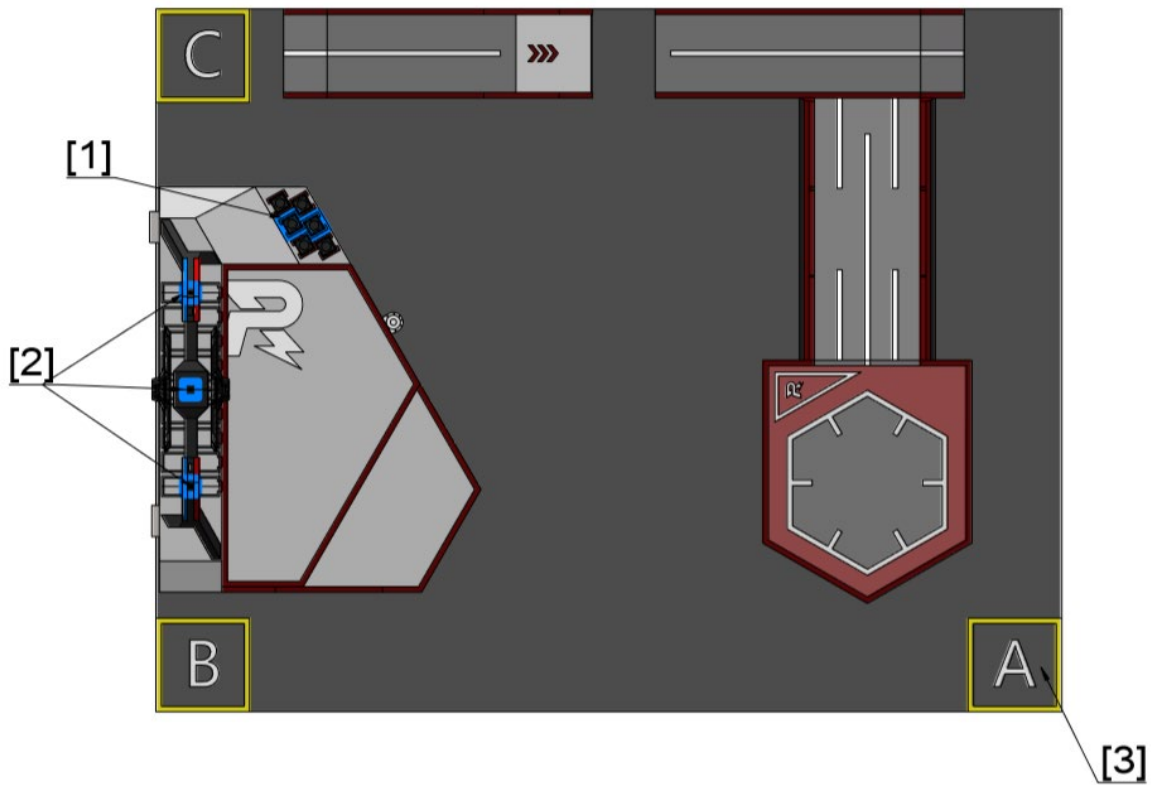
1. Each team can initiate three challenges and take the highest total score as the final score. All teams will be ranked from high to low based on the total score.
2. If the total scores of several teams are the same, the teams will be ranked based on the remaining HP values of Hero.
3. If the total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

6.1.2.4 Eligibility

Hero must successfully hits the Armor Module of the Base at least once.

6.2 Engineer Island Climbing and Projectile Obtaining

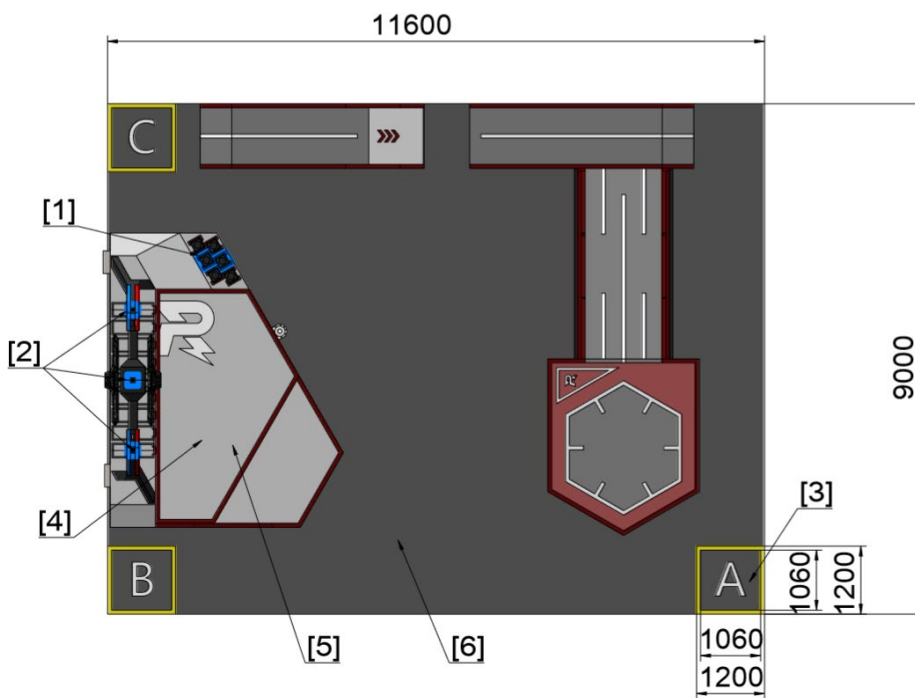
The Engineer Island Climbing and Projectile Obtaining challenge and the Standard Racing and Smart Firing challenge share one Battlefield which is set up in the Preparation Area of the RoboMaster Robotics Competition and the Battlefield includes the Resource Island, Bridge and Road.



- [1] Projectile Container is below the Resource Island [2] Projectile Container is on the Resource Island [3] Starting Zone

Figure 6-7 Battlefield of Engineer Island Climbing and Projectile Obtaining

6.2.1 Battlefield



- [1] Projectile Container is [2] Projectile Container is [3] Starting Zone

below the Resource Island on the Resource Island

- [4] Sand Texture Rubber [5] Resource Island [6] Litchi Texture Rubber

Figure 6-8 Battlefield Details of Engineer Island Climbing and Projectile Obtaining

6.2.1.1 Resource Island

Resource Island includes Projectile Depot, Power Rune and Assistive Column. In the Engineer Island Climbing and Projectile Obtaining challenge, Engineer needs to obtain Projectile Containers at the Resource Island.

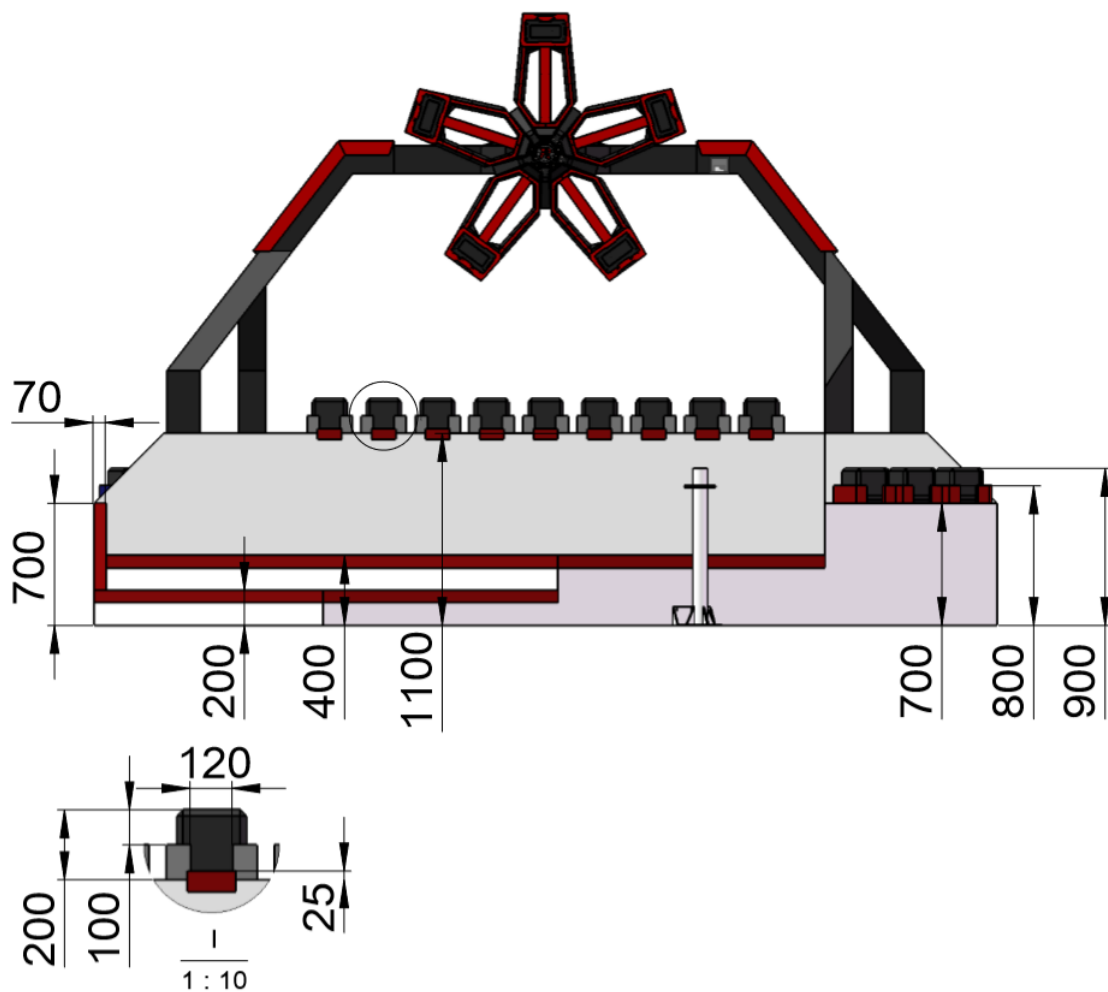


Figure 6-9 Resource Island Front View

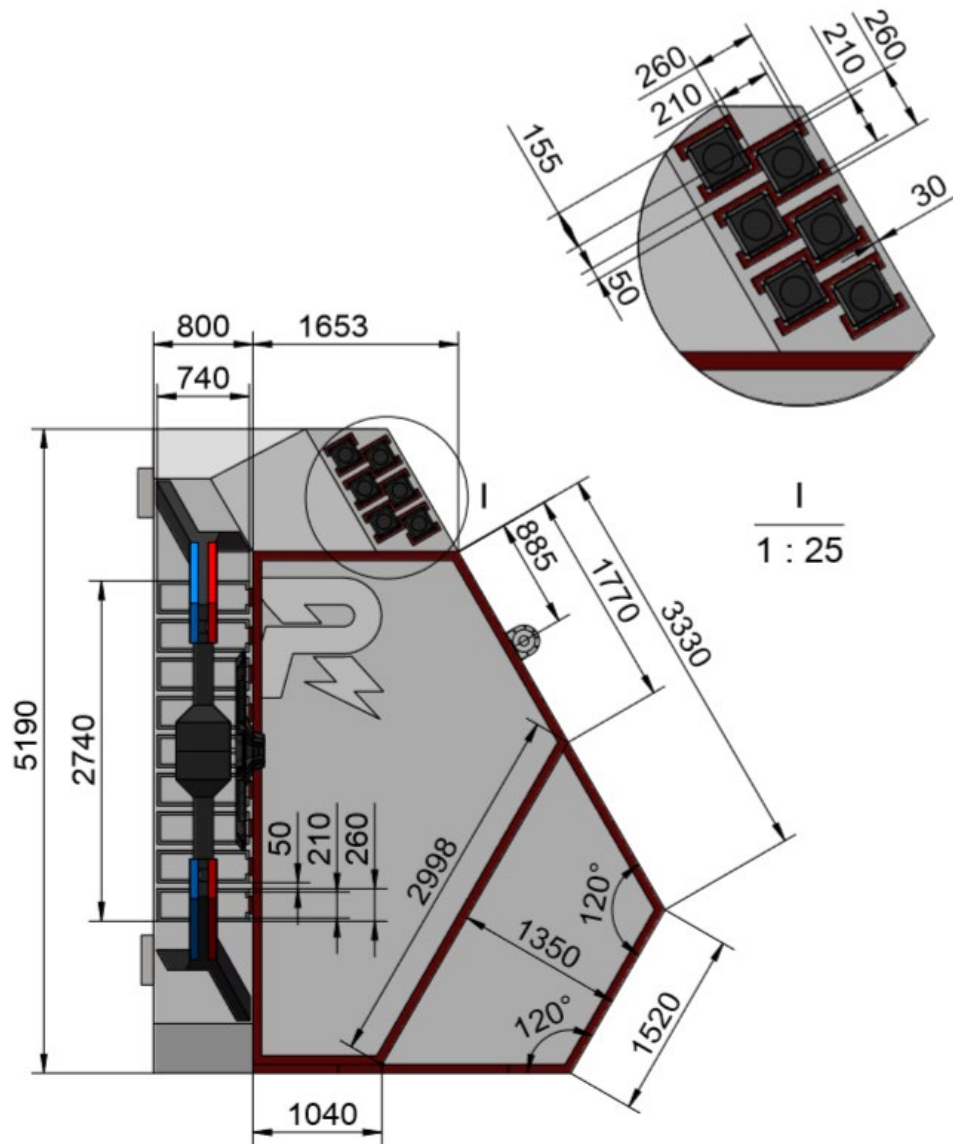


Figure 6-10 Resource Island Top View

6.2.1.2 Projectile Depot

The Resource Island has 15 fixed projectile container grooves, on which are containers with 42mm standard projectiles. In the Engineer Island Climbing and Projectile Obtaining challenge, three Projectile Containers are placed on the Resource Island, each of which contains twenty 42 mm projectiles. There are two projectile containers below the Resource Island and each has six 42 mm projectiles. The spots of Projectile Containers in the competition can be found in the above figures. Engineer can move or take away containers to obtain projectiles.

Projectile Container

Projectile container is 200 * 200 * 200 mm in size. Its six sides are chamfered and it is made out of EVA materials. The top side has a hole with a diameter of 115 mm. The hole depth of different types of Projectile Container is different. The depth of the Projectile Container on the Resource Island is 150 mm while below the Island is 75-80 mm.

Projectile Container below the Resource Island:

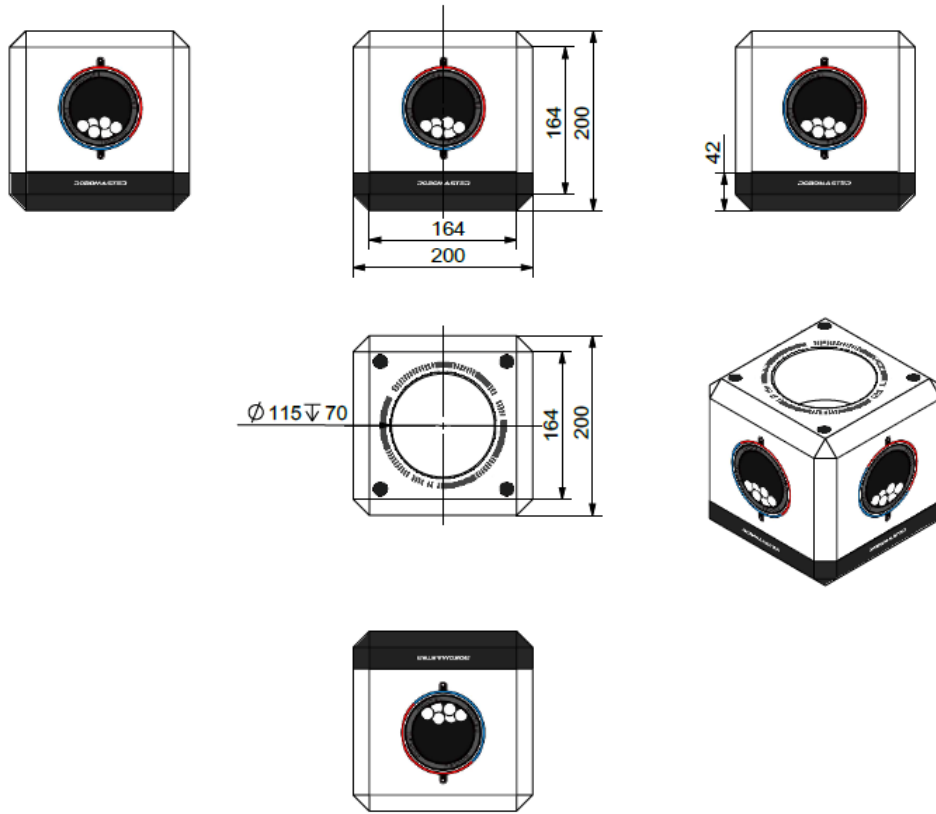


Figure 6-11 Projectile Container below the Resource Island

Projectile container on the Resource Island:

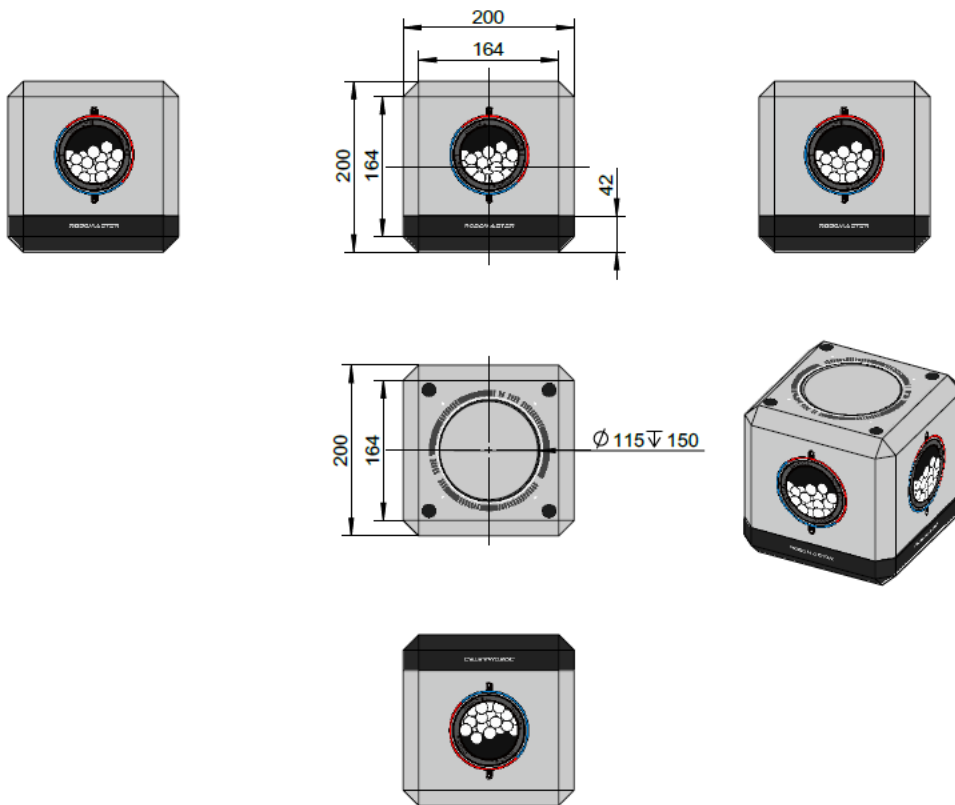


Figure 6-12 Projectile Container on the Resource Island

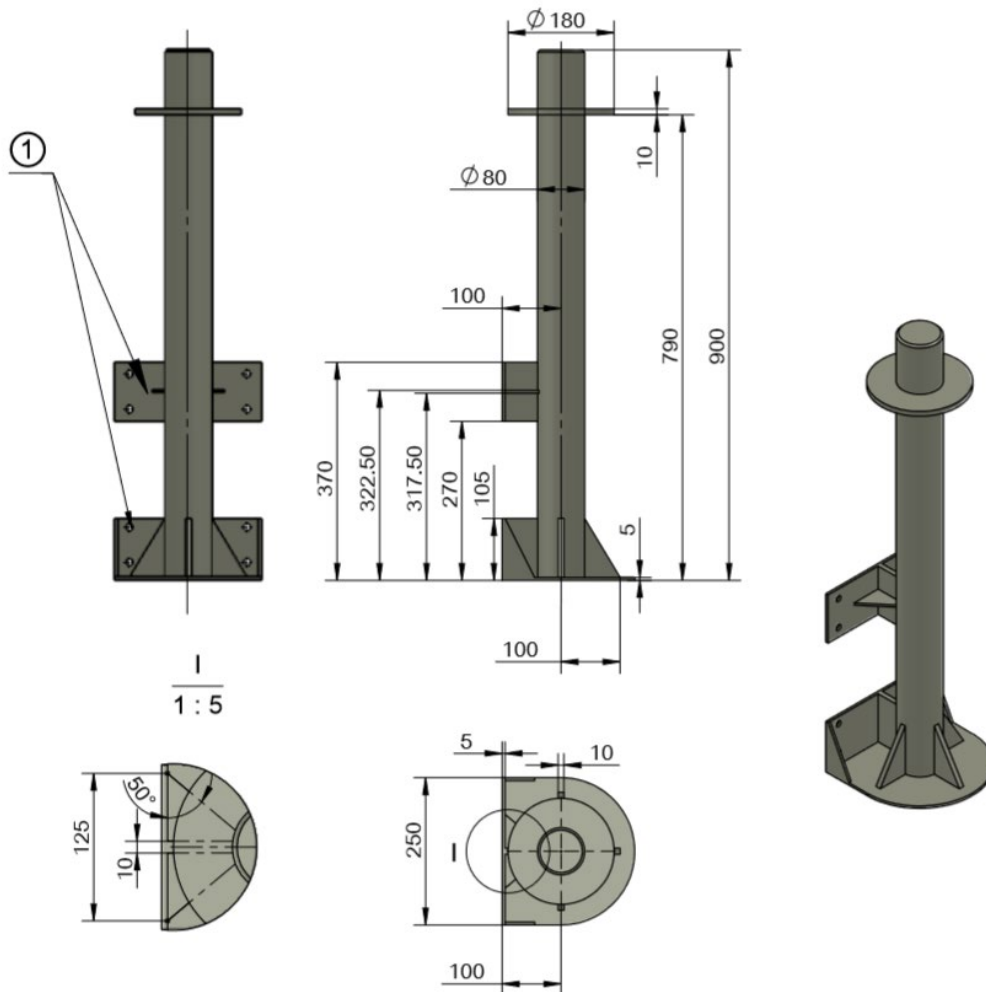
6.2.1.3 Assistive Column

On both sides of the Resource Island, there are two Assistive Columns which are made of Q235 carbon structural steel with a matt surface. Engineer can use the Assistive Column with its Landing Mechanism to ascend to the Island and obtain projectiles.

During the match, no robot shall set Projectile Containers on the Assistive Column.



- Since the surface of the Assistive Column is inevitably scratched from repeated use in the Battlefield, the mechanical structure of robots should be properly designed based on this assumption.
- Teams need to consider the possible impact to their own robots with a Projectile Container placing on the plane or stair of the Resource Island and prepare an appropriate solution.
- When Engineer uses the Assistive Column to ascend to the Resource Island, its mechanical structure will touch the Column. Teams should take this into consideration when designing robots and avoid structural damage to the mechanical structure.
- The connection between the step surface with a diameter of 180 mm and the two sides of the round tube with a diameter of 80 mm on the Assistive Column may have an inevitable structure (solder joint and surface finish) by improper processing.



[1] Holes of the Assistive Column are connected to the Resource Island by bolts, which are M8 hex cup head self-tapping screw

Figure 6-13 Resource Island Assistive Column

Violations and Penalties:

During a match, if a robot sets Projectile Containers on the Assistive Column, the violating team fails the challenge.

6.2.2 Rules

6.2.2.1 Challenge Rule

At the beginning of the competition, Engineer leaves the Starting Zone to retrieve two Projectile Containers below the Resource Island and three Projectile Containers on the Resource Island. After the Projectile Containers are retrieved, Engineer needs to return to the Starting Zone.

6.2.2.2 Scoring Rule

When Engineer returns to the Starting Zone, it can place the Projectile Container randomly and begins to count the quantity of projectiles. It needs to put the obtained projectiles into a bag held by the staff. Projectile needs to be obtained naturally from the interacting interface between Engineer and Hero. One projectile gains five points. The total time for each challenge is three minutes. If the projectile containers on the Resource Island are all taken, and the game time is not over when Engineer returns to the Starting Zone, one point will be added for each remaining second. The final score will be zero if Engineer fails to return to the Starting Zone.

6.2.2.3 Ranking Rule

Below is the team ranking rule in Engineer Island Climbing and Projectile Obtaining:

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

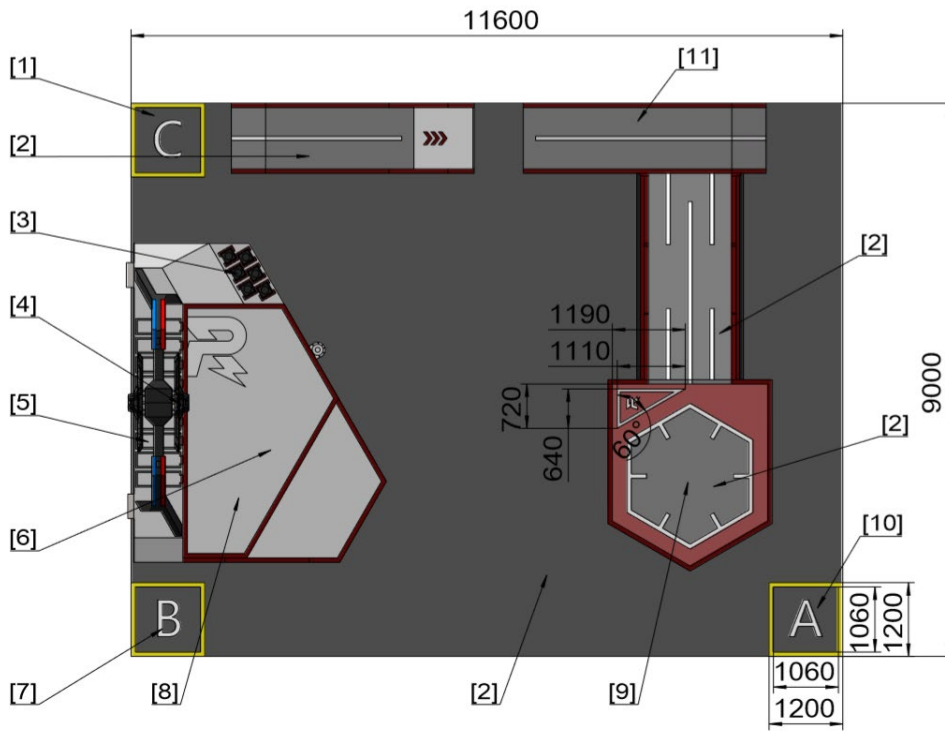
6.2.2.4 Eligibility

Engineer must successfully retrieve at least one projectile.

6.3 Standard Racing and Smart Firing

The Standard Racing and Smart Firing challenge and the Engineer Island Climbing and Projectile Obtaining challenge share one Battlefield. For the Battlefield, please refer to [Figure 6-7](#).

6.3.1 Battlefield



- | | | | |
|--|------------------------------|---|------------------------|
| [1] Zone C | [2] Litchi Texture
Rubber | [3] Projectile Container is
below the Resoure Island | [4] Power
Rune |
| [5] Projectile Container is
on the Resoure Island | [6] Sand Texture
Rubber | [7] Zone B | [8] Resource
Island |
| [9] Bridge | [10] Zone A | [11] Road | |

Figure 6-14 Standard Racing and Smart Firing Top View

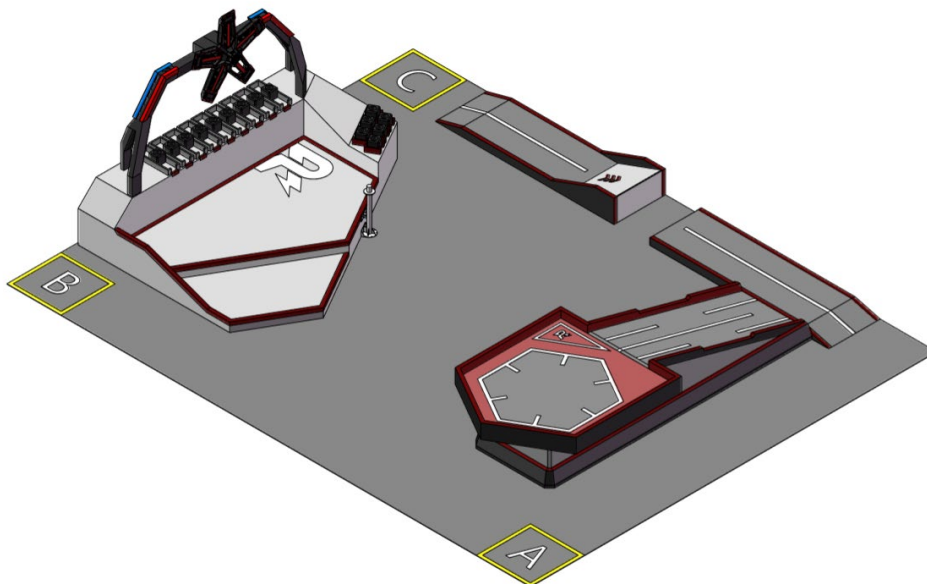
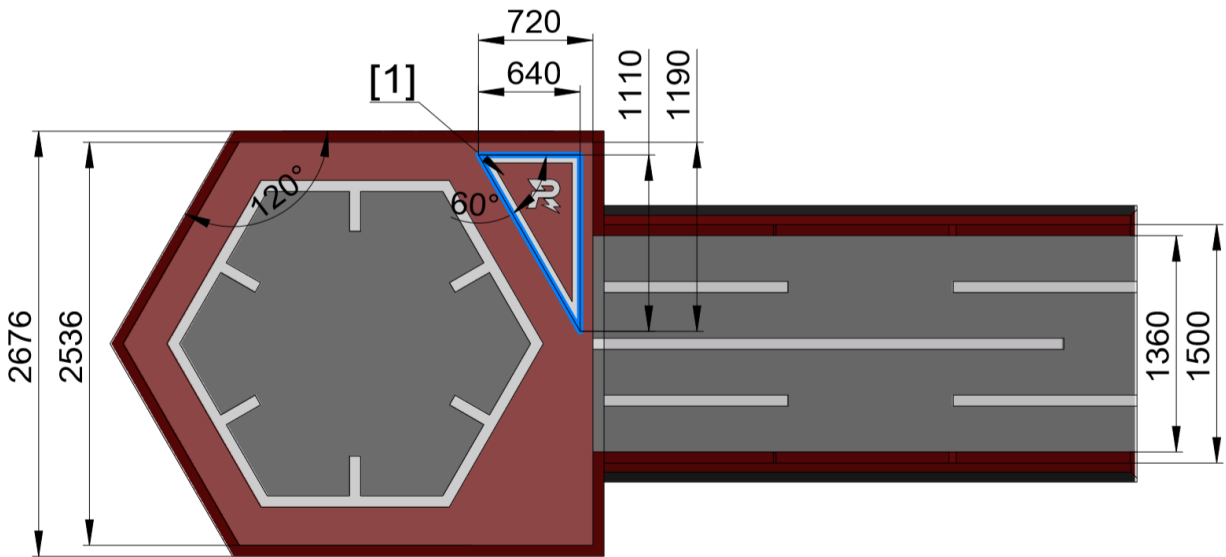


Figure 6-15 Standard Racing and Smart Firing Axonometric Drawing

6.3.1.1 Bridge

Standard needs to shoot the Power Rune within the blue frame area as shown below at Zone D on the Bridge.

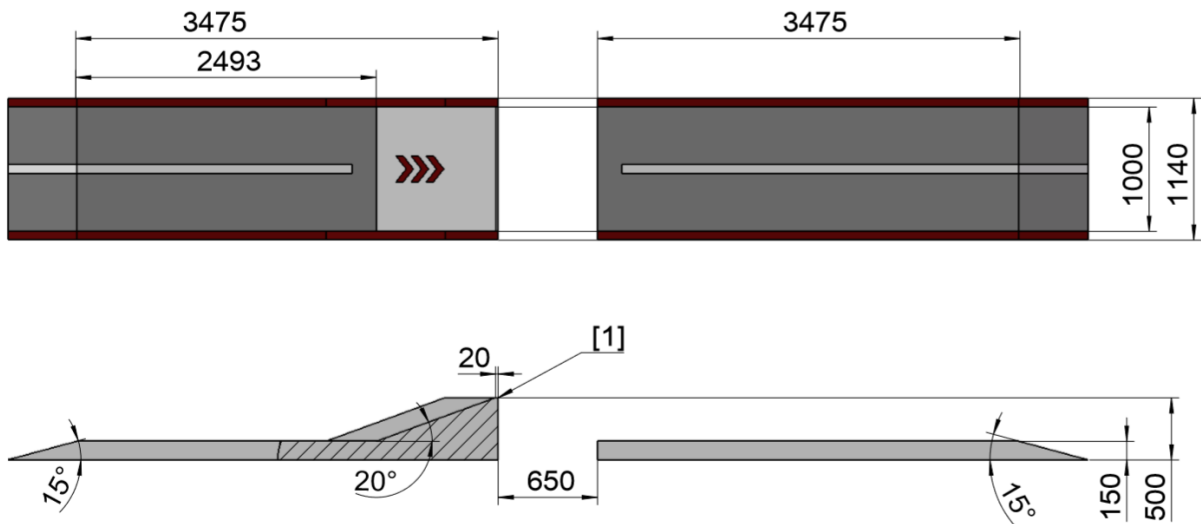


[1] RFID Interaction Module cards are laid inside the blue frame

Figure 6-16 Bridge in Standard Racing and Smart Firing

6.3.1.2 Road

When Standard reaches Zone C, it must get access to the Bridge through the Road. There is a 650 mm gully in the middle of the Road.



[1] Right angle corners are fitted with aluminum corner guards

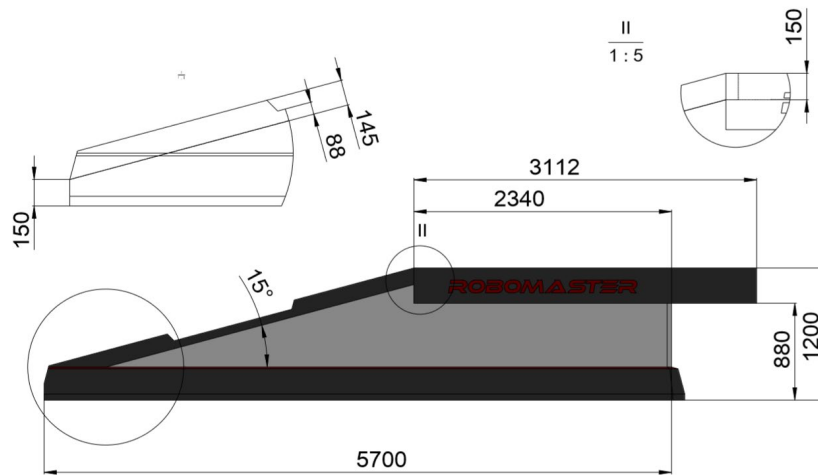


Figure 6-17 Road in Standard Racing and Smart Firing

6.3.1.3 Power Rune



- The next version of Rules Manual will fine-tune the parameters such as the rotation speed, structure and dimensions of the Power Rune, but such adjustments will not affect the identification of it.
- Due to the heavy weight in the middle of the bridge, there will be a slight fall and the fall range is 0-50 mm.
- Due to observation viewing angle problems and the transmission gap, some Power Rune may be seen when observing one side's Power Rune.

The Power Rune is located in the center of the Resource Island and there is only one Power Rune in Technical Challenge. The random direction of Power Rune is random. During the competition, the Power Rune rotates at a constant speed of 10 RPM (Round-Per-Minute).

The Power Rune is distributed evenly with five Large Armor Modules. The specific location and dimensions of Large Armor Module are as follows:

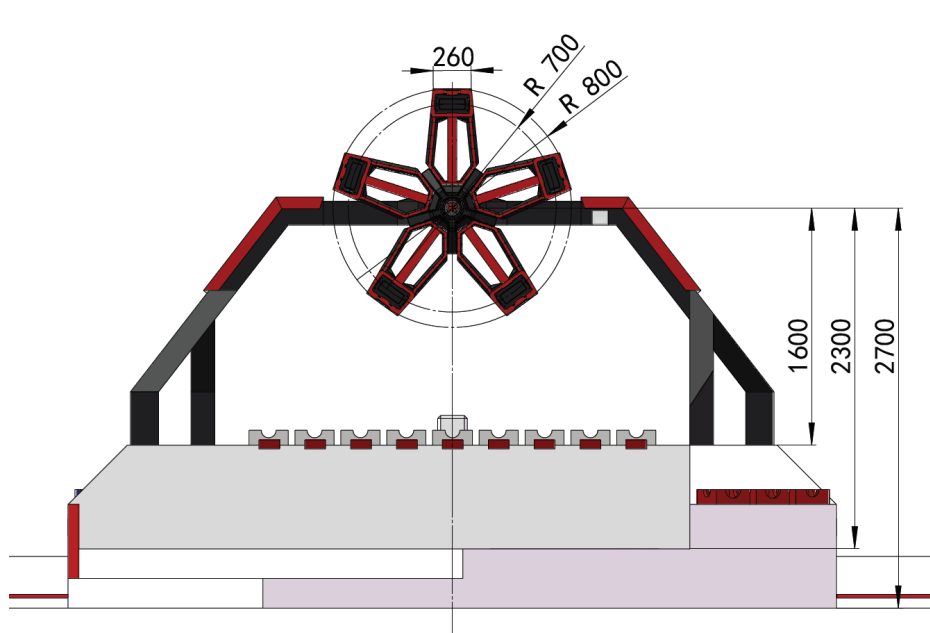


Figure 6-18 Location of Large Armor Module

Status

The Power Rune has five statuses: Unavailable, Available, Activating, Activated and Activation Failed.

1. Unavailable

Four minutes before the competition, the Power Rune is unavailable and stands still as shown below:



Figure 6-19 Power Rune is Unavailable

2. Available

After four minutes of the start, the Power Rune begins to rotate. When the red team robot reaches the red team's Bridge Top Platform and stays for 3 seconds (which means the robot enters into the green frame of the Bridge Top Platform (see [Figure 6-4](#)). The robot's RFID Interaction Module detects the RFID Interaction Module card within the Bridge Top Platform and prompts on the client), the Power Rune will illuminate one of the five Armor Modules randomly, and the center axis of the bracket will have an arrow-shaped light flow effect as shown below. At this moment, the Power Rune is available.



Figure 6-20 Power Rune is Available

3. Activating

When the Power Rune is available, if a projectile hits the illuminated armor module within 2.5 seconds, the bracket will be fully illuminated. At the same time, the Power Rune will randomly illuminate one of the

remaining four Armor Modules, and so on. At this moment, the Power Rune is activating.

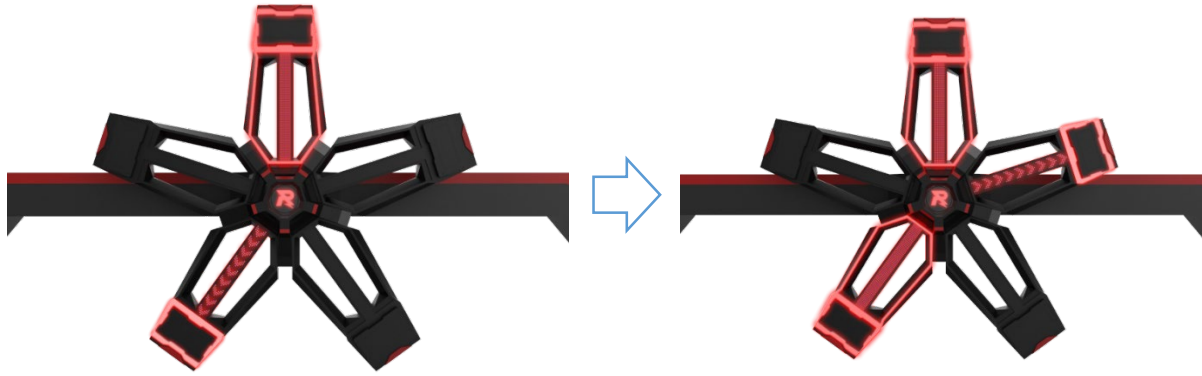


Figure 6-21 Power Rune is Activating

4. Activated

If all five Armor Modules are illuminated, the Power Rune is activated.



Figure 6-22 Power Rune is Activated

5. Activation Failed

In the activation process, if the randomly illuminated Armor Module is not hit within 2.5 seconds, the activation fails, and the Power Rune will return to the unavailable status.

6.3.2 Rules

6.3.2.1 Challenge Rule

Standard is pre-loaded with fifty 17 mm projectiles. In the three-minute round, Standard starts from Zone A and pass Zone A, B and C in the Battlefield before arriving at Zone D on the Bridge to fire at the Power Rune (the blue frame area as shown in [Figure 6-16](#)). When firing the Power Rune, the RFID Interaction Module will detect the corresponding card. Standard can try to activate the Power Rune at Zone D for multiple times. The round ends once the Power Rune is activated completely. The specific motion trajectory is undefined, but the above process must be completed in order.

6.3.2.2 Scoring Rule

Record the time when each challenge is completed. If Standard fails to activate the Power Rune when the three-minute countdown ends, the team loses the challenge.

6.3.2.3 Ranking Rule

Below is the team ranking rule in Standard Racing and Smart Firing:

1. Each team can initiate three challenges and take the shortest time used as the final score. The team that spends the least amount of time to finish the challenge ranks the highest.
2. If the time to finish the challenge is the same, the teams will be ranked based on the remaining HP values of their robots.
3. If the time and the remaining HP values are the same, the teams will be ranked based on the weight of their robots, with the lighter ranking higher.

6.3.2.4 Eligibility

Standard must successfully activate the Power Rune at least once.

6.4 Standard Confrontation

6.4.1 Participant

Participants qualify for Standard Confrontation are as follows:

- Teams that have made it into the (Chinese) Regional Competition for the first time in the RoboMaster 2018 Season.
- Teams that have never obtained the entry qualification for the (Chinese) Regional Competition before the RoboMaster 2019 Season.

6.4.2 Battlefield

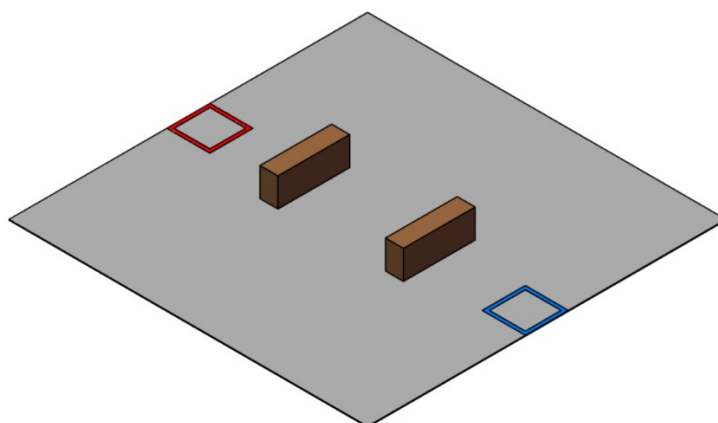
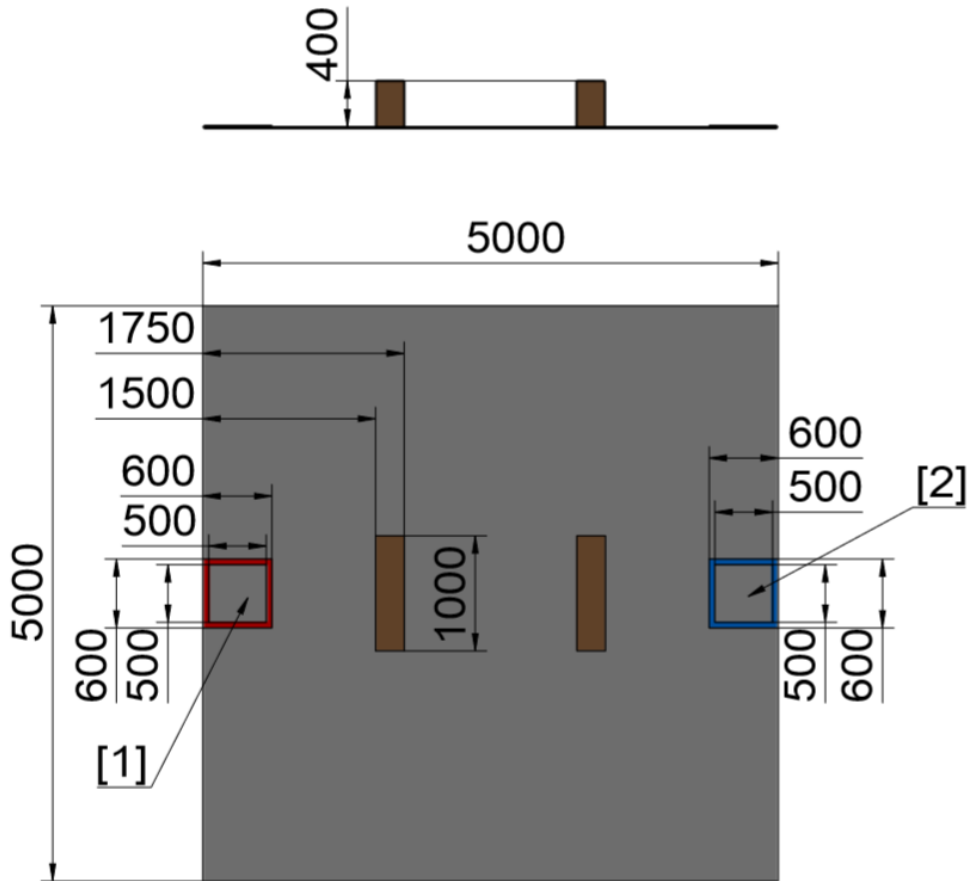


Figure 6-23 Standard Confrontation Axonometric Drawing



[1] Red Team Area [2] Blue Team Area

Figure 6-24 Standard Confrontation Top View

6.4.3 Rules

6.4.3.1 Challenge Rule

Standard is pre-loaded with 150 17 mm projectiles. In a two-minute round, Standard from both sides proceed with a 1v1 confrontation on the Battlefield and fire at the opponent's Armor Modules.

6.4.3.2 Criteria Required to Win

1. Robot attacks the opponent's armor modules until its HP drops to zero.
2. If the countdown of the two-minute round ends with the HP values of both teams greater than zero, the team with the higher remaining HP wins.
3. If the countdown of the two-minute round ends with the HP values of both teams greater than zero, and the remaining HP of both team is the same, then the team with the lighter robot wins.

6.4.3.3 Eligibility

Standard must have the ability to attack and move.

6.4.3.4 Collision and Getting Stuck Together

6.4.3.4.1 Collision

Collision refers to an occasion during a match when two team's robots collide with each other because of poor control by their operators. A robot may not use any of its structures to collide with the enemy's robots, regardless of whether the opposing robots have already been defeated. When a Battlefield component leaves the ground of the Battlefield and connects with a robot, it is considered part of the robot.

Teams can fire projectiles that meet the firing speed requirements at any part of the opposing team's ground robots. If the attack causes bending to any mechanical structure, damage of the VTM or circuit of the robot, this will be considered incidental damage and is not seen as basis for collisions or other types of penalties. However, if the Referee System module is damaged by projectile, technicians will provide backup modules.

Referees will decide the penalty as shown below for the culprit of such an occasion based on the actual contact that takes place and the impact the crash has on the match.

Violations and Penalties:

- If a robot intentionally touches and crashes into the opposing team's robot, the Referee will consider it plain collision and issue a Level 1 Warning.
- If a robot intentionally and rapidly crashes into the opposing team's robot or pushes the opposing team's robot to move, affecting its normal movement, the referee will consider it violent collision and issue a Level 2 Warning.
- If a robot intentionally and rapidly crashes into the opposing team's robot, pushes the opposing team's robot to move for a long distance or affects its normal movement for a long time, the referee will consider it violent collision and issue a Level 3 Warning.
- If a robot intentionally, directly, rapidly, and repeatedly crashes into the opposing team's robot or a robot intentionally crashes into the opposing team's robot and knocks it a far distance, affecting its normal movement, the referee will consider it severe and violent collision and issue a Level 4 Warning. The actual situation is determined by the Head Referee and Chief Referee.

6.4.3.4.2 Getting Stuck Together

Getting stuck refers to an occasion in a match when one team's robot cannot avoid the other team's robot. When two robots get stuck together during a match, the Referee will notify the two Operators to take appropriate actions to detach the robots. The two Operators must cooperate with the Referee's instructions and perform the requested operations. A robot must not get stuck together with any other robot due to active interference, blocking or collision.

Referees will decide the penalty as shown below for the culprit based on the actual contact that takes place and the impact the crash has on the match.

Violations and Penalties:

- If any part of a robot gets stuck together with any part of the opposing team’s robot due to interference, blocking or collisions for T second(s), affecting the normal movement of the opposing robot, the Referee will issue a Level X Warning.

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

- If any part of a robot gets stuck together with any part of the opposing team’s robot due to interference, blocking or collisions for a long period (longer than 60s), affecting the normal movement of the robot, and causing severe damage to the structure of the robot, or if an ejected robot remains sticking together with any part of the opposing team’s robot, affecting the normal movement of the robot, the Referee will issue a Level 5 Warning. The actual situation is determined by the Head Referee and Chief Referee.

If a robot gets stuck to a defeated robot, the Referee will issue a Level 1 to Level 4 Warning according to the above penalty criteria.

7. Competition Procedure and Rules

The RoboMaster Technical Challenge consists of the Reigional Competition and Final Tournament. This chapter mainly covers the core competition procedures and penalty explanations for the RoboMaster Technical Challenge. During the RoboMaster 2019 Technical Challenge, the team should follow the arrangements and guidelines of the RMOC staff and abide by relevant regulations of each region to ensure the competition can proceed smoothly.

During the official matches of RM2019 Technical Challenge, each team will prepare for the matches in the Preparation Area, arrive at the Inspection Area for the pre-match inspection, wait in the Staging Area, and finally enter the Competition Area to compete. Each team is required to leave the Competition Area and return to the Preparation Area after each match.

All team members can enter the Preparation Area, but only Pit Crew can involve in process of inspection, staging and entering into the Competition Area. The number of Pit Crew should meet the requirements stated in [Table 3-2](#).



Specific locations of these areas and way of arrival will be introduced in the Participant's Manual published later in the Season.

The procedure of a single match is shown below:

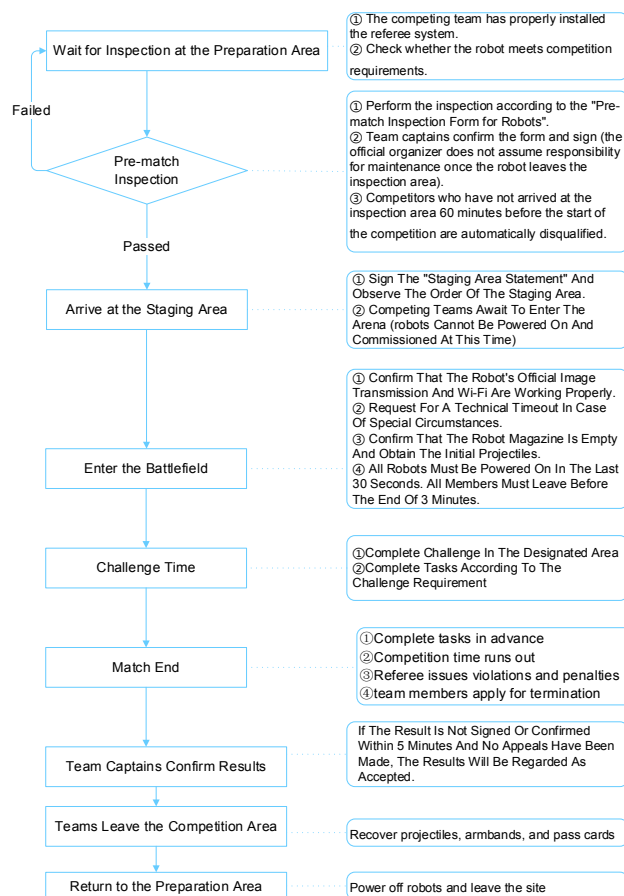


Figure 7-1 Procedure of A Single Match

7.1 Duty of Event Staff

Teams will be guided by volunteers and staff members throughout the competition. Apart from volunteers and general staff members, teams will also come into contact with the following event staff from the RMOC:

Table 7-1 Duty of Event Staff

Role	Duty
Head Inspector	Oversees all pre-match inspections and has the final decision on whether a team passes the pre-match inspection.
Inspector	Assists with pre-match inspections but does not get involved in or assist any team with the maintenance of robots in any way.
Chief Referee	Has the final decision and right of interpretation regarding competition rules. During the competition, Chief Referee issues severe violations and penalties (disqualification), accepts appeals after the match, and has the right to impose additional penalties before and after the competition.
Head Referee	In charge of the execution of Referees' decisions, controls the competition process, executes Official Technical Timeouts, receives and confirms Team Technical Timeout and ensures the validity of match results. During the match, Head Referee receives information from Side Referees and Operator Room Referees, and confirms and executes Level 1-5 Warnings for violations.
Side Referee	Executes competition procedures, guides team members to enter and exit the Battlefield, reports a robot's violation to the Head Referee during matches. Side Referee also receives applications of Team Technical Timeout and reports to the Head Referee for confirmation.
Operator Room Referee	Executes competition procedures, guides participants to enter and exit the Operator Room, reports Operator's violations and Technical Timeout to the Head Referee, assists operators in solving technical problems of the Operator Room's equipment, can apply for Official Technical Timeout, but does not assist participants in repairing their equipment.
Technician	Maintains components of the Battlefield, assists participants in solving technical problems with the Referee System during the setup period, can apply for Official Technical Timeout, but does not assist participants in repairing and maintaining their robots.

During the competition, the Chief Referee has the final right of interpretation regarding competition rules. Any questions related to competition rules can only be consulted with the Chief Referee.

7.2 Pre-match Procedure

7.2.1 Inspection Specification

To ensure that robots meet the required specifications, each team must undergo the pre-match inspection in the Inspection Area. For requirements of pre-match inspection, please refer to .

Teams must follow inspection specifications and if violating, they will get the following penalties:

Table 7-2 Inspection Specification and Violations and Penalties

Inspection Specification	Violations and Penalties
<p>Each team must reach the Inspection Area to start the pre-match inspection at least 60 minutes before the match begins.</p>	<p>Except for emergencies, teams that fail to reach the Inspection Area within the specified time will lose the match. The actual situation is determined by the Head Inspector and Chief Referee.</p>
<p>A maximum of 14 team members can enter the Inspection Area. Standard must be brought into the Inspection Area by one team member while Sentry, Aerial, Hero, and Engineer be brought by two members. 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 enter the Inspection Area.</p>	<p>Extra team members or those who do not participate in the pre-match inspection must leave the Inspection Area.</p>
<p>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 Competition Area. Teams need to modify their robots that fail the inspection in a designated area or the Preparation Area until the inspection requirements are met.</p>	<p>Robots without a Pass Card cannot enter the Staging Area and Competition Area.</p>
<p>Required robots must pass the inspection to be qualified for the round. When the inspection is complete, the team Captain must sign the Inspection Form to confirm that they agree with the inspection results. (see Table 3-2)</p>	<ul style="list-style-type: none"> ● If any required robot fails the pre-match inspection, the team is deemed as give up its qualification for the round of the match and lose the match.

Inspection Specification	Violations and Penalties
	<ul style="list-style-type: none"> After the team Captain signs for confirmation, no objection may be raised to the results of the inspection. Teams will be deemed as cheating if any robot that fails the pre-match inspection is found inside the Competition Area. Any round attended by the above-mentioned robot will be directly recorded as failed. The actual situation is determined by the Head Referee and Chief Referee.

7.2.2 Staging Area Specification

When the pre-match inspection is complete, the teams must arrive at the Staging Area at least 15 minutes before their match begins. All robots and team members must be re-checked at the Staging Area.

Teams must follow Staging Area specifications and if violating, they will get the following penalties:

Table 7-3 Staging Area Specification and Violations and Penalties

Staging Area Specification	Violations and Penalties
Team Captain must sign a Staging Area Statement five minutes before every match begins to confirm that the team is able to compete.	Except for emergencies, if the team Captain fails to sign the Staging Area Statement five minutes before the match, then the team will be disqualified and automatically lose the match. The actual situation is determined by staff of the Staging Area and the Chief Referee.
All robots in the Staging Area must pass the pre-match inspection and have a Pass Card placed on them.	Robots without a Pass Card will be denied entry to the Competition Area.
The total number of Pit Crew per team should meet the requirement.	Extra Pit Crew will be asked to leave the Staging Area.

Staging Area Specification	Violations and Penalties
<p>Robots cannot be powered on to be adjusted or maintained in the Staging Area. If robots require maintenance after entering the Staging Area, the team must first inform staff of the Staging Area. Only when the Pass Card on the robot be removed and the signed Staging Area Statement become invalid can the robot that needs maintenance return to the Maintenance Area. When the maintenance is finished, the team must bring their robots back to the Inspection Area for re-inspection. After passing the re-inspection, the team returns to the Staging Area and the Captain resigns the Statement. If a delay results in the failure to sign the Statement on time, the robot cannot play, and the team is held responsible.</p>	<ul style="list-style-type: none"> ● The first time a team powers on his robots will receive a verbal warning from Staging Area staff. If three warnings are not heeded, the team will lose the round. The actual situation is determined by the Staging Area staff and the Chief Referee. ● After the robots or the participating team members leave the staging area without authorization, the robot or the participating team member will be prohibited from entering the competition area during this game.

7.3 Match Procedure

Since the RM2019 Competition has a tight schedule and any delay or accident will have a negative impact on our teams and a million audience. To ensure the normal proceeding, all participants must adhere to the pre-arranged schedules, instructions, and guidelines provided by the RMOC event staff, referees and volunteers, and abide by the rules and regulations as outlined in the Rules Manual.

Before each game starts, the team members will have a certain amount of time to prepare, which is called “Pre-match Preparation Time”. During the Pre-match Preparation Time, the Pit Crew can enter the Battlefield to pre-load projectiles for the robot and prepare for the competition. By the end of the preparation time, all Pit Crew will be required to leave the Battlefield, and operators should be ready in the Operator Room. At this point, the referee will start the countdown, and the robot can leave the Starting Zone.

Violations and Penalties:

Only after all team members leave the Battlefield can the robot leave the Starting Zone; otherwise it will be regarded as “false start”. If a team jumps the gun for the first time in a challenge, the referee will instruct the Operator to return to the Starting Zone to restart the challenge. If the team has another false start, the referee will cancel the scores and give zero point to the offending team for this challenge.

During the game, the Operator must control the robot to complete the challenge in the Operator Room. The Operator must stand with his or her back towards the Competition Area. The competition will be carried out in the first person perspective of the robot.



The extra preparation time caused by delay of official Video Transmission Module will not be included in the preparation time of the team. After the preparation time is over, field technicians will assist in solving the problem with the official video transmission until it is recovered.

7.3.1 Official Technical Timeout

During the Setup Period, if the Referee System, Operator equipment or other modules related to the Referee System fails to work properly, the Head Referee can announce an Official Technical Timeout and suspend the setup countdown.

Table 7-4 Malfunctions

Rule	Description
1	Official equipment inside the Operator Room malfunctions.
2	During the Setup Period of the first round, the Referee System module on the robot fails. For example, the robot cannot normally transfer the image back to the Operator Room, or connect to the Referee System server.
3	Structural damage or malfunction of key Battlefield Components (Base cannot normally open shield, Base armor module shifts, drops or cannot detect hit damage, Power Rune cannot be triggered by normal hit, Aerial Safety Rope breaks or is worn out, and Projectile Supplier cannot provide projectiles, etc.)
4	Any other situations requiring an Official Technical Timeout determined by the Head Referee.

Teams should follow specifications as shown below:

- An Official Technical Timeout may only be implemented after an Operator Room Technician or Field Technician reports to the Head Referee. Pit Crew cannot request an Official Technical Timeout.
- If Rule 2 occurs during the Setup Period of the second round or later rounds, the damage will be considered incidental and an Official Technical Timeout will not be permitted. In these situations, it is too hard to determine whether the malfunctions were caused by the Referee System modules, a failure in the robot's mechanical or electrical system design, or operational mistakes made in previous matches. However, a Field Technician will provide backup Referee System modules, and the team can request a Team Technical Timeout to repair their robots.
- During an Official Technical Timeout, the team members can only cooperate with the technicians to eliminate the faults of the relevant referee system modules and cannot repair other faults. They must leave the Battlefield when the Referee System has been repaired.

7.3.2 Exception Handling

Below are exceptions and the corresponding handlings:

- If a robot breaks down after the pre-match inspection, it will be deemed as incidental damage and the competition continues. If a robot has been damaged in the first round of the match and there are safety risks like short circuit, it needs to be powered off immediately and leaves the Competition Area to avoid affecting the normal progress of the competition. The actual situation is determined by the Head Referee.
- When severe safety risks and exception of robots arise on the Battlefield (battery explosion, Aerial flying towards the Audience Area due to broken Aerial Safety Rope, stadium power outage, explosion of a compressed gas cylinder, or interpersonal conflict), the Head Referee will notify both teams through the Operator Room Referees after discovering and confirming the emergency, and slay all robots through the Referee System. The result of the round will be invalid. When safety risks or exception is eliminated, the round will restart.
- If there is a problem affecting the fairness of the competition between two parties during the competition, the referee will judge the treatment according to the actual situation.
- If the general Battlefield Components are damaged during a match (damage to the ground rubber, ground lighting, or Base lighting), the match will proceed normally. If there is structural damage or malfunction of key Battlefield Components (Base cannot normally open shield, Base armor module shifts, drops or cannot detect hit damage, Power Rune cannot be triggered by normal hit, Aerial safety rope breaks or is worn out), the Head Referee will notify both teams through the Operator Room Referees after discovering and confirming the emergency, and slay all robots through the Referee System. The result of the round will be invalid. The field technicians will enter the Battlefield to repair, and once the Components function normally, there will be a replay.
- If some Battlefield Components have logistic problem that is not caused by participants in the process of the match (hit Power Rune but HP gain is not triggered), the Head Referee will manually solve the problem through the Referee System. If the problem cannot be solved manually is confirmed cannot be eliminated, the Head Referee will announce to the Pit Crew on both teams that the Referee System will slay all robots. The round ends immediately, the result will be invalid. When problems are solved, there will be a replay.



This process may cause delays, and the RMOC will not be held responsible for the impact of these delays.

- During a match, if there is structural damage or malfunction of key Battlefield Components that affects the fairness of the match and the Head Referee did not confirm and end the game in time, leading to the situation that a game that should have ended continues to proceed and has victory,

the result of the round is deemed invalid once confirmed by the Chief Referee, and there will be one rematch.

- If there is a serious violation that obviously deserves a Level 5 Warning but the Head Referee did not confirm and execute in time, the result of the game will be invalid and a Level 5 Warning will be appended to the violating team once confirmed by the Chief Referee or through investigation after the match.

7.3.3 Severe Violation and Cheating

To ensure fairness and proper regulation of the competition, any cheating, violation or severe violation (as shown in [Table 7-5](#), [Table 7-6](#) and [Table 7-7](#)) by an individual or a team will lead to termination of the competition. The team will be prohibited from participating in the RM2019 Season and receiving any awards. The results of any match participated in by this team are documented for their opponents' reference.

Table 7-5 Violation

Rule	Violation
1	The robot has a tendency for malfunction or has already showed malfunctions (colliding with the side of the Competition Area at high speeds or damaging the Competition Area).
2	The team members enter the Competition Area without permission during the competition.
3	The robot leaves the Starting Zone before the team members leave the Battlefield.
4	The robots or team members commit cheating or severe violation.

Table 7-6 Severe Violation

Rule	Severe Violation
1	Violate rules mentioned in this document but refuse to accept penalties, for example ejected Pit Crew do not leave the Competition Area, intervene with the Referee, etc.
2	Refuse to leave the Competition Area immediately after the match ends, affecting the match process
3	Install explosives or other prohibited materials on robots
4	Team members use robots to crash into or attack people, creating safety risks
5	Team members purposely damage the opponent's robots, Battlefield Components and other related equipment
6	Team members engage in a physical confrontation with the Referee, their opponents, or the audience

Rule	Severe Violation
7	Team members do not cooperate when the RMOC is hearing an appeal
8	Other severe actions that go against the guidelines and spirits of the competition, and the penalties will be determined by the Head Referee and 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 RMOC will fully cooperate with the relevant authorities to pursue appropriate legal action against the offender

Table 7-7 Cheating

条例	作弊类型
1	Change or damage the Referee System, or affect any measuring function of the Referee System through technical tricks
2	A robot's behavior is different from that exhibited during the pre-match inspection, such as change in size and the installation of the Referee System
3	Operator is not team member and robot is not made by the team
4	Use unofficial projectiles
5	Other behavior that violates the game spirit or is determined to be cheating by the Chief Referee

7.4 Post-Match Procedure

Members from both teams must power off all their robots and remove them from the Competition Area when the match is over. Teams are required to empty all projectiles from the robots in the Competition Area and then return to the Preparation Area.

Violations and Penalties:

Once the match is over, if a robot has not emptied its projectiles, the robot should empty its projectiles in the Competition Area.

7.4.1 Results Confirmation

For every match, the Head Referee will record penalties in each challenge as well as scores and time used at the end of each match on the post-match results confirmation form. The Captain needs to confirm the results in the referee area within five minutes after the end of each match. If the team Captain fails to sign for results confirmation at the referee area within 5 minutes and does not file an appeal, it will be regarded that results of the match are accepted by default. Once the Captain signs for results confirmation, he or she can no longer file an appeal.

7.4.2 Appeal

Every team has the right to appeal during each Regional Competition and the Final Tournament. However, appeals cannot be accumulated across competitions. If an appeal is successful, the appeal right reserves; otherwise, one appeal right is consumed. When all rights are exhausted, the RMOC will not accept any appeal from the team. When processing an appeal, an Arbitration Commission, which is made up of Chief Referee and heads of the RMOC, will be formed. The Arbitration Commission makes the final decision on all appeals.

If the result of an appeal is “Result Determined by a Rematch”, both teams can appeal again after the rematch. 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 right regardless of the appeal results. Due to potential delays to the competition schedule, this “continued appeal” must be initiated by both the Captain and Supervisor within five minutes after the match ends (both sign on the Appeal Form at the same time). The appeal process for a “continued appeal” is also simplified. The time for the submission of evidence and materials being shortened to within 30 minutes of the appeal. The RMOC will announce the result of the appeal in the Appeal Form within 60 minutes of the continued appeal.

7.4.2.1 Appeal Process

Teams that filing an appel need to follow procedures as shown below:

1. Within five minutes after the challenge ends, the Captain submits an appeal to the Chief Referee in the Referee Area and signs an Appeal Form. After five minutes of the end, any appeal will be deemed invalid. No appeal can be initiated before or during the match.
2. The Chief Referee checks whether the appeal can be processed.
3. If either side needs to collect evidence or defense materials for a period of one hour, the materials will need to be submitted to the Arbitration Commission, which will further communicate with the players involved in the appeal. If neither side needs to collect evidence or defense materials, go directly to the next step.
4. After the Chief Referee has accepted the appeal, Event Staff will invite Captain from both teams to meet in the Arbitration Room. If the team that made the appeal requests a robot inspection, the Arbitration Commission will transfer all robots from both teams to the Arbitration Room for immediate inspection. Each team can only send three members to the Arbitration Room, and one must be either the Captain, OPM or key member. The presence of the team Captain or the project manager is mandatory.
5. The Arbitration Commission makes a final decision. Both Captains sign the Appeal Form to confirm the decision. Once signed, both teams can no longer question the appeal result.

7.4.2.2 Appeal Validity

Teams need to file an appeal within the validity period and below are different validity periods of different stages:

- **Appeal Request:** Appeals must be made within five minutes after the end of each match and recorded on the Appeal Form. The Arbitration Commission will not accept any appeal requests that exceeds the validity period.
- **Attendance to the Arbitration Room:** Both teams must arrive at the Arbitration Room within 30 minutes after receiving a notification from the Arbitration Commission. An absent team is deemed to give up their right to an appeal and must accept any decision made by the Arbitration Commission. If more than three members of a team enter the Arbitration Room or the identity of attendees do not meet the requirements, the team is also considered to give up their right to an appeal.
- **Submission of Evidence and Materials:** A team must submit evidence and materials within 60 minutes after requesting an appeal, and the Arbitration Commission will not accept any new materials beyond this 60-minute limit.

7.4.2.3 Appeal Material

Appeal material that teams submit must follow the following specifications:

- **Types:** The Arbitration Commission only accepts materials stored on a USB drive or on a competing robot.
- **USB Drive:** The team must prepare video extracts and other document files as materials for their appeal. The RMOC will not assist in the collection of videos to maintain neutrality throughout the process.
- **Format:** Each video cannot exceed 1 minute in length 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 Word format and not exceed 1,000 words in length.
- **Name:** The name of each video and photo must not exceed 30 characters.
- **Text:** 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).
- **Evidence of Robot:** The Arbitration Commission has the authority to isolate any relevant robot from both teams after an appeal has been made. These robots will not be isolated for more than three hours and will be returned to teams when the appeal is adjudicated.

7.4.2.4 Appealing Decision

The Arbitration Commission 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 Rematch. Neither team may argue against the outcome of an appeal.

If the Arbitration Commission requests both teams to have a rematch, they will inform both teams of the time of this rematch. If both teams refuse to have a rematch, this appeal is discarded and both teams retain their right to appeal. A team that refuses a rematch is considered to have forfeited the match and lost.

Appendix 1 Safety Instruction

Every team and all its members must fully understand and accept that safety is of paramount importance when competing at the RoboMaster 2019 Robotics 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 2019 Robotics 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 2019 Robotics 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 their teammates, members of the opposing team, referees, event staff, 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 agree to cooperate fully with the pre-inspection 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, training as well as competition stage of the event, all team members must pay full attention to potential safety issues, and the team's Advisor must be responsible for instructing and supervising the team on safety issues.
6. The team must guarantee the safety of all robots. This includes ensuring the projectile launcher installed on the robots is safe, and that the projectiles will not cause any harm either directly or indirectly to any operator, referee, event staff or audience.
7. The team will take sufficient and necessary safety measures during R&D, training, and competition stage of the event regarding any hazardous situations that may occur. This includes but is not limited to: preventing the control system 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 and making sure that one or more people have been appointed as an emergency responder; wearing goggles and helmets; properly applying the lock function in the robot control system before engaging in debugging or adjustments; and equipping 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 robot breaking down, drone 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.
10. All team members must remain in strict compliance with the laws and regulations of the country or region. All team members must also pledge that their robots will only be used for the RoboMaster competitions and that their robots will not be illegally modified or used for any illicit purpose(s).

Appendix 2 Definition of RoboMaster Terminology

Type	Term	Definition
Competition Name	Chinese Regional Competition	The actual number of participants in the Mainland China teams and the regional distribution will determine the city the qualifiers will be held in. The results of the competition will determine the teams that advance to the RoboMaster 2019 Final Tournament.
	Final Tournament	A week-long tournament for teams from Mainland China that win the grand prize and first prize of the Chinese Regional Competition and teams from Hong Kong, Macau, Taiwan and Overseas to determine the final champion of RoboMaster 2019.
Robot Type	Hero	The main robot of the competition.
	Standard	Required robots with multiple uses throughout the competition.
	Engineer	A robot built to provide assistance throughout the competition.
Staff Duty	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.
	Captain	A student leader of the team to direct all technological and strategic aspects. Also serves as the team's contact person for the RMOC.
	Organizational Project Manager	Oversees the RoboMaster project by managing project schedules, budgets, and personal safety.
	Team Member	Includes technical group, operations group, and operator group. The technical group is split into electronic (embedded system), algorithm (visual), mechanical, and hardware.

Type	Term	Definition
	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 Area and Competition Area.
	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 the pre-match inspection
	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.
	Operator Room Referee	Executes competition procedures and penalties from their position in the Operator Room.
	Technician	Consists of Site Technician and Operator Room Technician. Site Technician refers to event staff who maintains components of the Battlefield and solves technical problems of referee system. Operator Room Technician refers to event staff who assists operators in solving technical problems of the Operator Room's equipment.
	Safety Supervisor	In charge of the site safety
Technical Assessment	Final Robot Assessment Video	A comprehensive look at whether the team's robots meet all the minimum specifications required to show readiness for the competition.

Type	Term	Definition
	Referee System Exam	A test based on the RoboMaster 2019 Robotics Competition Referee System Specification Manual to check understanding of the ability to install and use the Referee System.
Participating Team	Team from Mainland China	A team that is qualified to participate in the competition after passing the registration and technical evaluations within the specified time. The team is typically from Mainland China.
	Team from Hong Kong, Macau, Taiwan and Overseas	A team that received an invitation from the RMOC and qualified for the competition by successfully passing the registration and technical evaluations. The team is typically from universities outside of Mainland China.
	Chinese and Foreign Joint Team	A team that is qualified to participate in the competition after passing the registration and technical evaluations within the specified time. The team is typically from universities cooperatively-run by Mainland China and outside of Mainland China.
Technical Specification	Working Gas 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 Equipment	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	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.
	Maximum HP	The maximum HP available for each robot.
	HP Deduction	Damage caused by enemy projectiles that hit a robot's armor modules and base. HP deduction as the result of a penalty given by a referee is also included.

Type	Term	Definition
	Net Base HP	The difference between the remaining HP of the Base of both teams.
	HP Gain	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 Module	Detects the initial speed of the projectile when it is launched by the robot's launching mechanism, and the Referee System deducts the robot's HP when the speed exceeds the limit.
	Armor Module	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 Components (such as the Revival/Recovery Zone) to activate predetermined functions.
	Positioning System Module	Obtains the location of each robot on the Battlefield.
	Main Controller Module	Monitors all referee system modules and sends the real-time status of the robot to the server.
	Power Management Module	Controls the propulsion power, detects the power consumption of the chassis, and when the HP is 0, it automatically cuts off power supply for propulsion.
	Light Indicator Module	The length of the light bar indicates the level of HP, and the color of the light bar can be used to distinguish between the red/blue sides and the status of the robot.
Functional Area	Preparation Area	Includes the Inspection Area, Maintenance Area, and a rest area.
	Staging Area	Where qualified robots and participants prepare for a match.

Type	Term	Definition
	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 and Arbitration Room.
	Competition Field (Battlefield)	The main competition site for participating robots. Includes a Starting Zone, Base Zone, Resource Islands, etc.
	Inspection Area	Where the participating robots undergo an inspection before competing.
	Maintenance Area	The only area where the robots' high-power devices can be repaired.
	Pit Area	The only area for players and robots to rest outside matches.
	Referee Area	Where the Head and Chief Referees implement competition procedures, confirm participants' performance, process appeal requests, and carry out other official duties.
	Red/Blue Operator Room	A room for robot Operators to control their robots during the competition.
	Red/Blue Pit Area	The only area where non-operating pit crew members may sit and observe matches.
	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 Component	Starting Zone	The only area where all ground robots have a pre-match preparation period. This area includes the Base Zone.
	Base Zone	Where each team's Base is located.
	Base	The area that has core tools with 2000 HP, and is the main factor that determines which team wins.

Type	Term	Definition
	Bridge Top Platform	Located at the top plane of the bridge with Perimeter Wall on both sides to prevent robots from falling off the Bridge Top Platform. Robots occupying the Bridge Top Platform can receive accelerated barrel heat cool-downs and additional defensive capabilities.
	Bridge End Platform	Located at one of the exits of the bridges. These are areas where occupying robots can get a double barrel heat cool down rate.
	Bridge	Robots can occupy higher spots on the bridges for attack advantages, including the Bridge Top Platform that has the highest point and the Bridge End Platform. The bridge connects the Base Zone on one side and the Bridge End Platform on the other.
	Resource Island	The most essential part of the Battlefield that consists of the projectile bank, Power Rune, and Assistive Column. The robot can get different quantities and different types of projectiles from the different projectile containers by ascending the Resource Island platform.
	Assistive Column	Fixed columns located on both sides of the Resource Islands. Robots can use the Assistive Columns to ascend to Resource Island and get projectiles from the projectile container.
Judging	Pre-match Preparation Period	This period provides a period of time before a challenge for teams to enter the Competition Area and test their robots and equipment.
	Match Period	A period for teams to complete the challenge on the Battlefield.
	20-Second 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.

Type	Term	Definition
	Official Technical Timeout	During the setup period of the first round, technicians can request that the Chief Referee provide a Official Technical Timeout when the Referee System or other equipment in the Operator Rooms malfunction, or functional problems occur with critical equipment in the Battlefield.
	Safety Hazard	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 preparation period to ensure that both teams have the same number of projectiles and the competition remains fair.
	Violation	If a team member violates any rule stated in the rulebook, he/she will receive different level penalties from referees.
	Level 1 Warning	The operation interface of all Operators from the violating team will be blocked for three seconds upon receiving a warning.
	Level 2 Warning	<ul style="list-style-type: none"> ● The operation interface of all Operators from the violating team will be blocked for five seconds. ● The Referee System will automatically deduct 5% of the current maximum HP from all surviving robots (except Aerial and Base) of the violating team. ● The violating robot will lose 2 points.
	Level 3 Warning	<ul style="list-style-type: none"> ● The operation interface of the violating Operator will be blocked for ten seconds and other operators on the violating team for five seconds. ● The violating robot will be deducted 50% of its current maximum HP and other surviving robots (except Aerial and Base) 5% of their current maximum HP. ● The violating robot will lose 4 points.

Type	Term	Definition
	Level 4 Warning	<ul style="list-style-type: none"> ● Ejected violating robots: In the round of the match, ground robots and Sentry are immediately slain by the Referee System (deduct all HP). Aerial will have its Launching Mechanism (including the loading mechanism and friction wheel) powered off and its VTM disconnected and must immediately land on the Landing Pad. Robots that are ejected cannot be revived. ● Ejected Operators or other members: Members ejected by the Referee must immediately leave the Competition Area and no substitute Operator or Pit Crew Member is allowed for the remaining rounds of the match. The robot operated by the ejected Operator will be ejected at the start of all rounds of the current match. The amount of HP deducted from the ejection will be counted towards the other team's HP Deduction.
	Level 5 Warning	<ul style="list-style-type: none"> ● If a Loss is issued before the match (not including the Three-Minute Setup Period) and the match has not yet started, the Pit Crew of the offending party must all leave the Competition Area. The Base HP and all robots' HP of the losing team are set to zero, while the opposing team's Base HP and robots' HP remain their maximum. ● If a Loss is issued during a match (including the three-minute setup period), the Head Referee directly slays all robots of the offending team via the Referee System, and the round is over. The Base HP and all robots' HP of the losing team is set to zero, while the opposing team's Base HP and robots' HP remain at the amount when the round ends. At this point, Pit Crew of both sides must listen to the Referee's instruction to power off and move robots off the Battlefield. ● If a Lose is issued after the round due to an appeal, the Base HP value and all robots' HP of the losing team is set to zero, and the opposing team's Base HP and robots' HP remain at the amount when the round ends.

Type	Term	Definition
	Collision	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.
	Getting Stuck Together	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 based on the actual contact that takes place and the impact the crash has on the match.
	Operator Desertion	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.
	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 teams hold different opinions regarding the results of a game, they can request for an appeal from the competition's RoboMaster Organizing Committee 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.

Type	Term	Definition
	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 Specification



Teams that pass the Technical Assessment of the RoboMaster 2019 Robotics Competition are considered to have directly passed the Technical Assessment of the RoboMaster 2019 Technical Challenge and do not need to submit repeatedly.

All teams that compete in the RoboMaster 2019 Robotics Competition must complete a Technical Assessment in accordance with the requirements of the RoboMaster Organizing Committee and within the time specified. For the schedule of the RoboMaster 2019 Robotics Competition Technical Assessment, please refer to [1.1 Season Schedule](#).

The purpose of the Technical Assessment is to demonstrate the technical skills of a team, better prepare the team for the competition, and help in the future development. During the Technical Assessment, the RMOC 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 RMOC does not accept Technical Assessment that is overly rigid or contains inaccuracies.

Technical Assessment will be graded according to certain requirements and the grade will be displayed in the registration system. The following shows the relation between scores and grades:

Table 7-8 Rating System

Score	Grade
$90 \leq X \leq 100$	A
$75 \leq X < 90$	B
$60 \leq X < 75$	C
$45 \leq X < 60$	D
$30 \leq X < 45$	E
$0 \leq X < 30$	F

Technical Assessment Task and Requirement



In RoboMaster 2019 Technical Challenge, there are two Technical Assessment tasks in total: Final Robot Assessment Video and Referee System Exam and Season Summary. Teams must complete the Technical Assessment task of corresponding stage before qualifying for further Assessment, Regional Competition and Final Tournament.

1. Final Robot Assessment Video

- Submission Format: Video
- Basic Requirement: Hero and Standard are required and other robots are optional.

- Submission Method: Upload the video to Youku, set an access password, and submit the video URL and password to the registration system.
- The video standard and submission opportunity are the same with the Mid-term Robot Assessment Video.
- Assessment Requirement: Different items have different requirements and scores. The following are the specific requirements for each item:

Table 7-9 Final Robot Assessment Video Evaluation Requirement

Challenge	Display Content	Criteria for pass
Hero Remote Firing	<ul style="list-style-type: none"> ● Launch 20 shoots of 40 mm projectiles successively to targets one, three, and five meters away and calculate the hit rate <hr/>  Human assistance is not allowed. <hr/> <ul style="list-style-type: none"> ● Climb a 15-degree slope and display the power consumption data in real time ● A place reserved to install the Referee System 	<ul style="list-style-type: none"> ● Can attack ● The power consumption should not exceed the limit during display ● Equipped with a protective case, presentable appearance and no bare wires ● The Referee System installation positions meet the requirements
Standard Racing and Smart Firing	<ul style="list-style-type: none"> ● Complete movement ● Launch 50 shoots of 17 mm projectiles successively to targets one, three, and five meters away and calculate the hit rate <hr/>  Human assistance is not allowed. <hr/> <ul style="list-style-type: none"> ● Climb a 15-degree slope and display the power consumption data in real time ● A place reserved to install the Referee System 	
Standard Confrontation	<ul style="list-style-type: none"> ● Climb a 15-degree slope and display the power consumption data in real time ● A place reserved to install the Referee System 	

Challenge	Display Content	Criteria for pass
Engineer Island Climbing and Projectile Obtaining	<ul style="list-style-type: none"> ● Complete movement ● Obtain projectiles ● A place reserved to install the Referee System 	<ul style="list-style-type: none"> ● Can obtain projectiles ● The Referee System installation positions meet the requirements

2. Referee System Exam

- Exam content: Multiple-choice questions randomly selected from the RoboMaster database.
- Exam form: Full mark is 100. The cut-off score is 90.
- If the pass requirements have not been met within the valid time of the evaluation, repeat the completion of questions. Once several requirements are met, then it will immediately pass the review. The minimum interval between the start of the two questions is 20 minutes.
- The result of the exam is based on the last submission within the effective exam period.

Appendix 4 RM Online Product Education Discount

Product	Standard	Hero	Engineer	Discount
Development Board Type A	1	1	1	40% Off
Development Board Cables Package	1	1	1	
M3508 P19 Brushless DC Gear Motor	4	4	4	
C620 Brushless Motor ESC	4	4	4	
M3508 Accessories Package	1	1	1	
M2006 P36 Brushless DC Gear Motor	1	1	1	
C610 Brushless Motor ESC	1	1	1	
TB47D Battery	1	2	2	
6020 Gimbal Motor	2	2	-	

Appendix 5 Pre-match Inspection Form

Category	Inspection Item	Description
Robot Size & Mass	Initial Size(length * width * height)	<ul style="list-style-type: none"> ● Standard: 600 * 600 * 500 mm ● Hero: 800 * 800 * 800 mm ● Engineer: 800 * 800 * 800 mm
	Expansion Size (length * width * height)	<ul style="list-style-type: none"> ● Standard: 700 * 700 * 600 mm ● Hero: 1200 * 1200 * 1200 mm ● Engineer: 1200 * 1200 * 1200 mm
	Mass	<ul style="list-style-type: none"> ● Standard: 20 kg (subtract the 3.7 kg of the Referee System) ● Hero: 35 kg (subtract the 5.0 kg of the Referee System) ● Engineer: 35 kg (subtract the 2.6 kg of the Referee System)
Robot Module	Referee System Completeness	The Referee System modules should be complete (intact) and unmodified.
	Armor Module	<ul style="list-style-type: none"> ● Only official mounts are allowed. They must not be modified or damaged. ● The imaginary connection lines between the X-axis armor plates and Y-axis armor plates respectively should be perpendicular to each other and intersect the geometric center of a robot. X-axis and Y-axis armor modules allow a ± 50 mm deviation from the geometric center. ● The weight-bearing surface and the armor plate mount must be firmly and rigidly connected, and the two screws of each mount must be installed. ● The infinitely extended range of the lower edge 105° of Armor Module must not be covered and HP can be deducted normally. The service life of Armor Module is normal and sensors work well. Atmost one Armor Module of Engineer is allowed to be covered beyond 150 mm. ● The top Armor Support Frame coupled with the front Armor Support Frame, and the impact surface top armor is angled at 15° to the horizontal plane. Any obstruction to the orthographic projection area of the Top Armor attack surface

Category	Inspection Item	Description
		<p>must not exceed 110 mm * 63 mm or the projection area should not exceed 3500 mm² for Standard and 120 mm * 74 mm for Hero or the projection area should not exceed 4500 mm².</p> <ul style="list-style-type: none"> ● The height of the lower edge of the armor before and after transformation must fall within 60-150 mm for Standard Robots, 60-400 mm for Engineers, and 60-200 mm for Hero. ● For Hero and Engineer, the height difference between the lower edge of any two Armor Modules must not exceed 100 mm. ● The projected vectors of the normal vectors of the armor module's stress-bearing surface on the XY plane must be equal to the positive/negative X axis and Y axis in the body coordinate system, respectively. ● The robot armor sticker must be consistent with the robot number with no obvious bubbles. Only one sticker can be attached to one piece of armor. ● Any Armor Module should not actively move relative to the robot body's center of mass. For Hero, the relative position between the geometric center point of the four Side Armor Modules and the horizontal plane of the center axis of the barrel of any horizontal Launching Mechanism cannot be changed during the competition.
	Power Inspection	<ul style="list-style-type: none"> ● The power curve should be normal. ● A chassis should stop moving after its power is cut off. ● Standard or Hero faces and abuts the vertical rigid plane (such as the wall), the remote controller pushes to the maximum rod amount, the robot accelerates for 20 seconds, and there is no blood-deduction due to exceeding the limit throughout the whole process.

Category	Inspection Item	Description
	Main Controller Module	<ul style="list-style-type: none"> ● For the main control module screen, there can be no obstruction within 50 mm above the button, making it convenient for operation. ● There should be no electromagnetic device that may interfere with the Main Controller Module within 70 mm of the “RoboMaster” logo located on the module. ● The infrared receiver should not be blocked for the sake of convenience during manual connection to the server before each match. ● Ensure that the upgrade interface is accessible for wire plug-ins.
	Power Management Module	<ul style="list-style-type: none"> ● The indicators must not be blocked. ● The power module should have good heat dissipation.
	Light Indicator Module	<ul style="list-style-type: none"> ● The front main light bar and the top auxiliary light bar should be fully visible from at least one viewing angle. ● Connection wires of the left and right auxiliary light bars are parallel to the ground. ● The main light bar of Standard must be above the upper edge of the Armor Module.
	RFID Interaction Module	When the card is swiped, the RF card on the ground can be detected normally.
	Speed Monitor Module	<ul style="list-style-type: none"> ● The projectile speed and rate of fire should be displayed (each robot must be capable of shooting using a remote control for the convenience of inspection). ● Only Hero can be equipped with one 17 mm Launching Mechanism and one 42 mm Launching Mechanism. ● The area covered by any obstruction on the light bar on each side of the speed measurement module must not exceed 1/5 of the original area of the light bar.

Category	Inspection Item	Description
		<ul style="list-style-type: none"> ● There should be no large magnetic material or inducible magnetic material (e.g. iron barrel, motors, magnets) within 70 mm of the “RoboMaster” logo on the Speed Monitor Module. ● Re-calibration should be completed every time it leaves the Inspection Area. ● When the robot launches ten 17 mm projectiles or launches five 42 mm projectiles, the maximum speed difference detected by the speed measuring module shall not be more than 5 m/s.
	Positioning System Module	<ul style="list-style-type: none"> ● The Positioning System Module should be installed horizontally with its top surface facing up, the front surface should be parallel with the frontal plane of the robot. ● The above 145° range of the Positioning System Module should not be covered by conductors. Atmost 100 mm beyond one horizontal direction of Aerial is allowed to be covered. ● After connecting the Inspection Area Base, the LINK indicator should flash green, and the SYS indicator should flash red.
	Video Transmission Module	A robot should transmit pictures back normally.
Energy Source	-	<ul style="list-style-type: none"> ● Cylinder: Cylinder must have a valid conformity certificate or a steel plate. The plate should be viewable during the pre-match inspection and the certificate should be easily viewable. ● The compressed gas pressure inside the cylinder must not exceed 20 Mpa. The cylinder used should have a nominal pressure of no less than 30 MPa. The working pressure must not exceed 0.8 Mpa. A double gauge constant pressure valve should be placed at the outlet of the cylinder.

Category	Inspection Item	Description
		<ul style="list-style-type: none"> ● Working gas: Working gas must be non-flammable and non-toxic, such as air, nitrogen or carbon dioxide. ● Cylinder certification: Cylinder must be designed and manufactured for the pressure condition for usage, and certified by the officially recognized test organization of the country of origin with a valid conformity certificate. The certificate should be easily viewable. ● Pressure regulator: The constant pressure valve must be directly installed on the gas cylinder or gas tank. ● Protection measure: Gas cylinder and gas pipe must be protected to prevent damage caused by rollover, collision and rotation from any direction, and moving parts failures. The container opening shall not be exposed in order to prevent damage caused by projectiles. ● Location of gas cylinder and pipe: The gas cylinder should be installed in a way that it and the gas pipe will not touch the ground no matter how the robot rolls. ● Cylinder installation: The cylinder must be safely mounted on the frame and ensure the container opening remains either level or upward. To fix to the frame, the container must have at least two fixed points, or one fixed surface that is more than 1/5 of its length. ● Thermal insulation: The cylinder must be insulated from any possible heat sources by a barrier layer, such as a carbon fiber board or aluminum plate. ● Gas Pipes and fittings: Gas pipes and fittings must be able to handle the system's maximum possible working pressure.
Aesthetic Design	-	<ul style="list-style-type: none"> ● The lines of the robot are neat and not exposed. Exposure that is unavoidable requires line protection with materials such as drag chains and cable managers. ● There must be no materials that have an obvious influence on the appearance of the robot, such as washbasins, plastic

Category	Inspection Item	Description
		<p>bottles, corrugated paper, bed sheets, flesh-colored stockings, white foam boards, air cushion membranes, etc.</p> <ul style="list-style-type: none"> ● Fish nets should not be used as aesthetic design materials, unless necessary functional requirements exist. ● The Red team robot's protective shell color can use red series, the blue team robot can use blue series, but the opposing team's color should not be used, to avoid confusion. Except for black and metallic colors, the number of other colors must not exceed two. ● The surface glossiness of the case is required to be no more than 15 Gs. ● The robot must have two school badges or team badges from their own side (one for each perspective). The school badges or team badges must be in a prominent position across the robot. ● In a single robot advertising space, there are no more than two sponsor logos displayed and display of sponsors must be reported to the RMOC for approval.
Miscellaneous	-	<ul style="list-style-type: none"> ● Only use dry batteries such as No. 1, No. 5, and No. 7 produced by reputable manufacturers or specified by the RMOC. In the 2019 Season, battery that is specified by the RMOC is produced by DJI. ● The total battery capacity of robots not exceed 200 Wh. ● The supply voltage should not be higher than 48 V and there should be no risk of short circuiting. ● Participants are forbidden from setting up wireless networks in the relevant areas (including but not limited to the Preparation Area, Inspection Area, Staging Area, and Competition Area). ● Each Operator can use atmost one remore controller and each remote controller can only be targeted to one receiver. Only use remoter controller that is specified by the RMOC. In

Category	Inspection Item	Description
		<p>the 2019 Season, remote controller that is specified by the RMOC is produced by DJI.</p> <ul style="list-style-type: none"> ● The laser beam from the laser sight must be red and the optical power consumption of the laser beam is less than 35 mW. The projection angle of the laser sight must not exceed 5° (i.e. the diameter of the laser spot perpendicularly projected by the laser sight on a vertical wall with a horizontal distance of one meter is less than 9 cm). ● In addition to the laser sight, Engineers can be equipped with a visible light emitting device, and a fill light can be used to enhance the visual recognition feature when going to an island or acquiring a Projectile Container. Other ground robots must not be equipped with other obvious visible light emitting equipment. ● A robot should not possess any Mechanism that may damage the Battlefield. ● A robot should not possess any mechanisms that allow it to get stuck with other robots. ● Do not project light onto the armor and do not install any device that interferes with the computer vision feature identification of the Armor Module by reflecting or refracting the light on both sides of the armor on the robot.

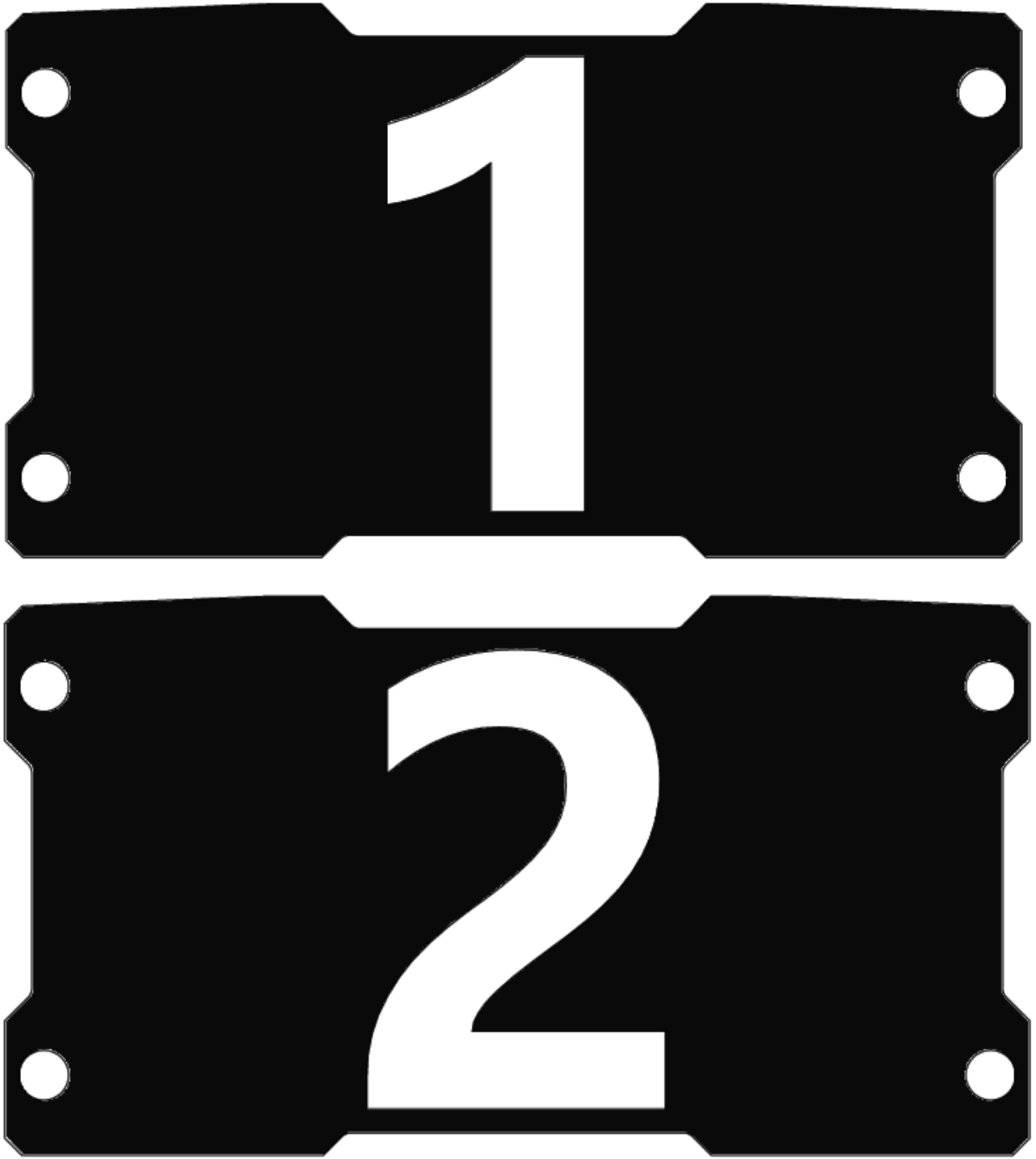
Appendix 6 Reference Drawing



















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