



## REGULATIONS OF THE COMPETITION

### "DOUBLES TENNIS"

*Age of participants:* 13-17 years.

*Team:* 2 people.

*Robots:* controlled by an operator.

*Equipment used:* no restrictions.

*Programming language:* no restrictions.

*Robots in the team:* 2 robots.

*Task Description:* In this competition, teams must create robots that can play doubles tennis by serving, hitting, and returning the ball to the opponent's court. The game is played according to the rules of doubles tennis. Students and mentors must behave in a manner that does not contradict the mission of the competition or make it difficult to conduct. What is valuable is not what you win or lose, but how much you learn.

#### 1. Requirements for robots

1.1. A team may use no more than two robots. The optimal number of robots on the field is two.

1.2. There are no restrictions on the controller, motors, or parts used to assemble the robots.

1.3. The dimensions of the robots are determined in a vertical position, taking into account all the maximum protruding parts. A robot positioned in this way must fit into a cube with an internal dimension of each edge of 200 mm.

1.4. If the robot is equipped with moving elements, then when measuring the robot, these parts must be in the maximum position.

1.5 All robots must have a sturdy handle to enable them to be quickly lifted or placed on the field. The handle must be easily accessible, for example from the top of the robot. The dimensions of the handle may exceed the height limit of 20 cm, but the part of the handle that exceeds the height limit of 20 cm may not be used to attach components to the robot.

1.6. The weight of one robot is no more than 1.2 kg.

1.7. Participants in the competition must mark their robots in some way so that their belonging to the same team is visible (for example: robots are painted in the same colors, distinctive team symbols are applied, etc.). This must not affect the gameplay.

1.8. Robots must be brought assembled on the day of the competition.

1.9 Pneumatic systems can be used and filled with air during training. If the pump is part of the robot, the system can also be filled manually between matches.

1.10. The robot body must not damage the surface of the competition area in any way, otherwise the team may be removed from the competition and disqualified.

1.11. One robot is controlled by one operator.

1.12. The operator controls the robot remotely using a PC, smartphone, tablet, or remote control.

1.13. It is permissible to use a Bluetooth connection to communicate between robots, but only if this does not affect the functionality of other robots.

1.14 Teams must prepare and bring with them all necessary equipment, software and laptops that they may need during the tournament.

## 2. Requirements for the landfill

2.1. The field is a special polygon, 2400×1200 mm in size (it is permissible to use laminated chipboard, banner field). The height of the walls is 10-15 cm. The internal color of the walls is white. The external color of the walls is not defined.

2.2. The banner field is marked with colored markings (see Fig. 1).

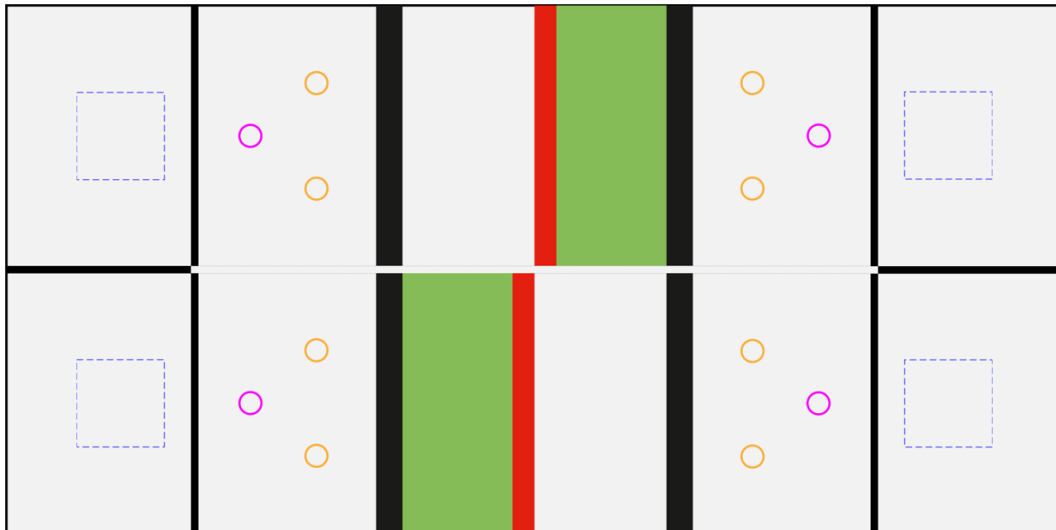


Fig. 1. Example of a game polygon

2.3. The width of thin black lines is 17 mm, the width of thick black lines is 60 mm. The size of the robot's starting area is 200 x 200 mm.

2.4. The playing field consists of two halves. Each half contains one ramp. A barrier divides the halves into quarters. The size of the barrier is 1562 x 17 x 50 mm. It must be firmly fixed to the field.

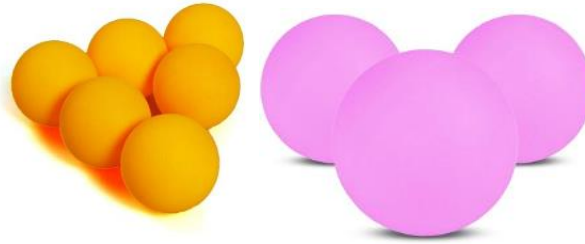
2.5. Two ramps 300 x 591.5 x 50 mm are fixed to the field. The ramp material is wood, laminated chipboard or foam. The main color of the ramp slope is green. The width of the red area is 50 mm. The color of the rest of the ramp is white.

2.4. There are six positions for balls on each half: four positions for red balls and two for purple balls.

2.5. The playing field is placed on a flat surface without slopes. At the beginning of the match, the balls are placed on small stands.

2.6 All balls are standard ping-pong balls with a diameter of 40 mm.

2.7. The color of the balls is orange and purple (violet).



2.8. The playing field requires 8 orange balls and 4 purple ones.

### **3. Procedure for holding the competition**

3.1 Preliminary settings:

3.1.1 Participants will be given time to prepare;

3.1.2. Before the start of the match, participants have 30 seconds to prepare for the match.

3.2. The operator is located on his side of the field.

3.3. Each match of the game is played by two teams. Each team places two robots on the playing field. Both robots work on one half of the field, and their goal is to jointly complete a common task - to push all the orange balls from their half to the opponent's half.

3.4. Initially, there are 4 orange and 2 purple balls on each half of the field. During the match, the orange balls will be thrown from one half to the other. In addition to pushing their initial orange balls, the team's robots must constantly find new orange balls delivered from the other half by the opposing team's robots. The robots must push these orange balls back. The purple ball, on the other hand, must remain on its half of the playing field. Orange balls on your half count as 1 point, and purple balls count as -2 points. The team with the fewest points at the end wins the match.

3.5. Game duration:

3.5.1. The maximum match time is 1.5 minutes. At the end of the match, the winner is determined by the number of orange and purple balls on each playing field.

3.5.2. The first, second and third matches of the game the team plays with a change of side of the field, the team is given 30 seconds to change the side of the field and prepare for the next match.

3.5.3. The stopwatch is started together with the referee's signal to start (whistle). The stopwatch runs throughout the entire match (1.5 minutes), without stopping the time (except for time-outs taken by the referee).

3.5.4. Once a team has been called by the referees to participate in a game, the team members must prepare to begin the match. If a team does not respond within 90 seconds of the referee's call,

it loses the opportunity to participate in the first match. The team receives a loss of 8:-8. If a team does not respond within the next 90 seconds for the second match, it loses the entire game, where all three matches are lost by a score of 8:-8. Between matches, the team is given 90 seconds to change sides of the field.

3.5.5. The robot is not allowed to touch the red area of the ramp on its half of the field. If any part of the robot touches the red area, the match is stopped and the team with the robot that violated the rule loses the match with a score of 8:-8.

3.5.6. If a robot touches one of the opponent's robots, the match is stopped and the referees decide whether the touch was intentional or not. If it was accidental, the balls in each half are counted and the result of the match is determined. If it was done intentionally by one team, that team will lose the match with a score of 8:-8. If the robot constantly reaches for the other team's playing field (for example, the robot stays in one place and raises its "hand" above the opponent's playing field), this will be counted as a deliberate search for contact.

3.5.7. It is not allowed for both robots of one team to interact with more than 4 orange balls at the same time. Interacting with the ball means intentionally changing the ball's movement, holding the ball still, or at least partially surrounding the ball with parts of one or two robots. Accidental contacts with the ball do not count as interaction (e.g. the ball bouncing off a robot). If such a situation occurs, the teams have 10 seconds to change it, otherwise the match will be stopped and the number of balls on each half of the field will be counted to get the result, the referees will count 10 seconds.

3.6. Start of the game:

3.6.1 All robots must be in their own half in the start zones. The position of the robot in the launch zone should be such that the projection of the robot on the playing field is completely in the launch zone.

3.6.2. Each half of the match begins with the placement of balls in the zones.

3.6.3. Robots must not move (wheels must not rotate).

3.6.4. At the judge's command, the stopwatch is started and the robots begin to move.

3.6.5. Any robot that starts playing before the referee's signal will be removed from the field for the rest of the match.

3.6.6. Before the second and third matches, the teams change sides.

3.7. Teams may modify their robots and programs between games if desired until the judges call the next game. Once a team is called to participate in the next game, the time for checking the team's robots begins again.

3.8. A team may choose to start a match with only one robot. In this case, the team must use only one robot for the entire match.

3.9. The game stops at the referee's signal (whistle), the robots must stop moving.

3.10. The referee may take a time-out to repair the playing field, for a referee meeting or to clarify the rules of the competition. During this period, the referee stops the match stopwatch.

3.11. The decisions of the referee on the field are not discussed by the team participants and coaches and are final.

3.12. Teams may not speak negatively towards opponents or judges, otherwise the team may be disqualified and removed from the competition.

#### **4. Game moments**

4.1 The robot is allowed to push, kick and throw balls.

4.2. The robot is allowed to drive onto the ramp on its half of the field.

4.3. If necessary, the robot is allowed to drop any part of itself that does not contain essential components (controller, motors, sensor) onto the field. As soon as a part of the robot touches the playing field or its playing element and no longer touches the robot, it is considered a loose element and not a part of the robot. The judges will remove loose elements from the field as quickly as possible.

If the robots of the team that lost elements are disturbed by these separated elements or by the judges (during the process of removing separated elements), this will be ignored and the match will continue.

Any balls that are thrown into the opponent's side of the field (either intentionally or accidentally) by a loose element will be returned to the corners of the field of the team from whose robots the loose element was separated. If the loose part of the robot touches the other team's robot or the playing field on the other team's side of the field, the match will be stopped and the team from whose robot the loose part was separated will lose the match with a score of 8:-8.

4.4 If the robot turns over, becomes unable to move, or has other malfunctions, it will be left on the field for the remainder of the match. A team may decide to remove the robot from the field with the referee's permission. Removing both robots from the field results in a loss of the match with a score of 8:-8.

4.5. If the ball goes out of bounds, it is returned to the half of the team that kicked the ball out, and the referees place it in one of the corners (in any situation).

#### **5. End of the match**

5.1 The match ends and time is stopped if any of the following conditions occur:

5.1.1. The match time is over.

5.1.2. A robot from one team touches a robot from another team or a surface (mat and ramp slope) on the opponent's half of the field.

5.1.3. The robot changes its size, i.e. the dimensions exceed 200x200 mm and/or the height of 200 mm. In the event that the dimensions of the robot exceed the permitted size due to a malfunction or an accident, the team must remove the damaged robot from the field with the permission of the judge and continue working with only one robot.

5.1.4 If all orange balls are on one half of the playing field for more than 10 seconds after the first 30 seconds of the match, the match will be stopped and the score will be counted. The referees will announce when the 30 second mark has been reached.

5.1.5 Any team member touches the robot, ball, mat, ramp, barrier or wall. The only exception is when a team member removes a damaged robot from the field.

5.1.6. The robot leaves the playing field.

5.1.7. A robot or team member damages the field or a game element.

5.1.8. If both robots are removed from the field (including as damaged).

5.2 Team members must stop their robots when the referee signals the match to stop. Robots must remain on the field until the referees allow the teams to take them. Team members are not allowed to move the balls from one half of the field to the other, or outside the field. If a team violates this rule, the match will be lost with a score of 8:-8.

5.3. The ball(s) that have been pushed, thrown or thrown by the robots after the referee's signal to stop the match shall be returned to the half of the field from which the robots moved them. If there is uncertainty as to whether the ball was moved before or after the signal, the referee is allowed to return it back to the half of the field where the robot responsible for the ambiguous movement of the ball is located.

5.4 The judges will base their decisions on the rules and fair play. They will make the final decision on the day of the competition. Please note that since this is a competition between teams, if there is a dispute, the judge's decision may result in one team losing the game.

## **6. Counting points and determining winners**

6.1 The official score will be calculated by the referees at the end of each match. The winner of a group of two teams is determined after three matches.

6.2. The ball score is calculated for both teams based on the number of balls in their half. Orange balls count as +1. Purple balls count as -2. The ball score for each team can range from -8 to +8.

6.3. The winner of a particular match is the team whose score is lower than that of the opponent.

6.4 If the ball does not contact any robot, the position of the ball on the field determines which team it belongs to. If the ball touches a robot, the balls are scored for that robot's team.

6.5 If a match is stopped due to the actions of a member of one of the teams (for example, a team member touches a robot), the team to which this participant belongs loses the match with a score of 8:-8.

6.6 The team that wins the most matches in a game wins and gets 3 points, the other team gets 0. Winning 2 matches is an obvious win, but also if a team wins 1 match and the other two are a draw, then the team wins the game.

6.7. If all three matches end in a draw, the result of the game is also a draw, and both teams receive 1 point. If each team wins one of the matches and one match ends in a draw, the result of the game is a draw.

6.8. The ranking of teams in the tournament (with teams listed in the table) is based on the sum of points earned by each team in the games. If two teams score the same amount of points, the following criteria are taken into account (listed in order of priority):

6.8.1. Number of violations: the team with the least number of violations has a better rating.

6.8.2. total number of balls (orange ball counts as +1 and purple ball as -2) / number of balls in the opponent's half in each match: of all the matches played by each of the selected teams, the team whose opponents have scored a greater total number of balls wins.

6.8.3 If the ranks of two teams remain the same, the judges may consider holding an additional series of matches until one team has two more wins (in additional matches) than the other team.

6.9 If the tournament mode uses (in addition to the table) a knockout mode, a winner must be determined in each game. If the game ends in a draw due to the match results, the winner is determined first by fouls and then by the ball score. If both teams still have the same rating, one or more additional matches must be played to determine the winning team of the game.

## **7. Permissible simplifications when conducting selection stages**

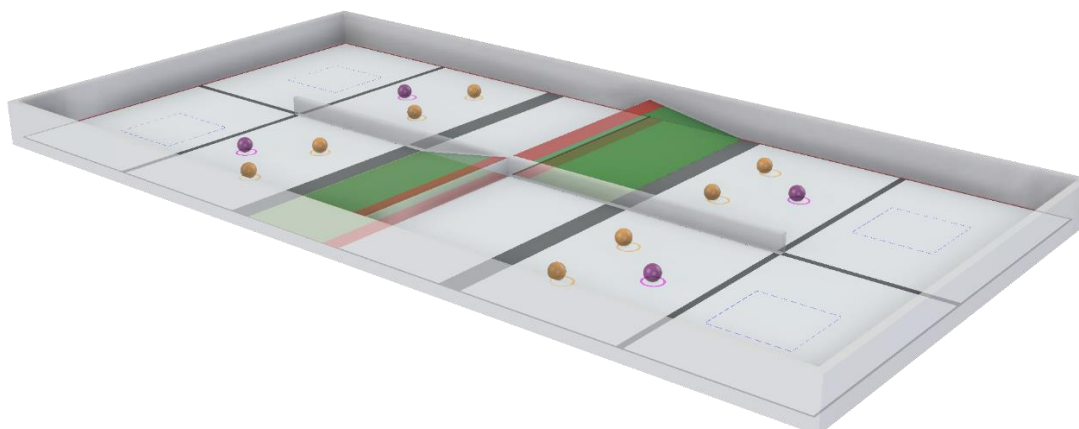
7.1. Balls of other colors are allowed, but they must be different from the field elements. Event organizers can change the colors of the mat on the field to make the balls distinguishable. They must inform the teams of the changes in advance.

### **Organizational recommendations**

1. The walls of the field must be strong enough and well secured to withstand the pressure of the robots.
2. It is recommended to print the banner field from a PDF file.
3. The surface of the field inside must be absolutely flat and strictly horizontal.
4. Each team is provided with a work space (table, 2 chairs).
5. It is better to locate the playing area closer to the spectators, as opposed to the place where the participants prepare.
6. Team leaders are not allowed to participate in the competition.
7. Assign a team of referees to each field, consisting of at least two people. Since in this category, referees play a more active role than in other categories, since they also need to make decisions on certain situations during the match. This is one of the characteristics of the sport category.



**Example of a competition site**



**Fig. 2. Sample of a competition site**

**Video of 3D model of the polygon at the link**

[https://drive.google.com/file/d/131JOU EK3x8epSni61mSmKgOOJ\\_qdKZIN/view?usp=sharing](https://drive.google.com/file/d/131JOU EK3x8epSni61mSmKgOOJ_qdKZIN/view?usp=sharing)

**Note:** When developing the regulations, materials from sportrobotics.ru were used