



RULES OF SEK 2014 Category

Version 1.0 – April 21th, 2014

1. INTRODUCTION

In 2050, the robot soccer players reached a huge goal since 1997, they beat the best human soccer team in the world. With an excellent ball possession and precise ball long passes, the robot team was far more effective than humans and won the match. The striker Robgoal was the best player in the field by scoring the 3 goals of the match.

Since then, the intelligent robots have been practicing sports all over the world. And the most known sports is the THBall (throw-and-hold ball), which consists of keep blue balls in possession and throw orange ball to the opponent. Mathematical precision, fast reasoning and adaptive strategy, features that any sports robot proudly has, are essentials in this challenge. That is the reason of THBall be so popular among robots.

This popularity forced robots to found the METAL PREMIER LEAGUE, and it's the 3rd World THBALL CUP. The THBall became to be known and respected in all areas of the World, including Latin American, where the first THBall of the history took place in 2012.

2. THE THBALL RULES

The THBall has one single arena, 2.0mx2.0m, made of MDF wood with thickness of 15mm, in matte white color, divided in two fields, as can be seen in Figure 1. Each field admits a team with 2 robots.

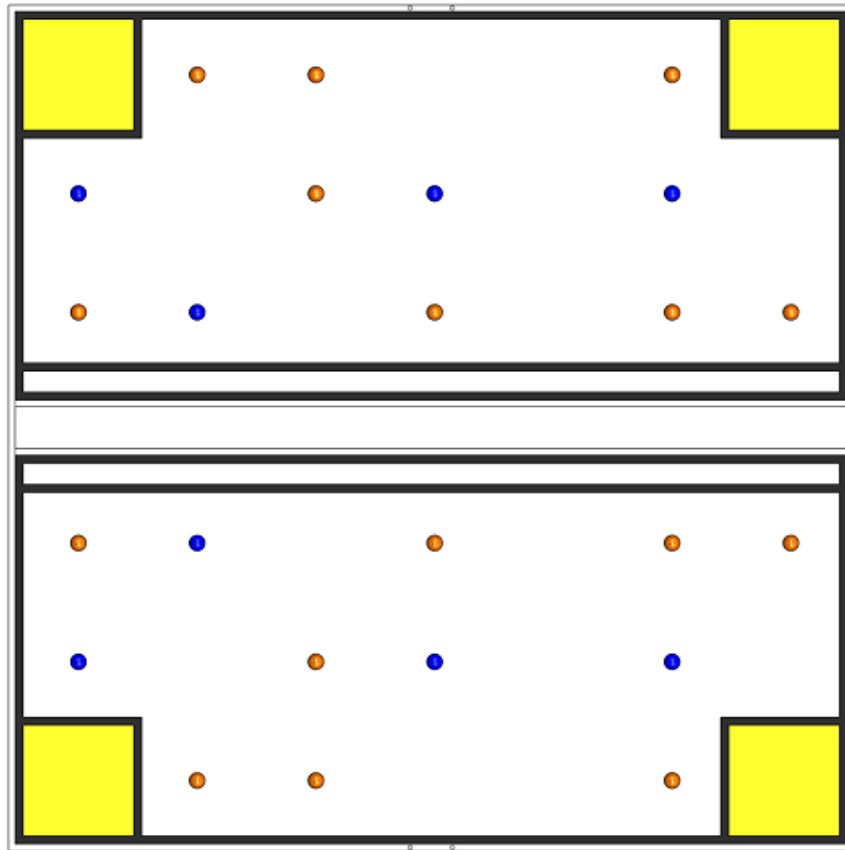
Table-Tennis balls in Orange and blue colors are distributed in the field. Each team must maximize the blue balls in its field and reduce the number of orange balls. The dimensions of the entire arena are deployed in figure 2.

The external walls of the arena are made of MDF wood with thickness of 15mm each. They are also painted in matte white color with a height of 400mm and fixed in the arena floor. There is a dead-zone between the fields, with two walls in MDF wood of 15mm thickness, also in matte white color, fixed in arena floor and with a height of 100mm. Figure 3 shows the dimensions and distance of the walls.

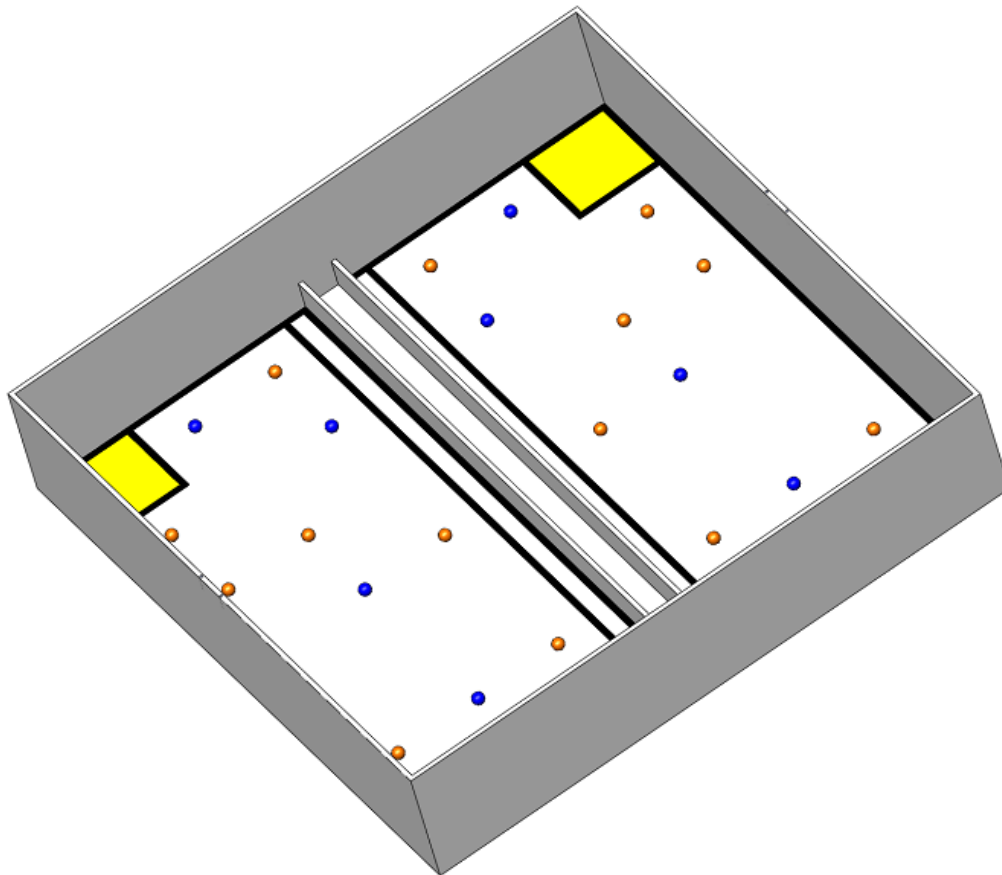
The dead-zone exists to avoid robots collisions. This area is between the two team's fields and it cannot be invade at any cost. Any invasion will imply that the robot must be restarted in any start areas (yellow zones). The team that violates the dead-zone area can choose any start area that the robot will restart.

There is a black tape of 19mm of thickness (ref 3M® insulating tape) closed to the walls around the entire field and the start areas, as fig. 1. Be aware that these tapes are not shown in fig 2 (except for start areas). There is also an auxiliary black tape far 50mm away from the dead-zone wall in the two team's field. Fig 3(c) shows this tape. All dimensions in the figures are in mm (millimeters).

The dead-zone area is called dead because any ball that falls in it will be out of the game and will be considered a 50 points penalty for the final score.



(a)



(b)

Figure 1. Arena Specification. (a) Bird-Eye View; (b) 3D view.

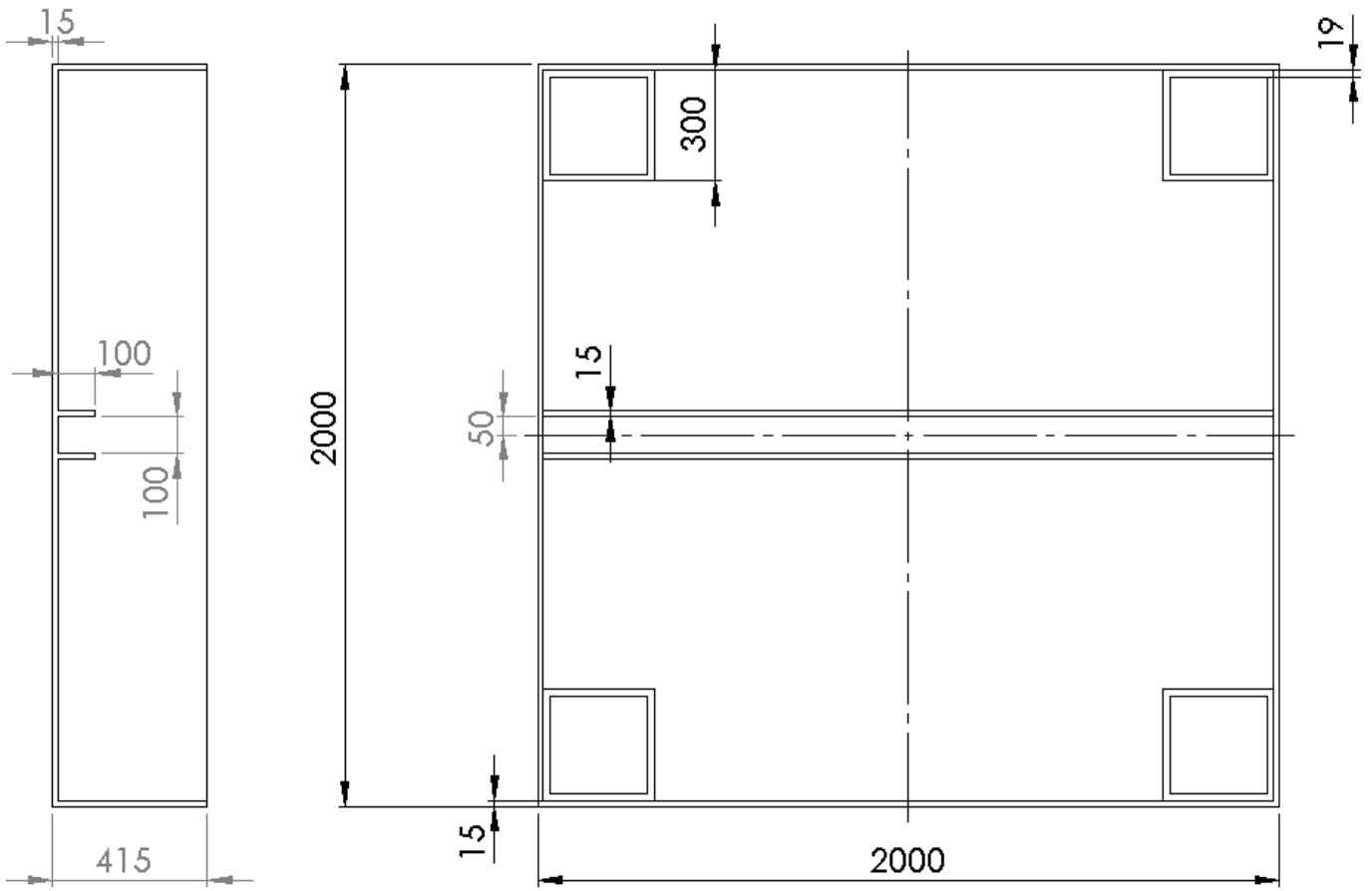


Figure 2. Arena Dimensions.

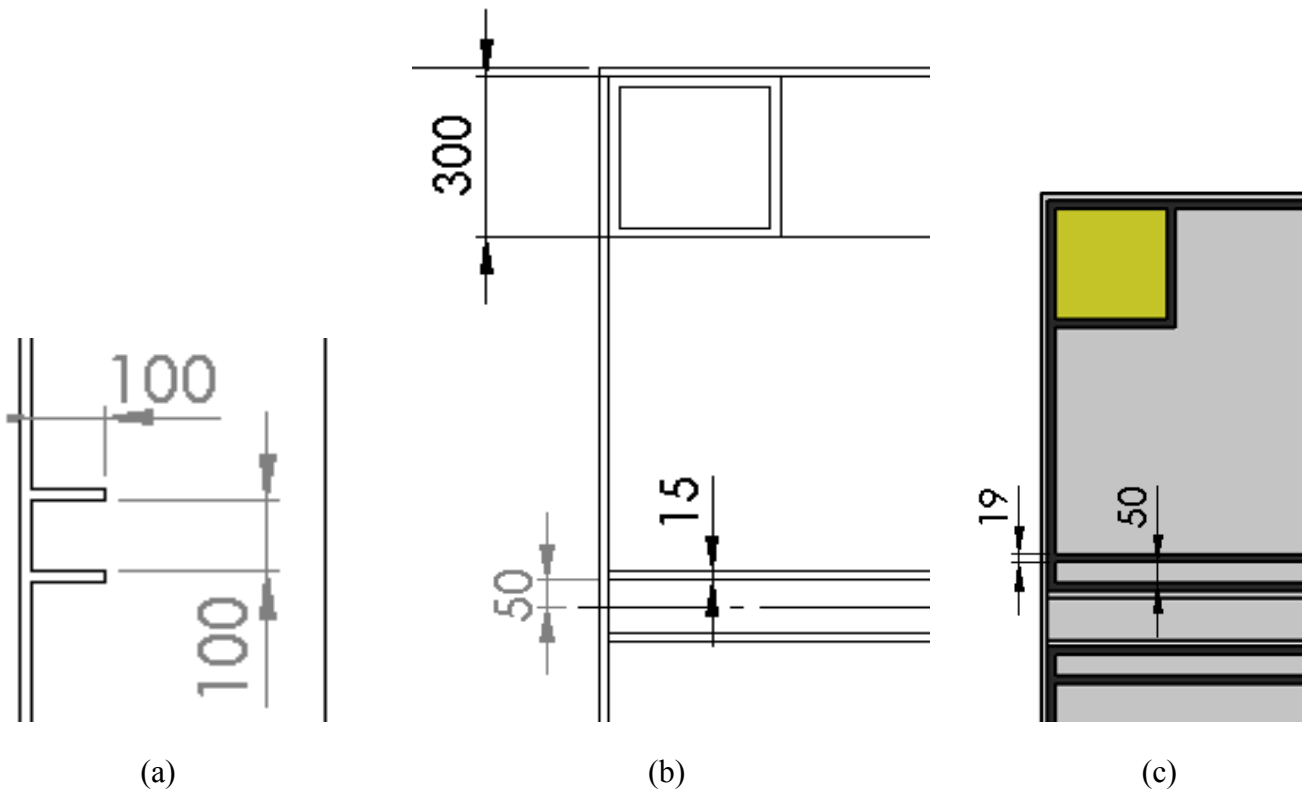


Figure 3. (a) Dead-Zone dimensions; (b) Dead-Zone Dimensions; (c) Auxiliar black tape.

2.1. Initial Configuration of the Match

Each field of the arena will have 12 balls (6 blue and 6 oranges). The initial position of these balls in the two fields will be raffled before the start of the match. Each field will have the same symmetrical configuration of the balls. There are 19 positions (except the position in the start yellow areas), as Fig. 4.

Each ball position in the field is defined as a center of virtual squares, represented in Fig 4 as the junctions of spotted lines. White and circular adhesives with 13mm of diameter will be used to represent the center of the squares during the matches (ref. PIMACO Labels – cod. R-1313 in Brazil). These labels will be presented in the arena and they will not be removed.

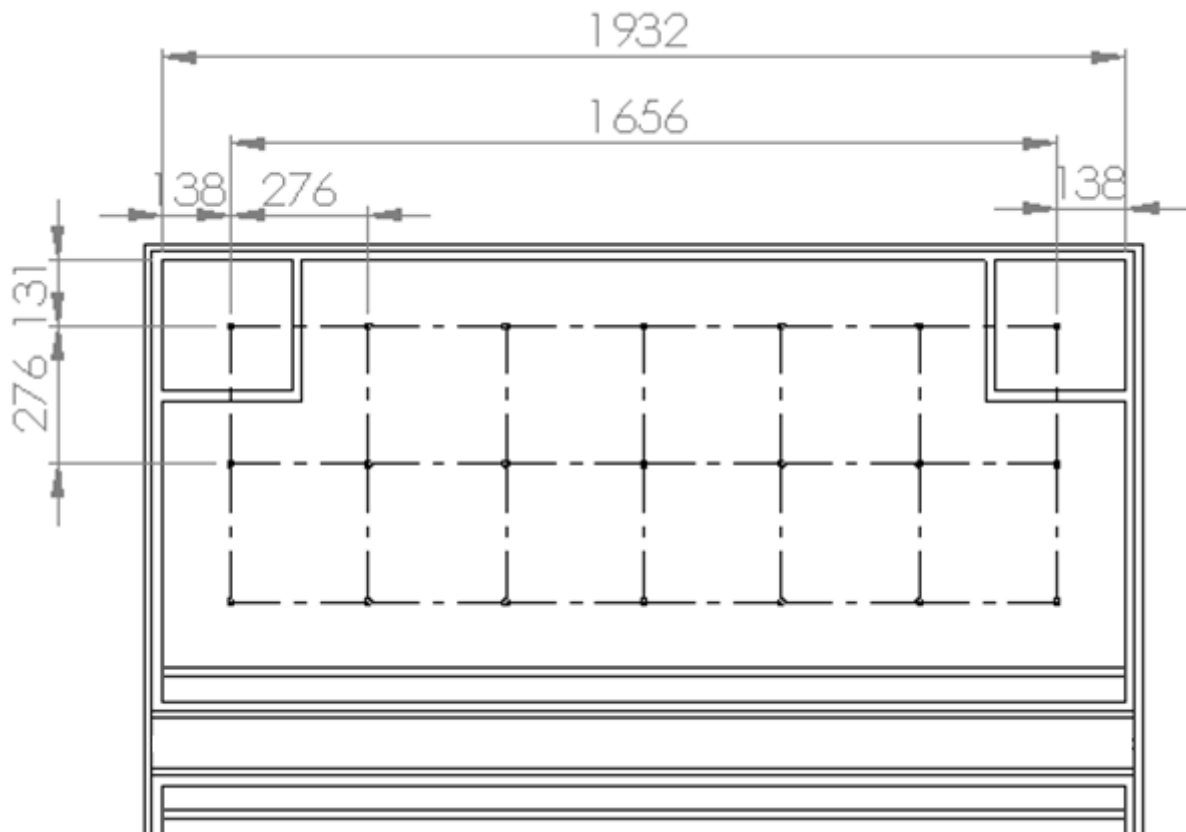


Figure 4. Initial positions of the balls.

2.2. Team ID in the arena

The arena has two pins in the walls that will allow the teams to fix panels with their logo and names during a match. The figure 5 shows the arena with these panels.

Each panel can have a free format and must contain the name and logo of the team. The panel must fit in a square of 300x300mm and with 15mm of thickness. The central 100mm of the panel's bottom must be flat and must contain correct holes to allow it to be fixed on the arena. The figure 6 shows the dimensions and limits that each panel must respect. Each team can make its own panel.

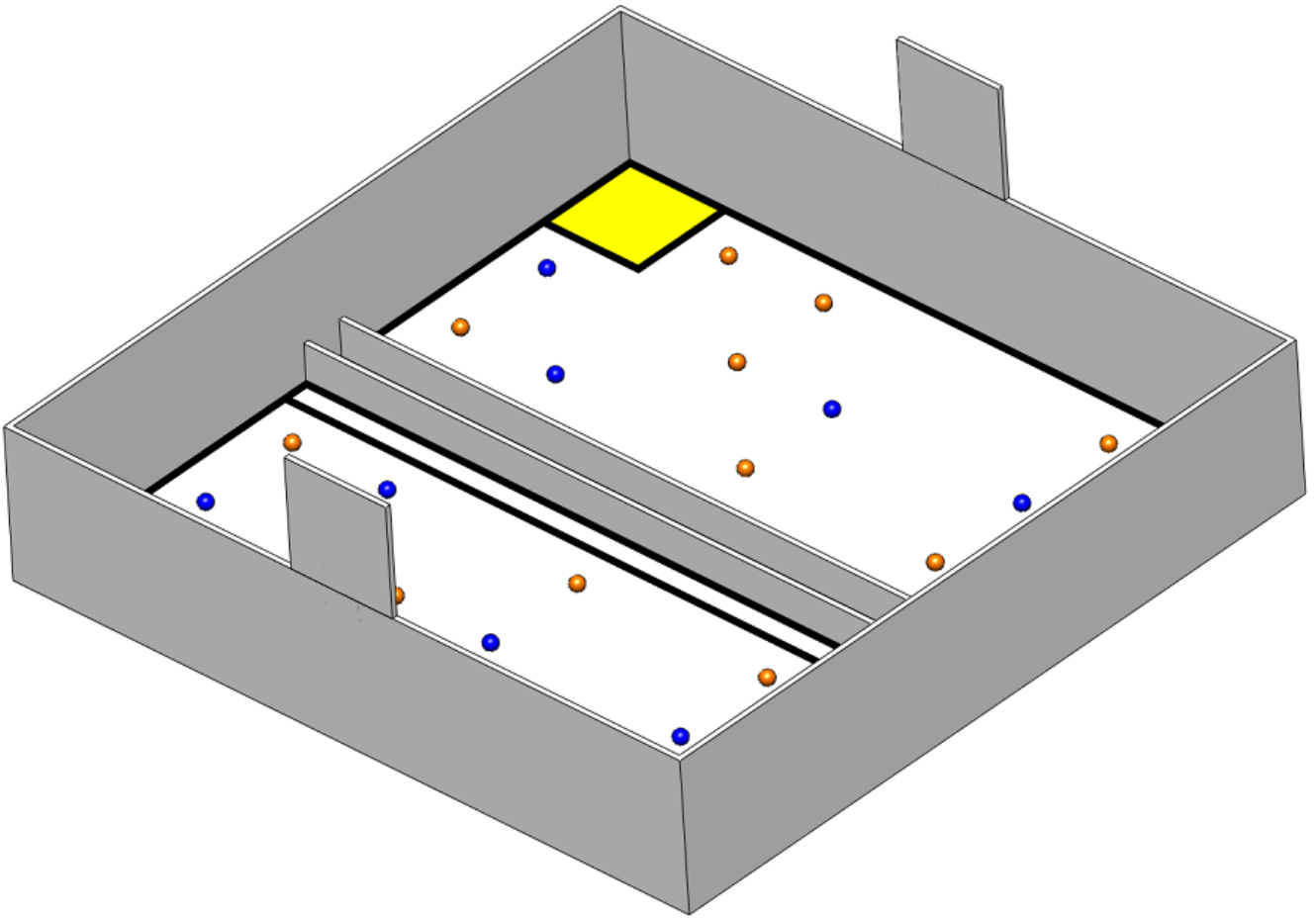


Figure 5 –THBall Arena with team's panel.

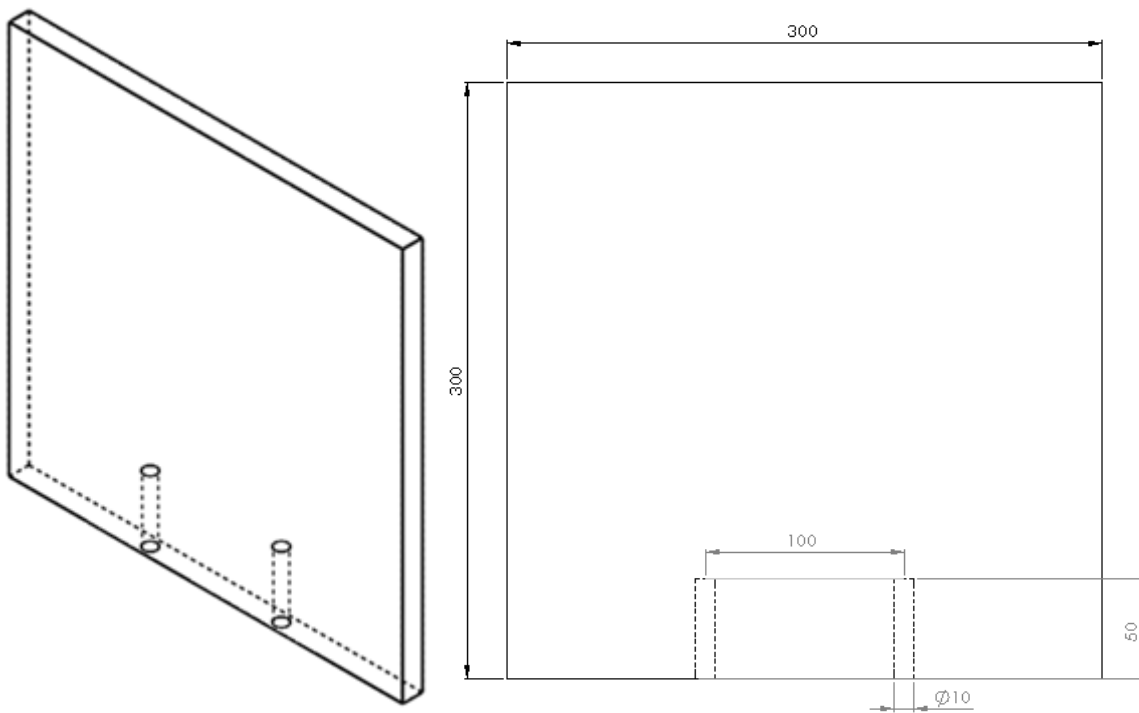
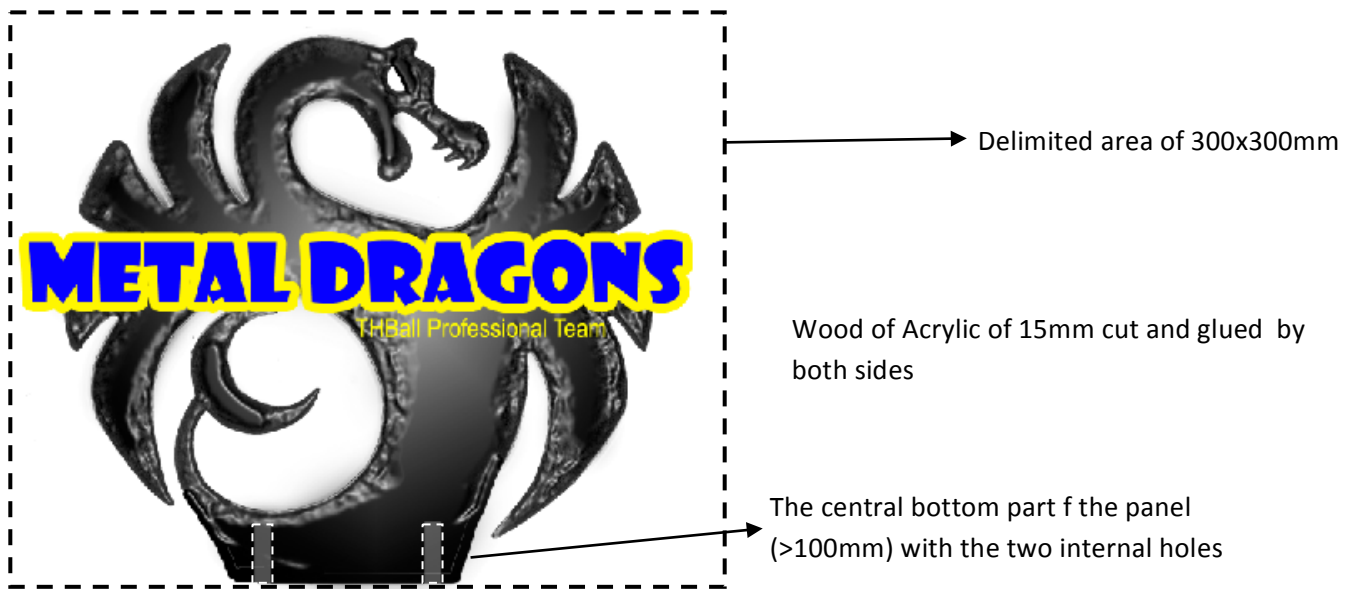


Figura 6. Maximum dimensions and correct holes places that panel must follow

Na example of a panel used in the last world cup of THBall is the METAL DRAGONS Team's panel:



3. ROBOTS

Any robot player of a THBall match must be an autonomous mobile device and must be capable of pursuing its goals and to move freely in the arena without any human interference. Only robot players constituted by educational kits like LEGO® (NXT or RCX or EV3), PNCA®, MECCANO® or VEX Robotics® are permitted.

The elements of any educational kit CANNOT be modified under any circumstance. Not observing this condition can lead the team to be disqualified from THBall.

An important advice is that robot players must be tough enough to avoid loose pieces and support impacts from launched balls. If any damage happens to a robot player, it can be substituted by reserve robots and be fixed outside the arena. The match time does not stop.

Robot player with an explicit goal to damage the opponent robot is forbidden.

3.1. Robot Restrictions

- Any robot must always fit in a cube of 250mm to enter the arena. After the match starts (during the match), this restriction becomes invalid.
- Each robot must have 6 sensors and 6 actuators at most.
- It is strictly prohibited to establish any kind of communication with external advices. Any disrespect to this condition can lead the team to disqualification. The communication between robots of the same team in the arena is the unique form of communication permitted.
- The robots cannot damage the arena. Not observing this condition can lead the team to be disqualified from THBall.

4. THE THBALL MATCH

A THBall match follows the METAL PREMIER LEAGUE rules. It happens with 2 teams, each one in its field. Each team can have 2 robots at most and at the same time in the arena. The robot of the same team can cooperate with each other. A team can have as many reserve robots as they wish. The robots can be different.



For the beginning of a match, 12 balls (6 blue and 6 orange) will be disposed in each field. Each robot must start the match in the denominated place: start area (yellow square in figure 1).

Each match has 5 minutes without stop.

Each team can replace or substitute robots **only 2 (two) times** among titular robots players and reserves during the entire match time.

The substitutions can be performed at any moment during the match. The robot that was substituted can back to the game with any kind of modification (pieces, format, programming, etc), since it keeps the restrictions described in section 3.1.

The robots can be projected to block the opponent attack. However, none robot can stand still in the same place without movement during the match, even the blocking robot. If any robot stands still, it will be eliminated by a red card and it will be retained by the referee without any possibility to return to the arena. The eliminated robot can be replaced by a reserve if the team has a substitution left. ■

The time never stops, even for substitutions.

The human member of the team that wishes to replace a robot must ask for permission to the referee and must inform which robot will left the arena and which reserve robot will enter the match.

The robot player always enters the match in a start arena. Which start area the robot will start is a team's choice.

If during a substitution, resulting from a robot player replacement, penalty by a red card or penalty by dead-zone invasion, one or more balls collide with a human member body and falls the arena, they will remain in the field of the team that is performing the substitution to be considered for the final score. If the ball falls outside the arena or in the dead-zone after hit the human member body, the ball will be retained by the referee to be considered in the final score. The team will be advice for each ball retained.

If the robot that is leaving the arena by penalty or replacement has balls in its possession, they will be withdraw from and be considered in the final score if they are orange color. If they are blue color they will not be considered for final score. These balls, orange or blue, will not return to the arena.

The match will finish by the end of 5 minutes or if a team decides to give up.

4.1. Score system

The METAL PREMIER LEAGUE championship considers points and screws. **For a match, each team starts with 0 points.**

The ball can reach the opponent field by any means since it follows the rules.

By the end of 5 minutes, each team will count the final score. The final score is composed by the start points (1000 for each team) and the balls in its field:

- **each blue ball in the team's field: + 100 points**

- each orange ball in the team's field: - 100 points

A team can also receive some penalty points:

- It will be discounted 50 points (-50) for each ball (Orange or blue) launched to outside of the arena that was not pointed directed to the opponent field.

- **It will be discounted 50 points (-50) for each ball (Orange or blue) at dead-zone.**

- It will be discounted 100 points (-100) for each invasion of dead-zone by the robot (wheel, clamp, screw, wire, etc). The robot that invades the dead-zone must restart in start area.

The team that holds the most points by the end of the match will be declared the winner. If both teams ended with the same points, a match draw is declared.

The winner team receives 3 screws by the match. The loser team receives only 1 screw by the match participation. In case of draw, each team receives 2 screws. If any team gave up during the match, or refuse to compete (W.O.), this team will receive 0 (zero) screws while the team that did not give up will receive the same 3 screws of victory.

It will be considered give-up when a human member declares the intention to give up the match.

It will be considered W.O. when a team does not show up the robots to compete in the arena for the match.

Each team will receive a panel where can allocate the screws received after the matches. Figure 7 shows an example of the panel that team can hold as a souvenir and a memory of conquered screws.

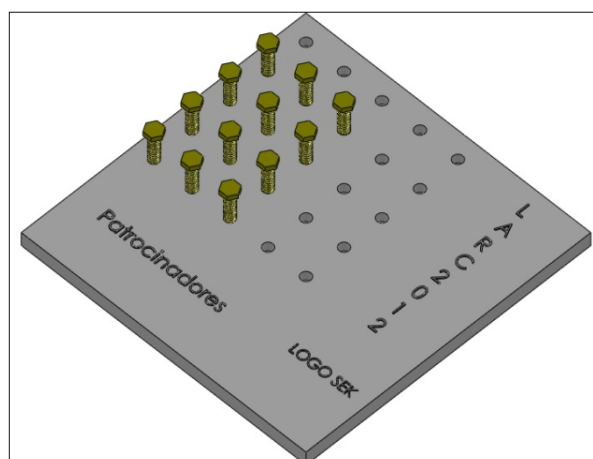


Figure 7 – Example of the screws panel for the teams.

4.2. RED CARD penalizations

In order to guarantee a dynamics game, some penalties can be imposed to the teams.

If any robot remains deliberately still, by the referee free interpretation, it will receive a RED CARD. The robot that received a red card must leave the match. It can be replaced by other robot (if the team has a substitution left) and it will be considered as a single substitution. The robot that received a red card cannot back to the match and it will be retained by the referee.

4.3. Teams Group Classification

In order to distribute teams in groups of 4, a pre-classification phase is imposed. Each team must enter in the arena, in one field, without opponent, and must launch as many orange balls as possible to the opponent side in 2 minutes. There will be 19 orange balls to be launched.

Each team will consider the number of balls in the opponent field after 2 minutes. The teams will be ranked by the number of balls launched. If two or more teams launched all balls to the opponent field in 2 minutes, the tie-breaker will be decided by the shortest time to complete the launching of all balls. If two or more teams launched the same number of balls in 2 minutes, the tie-breaker will be the time to launch the first ball to the opponent field (it will be considered the time from the start to the first hit of the ball on the opponent's floor).

With this ranking of teams, 4 team sets will be created. The 25% best teams in this ranking will form the A set. Then the following 25% will form the B set, then the C set is formed and the last 25% worst teams in this ranking form the D set. Each team in A set will be the head of a group. Each group will have a team from each remaining sets (B, C and D) decided randomly.

These groups will form the FIRST ROUND of the THBall championship.

Tie-break criteria (used in the first and second rounds of the competition)

In case of draw, no extra match will be imposed for the teams as a tie-break. If the draw remains after the extra match, the teams will perform the same process of the pre-classification phase but with only 1 minute available to complete the task. The team that throw the most number of balls to the opponent field in 1 minute will be declared the winner of the match. If the draw insists to remain, the winner of the match will be decided by a lottery.

FIRST ROUND – Groups competition

With the groups formed as stated above, each team must compete with all others teams belong to the same group.

The team that received the major number of screws will be automatically classified to the THIRD PHASE of the competition. The second team with the major number of screws in the group is classified to the SECOND ROUND, also called RECAP PHASE. The tie-break criteria is used to decide which team will be the first or the second in the group in case of two or more teams finished the FIRST ROUND with the same number of screws.

SECOND ROUND – Recap Phase

The teams that finished the FIRST ROUND in second place in a group dispute the SEOND ROUND, also known as RECAP PHASE.

During this phase, the team faces another team in a knockout stage. The team that loses the match in this phase is eliminated. Only the winner remain in the competition and goes to the THIRD ROUND. The tie-break criteria is used to decide which team will be the winner in a case of match draw.

THIRD ROUND – Converging to the champion

The third round is the most exciting phase of the competition. This round is composed by knockout matches among classified teams from the FIRST and SECOND ROUNDS. The teams are eliminated by a knockout system until only two teams remain. These two remain will perform the final match of the championship. During the knockout system, if any match finishes draw, an extra match will be imposed. If the draw remains after this extra match, the winner will be the team with the major number of screws in the first round. If the draw still remains, the teams will perform the same process of the pre-classification phase but with only 1 minute available to complete the task. The team that throw the most number of balls to the opponent field in 1 minute will be declared the winner of the match. If the draw insists to remain, the winner of the match will be decided by a lottery.

5. REQUIREMENTS TO PARTICIPATE IN THE THBALL COMPETITION

Those interested in participating in the Brazilian Robotics Competition CBR 2013 IEEE SEK category must form teams of undergraduate students in any educational institution in any country. Nevertheless, high school students will also be allowed to participate to register, teams must submit a document describing the development and operation of the robot (TDP) in IEEE format. This TDP will be used for the winners to make a brief report to the other competitors. Please, verify the deadlines on the event website.

6. THE JURI

To the players robot despair, the JURI will be composed by humans (and their unavoidable flaws) in this THBall competition in Latin America. **The JURI is composed by a member of organizing chairs, two auxiliaries of the organization and two member of other team that is not competing in the match, chosen before the match starts.**

7. EXTRAORDINARY SITIATIONS DURING THE COMPETITION

If there is any situation not covered under the above mentioned rules, or any doubt about the score, it will be up to the judges and the organizers of the competition to consider the case in the greatest possible impartiality and make a decision.

