The Beach Bots

Note: All the pictures in this document are provided for information. They cannot be used as references. Dimensions, colors and materials listed in the appendix are the only to be considered.

A. Presentation 4

B. Rules of the match 6

C. Playing area and actions 7
1. Playing area 8
2. Starting areas 8
3. The flags 9
4. The Sea fishing 10
5. The sand castle 11
6. The sea shells 13
7. Hide in the shade (funny action) 14
8. The black lines 15

D. Project presentation 16
1. Eurobot^Open 16
2. EurobotOpen Junior 17

E. The robots 18
1. Foreword 18
2. Dimensions 19
3. Energy sources 19
4. Design constraints and mandatory equipment 21
5. Safety 23

F. Beacon systems (specific Eurobot^Open) 25
1. General points 25
2. Opponent beacon 25
3. Fixed beacon 26
4. Communication signals 26
5. Identification tag 27

G. Match procedure 28
1. The preparation phase 28
2. The match 28
3. The scoring 29

H. The contests 30
1. Forewords 30
2. Approval 30
3. Qualification phases 30
4. The finals 31
5. Qualification for the national finals 31
6. Qualification for the European finals 32

I. Appendix 33
1. The sand castle plan 33
2. Seashell positioning cards 34
3. Playing area view from top 39
4. Table (Painting) 40
5. Black line painting 41
6. Dune painting 42
7. The rocks 43
8. The sand dune limit 44
9. The sea 45
10. The net fixing system 46
11. The windbreak 47
12. The beach hut 48
13. The dune 52
14. Playing elements 53
15. Placement of the playing elements at the beginning of the match 55
16. Beacon supports (specific EurobotOpen) 57
17. Painting references 58
18. Material references 58

A. Presentation

Eurobot[open] and Eurobot[open] Junior are two events open to young robotics teams of amateurs. These teams can be composed of students involved in Eurobot[open] in the frame of a school project, group of friends, or independent clubs. Eurobot[open] and Eurobot[open] Junior share the same goal: to allow young people to be involved in an active-learning process and put into practice their knowledge and know-how by participating in a friendly event.

About Eurobot[open]

The age limit for participating in the **Eurobot[open]** final is **30 years**. Each team may have a supervisor to whom the age limit does not apply. Teams that do not respect this age limit will not be allowed to participate in the Eurobot[open] final. The technical challenge is to build an **autonomous robot** as well as an optional secondary autonomous robot.

About Eurobot[open] Junior

The age limit for participating in the Eurobotopen Junior final is **18 years**. Each team may have a supervisor to whom the age limit does not apply. The technical challenge is to build a **remote controlled robot** as well as an optional autonomous robot.

Be careful, according to your country's educational system, this age limit may be slightly different. Check the registration requirements stated by your National Organizing Committee.

A team is a group of young people who have built one robot (and optionally a secondary robot) for the event. One person can be part of only one team, **even if both teams belong to the same organization**, but we encourage teams to share their experiences. The project can be supervised by someone over the age limit (teacher, parent, group leader, etc.), but the robot **must be designed and built by the team's members**, not the supervisor.

One organization (club, school, etc.) can supervise and register several teams, if allowed by the registration requirements set by your National Organizing Committee. The acceptance of these requirements is compulsory to validate your inscription.

Eurobot[open] and Eurobot[open] Junior are intended to be held in a friendly, sporting and fair-play spirit. As every sport events, refereeing decisions are pronounced with no possible recourse, except if an agreement between each participant is met.

Eurobot[open] and Eurobot[open] Junior European finals gather teams which are selected on national finals. These final events take place in Europe, but remain open to all other countries. Countries where more than three teams are registered must organize a national qualification (or national robotic cup), in order to select teams among registered teams, that will attend the international final.

As usual, some parameters can vary from one year to the next. Accordingly, please read the rules carefully even if the chapters may seem familiar to you (playing field dimensions, robots dimensions, etc.).

The rules for both events (Eurobotopen and Eurobotopen Junior) are similar. The aim of this approach is to provide an almost common platform for the Eurobotopen event, dedicated to autonomous robots, and for Eurobotopen Junior event, dedicated to wire-guided robots. Thus, a Eurobotopen organizer has also the ability to organize a Eurobotopen Junior contest, and vice versa. Think about it when you will organize a friendly or official event.

WARNING! : This document presents the Eurobot^{Open} and the Eurobot^{Open} Junior 2016 rules. To distinguish between them, you will find information dealing with Eurobot^{Open} in blue and Eurobot^{Open} Junior in yellow. Information common to both rules is in black.

B. Rules of the match

After an intense year spent on film sets, the robots take some holidays. Fishing, sandcastles and shells are on the agenda. Before taking the plunge, do not forget to check your flags!

Tasks:

- **The flags:** Having arrived on the beach, the flags can be hoisted.
- **The fishing on sea:** To insure the dinner, the robots go fishing. How many fish will they catch in their nets?
- **The sandcastle:** Who says beach, says sandcastles! At your shovels!
- **The shells:** The robots improvise a collection of shells.
- **Stand in the shade:** At the end of the match, the robots can open their embedded parasols. (Funny action)

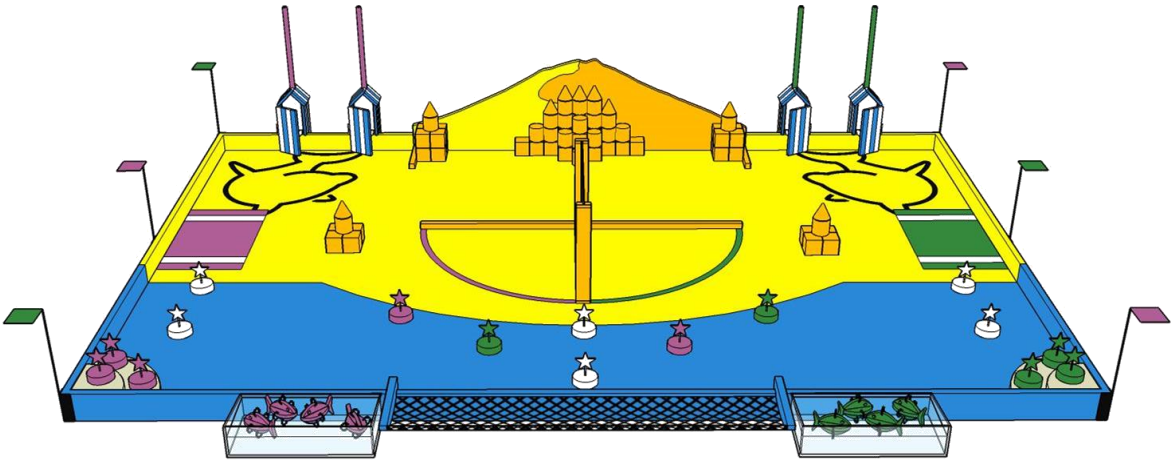


Figure 1 : Overview of the playing area (table and elements)

Warning:

- The tasks are independent from each other and no order is required in fulfilling them.
- No task is mandatory. Define your priorities.

C. Playing area and actions

Important information:

Organizers commit themselves to build the playing area with as much accuracy as possible. Nevertheless, they reserve the right to some modifications if they think it is necessary.

No objections regarding differences in dimensions will be taken into account.

Eventual changes of the technical specifications will be announced on the Eurobot website, or on the website of the National Organization Committee (NOC) in your country.

Teams are advised that the quality of the painting on surfaces can vary from one table to another, and can deteriorate as time goes by.

If any problems concerning the rules occur, the specifications of the playing area and its elements could be changed during the year. We therefore strongly encourage the participants to check our website regularly: http://www.eurobot.org/ as well as your NOC's own website for news. You can also follow the discussions and get further information in the forum: http://www.planete-sciences.org/forums/

1. Playing area

The playing area is a 3000x2000 mm rigid rectangular flat, which can be made in two parts of 1500x2000 mm or more. References are provided in the appendix.

This playing area is 10% tilted towards the public for EurobotOpen Junior.

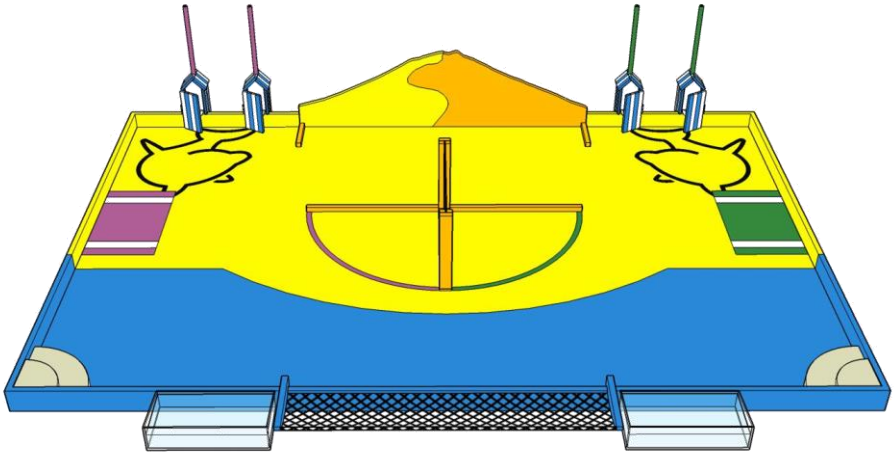


Figure 2: Overview of the playing area without elements

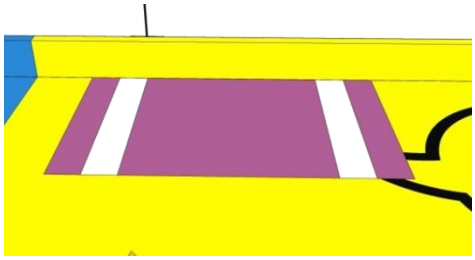
Full specifications of the playing area and playing elements (dimensions, positions at the beginning of the match, colors and other references) are listed in the appendix.

In the rest of the document, horizontal and vertical directions are stated relative to the playing area.

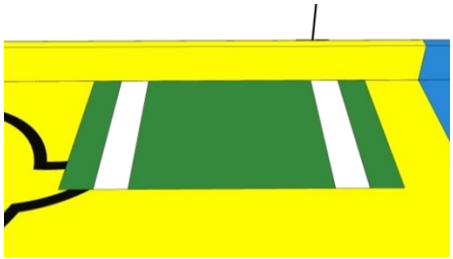
2. Starting areas

a. Description

Starting areas are located on the left and right sides of the playing area. They are represented by an area painted with the color of the team. The wooden borders of the area are included in the starting area whereas the playing area borders are not.



Team A starting area



Team B starting area

Figure 3: Overview of starting areas

b. Constraints

The robots are not allowed to enter the starting area of the other team.

Before starting, the robots must stand entirely within the limits of the starting area. Please make sure that your robots can stand together in the starting area.

3. The flags

Arrived on the beach, it's the party! To indicate their arrival, robots can raise the Beach Bots' flag

a. Description of the playing elements and layout

- **Beach huts:** There are two huts for each team, painted in the color of the team.
- **Flags:** There are two flags per team, each hanged on a mast over one beach hut.
- **The beach huts' door:** The door is a part of a mechanism that, when being closed, will raise the flag at the top of the mast. At the beginning of a match, the door is open.

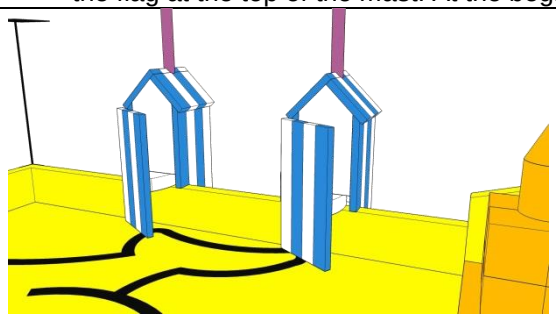


Figure 4 : Beach hut

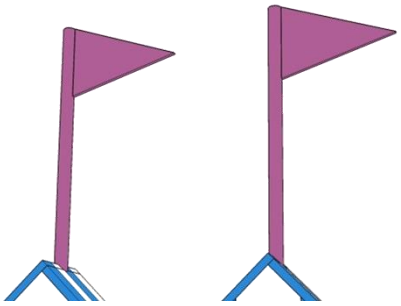


Figure 5 : Flags

b. Actions and constraints

Actions:

- Robots have to close the door of every beach hut. It will allow to raise the flag situated on its mast.

Constraints:

- A flag is counted if and only if the door of the hut is completely leaning on the boarder of the area at the end of the match. We will accept an angle of 10° maximum;
- It is not allowed to push or re-open the door of the hut of the opponent's color.

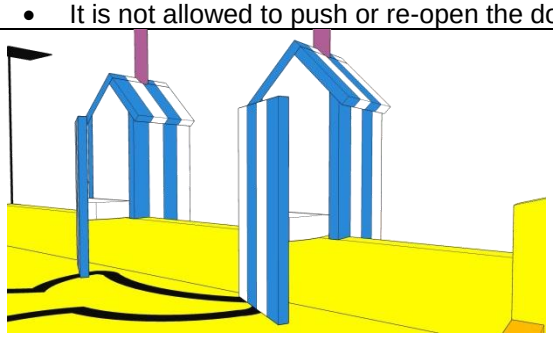


Figure 6 : invalid door

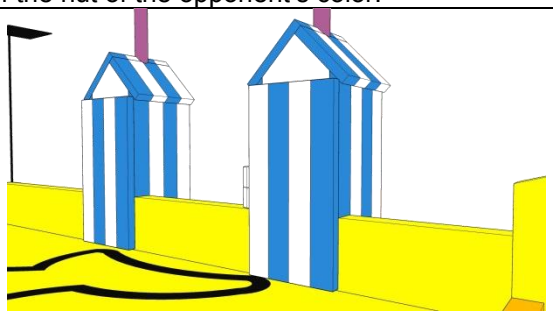


Figure 7 : valid door

4. The Sea fishing

It's fishing time. Robots need to catch some fish

a. Description of the playing elements and layout

- **The sea:** it is represented by two tanks full of water placed in front of the playing area. The water level is defined on the appendix.
- **Fish:** there are 4 fish by team.
  - They are floating on top of the water
  - They have the colors of the teams.
  - They are on the side of the starting area of the team whose color they carry.
  - They have magnetisable metallic rings.
- **The net:** it is situated between the two tanks and can receive the fish of both teams

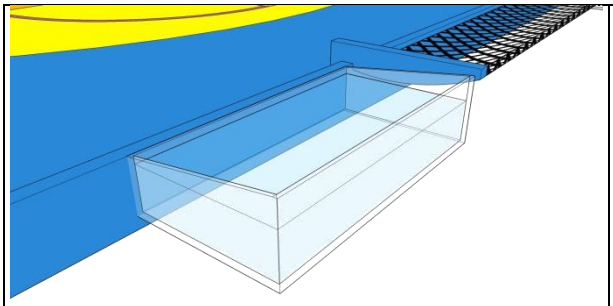


Figure 8 : The sea

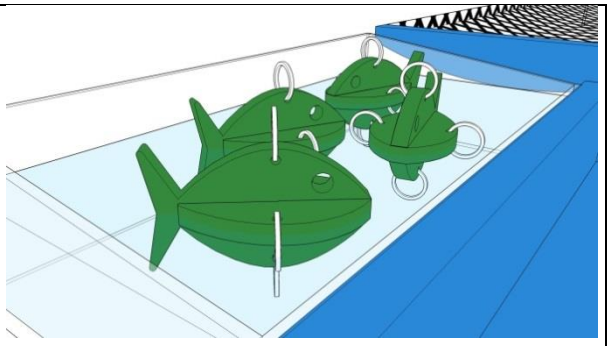


Figure 9 : The fish

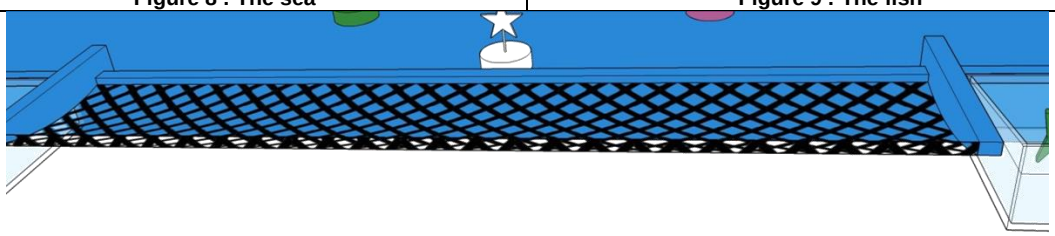


Figure 10 : The net

b. Actions and constraints:

Actions:

- Robots have to fish their own colored fish.
- Robots can drop their fish in the net.

Constraints:

- Robots have to catch only fish of their own color.
- Robots cannot move in any case the water of the sea.
- Robots are not allowed to remove the opponents' fish from the net.

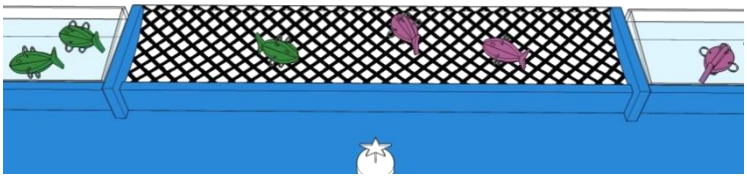


Figure 11 : Valid fish in the net

Warning:

Water and electricity do not mix up, be careful about the conception of your(s) robot(s).

It is strictly forbidden to put playing elements on the water.

5. The sand castle

Robots are playful and accept a new challenge: to build the most beautiful sand castle.

a. Description of the playing elements and layout

- **The dunes:** They are the 3 piles of sand situated at the bottom of the playing area at the start of the match.
- **The sand:** it is represented by three different block shapes:
  - Cubes (40x)
  - Cylinders (20x)
  - Cones(9x)
  - Each team can pre load one cone in one of their robots (the cone is one on the pile of sand of their side)
- **The beach windbreak:** It is situated in the middle of the playing area.
- **The building area:** That area in in the middle of the playing area, separated in two by the beach windbreak. The building area of the team is on the side of their starting area. The building area is delimited by a team colors line. This line is included in the building area.

During the construction, we shall distinguish:

- **The towers:** It is a pile of cylinder(s) and on top a cone
- **The walls:** they are chains of cubes connecting two towers
- **The castle:** It is a set of towers and walls
- **The plan of the castle:** it is a predefined plan of a castle. (See the annexes)

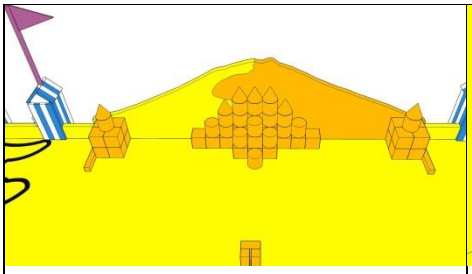


Figure 12 : The dune

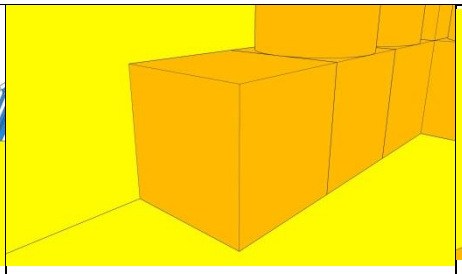


Figure 13 : A sand cube

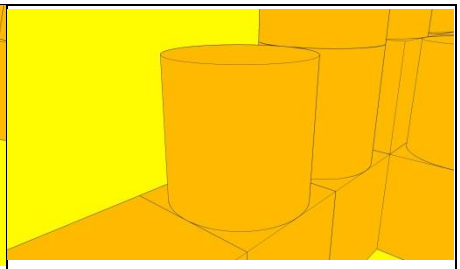


Figure 14 : A sand cylinder

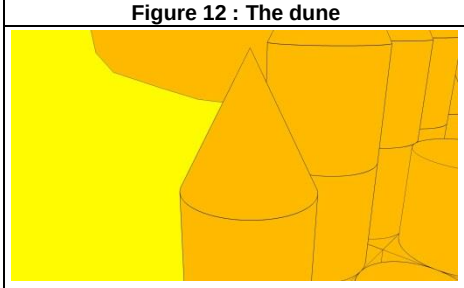


Figure 15 : A sand cone

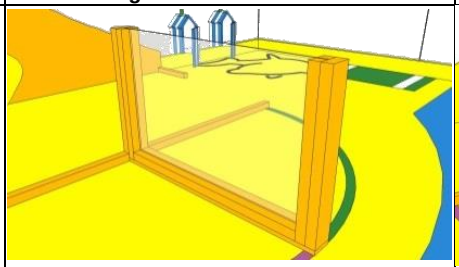


Figure 16 : The beach windbreak

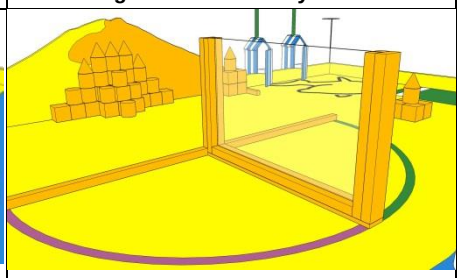


Figure 17 : The construction area

b. Actions and constraints

Actions:

- Robots can bring the sand in their building area.
- Robots can build towers and walls in their building area.
- Robots can build a castle that respects the plan in their building area.

Constraints:

- A block of sand is valid for a team if it is located at least partially inside the building area of the team.
- A tower is valid if and only if all the blocks making it up are valid.
- A wall is valid for a team if all the conditions below are respected:
  - All the blocs of sand making it up are valid.
  - Two cubes of sand in a row in the chain linking two towers are in contact
  - A cube at the end of the chain is in contact with the tower of that end.
- Robots can try to build a castle that respects the shape predefined to get extra points
- The castle is valid if the conditions below are respected:
  - Towers and walls are valid
  - It respects the plan of the castle
- The points of only one castle will be taking into consideration.
- For that action, one robot can move any sand block even if it give points to the other team.

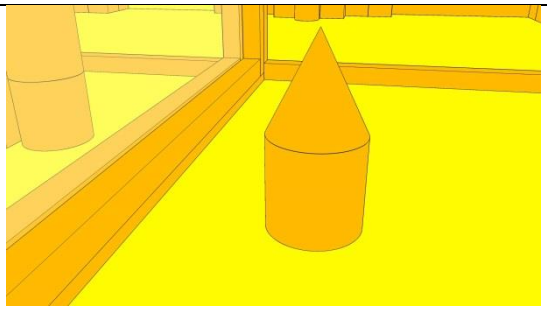


Figure 18 : A valid tower

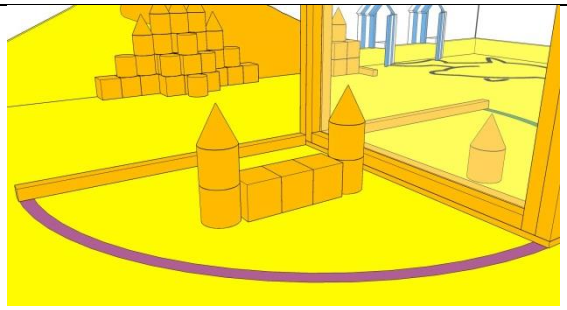


Figure 19 : A valid wall

6. The sea shells

To end this beautiful day, robots are walking on the beach and they find so many beautiful seashells, that they want to bring as many as they can into their beach towels. The beach towels are the starting area.

a. Description of the playing elements and layout

- **Seashells:** they are symbolized by a round disc with an ornament on top. There are two types:
  - Neutrals common to both teams (6x).
  - Coloured, of colours of the teams, 5 for each team.
- **Rocks:** some seashells are harder to catch, they are on rocks. They are situated on the corners in front of the playing area.
- **Beach towels:** it is the starting area.
- **Seashell positioning cards :** they are 5 cards displaying the different possible position of the seashells on the playing area. (ie appendix seashell positioning)

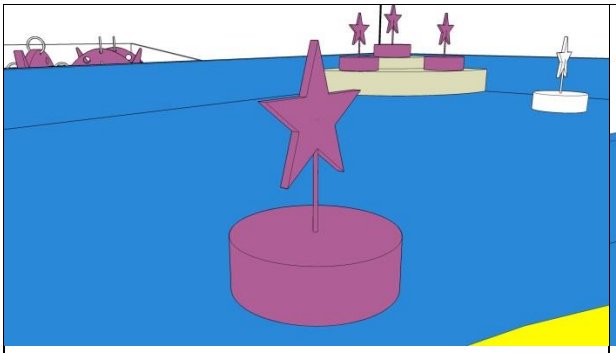


Figure 20 : A seashell

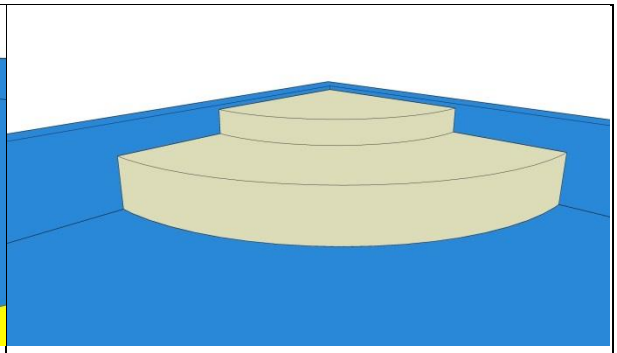


Figure 21 : A rock

b. Actions and constraints

Actions:

Robots can bring back seashells on their beach towels

Constraints:

- Seashells are placed everywhere on the beach and on the rocks
- The position of the seashells on the rocks is known.
- Seashells are counted if they are at least partially on the beach towel of the team.
- Seashells are placed randomly on the playing area, according to seashell positioning card drawn by lot during the playing area preparation, before the 3 minutes of team preparation.
- Seashells, whose are at least partially on the starting area, can't be moved by robots of the other team.

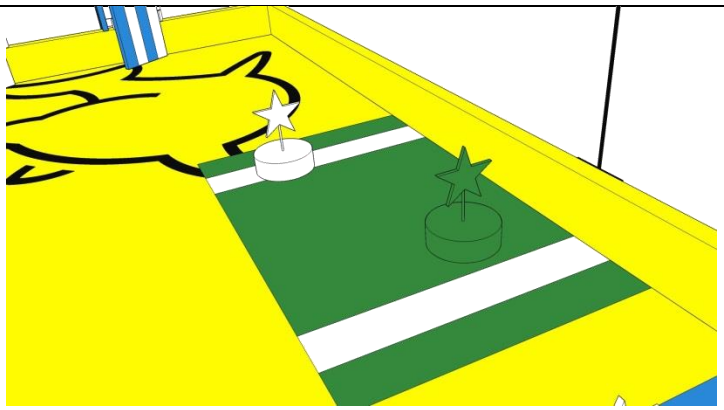


Figure 22 : Valids seashells

7. Hide in the shade (funny action)

It is hot, and the sun is high in the sky. To protect themselves, robots can open their parasol.

a. Description of the playing elements and layout

- **Parasols:** Teams can embark their own parasol on their robot. The parasol is supplied by the teams.

b. Actions and constraints

Actions:

After the end of the regular match time of 90 seconds, the robots have 5 additional seconds to open their parasol.

Constraints:

- At the end of the regular match time of 90 seconds, robots have to stop and only the parts dedicated to the opening of the parasol can start and work during 5 seconds.
- The actuators parasol opening system may in no case entail the movement of the robot.
- The parasol has to be attached to the robot.
- Space occupied by the parasol has to be increased significantly.
- To be valid, the parasol has to be open, and stay open after the 5 seconds. The opening of the parasol cannot begin before the end of the match, and be visible for the outside.
- For that time, the height of robots is not restrained
- Only one parasol is counted for each team.
- Parasols will be counted after the end of the 5 seconds

8. The black lines

A black line is available for each team in order to do line tracking.

This line starts from the starting area of the team and leads to the doors of the beach cabin.

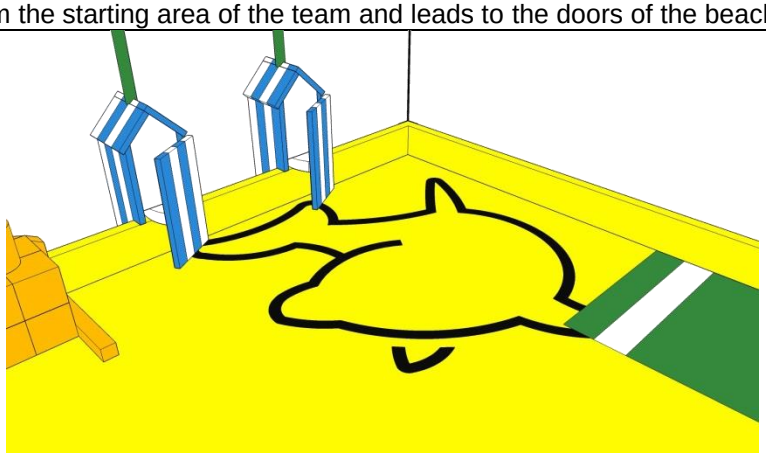


Figure 23 : Black line

D. Project presentation

Both Eurobot[open] and Eurobot[open] Junior encourage you to practice science through entertainment. One of the fundamental objectives is to assist and value your work and projects of this year. To achieve this, we require you to make a Technical survey and a Poster.

1. Eurobot[Open]

a. Technical survey

Over the year, each team is required to submit a technical survey to the refereeing committee; your national organizer specifies the submission deadline. The purpose of this paper is to provide a clear and concise vision of your project, focusing on 2 topics:

- General information (team, schedule, budget)
- Technical information (strategy, technical choices, etc.). It should include details about mechanics, electronics and the software your team plans to use. If possible, your technical survey should include illustrative charts and pictures. This part must be written using a template (downloadable from the registration website).

The goal of the technical survey is not to give the teams more work, but to help them to complete their projects successfully. The refereeing committee will read it carefully in order to identify possible misunderstandings of the rules, etc. in the development process as soon as possible.

Thus it will allow us to identify doubtful solutions and to help the teams to avoid failure situations.

b. Technical poster

Each team is required to provide a technical poster. This poster should present information related to the design of the robot (drawings, technical references, design specifications, etc.). It should be at least DIN A1 (594x841 mm) in size, and ideally should be printed. The poster is intended to promote exchange and communication between teams.

Special effort should be made to make the poster understandable to a novice audience. Ideally the poster should include pictures and charts to explain the concepts.

The poster must also include:

- the team's name,
- the team members' names,
- the team's nationality.

This poster will be displayed in the team's stand. An English version of the poster must be supplied. Optionally, the team can provide other language versions as well. The poster must be supplied to the Eurobotopen association in PDF Format.

The chosen resolution of the PDF must guarantee that all texts on the poster will remain readable. If possible, the file size of the PDF should remain below 25 MB. The PDF version of the poster may be sent to Eurobotopen beforehand via your National Organizing Committee. It may also be provided on CDROM or USB key during the contest when presenting your robots for the approval.

In a general way, we strongly encourage the teams to discuss their projects by posting information on the internet or for example in the Eurobotopen forums.

2. EurobotOpen Junior

As in the previous years, the presentation of your team's project (through project management on the long-term, tasks distribution ...) as well of your robots (technical systems implemented, chosen strategies ...) is an integral part of the event. Teams should present their projects in a way that is easily understandable and visible for the public and the other participants.

a. Constraints

This presentation should be done on a poster with a size of at least DIN A1 (594x841 mm). It is also possible to add further presentation supports (like video). Be creative!

We propose to the teams to create a blog, explaining the advancement of the robot. The blog we be created automatically when the team will register on the software Poolzor, the procedure will be explain in details. Writing the blog is not compulsory to validate your register, but we encourage strongly the teams to make it to favor the exchange around their projects.

b. Evaluation

The project should be presented to the referees and/or "guardian angels" during the approval of the robots in order to show the whole work. This presentation will be taken into account for the approval process. During the event, a jury will examine all the posters and discuss with all present teams, in order to be able to give an "award for the best-presentation".

E. The robots

1. Foreword

Each team is allowed to register a maximum of two robots which are referred to as the “main robot” and the “secondary robot”. The secondary robot has different constraints to its dimensions.

For EurobotOpen Junior, the main robot is wire-guided and the secondary robot is autonomous.

For EurobotOpen both robots are autonomous.

The construction of a secondary robot is optional. For beginner teams that are new to Eurobot it is recommended to focus on building a single robot. In general it is better to have one working robot instead of two robots that are barely finished. Having a secondary robot allows larger teams with more members to split their work into two projects.

The secondary robot can participate only with the main robot it has been created for and approved with. However it can participate alone if the main robot cannot participate. It cannot be re-approved with another robot.

A robot must not damage the opponent, the playing area or its elements.

During the contest, only two members per team are allowed on stage and in the backstage area. The path to the stage may contain steps or stairs. Therefore it is recommended to make the equipment easy to transport.

Both the main and the secondary robots must each consist of interconnected parts. Hence they are not allowed to leave or lose any parts on the playing area with the exception of playing elements.

The use of objects, graphics or colours resembling the table or its playing elements is against the idea of fair-play and must not be used on the robot(s). This will be checked during the approval.

The robots are not allowed to fixate themselves on the playing area (for example by suction).

The robot(s) shall never prevent the opponent’s robot(s) from scoring points, in particular blocking the access to playing elements. If a robot is motionless after for example finishing a task it should clear the area. However, blocking the access to already scored points is allowed.

Deliberately making the table vibrate or other similar actions will not be approved. If you are in doubt please contact the referees.

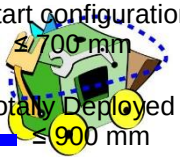
Use your imagination and be creative! Your robot can show emotions, play sounds or music to provide the audience and media with an attractive show.

2. Dimensions

The dimensions of the main and the secondary robot in Eurobot[Open] are identical to the ones in Eurobot[Open] Junior. Thus, a robot built for Eurobot[Open] Junior can potentially compete in Eurobot[Open]. The Eurobot[Open] Junior robot would only need to be modified in order to be autonomous.

Dimensions of the main and the secondary robot:

The perimeter is measured according to the figure below:

Dimensions of the main robot:	Dimensions of the secondary robot:
Start configuration ≤ 1200 mm Totally Deployed ≤ 1500 mm	 Start configuration ≤ 700 mm Totally Deployed ≤ 900 mm

The perimeter of the main robot must not exceed 1200 mm at the beginning of a match. This is called the “starting configuration”. During the match the robot may deploy to a maximum perimeter of 1500 mm which is called the deployed configuration.

The secondary robot’s perimeter is independent from the main robot’s perimeter. At start it must not exceed 700 mm but can extend up to 900 mm in the deployed state during a match.

In any case the height of the main robot and the secondary robot must never exceed 350 mm. The emergency button is allowed to exceed this limit but must stay below 375 mm in height.

For Eurobot[Open] this height excludes the beacon support, sensors and electronic circuits that can be placed below the beacon support.

No components of the robot and playing elements manipulated at any moment by the robot should exceed 350 mm in height, in order not to disturb the beacons.

At the beginning of a match both robots together must be completely inside the starting area and may not exceed its limits.

3. Energy sources

In general, all forms of energy sources stored in the robot are allowed (batteries, springs, compressed air, gravitational energy...). Energy sources using chemical reactions like combustion or pyrotechnic processes are prohibited for safety reasons. Any corrosive products or other liquids that can splash are not allowed for the same reason. It is also prohibited to use living beings inside the robot.

If you have any doubts about an unusual energy source, please ask the referees in time and sharing with them the corresponding datasheets.

To prevent the risk of fire, special attention should be paid to the choice of conductors, depending on the intensity of current passing through them. It is also recommended to protect the wiring with a fuse that should be placed as close to the batteries as possible.

For Eurobot[Open] Junior:

Beware! Power supply systems must be easily transportable. Teams may have to walk up/walk down stairs to access the stage where the matches take place.

Only electric energy can transmitted to the robot. The maximal voltage allowed is 13.8V (measured between two wires of the cable and of the robot). The organizers do not provide this energy source during the event. Teams will have access to the standard 230V, 50Hz. In case of using batteries, these ones should be waterproof.

The terminals must be insulated.

Batteries

If the team make the choice to use batteries for energy source, we remind that only airtight batteries can be used.

Both robots must be able to play at least three matches consecutively. Please note that this also includes the time during the preparation phase before the match itself.

During the preparation phase the robots have to stand by waiting for the start signal. For details on the procedures of a match please take a look at chapter **"G. Match procedure"**.

Therefore, it is strongly recommended to have several sets of batteries with the possibility to **change them easil**y without too much effort. It is also very advisable to keep a set of batteries fully charged at any time.

Special note for batteries based on Lithium:
These types of batteries are permitted only under strict conditions:

- A charger suitable for the batteries in use must be presented during the approval.
- The batteries must remain inside certified and unaltered safety bags at any time. (This includes also the time when they are not in use or being recharged)
- A system to detect and prevent undervoltage is strongly advised.
- Those restrictions do not apply if the batteries are inside commercial products such as laptops, mobile phones or LEGO NXT and only if they are not altered or modified in any way.

4. Design constraints and mandatory equipment

a. Common part

1. Visibility

Two rectangular areas of 100x70 mm shall be free on at least two faces no matter which ones of the robot. Teams will receive stickers printed by the organization (team numbers, event sponsors, etc…) to place on these free areas.

The teams are strongly encouraged to make the mechanism inside the robot visible from the outside of the robot. The goal of this advice is to allow the audience end other participants to see how elements are moved and carried in the robot. It is in the spirit of education and knowledge transfer to understand how the robots are functioning.

2. Starting cord of autonomous robots

The robots have to be equipped with an accessible device which shall be accessible on the robot. This device has to be triggered by pulling a cord with at least e length of 500 mm. This cord will not stay attached to the robot after the start. Any other devices like a remote control, activating by a switch hand or releasing the emergency button will not be approved.

The start of the first robot may start the second robot.

3. Emergency stop button of autonomous robots

The autonomous robots must be equipped with an emergency stop button that is at least a diameter of 20 mm and composed of red colour. **It must be placed on top of the robot in a spot that can be accessed safely by the referees at any time during the match.**

The button in the released state may exceed the height limit by additional 25mm.

A simple downward movement, for example by the hit of a fist, must actuate the button.

Pushing this button shall stop immediately all actuators of the robot.

4. Automatic shutdown (optional for EurobotOpen Junior)

Both robots must be equipped with a timer that stops the robot and its actuators after the 95 seconds of a match.

5. Obstacle avoidance system (optional for EurobotOpen Junior)

Teams shall equipped their robots with an equipment to detect opponent robots.

The objective of such a system is to prevent collisions between robots during a match.

This point will be strictly verified at the approval. Referees will be attentive to non-fair-play teams which deactivate their avoiding system after the approval. The deactivation on purpose of avoiding systems might lead to the entire team disqualification.

Warning: Most events are filmed or photographed. Some cameras use autofocus systems with infrared light that could have a negative effect on your robot's sensors. Please make sure your system is robust against this influence.

b. Eurobot Open

Beacon support

It is strongly recommended to equip your robots with a beacon support. Its purpose is to allow the opponent to put a beacon on top of each of your robots to be able to detect it.

This support can be made removable to only be mounted if needed. In that case the teams must be able to set it up quickly prior to a match.

The beacon support is optional. A team can also choose not to facilitate their robots with it. In a match with an opponent that depends on putting a beacon on your robot you will not be able participate. It will be considered as a scratch for your side.

The beacon support should at all times comply with the following specifications:

- It needs to have an 80x80 mm square surface, located at 430 mm above floor level. This is where the opponent's beacon will be placed.
- The surface of this platform has to be entirely covered with Velcro (the rough "hook" side)
- The structure supporting the platform (mast) must stay within the vertical projection of this platform.
- The mast can only host sensors and electronic circuits that also need to stay inside the platform's vertical projection.
- The mast should be stable and must be able to support a weight of at least 400 g.

c. Eurobot Open Junior

1. Main robot control system

The Control panel

Each team must design a control panel for its main robot that may only be operated by a single pilot. The control panel is an in-box system allowing the control all the electrical devices of the robot. It is the only authorized communication device with the robot. As a consequence, any other remote control device is strictly forbidden.

The cable

The cable linking the robot to its control panel is not provided, it must be designed and built by each team, according to its own needs.

For the reason of sufficient mobility on the playing area it should be at least 5 meters long. It will be supported by the co-pilot with a pole provided by the organizers.

During the match, the co-pilot should interfere neither in the piloting nor in the robot's settings (like the voltage for example).

Furthermore, the cable must not be used to guide the robot or to put it upright again after it fell down. Such action can be penalized.

2. Secondary robot control system

Teams can use any kind of control system for their secondary robot (analogue, microprocessor-based, microcontroller-based, embedded computer, programmed...).

These systems must be entirely embedded in the secondary robot.

The control system must allow the robot to play a match in the role of both colors. Ideally, this technical point should be configured just before the match starts.

5. Safety

a. General

All systems (i.e. robots and beacons) should comply with current national and European safety regulations. They must endanger neither the participants nor the audience during matches, as well at stands and backstage.

The robots must not have any protruding or sharp parts that can cause injuries or damage to the table, its playing elements or other robots.

The use of liquids, corrosives, pyrotechnics and living components is strictly prohibited.

All robots must comply with the legal standards for "low voltage". Therefore, **the internal voltage of the robots and beacons must not exceed 48 V**.

Potentials higher than 48 V are allowed only inside sealed commercial devices which comply with national and European regulations (such as lasers or LCD display back lighting). Those devices must be left unmodified and unaltered.

As a general rule, any device or system considered as potentially dangerous by the referees will be rejected. It must be removed from the robot prior to the competition, or will result in the team's disqualification.

b. Lasers

Only considerations based on the laser class definition "EN 60825-1:2007, Edition 2 -Safety of laser products– Part 1: Equipment classification and requirements" will be taken into account.

Teams using a laser have to provide either the classification notice of the equipment or the laser component data sheet. Not being able to provide such a document will prevent the robot from being approved.

Based on this classification, lasers of classes:

- 1 and 1M are allowed without any restrictions
- 2 are tolerated if the projected spot is never projected outside the game area
- 2M, 3R, 3B and 4 are strictly prohibited

Caution: A laser device consists of the laser source, its electronics and the optics. Disassembling or modifying any of those components often leads to a change of classification. Only commercial products with unaltered components can be approved for Eurobot[Open].

c. Powerful lights

In case of use a powerful light, light intensity shall not be dangerous for the human eye in case of direct spot exposition. Be aware that some kind of LED provide warnings.

Be responsible! Your machines runs in front of an non-well-informed public.

If any doubt, organization has the right to ask for manufacturer specification to verify that the lighting system is not dangerous.

If the system is considered as dangerous, it could be refused as well as laser class 2M and more.

d. Compressed air system

The pressure in systems using compressed air may not exceed 400kPa (4 bar).

F. Beacon systems (specific Eurobot[Open])

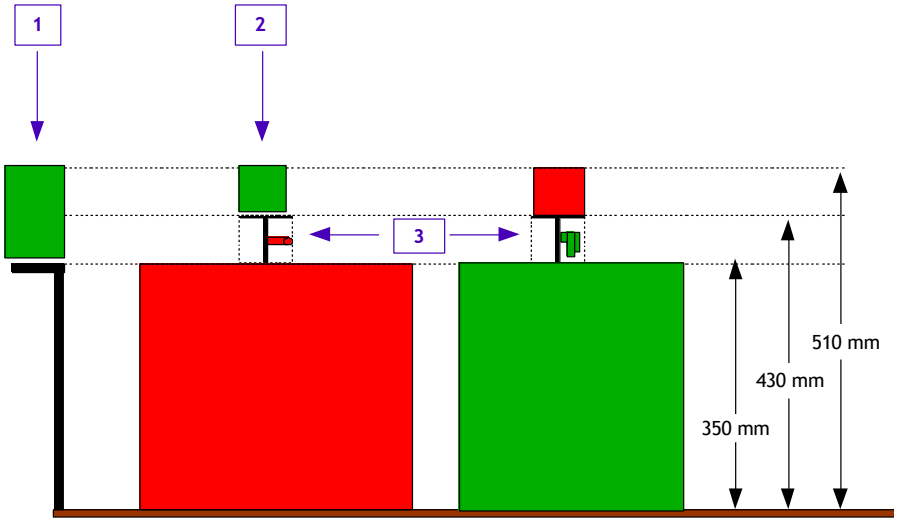
1. General points

Teams can use beacons around the playing area and on the opponent robot(s) to design a system for localization. The table provides three support platforms for each team to place beacons upon. These beacon supports are located on fixed positions as indicated by the figure below.

All beacons, i.e. those around the table and on the opponent robot(s) must have Velcro on the bottom side. It has to be the soft (“loops”) side of the Velcro.

Beacons need to remain on their supports for the entire match.

All points regarding the safety of robots also apply to the beacons.



Legend:

- 1: Fixed beacon (maximum size: L x W x H: 80 x 80 x 160 mm)
- 2: Opponent beacon (maximum size: L x W x H: 80 x 80 x 80 mm)
- 3: Mast to support the platform. Sensors and electronics may be placed around the mast as long as they stay within the vertical projection of the platform

2. Opponent beacon

A beacon can be placed on top of each opponent robot. It can be used to localize the robot for the obstacle avoidance system.

This beacon must not exceed the size of a cube with 80 mm edges. In the spirit of fair play the beacons may only contain components that have a real use.

Additionally, opponent beacons also need to have Velcro on the topside. It has to be the rough ("hook") side. During the matches a tag indicating the team's colour will be placed on top of it.

A beacon must not exceed 400g.

The superior face of the embarked beacon must be covered with Velcro ™ face hooks to receive the mark of identification of the robot, in the color of the team.

3. Fixed beacon

Each team can place three beacons on fixed locations around the table. Those locations are defined by the team's colour in the match as indicated in the figure below. The dimensions of the beacons must not exceed a cuboid with a base of 80 x 80 mm and 160 mm height.

The fixed beacons can be connected to each other using a wire. This wire must not disturb the match in any case.

The setup of the whole system must be possible during the 3 minutes preparation phase prior to the match and must not disturb the opponent team.

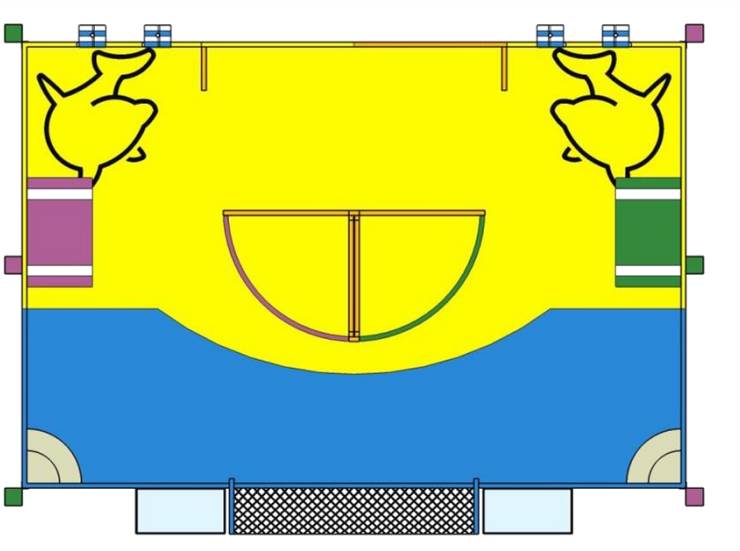


Figure 24 : Position of the beacon on the playing area

4. Communication signals

It is recommended to encode all communications to avoid interferences between the signals of different teams.

The organizers use high-frequency radio devices and cannot be held responsible for any interference with a robot caused by them.

Special attention should be paid to the strong ambient light during the event, especially when using infrared or other optical devices. Furthermore, this light may vary between different tables and also even during a single match.

Caution: beyond the edge of the playing area, there may be elements which can disturb color detection and communications signals such as:

- Decorative elements of the playing area
- People (referees, teams, etc.)
- Electronics systems (micro, camera, etc.)

Under no circumstances it is possible to requested to the people and decorative elements of the playing area to move away

5. Identification tag

Tags are assigned to the robots in each match. These tags have a negligible weight and are placed on top of the opponent beacon or beacon support if there is no beacon.

The tags have the colour of the team and allow the audience to assign the robots to the teams.

G. Match procedure

The matches have a duration of 90 seconds + 5 seconds for the funny action.

Only two members of each team are allowed to access the stage and the backstage area.

1. The preparation phase

At first the playing elements are put in place according to the figures in the appendix.

When arriving at the playing table, the teams have 3 minutes to set up their robots and beacons.

Failing to meet this deadline may result in the team's disqualification (scratch) from that match. In that case the opponent will play the match alone.

If both teams completed the setup, the referees ask if the teams are ready for the match. From this moment on it is forbidden to touch their robots or beacons (except the starting cord) ! No objection regarding the playing elements or their placement will be accepted from this point on.

When both teams are ready, referees ask both teams if they are ready. At that point, both teams are not allowed to touch robots. No contesting on the positioning of any elements are allowed after the start of the game.

If both teams are ready before the 3 minutes the match can start earlier.

2. The match

The referees will give the signal to start the robots after a short countdown. It is forbidden to touch the robots, the beacons, the table and its elements unless it is explicitly authorized by a referee. This also includes pressing the emergency button! Failing to comply with that rule may result in a team's disqualification from that particular match (scratch).

Any elements leaving the table may not be returned.

After 90 seconds the robots must have stopped moving and switched off all actuators.

After the end of a match, **no one except the referees** is allowed to touch the robots or the playing elements. The referees count the points on a so called match sheet and explain them to the teams. (Please take a look at the next section on how to count points.) If both teams agree with the result, they sign the match sheet, take their robots and leave the stage.

If one team does not agree with the result of the match it may present its arguments **calmly**, while the robots stay in place. Please remember that only two members per team are allowed on stage. The decision of the referees is final.

In case of judging difficult situations, the referees can decide to replay the match or not.

If for example all robots are blocked, the referees may announce an early end of the match with both teams' affirmation.

A team is scratched for the match:

- when none of the robots of a team has completely left the starting area during the match
- when the emergency button has been pushed during the time of the match
- For other refereeing decisions.

3. The scoring

The referees will count the points for each team as follows:

a. The flags

10 points for each valid flag

b. The sea fishing

5 points for each fish controlled by the robot and out of water
10 points for each fish in the net
Caution: the points are not cumulated

c. The sand castle

2 points for each valid sand block in the construction area
2 additional points for each block of a valid tower or a valid wall
12 additional points if the castle plan is respected

d. The seashells

2 points for each valid seashell in the beach towel

e. Hide in shade (funny action)

20 points for the valid parasol

f. Penalties

A penalty leads to **a loss of 20 point**s for the match it occurred in.

A negative score will be rounded to 0.

An element controlled by a robot, except for the fish, does not score any points. A playing element is considered to be in the control of a robot if by moving the robot along its innate axis of locomotion the element is also moved.

Reminder:

Penalties are intended to compensate for damages or disadvantages as a result of an incident during the match. A penalty situation is considered as a non-compliance with the rules and should remain the exception. A penalty may result in a scratch for the team. The referees will also pay attention to the cumulated penalties given during the qualification phases (regional, national and also European).

g. Bonus points:

15 bonus points is given to all teams that are not “scratched”, i.e. that have won or lost the match.

H. The contests

1. Forewords

The Eurobot[Open]/Eurobot[Open] Junior events are organized on three levels:

- **Regional:** where they exist (e.g. in France for Eurobot[Open] Junior), they enable to qualify teams for the national final,
- **National:** it enable to qualify teams for the European final,
  Be aware that the number of team that can qualify has changed since last year!
- **European:** the last step that get together, in the same friendly spirit, qualified teams from country of Europe and elsewhere.

2. Approval

Pre-approval:

Before a robot can participate in a match it needs to be approved by a referee. In the **pre-approval** a referee verifies the robots' compliance with the rules. Therefor the robot should be able to demonstrate all action it is capable of.

Approval:

The robot(s) must demonstrate their ability to score at least one point under match conditions, i.e. in 95 seconds without the presence of an opponent team. The avoidance system and other equipment will also be tested in that phase.

If the main robot and the secondary (optional) robot pass the tests, they are declared as approved. If only one out of two robots pass the approval this robot is can play the matches on its own.

Significant technical modifications after the approval:

If significant changes are made to a robot, e.g. in its function, structure or dimensions, a referee needs to be informed. That referee will reapprove the robot and redo some test if it is considered necessary.

3. Qualification phases

Each team should have the possibility of playing at least three matches during the qualification phase. The local organizers can also decide to play more matches which are normally organized in rounds.

To choose the teams for the finals, a ranking is set up by using the accumulated points of each team during the qualification phase.

If two or more teams have the same number of points, the teams will be ranked by comparing their scores without considering the bonus points. If teams still level, the referees may decide to organize extra matches. In that case, pairs of teams competing for the same ranking will be drawn by lot and the winner of the resulting matches will move on to the final round.In the case of an odd number of teams, an opponent for the last team is drawn by lots. Points scored by the randomly chosen team will enter the ranking.

4. The finals

After the qualification phase, the first 8 or 16 teams (depending on the number of approved teams) will participate to the final phase according to the following figure:

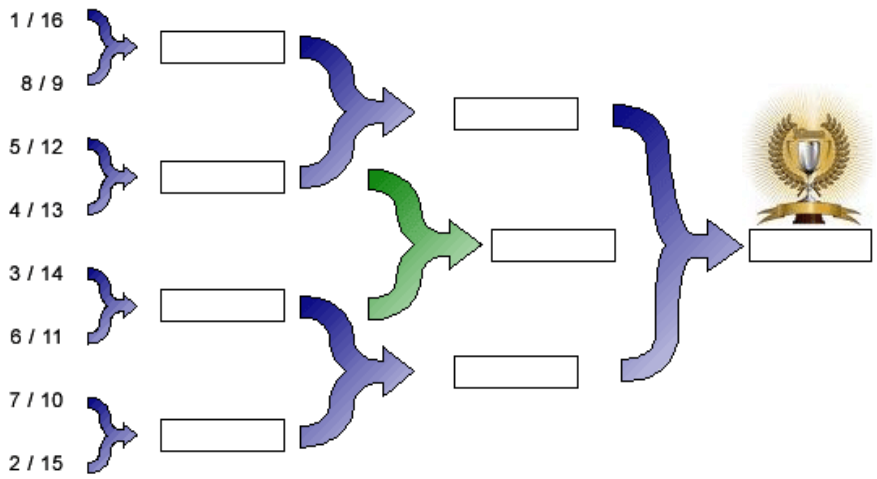


Figure 27: Schematic of the finals

In this phase the matches are played as knock-out matches, i.e. the winner moves on to the next round. If a winner cannot be determined (double scratch or draw) the match is replayed immediately. If the situation is still unresolved, the points during the qualification can be taken as a criterion to declare the winner.

The final match for the first place is played as “best of three”. The team that first wins two matches wins the match.

5. Qualification for the national finals

Where the regional competitions exist (e.g. in EurobotOpen Junior in France) the number of teams that can qualify for the national competition is proportional to the total number of teams on national level.

The results of the qualification rounds are used to select the teams for the national finals.

Final rounds can still be hold to define the regional champion, but this champion is not necessarily qualified for the national competition!

At least one team received as special award (for example for creativity, fair play, best presentation, ...) and is also qualified for the national competition.

6. Qualification for the European finals

Each country participating in Eurobot[Open] and/or Eurobot[Open] Junior organizes a national competition to determine the teams qualified for the international phase. The top teams in the final rounds (not the qualification rounds) as well as the team who received a special award will qualify for the European finals.

In the case where no team receives a special awards, the top four teams will qualify for the European finals.

For questions and comments feel free to visit the forum on http://www.planete-sciences.org/forums/. A volunteer from the refereeing committee will answer your questions there.

News and more information about EurobotOpen and EurobotOpen Junior are available at our website www.eurobot.org. It also contains links to your local organizations

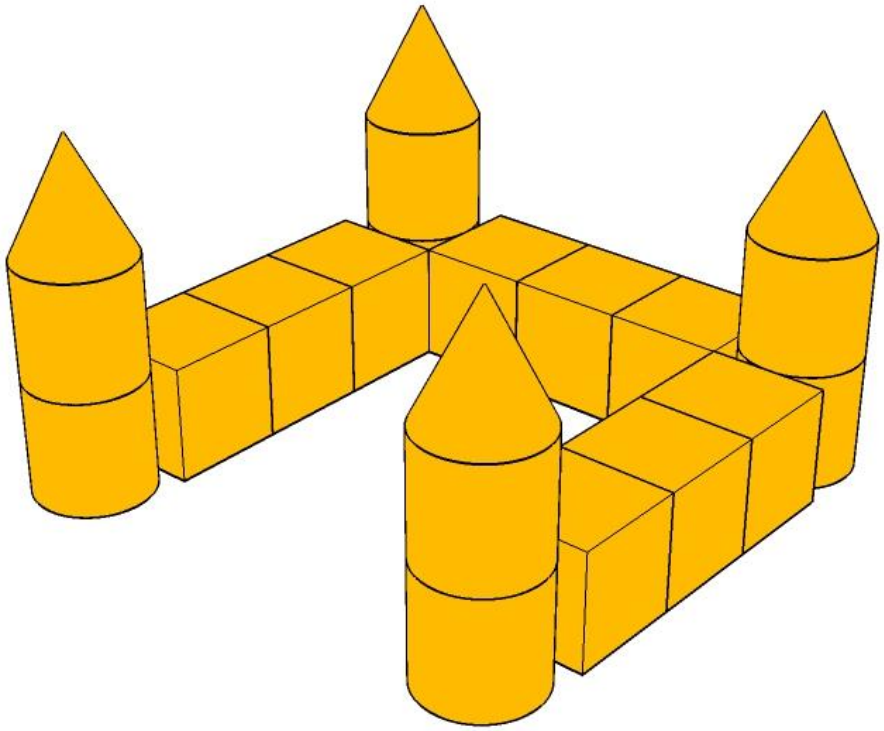
The whole organization team of Eurobot[Open] and Eurobot[Open] Junior wishes you a lot of fun and success for the coming months, and looks forward to seeing you soon around a playing field!

Robotic Regards,

The Eurobot[Open] and Eurobot[Open] Junior organization committee.

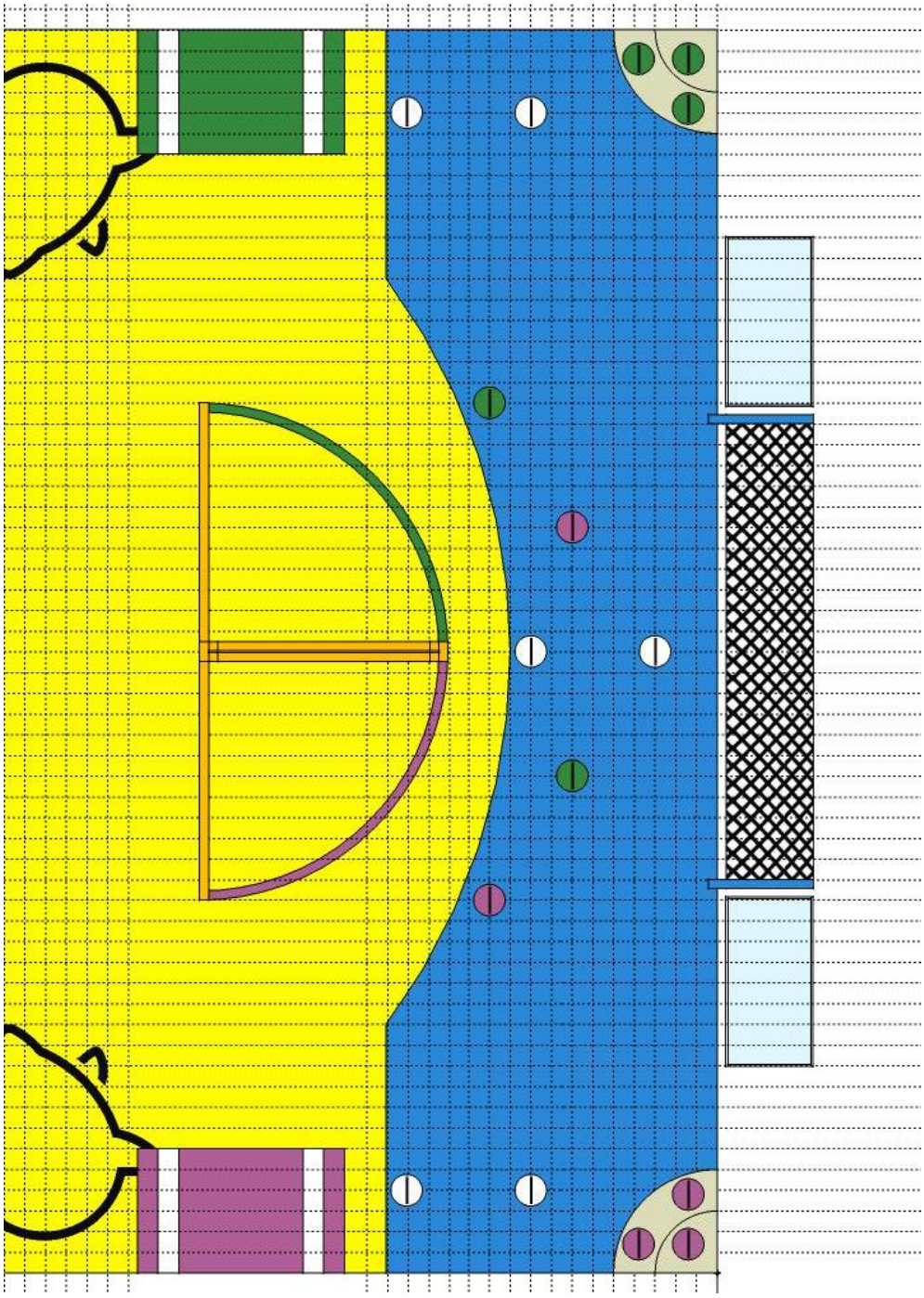
I. Appendix

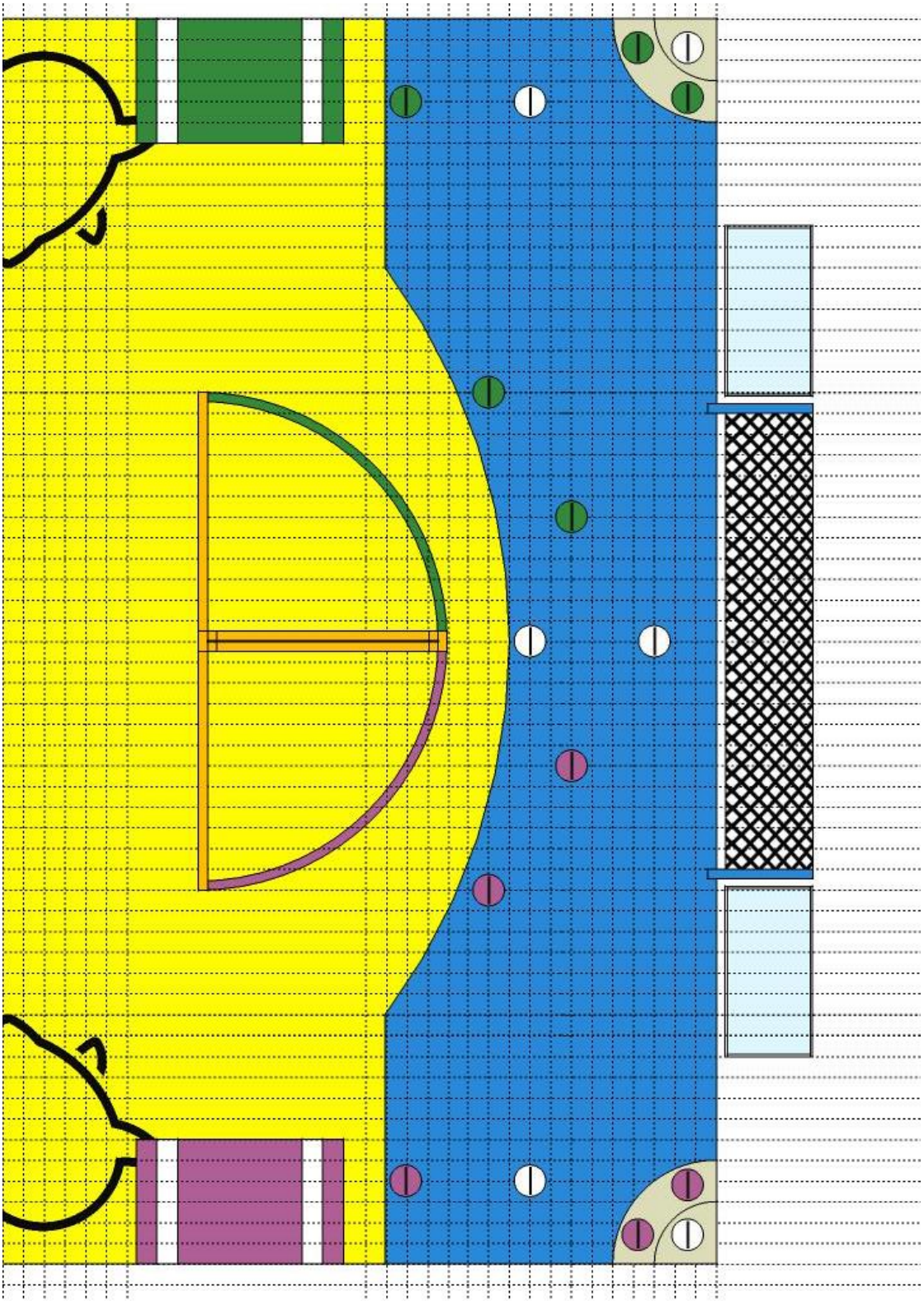
1. The sand castle plan

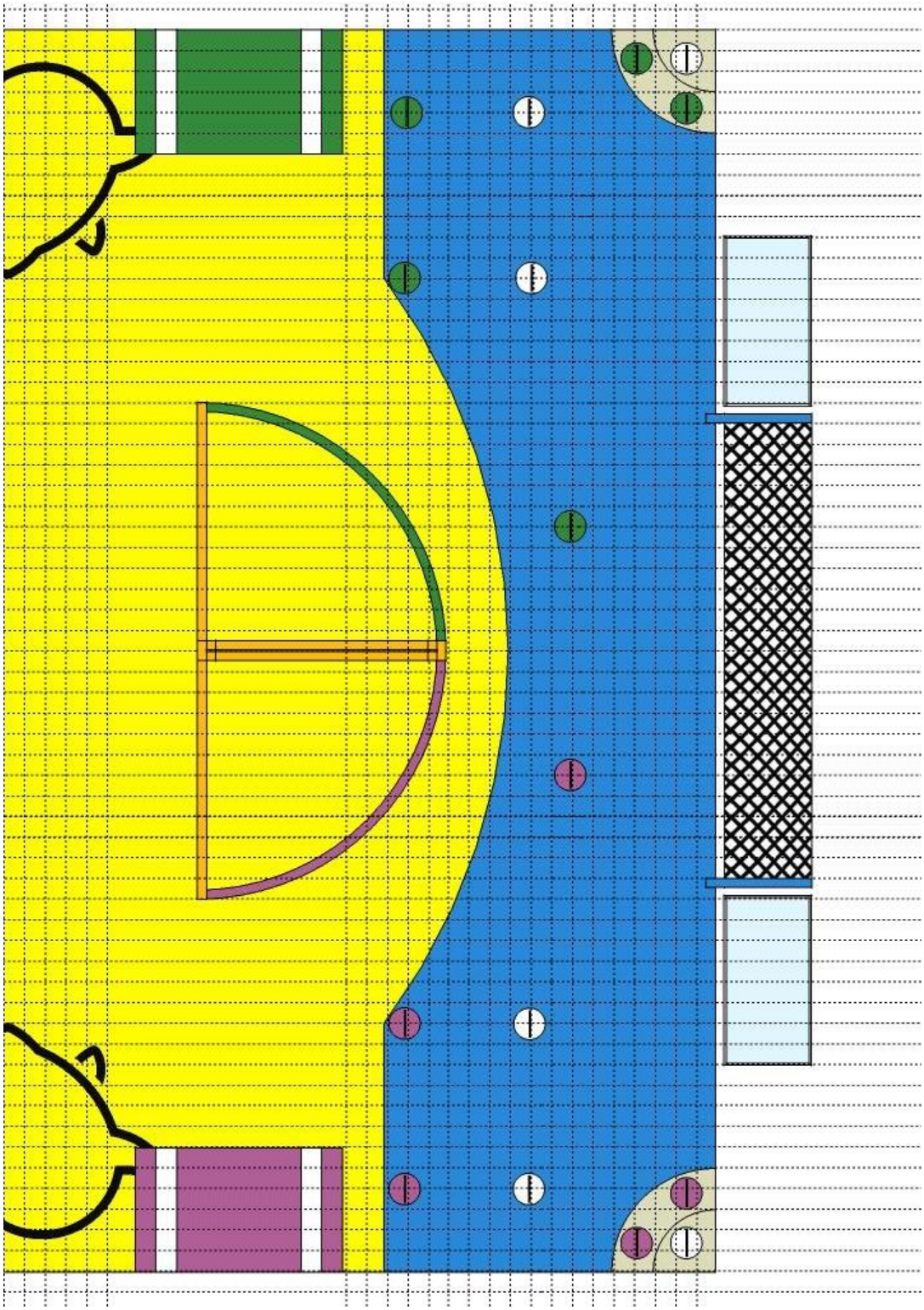


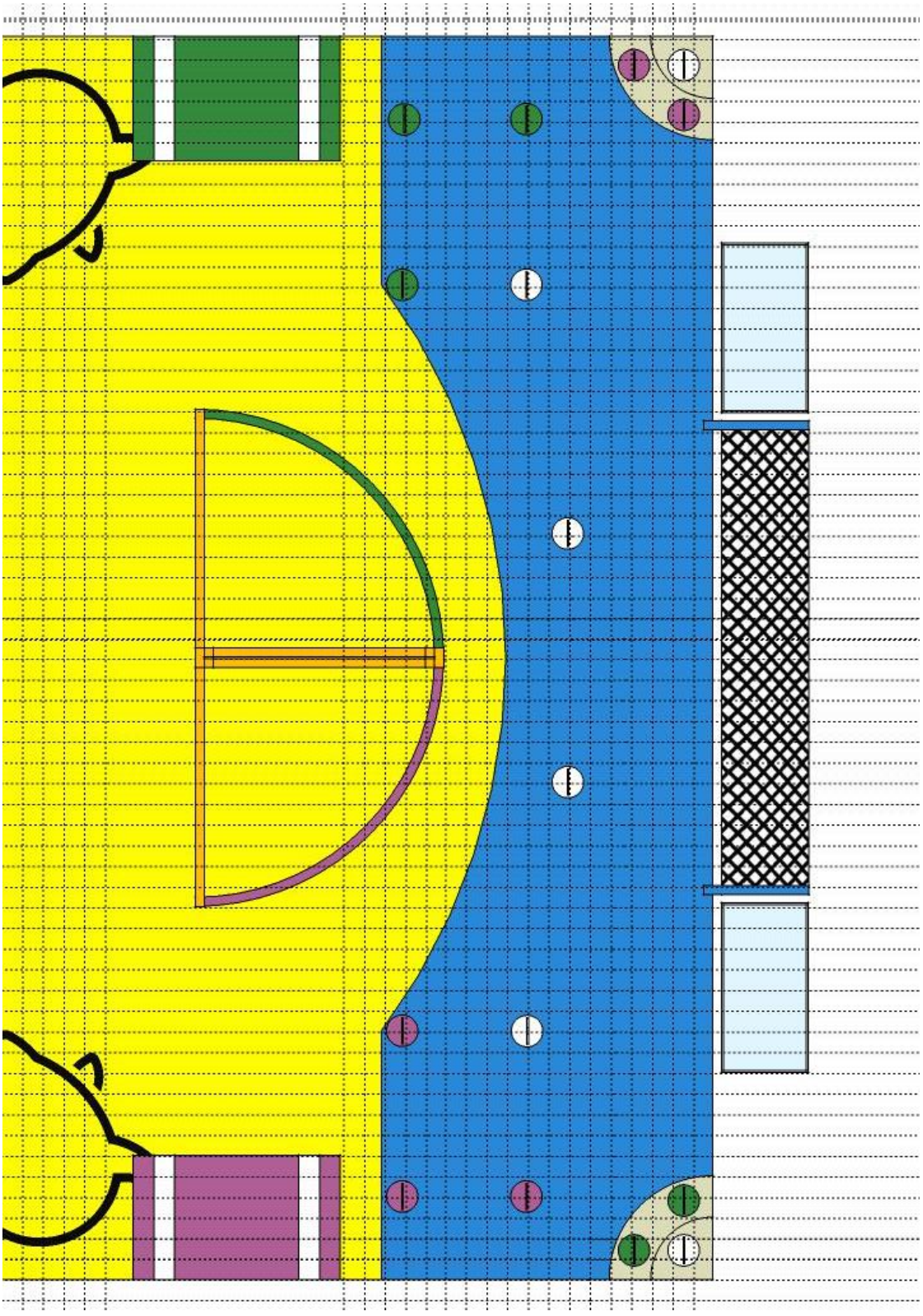
2. Seashell positioning cards

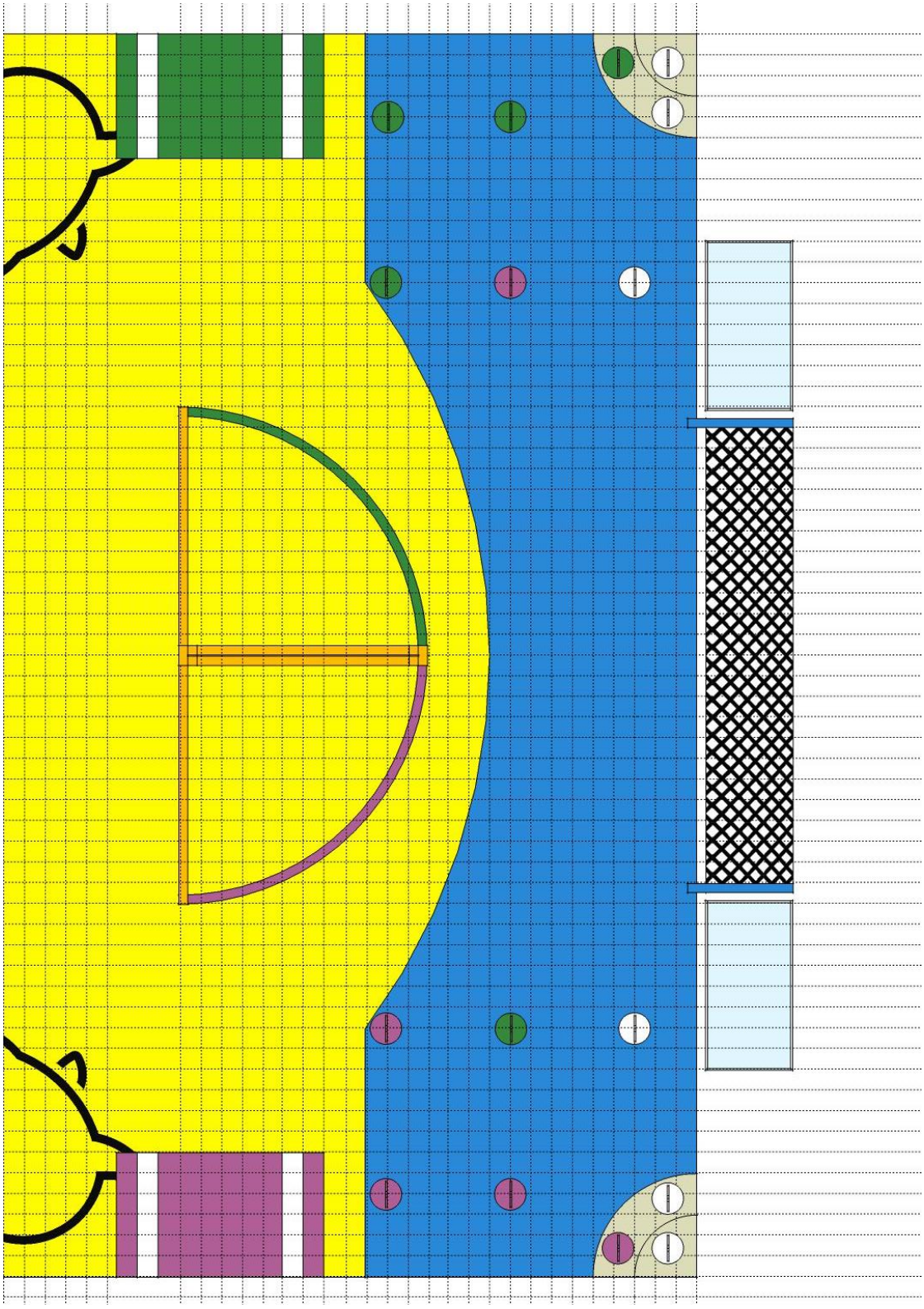
The grid is a 50mm by 50mm.



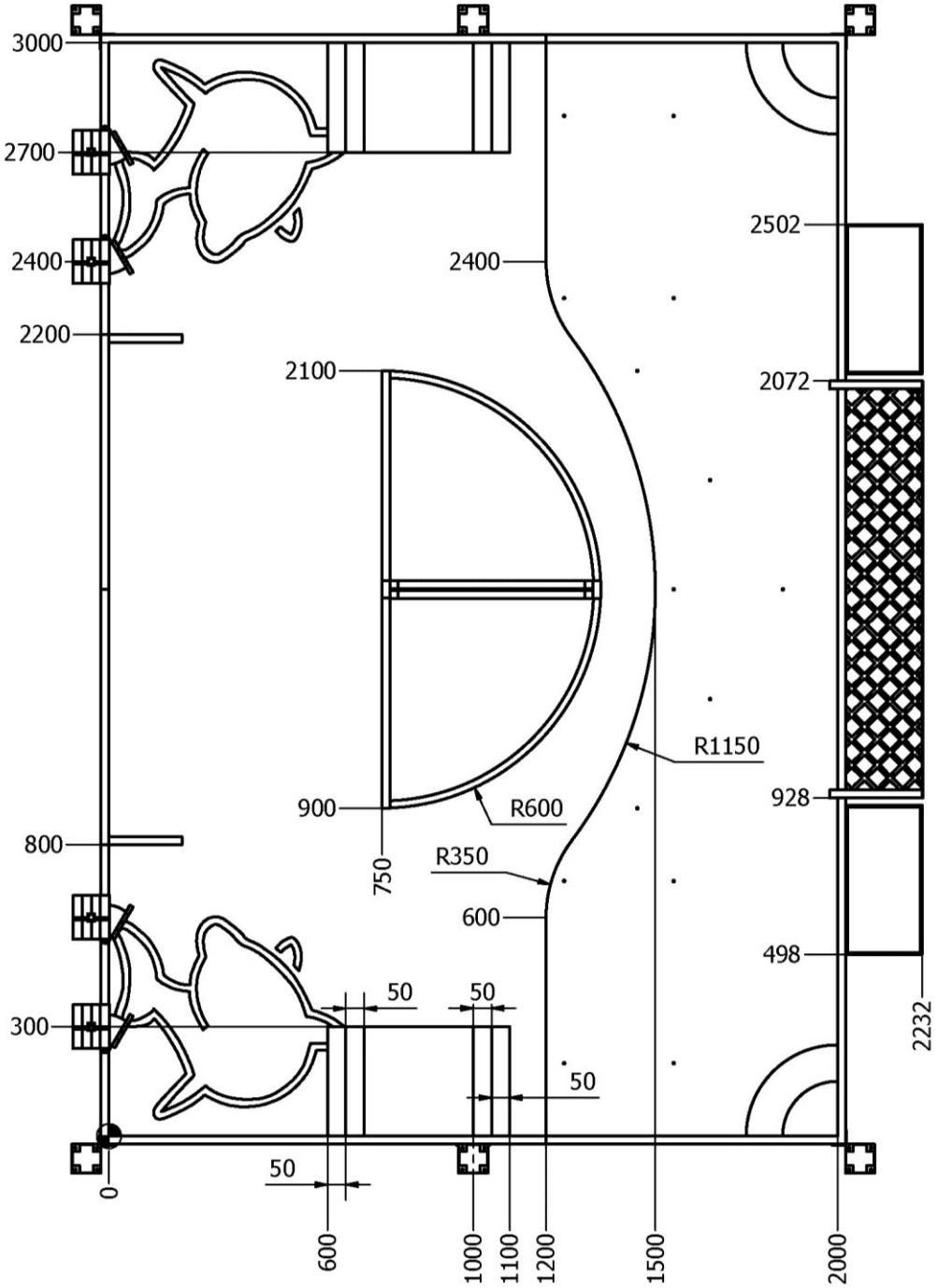




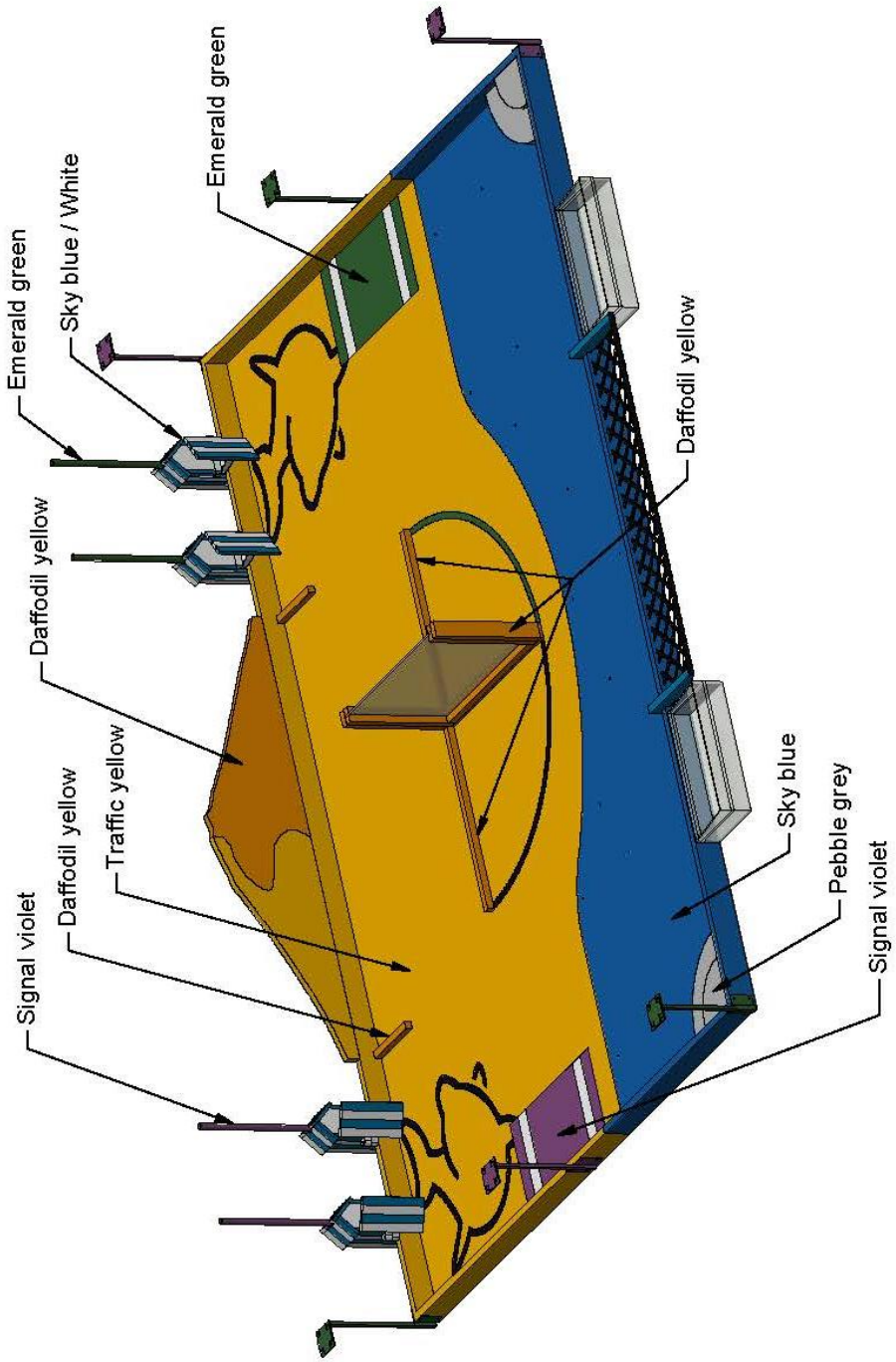




3. Playing area view from top

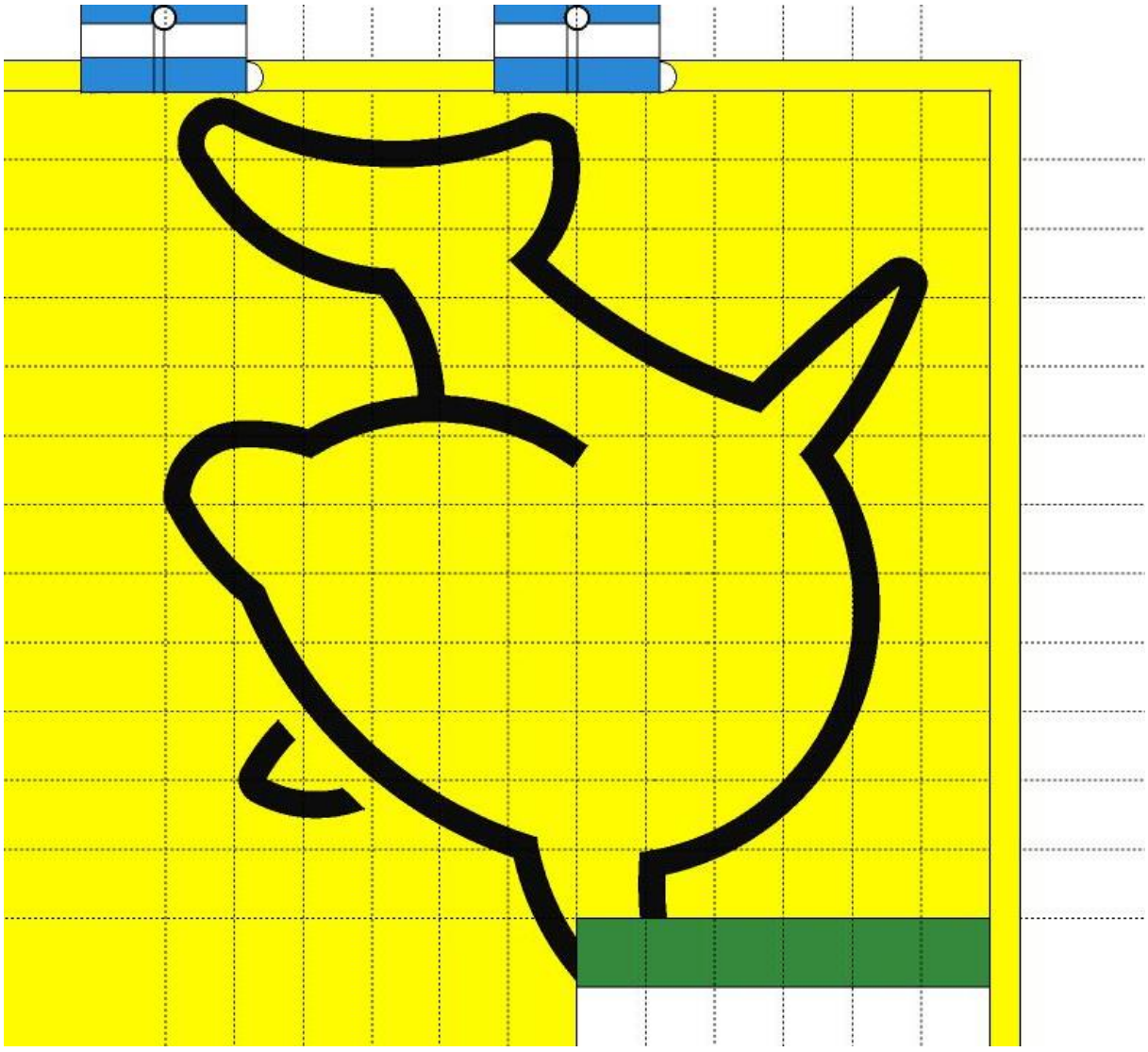


4. Table (Painting)



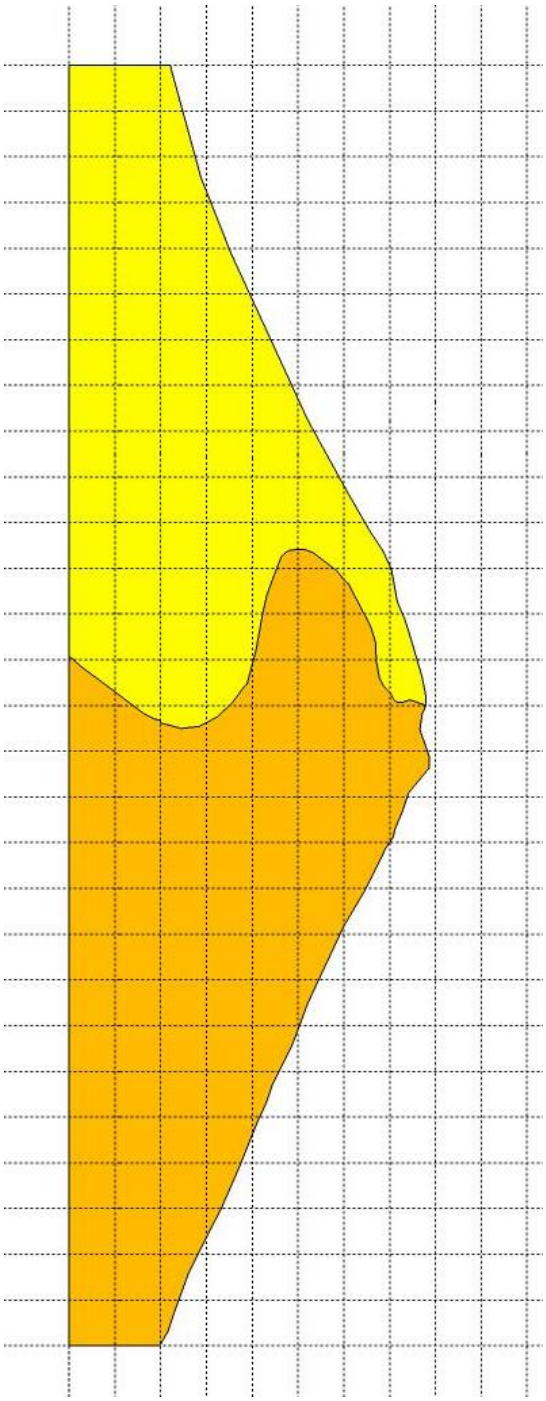
5. Black line painting

The grid is a 50mm by 50mm

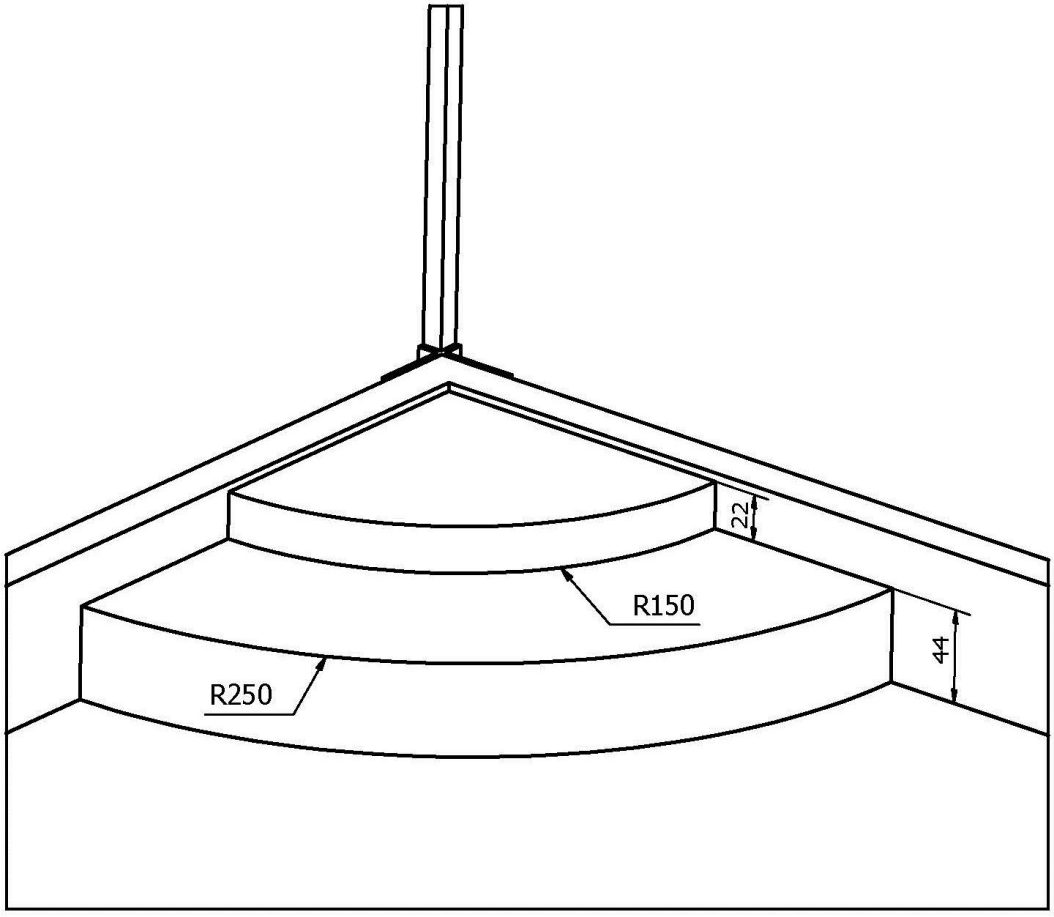


6. Dune painting

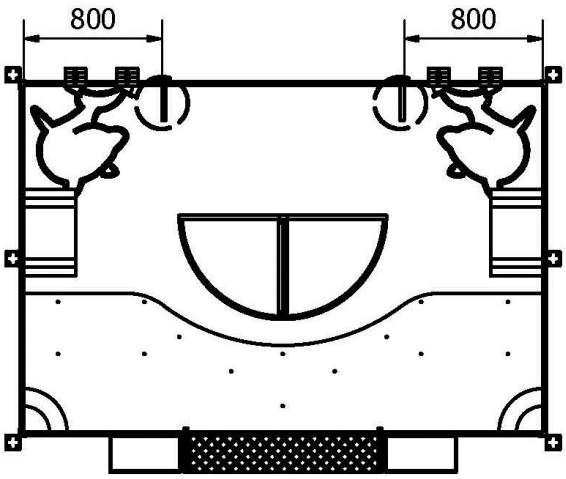
The grid is a 50mm by 50mm

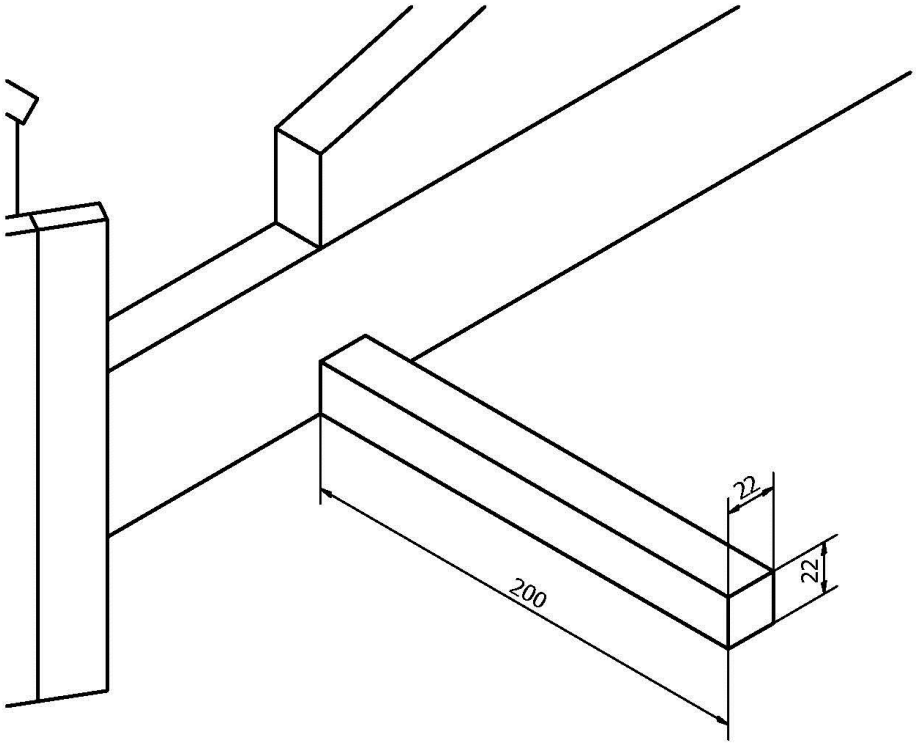


7. The rocks

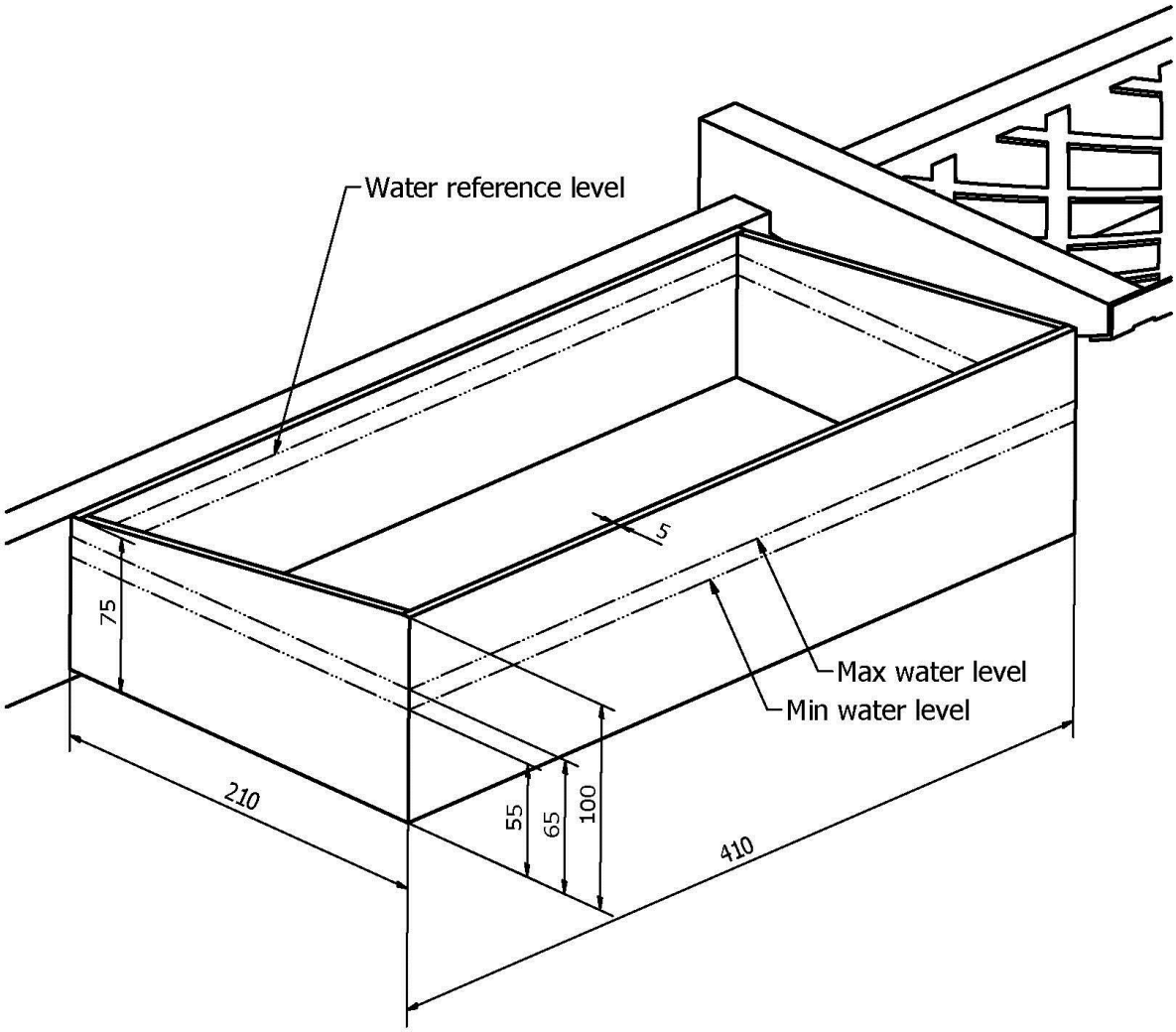


8. The sand dune limit

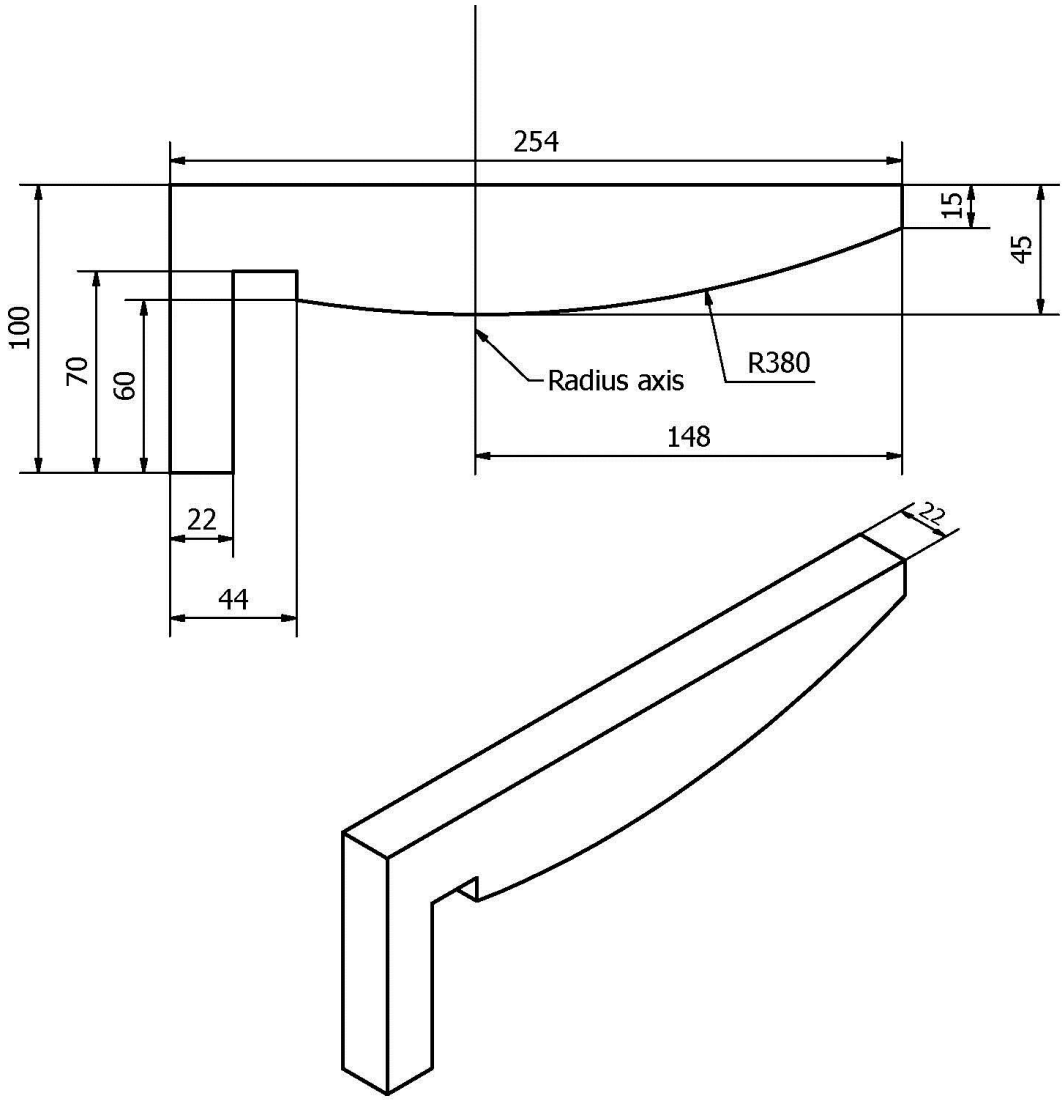




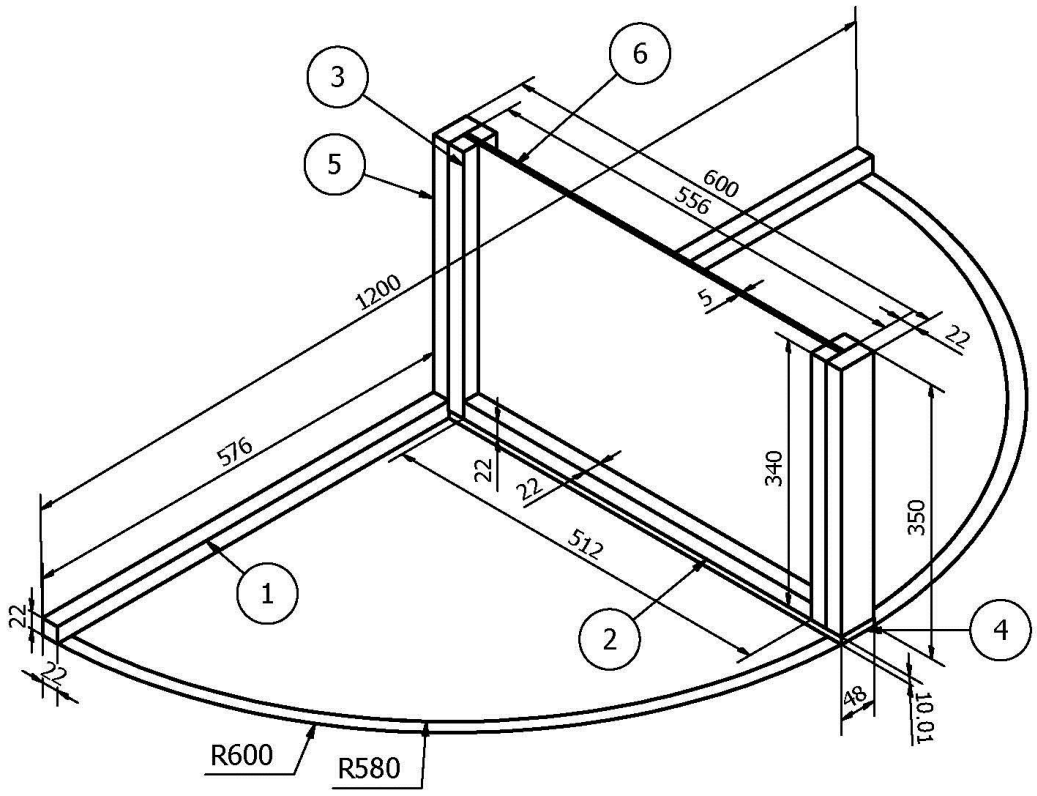
9. The sea


Water reference level
5
75
Max water level
Min water level
210
55
65
100
410

10. The net fixing system

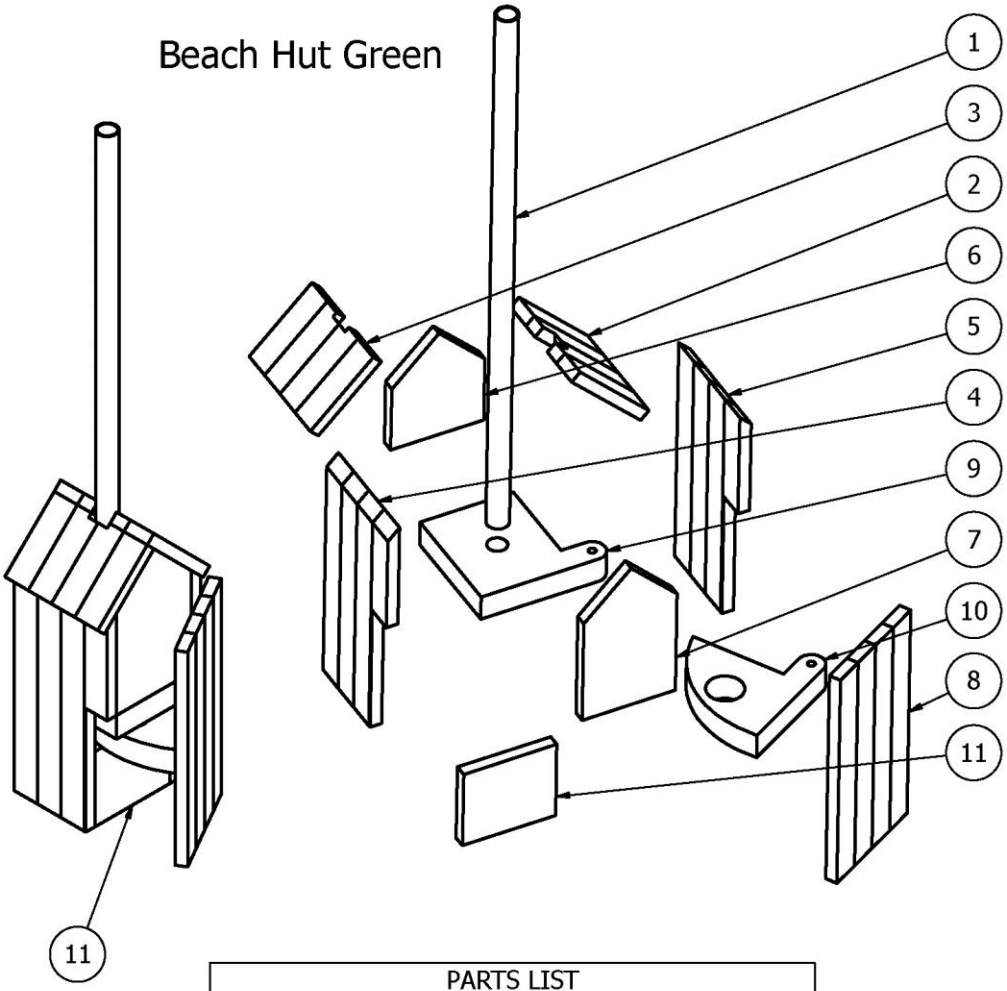


11. The windbreak

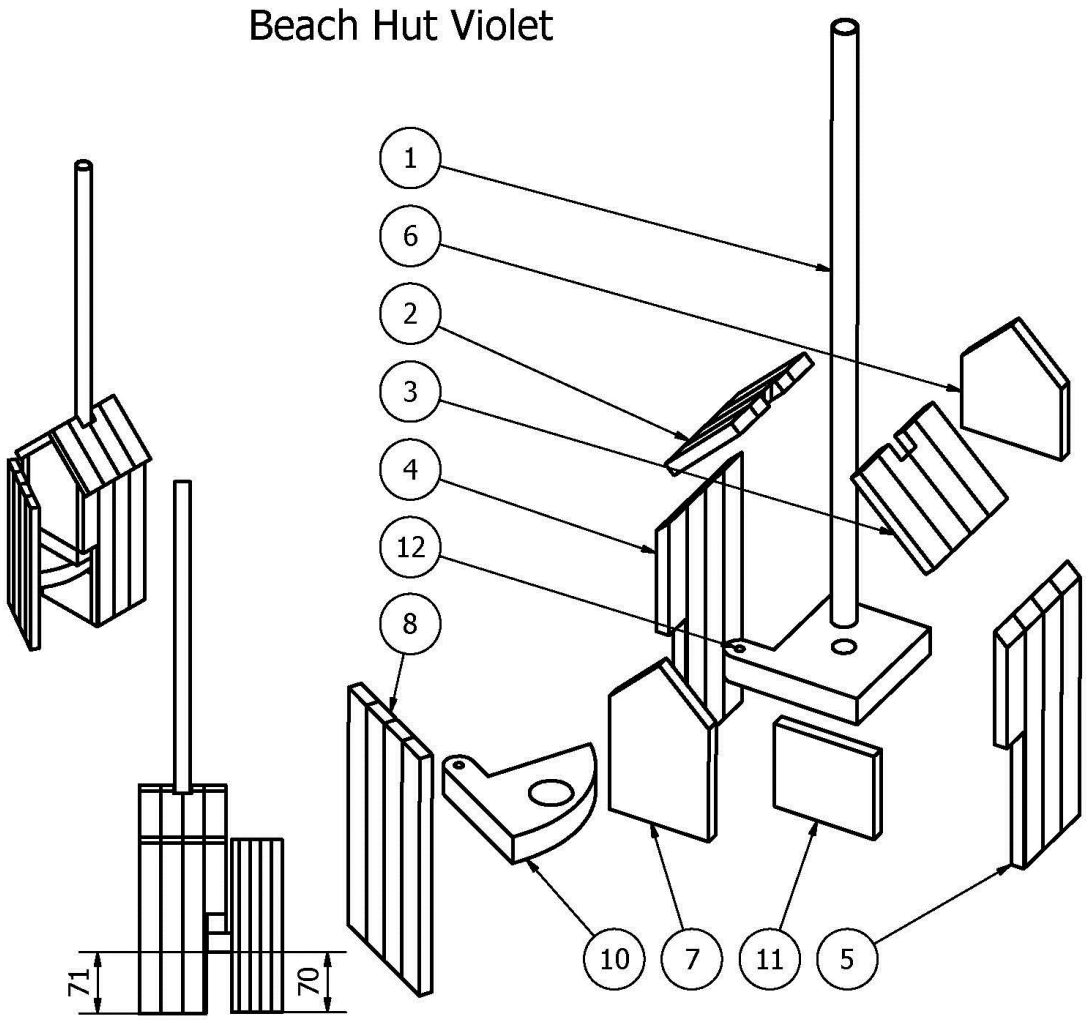


ELEMENT LIST			
N°	SHAPE	DIM.	QTY.
1	ROD	22x22x576	2
2	ROD	22x22x512	2
3	ROD	22x22x340	4
4	ROD	10x48x600	1
5	ROD	22x48x340	2
6	PLATE	5x340x556	1

12. The beach hut

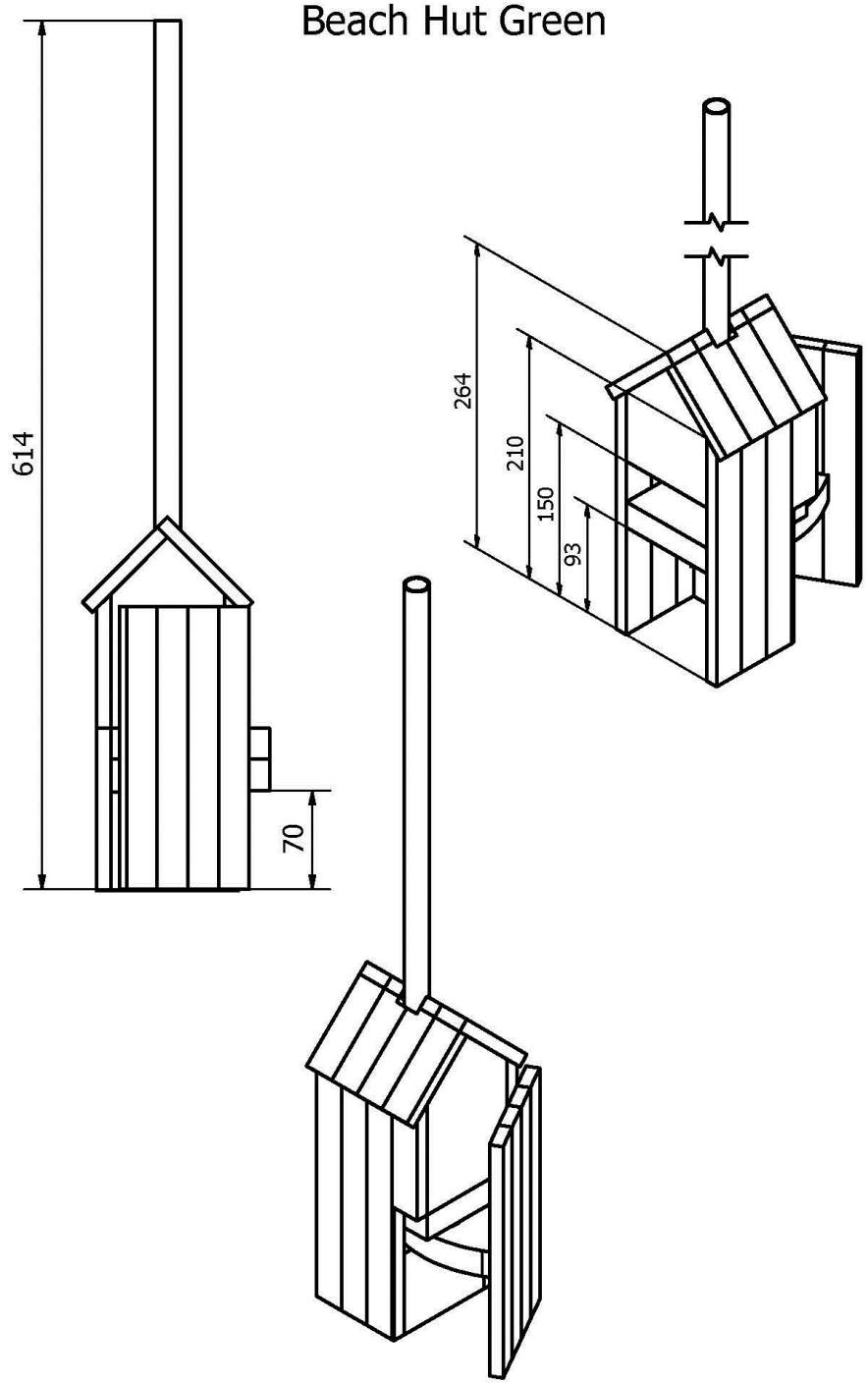


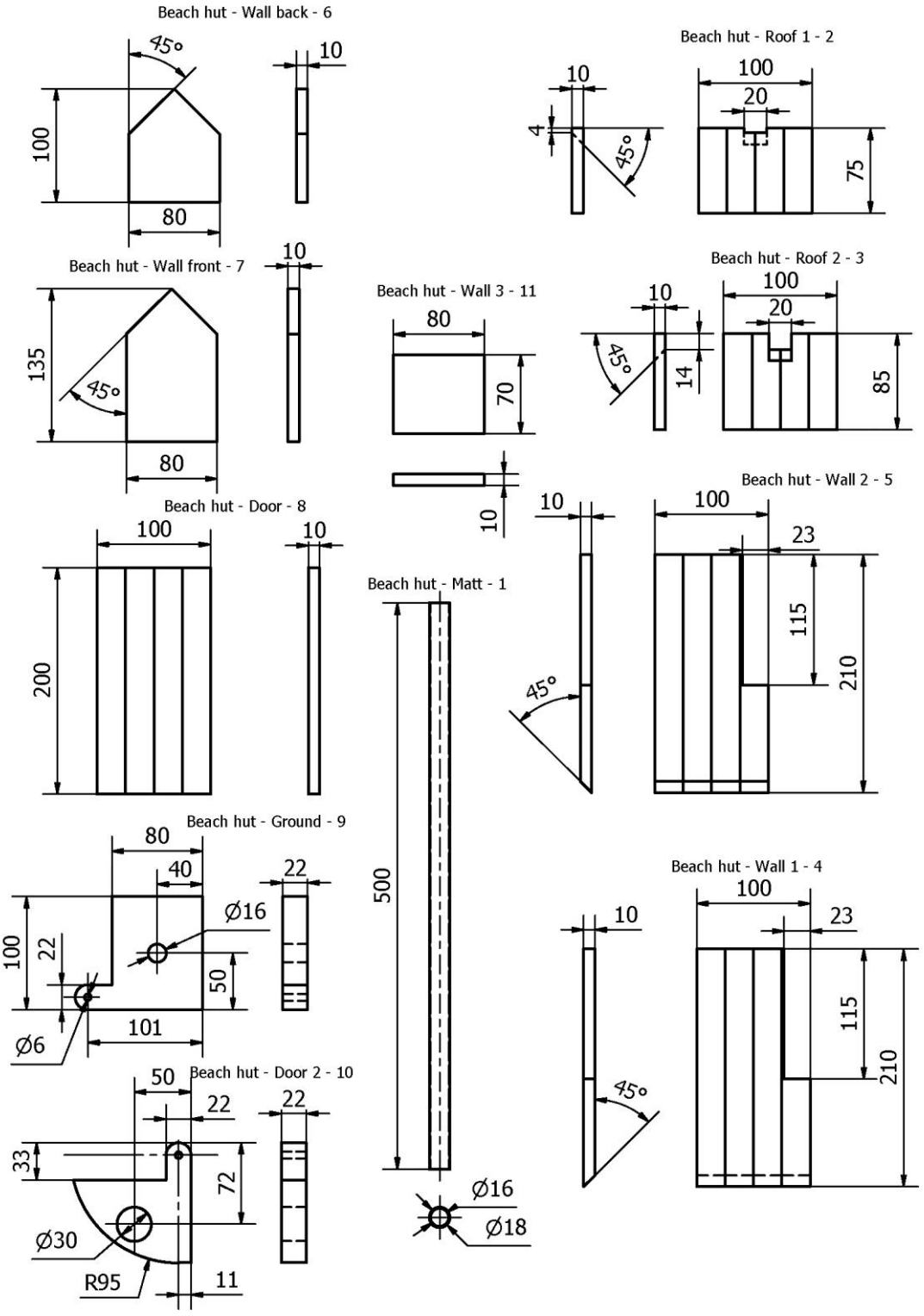
PARTS LIST		
ITEM	QTY	PART NUMBER
1	1	Beach hut - Matt
3	1	Beach hut - Roof 1
2	1	Beach hut - Roof 2
4	1	Beach hut - Wall 1
5	1	Beach hut - Wall 2
6	1	Beach hut - Wall back
7	1	Beach hut - Wall front
8	1	Beach hut - Door
9	1	Beach hut - Ground
10	1	Beach hut - Door 2
11	1	Beach hut - Wall 3



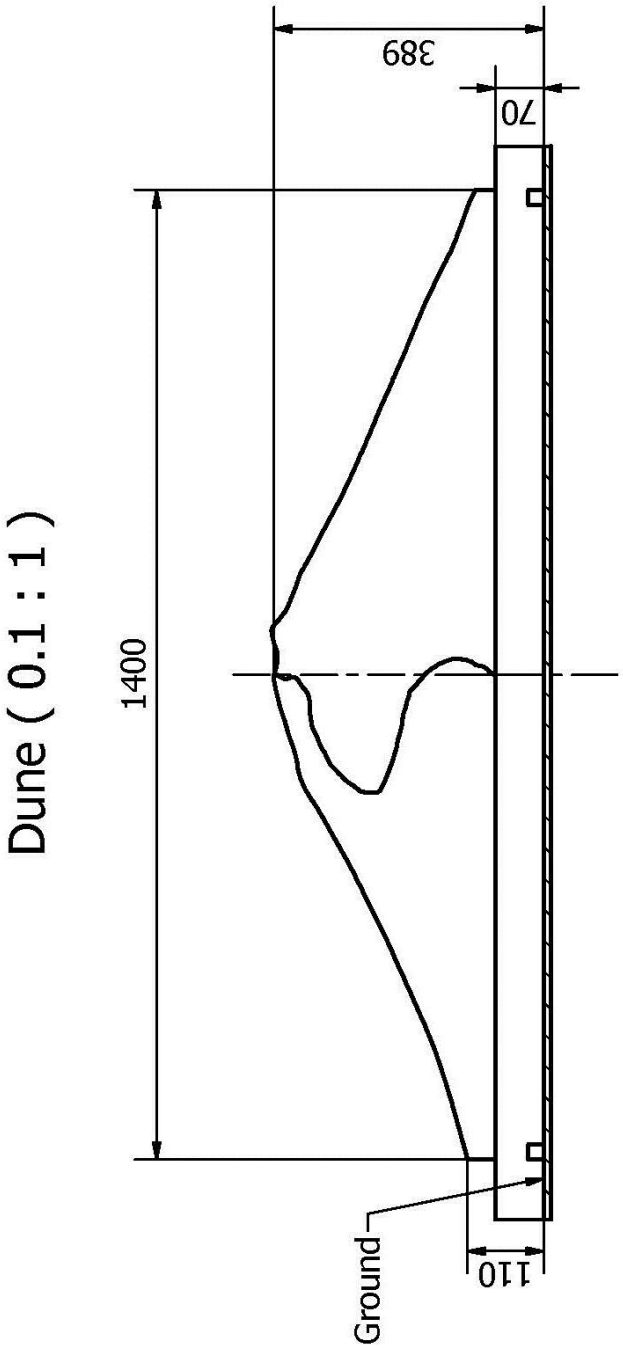
PARTS LIST		
ITEM	QTY	PART NUMBER
1	1	Beach hut - Matt
2	1	Beach hut - Roof 1
3	1	Beach hut - Roof 2
4	1	Beach hut - Wall 1
5	1	Beach hut - Wall 2
6	1	Beach hut - Wall back
7	1	Beach hut - Wall front
8	1	Beach hut - Door
10	1	Beach hut - Door 2
11	1	Beach hut - Wall 3
12	1	Beach hut - Ground

Beach Hut Green

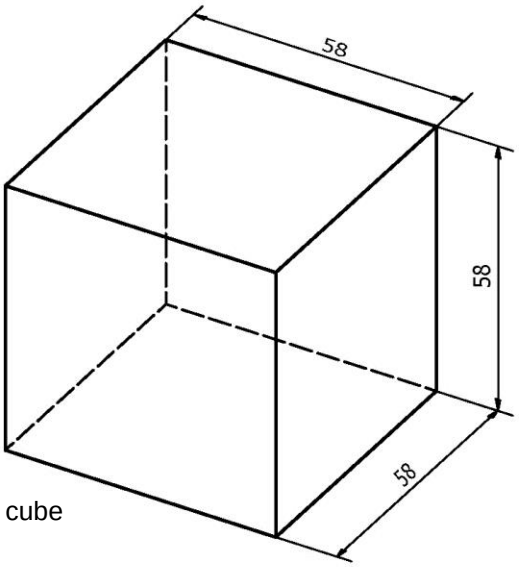



Beach hut - Wall back - 6
45°
10
100
80
Beach hut - Roof 1 - 2
10
100
20
4
45°
75
Beach hut - Wall front - 7
10
135
45°
80
Beach hut - Wall 3 - 11
80
70
10
Beach hut - Roof 2 - 3
100
10
20
45°
14
85
Beach hut - Door - 8
100
10
200
Beach hut - Wall 2 - 5
10
100
23
115
210
45°
Beach hut - Matt - 1
500
Ø16
Ø18
Beach hut - Ground - 9
80
40
22
Ø16
100
22
50
101
Ø6
Beach hut - Wall 1 - 4
100
10
23
115
210
45°
Beach hut - Door 2 - 10
50
22
22
33
72
Ø30
R95
11

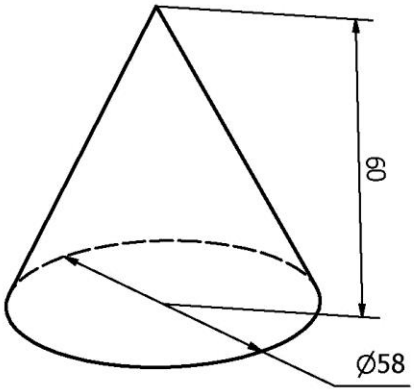
13. The dune



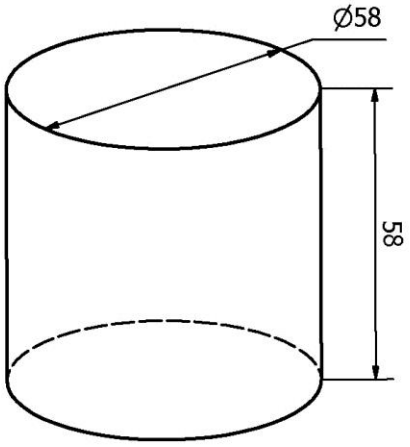
14. Playing elements



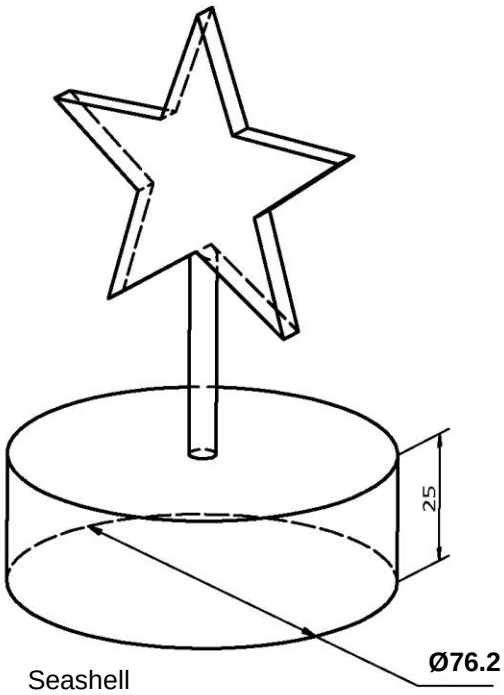
Sand cube



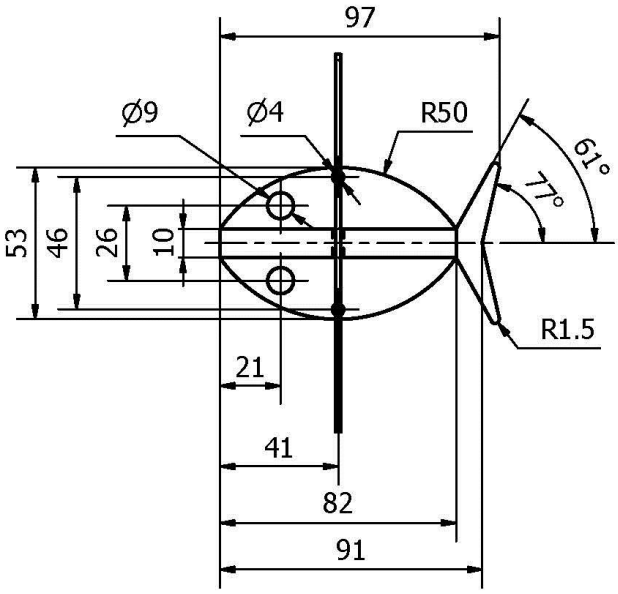
Sand cone

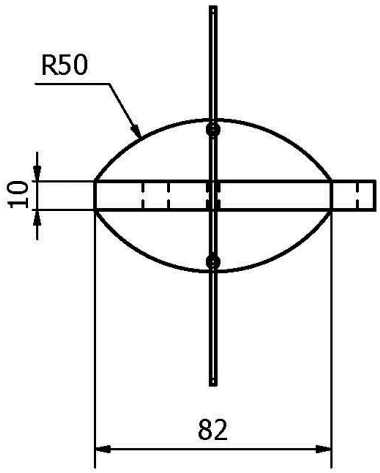


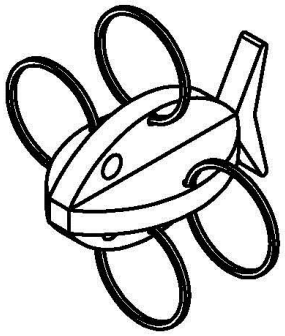
Sand cylinder



Seashell

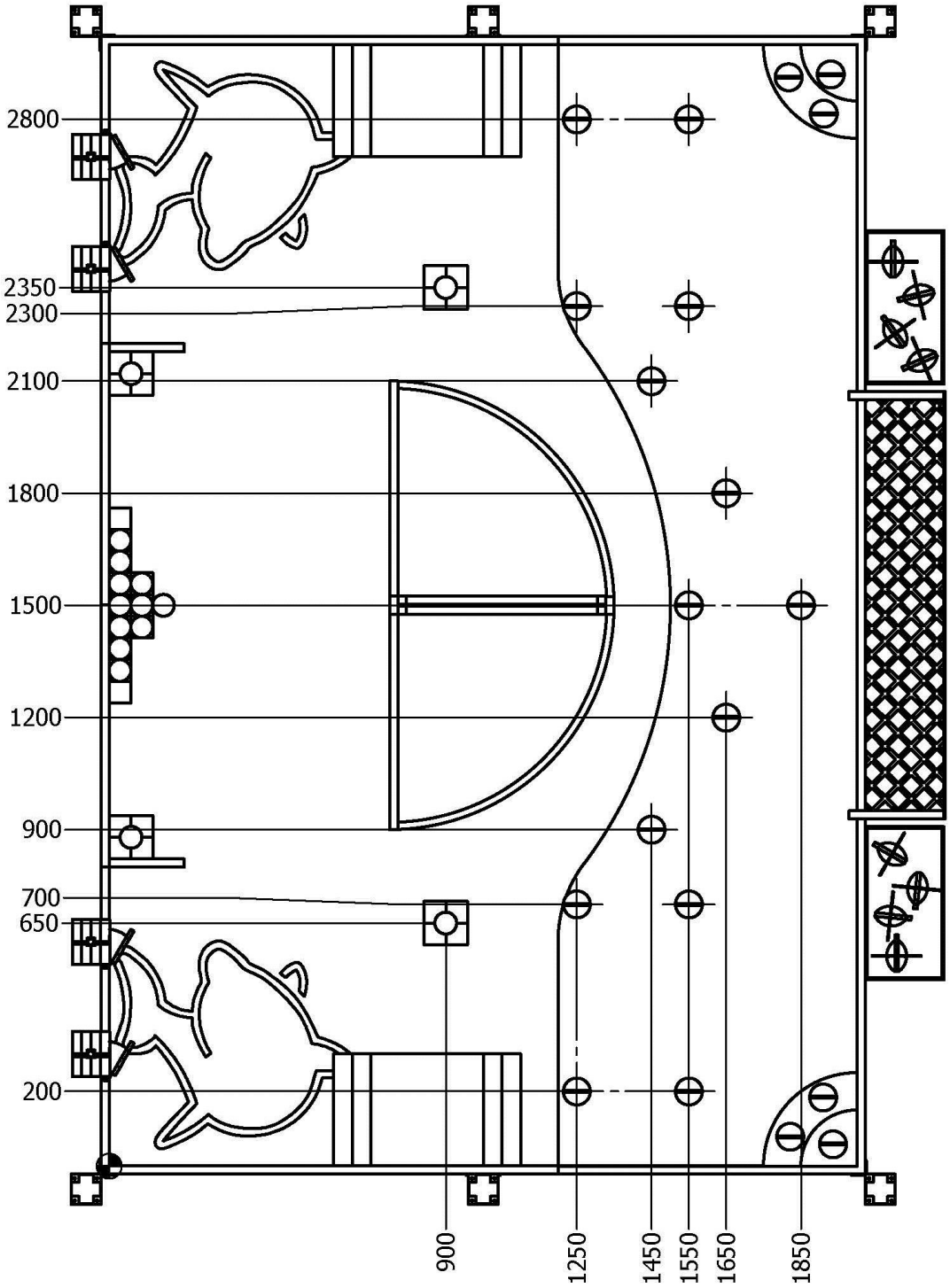


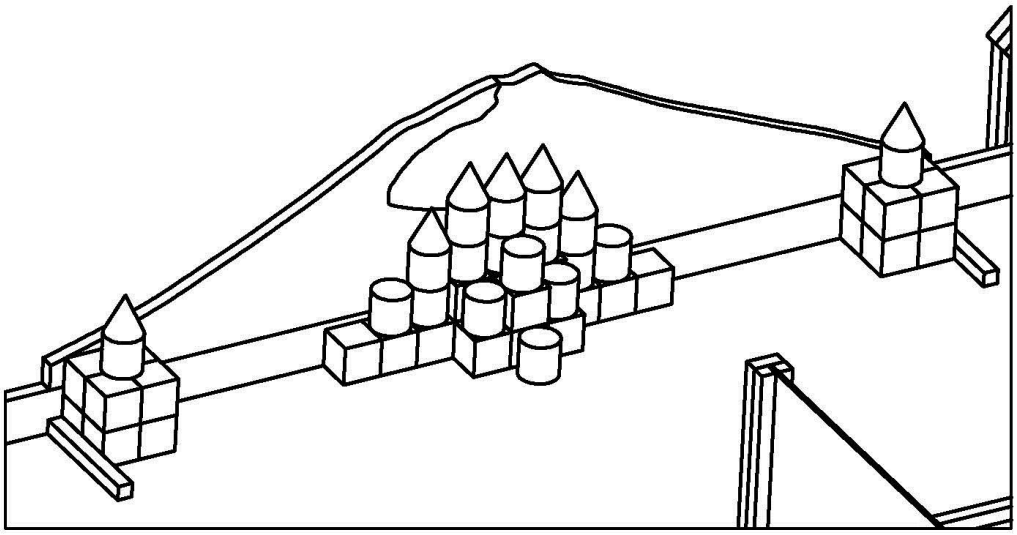




The fish

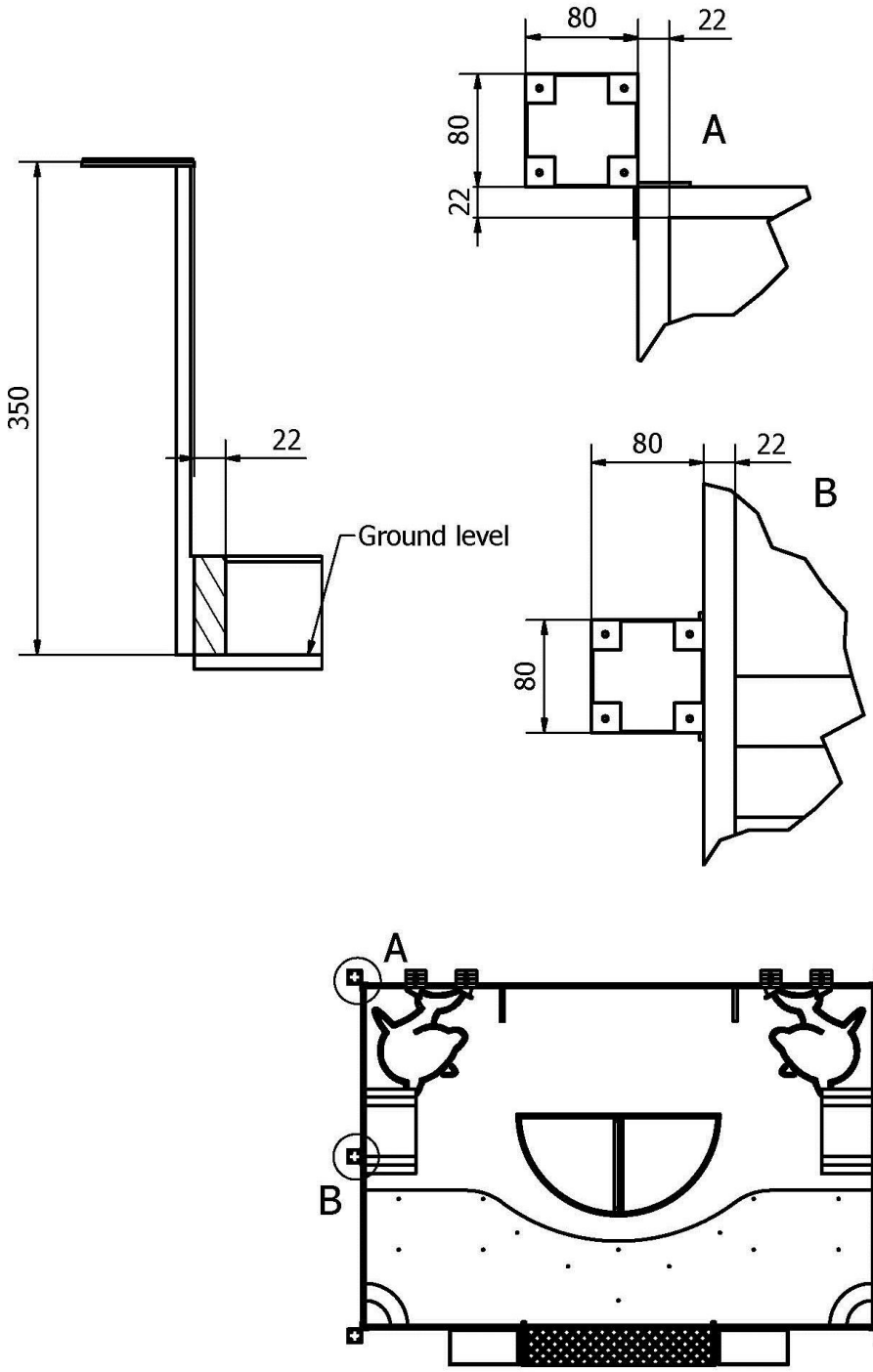
15. Placement of the playing elements at the beginning of the match





PLAYING ELEMENTS			
ITEM	QTY	PART NUMBER	DESCRIPTION
2	40	Sand Cube	
3	20	Sand Cylinder	
4	9	Sand Cone	
5	6	Seashell	
6	5	Seashell Violet	
7	5	Seashell Green	
8	4	Fish Green	
9	4	Fish Violet	

16. Beacon supports (specific EurobotOpen)



17. Painting references

	Color	Reference
Sea, edge of the playing area	Sky blue	Ral 5015 Mate
Sand, edge of the playing area	Traffic yellow	Ral 1023 Mate
Team A color, flags, fish and shellfish	Signal violet	Ral 4008 Mate
Team B color, flags, fish and shellfish	Emerald green	Ral 6001 Mate
Black lines	Dark black	Ral 9005 Mate
Neutral shellfish	Traffic white	Ral 9016 Mate
Rocks	Pebble grey	Ral 7032 Mate
Sands blocs, construction area battens, beach windbreak posts	Daffodil yellow	Ral 1007 Mate

18. Material references

Material references for the elements available on the playing table:

Element	Material	Remark
Beach windbreak	Transparent PMMA	5mm thick
Sea	Transparent PMMA	5mm thick
Sand cubes	wood	
Sand cylinders	Wood	
Sand cone	PLA or ABS	3D print
Fish	PLA or ABS	3D print
Net		Mesh around 20mm
Shellfish	Vulcanized rubber	ice hockey puck line with international standards of the IIHF
Rocks	wood	
Windbreak posts	wood	

No objections regarding differences in dimensions will be taken into account.

The wood's density can change from one a country to another. It is highly recommended that the team tries different types of wood as the weight can vary change in a significant way.

The transparent plastic's density can change from one a country to another.