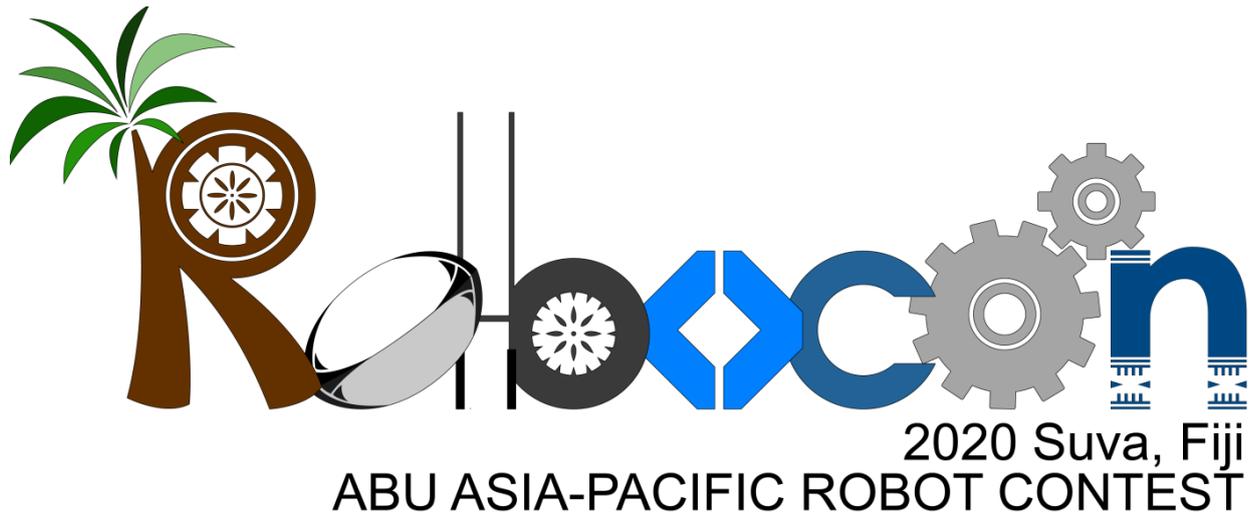


ABU
Asia-Pacific Robot Contest 2020
Suva, Fiji



THEME & RULES
"ROBO RUGBY 7s"

August 2020

ABU Asia-Pacific Robot Contest 2020 Suva, Fiji
Host Organising Committee

<http://aburobocon2020.com.fj>

Contest Theme
"ROBO RUGBY 7s"

The concept of the contest:

The ABU Robocon 2020 Suva contest is to play rugby 7's game using two robots and five obstacles as five defending players. The highlight of this game is how the two robots collaborate to score Try and the Goal Kick. The main and unique challenge of this game will be Goal Kick, kicking the Kick Ball over the cross bar of the conversion post because of the unique shape of the rugby ball. The audience will be fascinated if the robot made all the Goals successfully. We are looking forward to witnessing exciting games of unique robots built by the young budding engineers in Suva, Fiji. Based on this concept, ABU Robocon 2020 Suva is designed to promote the idea of "Rugby 7's".

A game is between Red and Blue teams. It lasts three minutes at most. Each team has two robots known as Pass Robot (PR) and Try Robot (TR). The two robots can be either manual or automatic. The PR starts from the PR Start Zone. The PR picks up one Try Ball from the Ball Rack and passes the Try Ball from the Passing Zone to TR located in the Receiving Zone. The TR starts from the TR Start Zone and moves into the Receiving Zone to receive the Try Ball from PR. The TR then goes along the five defending Obstacles to score the Try in the one of the five Try Spots. After a successful Try by TR, a kick step can be taken from the Kicking Zone to make the Goal. The game continues until all the seven Kick Balls are used or when the 3 minutes passed.

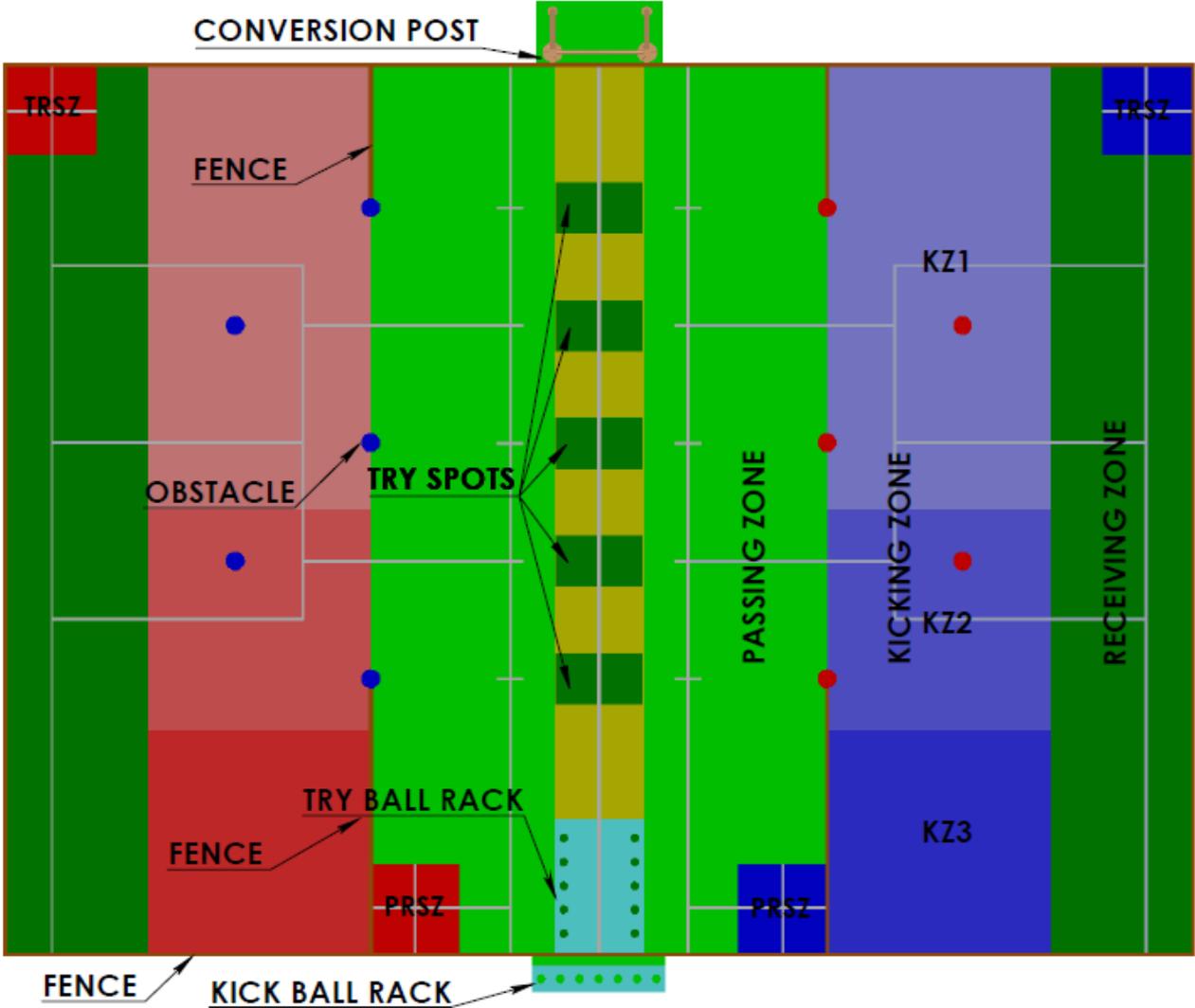


Figure 1. Game field- Areas and Zones

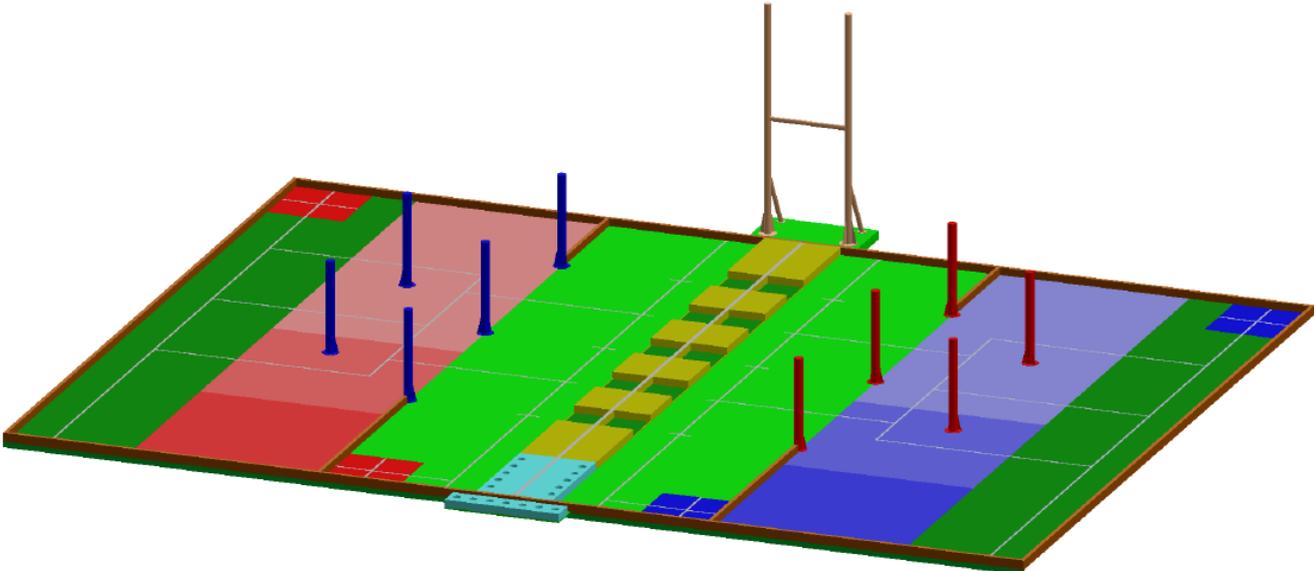


Figure 2. Game field- Objects

Importance of Safety

Safety is one of important elements in the sustainable development of the ABU Robocon.

The safety of the designed robots is the first and foremost issue for the safety principle of the contest. The participating teams, as the robot's designers, are responsible for the safety of their robots.

The teams must work and cooperate closely with the organizers to ensure the utmost safety of the contest.

Safety must always be the top priority and must be considered by all people involved in the contest including officials, participants and spectators in all circumstances.

Teams are required to pay sufficient attention to the safety of their robots before applying to take part in the contest.

It must be observable whether the designed robots meet the safety during the video check and test runs.

Please attach hardwired emergency stop button on the robots.

Team members must wear running shoes, helmets, and safety goggles during the games and test runs.

Domestic Contest in Each Country and/or Region

Since all domestic contests in each country and/or region are organized in order to find the representatives to participate in ABU Robocon 2020 Suva, they should conform to the rules. It is known that materials may not be available in some places. Domestic organizers are advised to use the best possible materials and adhere as closely as possible to the specifications laid down for the final contest.

Transporting the Robots

1. The robots must fit inside a single box with the dimension of 1000 mm Width x 1800 mm Length x 800 mm Height for transport. Only one box is used. The weight of the box, including the robots, must not exceed 240 kilograms.
2. As for ABU Robocon 2020, the robot pick-up time will be late July. Please ask participants to prepare for the contest by taking it into consideration.

The contest outlines

Title:	Asia-Pacific Robot Contest 2020 Suva, Fiji (Alias: ABU Robocon 2020 Fiji)	
Organizer:	ABU (Asia-Pacific Broadcasting Union)	
Host:	ABU Asia-Pacific Robot Contest 2020 Suva, Fiji Host Organising Committee (Government of the Republic of Fiji, Fiji TV and FBC TV)	
Contest Date:	Sunday, 23 August 2020	
Contest Venue:	Vodafone Arena	
Schedule:	Friday, 21 August	Participants' Arrival
	Saturday, 22 August	Orientation, Test-run, Rehearsal
	Sunday, 23 August	Contest Day
	Monday, 24 August	Friendship Exchange Programme, ABU Robocon Meeting
	Tuesday, 25 August	Participants' Departure
Theme and rules	'ROBO RUGBY 7s'	
Competition Method:	Preliminary League and Final Tournament	
Participants:	To be confirmed in July 2020	
Awards:	ABU Robocon award, Grand Prix, 1st runner-up, 2nd Runner-ups, Best Idea Award, Best Engineering Award, Best Design Award, Special Awards.	

Rules

Terms and Definitions

Terms and definitions which are used in the rules of ABU Robocon 2020 Suva, are given in the following table.

#	Term	Definition
1	Pass Robot (PR)	Either a manual or an automatic robot to pick up the Try Ball, pass the Try Ball and may kick the Kick Ball.
2	Try Robot (TR)	Either a manual or an automatic robot to receive the Try Ball, score try with the Try Ball and may kick the Kick Ball.
3	Try Ball	A standard size 3 rugby ball. It is only used to score tries in the Try Spots. At the start of the game, five rugby balls will be placed in the Ball Rack by the organiser. Red colored balls for the red team and blue colored balls for the blue team.
4	Kick Ball	A standard size 3 rugby ball colored yellow. 7 balls will be shared by the red and blue teams. It is only used for kicking through the Conversion Post. At the start of the game, seven rugby balls will be placed in the Ball Rack by the organiser.
5	Tee	An object that must be used to securely support the Kick Ball. Teams must place the Tee on the ground in the Kicking Zone, and then place the Kick Ball on top of the Tee for kicking.
6	Pass Robot Start Zone (PRSZ)	The Start Zone for the Pass Robot. The size of the Pass Robot Start Zone is 1000mm x 1000mm.
7	Try Robot Start Zone (TRSZ)	The Start Zone for the Try Robot. The size of the Try Robot Start Zone is 1000mm x 1000mm.
8	Passing Zone	The zone from which PR must pass the Try Ball to the TR.
9	Receiving Zone	The zone in which TR must receive the Try Ball from PR.
10	Kicking Zone(KZ)	The zone from which PR or TR must kick the Kick Ball. The Kicking Zone is divided into three sections, KZ1, KZ2 and KZ3. Teams can gain different points depending on the section where the Kick Ball is placed and kicked provided the Goal is successful.
11	Try Spots	The spots where the TR will score the try. Both teams have five Try Spots each and only one Try Ball can be placed in each Try Spot.
12	Obstacles	These are obstacles (stationary cylindrical posts) placed on each side of the game field representing five defending players for each team.
13	Ball Rack	Racks used to hold the Try Balls and Kick Balls.
14	Conversion Post	The H-shaped stationary post at which the Goal Kick is aimed.
15	Fence	Barriers used to restrict the movement of the robots. Robots cannot touch the top surface and outer side of the Fence. However, they can enter the space above the Fence and touch the inner side of the Fence.
16	Border Zone	The yellow area that divides the Try Spots. Robots cannot touch the top surface of the Border Zones. However, they can enter the space above the Border Zones and touch the sides of the Border Zones.

17	Pass	Throwing the Try Ball in the air and/or rolling the Try Ball on the ground by the Pass Robot.
18	Receive	Receive means for TR to hold the Try Ball that has been passed on from PR. If PR rolls the Try Ball to the Receiving Zone, TR must pick the Try Ball only in the Receiving Zone. A successful 'Receive' means TR holds the Try Ball and the Try Ball is not in contact with the surface of the game field.
19	Try	Try means placing the Try Ball in one of the 5 Try Spots. A successful Try means: a) when the Try Ball touches the surface of the Try Spot for the first time, TR and Try Ball has to be in contact with each other. b) With the moment of a), the Try Ball must not touch the boundaries of the Try Spots. c) After the Try, the Try Ball must remain within the Try Spot.
20	Kick (Goal Kick)	The 'Kick' must satisfy the following five conditions: a) The robot must not stay in touch with the Kick Ball before its starts the kicking. (The robot must start the kicking from a certain distance from the ball) b) The surface of the robot which comes in contact with the ball must be limited to <u>one flat surface</u> or <u>one convex surface</u> . The use of soft and flexible materials is not allowed. c) When the moment robot's contact surface comes in contact with the ball, the contact surface of the robot must not reduce the speed to zero. d) The contact surface of the robot with the balls must not have grabbing or bonding function. e) The contact surface must be outside the prism which is made in the vertical direction by connecting all robot's parts in contact with the ground.
21	Goal	For a successful Goal, the Kick Ball must pass over the cross bar in between the sticks of the H-shaped stationary post (Conversion Post)

1. Game Procedure and Competition Tasks

Each team has to complete tasks in the following orders:

(Robots in any defined zone means all parts in contact with the ground needs to be within that zone.)

1.1. Setting of robots

- a) Team must set up their robots in a one minute 'setting-time' before the game starts.
- b) Three (3) team members and up to three (3) pit crew members are allowed to participate in the set-up process.
- c) The team that fails to complete setting up within one minute can resume setting up after the game has started. Once setting up is finished, the team can start their robot with permission from referee.

- 1.2. Deployment of the robots at the start of the game and team members during the game
- a) Pass Robot (PR) must start from PR start zone. The robot must fit into the PR start zone including its space above.
 - b) Try Robot (TR) must start from TR start zone. The robot must fit into the TR start zone including its space above.
 - c) If PR or TR is manually controlled then the operator is allowed to be inside the game field. The operator must not run while controlling the manual robot. All other team members have to be outside the game field except when the ball is set manually.
 - d) If PR and TR are designed as a fully automatic robot, all team members must be outside the game field except during start of operation or a retry.
 - e) PR is allowed to enter the Kicking Zone and Passing Zone only. TR is allowed to enter Receiving Zone, Passing Zone and Kicking Zone. However, both robots must not enter the space above opponent team's field. The robots can enter the space above the fence outside the field.

1.3. Try Ball and Kick Ball

- a) Each team uses following items prepared by the Host Organiser;
 - Five Try Balls
 - Seven Kick Balls to be shared by 2 teams
 - Five Tees

All the balls are placed in the Ball Rack by the Host Organizer at the beginning of the game.

- b) Both robots are not allowed to hold the ball when the game starts.
- c) Team members are not allowed to touch the Try Balls except during a retry.
- d) The team members are not allowed to touch the Kick Ball except for preparing for the Goal Kick or during a retry.
- e) A Try Ball and a Kick Ball have the same specifications except with different colors.

1.4. Task in the Passing Zone

- a) PR starts from PR Start Zone with the start sound. It travels to the Ball Rack and picks up one Try Ball. It is then required to pass the Try Ball to the TR.
- b) PR can pick only ONE Try Ball at a time.
- c) PR can pass the Try Ball to the TR only when in the Passing Zone.

1.5. Task in the Receiving Zone

- a) TR starts from TR Start Zone with the start sound. It travels to the Receiving Zone to receive the Try ball from the PR.
- b) TR can receive the Try Ball only in the Receiving Zone.
- c) After receiving the Try Ball, TR can go out of the Receiving Zone and travel through the field avoiding the 5 defending players (Obstacles) to score a Try in one of the 5 Try Spots.
- d) The robots can touch the Obstacles but cannot break it which leads to disqualification.
- e) If the Try Ball enters the opponent's field the opponent team will receive 10 points automatically. This Try Ball will be picked up by the referee and will not be used again.
- f) If the ball moves out of the game field while playing it cannot be used again.
- g) PR can pick up the next Try Ball when the TR has successfully placed the Try Ball in the Try Spot or the current ball moves out of the game field excluding the Try Spots.

1.6. Task in the Kicking Zone

- a) After TR has successfully placed ONE Try Ball in the Try Spot, the team is allowed to use ONE Kick Ball. Throughout the game a team will get the same number of Kick Ball as the number of successful Try. A maximum of three Kick Balls can be used at the same time provided a team has three or more successful Tries.
- b) There are 7 Kick Balls. These will be shared by the two teams.
- c) If the team is entitled to a Kick Ball, a team member is required to pick the Kick Ball from the Ball Rack after informing a referee.
- d) The team has to choose one of the following for goal kick process;
 - i. A team member sets the Kick Ball in one of the Kicking Zones using a Tee. During this time both PR and TR must stay out of the Kicking Zones and they must not be in motion. After placement of the Tee and Kick Ball the team member must move out of the game field (Except for an operator of a manual robot). Then PR or TR can move to kick the Kick Ball.
 - ii. A team member loads the Kick Balls into PR or TR inside its respective Start Zone. The team member can load the Tee during

this time or before the game starts. Then the robot sets the Kick Ball in one of the Kicking Zones using a Tee and the same robot must kick the Kick Ball. The other robot must stay out of the Kicking Zones throughout the kicking process.

- e) The Goal kick can be done by either PR or TR.
- f) The points will be awarded after a successful Goal kick.
- g) If the Kick Ball enters the opponent's field directly then the opponent team will automatically receive 10 points. If in case the Kick Ball hits the conversion post and lands in the opponent's field no points are given to the opponent's team. This Kick Ball will be picked up by the referee and will not be used again.
- h) If the Kick Ball lands in the team's own game field during the kicking process the team member must pick the Kick Ball and move it out of the game field but not to be used again.
- i) If the Kick Ball remains on the Tee after a kick attempt the team can kick again. During this time the team member is not allowed to touch the Kick Ball or Tee.
- j) If the Kick Ball falls of the Tee without a kick attempt the team member is allowed to place the Kick Ball on the Tee provided the robots are not in motion.
- k) If the team member picks up multiple Kick Balls, the team must kick all the Kick Balls before proceeding to the next task.

1.7. Others

- a) Team members cannot touch robots except during retry, start and when loading the Kick Ball.
- b) In case of an emergency, with permission from referee, team members can enter the contest field to push hardwired emergency stop button.

2. Retries of the Robots

- a) A retry can be made only after the referee's permission.
- b) Team members must place both robots at their Start Zone while preparing for a retry and must restart from Start Zone.
- c) There are no limits for retry. A retry is considered by the rule with approval from the referee.
- d) If a retry is required before the 'receive' the Try Ball must be placed on the

Ball Rack. If a retry is required after the 'receive' is complete, the Try Ball must be placed into the TR in the Try Robot Start Zone.

- e) A retry is compulsory when the robots drop the Try Ball in the Kicking Zone and Passing Zone or did not make a Try.

3. Deciding of the Winner

3.1. The winner is decided based on the earning scores at the end of the 3 minutes game or when all the 7 Kick Balls are used. The team that earns higher score is the winner. The score for each task is described as follows:

Tasks	Points
TR receives the ball successfully from the PR.	1 point for each ball
TR makes the try successfully.	2 points for each try
Successful Goal kick from the Kicking Zone 1 (KZ1).	5 points for each successful Goal
Successful Goal kick from the Kicking Zone 2 (KZ2).	10 points for each successful Goal
Successful Goal kick from the Kicking Zone 3 (KZ3).	20 points for each successful Goal
If the opponent's Try Ball or Kick Ball lands in your field without touching the conversion post.	10 points for each ball

3.2. Game results

- a) The game result is announced at the end of 3-minutes game as a referee checks and confirms completion of each task.
- b) End of game:
 - i. End of 3 minutes.
 - ii. When all the 7 Kick Balls are used.
 - iii. One of teams is disqualified.
- c) At the end of the game, the team that scores the highest points is a winner. If in case of a tie the following order will decide the winner;
 - i. The team with the most successful Goal kick from Kick Zone 3.
 - ii. The team with the most successful Goal kick from Kick Zone 2.
 - iii. The team with the most successful Goal kick from Kick Zone 1.
 - iv. The team that is announced as winner by Judge.

4. Robots' Design and Development Regulations

- 4.1. Each team builds 2 robots.
- 4.2. Each robot cannot be split into sub-units or connected by flexible materials during the game.
- 4.3. The robots are not allowed to suction or to stick on the game field.
- 4.4. The robots in the contest must be built by team members from the same university/college/polytechnics.

4.5. The weight of robots

Total weight of two robots, controller, cable, the primary set of batteries used in the game must not exceed 50 kg. Any other equipment that team brings for setup purposes and backup batteries (of the same type as that originally installed in the robot) are exempt.

4.6. The power source of the robots

- a) Each team shall prepare its own power source.
- b) Teams can use only batteries, compressed air, and elastic force as power source.
- c) All batteries used in the robot, controller, and any other device used during the game shall not exceed nominal voltage of 24V. When connecting batteries in series, the total must be 24V or less.
- d) The voltage in the circuit should be set to 42 V or less by actual measurement. If the power supply system includes multiple isolated circuits, voltage in each system must be 42V or less.
- e) Teams using compressed air must use either a container made for the purpose, or a plastic bottle in pristine condition that is prepared appropriately. Air pressure must not exceed 600kPa.
- f) Any power source deemed dangerous may be banned from use.

4.7. Robots (PR and TR)

PR and TR can be either a manual or automatic robot.

- a) PR must fit into the PR Start Zone (Width 1000mm x length 1000 mm x height 1200mm) at the beginning of the game. PR must have dimension of no larger than 1200 mm in width, length and height during the game.
- b) TR must fit into the TR Start Zone (Width 1000mm x length 1000 mm x height 1500mm) at the beginning of the game. TR must have dimension of no larger than 1200 mm in width, 1200 mm in length and 1500 mm in height during the game.

- c) The robot is allowed to expand, stretch or extend as long as the dimension is still within limit of dimension only during the game.
- d) PR and/or TR can be operated by the operator through a connected cable or wireless.
- e) If PR and/or TR is operated through a connection cable, the length of cable from robot to controller must be in between 1000mm and 3000mm.
- f) Wi-fi (IEEE 802.11), Zigbee (IEEE 802.15) and Bluetooth controllers are allowed to operate PR and/or TR. The organizer will not control the environment of Wi-Fi, Zigbee and Bluetooth.

5. Fouls

A retry is compulsory after each foul. The fouls are categorized as follows:

- a) Any part of any robots lands out of the game field.
- b) Any part of any robot enters an area that is not allowed during the current task.
- c) Any team member touches any part of robot except controller or cable of robots and the situations this rulebook allows.
- d) Other actions that infringe on the rules without mentioning in the disqualification are considered a foul.
- e) The Try Ball lands and comes to a stop on the Border Zone.
- f) The robots enter the opponent's game field (including the space above).
- g) The team makes a false start. Both teams must bring their robots to the Start Zone and the game will be restarted.

6. Disqualification

A team is disqualified if it takes any of the following actions during the game:

- a) The team intentionally damages or tries to damage the field, facilities, equipment or opponent's robots.
- b) The team performs any acts that are not in the spirit of fair play.
- c) The team fails to obey instructions or warning issued by referees.
- d) The team has made the false start two times in the same game.

7. Safety

- 7.1. All robots must be designed and manufactured as to pose no danger of any kinds to any persons in the venue.
- 7.2. All robots must be designed and manufactured as to cause no damage to any robots of the opposing team or the field.
- 7.3. Hardwired emergency stop buttons must be built on all robots.
- 7.4. The use of explosives, fire or dangerous chemicals is prohibited.
- 7.5. Accumulator, lead-acid batteries are prohibited.
- 7.6. In designing and preparing the laser or infrared, full care must be taken to protect all persons at the venue from harm during all procedures. In particular, the beams must be so oriented that they cannot shine into the eyes of the spectators.
- 7.7. If the laser is used, it must be of class 2 or less.
- 7.8. When using radio for signal transmission, teams must design so that circuits and mechanisms do not go out of control or move dangerously even if the connection is broken.
- 7.9. When teams have multiple power supply systems, teams must design the circuits and mechanisms not to go out of control or move dangerously no matter which power supply is lost, or regardless of the order of turning on the power.
- 7.10. To avoid starting of a fire or smoking by overload of a motor stall and so on, proper current limiting devices such as a circuit breaker must be installed to power supply circuits.
- 7.11. Use wires, connectors, terminals, etc. with a rated current that is equal to, or higher than the assumed maximum current.

8. Teams

- 8.1. Each participating country or region in the contest can be represented by one team only. Fiji, as the host country, may be represented by two teams.
- 8.2. A team consists of three students, called team members, and one instructor who all belong to the same college, university, or polytechnic. The three students on the team are entitled to participate in the game.
- 8.3. In addition, three members of pit crews are allowed to assist in the pit area, to carry the robots to the field, and participate in the setting of the robots. The members of the pit crew must be students of the same college, university or polytechnic as the team.
- 8.4. Participation of graduated students is not permitted.

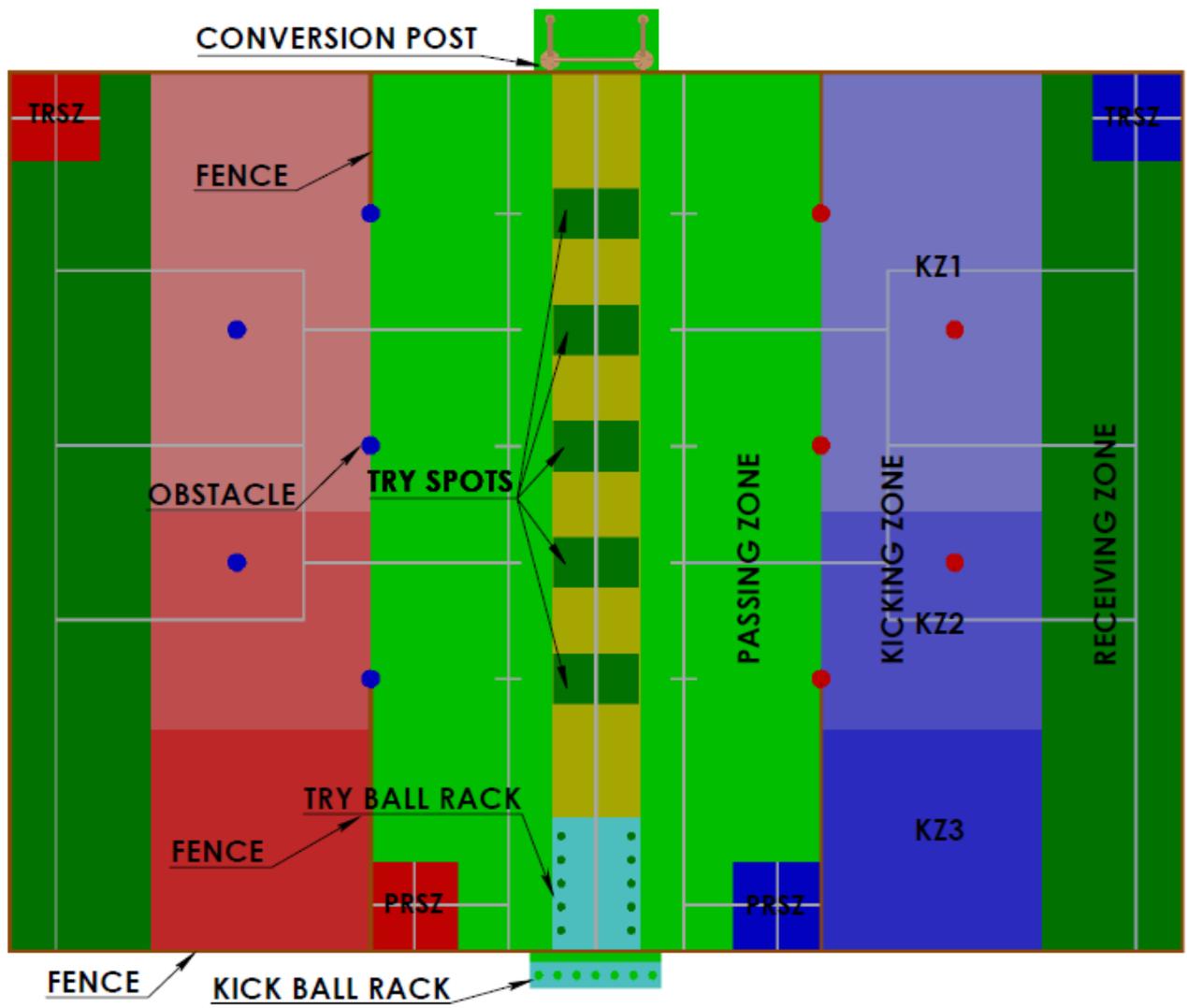
9. Others

- 9.1. The legitimacy of any actions not provided in this rulebook is subject to the discretion of the referee.
- 9.2. The dimensions, weights, etc., of the field, facilities and equipment described in this rulebook have a margin of error of plus or minus 5% unless otherwise stated. However, the dimensions and weights of the robots as shown in the rulebook are the maximum and cannot be tolerated.
- 9.3. All questions should be addressed to the official website of the ABU Asia-Pacific Robot Contest 2020 Suva, Fiji, <http://aburobocon2020.com.fj>. FAQ section is provided on the site. Notification of any additions and/or corrections to this rulebook is made on the official website.

10. Materials and colors of the contest tools

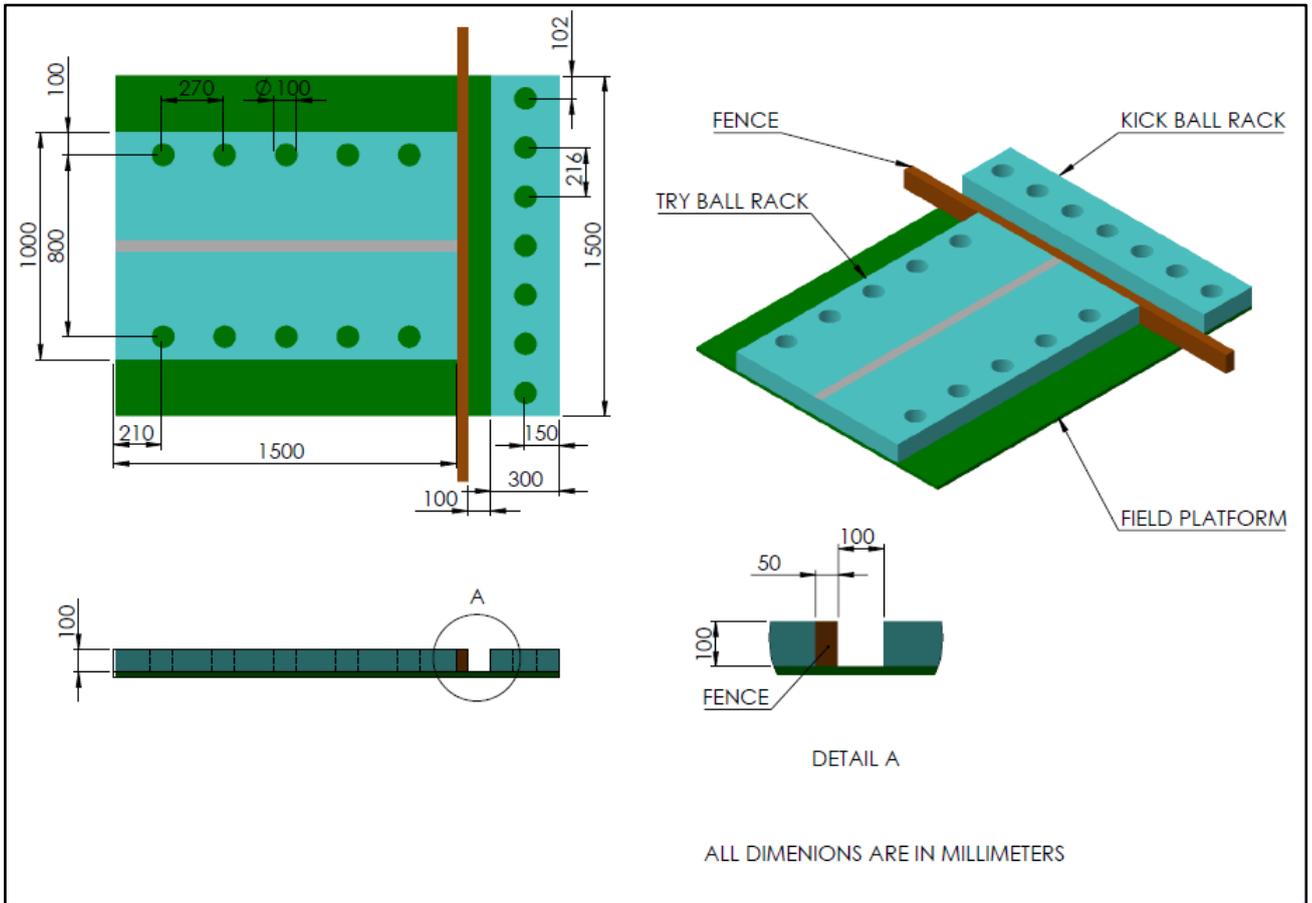
Items	Colors	Dulux Paint Name and RGB	Materials
Robot Start Zones	Red	Brilliant Red SB7F1 R:176, G:49, B:53	Plywood Water Paint
	Blue	Wing Commander S35H7 R:0, G:107, B:172	
Passing Zone	Green	Conceptual S22H7 R:126, G:195, B:79	Plywood Water Paint
Receiving Zone	Dark Green	Calm Balm S23F8 R:97, G:157, B:71	Plywood Water Paint
Try Spots	Dark Green	Calm Balm S23F8 R:97, G:157, B:71	Plywood Water Paint
Kicking Zone 1 (Blue Team)	Light Blue	Shimmer S35H1 R:136, G:202, B:233	Plywood Water Paint
Kicking Zone 2 (Blue Team)	Medium Blue	High Blue S35H3 R:76, G:173, B:223	Plywood Water Paint
Kicking Zone 3 (Blue Team)	Dark Blue	Wing Commander S35H7 R:0, G:107, B:172	Plywood Water Paint
Kicking Zone 1 (Red Team)	Light Red	Retro Disco S04H7 R:233, G:110, B:108	Plywood Water Paint
Kicking Zone 2 (Red Team)	Medium Red	Red Capital SB7E5 R:190, G:76, B:62	Plywood Water Paint
Kicking Zone 3 (Red Team)	Dark Red	Brilliant Red SB7F1 R:176, G:49, B:53	Plywood Water Paint
Conversion Post	Brown	Coconut Husk S11D7 R:145, G:113, B:90	Metal/Steel Oil Paint
Ball Rack	Light Blue	Shimmer S35H1 R:136, G:202, B:233	Plywood Water Paint
Obstacles	Red	Brilliant Red SB7F1 R:176, G:49, B:53	Metal/Steel Oil Paint
	Blue	Wing Commander S35H7 R:0, G:107, B:172	
Guideline	White	-	Non-Shiny Vinyl Tape
Border Zone	Yellow	Pale Daffodil S16H3 R:253, G:229, B:153	Plywood Water Paint
10mm x 10mm x 580 mm bar in Border Zone	Yellow	Pale Daffodil S16H3 R:253, G:229, B:153	Metal/Steel Oil Paint
Fence	Brown	Coconut Husk S11D7 R:145, G:113, B:90	Wood Oil Paint

Game Field: Top View with Labels



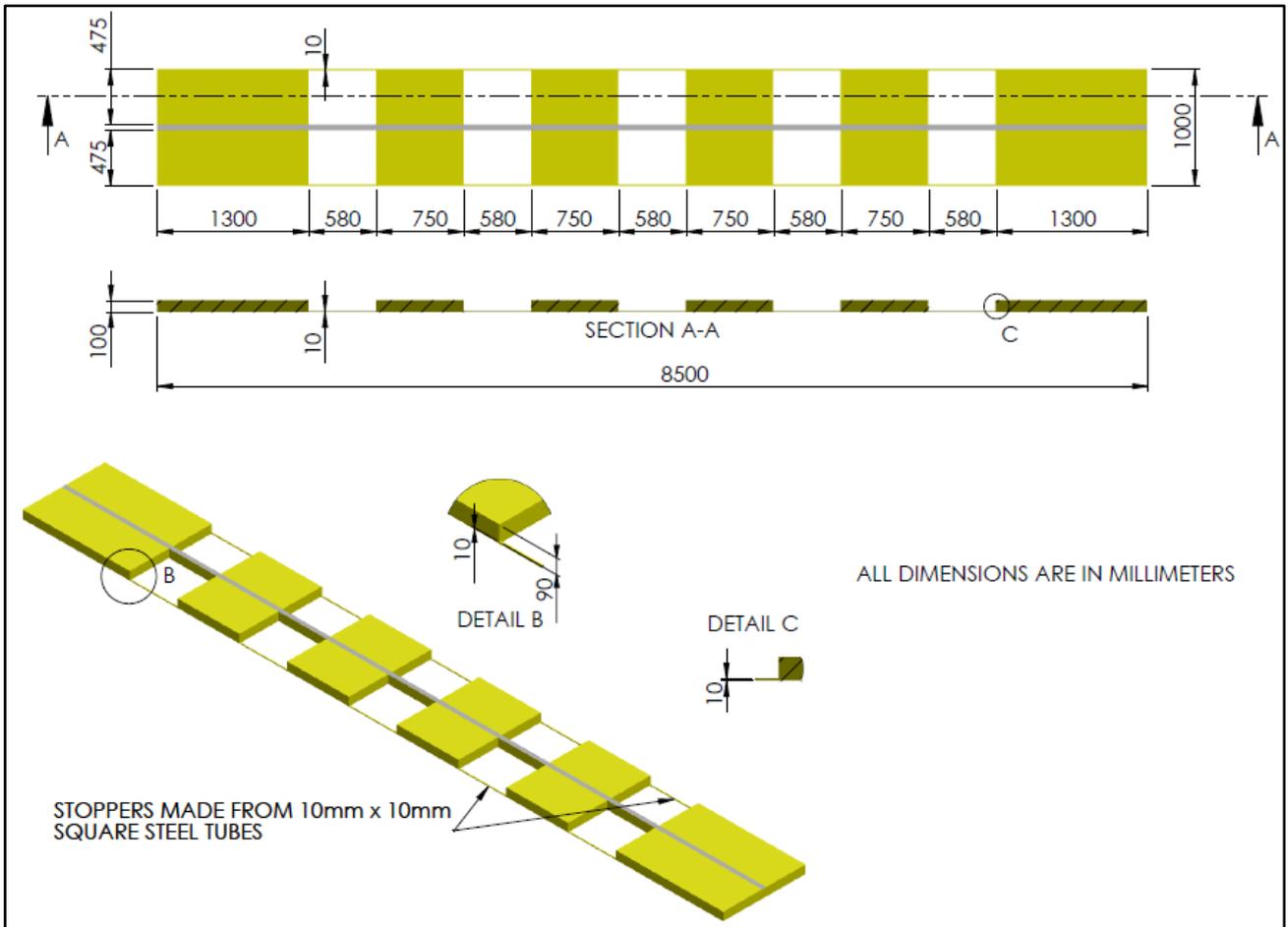
Ball Rack

All Dimensions are in Millimeters



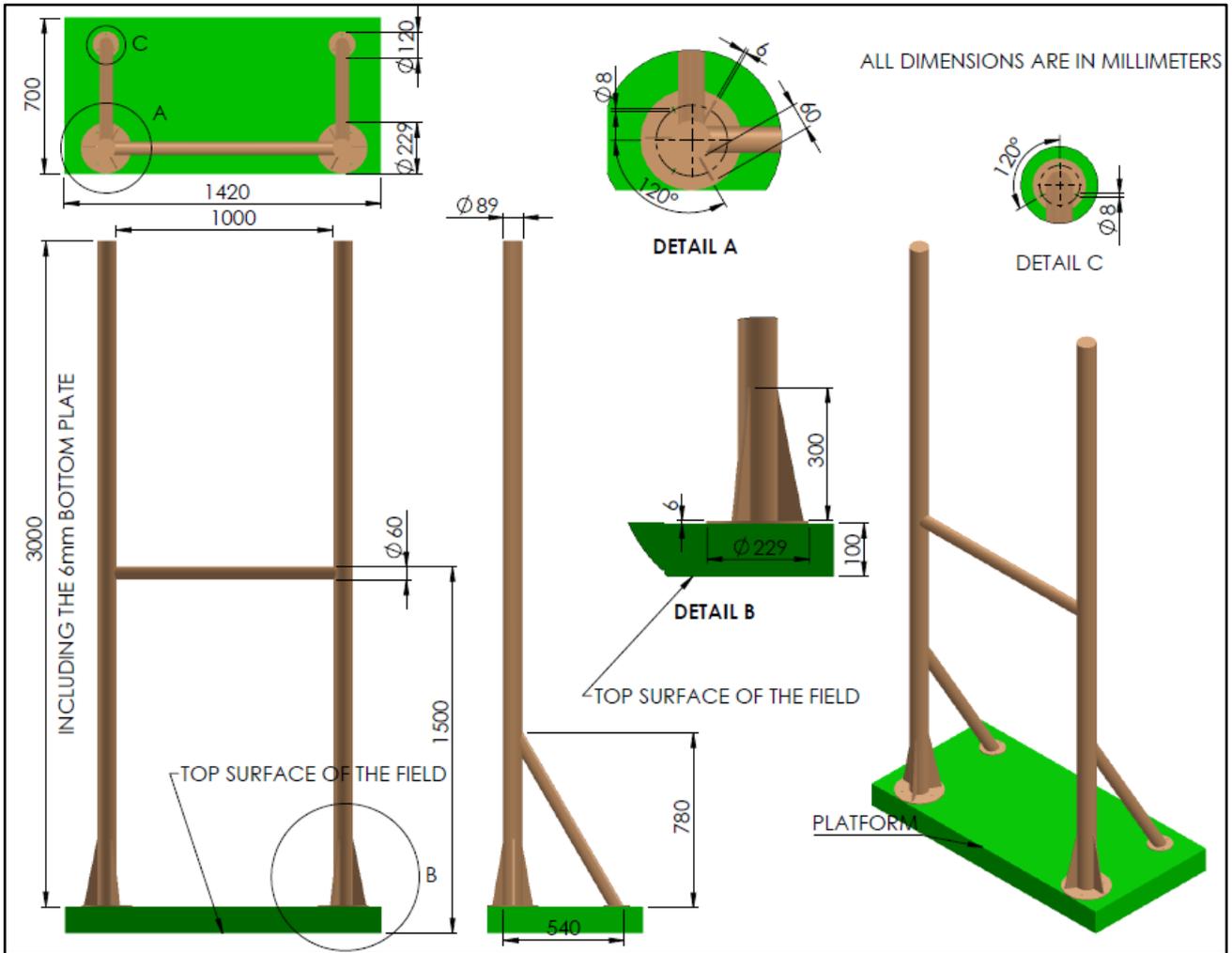
Try Spots and Border Zone

All Dimensions are in Millimeters



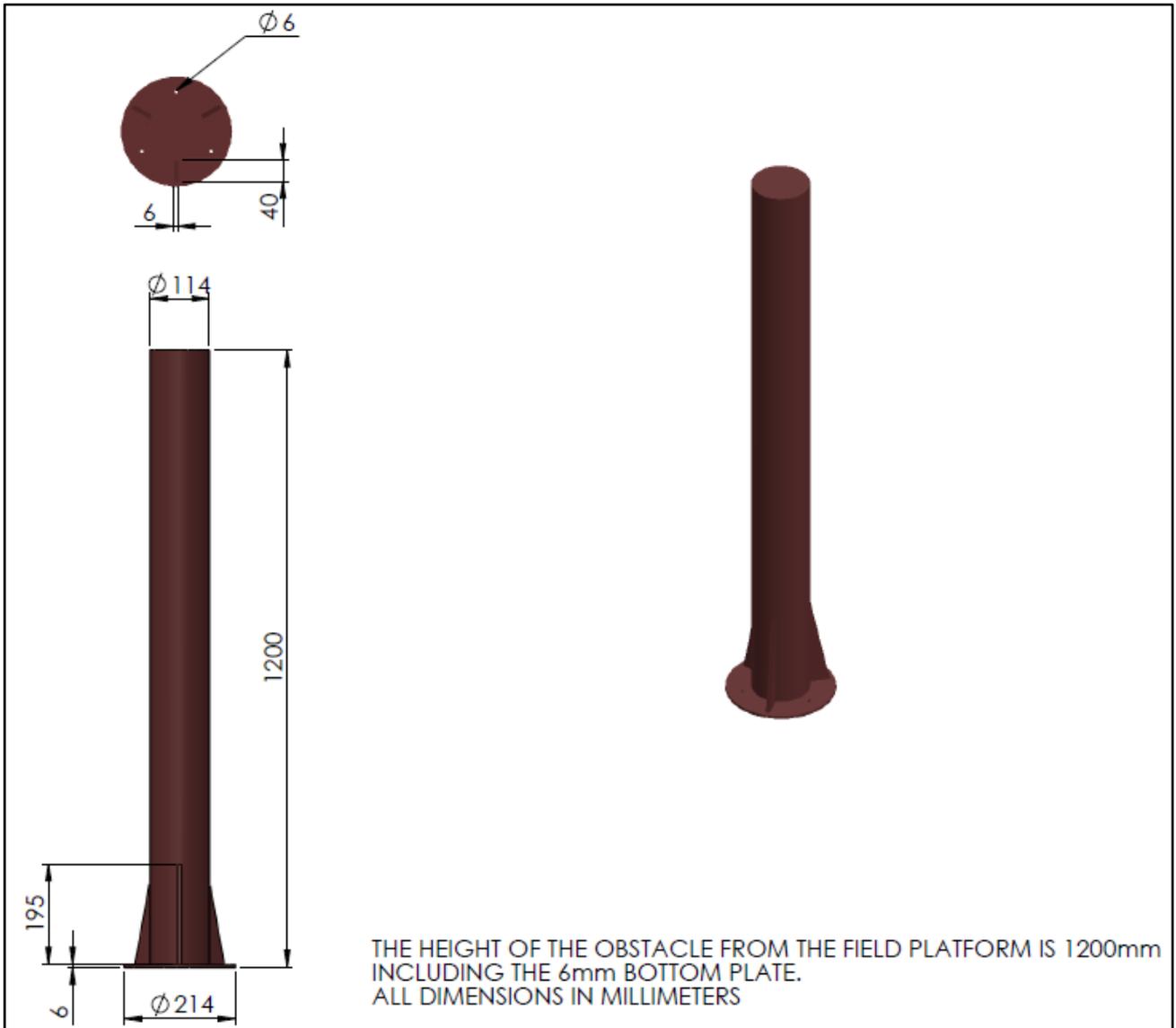
Conversion Post

All Dimensions are in Millimeters



Obstacle

All Dimensions are in Millimeters



Rugby Ball and kicking Tee Specification

Try Ball Specification	Kick Ball Specification	Tee Specification
<p>Name: Gilbert G-TR4000 Training Ball Color: Blue and Red Size: 3 Inflated pressure: 9.5-10 psi</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Red</p>  </div> <div style="text-align: center;"> <p>Blue</p>  </div> </div>	<p>Name: Gilbert G-TR4000 Training Ball Color: Yellow Size: 3 Inflated pressure: 9.5-10 psi</p> <div style="text-align: center;"> <p>Yellow</p>  </div>	<p>Name: Gilbert 450 Precision Kicking Tee Color: Black Size: High Fit Weight: 450 grams</p> 

Correct way of placing the Tee (allowed)



The Tee should be placed on the ground.

Correct way of placing the Tee and the Kick Ball (allowed)



The ball can be placed on the Tee at any angle as long as it is stable and not touching the ground.

In-correct way of placing the Tee and the Kick Ball (not allowed)

Top View



Side View

