IEEE Very Small Size Soccer (VSSS) Rules

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Contents

1 The field and the ball

1.1 Playground dimensions

A black (non-reflective) wooden rectangular playground, 150cm **x** 130cm in size with 5cm high and 2.5 thick with side-wall will be used. The topsides of the side-walls shall be black in color with the walls painted in white (side view). Solid 7cm X 7cm isosceles triangles shall be fixed at the four corners of the playground to avoid the ball getting cornered. The surface texture of the board will be that of a ping pong table.

1.2 Marking on the playground

The field of play shall be marked as shown in Figure 1. The center circle will have a radius of 20cm. The arc, which is part of the goal area, will be 20cm along the goal line and 5cm perpendicular to it. The major lines/arcs (centerline, goal area borderlines and the center circle) will be white in color and 3mm in thick. The free ball (Law 13) robot positions (circles) shall be marked in gray or white color.

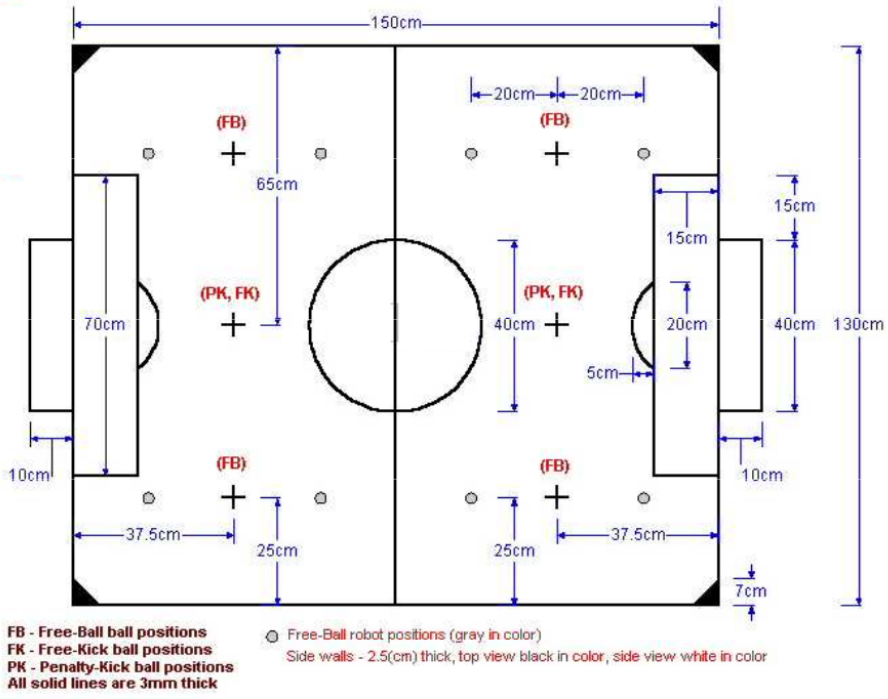

Figure 1: Arena dimensions

1.3 Goal

The goal shall be $40cm$ wide with $10cm$ of depth. Posts and nets shall not be provided at the goal. This $10cm$ go beyond the $150cm$ of the field

1.4 The goal line and goal area

The goal line is the line just in front of the goal which is $40cm$ long. The goal areas shall comprise of areas contained by the rectangle (sized $70cm$ X $15cm$ in front of the goal) and the attached arc ($20cm$ in parallel to the goal line and $5cm$ perpendicular to it).

1.5 The Ball

An orange golf ball shall be used as the ball, with $42.7mm$ diameter and $46g$ weight. To avoid vision problems, the ball will be provided by the competition.

1.6 The field and lighting conditions

The field shall be indoors. The lighting condition in the competition site shall be fixed around 1000 Lux.

2 The players

2.1 The overall system

A match shall be played by two teams, each consisting of a maximum of three robots. One of the robots can be the goalkeeper. Three human team members, a "manager", a "coach" and a "trainer" shall only be allowed on stage. One host computer per team, mainly dedicated to vision processing and for location identifying, can be used.

2.2 The robots

2.2.1 Size

The size of each robot shall be limited to $7.5cm$ X $7.5cm$ X $7.5cm$. The height of the RF communication antenna will not be considered in deciding a robot's size. The robots should wear uniforms and the size of which shall be limited to 8cm X 8cm X 8cm. **A uniform cannot be part of the robot, *i.e.*, the robot must be able to play a game even without the uniform**

2.2.2 Colors

The topside of a robot must not be colored in orange, white or gray nor must not be colored with more than two colors different from black and the team color. A color patch either blue or yellow, as assigned by the organizers, will

identify the robots in a team. All the robots must have, visible on their top, a solid region of their team color patch, blue or yellow. This region can be of any shape, but must be able to contain (at least) a square with 3.5 cm of side or a circle with 4 cm of diameter. A team's identification color will change from game to game, and the team color patch used should be detachable. When assigned with one of the 2-team colors (blue or yellow), the robots must not have any visible patches of those colors used by an opponent team.

Note: The teams are recommended to prepare a minimum of double blue and yellow patches for competition. The teams are also recommended to prepare a minimum of 6 different color patches, other than blue and yellow, for individual robot identification.

2.2.3 Positioning and Equipment

A robot within its own goal area (Law 1.4) shall be considered as the "goalkeeper". The robot assuming the role of goalkeeper can be dynamically changed during the match, as the robot inside its own area (if any) will always be considered as the goalkeeper. The goalkeeper robot shall be allowed to catch or hold the ball only when it is inside its own goal area. None of the robots, except the single designated goalkeeper, shall be allowed to catch or hold the ball such that more than 30% of the ball is out of view either from the top or from the sides.

Each robot must be fully independent, with powering and motoring mechanisms self-contained. Only wireless communication shall be allowed for all kinds of interactions between the host computer and a robot. The robots are allowed to equip with arms, legs, etc., but they must comply with the size restrictions even after the appendages fully expanded

2.3 Substitutions

Two substitutes shall be permitted while a game is in progress. At half time, unlimited substitutions can be made. When any kind of substitution is desired while the game is in progress, the concerned team manager should call 'time-out' to notify the referee, and the referee will stop the game at an appropriate moment. The game will restart, with all the robots and the ball placed at the same positions as they were occupying at the time of interrupting the game. Damaged robots are not included in the substitution count and can be returned to the field after maintenance.

2.4 Time-out

The human operator can call for 'time-out' to notify the referee, and the referee will stop the game at an appropriate moment. Each team will be entitled for two time-outs in a game and each shall be of 2 minutes duration.

3 Transmissible Information

The manager, the coach or the trainer may transmit certain commands directly from the remote host computer to their robots only when authorized by the referee or when the game is not in progress. It is not allowed to transmit commands such as reset signals to stop any/all of the robots or restart signals, without the permission from the referee. Any other information, such as game strategy, can be communicated to robots only when a game is not in progress. The human operator should not directly control the motion of their robots either with a joystick or by keyboard commands under any circumstances. While a game is in progress the host computer can send any information autonomously.

4 The vision system

In order to identify the robots and the ball on the playground, a vision system can be used. The location of a team's camera or sensor system should be restricted to, over and above their own half of the field including the center line, so that the camera need not has to be moved after the side change at halftime. If both teams wish to keep their cameras over and above the center circle 4 of the playground, they shall be placed side by side, equidistant from the centerline and as close to each other as possible. The location of the overhead camera or sensor system should be at a height of $2m$ or higher.

5 Game Duration

The duration of a game shall be two equal periods of 5 minutes each, with a half time interval for 10 minutes. The duration of the game and the half time can be changed if by mutual agreement between teams and chair, depending on the conditions of the championship. An official timekeeper will pause the clock during substitutions, while transporting an injured robot from the field, during time-out and during such situations that deem to be right as per the discretion of the timekeeper. If a team is not ready to resume the game after the half time, additional 5 minutes shall be allowed. Even after the allowed additional time if such a team is not ready to continue the game, that team will be disqualified from the game.

6 Game Commencement

Before the commencement of a game, either the team color (blue/yellow) or the ball shall be decided by the toss of a coin. The team that wins the toss shall be allowed to choose either their robot's identification color (blue/yellow) or the ball. The team who receives the ball shall be allowed to opt for their carrier frequency band as well. At the commencement of the game (and any kickoff), the attacking team will be allowed to position their robots freely in their own

area and within the center circle. Then the defending team can place their robots freely in their own area except within the center circle. At the beginning of the first and second halves and after a goal has been scored, the ball should be kept within the center circle. With a signal from the referee, the game shall be started and all robots may move freely. After the half time, the teams have to change their sides. Since the start or restart of the game is marked by the signal from the judge, any team that moves before this mark will cause a "False start" (Law 9).

7 Method of Scoring

1. **The Winner:** A goal shall be scored when the whole of the ball passes over the goal line. The winner of a game shall be decided on the basis of the number of goals scored.

2. **The Tiebreaker:** In the event of a tie after the second half and if the rules of the competition do not allow a tie to happen in this specific match, the winner will be decided by in over time. The game will be continued after a 5 minutes break (extendable for another 3 minutes), in only one three minutes period. If the tie persists even after the extra 3 minutes game, the winner shall be decided through penalty-kicks. Each team shall take three penalty-kicks, which differs from Law 12 as only a kicker and a goalkeeper shall be allowed on the playground. After the referee's whistle, the goalkeeper may come out of the goal area. In case of a tie even after the three-time penalty kicks, additional penalty-kicks shall be allowed one-by-one, until the winner can be decided. All penalty-kicks shall be taken by a single robot and shall commence with the referee's whistle. A penalty-kick will be completed, when any one of the following happens:

   - The goalkeeper catches the ball with its appendages (if any) in the goal area;
   - The ball comes out of goal area;
   - Thirty (30) seconds pass after the referee's whistle.

   Note: If neither team is able to take penalties, the winner will be decided in the coin (heads or tails).

3. ***Walkover*(WO):** If a team does not appear on the field or does not have robots in playing conditions, it will be called WO. In this case, the opposing team must enter the field for 3 minutes and the score that the team manages to reach in that period of time will be considered. The robot is considered to be in playing conditions if it has a battery and demonstrates game-like behaviors. **Motionless players are not allowed to remain on the field**. The team that declares WO receives a score of -1 and a negative score according to the final score of the game.

Note 1: If both teams declare WO, both will receive a negative score and have a negative balance of 3 goals. If this happens in a knockout contest, both teams will be disqualified.

Note 2: If a team enters the field after the opponent declares WO and fails to score a goal within 3 minutes, the referee must declare double WO.

8 Fouls

8.1 Personal Foul

Colliding with a robot of the opposite team: the referee will call such fouls that directly affect the play of the game or that appear to have potential to harm the opponent robot. Robots move at high speed and collisions can happen, so the referee will consider only if the foul is relevant to the match. It is permitted to push the ball and an opponent player backwards provided the pushing player is always in contact with the ball.

It is referred to as handling, as judged by the referee, when a robot other than the goalkeeper catches the ball. The ball is considered caught when a robot firmly attaches itself to the ball in such a way that no other robot can move the ball. The team will be penalized with a free kick if the infraction happens outside its own goal area or with a penalty kick if it happens inside its own goal area.

When the goalkeeper controls the ball without dispute, it must kick out the ball from its goal area within 10 seconds. The failure to do so will be penalized by giving a penalty kick to the opposite team. If an attacking robot disputes the ball with the goalkeeper during this time, the time count is restarted.

However, if the attacker blocks the goalkeeper, it will be considered a goal kick. Only the referee and one of the human members of a team (previously defined) shall be allowed to touch the robots. The award of a penalty-kick shall penalize touching the robots without the referee's permission. The human operator is only allowed to send a direct message to the robot with the judge's authorization. If communication is found at any other time, the game will be immediately stopped for analysis and the punishment may be a penalty kick for the opposing team until the disqualification of the team that committed the infraction.

8.2 Attacking Foul

Attacking with more than one robot in the goal area of the opposite team shall be penalized by a goal kick to be taken by the team of the goalkeeper. A robot is considered to be in the goal area if any part of it is within the goal area.

Note 1: The second robot in the goal area must effectively participate in the play for the foul to be considered. That is, the foul will be called in the case of the second player:

- Prevent or hinder the goalkeeper's movement;

- Touch the ball at any time

Note 2: If the second player is disputing the ball and is pushed into the area, the team **will not** be penalized. Blocking the goalkeeper of the opposing team in its respective area will result in a free kick, and will be charged by the goalkeeper's team.

8.3 Defensive Foul

Defending with more than one robot in the goal area when the ball is inside the goal area shall be penalized by a penalty-kick, except if a goal is scored by the attacking team. If the ball is not in the goal area, there are no penalizations for teams with two defending robots inside its own goal area. It is allowed to push the goalkeeper robot into the goal area, if the ball is between the goalkeeper and the robot that is pushing. A robot is considered to be in the goal area if it is more than 50% inside, as judged by the referee.

Note 1: The second robot in the goal area must effectively participate in the play for the foul to be considered. That is, the penalty kick will be called in the case of the second player:

- Prevent or hinder the attacker's movement;
- Touch the ball at any time.

Note 2: If the second player is disputing the ball and is pushed into the area, the team **will not** be penalized.

9 False Start

A false start will be considered when the robot starts a move before the referee's warning. The false start may occur at all times when the ball is stopped. There are cases in which a team has possession of the ball, here now defined as the attacking team, and a team without possession, defined in this item as the defending team. Only in the case of the free ball there is no team with possession.

In all cases, the first time the infraction occurs, the team receives a warning, the players are repositioned and the match is restarted. For the case of recidivism, the penalty is according to the team that committed the infraction and the type of game status:

1. Kick Off
    - **Attacking team:** first possession of the ball is changed and on a new recidivism, a free kick is called
    - **Defending team:** first the team is positioned on the edge of its area and, in a new recidivism, a free kick is called
2. Penalty

- **Attacking team:** free ball is scored and the team loses the penalty
- **Defending team:** the goalkeeper is cautioned with a yellow card and, in a new recidivism, is excluded from the game. He will not be substituted and will be kept out for 30 seconds of straight play or until the opponent scores a goal.

3. Free Kick

   - **Attacking team:** the possession of the ball is reversed and the attacking team must be completely positioned in their defense field
   - **Defending team:** a penalty is called for the other team

4. Free Ball

   - A free kick is awarded to the other team

Note: If the judge perceives that a team deliberately abuses of false starts, the punishment can be more severe, reaching the team's declaration of W.O. defeat.

10 Play Interruptions

The play shall be interrupted and relocation of robots shall be done only when:

- A robot has to be changed;
- A robot has fallen in such a way as to block the goal;
- A goal is scored or a foul occurs;
- Referee calls free kick, penalty kick, goal kick or free-ball.

The robots can be relocated by a human operator or by their own means. When the referee calls free-ball, the relocation by humans is not allowed, as presented in Law 14

11 Free Kick

For the cases defined as a foul, a free kick will be given to the opposite team. The ball will be placed at the relevant free kick position (FK) on the playground. The robot taking the kick shall be placed behind the ball. The attacking team (team with ball possession) can position its robots freely within its own side. If it is not positioned correctly, the team will be warned. If the error recurs, a penalty will be awarded to the team with ball possession. The defending robots shall be placed in touch with the goal area on either side of the arc. With the referee's whistle all robots can start moving freely.

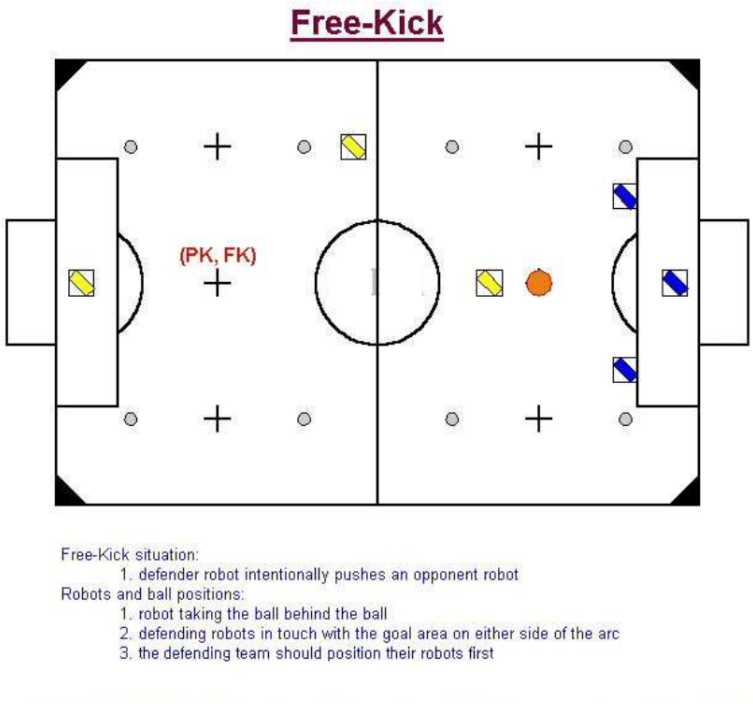

Figure 2: Free Kick Positioning

12 Penalty Kick

For all cases defined as penalty (Laws 8, 9, 11) during the game, the ball will be placed at the relevant penalty kick position (PK) on the playground. The robot taking the kick shall be placed behind the ball. While facing a penalty kick one of the sides of the goalkeeper must be in touch with the goal line. The goalkeeper may be oriented in any direction. Other robots shall be placed freely within the other side of the half-line, but the attacking team will has to positioning their robots first. The game shall restart normally (all robots shall start moving freely) after the referee's whistle. The robot taking the penalty-kick may kick or dribble the ball.

In the event of a penalty shootout after an overtime, only one player from each team will be placed in the arena, with the rest of the team remaining out of bounds. Teams are allowed to use any of their players in the dispute, without the need to use different robots for attack and defense. The other aspects of the dispute follow the rules already described.

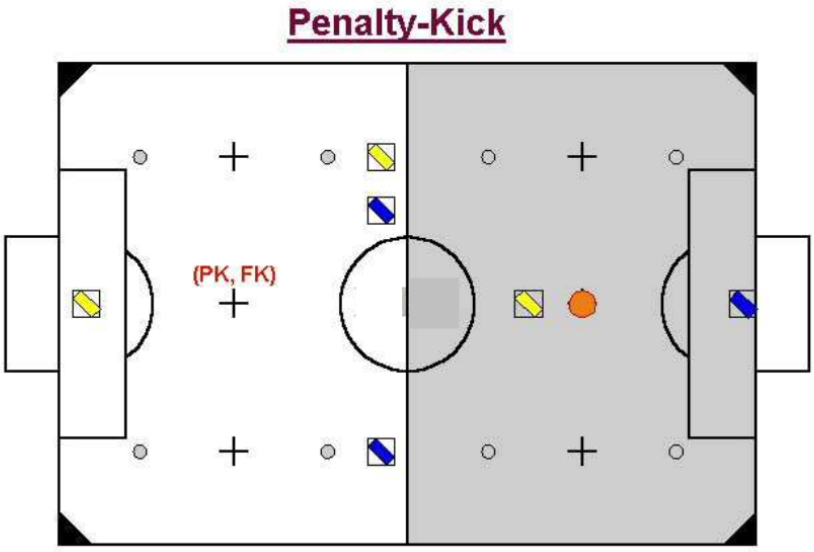

Figure 3: Penalty Positioning

13 Goal Kick

A goal kick will be called under the following situations:

- When an attacking robot pushes the goalkeeper in its goal area, without the ball dispute;
- Attacking with more than one robot in the goal area of the opposite team;
- When the goalkeeper catches the ball with its appendages (if any) in its own goal area;
- When a stalemate occurs in the goal area for 10 seconds, where a goalkeeper and a player actively dispute the ball.

During goal kick only the goalkeeper will be allowed within the goal area and the ball can be placed anywhere within the goal area. Other robots of the team shall be placed outside the goal area during goal kick. Any player can hit the goal kick, respecting the Law 8. The team with ball possession will position their robots first. The game shall restart with the referee's whistle.

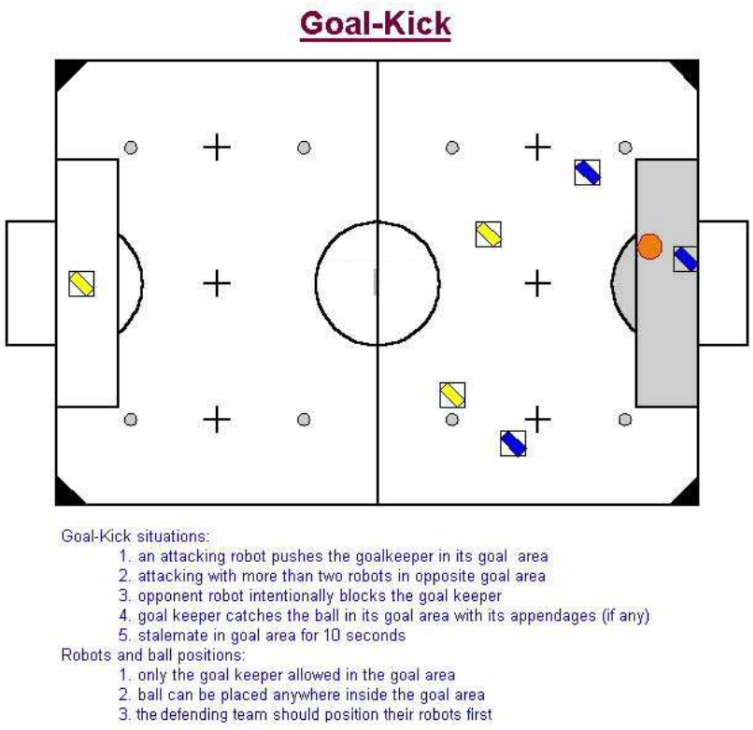

Figure 4: Goal kick Positioning

14 Free Ball

The referee will call a free-ball when a stalemate occurs for 10 seconds outside the goal areas. In this case, the robots can only be relocated by their own means or by the referee, and not by a human member of the team. When a free-ball is called within any quarter of the playground, the robots must stop and the ball will be placed by the referee at the relevant free ball position (FB). The referee must also manually relocate all the robots which are less than $20cm$ of distance from the relevant free ball mark, longitudinally moving the robots toward their own field until they are aligned with the relevant free ball robot positions (gray circles), located $20cm$ apart from the ball position in the longitudinal direction of the playground. After that, one (or none) robot per team can automatically place itself at the relevant free ball robot position (gray circle) nearest its own goal. The other robots (of both teams) must stay where they are. The game shall resume when the referee gives the signal and all robots may then move freely.

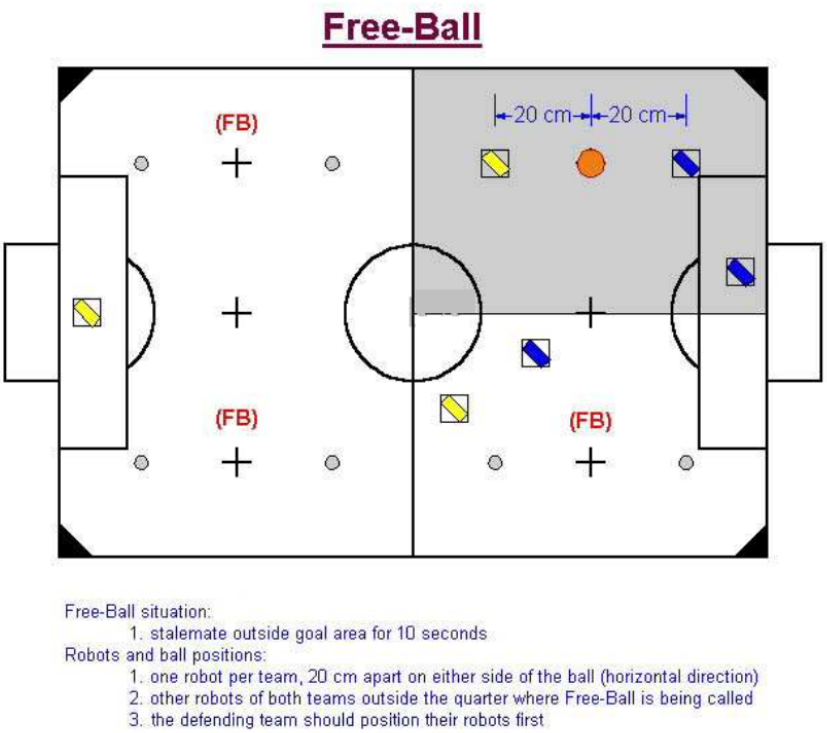

Figure 5: Positioning in Free Ball

15 Technical Challenge

The technical challenge is an parallel activity to the competition, but the participation of the 4 best placed teams in the previous year is **mandatory**. The occurrence of the challenge is conditioned to the advance disclosure of the challenge rules and also to the guarantee that participation does not hinder the team's participation in the main VSSS competition.

16 Ball cover-up

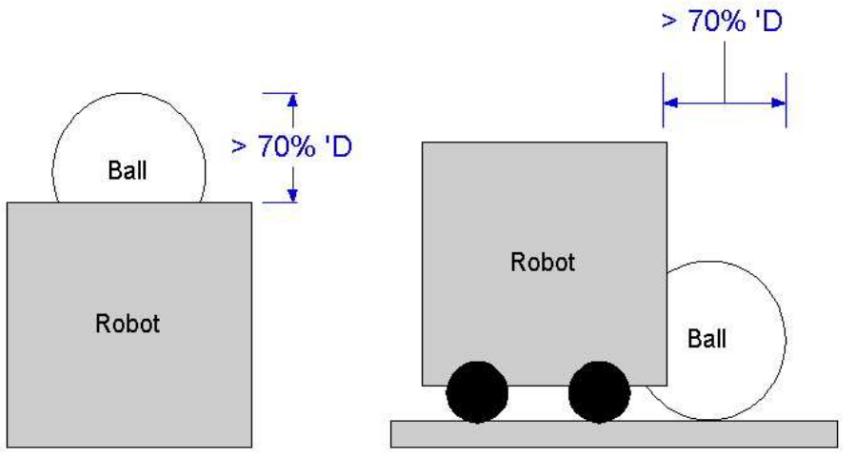

Figure 6: Ball cover-up

17 Missing cases

Missing cases the rules described here will be evaluated by a committee of judges. For the smooth running of the competition, an extra booklet can be attached with changes or extra rules, as long as previously notified to captains and judges, and by mutual agreement at the captains meeting. This meeting takes place at the beginning of the competition, together with the draw of the teams. The presence of captains (or a team representative) is not mandatory, but no team can complain about any decision made at this meeting.