

# KONTES ROBOT SEPAK BOLA INDONESIA (KRSBI) Humanoid 2018

## RoboSoccer Humanoid League Kid Size

### I. PENDAHULUAN

Kontes Robot Sepak Bola Indonesia (KRSBI) Humanoid 2018 adalah penyelenggaraan KRSBI tahun ke-6 semenjak KRSBI diadakan pertama kali di tahun 2013. Cikal bakal KRSBI adalah Kontes Robot Cerdas Indonesia (KRCI) *Robo Soccer Humanoid League* (RSHL) tahun 2011. Sebelumnya pada tahun 2010 bernama KRCI Expert Battle.

KRSBI adalah salah satu program kreatifitas mahasiswa di bawah kegiatan induk Kontes Robot Indonesia (KRI) yang pada tahun 2018 memasuki tahun ke-18 sejak pertama kali diadakan. Sesuai dengan *Road Map* kegiatan ini dinilai sangat strategis untuk dapat menjadi salah satu unggulan obyek penelitian dan edukasi rekayasa robotika tingkat dunia dengan kiblat langsung kepada komunitas yang sama di seluruh dunia. Kontes ini menjadi ajang kualifikasi nasional untuk mewakili Indonesia dalam RoboCup yang merupakan kompetisi robot sepakbola resmi tingkat dunia di bawah organisasi RoboCup (<http://www.robocup.org>), seperti organisasi FIFA dalam kejuaraan dunia sepakbola manusia.

Pertama kali tahun 2012 Indonesia mengirimkan wakilnya ke RoboCup 2012 di Mexico melalui tim EROS dari PENS, dan berhasil mencapai urutan ke-12. Tahun 2013 dengan tim yg sama – EROS –, setelah menjuarai tingkat nasional tahun 2012, berhasil meningkatkan prestasinya ke babak perempat final dan menduduki peringkat ke-5 dunia. Di tahun 2014 RoboCup yang telah digelar di Brazil dalam waktu yang berurutan setelah final Piala Dunia 2014 Indonesia berhasil memperbaiki peringkatnya dengan menduduki posisi 4 besar melalui tim yang sama. Di tahun 2015 kembali Indonesia menempatkan wakilnya (EROS-PENS) di RoboCup 2015 Hefei – China dan bertahan meraih posisi pada urutan keempat. Terakhir, tahun 2016 EROS kembali mewakili Indonesia di RoboCup 2016 di Leipzig Jerman meski di tingkat nasional 2016 EROS dikalahkan oleh tim BARELANG-FC dari Politeknik Negeri Batam. Tahun 2017 BARELANG-FC yang mewakili Indonesia di laga KidSize Humanoid RoboSoccer RoboCup 2017 bulan Juli 2017 di Nagoya Jepang berhasil pula langsung melesat ke posisi 4 besar dunia.

Meski Indonesia belum pernah menjadi juara-1 namun tim Indonesia ini secara berturut-turut dalam 5 tahun terakhir menjadi tim unggulan 4 besar (seeded-team) di ajang

RoboCup ini.

Sesuai dengan namanya: *humanoid league*, maka dalam divisi ini peserta diharuskan membuat robot *humanoid*, robot mirip manusia dengan tinggi tertentu yang dapat bermain sepakbola seperti pada pertandingan sepakbola manusia. Aturan pertandingannya disesuaikan dengan *road map* Robocup hingga tahun 2050. Untuk rule KRSBI Humanoid tahun 2017 tinggi robot harus berkisar antara 40 hingga 90 cm, bermain di lapangan rumput sintetis berukuran (6 x 9) meter. Bola yang digunakan adalah bola standar FIFA ukuran nomer-1.

Sesuai dengan arahan pemerintah melalui Direktorat Kemahasiswaan, Direktorat Jenderal Pembelajaran dan Kemahasiswaan, Kementerian Riset, Teknologi, dan Pendidikan Tinggi untuk makin banyak mengirim pemenang dan hasil-hasil kontes robot di tingkat nasional ke tingkat internasional maka KRSBI Humanoid ini digelar kembali di tahun 2018. Tujuannya adalah agar mahasiswa Indonesia makin terpacu untuk berkarya dan berprestasi di tingkat dunia melalui ajang kreatifitas kontes robot.

Harapan lebih jauh ke depan, sesuai dengan cita-cita organisasi ROBOCUP (<http://www.robocup.org>), yaitu bahwa pada tahun 2050 atau 32 tahun lagi organisasi ini mampu mencetak tim sepakbola robot yang mampu melawan tim juara dunia sepakbola, maka mahasiswa Indonesia peminat robotika sudah seyogyanya turut andil aktif sebagai peneliti, bukan hanya menjadi penonton. Dampak positif secara nasional mahasiswa dapat makin terpacu untuk berkreasi mengikuti perkembangan dunia robotika yang secara tidak langsung juga akan meningkatkan pemahaman dan penguasaan iptek dan aplikasi robotika dalam dunia industri masa depan.

## II. TEMA

**Tema KRSBI Humanoid 2018 adalah: “Liga Sepakbola Robot Humanoid menuju tahun 2050”**

## III. RULE OF THE GAME

Aturan main dalam KRSBI tahun 2018 divisi KidSize Humanoid League ini diadopsi dari *RoboCup Soccer Humanoid League Rules* yang digunakan dalam RoboCup 2017 di Nagoya Jepang divisi Humanoid League seperti yang digunakan juga dalam RoboCup 2016 divisi Humanoid League tipe KidSize di Leipzig - Jerman. Robot dalam divisi KidSize ini berukuran antara 40 hingga 90 cm. Secara umum setiap pertandingan antara dua tim yang berhadap-hadapan dilaksanakan dalam waktu (2 x 5) menit atau (2 x 10) menit dengan masa istirahat di paruh pertandingan selama maksimal 5 menit. Setiap tim terdiri dari maksimal 5 (lima) robot humanoid yang salah satunya harus diprogram sebagai penjaga gawang dengan satu hingga empat lainnya sebagai pemain penyerang atau bertahan. Dalam pertandingan minimal 1 (satu) dan maksimal 5 (lima) robot boleh diturunkan untuk bermain. Peraturan selengkapnya seperti pada *RoboCup Soccer Humanoid League Laws of the Game* 2016/2017 dapat dilihat di Lampiran.

Perbedaan tingkat kesulitan bila dibanding dengan Rule KRSBI 2017 adalah bahwa lapangan KRSBI 2018 ini telah sepenuhnya sama ukurannya seperti di RoboCup, yaitu (9

x 6) m persegi dan menggunakan rumput sintetis. (Lihat di lampiran).

### **3.1 Tim Robot**

Tim Robot harus berasal dari Perguruan Tinggi yang terdiri dari 4 (empat) mahasiswa aktif, termasuk mahasiswa program pascasarjana, dan 1 (satu) dosen pembimbing.

### **3.2 Spesifikasi Robot**

Robot yang dipertandingkan harus memenuhi spesifikasi tipe robot KidSize seperti yang tercantum dalam *RoboCup Soccer Humanoid League Laws of the Game 2016/2017* (lihat di Lampiran).

### **3.3 Lapangan Pertandingan**

Lihat di *RoboCup Soccer Humanoid League Laws of the Game 2016/2017* di Lampiran. Perlu diperhatikan bahwa lapangan tahun 2018 ini menggunakan rumput sintetis seperti yang dipakai di lapangan sepakbola FIFA.

### **3.4 Sistem Pertandingan dan Penilaian**

Pertandingan dan penilaian dilaksanakan sepenuhnya mengacu pada *RoboCup Soccer Humanoid League Laws of the Game 2016/2017* untuk kelas KidSize.

## **IV. INFORMASI TAMBAHAN dan FAQ (FREQUENTLY ASK QUESTIONS)**

Informasi Tambahan dan kolom FAQ akan diberikan sesuai dengan kebutuhan hingga menuju hari pertandingan.

## **V. PENDAFTARAN PESERTA**

Tiap Perguruan Tinggi dapat melakukan pendaftaran untuk ikut serta dengan pertama kali mengirimkan proposal ke alamat:

**Panitia Pusat KRSBI 2018  
Direktorat Kemahasiswaan  
Direktorat Jenderal Pembelajaran dan Kemahasiswaan  
Kementerian Riset, Teknologi dan Pendidikan Tinggi,  
Gedung D Lt.4 Jl. Jend. Sudirman Pintu I, Senayan-Jakarta, 10270.**

Proposal berisi setidaknya:

- 5.1. Identitas tim yang terdiri dari satu pembimbing (dosen) dan empat anggota tim (mahasiswa aktif)

- 5.2. Lembar pengesahan dari pejabat di perguruan tinggi.
- 5.3. Bentuk rekaan seluruh robot yang akan dibuat disertai penjelasan tentang sistem prosesor, sensor dan aktuator, berat dan dimensi masing-masing.
- 5.4. Penjelasan detil tentang tinggi robot masing-masing (H) dan ukuran telapak kaki masing-masing (panjang x lebar).
- 5.5. Penjelasan secara singkat tentang metoda visualisasi dan lokalisasi bola, lapangan, gawang dan robot-robot lawan.
- 5.6. Selain pengiriman berkas hard copy, proposal dalam format pdf juga WAJIB didaftarkan secara online pada website <http://kontesrobotindonesia.id>. Selain itu proposal juga dikirimkan ke alamat email: [epit@eepis-its.edu](mailto:epit@eepis-its.edu) dan [harusnasrullah@kontesrobotindonesia.id](mailto:harusnasrullah@kontesrobotindonesia.id)

Nama file PDF proposal KRSBI Humanoid 2017 adalah:

**KRSBI Humanoid\_2017 <Nama PT> <Nama Tim>.PDF**

## **VI. BIAYA PEMBUATAN ROBOT, TRANSPORTASI DAN AKOMODASI PESERTA**

- 6.1. Untuk pertandingan tingkat regional panitia hanya akan menanggung biaya akomodasi selama berada di lokasi pertandingan. Biaya pembuatan robot dan transportasi adalah tanggungjawab masing-masing tim.
- 6.2 Untuk pertandingan tingkat nasional, peserta akan mendapat bantuan biaya untuk pembuatan robot (yang *besarnya akan ditentukan kemudian*), akomodasi dan transportasi dari/ke daerah asal ke/dari tempat pertandingan.

## **VII. SIMPOSIUM KRSBI 2018 ke-6 (6th ISRSC 2018)**

Seperti tahun-tahun sebelumnya sejak tahun 2013 KRSBI didampingi sebuah kegiatan temu ilmiah berupa Indonesia Symposium on Robo Soccer Competition, yang sejak tahun 2017 berubah nama menjadi Indonesian Symposium on Robotic System and Control (ISRSC). Sejak tahun 2017 ISRSC digelar dalam rangka mendukung bukan saja KRSBI Humanoid, namun juga seluruh divisi yang dipertandingkan dalam KRI.

Berikut adalah informasi dan tanggal-tanggal penting Simposium KRSBI 2018:

- Nama simposium: *the 6th Indonesian Symposium on Robotic Systems and Control* (6th **ISRSC 2018**)

- Peserta/pemakalah wajib: tim peserta yang lolos ke tingkat nasional (dengan mengangkat tema robot dari tim yg bersangkutan)
- Peserta/pemakalah reguler: kelompok peneliti (mahasiswa, dosen, praktisi)
- Pembicara kunci: (akan ditentukan kemudian)
- Topik simposium: *all related issues on robot soccer competition, robotic systems and technology*.
- Format makalah: *double columns, Times-New Roman, 10pt*, maksimum 5 halaman, ditulis dalam bahasa Indonesia atau Inggris. Penulisan dalam bahasa Inggris adalah sangat disarankan untuk persiapan jika jadi wakil ke RoboCup 2019.
- Batas akhir pengiriman *full paper*: 06 Juni 2018
- Pemberitahuan makalah yg lolos cetak ke *proceeding*: 13 Juni 2018
- Batas akhir pengiriman *camera ready full paper*: 18 Juni 2018.
- Hari simposium: Kamis, 28 Juni 2018.
- Kontribusi Peserta (Biaya Pendaftaran): akan ditentukan kemudian.
- Tempat simposium: *venue* kontes robot nasional 2018 (akan diumumkan kemudian)
- *Program Chairman & Alamat Email*:  
 Dr. Endra Pitowarno [epit@eepis-its.edu](mailto:epit@eepis-its.edu)  
 Dr. Kusprasapta Mutijarsa [kusprasapta.mutijarsa@itb.ac.id](mailto:kusprasapta.mutijarsa@itb.ac.id)  
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- Alamat kontak dan pengiriman makalah: <menunggu *host nasional siap*>
- Paper Online Submission: <menunggu *portal host nasional siap*>

## VIII. JADWAL DAN TEMPAT KONTES

Jadwal Lengkap KRSBI 2018 adalah sebagai berikut:

- Pengumuman awal *Rule of Game*: 12 Desember 2017.

- Pengiriman Proposal: Proposal harus sudah sampai di Gedung D (lihat V) paling lambat pada 8 Januari 2018 pk.16:00 WIB.
- Pengumuman Tahap I (proposal): 12 Januari 2018.
- Pengiriman Laporan Kemajuan berupa video dan *slide Power Point* tim robot: paling lambat 19 Maret 2018 (alamat sama dengan V).
- Pengumuman Tahap II (peserta tingkat regional): 26 Maret 2018.
- Jadwal kontes tingkat regional dan nasional: akan diumumkan kemudian. **IX.**

## **IX. PENYELENGGARA**

**Direktorat Kemahasiswaan  
Direktorat Jenderal Pembelajaran dan Kemahasiswaan  
Kementerian Riset, Teknologi dan Pendidikan Tinggi,  
Gedung D Jl. Jend. Sudirman Pintu I, Senayan-Jakarta, 10270.  
TEL. 021-5700049, 5731251, 5731956 (hunting) ext. 1855. FAX. 021-5732468.**

## **X. ALAMAT KONTAK**

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HP:08123030162, Email: [epit@eepis-its.edu](mailto:epit@eepis-its.edu), [epit@kontesrobotindonesia.id](mailto:epit@kontesrobotindonesia.id)

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LAMPIRAN A

RoboCup Soccer  
Humanoid League  
Laws of the Game\*  
2016/2017



# RoboCup Soccer Humanoid League Laws of the Game\* 2016/2017

15. March 2017



Louis Vuitton Cup

RoboCup Humanoid League Mailing List (for important announcements, rule discussion and questions):  
[lists.cc.gatech.edu/mailman/listinfo/robocup-humanoid](https://lists.cc.gatech.edu/mailman/listinfo/robocup-humanoid)

RoboCup Humanoid League Home Pages:

10 <http://www.robocup.org/leagues/3> [www.robocuphumanoid.org](http://www.robocuphumanoid.org)

- inspired by the [Laws of the Game of Fédération internationale de Football Association \(FIFA 2013/2014\)](#)
- with RoboCup Humanoid League specific amendments

## Overview

Section I – Laws of the Game

15 Section II – RoboCup Humanoid League Competition Rules

Section III – Rules for RoboCup Humanoid League Technical Challenges

# Section I

## Laws of the Game

The Laws of the Game should be updated regularly to refer to the most recent FIFA document.

20 Deviations from the FIFA rules are marked in the text:

'replaces': A RoboCup-specific rule temporarily replaces a FIFA rule.

'suspended': A specific FIFA rule is not yet applied.

'new': A RoboCup-specific rule is temporarily introduced.

## NOTES ON THE LAWS OF THE GAME

### Modifications

25 Subject to the agreement of the member association concerned and provided the principles of these Laws are maintained, the Laws may be modified in their application for regional matches.  
Any or all of the following modifications are permissible:

- size of the field of play
- size, weight and material of the ball
- width between the goalposts and height of the crossbar from the ground
- 30 • duration of the periods of play
- substitutions

### Male and Female

References in respect of referees, assistant referees and officials have been changed from the original FIFA document to a gender neutral language. The reference to players, since they refer to robots in this context, have been kept in  
35 the male gender. However, we strongly encourage the FIFA to officially change their laws of the game to fully gender neutral language in the future in respect to all participants in the game.

(replaces: References to the male gender in the Laws of the Game in respect of referees, assistant referees, players and officials are for simplification and apply to both men and women.)

### Official languages

40 RoboCup Humanoid League Technical Committee publishes the Laws of the Game in English.

### Key

A single line in the left-hand margin indicates new Law changes.

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## Law 1 – The Field of Play

### Field surface

- 70 Matches may be played on artificial surfaces with a height of approximately 30 mm.  
(replaces: Matches may be played on natural or artificial surfaces, according to the rules of the competition.)

The colour of artificial surfaces must be green.

- (suspended: Where artificial surfaces are used in either competition matches between representative teams of member associations affiliated to FIFA or international club competition matches, the surface must meet the requirements of the FIFA Quality Concept for Football Turf or the International Artificial Turf Standard, unless special dispensation is given by FIFA.)
- 75

### Field markings

- 80 The field of play must be rectangular and marked with lines. These lines belong to the areas of which they are boundaries.

The two longer boundary lines are called touch lines. The two shorter lines are called goal lines.

The field of play is divided into two halves by a halfway line, which joins the midpoints of the two touch lines.

- 85 The centre mark is indicated at the midpoint of the halfway line. A circle with a radius of 0.75 m is marked around it. (replaces: A circle with a radius of 9.15 m (10 yds) is marked around it.)

(suspended: Marks may be made off the field of play, 9.15 m (10 yds) from the corner arc and at right angles to the goal lines and the touch lines, to ensure that defending players retreat this distance when a corner kick is being taken.)

### Dimensions

- 90

The length of the touch line must be greater than the length of the goal line.

Length (touch line): approximately 9 m

Width (goal line): approximately 6 m

(replaces:

Length (touch line): minimum 90 m

maximum 120 m

- 95 Width (goal line): minimum 45 m

maximum 90 m)

All lines must be of the same width, which must be approximately 5 cm.

(replaces: All lines must be of the same width, which must be not more than 12 cm (5 ins).)

International matches

Length (touch line): approximately 9 m

Width (goal line): approximately 6 m

100 (replaces:

Length (touch line): minimum 100 m

maximum 110 m

Width (goal line): minimum 64 m

maximum 75 m)

## The goal area

105 Two lines are drawn at right angles to the goal line, 1.2 m from the inside of each goalpost. These lines extend into the field of play for a distance of 1 m and are joined by a line drawn parallel with the goal line. The area bounded by these lines and the goal line is the goal area.

(replaces: Two lines are drawn at right angles to the goal line, 5.5 m (6 yds) from the inside of each goalpost. These lines extend into the field of play for a distance of 5.5 m (6 yds) and are joined by a line drawn parallel with the goal line. The area bounded by these lines and the goal line is the goal area. )

## The penalty area

(suspended: Two lines are drawn at right angles to the goal line, 16.5 m (18 yds) from the inside of each goalpost. 115 These lines extend into the field of play for a distance of 16.5 m (18 yds) and are joined by a line drawn parallel with the goal line. The area bounded by these lines and the goal line is the penalty area.)

A penalty mark is made 2.1 m from the midpoint between the goalposts and equidistant to them. (replaces: Within each penalty area, a penalty mark is made 11 m (12 yds) from the midpoint between the goalposts and equidistant to them.)

120 (suspended: An arc of a circle with a radius of 9.15 m (10 yds) from the center of each penalty mark is drawn outside the penalty area.)

## Flagposts

125 (suspended: A flagpost, not less than 1.5 m (5 ft) high, with a non-pointed top and a flag must be placed at each corner.)

(suspended: Flagposts may also be placed at each end of the halfway line, not less than 1 m (1 yd) outside the touch line.)

## The corner arc

130 (suspended: A quarter circle with a radius of 1 m (1 yd) from each corner flagpost is drawn inside the field of play.)

## Goals

135 A goal must be placed on the center of each goal line.

A goal consists of two upright posts equidistant from the corner flagposts and joined at the top by a horizontal crossbar. The goalposts and crossbar must be made of wood, metal or other approved material. They must be square, rectangular, round or elliptical in shape and must not be dangerous to players.

140 The distance between the posts is 2.6 m and the distance from the lower edge of the crossbar to the ground is 1.8 m.

(replaces: The distance between the posts is 7.32 m (8 yds) and the distance from the lower edge of the crossbar to the ground is 2.44 m (8 ft).)

(suspended: figures of different goal post geometries)

145 (suspended: The position of the goalposts in relation to the goal line must be according to the graphics below.)

If the shape of the goalposts is square (viewed from above), the sides must be parallel or perpendicular to the goal line. The sides of the crossbar must be parallel or perpendicular to the field plane.

If the shape of the goalposts is elliptical (viewed from above), the longest axis must be perpendicular to the goal line. The longest axis of the crossbar must be parallel to the field plane.

- 150 If the shape of the goalposts is rectangular (viewed from above), the longest side must be perpendicular to the goal line. The longest side of the crossbar must be parallel to the field plane.

Both goalposts and the crossbar have the same width and depth, which do not exceed 12 cm (5 ins). The goal lines must be approximately 5 cm of width. (replaces: The goal lines must be of the same width as the goalposts and the crossbar.) Nets (new:) which must not be green or white may be attached to the goals and the ground behind the goal, provided that they are properly supported and do not interfere with the goalkeeper.

The goalposts and crossbars must be white.

### Safety

- 160 Goals must be anchored securely to the ground. Portable goals may only be used if they satisfy this requirement.

### The field of play

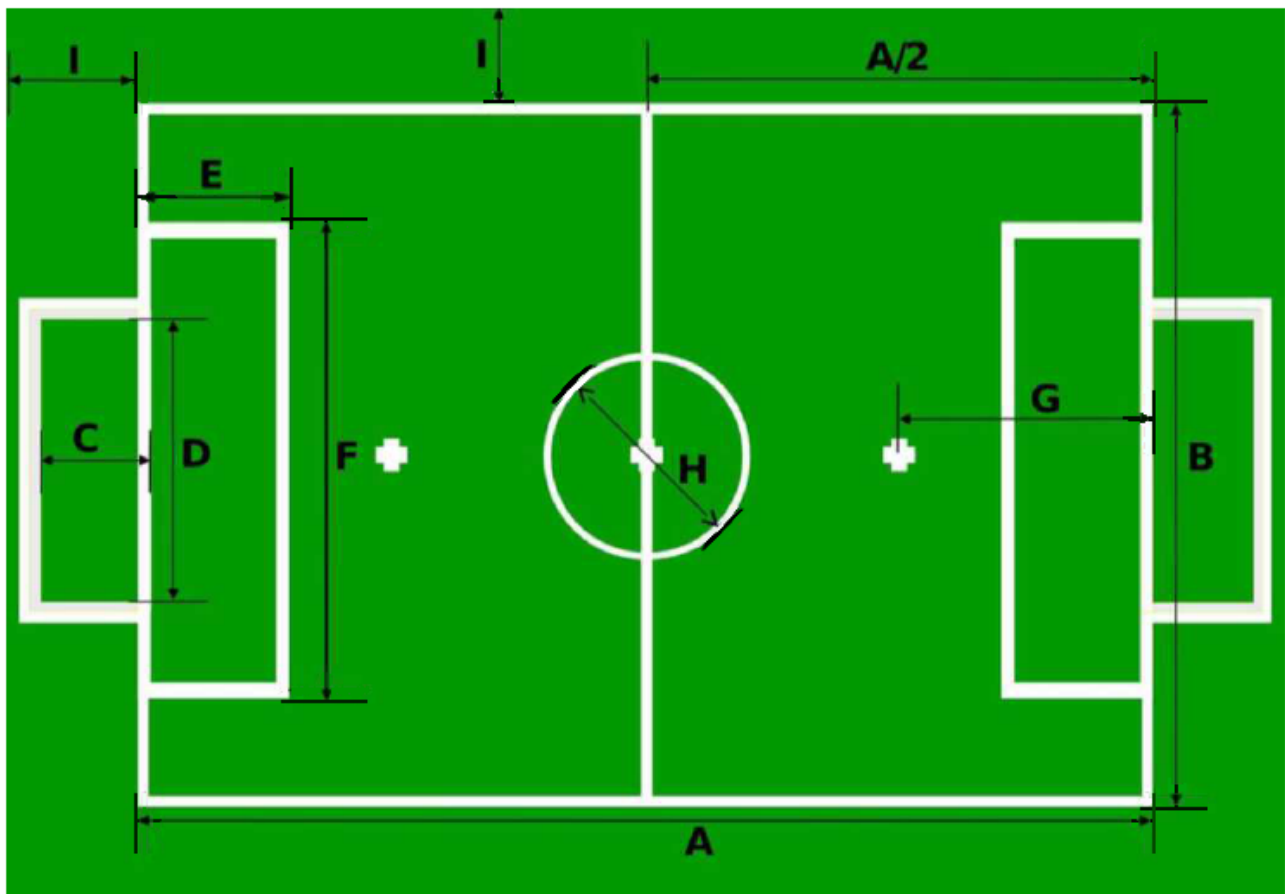


Figure 1: Humanoid robot soccer field (not to scale)

Table 1: Approximate dimensions of the rectangular field of soccer play.

|   |                           |       |
|---|---------------------------|-------|
| A | Field length              | 9 m   |
| B | Field width               | 6 m   |
| C | Goal depth                | 0.6 m |
| D | Goal width                | 2.6 m |
|   | Goal height               | 1.8 m |
| E | Goal area length          | 1 m   |
| F | Goal area width           | 5 m   |
| G | Penalty mark distance     | 2.1 m |
| H | Center circle diameter    | 1.5 m |
| I | Border strip width (min.) | 0.7 m |

165

(replaces figure of field)

**Corner flagpost**

170

(suspended: figure of flagpost)

**Metric measurements**

(suspended: figure with metric dimensions of field)

175

**Imperial measurements**

(suspended: figure with imperial dimensions of field)

## Decisions of the International F.A. Board

180

(suspended: Decision 1

Where a technical area exists, it must meet the requirements approved by the International F.A. Board, which are contained in the section of this publication entitled The Technical Area.)

185 (suspended: Decision 2

Where goal-line technology (GLT) is used, modifications to the goal frame may be allowed. They must be in accordance with the specifications stipulated in the FIFA Quality Programme for GLT and according to the above description, "Goals".)

## Law 2 – The Ball

### 190 Qualities and measurements

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The ball is:

- spherical
- 195 • made of leather or other suitable material
- FIFA size 1 for KidSize, size 3 for TeenSize and size 5 for AdultSize leagues. (replaces: of a circumference of not more than 70 cm (28 ins) and not less than 68 cm (27 ins) and: not more than 450 g (16 oz) and not less than 410 g (14 oz) in weight at the start of the match)
- 200 • (suspended: of a pressure equal to 0.6 – 1.1 atmosphere (600 – 1,100 g/cm<sup>2</sup>) at sea level (8.5 lbs/sq in – 15.6 lbs/sq in))

### Replacement of a defective ball

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If the ball bursts or becomes defective during the course of a match:

- 205 • the match is stopped
- the match is restarted by dropping the replacement ball at the place where the original ball became defective, unless play was stopped inside the goal area, in which case the referee drops the replacement ball on the goal area line parallel to the goal line at the point nearest to where the original ball was located when play was stopped

210 If the ball bursts or becomes defective during a penalty kick or during kicks from the penalty mark as it moves forward and before it touches any player or the crossbar or goalposts:

- the penalty kick is retaken

If the ball bursts or becomes defective whilst not in play at a kick-off, goal kick, corner kick, free kick, penalty kick or throw-in:

- 215 • the match is restarted accordingly

The ball may not be changed during the match without the authority of the referee.

## Decisions of the International F.A. Board

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220 (suspended: Decision 1

In addition to the requirements of Law 2, acceptance of a ball for use in matches played in an official competition organised under the auspices of FIFA or the confederations is conditional upon the ball bearing one of the following:

- the official “FIFA APPROVED” logo
- the official “FIFA INSPECTED” logo
- 225 • the “INTERNATIONAL MATCHBALL STANDARD” logo

Such a logo on a ball indicates that it has been tested officially and found to be in compliance with specific technical requirements, different for each logo and additional to the minimum specifications stipulated in Law 2. The list of the additional requirements specific to each of the respective logos must be approved by the International F.A. Board. The institutes conducting the tests are subject to the approval of FIFA.

230 Member association competitions may also require the use of balls bearing any one of these three logos.

(figures...))

(suspended: Decision 2

In matches played in an official competition organised under the auspices of FIFA, the confederations or the member associations, no form of commercial advertising on the ball is permitted, except for the emblem of the competition, 235 the competition organiser and the authorised trademark of the manufacturer. The competition regulations may restrict the size and number of such markings.)

(suspended: Decision 3

Where goal-line technology (GLT) is used, balls with integrated technology are allowed, but they must either be “FIFA APPROVED”, “FIFA INSPECTED” or “INTERNATIONAL MATCHBALL STANDARD” (see “Decision 1”).)

## 240 Law 3 – The Number of Players

### Number of Players

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245 A match is played by two teams, each consisting of not more than four players in KidSize and not more than three players in TeenSize, one of whom must be designated as goalkeeper. In AdultSize, a team consists of not more than one player who takes the role of a field player. A match may not start if either team consists of less than one player. If a team has not at least one player (who may be incapable to play) at the side of the field, it is considered a forfeit. (replaces: A match is played by two teams, each consisting of not more than eleven players, one of whom is the goalkeeper. A match may not start if either team consists of fewer than seven players.)

### 250 Number of substitutions

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#### Official competitions

255 Up to a maximum of two (replaces: three) substitutes may be used in any match played in an official competition organised under the auspices of FIFA, the confederations or the member associations.

The rules of the competition must state how many substitutes may be nominated, from three up to a maximum of twelve.

(suspended: **Other matches**

In national “A” team matches, up to a maximum of six substitutes may be used.

260 In all other matches, a greater number of substitutes may be used provided that:

- the teams concerned reach agreement on a maximum number
- the referee is informed before the match

If the referee is not informed, or if no agreement is reached before the match, no more than six substitutes are allowed.

### 265 Substitution procedure

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In all matches, the names of the substitutes must be given to the referee prior to the start of the match. Any substitute whose name is not given to the referee at this time may not take part in the match.

270 To replace a player with a substitute, the following conditions must be observed:

- the referee must be informed before any proposed substitution is made
- the substitute only enters the field of play after the player being replaced has left and after receiving a signal from the referee
- 275 • the substitute only enters the field of play at the penalty mark of the player’s own half (replaces: the halfway line) and during a stoppage in the match
- the substitution is completed when a substitute enters the field of play
- from that moment, the substitute becomes a player and the player he has replaced becomes a substituted player
- the substituted player takes no further part in the match
- all substitutes are subject to the authority and jurisdiction of the referee, whether called upon to play or not

### 280 Changing the goalkeeper

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Any of the other players may change places with the goalkeeper, provided that:

- the referee is informed before the change is made
- the change is made during a stoppage in the match

## **Infringements and sanctions**

If a substitute or substituted player enters the field of play without the referee's permission:

- the referee stops play (although not immediately if the substitute or substituted player does not interfere with play)
- the referee cautions him for unsporting behaviour and orders him to leave the field of play
- if the referee has stopped play, it is restarted with an indirect free kick for the opposing team from the position of the ball at the time of the stoppage (see Law 13 – Position of free kick)

If a named substitute enters the field of play instead of a named player at the start of the match and the referee is not informed of this change:

- the referee allows the named substitute to continue the match
- no disciplinary sanction is taken against the named substitute
- the number of substitutions allowed by the offending team is not reduced
- the referee reports the incident to the appropriate authorities

If a player changes places with the goalkeeper without the referee's permission before the change is made:

- the referee allows play to continue
- the referee cautions the players concerned when the ball is next out of play

In the event of any other infringements of this Law:

- the players concerned are cautioned
- the match is restarted with an indirect free kick, to be taken by a player of the opposing team from the position of the ball at the time of the stoppage (see Law 13 – Position of free kick)

## **Players and substitutes sent off**

A player who has been sent off before the kick-off may be replaced only by one of the named substitutes.

A named substitute who has been sent off, either before the kick-off or after play has started, may not be replaced.

## Law 4 – The Players ('Equipment')

### Safety

A player must not use equipment or wear anything that is dangerous to himself or another player (including any kind of jewellery).

### The Design of the Robots (new)

Robots participating in the Humanoid League competitions must have a human-like body plan, as shown in Fig. 2. They must consist of two legs, two arms, and one head, which are attached to a trunk.

(new:) Robots in kid and teen size sub-leagues must be equipped with a handle, to be picked up safely and with no harm to the robot and the handler.

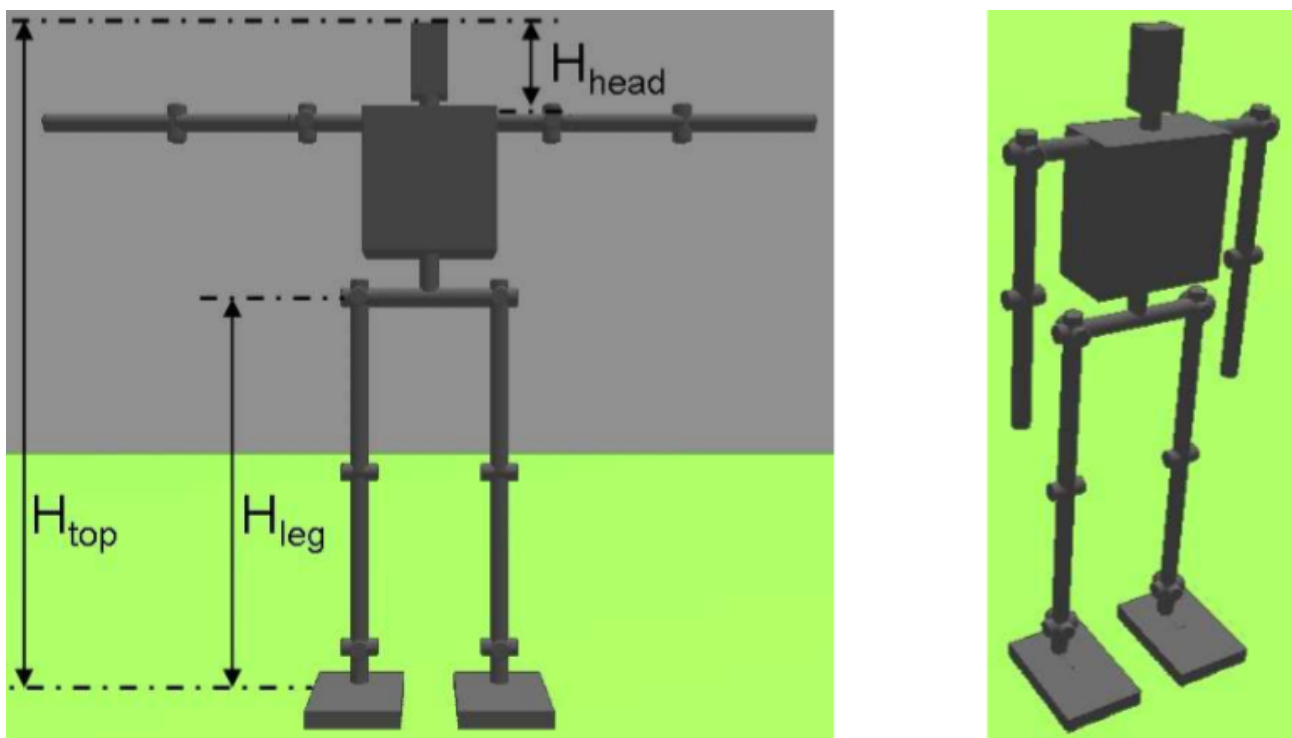


Figure 2: Example of a humanoid robot body plan (left) and standing upright pose (right)

The robots must be able to stand upright on their feet and to walk on their legs. KidSize and TeenSize robots need to be able to recover from a fall (get back to a standing position). The only allowed modes of locomotion are bipedal walking, running and jumping.

All actions of the robots must be kinematically equivalent to humanoid motions.

### Robot Height (new)

Based on  $H_{\text{top}}$ , the following size restrictions apply:

- $40\text{cm} \leq H_{\text{top}} \leq 90\text{cm}$  to play in the KidSize class,
- $80\text{cm} \leq H_{\text{top}} \leq 140\text{cm}$  to play in the TeenSize class,
- $130\text{cm} \leq H_{\text{top}} \leq 180\text{cm}$  to play in the AdultSize class.

$H_{top}$  is defined as the height of the robot when standing upright (with fully extended knees, cf. Fig. 2 right) and  $H_{COM}$  denotes the height of the robot's center of mass, measured in upright posture.

## Weight Restrictions (new)

- The maximum weight for robots allowed to play in the TeenSize class is 20 kg.
- The minimum weight for robots allowed to play in the AdultSize class is 10 kg

## Size Restrictions (new)

All robots participating in the Humanoid League must comply with the following restrictions:

- Each foot must fit into a rectangle of area  $\frac{(2.2 \cdot H_{COM})^2}{32}$ .
- Considering the rectangle enclosing the convex hull of the foot, the ratio between the longest side of the rectangle and the shortest one, shall not exceed 2.5.
- The robot must fit into a cylinder of diameter  $0.55 \cdot H_{top}$ .
- The robot does not possess a configuration where it is extended longer than  $1.5 \cdot H_{top}$ .
- The length of the legs  $H_{leg}$ , including the feet, satisfies  $0.35 \cdot H_{top} \leq H_{leg} \leq 0.7 \cdot H_{top}$ .
- The height of the head  $H_{head}$ , including the neck, satisfies  $0.05 \cdot H_{top} \leq H_{head} \leq 0.25 \cdot H_{top}$ .  $H_{head}$  is defined as the vertical distance from the axis of the first arm joint at the shoulder to the top of the head.
- The leg length is measured while the robot is standing up straight. The length is measured from the first rotating joint where its axis lies in the plane parallel to the standing ground to the tip of the foot.
- The minimum length of the arm, measured from the first joint, is  $H_{top} - H_{leg} - H_{head}$ .

## Sensors (new)

Teams participating in the Humanoid League competitions are encouraged to equip their robots with sensors that have an equivalent in human senses. These sensors must be placed at a position roughly equivalent to the location of the human's biological sensors. In particular,

- The only active external sensor allowed is sound ("human-like" with respect to volume and frequency) with one loudspeaker on the robot. The loudspeaker may be placed in the head, neck or trunk of the robot. Any other active sensor (emitting light, sound, or electromagnetic waves into the environment in order to measure reflections) is not allowed.
- External sensors, such as cameras and up to two microphones, may not be placed in the legs or arms or the torso of the robots. They must be placed in the robot's head and above any neck joint.
- The number of cameras is limited to a stereo vision setup (i.e., max. 2 cameras with a large overlap) only. Monocular vision is also allowed.
- The field of view of the robots is limited at any time to 180 degrees. This means that the maximum angle between any two points in the overlap of the field of view of all cameras mounted on the robot must be less than 180 degrees. Also the pan-tilt motion of the head and the cameras mounted on the robot's head is restricted to be more human like not only with respect to the field of view but also to the range of motion of the neck joints. Therefore, the mechanism to pan the camera is limited to 270 degree pan, which means  $\pm 135$  degrees from the position looking straight ahead. The mechanism to tilt the camera is limited to  $\pm 90$  degrees (measured from the horizontal line). Furthermore, if positioned at the center mark the robot may not be able to see both goals in any tilt angle and in any standing or walking posture of the robot.
- Touch sensors, force sensors, and temperature sensors may be placed at any position on the robot.

- Sensors inside the robot may measure all quantities representing the local state of the system, including (but not limited to) voltages, currents, forces, movements, accelerations, and rotational speeds. They can be at any position inside the robot. Measurements from earth magnetic field sensors may not be used in the software and - in case of doubt - the code must be made available to members of the Technical Committee for inspection.

## Communication and Control (new)

Robots participating in the Humanoid League competitions must act autonomously while a competition is running. No external power supply, teleoperation, remote control, or remote brain of any kind is allowed.

Robots may communicate only via the wireless network provided by the organizers, which must support the referee box. The total bandwidth of the robots belonging to one team may not exceed 1 Mbit/s. The robots must not rely on the quality of the wireless network. They must be able to play if the network is of low quality. Only robots are allowed to communicate by WLAN. Any other computers of team members are only allowed to communicate by tethered LAN. No other wireless communication is allowed onsite. All other wireless hardware must be deactivated. A team may be disqualified if one of the team members violates this rule.

Robots in play may communicate with each other at any time during a game. Any kind of transmission from an external computer or an out of play robot to the playing robots is prohibited. This implies that any monitoring is only done by receiving UDP communication from the robots using an external computer connected by tethered LAN to the official wireless router.

Sending any direct or indirect transmission from an external computer to the robots has to take place during a timeout or service of the robot. Connecting a LAN cable to the robot is automatically considered service. Any other type of communication with the robot, excluding verbal communication of the robot handler and pressing a button to start or stop the robot's general behaviour, has to be announced to the referee so a service penalty can be given to the respective robot. If the team does not announce the communication before starting it, an additional 30 second penalty is given to the team. In case of repeated violation, the referee may take disciplinary actions against the team as defined in Law 5.

Teams may not use any type of communication, excluding verbal communication, with robots in play, in service or with robots suffering a removal penalty that contains information which reduces the need for autonomy in detecting the current game state of the robots, including the position of the ball, the location where the robot re-enters the field, the orientation of the robots own or opponents goal, and the position of team members or opponents. In case of doubt that a team violates this rule, the code must be made available to members of the Technical Committee for inspection.

During the game an official game controller/referee box will be used. It uses UDP to broadcast information to the robots like elapsed time, current score, game state (ready, set, playing, finished) and the robot-specific penalized state. The source code is open. To encourage teams to use the referee box, 15 seconds advantage is given to teams using the referee box in any stoppage of the game.

In KidSize and TeenSize, no humans are allowed on the field while the ball is in play. Robot handlers stay in a designated area and must receive permission from the referee prior to entering the field. Each team may designate only one person as robot handler. The robot handler of a team may not touch a robot of another team in order to avoid any (unintentional or intentional) damage to that robot.

The source code of the game controller/referee box is available from <https://github.com/RoboCup-Humanoid-TC/GameController>, see also <https://www.robocuphumanoid.org>.

## (suspended: Basic equipment

The basic compulsory equipment of a player comprises the following separate items:

- a jersey or shirt with sleeves – if undergarments are worn, the colour of the sleeve must be the same main colour as the sleeve of the jersey or shirt

- shorts – if undershorts or tights are worn, they must be of the same main colour as the shorts
- stockings – if tape or similar material is applied externally it must be the same colour as that part of the stocking it is applied to shinguards footwear)

#### 4 35 (suspended: Shinguards

- are covered entirely by the stockings
- are made of rubber, plastic or a similar suitable material
- provide a reasonable degree of protection)

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### Colours

- (new) Robots must be mostly black or of dark grey color (i.e. RAL 7011 Iron Grey or darker) and non reflective. Robots may also be colored in aluminum-like silver, grey or white but then their feet must be colored black. Any color used for the field (green, white) or colors similar to the opponent team's team markers must be avoided. Arms, legs and bodies of the robot must be of solid shape appearance.
- (new) The robots must be marked with team markers. These markers are colored magenta (referred to as red) for one team and cyan (referred to as blue) for the other team. Robot legs and arms must be covered by team markers. From each side of the robot, at least one team marker must be visible on both an arm and a leg. The marker must be at least 5 cm in height and as wide as the leg or arm of the robot as seen from that side. If both teams cannot agree, which team color to use, a coin will be flipped 15 minutes prior to the game to assign the team colors.
- (new) The robots of each team must be uniquely identifiable. They must be marked with numbers or names. The goal keeper robot must be marked uniquely that it can be easily distinguished from the other robots of a team by the referees.
- The two teams must wear colours that distinguish them from each other and also the referee and the assistant referees.
- (suspended: Each goalkeeper must wear colours that distinguish him from the other players, the referee and the assistant referees)

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### Infringements and sanctions

In the event of any infringement of this Law:

- play need not be stopped
- the player at fault is instructed by the referee to leave the field of play to correct his equipment
- the player leaves the field of play when the ball next ceases to be in play, unless he has already corrected his equipment
- any player required to leave the field of play to correct his equipment must not re-enter without the referee's permission
- the referee checks that the player's equipment is correct before allowing him to re-enter the field of play
- the player is only allowed to re-enter the field of play before the respective penalty time is over (replaces: when the ball is out of play)

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A player who has been required to leave the field of play because of an infringement of this Law and who re-enters the field of play without the referee's permission must be cautioned.

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## Restart of play

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If play is stopped by the referee to administer a caution:

- 480 • the match is restarted by an indirect free kick taken by a player of the opposing team from the place where the ball was located when the referee stopped the match (see Law 13 – Position of free kick)

## Decisions of the International F.A. Board

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### 485 Decision 1

Players must not reveal undergarments showing slogans or advertising. The basic compulsory equipment must not have any political, religious or personal statements. A player removing his jersey or shirt to reveal slogans or advertising will be sanctioned by the competition organiser. The team of a player whose basic compulsory equipment has political, religious or personal slogans or statements will be sanctioned by the competition organiser (new) or by

490 RoboCup Federation Humanoid League.

## Law 5 – The Referee

### The authority of the referee

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495 Each match is controlled by a referee who has full authority to enforce the Laws of the Game in connection with the match to which they has been appointed.

### Powers and duties

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500 The Referee:

- enforces the Laws of the Game
- controls the match in cooperation with the assistant referees and, where applicable, with the fourth official
- ensures that any ball used meets the requirements of Law 2
- ensures that the players' equipment meets the requirements of Law 4
- 505 • acts as timekeeper and keeps a record of the match
- stops, suspends or abandons the match, at their discretion, for any infringements of the Laws
- stops, suspends or abandons the match because of outside interference of any kind
- stops the match if, in their opinion, a player is seriously injured and ensures that he is removed from the field of play. An injured player may only return to the field of play after the respective penalty time is over (replaces:  
510 after the match has restarted)
- allows play to continue until the ball is out of play if a player is, in their opinion, only slightly injured
- ensures that any player bleeding from a wound leaves the field of play. The player may only return on receiving a signal from the referee, who must be satisfied that the bleeding has stopped
- allows play to continue when the team against which an offence has been committed will benefit from such an  
515 advantage and penalises the original offence if the anticipated advantage does not ensue at that time
- punishes the more serious offence when a player commits more than one offence at the same time
- takes disciplinary action against players guilty of cautionable and sending-off offences. They is not obliged to take this action immediately but must do so when the ball next goes out of play
- takes action against team officials who fail to conduct themselves in a responsible manner and may, at their  
520 discretion, expel them from the field of play and its immediate surrounds
- acts on the advice of the assistant referees regarding incidents that they has not seen
- ensures that no unauthorised persons enter the field of play
- indicates the restart of the match after it has been stopped
- provides the appropriate authorities with a match report, which includes information on any disciplinary action  
525 taken against players and/or team officials and any other incidents that occurred before, during or after the match

### Decisions of the referee

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530 The decisions of the referee regarding facts connected with play, including whether or not a goal is scored and the result of the match, are final.

The referee may only change a decision on realising that it is incorrect or, at their discretion, on the advice of an assistant referee or the fourth official, provided that they has not restarted play or terminated the match.

## Decisions of the International F.A. Board

535

### Decision 1

A referee (or where applicable, an assistant referee or fourth official) is not held liable for: any kind of injury suffered by a player, official or spectator any damage to property of any kind any other loss suffered by any individual, club, company, association or other body, which is due or which may be due to any decision that they may take under the terms of the Laws of the Game or in respect of the normal procedures required to hold, play and control a match.

540

Such decisions may include:

- a decision that the condition of the field of play or its surrounds or that the weather conditions are such as to allow or not to allow a match to take place
- a decision to abandon a match for whatever reason
- a decision as to the suitability of the field equipment and ball used during a match
- a decision to stop or not to stop a match due to spectator interference or any problem in spectator areas
- a decision to stop or not to stop play to allow an injured player to be removed from the field of play for treatment
- a decision to require an injured player to be removed from the field of play for treatment
- a decision to allow or not to allow a player to wear certain apparel or equipment
- a decision (where they has the authority) to allow or not to allow any persons (including team or stadium officials, security officers, photographers or other media representatives) to be present in the vicinity of the field of play
- any other decision that they may take in accordance with the Laws of the Game or in conformity with their duties under the terms of FIFA, confederation, member association or league rules or regulations under which the match is played

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### Decision 2

In tournaments or competitions where a fourth official is appointed, their role and duties must be in accordance with the guidelines approved by the International F.A. Board, which are contained in this publication.

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### Decision 3

Where goal-line technology (GLT) is used (subject to the respective competition rules), the referee has the duty to test the technology's functionality before the match. The tests to be performed are set out in the FIFA Quality Programme for GLT Testing Manual. If the technology does not function in accordance with the Testing Manual, the referee must not use the GLT system and must report this incident to the respective authority.

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## Law 6 – The Assistant Referees

### Duties

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- 570 Two assistant referees may be appointed whose duties, subject to the decision of the referee, are to indicate:
- when the whole of the ball leaves the field of play
  - which team is entitled to a corner kick, goal kick or throw-in
  - when a player may be penalised for being in an offside position
  - when a substitution is requested
  - 575 • when misconduct or any other incident occurs out of the view of the referee
  - when offences have been committed whenever the assistant referees have a better view than the referee (this includes, in certain circumstances, offences committed in the penalty area)
  - whether, at penalty kicks, the goalkeeper moves off the goal line before the ball is kicked and if the ball crosses the line
  - 580 • (new) operate the game controller

### Assistance

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585 The assistant referees also assist the referee in controlling the match in accordance with the Laws of the Game. In particular, they may enter the field of play to help control the distances as defined by the laws of the game (replaces: 9.15 m (10 yds) distance).

In the event of undue interference or improper conduct, the referee will relieve an assistant referee of their duties and make a report to the appropriate authorities.

## Law 7 – The Duration of the Match

### Periods of play

The match lasts two equal periods of 10 minutes, unless otherwise mutually agreed between the referee and the two teams. Any agreement to alter the duration of the periods of play (e.g. to reduce each half to 8 minutes because of insufficient light) must be made before the start of play and must comply with competition rules. (replaces: The match lasts two equal periods of 45 minutes, unless otherwise mutually agreed between the referee and the two teams. Any agreement to alter the duration of the periods of play (e.g. to reduce each half to 40 minutes because of insufficient light) must be made before the start of play and must comply with competition rules.)

### Half-time interval

Players are entitled to an interval at half-time.

The half-time interval must not exceed 5 minutes. (replaces: The half-time interval must not exceed 15 minutes.) Competition rules must state the duration of the half-time interval.

The duration of the half-time interval may be altered only with the consent of the referee.

### Allowance for time lost

Allowance is made in either period for all time lost through:

- substitutions
- assessment of injury to players
- removal of injured players from the field of play for treatment
- wasting time
- any other cause

The allowance for time lost is at the discretion of the referee.

### Penalty kick

If a penalty kick has to be taken or retaken, the duration of either half is extended until the penalty kick is completed.

### Abandoned match

An abandoned match is replayed unless the competition rules provide otherwise.

## Law 8 – The Start and Restart of Play

### Definition of kick-off

A kick-off is a way of starting or restarting play:

- at the start of the match
- after a goal has been scored
- at the start of the second half of the match
- at the start of each period of extra time, where applicable

A goal may (new:) not be scored directly from the kick-off. Either the ball must move 20 cm from the kick-off point or must be touched by another player before being kicked into the goal. If the ball is kicked directly into the goal the kick-off is awarded to the opposing team.

### Procedure

Before a kick-off at the start of the match or extra time

- a coin is tossed and the team that wins the toss decides which goal it will attack in the first half of the match.
- the other team takes the kick-off to start the match.
- the team that wins the toss takes the kick-off to start the second half of the match.
- in the second half of the match, the teams change ends and attack the opposite goals.

### Kick-off

- after a team scores a goal, the kick-off is taken by the other team.
- all players must be in their own half of the field of play
- the opponents of the team taking the kick-off are at least 0.75 m from the ball until it is in play (replaces: the opponents of the team taking the kick-off are at least 9.15 m (10 yds) from the ball until it is in play)
- the ball must be stationary on the center mark
- the referee gives a signal
- the ball is in play when it is touched (replaces: kicked and moves forward) (new: or 10 seconds after the referee gave the signal)
- (suspended) the kicker must not touch the ball again until it has touched another player

### Infringements and sanctions

(suspended: If the player taking the kick-off touches the ball again before it has touched another player:

- an indirect free kick is awarded to the opposing team to be taken from the position of the ball when the infringement occurred (see Law 13 – Position of free kick)

In the event of any other infringement of the kick-off procedure:

- the kick-off is retaken

## Definition of dropped ball

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665 A dropped ball is a method of restarting play when, while the ball is still in play, the referee is required to stop play temporarily for any reason not mentioned elsewhere in the Laws of the Game.

## Procedure

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670 The game is continued at the center mark. A goal can be scored directly from a dropped ball. The procedure for dropped ball is the same as for kick-off, except that the players of both teams must be outside the center circle. The ball is in play immediately after the referee gives the signal. If a player moves too close to the ball before the referee gives the signal, a kick-off is awarded to the opponent team.

(replaces: The referee drops the ball at the place where it was located when play was stopped, unless play was stopped inside the goal area, in which case the referee drops the ball on the goal area line parallel to the goal line at the point nearest to where the ball was located when play was stopped.)

Play restarts when the ball touches the ground.)

## Infringements and sanctions

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680 The ball is dropped again:

- if it is touched by a player before it makes contact with the ground
- if the ball leaves the field of play after it makes contact with the ground, without a player touching it

(suspended: If the ball enters the goal:

- 685
- if a dropped ball is kicked directly into the opponents' goal, a goal kick is awarded
  - if a dropped ball is kicked directly into the team's own goal, a corner kick is awarded to the opposing team

## Law 9 – The Ball In and Out of Play

### Ball out of play

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The ball is out of play when:

- it has wholly crossed the goal line or touch line whether on the ground or in the air
- play has been stopped by the referee

### Ball in play

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The ball is in play at all other times, including when:

- it rebounds off a goalpost, crossbar or corner flagpost and remains in the field of play
- it rebounds off either the referee or an assistant referee when they are on the field of play

## 700 Law 10 – The Method of Scoring

### Goal scored

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705 A goal is scored when the whole of the ball passes over the goal line, between the goalposts and under the crossbar, provided that no infringement of the Laws of the Game has been committed previously by the team scoring the goal. A goal can only be scored from the respective half of the field.

### Winning team

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710 The team scoring the greater number of goals during a match is the winner. If both teams score an equal number of goals, or if no goals are scored, the match is drawn.

### Competition rules

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715 When competition rules require there to be a winning team after a match or home-and-away tie, the only permitted procedures for determining the winning team are those approved by the International F.A. Board, namely:

- away goals rule
- extra time
- kicks from the penalty mark
- 720 • (new) extended kicks from the penalty mark

### Goal-line technology (GLT)

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725 GLT systems may be used for the purpose of verifying whether a goal has been scored to support the referee's decision. The use of GLT must be stipulated in the respective competition rules.

## **(suspended: Law 11 – Offside**

### **Offside position**

It is not an offence in itself to be in an offside position. A player is in an offside position if:

- he is nearer to his opponents' goal line than both the ball and the second-last opponent

A player is not in an offside position if:

- he is in his own half of the field of play or
- he is level with the second-last opponent or
- he is level with the last two opponents

### **Offence**

A player in an offside position is only penalised if, at the moment the ball touches or is played by one of his team, he is, in the opinion of the referee, involved in active play by:

- interfering with play or
- interfering with an opponent or
- gaining an advantage by being in that position

### **No offence**

There is no offside offence if a player receives the ball directly from:

- a goal kick
- a throw-in
- a corner kick

### **Infringements and sanctions**

In the event of an offside offence, the referee awards an indirect free kick to the opposing team to be taken from the place where the infringement occurred (see Law 13 – Position of free kick).)

## Law 12 – Fouls and Misconduct

755 Fouls and misconduct are penalised as follows:

### Direct free kick

760 A direct free kick is awarded to the opposing team if a player commits any of the following offences to a player of the opposing team:

- uses forceful contact that significantly destabilizes a player, such that walking and/or kicking is impeded. Examples for forceful contacts include falling into another player or walking carelessly into another player at significant speed.
- walks into another player for 4 to 5 seconds (even a fallen or getting up player), even if the 'force to push' is minimal.

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A free kick is not awarded if one of the following exceptions occurs:

- The player committing the offence is stationary, including a player that is kicking, provided that the ball was close enough where a kick could have succeeded at the start of the kick motion.
- The player committing the offence is currently getting up.
- 770 • The player committing the offence is the current goal keeper and is currently looking at or chasing the ball in it's own penalty area.
- Front to front contact between players with the ball between them does not lead to a free kick, unless one player walks at a significantly higher speed or with significantly more force that is impossible to stand for the other player.
- 775 • Any player proceeding to the ball whose side (i. e. arm, shoulder etc.) makes contact with another player is not committing an offence, even if the second player is not proceeding to the ball.
- A player that had an offence committed against himself can not simultaneously be called for a free kick offence himself.

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780 (replaces: A direct free kick is awarded to the opposing team if a player commits any of the following seven offences in a manner considered by the referee to be careless, reckless or using excessive force:

- kicks or attempts to kick an opponent
- trips or attempts to trip an opponent
- jumps at an opponent
- charges an opponent
- 785 • strikes or attempts to strike an opponent
- pushes an opponent
- tackles an opponent)

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A direct free kick is also awarded to the opposing team if a player commits any of the following three offences:

- holds an opponent
- 790 • spits at an opponent
- handles the ball deliberately (except for the goalkeeper within his own penalty area)

790

- (new:) holds the ball for more than 1 second in a way that the ball cannot be removed from the player (a goal keeper may hold the ball up to 6 seconds on the ground or 10 seconds lifted up with one or both hands). More than half of the ball's volume must be outside the convex hull of the player, projected to the ground, for the ball to be considered removable. If the ball enters the convex hull repeatedly, it must be removable in between for the majority of the time. If more than one player of a team is in the vicinity of the ball, the convex hull is taken around all the player of a team, which prevent removal of the ball.

(new:) If an offense did not happen within a radius of approx. 1 m around the current ball position, the direct free kick is replaced by a removal penalty.

A direct free kick is taken from the place where the offence occurred (see Law 13 – Position of free kick). (new:) If moving the ball to the place where the offence occurred would be to the disadvantage of the team to which the free kick is awarded, the referee allows play to continue.

### Penalty kick

A penalty kick (new) as defined by Law 14 is awarded if any of the above ten offences is committed by a player inside his own penalty area, irrespective of the position of the ball, provided it is in play.

### Indirect free kick

An indirect free kick is awarded to the opposing team if a goalkeeper, inside his own penalty area, commits any of the following four offences:

- controls the ball with his hands for more than ten seconds before releasing it from his possession
- touches the ball again with his hands after he has released it from his possession and before it has touched another player
- touches the ball with his hands after it has been deliberately kicked to him by a team-mate
- touches the ball with his hands after he has received it directly from a throw-in taken by a team-mate

An indirect free kick is also awarded to the opposing team if, in the opinion of the referee, a player:

- plays in a dangerous manner
- impedes the progress of an opponent
- prevents the goalkeeper from releasing the ball from his hands
- commits any other offence, not previously mentioned in Law 12, for which play is stopped to caution or send off a player

(new:) If an offense did not happen within a radius of approx. 1 m around the current ball position, the indirect free kick is replaced by a removal penalty.

The indirect free kick is taken from the place where the offence occurred (see Law 13 – Position of free kick). (new:) If moving the ball to the place where the offence occurred would be to the disadvantage of the team to which the free kick is awarded, the referee allows play to continue.

### Disciplinary sanctions

The yellow card is used to communicate that a player, substitute or substituted player has been cautioned.

The red card is used to communicate that a player, substitute or substituted player has been sent off.

Only a player, substitute or substituted player may be shown the red or yellow card.

835 The referee has the authority to take disciplinary sanctions from the moment he enters the field of play until he leaves the field of play after the final whistle.

A player who commits a cautionable or sending-off offence, either on or off the field of play, whether directed towards an opponent, a team-mate, the referee, an assistant referee or any other person, is disciplined according to the nature of the offence committed.

#### 840 **Cautionable offences**

A player is cautioned and shown the yellow card if he commits any of the following seven offences:

- unsporting behaviour
- 845 • dissent by word or action
- persistent infringement of the Laws of the Game
- delaying the restart of play
- (suspended: failure to respect the required distance when play is restarted with a corner kick, free kick or throw-in)
- 850 • entering or re-entering the field of play without the referee's permission
- (suspended: deliberately leaving the field of play without the referee's permission)

A substitute or substituted player is cautioned if he commits any of the following three offences:

- unsporting behaviour
- dissent by word or action
- 855 • delaying the restart of play

#### **Sending-off offences**

A player, substitute or substituted player is sent off if he commits any of the following seven offences:

- 860 • serious foul play
- violent conduct
- spitting at an opponent or any other person
- denying the opposing team a goal or an obvious goalscoring opportunity by deliberately handling the ball (this does not apply to a goalkeeper within his own penalty area)
- 865 • (suspended: denying an obvious goalscoring opportunity to an opponent moving towards the player's goal by an offence punishable by a free kick or a penalty kick)
- using offensive, insulting or abusive language and/or gestures
- receiving a second caution in the same match

870 A player, substitute or substituted player who has been sent off must leave the vicinity of the field of play and the technical area.

## Law 13 – Free Kicks

### Types of free kick

875 Free kicks are either direct or indirect.

### The direct free kick

Ball enters the goal:

- 880 • if a direct free kick is kicked directly into the opponents' goal, a goal is awarded
- if a direct free kick is kicked directly into the team's own goal, a corner kick is awarded to the opposing team

### The indirect free kick

885 (suspended: Signal  
The referee indicates an indirect free kick by raising his arm above his head. He maintains his arm in that position until the kick has been taken and the ball has touched another player or goes out of play.)

Ball enters the goal

890 A goal can be scored only if the ball either moves 20 cm from the free-kick point or has been touched by another player before being kicked into the goal (replaces: subsequently touches another player before it enters the goal):

- if an indirect free kick is kicked directly into the opponents' goal, a goal kick is awarded
- if an indirect free kick is kicked directly into the team's own goal, a corner kick is awarded to the opposing team

### Procedure

895

(new) Signal

900 The referee blows the whistle, announces 'Free-Kick' cyan or Magenta (Blue or Red) and then places the ball depending on the call. The assistant referee who operates the game controller clicks on Free Kick Cyan/Magenta Ready.

For both direct and indirect free kicks, the ball must be stationary when the kick is taken (suspended: and the kicker must not touch the ball again until it has touched another player).

### Position of free kick

905

Free kick inside the penalty area

Direct or indirect free kick to the defending team:

- 910 • all opponents must be at least 0.5 m from the ball. (new:) Players have a maximum of 15 seconds to move away from the ball. Any opponent robot still closer than 50cm is considered as an incapable player and must be removed from the field for 30 seconds removal penalty. (replaces: all opponents must be at least 9.15 m (10 yds) from the ball )
- all opponents must remain outside the penalty area until the ball is in play
- the ball is in play when it is kicked directly out of the penalty area (new): or 10 seconds after the referee gave the signal
- 915 • a free kick awarded in the goal area may be taken from any point inside that area

Indirect free kick to the attacking team:

- all opponents must be at least 0.5 m from the ball until it is in play, unless they are on their own goal line between the goalposts. (new:) Players have a maximum of 15 seconds to move away from the ball. Any opponent robot still closer than 50cm and not at the goal line is considered as an incapable player and must be removed from the field for 30 seconds removal penalty. (replaces: all opponents must be at least 9.15 m (10 yds) from the ball until it is in play, unless they are on their own goal line between the goalposts)
- the ball is in play when it is kicked and moves (new): or 10 seconds after the referee gave the signal
- an indirect free kick awarded inside the goal area must be taken on the goal area line parallel to the goal line at the point nearest to where the infringement occurred

Free kick outside the penalty area:

- all opponents must be at least 0.5 m from the ball until it is in play. (new:) Players have a maximum of 15 seconds to move away from the ball. Any opponent robot still closer than 50cm is considered as an incapable player and must be removed from the field for 30 seconds removal penalty. (replaces: all opponents must be at least 9.15 m (10 yds) from the ball until it is in play )
- the ball is in play when it is kicked and moves (new): or 10 seconds after the referee gave the signal
- the free kick is taken from the place where the infringement occurred or from the position of the ball when the infringement occurred (according to the infringement)

### Infringements and sanctions

If, when a free kick is taken, an opponent is closer to the ball than the required distance:

- the opponent receives a 30 second removal penalty (replaces: the kick is retaken)

If, when a free kick is taken by the defending team from inside its own penalty area, the ball is not kicked directly out of the penalty area:

- the kick is retaken (new:) if the goal keeper managed to reach the ball within the time frame. Otherwise, the ball is in play again.

Free kick taken by a player other than the goalkeeper

If, after the ball is in play, the kicker touches the ball again (except with his hands) before it has touched another player (new) or before it was moved for at least 20 cm:

- an indirect free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

If, after the ball is in play, the kicker deliberately handles the ball before it has touched another player (new) or before it was moved for at least 20 cm:

- a direct free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)
- a penalty kick is awarded if the infringement occurred inside the kicker's penalty area

Free kick taken by the goalkeeper

If, after the ball is in play, the goalkeeper touches the ball again (except with his hands), before it has touched another player (new) or before it was moved for at least 20 cm:

- an indirect free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

If, after the ball is in play, the goalkeeper deliberately handles the ball before it has touched another player (new) or before it was moved for at least 20 cm:

- 960
- a direct free kick is awarded to the opposing team if the infringement occurred outside the goalkeeper's penalty area, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)
  - an indirect free kick is awarded to the opposing team if the infringement occurred inside the goalkeeper's penalty area, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

(new) If a free kick was awarded to team A and any player of team A touches the ball before the referee announced the execution of the free kick:

- 965
- The ball is in play.
  - The player touching the ball received a warning. For the second warning, the player received a yellow card. For the fourth warning, the player receives a second yellow card.

(new) If a free kick was awarded to team A and any player of team B touches the ball before the referee announced the execution of the free kick:

- 970
- The free kick is retaken.
  - The player touching the ball received a warning. For the second warning, the player received a yellow card. For the fourth warning, the player receives a second yellow card.

## Law 14 – The Penalty Kick

975 A penalty kick is awarded against a team that commits one of the ten offences for which a direct free kick is awarded, inside its own penalty area and while the ball is in play.

A goal may be scored directly from a penalty kick.

(suspended: Additional time is allowed for a penalty kick to be taken at the end of each half or at the end of periods of extra time.)

### Position of the ball and the players

980

The ball:

- is placed at the position where the offence occurred (replaces: must be placed on the penalty mark)

(suspended: The player taking the penalty kick:

- 985
- must be properly identified)

The defending goalkeeper:

- must remain on his goal line, facing the kicker, between the goalposts until the ball has been kicked

The players other than the kicker must be located at least 0.5 m from the ball and not anywhere between the current ball position and the goal.

990 (replaces:

- inside the field of play
- outside the penalty area
- behind the penalty mark
- at least 9.15 m (10 yds) from the penalty mark)

995

### Procedure

The same procedure as in regular direct free kicks is applied.

1000

(replaces:)

- After the players have taken positions in accordance with this Law, the referee signals for the penalty kick to be taken
- The player taking the penalty kick must kick the ball forward
- He must not play the ball again until it has touched another player
- The ball is in play when it is kicked and moves forward

1005

When a penalty kick is taken during the normal course of play, or time has been extended at half-time or full time to allow a penalty kick to be taken or retaken, a goal is awarded if, before passing between the goalposts and under the crossbar:

- 1010
- the ball touches either or both of the goalposts and/or the crossbar and/or the goalkeeper

The referee decides when a penalty kick has been completed.)

## Infringements and sanctions

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1015 The same infringements and sanctions as in regular direct free kicks are applied.

(replaces:) If the referee gives the signal for a penalty kick to be taken and, before the ball is in play, one of the following occurs:

the player taking the penalty kick infringes the Laws of the Game:

- 1020
- the referee allows the kick to be taken
  - if the ball enters the goal, the kick is retaken
  - if the ball does not enter the goal, the referee stops play and the match is restarted with an indirect free kick to the defending team from the place where the infringement occurred

the goalkeeper infringes the Laws of the Game:

- 1025
- the referee allows the kick to be taken
  - if the ball enters the goal, a goal is awarded
  - if the ball does not enter the goal, the kick is retaken

a team-mate of the player taking the kick infringes the Laws of the Game:

- 1030
- the referee allows the kick to be taken
  - if the ball enters the goal, the kick is retaken
  - if the ball does not enter the goal, the referee stops play and the match is restarted with an indirect free kick to the defending team from the place where the infringement occurred

a team-mate of the goalkeeper infringes the Laws of the Game:

- 1035
- the referee allows the kick to be taken
  - if the ball enters the goal, a goal is awarded
  - if the ball does not enter the goal, the kick is retaken

a player of both the defending team and the attacking team infringe the Laws of the Game:

- the kick is retaken

If, after the penalty kick has been taken:

1040 the kicker touches the ball again (except with his hands) before it has touched another player:

- an indirect free kick is awarded to the opposing team, the kick to be taken from the place where the infringement occurred (see Law 13 – Position of Free Kick)

the kicker deliberately handles the ball before it has touched another player:

- 1045
- a direct free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

the ball is touched by an outside agent as it moves forward:

- the kick is retaken

the ball rebounds into the field of play from the goalkeeper, the crossbar or the goalposts and is then touched by an outside agent:

1050

- the referee stops play
- play is restarted with a dropped ball at the place where it touched the outside agent, unless it touched the outside agent inside the goal area, in which case the referee drops the ball on the goal area line parallel to the goal line at the point nearest to where the ball was located when play was stopped)

)

## 1055 Law 15 – The Throw-In

A throw-in is a method of restarting play.

A throw-in is awarded to the opponents of the player who last touched the ball when the whole of the ball crosses the touch line, either on the ground or in the air.

A goal cannot be scored directly from a throw-in.

### 1060 Procedure

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If the ball leaves the field it will be replaced on the field by the referee or an assistant referee. There is no stoppage in play.

1065 The positions for replacement of the ball are described in the following with respect to the touch lines and always meant to be in a distance of about 40cm orthogonal to the position on the touch line and inwards to the playing field.

If the whole of the ball passes over a touch line then the assistant referee will replace the ball back on the field on the same side of the field as the ball went out of play. The ball will be replaced in one of three positions:

- 1070 • If the referee cannot determine which robot was the last to touch the ball before it left the field, then the ball is replaced directly in from the point at which the ball left the field.
- Otherwise, the ball is placed one meter back from the point it went out, where “back” is defined as being towards the goal of the team that last touched the ball.

In any case, the ball cannot be placed closer than the length of the goal area to either end of the field.

1075 Balls are deemed to be out based on the team that last touched the ball, irrespective of who actually kicked the ball. After placing the ball, the ball is in play immediately.

(replaces: At the moment of delivering the ball, the thrower:

- faces the field of play
- has part of each foot either on the touch line or on the ground outside the touch line)
- 1080 • holds the ball with both hands)
- delivers the ball from behind and over his head)
- delivers the ball from the point where it left the field of play

All opponents must stand no less than 2 m (2 yds) from the point at which the throw-in is taken.

The ball is in play when it enters the field of play.

1085 After delivering the ball, the thrower must not touch the ball again until it has touched another player.)

### Infringements and sanctions

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(suspended: Throw-in taken by a player other than the goalkeeper

1090 If, after the ball is in play, the thrower touches the ball again (except with his hands) before it has touched another player:

- an indirect free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

If, after the ball is in play, the thrower deliberately handles the ball before it has touched another player:

- 1095
- a direct free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)
  - a penalty kick is awarded if the infringement occurred inside the thrower's penalty area

Throw-in taken by the goalkeeper

1100 If, after the ball is in play, the goalkeeper touches the ball again (except with his hands), before it has touched another player:

- an indirect free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

If, after the ball is in play, the goalkeeper deliberately handles the ball before it has touched another player:

- 1105
- a direct free kick is awarded to the opposing team if the infringement occurred outside the goalkeeper's penalty area, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)
  - an indirect free kick is awarded to the opposing team if the infringement occurred inside the goalkeeper's penalty area, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

If an opponent unfairly distracts or impedes the thrower:

- he is cautioned for unsporting behaviour

1110 For any other infringement of this Law:

- the throw-in is taken by a player of the opposing team)

## Law 16 – The Goal Kick

A goal kick is a method of restarting play.

1115 A goal kick is awarded when the whole of the ball passes over the goal line, either on the ground or in the air, having last touched a player of the attacking team, and a goal is not scored in accordance with Law 10.

A goal may be scored directly from a goal kick, but only against the opposing team.

### Procedure

1120 If the ball leaves the field it will be replaced on the field by the referee or an assistant referee. There is no stoppage in play.

If the whole of the ball passes over a goal line then the ball will be replaced back on the field according to the following rules:

- 1125 • If the referee cannot determine which robot was the last to touch the ball before it left the field, then the ball is replaced in about 1 meter distance from the corner of the field.
- If the ball was last touched by the offensive team then the ball is placed on the halfway line on the side of the field the ball went out.

Balls are deemed to be out based on the team that last touched the ball, irrespective of who actually kicked the ball. (replaces:

- 1130 • The ball is kicked from any point within the goal area by a player of the defending team
- Opponents remain outside the penalty area until the ball is in play
- The kicker must not play the ball again until it has touched another player
- The ball is in play when it is kicked directly out of the penalty area)

### Infringements and sanctions

1135

(suspended: If the ball is not kicked directly out of the penalty area from a goal kick:

- the kick is retaken

Goal kick taken by a player other than the goalkeeper

1140 If, after the ball is in play, the kicker touches the ball again (except with his hands) before it has touched another player:

- an indirect free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

If, after the ball is in play, the kicker deliberately handles the ball before it has touched another player:

- 1145 • a direct free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)
- a penalty kick is awarded if the infringement occurred inside the kicker's penalty area

Goal kick taken by the goalkeeper

1150 If, after the ball is in play, the goalkeeper touches the ball again (except with his hands) before it has touched another player:

- an indirect free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

If, after the ball is in play, the goalkeeper deliberately handles the ball before it has touched another player:

- 1155
- a direct free kick is awarded to the opposing team if the infringement occurred outside the goalkeeper's penalty area, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)
  - an indirect free kick is awarded to the opposing team if the infringement occurred inside the goalkeeper's penalty area, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

In the event of any other infringement of this Law:

- the kick is retaken)

## 1160 Law 17 – The Corner Kick

A corner kick is a method of restarting play.

A corner kick is awarded when the whole of the ball passes over the goal line, either on the ground or in the air, having last touched a player of the defending team, and a goal is not scored in accordance with Law 10.

(suspended: A goal may be scored directly from a corner kick, but only against the opposing team.)

### 1165 Procedure

If the ball leaves the field it will be replaced on the field by the referee or an assistant referee. There is no stoppage in play.

1170 If the whole of the ball passes over a goal line then the ball will be replaced back on the field according to the following rules:

- If the referee cannot determine which robot was the last to touch the ball before it left the field, then the ball is replaced in about 1 meter distance from the corner of the field
- If the ball was last touched by the defensive team then the ball is replaced in a distance of about the goal area length from the closest corner of the field

1175

Balls are deemed to be out based on the team that last touched the ball, irrespective of who actually kicked the ball.

(replaces:

- The ball must be placed inside the corner arc nearest to the point where the ball crossed the goal line
- The corner flagpost must not be moved
- Opponents must remain at least 1 m from the corner arc until the ball is in play (replaces: Opponents must remain at least 9.15 m (10 yds) from the corner arc until the ball is in play )
- The ball must be kicked by a player of the attacking team
- The ball is in play when it is kicked and moves
- The kicker must not play the ball again until it has touched another player)

1180

### 1185 Infringements and sanctions

(suspended: Corner kick taken by a player other than the goalkeeper

If, after the ball is in play, the kicker touches the ball again (except with his hands) before it has touched another player:

1190

- an indirect free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

If, after the ball is in play, the kicker deliberately handles the ball before it has touched another player:

- a direct free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)
- a penalty kick is awarded if the infringement occurred inside the kicker's penalty area

1195

Corner kick taken by the goalkeeper

If, after the ball is in play, the goalkeeper touches the ball again (except with his hands) before it has touched another player:

- 1200
- an indirect free kick is awarded to the opposing team, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

If, after the ball is in play, the goalkeeper deliberately handles the ball before it has touched another player:

- a direct free kick is awarded to the opposing team if the infringement occurred outside the goalkeeper's penalty area, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)
- 1205
- an indirect free kick is awarded to the opposing team if the infringement occurred inside the goalkeeper's penalty area, to be taken from the place where the infringement occurred (see Law 13 – Position of free kick)

In the event of any other infringement:

- the kick is retaken)

## PROCEDURES TO DETERMINE THE WINNER OF A MATCH OR HOME-AND-AWAY

1210 Away goals, extra time, kicks from the penalty mark and extended kicks from the penalty mark are the four methods approved for determining the winning team where competition rules require there to be a winning team after a match has been drawn.

### Away goals

1215 Competition rules may provide that where teams play each other home and away, if the aggregate score is equal after the second match, any goals scored at the ground of the opposing team will count double.

### Extra time

Competition rules may provide for two further equal periods, not exceeding 5 minutes each, to be played. The conditions of Law 8 will apply. (replaces: Competition rules may provide for two further equal periods, not exceeding 15 minutes each, to be played. The conditions of Law 8 will apply. )

### 1220 Kicks from the penalty mark

#### Procedure

- The referee chooses the goal at which the kicks will be taken
- 1225 • The referee tosses a coin and the team whose captain wins the toss decides whether to take the first or the second kick
- The referee keeps a record of the kicks being taken
- Subject to the conditions explained below, both teams take five kicks
- The kicks are taken alternately by the teams
- 1230 • If, before both teams have taken five kicks, one has scored more goals than the other could score, even if it were to complete its five kicks, no more kicks are taken
- (suspended: If, after both teams have taken five kicks, both have scored the same number of goals, or have not scored any goals, kicks continue to be taken in the same order until one team has scored a goal more than the other from the same number of kicks)
- 1235 • A goalkeeper who is injured while kicks are being taken from the penalty mark and is unable to continue as goalkeeper may be replaced by a named substitute provided his team has not used the maximum number of substitutes permitted under the competition rules
- With the exception of the foregoing case, only players who are on the field of play at the end of the match, which includes extra time where appropriate, (new) or which are suffering from a removal penalty or are currently in service, are eligible to take kicks from the penalty mark
- 1240 • (suspended: Each kick is taken by a different player and all eligible players must take a kick before any player can take a second kick)
- An eligible player may change places with the goalkeeper at any time when kicks from the penalty mark are being taken
- 1245 • Only the eligible players and match officials are permitted to remain on the field of play when kicks from the penalty mark are being taken
- All players, except the player taking the kick and the two goalkeepers, must remain within the centre circle
- The goalkeeper who is the team-mate of the kicker must remain on the field of play, outside the penalty area in which the kicks are being taken, on the goal line where it meets the penalty area boundary line
- 1250 • Unless otherwise stated, the relevant Laws of the Game and International F.A. Board Decisions apply when kicks from the penalty mark are being taken

- 1255 • If at the end of the match and before the kicks start to be taken from the penalty mark, one team has a greater number of players than its opponents, it must reduce its numbers to equate with that of its opponents and the team captain must inform the referee of the name and number of each player excluded. Any player thus excluded may not participate in kicks from the penalty mark.
- Before the start of kicks from the penalty mark, the referee must ensure that an equal number of players from each team remains within the centre circle and they shall take the kicks

### Extended kicks from the penalty mark (new)

#### Procedure

1260

- All penalty shoots are taken on an empty goal.
- The player performing the penalty kick may enter the goal area.
- The team wins which...
  - 1265 1. ... kicked the ball into the goal / scores more often. If this is a tie:
  2. ... kicked the ball into the goal area more often. If this is a tie:
  3. ... touched the ball more often. If this is a tie:
  4. ... in sum needed less time to score the goals. If this is a tie:
  5. ... in sum needed less time to kick the ball into the goal area. If this is a tie:
  - 1270 6. ... in sum needed less time to touch the ball
- If this is a tie a coin is flipped

## THE TECHNICAL AREA

The technical area relates to matches played in stadiums with a designated seated area for technical staff and substitutes as described below.

1275 While the size and position of technical areas may differ between stadiums, the following notes are issued for general guidance:

- the technical area extends 1 m (1 yd) on either side of the designated seated area and extends forward up to a distance of 1 m (1 yd) from the touch line
- it is recommended that markings are used to define this area

- 1280
- the number of persons permitted to occupy the technical area is defined by the competition rules
  - the occupants of the technical area are identified before the beginning of the match in accordance with the competition rules
  - only one person at a time is authorised to convey tactical instructions from the technical area
- 1285
- the coach and other officials must remain within its confines except in special circumstances, e.g. a physio-therapist or doctor entering the field of play, with the referee's permission, to assess an injured player
  - the coach and other occupants of the technical area must behave in a responsible manner

## THE FOURTH OFFICIAL AND THE RESERVE ASSISTANT REFEREE

- A fourth official may be appointed under the competition rules and officiates if any of the three match officials is unable to continue, unless a reserve assistant referee is appointed. They assists the referee at all times
- 1290 • Prior to the start of the competition, the organiser states clearly whether, if the referee is unable to continue, the fourth official takes over as the referee or whether the senior assistant referee takes over as referee with the fourth official becoming an assistant referee
- The fourth official assists with any administrative duties before, during and after the match, as required by the referee
- 1295 • They is responsible for assisting with substitution procedures during the match
- They has the authority to check the equipment of substitutes before they enter the field of play. If their equipment does not comply with the Laws of the Game, they informs the referee
- They supervises the replacement balls, where required. If the match ball has to be replaced during a match, they provides another ball, on the instruction of the referee, thus keeping the delay to a minimum
- 1300 • They assists the referee to control the match in accordance with the Laws of the Game. The referee, however, retains the authority to decide on all points connected with play.
- After the match, the fourth official must submit a report to the appropriate authorities on any misconduct or other incident that occurred out of the view of the referee and the assistant referees. The fourth official must advise the referee and their assistants of any report being made
- 1305 • They has the authority to inform the referee of irresponsible behaviour by any occupant of the technical area
- A reserve assistant referee may also be appointed under competition rules. Their only duty shall be to replace an assistant referee who is unable to continue or to replace the fourth official, as required

## THE ADDITIONAL ASSISTANT REFEREE

1310 Additional assistant referees may be appointed under the competition rules. They must be active referees of the highest category available. The competition rules must state the procedure to be followed when a referee is unable to continue, and whether:

1. the fourth official takes over as the referee, or
2. the senior additional assistant referee takes over as the referee, with the fourth official becoming an additional assistant referee

### 1315 Duties

Where appointed, the additional assistant referees, subject to the decision of the referee, are to indicate:

- when the whole of the ball leaves the field of play over the goal line
- 1320 • which team is entitled to a corner kick or goal kick
- when misconduct or any other incident occurs out of the view of the referee
- when offences have been committed whenever the additional assistant referees have a better view than the referee, particularly inside the penalty area
- 1325 • whether, at penalty kicks, the goalkeeper moves off the goal line before the ball is kicked and if the ball crosses the line

### Assistance

1330 The additional assistant referees also help the referee to control the match in accordance with the Laws of the Game but the final decision will always be taken by the referee. In the event of undue interference or improper conduct, the referee will relieve an additional assistant referee of their duties and make a report to the appropriate authorities.

# Interpretation of the Laws of the Game and Guidelines for Referees

Please see the respective FIFA documents.

1335 (e.g. pp. 60 of [http://resources.fifa.com/mm/document/footballdevelopment/refereeing/02/36/01/11/lawsofthegameweben\\_neutral.pdf](http://resources.fifa.com/mm/document/footballdevelopment/refereeing/02/36/01/11/lawsofthegameweben_neutral.pdf))

## Section II

# RoboCup Humanoid League Competition Rules

## The Competitions and Trophies

### 1340 Setup and Inspections

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1345 The competitions in the Humanoid League are preceded by a setup and inspection period of at least 24 h. During this time, every robot will be inspected by the league organizing committee for compliance with the design rules detailed in law 4. Robots need to demonstrate the ability to walk (all sub-leagues) and stand up from front and back (kid and teen size). The teams must be able to demonstrate at least one successful stand-up action from each side during the robot inspection. All robots will be photographed during the inspection. A re-inspection becomes necessary after any change that could affect the compliance to the design rules. A re-inspection might be requested by any team leader up to 1 hour prior to a game.

### 1350 Referee Duty

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Each team must name at least one person who is familiar with the rules and who might be assigned for referee duties by the league organizing committee.

### 1355 Competitions

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The competitions consist of:

1. Soccer games for KidSize (4 vs. 4),
- 1360 2. Soccer games for TeenSize (3 vs. 3),
3. Soccer games for AdultSize (1 vs. 1),
4. Drop-In games for Kid and TeenSize
5. Technical challenges.

In the event of less than 3 teams participating in TeenSize the TeenSize teams will join the AdultSize competition.

1365 Soccer Games are organized in one or more round robins and playoffs. For the first round robin, the teams are assigned to groups at random. All teams of a group play once against each other. The round robin games may end in a draw. In this case, both teams receive one point. Otherwise, the winning team receives three points and the not winning team receives zero points.

1370 For the AdultSize soccer games a specific rule for robot handler will apply. For every robot one robot handler is allowed to stay near the robot such that the robot handler does not interfere with the game. Specifically, the robot handler:

- should position himself behind the robot or at a distance that allows the robot to operate freely.
- must not block the vision of any the robots on ball or goals.
- must not block the path of any robot.
- 1375 • must not touch any robot. Touching a robot is considered as an offense that is penalised by a removal penalty according to the laws of the game.
- has to be dressed in black clothes.
- may not communicate with the robot in any way, including verbally, while the robot is in play.

After games of a round robin have been played, the teams of a group are ranked based on (in decreasing priority):

- 1380 1. the number of earned points,

2. the goal-difference,
3. the absolute number of goals,
4. the result of a direct match,
5. the time needed to score a penalty kick into an empty goal (up to five alternating attempts to score, until at least one team scored),
6. the drawing of a lot.

For each game that a team has won with a difference of 10 goals only 10 goals are counted.

At least two teams of every group will enter the next round robin or the playoffs.

In the knock-out games of a tournament two further equal periods of 5 minutes each are played if the game is not decided after the regular playing time. If during regular playing time none of the two teams in a knock-out match was able to kick the ball to reach their respective opponent's goal the extra time is skipped and the game immediately continues by the five alternating penalty kick trials. If both teams agree, the regular penalty kick trials may be skipped and the extended penalty kick procedure applies instead.

The game plan needs to be announced prior to the random assignment of teams to groups.

Participation in the drop-in challenge is mandatory to advance to the quarter final. If a team advances to the quarter final without participating in the drop-in challenge it is replaced by the team that would have had the next best prospects to reach the quarter finals in direct comparison.

## Forfeits

A team that forfeits is disqualified from the competition. Forfeiting is defined as refusing to make a good faith effort to participate in a scheduled game<sup>1</sup>.

- If a team chooses to forfeit a match in the round robin games the other team plays on an empty goal.
- If a team chooses to forfeit in a knock-out game before the quarter final, the other team continues in the competition.
- If a team chooses to forfeit in the quarter finals, it will be replaced by the runner up team in the round robin group that included the forfeiting team.
- If a team chooses to forfeit in the semi finals or the game for 3rd and 4th place, it will be replaced by the team that lost to the forfeiting team in the quarter finals.
- A team forfeiting the final match should announce its decision at least 30 minutes before the start of the 3rd vs 4th final. The league organization committee may impose a one year disqualification of the team and its members in case of avoidable delayed announcements.
- If a team chooses to forfeit the final after the game for 3rd and 4th place began, it will be replaced by the 3rd place winner, and the 4th place winner will be 3rd place. No new 4th place will be selected.
- If a team chooses to forfeit the final before the game for 3rd and 4th place, it will be replaced by the team that lost to the forfeiting team in the previous semi-finals. The team that lost to the forfeiting team in the previous semi-finals (i.e. the one initially being qualified for the game for 3rd and 4th place) will be replaced for the game for 3rd and 4th place by the team that lost to it in the respective quarter final.

<sup>1</sup>If robots are broken, then they should be placed on the field anyway as an indication that the team is willing to participate.

### Kick-off procedure

- The referee gives the signal “READY” that all robots have to reach their own half of the field.
- 1425 • After a period between 15 and 30 seconds the referee gives the signal “SET”. The referee calls robots illegally positioned to be removed with exception of the goal keeper and a striker for the team having kick-off that may be placed manually by the respective robot handler. The robot playing the goal keeper has to be announced before the beginning of the game. The striker can be chosen after the end of the “READY” phase among all robots of the team (even those being called for illegal positioning). A manually placed goal keeper has to be within the team’s own goal area touching the goal line. A manually positioned striker can take any legal 1430 position within the team’s own half. Removed players are placed on the touch line of the respective team’s side, facing the opposite touch line, to enter the field from there upon the “PLAY” signal.
- The opponents of the team taking the kick-off are outside the center circle until the ball is in play.
- The ball is stationary on the center mark.
- The referee gives the signal “PLAY” or whistles.
- 1435 • The ball is in play when it is touched or 10 seconds elapsed after the signal.

Robots being able to autonomously reposition themselves can take any position on the field that is consistent with the above requirements. It is not allowed to manually (re-)position an autonomously positioned robot that took a legal position, except for the goal keeper and the striker for kick-off or dropped ball, if applicable.

1440 For initial kick-off (to initially start or restart after a half-time interval), robots can be placed anywhere on the touch lines or goal lines on the respective team’s own side outside of the goal, facing the opposite touch line or goal line, to autonomously enter the field from there. For other kick-off situations robots need to position themselves from the the position they were when the game was stopped.

Similar to a kick-off situations one striker robot for each team may be placed manually for a dropped ball, if both teams can not position themselves automatically. The striker for dropped ball may be positioned at any legal position 1445 within the team’s own half outside of the center circle.

If one or both of the teams in a match have permission to use a manual startup procedure, the referee gives the two signals “SET” and “PLAY” with an interval of exactly 10 seconds. Robot players without remote start capability may be started on the field after the “SET” signal. They may not move before the “PLAY” signal was given by the referee. Robots with autonomous positioning ability are given between 15 and 30 seconds for re-positioning after a 1450 goal has been scored by one of the teams before the “SET” signal for kick-off is given by the referee. All human team members must leave the field of play immediately after the “SET” signal and before the “PLAY” signal.

A team which uses manual kick-off and not kick-off with the referee box is punished by a penalty of having to wait for 15 seconds after the signal “PLAY” before they are allowed to locomote. If such a team has kick-off then at the signal “PLAY” the referee immediately moves the ball from the kick-off position to a position somewhere on the 1455 center line and outside of the center circle and the ball is in play. This rule does not apply if the referee box is out of commission.

### Free-kick procedure

1. The referee blows the whistle, announces ‘Free-Kick’ cyan or Magenta (Blue or Red).
2. The assistant referee who operates the game controller clicks on "Free Kick Cyan/Magenta".
- 1460 3. The referee places the ball depending on the call and announces "Free Kick Ready"
4. The assistant referee who operates the game controller clicks on "Free Kick Cyan/Magenta Ready". Now opponent robots must move to a position at least 50cm away from the ball. They have a maximum of 15 secs. to do this. During the 15 seconds, robots of the team that got awarded the free kick may re-position themselves as well.
- 1465 5. The assistant referee announces that the 15 seconds are over.

6. Any opponent robot still closer than 50cm is considered as an incapable player and must be removed from the field for 30 seconds removal penalty.
7. After 15 seconds or sooner if the referee considers the kicking team to be ready and all opponent robots are at least 50cm away or have been removed from the field, the referee blows the whistle. Then the assistant referee who operates the game controller clicks on "Free Kick Cyan/Magenta Set/Play". The team that was awarded the free-kick can kick now.
8. The ball is in play after it has been touched by a player or after 10 secs.

The distance between the ball and the player of the opponent team is measured between the point on the convex hull of the robot and the point on the outside of the ball which are most close together.

#### **Request for Pick-up**

A robot handler may request to pick-up a robot if and only if a robot is in a dangerous situation that is likely to lead to physical injuries. If a robot handler touches a robot without the allowance of the referee, the respective robot receives a yellow card and the robot handler an official warning. After two warnings for robot touching, the robot handler may not serve as a robot handler again for the rest of the game and needs to be replaced by a different person from the team immediately. In case of repeated violations throughout the tournament, the Technical Committee can decide to permanently disallow a certain person from serving as a robot handler for the rest of the tournament.

#### **Incapable Players**

Players not capable of play (e.g. players not able to walk on two legs, players not able to stand, or players with obvious malfunctions) are not permitted to participate in the game. They must be removed from the field. It is up to the referee to judge whether a player is capable of play. The referee may ask the team leader of a player suspected to be incapable of play to demonstrate playing ability at any time. A field player that is not able to get back into a stable standing or walking posture from a fall within 20 seconds will be removed from the field for 30 seconds removal penalty. It has to enter the field from the team's own half of the field close to the penalty mark facing the opposite touch line, as indicated by the referee. If the ball is within a radius of 0.5 m around the goal keeper inside the goal area, the goal keeper has to show active attempts to move the ball out of this radius. If no attempt is shown for 20 seconds, the goal keeper is considered to be an inactive player and removed from the field.

#### **Substitutions**

Up to two players per game can be substituted by other players of the same team. The referee must be informed prior to the substitution. A substitute only enters the field after the player being replaced left the field and after receiving a signal from the referee. Any of the other players may change places with the goalkeeper, provided that the referee is informed before the change is made and that the change is made during a stoppage of the match. Exchanging a field player with a goalie does not count as substitution. Changing places/roles between a field player and a goalie does not count as substitution.

#### **Temporal Absence**

Servicing robots on the playing field is not permitted. A robot may be taken out of the field for service, after receiving permission from the referee. Taking out a robot for service does not count as a substitution. A serviced robot may not come into play again before 30 seconds elapsed after it was taken out. It has to enter the field from the team's own half of the field close to the penalty mark facing the opposite touch line, as indicated by the referee.

#### **Manual Untangle of Robots**

If entangled robots fail to untangle themselves, the referee might ask designated robot handlers of both teams to untangle the robots. Untangling must not make significant changes to robot positions or heading directions. Untangled robots must be laid on the ground not closer than 50cm to the ball and in a way not gaining an advantage.

#### **Attack and Defense**

Not more than one robot of each team is allowed to be inside the goal or the goal area at any time. If more than one robot of the defending team is inside its goal or goal area for more than 10 s, this will be considered illegal defense. If more than one robot of the attacking team is inside the opponent's goal or goal area for more than 10 s, this will be considered illegal attack. The referee may delay the call of illegal defense or illegal attack if the robots make serious attempts to leave the goal area or if they are hindered from leaving the goal area by robots of the opponent team. The referee allows play to continue when the team against which an illegal defense or illegal attack has been committed will benefit from such an advantage and penalizes the original offence if the anticipated advantages does

not ensue at that time. The player committing an illegal defense or an illegal attack will be removed from the field for 30 seconds removal penalty.

### Removal Penalty

- 1520 • Time penalties of 30 seconds for players are called by the referee. When a penalty is called, the designated robot handler has to remove the robot as soon as possible and by that interacting as little as possible with the game.
- A robot suffering a penalty (except called for inactivity or service) may not be serviced. A robot suffering a penalty due to a foul or misconduct has to stay out of play for a minimum of 60 seconds if it is serviced during the penalty time.
- 1525 • The referee and assistant referees are in charge of timing the penalties and notifying the teams to put back their robots to play.
- A field player or goal keeper suffering a time penalty will be removed from the field and is only allowed to re-enter the field from the team's own half of the field close to the penalty mark facing the opposite touch line, as indicated by the referee.

1530 **Timeouts** A team may extend a stoppage of the game by taking a timeout. During a timeout robots may be serviced. Each team may take at most one timeout per period. If a team is not ready to resume the game when the referee wants to start the game, it has to take a timeout. If there is no timeout left, the referee will start the game anyway. A timeout ends automatically after 120 s. A timeout also ends when the team signals its end to the referee

**Referee Timeouts** The head referee may call a timeout at any stoppage of play if they deems it necessary. A referee  
1535 timeout should only be called in dire circumstances - one example might be when the power to the wireless router is down. However, when and whether to call a referee timeout is left up to the head referee.  
Referees may call multiple timeouts during a game if needed. Teams may do anything during these timeouts, but they must be ready to play 2 minutes after the referee begins a timeout. The referee should end the timeout once they believes the circumstance for which the timeout was called has been resolved. In cases where the circumstance  
1540 for which the timeout was called is not resolved within 10 minutes, the Technical Committee should be consulted regarding when/if play should continue.  
The team who would have kicked off if the timeout had not been called shall kickoff when the game resumes.

### Disciplinary sanctions

Yellow and red cards given to robots do only accumulate for the current game and are cleared again after the end  
1545 of each game. Warnings against robot handlers and/or teams have to be reported to the Technical Committee after each game. They are recorded and accumulated for the whole tournament.

### Drop-In Games

#### Organisation

1550 Each participating team will contribute one drop-in player for each drop-in game. The drop-in player may be chosen from all available robots of the team and does not have to be the same in all drop-in games. Each drop-in player will compete in games with many different teams composed of randomly chosen drop-in players. In each game, the opponent will be a similarly composed team of randomly selected drop-in players. The exact number of games played  
1555 by each drop-in player depends on the number of teams that participate in the competition. A minimum of 3 drop-in games will be played by every drop-in player.

The Drop-in players will be allocated to teams randomly at least 24 hours before the first game takes place. The allocation to teams for the individual games is randomly chosen and changes for every single game. Drop-in players that reached the minimum number of games will not be considered for drawing unless needed to fill up a team, to  
1560 have games for remaining players with less than 3 games.  
If less than 6 KidSize or 4 TeenSize teams participate in the respective drop-in challenge, the challenges are merged, playing with the KidSize ball.

### Rules

All normal game rules apply to this competition. The only exceptions are:

- 1565 1. The games are played with 5 players in a KidSize team and 4 players in a TeenSize team. If there is an insufficient number of participants, games may be played 4 vs. 4 resp. 3 vs. 3 or 3 vs. 3 resp. 2 vs. 2 for KidSize resp. TeenSize.
2. Games may end in a draw.
3. Each of the players has a jersey number from the set 1, 2, 3, 4, 5, resp. 1, 2, 3, 4.
- 1570 4. Drop-in teams will wear the cyan and magenta team colors.
5. One robot handler per competing robot is allowed.

Removal of incapable players has to be enforced strictly.

### Communication

Teams are strongly encouraged to implement the mitecom team communication protocol which is available at  
1575 <https://github.com/RoboCup-Humanoid-TC/mitecom>

### Selection of the Referees

Referees will be drawn from the remaining participating teams, or if needed, due to a low number of teams, the TC and OC will provide referees.

### Scoring

- 1580 When a goal is scored, all players of the scoring team on the field receive 1 point and the player who scored the goal receives an additional 1 point if it was not an own goal. Incapable players, penalized players or players having been removed for any other reason, e.g. service, will receive no point. When a goal is suffered, all players of the team suffering the goal receive -1 point, including incapable players, penalized players or players having been removed for any other reason, e.g. service will. Points from all games are summed up. For players with one or more games than  
1585 others only the points of those games with the higher scores are considered.
- Drop-in players are initially ranked according to the accumulated points. If there are ties, the tied players are ranked according to the arithmetic mean, the number of games played, the maximum points awarded in a single game and the number of goals scored. The three most highly ranked players of a sub-league receive a 'Best Player' certificate. If the three best drop-in players can not be identified with the scheme provided above, an additional game with  
1590 players drawn group wise (from the groups of equally high ranked players with a total number of points greater than zero) from the highest-ranked players is to be played.
- If there are still ties a penalty shot out among the equally high ranked drop-in players with a total number of points greater than zero takes place.

### Example

- 1595 There are 20 participating players for 4 KidSize Drop-In teams (A, B, C, D). Games shall be A-B, A-C, A-D, B-C, B-D, C-D. For the first game (A-B), Player 1 is randomly drawn for Team B and plays the game with the other team members. For the second game (A-C), player 1 is not drawn. For the third game (A-D), player 1 is drawn for team A and plays the game. For the fourth game (B-C), player 1 is drawn to team C and plays the game. Now player 1 will be removed from the drawing, because the number of 3 games was reached. If there would be only 19 participants,  
1600 player 1 may be drawn for the final game.
- Assuming teams with player 1 to score a single goal in every game (with player 1 on the field), then player 1 will have a score of 3 and an arithmetic average of 1.

### Technical Challenges

1605 The technical challenges consist of:

1. Push Recovery (KidSize, TeenSize and AdultSize)
2. Goal Kick from Moving Ball (KidSize, TeenSize and AdultSize)
3. High Jump (KidSize and TeenSize and AdultSize)
- 1610 4. High-Kick (KidSize, TeenSize and AdultSize)

For details on the technical challenges, please refer to section III of this document.

### Best Humanoid Award (Louis Vuitton Cup)

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- 1615 The teams of AdultSize class and the teams of Kid and TeenSize size classes that have participated in the drop-in competition are ranked in separate lists to determine the overall best humanoid.  
The ranking is based on the aggregated number of points earned in the individual competitions.

The points earned in the technical challenge are used directly.

The points earned in the Drop-In challenge are used directly.

- 1620 For the soccer games the winner receives 60 points. The second best team receives 42 points. The third best team receives 30 points.

- As KidSize, TeenSize and AdultSize robots do not compete directly, a jury decides the overall best humanoid robot, 2nd best humanoid robot, 3rd best humanoid robot. The jury consists of the team leaders of all teams, except for the teams ranked first in the KidSize, TeenSize and AdultSize lists. The jury decides by majority vote. In case of a  
1625 draw, the president of the RoboCup federation decides the vote.

- The teams ranked first in the KidSize, TeenSize and AdultSize lists are candidates for the best humanoid. The jury decides from the general picture of the performance according to the criteria:

1. Robustness
2. Walking ability
- 1630 3. Ball handling
4. Soccer skills

for the robot that is the best humanoid.

- Of each, KidSize, TeenSize and AdultSize, the best robot that was not chosen to be the best humanoid robot is candidate for the 2nd best humanoid robot. Criteria are the same as for the best humanoid.
- 1635 • The robot ranked first in the KidSize, TeenSize or AdultSize lists that was not chosen for 1st or 2nd best humanoid is the 3rd best humanoid robot.

### Trophies

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- 1640 A trophy is awarded to the winner of the soccer tournament in each of the individual size classes and technical challenges. In case of less than 3 teams participating in a size class no trophies will be given in this class.

- A trophy is awarded to the teams second and third in the KidSize 4-4 soccer game, the TeenSize 3-3 soccer games and the AdultSize 1-1 soccer game. In case of less than 5 teams participating in a size class the team ranked third will be awarded a certificate instead of a trophy. In case of less than 4 teams participating in a size class the team  
1645 ranked second will also be awarded a certificate instead of a trophy. The final number of trophies awarded will be decided by the RoboCup Federation based on the number of actually participating teams.

Certificates are awarded to the teams second and third in the technical challenges, to the teams ranked second and third in the Best Humanoid list and a 'Best Player' certificate to the three most highly ranked Drop-in players. A team does only receive a 'Best Player' certificate if their total amount of points is greater than 0.

- 1650 The Louis Vuitton Humanoid Cup is awarded to the team ranked first in the Best Humanoid list.

### Conflict Resolution

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Doubts concerning a serious violation of any rule during a specific game must be brought up to a member of the  
1655 Technical Committee and investigated before signing the result sheet. By signing the result sheet, a team agrees that  
the result came off in a fair game. If a team brings up an official concern to the Technical Committee, a meeting of  
the Technical Committee must be called as soon as possible. If the team of a member of the Technical Committee  
is directly involved in the game in question, the respective member is excluded from the meeting. At least three  
members of the Technical Committee need to be part of the meeting and the decision process. If less than three  
1660 members of the Technical Committee are available, members of the Organizing committee or, if necessary, Trustees  
or members of committees from other leagues have to be called into the meeting. Members of these meetings  
may request to inspect the hardware and software of any team involved in the issue. If serious violations of rules  
are detected, the committee may, among others, decide to invalidate the result of the game in question or take  
disciplinary actions against a team as defined in Law 5, depending on the severity of the rule violation. The decision  
1665 of the committee meeting need to be announced to the whole league.

## The Trend in Rule Evolution for the Next Years

1670 In this section the Technical Committee (TC) wants to make explicit the trends to be followed in the rules in the next years in order to improve the scientific level of the robots developed by the RoboCup teams. The evolution of rules in the humanoid league has been following a biennial schedule where major changes (like the number of players per team) have been introduced every two years and only incremental changes every other year.

### The Layout of the Field

Size of the playing field is intended to increase to 20 meters \* 12 meters in the year 2020.

### 1675 The Design of the Robots

The height of the robots In the future, the minimum size of KidSize robots and the overlap between size classes may be increased.

### 1680 Handling of the robots.

1685 In the future (envisioned for the year 2018), robot players will be untangled and removed from the field in the respective cases by assistant referees in order to limit the number of humans on the field. In order to facilitate this, the robots must feature a handle in the neck area and must be designed in a way that they tolerate to be lifted vertically by this handle without taking harm or causing harm to the handler.

In the future the involvement of robot handlers for the AdultSize sub-league will be reduced. AdultSize robots should become more and more robust and autonomous over the coming years.

### Laws of the Game

1690 The number of players in soccer games will be increased. This is to encourage team play and cooperation among humanoid robots.

### Acknowledgements

1700 These rules evolved from previous versions of the RoboCup Humanoid League rules. We would like to thank Henry Yen for the conversion of the rules into a basic LaTeX version in 2010. The 2008 version of the rules was compiled by Pasan Kulvanit and Oskar von Stryk, the 2007 version of the rules by Emanuele Menegatti and the 2006 version by Sven Behnke, who did a remarkable job improving the rule document and gearing it towards the FIFA Laws of the Game. The improvements of the 2005 version were compiled by Norbert Michael Mayer. Other input came earlier from the rules of the RoboCup MiddleSize and Four-Legged Leagues.

1705 The rules were continuously discussed within the technical committee of the humanoid league and also on the humanoid league mailing list. The following members of the technical committee for 2017 were responsible for the rule evolution: Jacky Baltes, Reinaldo Bianchi, Reinhard Gerndt, Sean Luke, Luis F. Lupian, Maike Paetzel and Soroush Sadeghnejad. Special thanks go to Martin Friedmann and Sebastian Mielke for the contribution of several figures and to Philipp Allgeuer for helping with the conversion of the 2017 rule book to LaTeX.

## Section III

# Rules for RoboCup Humanoid League Technical Challenges

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## General Rules for Technical Challenges

The technical challenges consist of the following individual challenges:

- Part A: Push Recovery
- Part B: Goal Kick from Moving Ball
- Part C: High Jump
- Part D: High Kick

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Only the robots used for the soccer games are allowed to participate in the technical challenges. No hardware modifications of the robots are allowed for the Technical Challenge (i.e., a robot cannot be modified from the configuration it had in the soccer games).

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The team scheduled for the Technical Challenge must have access to the field five minutes prior to the scheduled starting time. The referee will give the start signal at the scheduled time.

### Method of scoring

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The Technical Challenge consists of four parts A, B, C and D. Each of the parts can be attempted multiple times, in any order. The team might terminate a trial at any time, in order to reattempt the same part or switch to another part of the challenge. A trial terminates automatically when 25 minutes elapsed after the referee gave the start signal. This concludes the Technical Challenge for the team. The time is taken for each of the trials, if completed successfully. Ranking in the individual challenges is determined according to the rules defined for each individual challenge. For each part, the highest ranked team receives 10 points. The second team receives 7 points. The third team receives 5 points. All other teams who successfully managed this part of the challenge receive 3 points.

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### Robot Handlers During the Technical Challenge

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During an ongoing trial of a technical challenge the robot handler is not allowed to interact with the robot's sensors in any way. In the moment the handler either touches the robot or interacts with the robot in any way, the trial is finished and counted as unsuccessful.

- In KidSize and TeenSize robot handlers are not allowed to enter the field vicinity of the robot during a trial, unless the referee asks them to remove a robot.
- In AdultSize one robot handler is permitted to stay on the field near the robot during a trial.

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## Part A: Push Recovery

The goal of the push recovery challenge is to withstand a strong push. PET bottles, partially filled with sand or water to determine the weight, cushioned with a layer of foam material (max. 1 cm thick), and suspended by a rope, will be used as a pendulum to apply the push. A 1 kg weight will be used for KidSize, 2 kg for TeenSize, and 3 kg for AdultSize.

The length of the rope (between 1 and 2 meters) will remain fixed for all trials in a size class. The rope is attached to a frame with variable height, which is used to adjust the bottom of the bottle to be at the height of the center of mass of the robot. To swing the bottle against the robot's body, the pendulum is released from an angle which is measured by the ground projected distance between the robot and the bottle. At each attempt, the team announces the ground projection distance for the pendulum. The robot must be walking in place during the attempt. A push is successfully absorbed when after receiving the push, the robot returns to a stable standing or walking posture.

A trial consists of three random pushes. For a fully successful trial, the robot needs to accomplish the push recovery for three out of three pushes. For a partially successful trial, the robot needs to accomplish the push recovery for two out of three pushes. The robots are first ranked by the square root of the linear momentum  $H = L - \sqrt{L^2 - D^2}$  divided by the robot weight for fully successful trials and then for partially successful trials. The formula for calculating the rank is thereby:

$$\frac{\sqrt{H}}{m_{Robot}} = \frac{\sqrt{L - \sqrt{L^2 - D^2}}}{m_{Robot}}$$

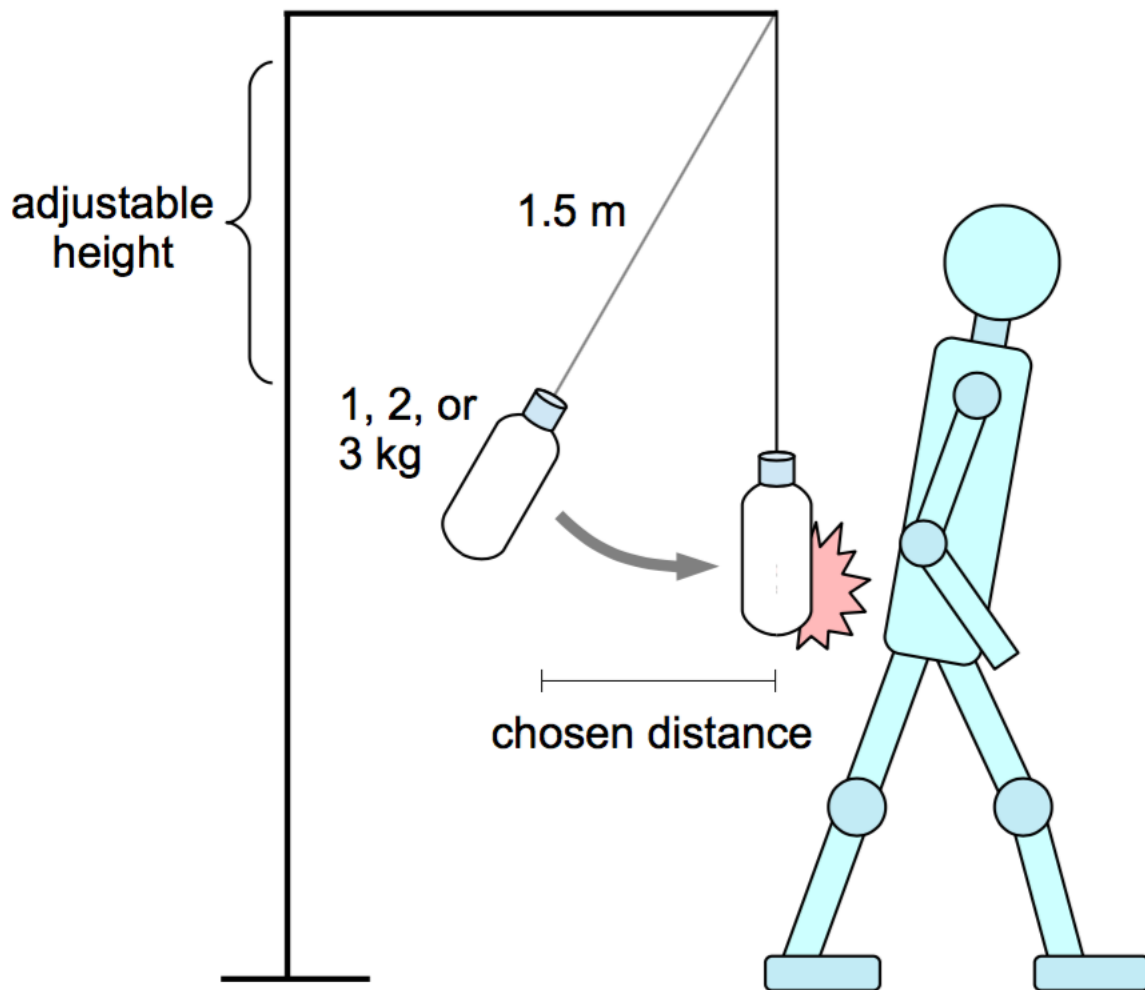


Figure 3: Setup for the push recovery challenge.

## Part B: Goal-Kick from Moving Ball

1760 The goal of the goal-kick from a moving ball challenge is to kick a moving ball into the goal. A ramp will be placed in a fixed position on the extension of the goal area line, such that a ball released from the ramp will travel parallel to the goal line towards the center of the field. The height of the ramp is adjustable and determines the initial velocity of the ball. Teams may place one robot anywhere on the field. After the ball has been released, the robot must make contact with it before the ball comes to a stop, otherwise the trial is unsuccessful. If after the ball contact the ball enters the goal, the trial is successful. Otherwise the trial is partially successful. Teams are first ranked by the release height of the ball from the ramp for successful trials and then by the shortest distance between the ball and the goal for partially successful trials.

1765

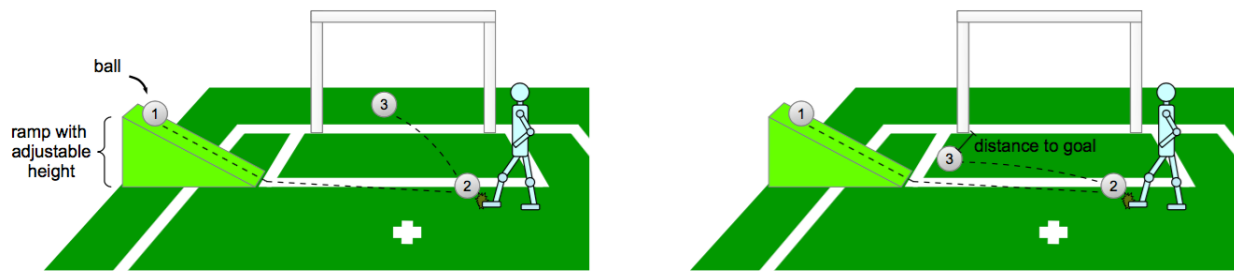


Figure 4: Successful (left) and partially successful (right) goal-kick from a moving ball challenges.

### Part C: High Jump

1770 The goal of the high jump challenge is to terminate ground contact and to stay in the air as long as possible. Robots are placed on a contact device of approximately  $40 \times 40$  cm that records the time of flight of a jump. A fully successful jump requires the robot to remain upright for a minimum of 3 seconds after landing without leaving the measuring device. All other attempts are considered partially successful. The robots are ranked first according to the time of flight of fully successful attempts and then according to the time of flight of partially successful attempts.

## Part D: High-Kick Challenge

1775 The goal of the high-kick challenge is to kick the ball in the goal at maximum height. At each attempt, the team announces the minimum height their robot tries to achieve. The minimum height must be at least  $\frac{1}{3}$ rd of the ball's diameter and must be a multiple of 1cm.

The ball is then placed on the penalty mark and the team may position the robot freely but at least 30cm away from the ball. After the start signal, the robot may move the ball to any position before attempting a kick from the ground. Only kicks count that score a goal of at least the minimum height. The trial ends unsuccessfully when the ball leaves the field, or when the robot touches the goal obstacle.

1780 The robots are ranked by the maximum height they successfully managed to kick the ball into the goal.