

Mechanical Construction Rules

Introduction: In the mechanical construction competition, each team will be ranked according to the total score and time by completing three consecutive relay tasks. The duration of the game is 6 minutes. After the start of the timing, the robot can be modified and adjusted, but the timing does not stop.

Group: \leq Grade 2

Revision v7-2025.2.17

Revision 4.4 A, d, f, g

Revision v6-2024.9.3

Revise 4.4 A and add rule i

Revise 4.4 B c to standardize the determination of invalid balls

Revision **v5-2023.8.30**

Revised 4.4 D competition format, revised to each team having 1 round of competition opportunities.

Rule revision **v4- 2023.5.30**

2 Illustration of the stage

1. The floor plan of the competition table has a fixed area for placing the ball box, and during the game, the ball box must not exceed the specified placement area.

2. Determine the size of the ball box.

Revise 3 C to clarify the minimum unit of competition equipment.

Revision 4.4 marks the area where the ball box is placed in tasks 1-3. It is not allowed to move beyond the ball box area, let alone pick up the ball box.

Revision 4.4 B Task 2 b, limited ball retrieval method, the ball can be dragged in the three hole areas. When entering the "START" area, it must cross the boundary line from the air, and then put it into the ball box placed in the fixed area and cannot be moved.

The 4.4 D competition format is revised and increased to 2 rounds of competition, determined according to the ranking rules of the 2 rounds of competition.

Rule Revision **v3-2023.3.3**

Revision 4.4 Task 1 H If there is a team that does not effectively transport the ball in Task 1, Task 1 does not transport the ball's score, but can give a ball to enter Task 2.

Revision 4.4 Task 2 B The "ball box" is fixed in the "START" area and must not be moved or picked up. Team members are allowed to make a basket structure that fits the tool holder, but the basket must not extend beyond the "START" area.

Revision 4.4 Task 2 f If there is a team that does not have a valid ball in Task 2, the valid ball in Task 2 is not scored, but a ball can be given to the "ball box" to enter Task 3.

Rule Revision **v2-2022.11.25**

Add Figure 2 3D simulation diagram of the competition platform

Rule revision **v1-2022.08.04**

The rules of the event were created

Figure 2 Top View of the Race Table

3 Competition equipment requirements

- A. There are no restrictions on equipment.
- B. The competition examines the mechanical construction ability of robots. The core power needs to be ejected by rubber bands, and the use of automatic power, such as motors, is limited.
- C. When entering the competition, you need to bring the minimum unit parts and equipment into the competition venue.
 - a The non-detachable whole is a minimum unit.
 - b Bonding and bundling cannot be used as a whole.
- D. The equipment involved in the setting of the venue is provided by the Organizing Committee, such as Task 3 "Basket", and all the competition equipment of the team should be carried by themselves.

4 Rules of the game

4.1 Robot size requirements

- A. Task 1 Robot Size Requirements:
 - a The height and weight of the robot are not limited.
 - b The length and width of the robot shall be less than the "START Area" of Task 1, and the vertical projection of the robot shall not exceed the "START Area".
 - c The robot cannot be expanded during operation.
- B. Task 2 Robot Size Requirements:
 - a. There are no restrictions on the size and weight of the robot "tool holder".
- C. Task 3 Robot Size Requirements:
 - a. The length and width of the robot shall be less than "Area B" of Task 3, and the vertical projection of the robot shall not exceed "Area B".

4.2 Robot power requirements

- A. Task 1 Robot Power Requirements:
 - a. Robots only allow rubber band power output.
- B. Task 2 Robot Power Requirements:
 - a. The power of the robot "tool clip" can only use rubber bands except for the team members.
- C. Task 3 Robot Power Requirements:
 - a. There is no limit to the way the robot throws, and the power can only be output by rubber bands.

4.3 Time limit

- A. The total time for the construction and debugging of the competition works is 80 minutes. At the end of the debugging, the participating teams are not allowed to adjust the structure. If they are found to modify the structure, they will record one violation every time they are found.
- B. Each team's competition time is limited to 6 minutes (this time is the total competition time of three tasks, three tasks are carried out continuously, and the timing does not stop). If completed ahead of schedule, the remaining time will be higher in the case of the same score.
- C. Each team has a chance to compete in one round.

4.4 Competition process and scoring instructions

Before the start of the competition, the team members can place the robots used in Task 1, Task 2 and Task 3 in the starting area of Task 1, Task 2 and Task 3 respectively.

A. Task 1:

- a. After the team members adjust the robot, they signal the referee, the referee's whistle blows, and the game begins. Before the departure of the robot, the front head of the robot and any part of the body of the participants are not allowed to enter the sliding area, otherwise one violation will be recorded.
- b. When the robot starts, only the rubber band is allowed to output power, and no external force is allowed to be applied when starting, otherwise one violation will be recorded.
- c. The robot needs to carry 20 ping-pong balls (the robot can transport 20 ping-pong balls at one time, and can also transport them for many times). The ball is transported to the 1/2/3 area by the ejection power of the rubber band. After the robot stops completely, the vertical projection position of the front end (the forward direction of the robot is the front end) is used to judge which area stays in the 1/2/3 area.
- d. Each time the robot transports, if it stays in the 1/2/3 area, each valid table tennis ball transported in a single transport will score 5 points. If it stays in the 0/4 area, mission 2 hole area, or falls off the stage, then the table tennis ball transported this time will not score. In addition, no points will be awarded for table tennis balls dropped during a single shipment.
- e. If the robot drops any part in the process of moving, it will be recorded as a violation. At this time, the team members can repair it, but the timing will not stop.
- f. During a single transport, the transport vehicle stays completely in the 1/2/3 area, and the referee signals that any member of the team can put the table tennis ball into the "ball pit" in the 1/2/3 area corresponding to task 2 (there is no fixed order requirement for placement here). When placing the ball, if the transport vehicle is an integral structure, the transport vehicle cannot leave the parking area, and the players can place the ball by passing it. If the transport vehicle is a detachable structure, the team members can take the ball box to the task 2 area to place the balls, and the chassis of the vehicle must remain in the parking position. Balls dropped during the placement process are valid and can continue. After placing the table tennis balls in the "ball pit" of task 2, the team members can take the robot back to the "START" area for the next transportation. For this transportation, if the team members pick up the robot for the next transportation before completely placing the table tennis balls in the "ball pit" of task 2, one violation will be recorded.
- g. If 20 ping-pong balls are transported and the last ping-pong ball is stably placed in the "ball pit" of task 2, the team members can start task 2. If task 1 is not completed, start task 2 and record a violation. The Task 1 robot can stay in the Task 1 field area. The players decide on their own the time node when the empty ball box in Task 1 is placed in the limited area of Task 2, provided there is no ball in the ball box. As long as the ball box is placed after task 2, it cannot go out of bounds or be picked up, otherwise it will be considered a violation.
- h. If task 1 has 20 ping-pong balls, all of which are effectively transported to the 1/2/3 area, task 1 has no successful transportation score. The referee may allow the team to place 1 ball in the 3 "ball pits" of Task 2, turning Task 2 on.
- i. **When transporting table tennis balls in Task 1, the team has two reset opportunities. If the team's dribbling is invalid or the position is not ideal, they can apply to the referee for a reset. The successfully transported ball will be invalid and the team will restart dribbling, but the timer will not stop. And a reset will record a violation (10 points will be deducted for each violation).**

B. Task 2:

- a. According to task 1, the robot transports the ball and stays at 1/2/3. The players can place the ping-pong ball in the "ball pit" in the 1/2/3 area of task 2. After task 1 is completed, the team members immediately enter the task 2 competition.
- b. Team members use the prepared "tool clip" to clamp the table tennis ball into the "ball box" in the "START" area. The ball box can only be moved in the limited area and cannot be exceeded or picked up. Team members can also make and collect it. The structure of the ball basket, together with the ball into the "ball box". No part of a player's body or the structural basket made to collect the ball may exceed the boundary between the "START" and "3" areas. If it exceeds the boundary between the "START" and "3" areas, 1 violation will be recorded. When collecting the ball, the ball must be in the air, cross the boundary between the "START" and "3" areas, and be put into the structure frame or ball box, otherwise the ball will be invalid and no points will be scored.

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- c. If the ping-pong ball falls outside the 1/2/3 area of Task 2 during the pinching process, the ball will be invalid and no score will be scored. If the ping-pong ball falls in the 1/2/3 area of Task 2, it can continue to be picked up to the "ball box", and the invalid ball will be quickly recovered by the referee. Successfully pick up the "ball box" table tennis, each ball gets 5 points.
- d. If the robot drops any part in the process of clamping, it will be recorded as a violation. At this time, the team members can repair it, but the timing will not stop.
- e. After all the ping-pong balls in the "ball pit" of task 2 are picked up, you can take the "ball box" to task 3 and start the match of task 3. The Toolholder for Task 2 can be placed in the Task 2 area.
- f. **If there is no task valid ball in the "ball box" in task 2 and there is no score in the task valid ball, the referee may allow the team to put 1 ping-pong ball in the "ball box" and enter task 3.**

C. Task 3:

- a. The task 2 "ball box" can be placed next to the task 3 "B" area, or the team members can hold it. Task 3 Each "shot" is only allowed to take one ball. If more than one ball is thrown each time, the ball is invalid.
- b. The throwing mode of the robot is not limited, but the power output of the throwing must be a rubber band. If other auxiliary materials are used, it can not be used as the throwing power.
- c. The robot vertical projection must not extend beyond the "B" area when the robot is throwing.
- d. Each time the robot throws, the player loads a ping-pong ball on the robot, and the robot throws the ball from the "B" area to the "basket" in the "A" area, either by "hollow" throwing into the "basket" or by "hitting the board".
- e. Each ball thrown into the "basket" is worth 5 points, otherwise no points are scored.
- f. If the robot drops any part in the process of "shooting", it will be recorded as a violation. At this time, the team members can repair it, but the timing will not stop.

D. Competition format

The game lasts for 1 round in total, and the players will be ranked based on their scores. If the scores are the same, they will be ranked based on the remaining time.

4.5 A description of the violation

A. Deduct 10 points for each violation.

5 Scoring table

Project	Referee count	Score	Total score
Task 1 Valid Ball		5	
Task 2 Effective Ball		5	
Task 3 Valid Ball		5	
Number of violations		-10	
Total score			
Time remaining			