

**36th ROBO-ONE**  
**20th ROBO-ONE Light**  
**6th ROBO-ONE auto**  
**Competition Rules**



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## Participation Flow for **36th ROBO-ONE / 20th ROBO-ONE Light / 6th ROBO-ONE auto**

The participation and attendance flow for the **36th ROBO-ONE / 20th ROBO-ONE Light / 6th ROBO-ONE auto** competition is as follows.

- 1) Publication of competition rules (3 months prior to the competition)
- 2) Participation applications received (from 1 month prior to the competition)
- 3) First day of the competition
  - ROBO-ONE Light Standards screening/ Preliminaries
  - ROBO-ONE auto Standards screening
  - ROBO-ONE Light Finals Tournament
  - ROBO-ONE auto Finals Tournament
- 4) Second day of the competition
  - ROBO-ONE Standards screening/ Preliminaries
  - ROBO-ONE Finals Tournament

\* Participant guide will be issued 10 days before the event as a guide. Please check it and join us. Especially the judges and the referee will check the ID card in the standards screening, Preliminaries, and the finals tournament. Please do not forget to print and bring it.

### 1 Publication of competition rules

The competition rules are generally published on the official ROBO-ONE website (<http://www.robo-one.com>) three months prior to the competition.

### 2 Participation applications

Participation in ROBO-ONE/ROBO-ONE Light/ROBO-ONE auto is open to all. There are no nationality requirements.

(\*However, please apply for each one of the following areas through each association.

**Korea:** Korean Robot Education and Content Association: <http://www.reca.or.kr>

Taiwan: Taipei Computer Association

Robot Industrial Development Office <http://www.robo-one.tw>

(\*We will cooperate with organizations that wish to operate ROBO-ONE in various countries around the world and create a system that allows more people to participate in the event smoothly.)

Participation applications are only taken on the official ROBO-ONE website (<http://www.robo-one.com>). You must register as a competitor and register to participate. Complete the registration procedures by following the instructions on the screen. Applications are not screened, so when building your robot be sure to read the competition rules carefully to



avoid rule infractions.

Team and robot names should be 14 20 letters or less.

Also, please be sure to register the photo of the robot by the day of the convention.

An operator can register one person for each robot. It is impossible for anyone other than the registered operator to steer the robot.

#### **Explanation 1**

Robot and team names can be registered in Japanese, but you must also enter English names. At international competitions, the English names (letters) are used. **The English robot name should be easy to read and understand in 14 characters or less. Make sure to check it because it will be called in the same way as the pronunciation on the Google translation site.**

### **3 Standards screening**

In the standards screening, robots are screened for whether they have been created in accordance with the competition rules. The weight limits for this competition are 5 kg or less for ROBO-ONE auto 3 kg or less for ROBO-ONE and 1 kg or less or a certified robot for ROBO-ONE Light. Certified robots can participate in all classes if they satisfy the certified robot standards.

**(Caution) The certified robot standard has been moved to “4.5 Robot Standard” in the “ROBO-ONE Competition Rules”.**

~~The standards for certified robots are as followed.~~

#### **~~Standards for certified robots~~**

- ~~(a) Commercially available robot certified by the Biped Robot Association.~~
  - ~~(b) Complies with the rules stipulated for each certified robot listed on the official ROBO-ONE website.~~
  - ~~(c) Do not use optional parts other than the certified optional parts listed on the official ROBO-ONE website.~~
  - ~~(d) When attaching a part to arms, the weight must not increase more than 20% and the length of the left and right arms must not exceed more than 260 mm each. However, the weight must not exceed 2 kg.  
Modifications may include adding color, adding stickers, adding head parts that do not enhance performance, decorating with paper, fabric, plastic, or sponge materials, and changing the software. Adding decorative lights and sensors and changing the control microprocessor are also permitted.~~
  - ~~e) When participating in ROBO-ONE auto, allow weight increase to 20% + 500g due to the addition of CPU board and camera.~~
- ~~In addition, for these mountings, if the safety regulations are satisfied, modification is~~



permitted.

If your robot fails the standards screening, you will not be able to participate in the competition, so make sure to sufficiently review the rules and standards in advance.

## 4 Preliminaries

ROBO-ONE's preliminaries will be done by the “**floor exercise**”.

Places are determined by score and time, and the top 48(maximum) robots (including the top 3 robots in the world rankings and robots certified at sanctioned tournaments) move on to the final tournament.

In the preliminaries of ROBO-ONE Light, the robots travel 4.5 meters (subject to change depending on the venue. In addition, preliminaries may not be carried out depending on the number of participants.).

In the case of course-out or time-out, you can't participate in the final tournament.

Places are determined by the time to the goal, and the top 32(maximum) robots for ROBO-ONE Light (including the top 3 robots in the world rankings and robots certified at sanctioned tournaments) move on to the finals tournament.

The top 3 robots in the world rankings, robots certified at sanctioned tournaments are automatically in the finals, but they participate in the prelims for tournament seeding purposes.

The preliminaries for ROBO-ONE auto will be “Defeat KHR” .

~~ROBO-ONE auto does not perform the preliminaries. we perform standard screening of recognition of robot and referee on the stage. Robots that have been cleared standard screening can participate in the final tournament. The top three players in the world rankings should also complete the standard screening.~~

Places are determined by the time to defeat the standing KHR, and the top 16(maximum) robots for ROBO-ONE auto (including the top 3 robots in the world rankings and robots certified at sanctioned tournaments) move on to the final tournament. Robots that could not defeat the standing KHR cannot participate in the final tournament.

The top 3 robots in the world rankings, robots certified at sanctioned tournaments are automatically in the finals, but they participate in the prelims for tournament seeding purposes.

### About ranking

The robots will be ranked after the ROBO-ONE tournament held by the Biped Robots Association. ROBO-ONE preliminaries, finals and points up to 3 years ago will be added.

Please see the website for details.

<Benefit>

The robots up to 3rd in each class ranking will be applied when participating in the next



tournament.

1. The participation fee to the corresponding convention is free.
2. You can participate in the finals regardless of the preliminaries result.

### **About Finals participation right**

The official ROBO-ONE, which will be held after the certified tournament, is entitled to participate in the final tournament regardless of the result of the qualifying. Rights are given to robots and pilots. Robot and pilot changes are not permitted. However, remodeling of the robot is permitted.

You will be awarded if you get excellent results at a certified tournament. Official tournament entry fee will be free.

### **Rules of certified tournament**

A certified tournament is a tournament in which a team that has achieved excellent results in the tournament is entitled to compete in ROBO-ONE's finals (Finals participation right system). Biped robot contests in various places applies this system.

It is necessary to hold a certified referee at the certified tournament.

It is also a requirement to use the latest competition rules as of 1 month ago.

Up until now, it has been held by member companies, but now it is possible to hold an accredited tournament by general companies and groups. Please apply from the Biped Robots Association website. We will also introduce certified referees.

### **Official Referee System**

It is considered as the official referee system of 3 ranks of special A grade, A grade and B grade. At first, we examine referee in certified tournaments etc. and assume registration system.

Special Class A: You can refer to all competitions, including international matches. The referee is required to be able to respond to players in English in the game.

Class A: You can refer to official tournaments in each country.

Class B: You can refer to certified tournaments and ROBO-ONE Light.

Those who have passed a year or more in each class, who have experienced 2 or more certified tournaments, or who have 20 or more matches in the C-Ring can take an A grade or higher.

## **5 Finals Tournament**

The final tournament will be held with each class of preliminary winners.

Only one robot per operator may participate in the final tournament.

The competition consists of one round of 3 minutes and an overtime of 2 minutes, depending on the circumstances. There may be multiple overtimes, so have batteries, etc. ready.



Depending on the situation, the game time may be set to 2 minutes per round and an overtime of 1 minute without maintenance time.

Overtimes will not be performed in some cases.

## ROBO-ONE Competition Rules

### 1 Preamble

The purpose of ROBO-ONE is to promote the fun and excitement of robots to more people. It aims to be a robot competition that is enjoyable for spectators and highly motivating for participants. For this reason, it emphasizes technological prowess and entertainment value over winning and losing.

Technical information is also released to the extent possible to promote the spread and sound development of robotic technologies.

### 2 About the Competition

The competition involves matches in a preset ring between biped robots created by participants. The decision of referees and judges determine winners and losers. The competition consists of a tournament-style main round and a preliminary round preceding it.

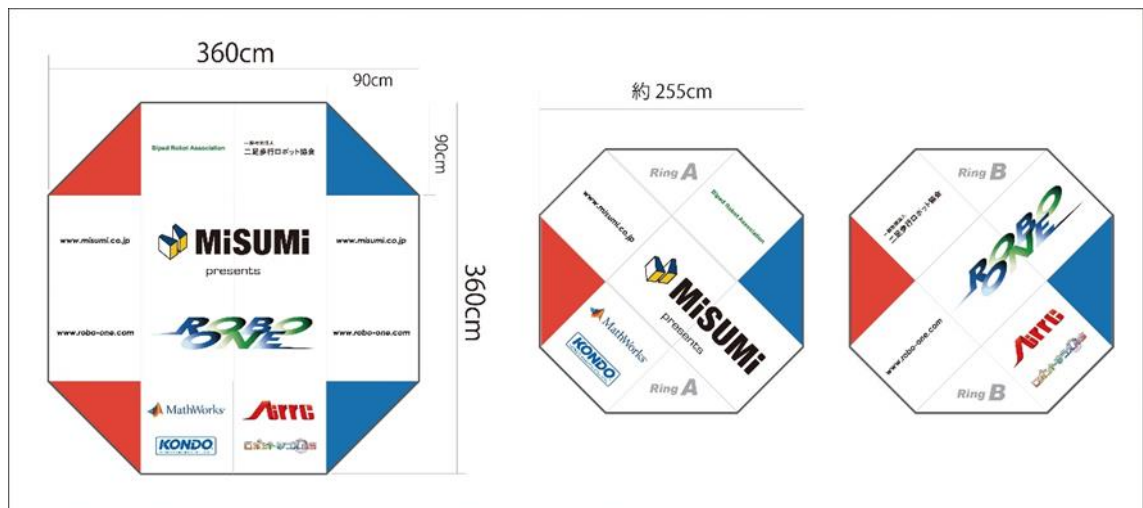
### 3 Ring Standards and Conditions

#### 3.1 Ring

The size of the rings is shown in Diagram 1. There are cases where the game progresses simultaneously with two rings and the case where it progresses with one ring and the dimensions are as described respectively.

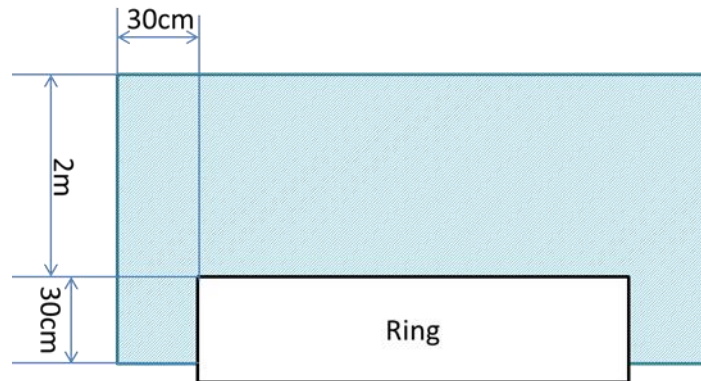
Surface bumps are  $\pm 1\text{mm}$  or less. There are no specifications regarding the material.

Do not place objects up to 2 m of the ring and 30 cm around the ring, down to 30cm to the floor around the ring. However, the referee can move this range freely. (See diagram 1-(3))



(1) With one ring

(2) With two rings



(2) Side view of the ring

Diagram 1 the size of rings

### 3.2 Outside disturbances

There are no specific regulations on the photographic equipment used by general spectators, media members or competition officials. For this reason, if there is a chance that a participating robot will be impacted by indoor lighting, sunlight, infrared light from cameras or video cameras, flashes, or photographic lighting, etc., the participant is responsible for taking countermeasures.

## 4 Robot Standards

### 4.1 Method of movement

Robots must be bipeds capable of walking with steps that are 10 mm or higher.

#### **Explanation 2**

Walking is not screened in the standards screening, but if a referee or judges during the competition that this standard has not been met, the competition will be interrupted, and walking will be judged, so make sure your robot is able to walk right, left, forward and back taking steps that are 10 mm or higher. If it is not possible to judge whether it is 10 mm higher or not, judge it by going up and down to 10 mm board. Please be prepared. It is not being prohibiting to walk with step lower than 10mm during the game.

If the robot does not satisfy this standard, the referee gives 1 down and a correction time of 2 minutes. If you can't fix it, you will be a knockout. Everything related to the robot standards will be handled in the same way.

Robot standards are common to ROBO - ONE, ROBO - ONE Light, and ROBO - ONE auto unless otherwise specified.

Please prepare for regulations related to the referee instructions during the standard screening and game, so that you can operate as instructed.

Please refer to 8.1- (a) for the regulations of walking.



#### 4.2 Robot standards

The robot’s shape is open if the following rules are observed. However, it is required to have feet, two legs, two arms, trunk(torso) and head. Also, the head should be independent of the torso. **The size must be at least 2cm above and below, left and right, and front and back. Each arm must have at least one working axis.**

##### Explanation 3-1

- The head should be a separate part from the torso. We do not accept anything with eyes or mouth on the torso.
- It is possible to add tails for attack.

#### 4.2.1 Rules on feet and legs

(a) The size of the soles of the feet (the part that contact with the ground) is stipulated per weight category as shown in Table 1. The length of the sole from front to back must be X% or less of the length of the leg. **However, soles can be no longer than Y cm.** The width of the sole from right to left must be Z% or less of the length of the legs. Leg length is measured from the axis of forward and back movement at the very top of the leg to the sole of the foot when the leg is fully extended.

Table 1 Robot Sole by Weight

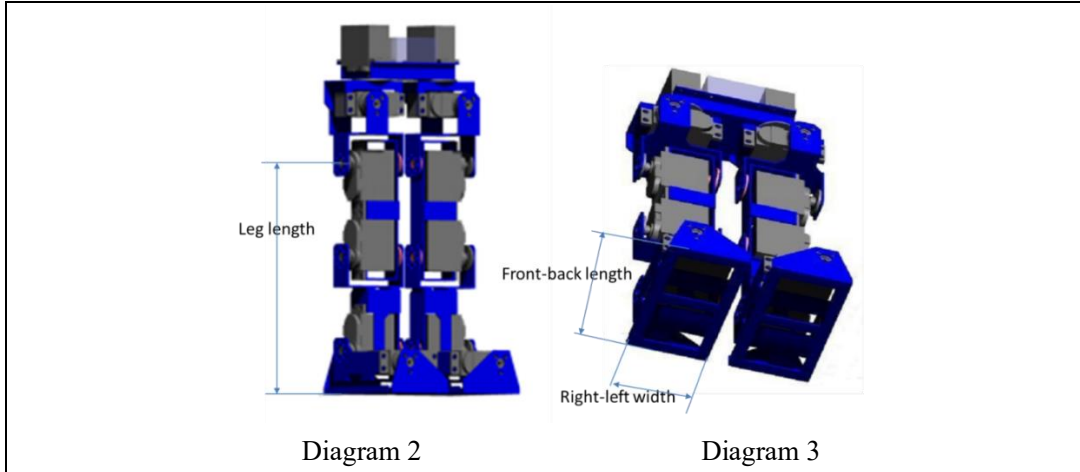
Robot Weight	X	Y	Z
1 kg or less (ROBO-ONE & Light & auto)	55%	10 cm	35%
2 kg or less (ROBO-ONE & auto)	50%	11 cm	30%
3 kg or less (ROBO-ONE & auto)	45%	12 cm	25%
5 kg or less (ROBO-ONE auto)	40%	13 cm	25%
7 kg or less	35%	14 cm	20%
10 kg or less	30%	15 cm	20%
Over 10 kg	25%	16 cm	15%

(Figures for weights over 3 kg are for reference.)

##### Explanation 3

As shown in Diagram 2, the leg length is the length from the axis of forward and back movement to the sole of the foot. The size of the foot is measured as shown in Diagram 3. If the axis moving back and forth is a parallel link, measure from a higher axis position.





(b) If in the shape of a clog (*geta*), the sole length is measured as the length of the red line in Diagram 4.

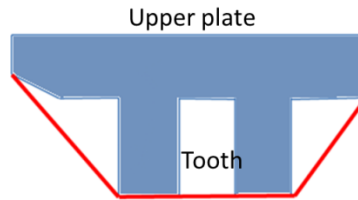


Diagram 4

(c) When the robot is standing, the lines tracing the outermost perimeter of the soles of the left and right feet must not overlap when looked at from above.

**Explanation 4**

In the structure shown in Diagram 5, the lines tracing the outermost perimeter of the soles overlap, so the robot would not be allowed to participate. (The dark blue portion is the area that would be judged to overlap.)

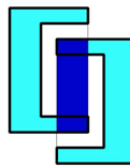


Diagram 5

(d) Suction/absorption devices (including adhesive materials) must not be placed on foot soles.

4.2.2 Arms, tails, etc.

(a) The length of parts that move away from the trunk must be Z cm or less, the torso (arms, tail, neck, etc. excluding legs) should be less than Zcm from the center of the servo axis that supports the part that moves away from the torso as shown in Table 2 by robot weight.



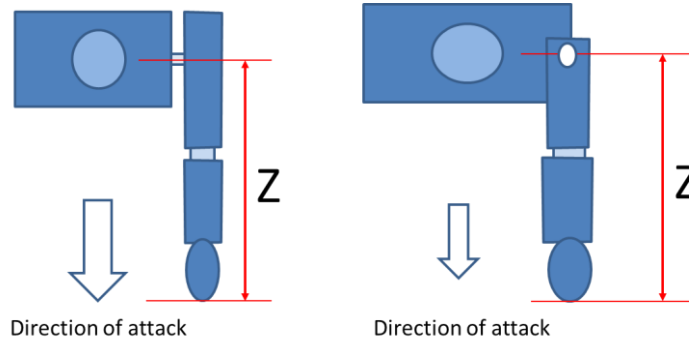
The judge will measure the length of the arm in the attack state extended back and forth. (see Diagram 6).

Table 2 Standards by Weight for Parts that Move Away from the Trunk

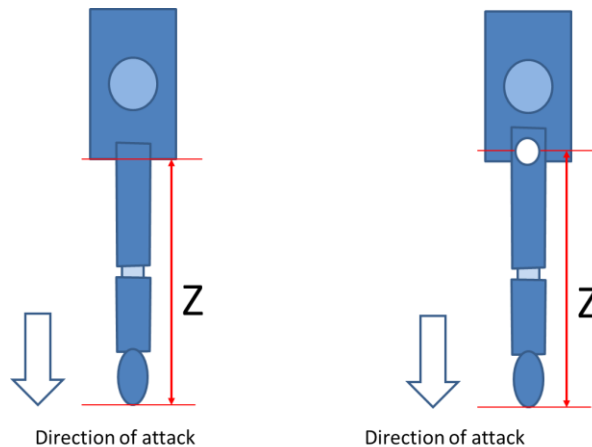
Robot Weight	Z
1 kg or less (ROBO-ONE & Light & auto)	26 cm
3 kg or less (ROBO-ONE & <del>auto</del> )	30 cm
5 kg or less (ROBO-ONE auto)	35 cm
7 kg or less	40 cm
10 kg or less	45 cm
Over 10 kg	50 cm

(Figures for the 5 kg or less category to the over 10 kg category are for reference.)

### Explanation 5



(1) Measurement of length (View from the top)



(2) Measurement when attacking while rotating the body

### Diagram 6

The judge will measure the length of the arm in the attack state extended back and forth as Diagram 6-1 and 6-2. In the case of an authorized robot, it conforms to the certified robot standard.

(The movable range regulation is abolished.)



#### ▪ 4.2.3 Battery safety management

For the safety control of a battery, you must bring altogether batteries used in the hall and take the examination by the start of the competition. (For details, refer to participant guide)

When it is judged that there is a dangerous possibility of leading to serious accidents, such as, the main part of a battery having swollen extremely, or serious damage of main part, cables, and connectors, it cannot be used.

The battery which safety has checked is attached a "checked seal."

Since batteries without the seal cannot be used, attach the seal till the end of the event.

When it turns out that the battery without the check seal is used and charged, we will suspend you.



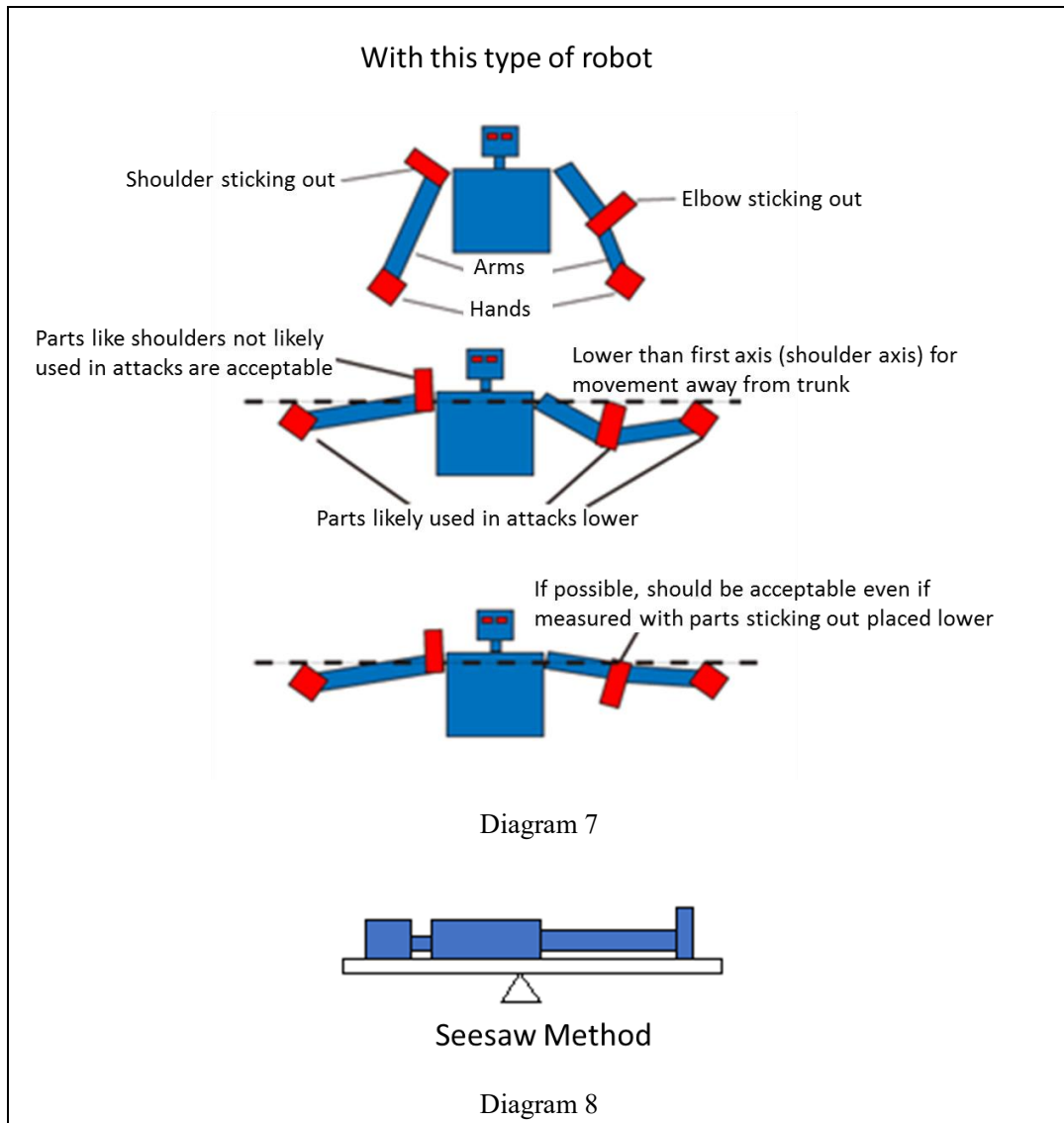
Diagram 7 checked seal

#### 4.2.4 Center of gravity rules

- (a) The robot's center of gravity in the vertical direction must be clearly higher than the axis of forward and back movement at the very top of the legs. Also, when measuring center of gravity, parts like hands used for attacks must be placed below the axis for moving them away from the trunk. Center of gravity is measured using the seesaw method.

##### **Explanation 6**

Center of gravity is measured with the legs fully extended and the hands placed lower than when horizontally extended (see Diagram 7). Program the robot so that it can get into a position that allows its center of gravity to be measured (see Diagram 8).



#### 4.2.5 Automatic recognition rules in ROBO ONE auto

In ROBO ONE auto, the robot must recognize the state of the opponent and the referee more than 1 m apart.

In this examination, KHR-3 HV, a certified robot is used as an opponent.

We will set the KHR-3 HV at 1 m away from your robot.

we will check that your robot 1) recognizes standing KHR-3 HV, 2) recognizes falling KHR-3 HV, and 3) a person can be recognized.

If the robot can recognize, send the following signal from the robot.

- ① If your robot recognizes the standing KHR-3 HV, take a fighting pose.
- ② If your robot recognizes a falling KHR-3 HV, raise both arms.
- ③ If your robot recognizes a person (referee), spread both arms.

We will place plastic bottles etc. instead of KHR-3 HV. Robots shall not react to these.



#### **Explanation 6-2**

- We carry out recognition examination on ring. We do not put a curtain on the background.
- Recognition examination randomly carries out each recognition 3 times and confirms that each correct answer 2 or more times. Recognize within 3 counts and keep pause during recognition.

Recognition examination proceeds at random as follows.

For example, (1) person, (2) fallen KHR, (3) standing KHR, (4) plastic bottle, (5) fallen KHR, (6) person (7) plastic bottle, (8) person, ...

Please recognize within 3 counts each. You will be disqualified if you make a mistake twice for the same target.

-For human recognition, the referee may touch the robot on the ring. The purpose is to recognize this and not attack it. Specifically, a person faces the robot 1 m ahead of the robot and stands with his hands beside the face. In order to adjust the height to the robot, the face and hands may come from the side.

-A plastic bottle is a bottle of drink that people generally tell. We remove the seal and wrap the white paper. We will use around 2 liters. Please be able to cope with various types of things.

#### 4.2.6 Prohibitions

- (a) The power source must be mounted inside the robot.

#### **Explanation 7**

If the battery is exposed on the outside, there is a risk of shorts or fire, so position the battery to prevent shorts and battery damage in normal matches between robots made of metal and plastic, etc. Also, adequately protect circuit boards and power-supply lines. Also, if the wiring is hanged down carelessly, it may be judged as a dangerous condition, so please bundle the wiring together.

If judged to be in a dangerous position, a red card (1 “down”) is assessed, and if it is not repaired within 2 minutes, a technical knockout is assessed. If there is smoke or fire, a technical knockout is immediately assessed.

For example, if the battery cover comes off during the match and exposes the battery, the referee judges that there is risk involved and orders it repaired. This count as 1 “down,” and the repair time is 2 minutes, the same as timeout rules.

At this time the participant is not allowed to increase the weight or change the position of the center of gravity. Repairs could include screwing the cover down or taping it down with plastic tape, etc.



Also, install the power switch in a position that is easy to operate and protect it against malfunctioning with a cover etc. The game will continue even if the switch turns off by contact of robots during game.

(b) Parts that could hurt someone are not allowed.

#### **Explanation 8**

The judge checks in the standards screening by directly touching the parts, and if judged to be a danger, the participant is asked to make repairs. If repairs cannot be made, the robot is disqualified. Make sure to conduct adequate processes such as deburring.

(c) Robots must not have jamming devices or other devices that intentionally disrupt the opponent's control such as lasers or strobes. **However, sensing equipment such as laser range sensor is excluded.**

(d) Robots must not use any parts that could damage or dirty the ring.

(e) Robots must not have objects, liquids, powders, or liquids that can be blown at the opponent.

(f) Robots must not have devices that ignite.

(g) Robots must not have weapons that could damage the opponent or ring. Dangerous objects like knives or things that revolve at high speeds are prohibited.

(h) Robots are not allowed to fly or move using fans or propellers, etc. that revolve at high speeds. CPU cooling fans are not limited to this.

(i) In addition to the above, if a judge or referee judges something to be antithetical to the spirit of ROBO-ONE, it is ruled non-compliant.

(j) Robots are not allowed to have structures that hook other things or have hands, arms or tails that hold highly adhesive materials, hooks among others.

(k) When decorating, keep the robot's decoration in a length that does not touch the ring when standing upright and walking.

#### **Explanation 9**

When a robot grabs and knocks down its opponent using a hooking structure or with hands made with a highly adhesive material, the attack is not valid.

If the referee decides that it is against the regulation, makes it 1 down and asks the player to make correction within 2 minutes.

It is desirable that the structure to be caught is about 120 degrees or more in the case of bending.



In the standard screening, the judges judge strictly whether the paper sticks to stickiness. However, this does not mean that grabbing, pinching or hugging actions, etc. are disallowed.

**Explanation 9-2**

Dazzling high-brightness LEDs etc. may be judged to be disturbing lights to the driver, so it is desirable that they be able to dim the light and turn off.

(Caution) ROBO-ONE auto recognition rules have been abolished. A recognition evaluation will be conducted during preliminaries. For preliminaries, see "6.3 ROBO-ONE auto preliminaries: "Defeat KHR" in ROBO-ONE Competition Rules.

#### 4.3 Shape may not be altered

Robots must not be modified to alter their shape at any time during the preliminaries and finals.

#### 4.4 Replicas not allowed

Robots that replicate the shapes or forms of existing characters or people not authorized by the Biped Robot Association, as well as use of their illustrations or photos, etc., are prohibited. Copyrighted music and voices, trademarked names and other equivalent items also must not be used.

When necessary, the participant must obtain permission.

In addition, if you receive permission, contact the Biped Robot Association in advance.

#### 4.5 Standards for certified robots

- (a) Commercially available robot certified by the Biped Robot Association.
- (b) Complies with the rules stipulated for each certified robot listed on the official ROBO-ONE website.
- (c) Do not use optional parts other than the certified optional parts listed on the official ROBO-ONE website.
- (d) When attaching a part to arms, the weight must not increase more than 20% and the length of the left and right arms must not exceed more than 260 mm each. However, the weight must not exceed 2 kg.

Modifications may include adding color, adding stickers, adding head parts that do not enhance performance, decorating with paper, fabric, plastic, or sponge materials, and changing the software. Adding decorative lights and sensors and changing the control microprocessor are also permitted.

- e). When participating in ROBO-ONE auto, allow weight increase to 20% + 500g due to the addition of CPU board and camera.

In addition, for these mountings, if the safety regulations are satisfied, modification is permitted.



f). ~~Certified robots with 400 or more ROBO-ONE Light ranking points cannot participate in ROBO-ONE Light.~~ A team with a certified robot of ROBO-ONE Light ranking point of 400 or more cannot participate in ROBO-ONE Light with that robot. However, this does not apply to students.

<http://www.robo-one.com/en/rankings/light/>

Explanation 9-3 Please refrain from participating with certified robots as much as possible for excellent robots with high ranking points, and participate with robots of 1 kg or less.

## 5 Robot Control

### 5.1 Prelims/Finals Control Method

During the prelims and finals, robots may be self-controlled by a computer or controlled manually by a human operator. If controlled manually, wireless communications must be used (radio, infrared, etc.). Participants must consider match conditions (light, sound, radio waves) and take steps to keep from obstructing control by the opponent even if using the same system. If using low-power, weak-signal radio control, use a wireless system with eight or more frequency channels. Also, if using an RC proportional controller, have at least eight crystal oscillators available.

#### Explanation 10

RC controllers should use the following frequencies.

27 MHz band: 26.975-27.255 MHz (12 bands, 1 to 12)

40 MHz band: 40.61-40.75 MHz (8 bands, 61, 63, 65, 67, 69, 71, 73, 75)

AD band (25 MHz weak, 20 bands)

2.4 GHz band, 5 GHz band

Approved wireless LAN, Bluetooth, ZigBee, etc. may also be used.

Use of wireless formats not approved in the host country is prohibited.

You should use systems that allow eight channels to be used simultaneously.

Preparations may be performed by friends or a team. After participants in the final's tournament are determined, wireless frequencies are assigned to the robots. If using a remote controller, have the crystal oscillators available up to this time.

#### 5.1-2. ROBO-ONE auto's robot operation method

Through preliminaries and the finals tournament, the robot must be an autonomous motion by a computer and a sensor installed in the robot during the game. However, the robot is connected to the network and the robot can exchange information without human operation.

The robot is designed to start its motion at the beginning signal of the referee and to stop the





motion with a wait or a stop signal, and at this time human manipulation is permitted. However, it shall be equipped with wireless start, stop, and depower mechanism. You cannot touch until the robot is completely stopped.

Also, do not touch the controller during the game. Therefore, take countermeasures such as hanging the controller from the neck to quickly stop or depower the robot.

## 6 Prelims Format

~~Preliminaries are done by 4.5m runs or floor exercise.~~

Preliminaries are done by “4.5m run”, “floor exercise” or “defeat KHR”.

### 6-1 4.5m runs

- Each robot travels 4.5 meters. The width of the lane is 90 cm. (See Diagram 9. This may change depending on the venue and operational circumstances.) The time limit is 1 minute. Decide the ranking by the time to the goal. In the case of course-out or time-out, you can't participate in the final tournament.
- The robot can start walking according to the signal of the system (monitor screen).
- Travelling in the direction of the goal must be accomplished by walking only—the left and right foot alternate in being put forward. The feet do not need to alternate if adjusting stay in the lane or change the robot's direction, etc.
- Robots must not move toward the goal when anything other than its feet soles are touching the ground.
- If the robot falls over, it gets up at that spot and continues the competition. If it goes beyond an obstacle at the time of getting up, it can continue from the place where it got up.
- The lane uses the ROBO-ONE ring, but a part of the course may have obstacles with a thickness of 10 mm or less placed down on it and affixed with double-sided tape. Obstacles material are used, one with good grip and one that is slippery. Also, obstacles may not be flat. (Changes may be made depending on the circumstances at the venue.)
- The order in the prelims is determined randomly and the robot's race in the predetermined order. A 10-second penalty is assessed each time a participant passes their place in the order. If a robot is unable to complete the race, the number of passes is limited to 2 times.



Diagram 9

### 6-2 Floor exercise



### 6.2-1. Content of competition

- 1). The robot performs floor exercise for one minute and competes in the ranking based on the score obtained. However, in the case of a tie, the ranking will be determined by the time of one performance.
- 2). There are 4 types of performances, the one is a competition that also measures time. The prescribed performance shall be the performance announced in advance in the specified order. A player performs an action by calling an acting name (or acting number).
- 3) Start the game according to the referee's instructions and start the 1-minute timer.
- 4). The performance score will be scored only once per type. If the same performance is performed several times in succession, the higher score is adopted. However, the order of performance cannot be changed.
- 5). Perform the performance from the upright position and make one set until the end of the performance. Hold that condition for 3 seconds after one performance is over and stand upright. **One point will be deducted when not standing upright or not holding for 3 seconds.**
- 6). During the competition, you can give instructions to the robot by wireless control.
- 7) Do not touch the robot during the competition. If you touch the robot, you will lose **1 2** points.
- 8). If the robot falls from the stage, the referee returns the robot to the stage and resume on the instruction from the referee. In this case, **1-2** points will be deducted.
- 9). The timer will not stop unless instructed by the referee.
- 10). Preliminaries order is determined by random numbers and do in the determined order. 2 points will be deducted for each pass. Pass is limited to 2 times.**

**Explanation 11.** Upright state means that the legs are parallel, and the knee angle is 180 degrees. (See Fig. 10)  
Please proceed at your own discretion. The referee calls the score, but there is a time difference.

### 6.2-2 Scoring method

- 1). Referee calls the score according to the regulations.
- 2). Judge judges whether the referee's call is correct.
- 3). Two or more judges are required.

### 6.2-3 Standard performance and points

The prescribed performance is the following four types, and "moving" performance measures the time.

Performance 1	Movement
Contents	Move from red corner to blue corner (or vice versa) <b>The robot must cross the start line, pass outside the checkpoint,</b>



	<p>cross the goal line, and have both feet completely in the area. See Figure 9-2. If you move without stopping during this time, add 1 point. Movement is in the forward or backward direction. The start line, goal line, and checkpoint are subject to change. Evaluate the moving time (*1) and gait.</p>				
Evaluation point	Skipping running	Running (both feet floated)	Feet 10 mm or more	sliding feet	Fall (* 2)
	5 points	4 points	3 points	2 points	1 point
	Measure travel time at the same time				

Performance 2	Handstand				
Contents	Make a handstand and stop for 3 seconds. (*3)				
Evaluation point	Stand a finger (*4)	One hand	Two hands	Three points	Fall
	10 5 points	4 points	3 points	2 points	1 point

Performance 3	Jump rotation				
Contents	Jump and rotate around the vertical axis of the body. (Angle is measured at the time of landing.)				
Evaluation point	270° or more	270° or less	180° or less	90° or less	Fall
	5 points	4 points	3 points	2 points	1 point

Performance 4	Forward and backward rotation				
Contents	Rotate with the whole body floating, Do not ground other than the feet.				
Evaluation point	Grounding other than foot	Grounding only one hand	Grounding both hands	Front-back rotation	Fall
	10 5 points	4 points	3 points	2 points	1 point

(\*1) Measure the time from the red or blue corner to the start line to the finish line.

(\*2) If it is carried out and falls, it will be 1 point, and it will be taken as a zero point if it is not carried out.



(\*3) The performance becomes effective when it stops for 3 seconds, and the same performance can be challenged continuously by advanced skills.

(\*4) Stand at a single contact area of 1 cm<sup>2</sup> or less.

Explanation 11

- In movement, it is prohibited to walk sideways except changing direction.
- There is one hand with "one hand upside down" such as by hand, and it is not judged that upside down with elbow is one hand upside down.

It is equivalent to two-point inversion. **Inverted by both elbows is a three-point inversion.**

In the case of a robot in which the hand is integrated with the arm, it is acceptable to use **grounding part of arm** is less than 20% of the total length of the arm. 20% of the arms are 20% from the tip of the arm or the tip of the hand. In the prior examination, please color-code the grounding part of the hand, etc., and declare it. The same is true for single finger "inverted".

- Please put both legs together and extend straightly for "handstand".

**6.2-4. Stadium**

- 1) Use two small ROBO-ONE rings.
- 2) Start position: A-ring is red corner red part, B-ring is blue corner blue part. The performance shall be in the middle of the ring.

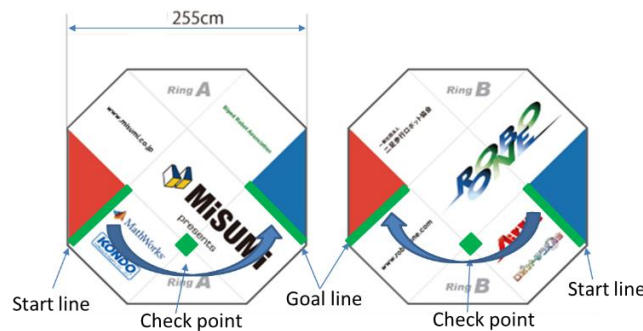


Diagram 9-2. Floor exercise field

**6.3 Preliminaries for ROBO-ONE auto: "Defeat KHR"**

6.3-1. Competition contents

In ROBO-ONE auto, the robot is autonomous and competes for the time it takes to find and defeat the standing KHR from among the randomly placed objects. The top 16 robots can participate in the final tournament. Robots that could not beat the standing KHR cannot participate in the final tournament. (However, robots that have won the top 3 rankings and the right to participate in the finals can participate in the final tournament even if they do not defeat the standing KHR, but please participate from the prelims to create the tournament.)



- 1) The start position is in the red or blue corner, and the timer starts with the referee's signal. The time limit is 2 minutes.
- 2) Place multiple items of obstacles that should not be defeated, such as plastic bottles, fallen KHR, and referee's hands.
- 3) If the robot defeats an obstacle other than the standing KHR, add 5 seconds to the time for each obstacle.
- 4) When falling from the ring, add 5 seconds to the time and continue from where it fell.
- 5). The qualifying tournament order will be determined by random numbers, and will be performed in the determined order. There is a 10 second penalty for each pass. Pass is limited to 2 times.

### 6.3-2 KHR and obstacles

- ~~For KHR robots, we use a photograph of the KHR-3HV certified robot on the panel. The "KHR" here is not a real robot, but a dummy that assumes it, and a photo of the KHR-3HV certified robot on the panel is used.~~

"KHR" here doesn't mean an actual robot, but a dummy object mimicking its appearance. It is a panel with a photo of a KHR-3HV (listed in the certified robot list) pasted onto it.

- Use a plastic bottle with a white paper on a 2 liter bottle.
- The referee's hand should be a photo of an open person's hand made into a panel with the same size. Also, palm height should be 50cm or less

### 6.3-3. Stadium

- Use a small ring for Preliminaries. Do not put a curtain on the background. The figure below is a reference diagram and the arrangement of obstacles etc. will be changed.

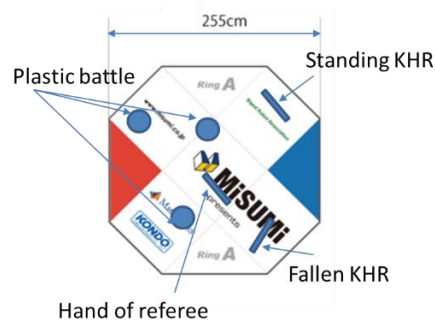


Diagram 9-3. Stadium

#### Explanation 11-2

~~To ensure safety, referees or judges will be disqualified if the robot attacks indiscriminately without recognizing the object.~~

To ensure safety, if a referee or a judge judges that a robot is conducting attack indiscriminately without recognizing objects, the robot will be disqualified.



## 7 Finals Tournament

- (a) Matches are generally 1 round of 3 minutes and are won by knockout or number of “downs.” Depending on the number of participants and other circumstances, the match time may be changed.
- (b) The referee issues yellow cards and red cards according to circumstances, but it becomes one red card with two yellow cards. Red cards are handled equally as one "down".

### Explanation 12

A 1-point difference in the number of yellow cards cannot determine a victory. Only the difference in the number of downs (including two yellow cards) determines which robot won. However, this does not apply to overtime.

- (c) When neither robot secures a victory in one round, there is a 2-minute overtime round that is decided by sudden death—whichever robot scores a down first wins. If there is no winner even after overtime, victory is determined by the judges on points. However, if it is the Final Tournament, depending on the situation, there may be overtime. Also, when there are large numbers of participants, victory may be determined by decision without conducting overtime.

### Explanation 13

Judgment of games is done as follows.

<In the usual round>

The number of downs (including red cards) will determine the outcome. Winning or losing is not decided by yellow card difference.

<Overtime round>

If winning or losing cannot be decided, the judges will score based on the number of yellow cards, the number of slips ~~downs~~ and the number of offenses within the extension time and decide on winning or losing. At this time the yellow cards in the round will be handed over. The number of slip and attacks are not handed over.

<Re-overtime round>

If the judge cannot judge it, we will perform re-overtime round, but at this time without a maintenance time (battery exchange is not allowed), we will immediately extend for 2 minutes.

If there is not down, decide the outcome by the number of slips. In the case of the same number of slips, decide by the number of attacks. Furthermore, if it is the same number, we do further extension without maintenance time.

<In the non-overtime round>

Just like the above "Overtime round", the judges will score based on the number of



yellow cards, the number of slips and the number of offenses ~~within the extension time~~ and decide on winning or losing.

If it is impossible to judge by any means, it will carry out an extension round in the same way as "Re-overtime round" above.

- (d) The preparation time to the start of the game shall be within 2 minutes, if it exceeds this, it shall be defeated. However, if there is an application for late arrival by a participant or an agent during the preparation time, we will wait for the participants to be ready. When the preparation time has passed, it will be 1 down and give a red card every 2 minutes thereafter.

#### **Explanation 14**

The match order is listed on the tournament schedule, so be ready at your match venue by the start of the match three matches prior to yours. After you are called, the match proceeds in accordance with the above competition rules.

The progress can be checked by updating the ROBO-ONE site's tournament table in real time.

- (e) The ring has a red corner and a blue corner; the left side of the tournament schedule is red, and the right side is blue. When the schedule is written vertically, the upper is red and the lower is blue.
- (f) There are rules on where participants may stand during the competition to allow spectators to enjoy the technological brilliance and entertainment value of the robots and to record the proceedings for video distribution. During finals matches (not including timeouts) and the prelims, participants must not enter the ring or touch the robots. Touching a robot results in a yellow card.

#### **Explanation 15**

Participants are everyone around the ring, including the people operating or controlling the robots, people participating in teams and other supporters, etc. People other than those controlling the robots may not stand. Also please keep at least 30 cm away from the ring. Please follow the instructions of the referee as to where the contestants stand in the convention venue.

#### **Request for operator's second or supporter**

**Avoid support that could affect the referee's judgment and management.**

**It may be a yellow card.**

## 8 Match Rules

### 8.1 Walking

- (a) If instructed by the referee, the robot must lift the soles of its feet at least 10 mm off the ground and proceed forward, backward, left and right for at least three steps.

If the walking of regulation can't be done, give 1 down and give 2 minutes correction time. If it can't be modified, it will be knocked out. (Refer to explanation 2 in 4.1)

- (b) Robots are not allowed to walk in a crouching position, and the judgment on this is made by the referee.

#### Explanation 16

Walking in a crouching position refers to when the knee joints are at 90 degrees or less, or when crouching with the hip joints open 90 degrees or more left to right. The same applies when two servos are used for the knee joint (see Diagram 10). This is not the limitation for the swing leg.

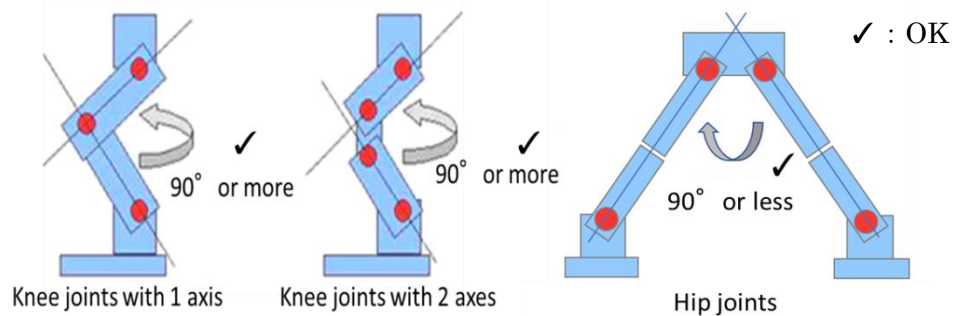


Diagram 10

### 8.2 Match Proceedings

- (a) The referee calls the start of the game "Hajime", the end of the game "Yame", and "Mate" to stop the game. At this time, the referee stops the timer as necessary. To resume, call "Hajime". After the opponent gets down (slipping, standing) and gets up, you can start an attack with a "fight" signal.

- (b) If the opponent goes down, you must leave a distance that does not disturb your opponent's getting up.

#### Explanation 17

Since the same rule is adopted also in ROBO - ONE auto, please be able to detect that opponent is down. It is a yellow card when you disturb opponent's getting up or attack. However, in the case of ROBO - ONE auto, if the opponent gets up, even if there is no instruction of the referee, it is possible to attack. At the time of game restart or at the start of the extension game, depending on the judgment of the judges, there are cases where the robot





is placed at a short distance for easy detection of the position of the opponent.

- (c) When a robot goes down and does not get up after the referee counts to ten, it is a knockout (K.O.), and the other robot is awarded the victory. The count will continue even if the round has ended.
- (d) If robot fall after doing own attack, even opponent go down it is not a "down" but "slip". However, if you can't get up during 10 counts of referee, it will be knocked out. If both sides cannot get up at the same time, an overtime will be held.
- (e) When a robot is knocked down three times during the same match, it is ruled a knockout and victory is awarded to the opponent.
- (f) The match continues even if both robots fall on top of each other due to an attack. However, if the referee judges that it is not possible to continue the match, the robots are placed in the fallen position apart from each other and the count is commenced.

#### **Explanation 18**

Make it possible for your robot to depower at the referee's signal if the two robots become entangled. Build your robot so that the power can be turned off quickly and it can be restarted quickly.

Also, in order to ensure the referee's safety, do not operate your robot without the referee's signal. The penalty is a yellow card. The referee leaves them to move from the intertwined position to the inside of the ring.

In addition, the venue makes a variety of lighting to improve the entertainment quality and make it easier to see. Please take countermeasures for this.

- (g) Do not attack a robot when it has gone down.
- (h) "Give up" may be indicated to the referee during the match. If the referee then judges that the match cannot be continued, a "technical knockout" may be declared.
- (i) In case of crouching with defense, fall prevention etc., it must stand back up within 3 seconds. The robot then may not attack or crouch again until it has taken at least three steps. If there is a violation, the referee will issue a yellow card.

#### **Explanation 19**

Walking in a crouching position refers to when the knee joints are 90 degrees or less, or when crouching with the hip joints open 90 degrees or more left to right. This same applies when two servos are used for the knee joint (see Diagram 10).

See Diagram 10 in Explanation 16.

- (j) If the match rules are broken or there is unsportsmanlike conduct, a yellow card or red card may be issued on the referee's judgment.
- (k) If a part falls off (not including screws), a yellow card is assessed. If the situation is



judged to be dangerous, a red card is assessed, and the participant is ordered to make repairs.

- (l) Time does not stop unless there is indication from the referee.

### 8.3 Rules on Downs

- (a) A robot is ruled “down” only if it falls due to a valid attack.

#### Explanation 20

Attacks should be effective punches or moves that involve grabbing and throwing the opponent.

- (b) If the robot goes out of the ring, it is treated as equivalent to one down.
- (c) If the robot goes out of the ring when standing up after going down due to a valid attack, it does not count as an additional down. If both robots go out of the ring at the same time as an attack, the robot that made the valid attack is not considered down.
- (d) If the robot stops for more than 3 seconds without falling, or if it does not move left and right more than 10 seconds, call "Standing" and if it does not move within 3 counts Then call "Standing down" and start to count from this point. If it cannot move within 10 counts, it will be a technical knockout. Assume that the robot has recovered from "down" when it moves.  
"Standing" is treated as equivalent to slip.
- (e) If the referee judges that a robot has repeatedly slipped intentionally (including falls that do not result in a down or diving in response to an attack, etc.), a yellow card is assessed.

### 8.4 Taking timeouts

- (a) Participants may request that the referee call “time” (a timeout) once per match.
- (b) The referee receives the request, judges the situation in the match and calls the timeout.
- (c) Timeouts must be no longer than 2 minutes.
- (d) When the timeout is called, it is treated as one down.
- (e) The timeout is not recognized if your robot has received a valid attack or during standing down. In the case of slip, timeout can be requested.

#### Explanation 21

For the timing to finish the timeout, priority is given to the call on the side that took the time. So, the side who have not taken must follow this.

### 8.5 Attack rules

#### 8.5-0. What is an effective attack?

An attack that defeats the opponent by an attack action that uses a part of the body such as hands, feet, head, tail, etc. If the own robot defeats the opponent



without falling down, it can be called an effective attack and take down.

### 8.5.1 Crouching attacks

(a) Crouching attacks are prohibited. This is the subject of the yellow card.

#### Explanation 22

“Crouching attack” refers to attacks made in a crouching position, the same as walking in a crouch in Explanation 16.

### 8.5.2 Lateral attacks

(a) Lateral attacks are prohibited. This is the subject of the yellow card.

#### Explanation 23

“Lateral attack” refers to attacks made at  $\pm 45$  degrees in the lateral direction from your robot. Lateral direction is the direction at a right angle from the direction the robot is walking; The walking of the robot must be same as the walking specified by prelims.

The intention to attack in the walking direction includes not only the upper body but the movement of the legs as well.

We will judge the direction orthogonal to the line connecting the yaw axes of both legs and the perpendicular of the ring as the front-back direction of the robot. If there is no yaw axis, it is judged on the pitch axis. See Diagram 12

Whether the attack is effective or not is judged by whether the hit point to the opponent is outside the NG range of plus or minus 45 degrees of yourself. For example, if you hit a hook to the opponent in the front direction, the place you hit is valid if it is out of NG range. Also, if you hit in the NG range in the middle of motion, it will be invalid and will be eligible for yellow card.

A motion that apparently attacks only the NG range in a series of actions is judged to be a side attack and is subject to the yellow card.

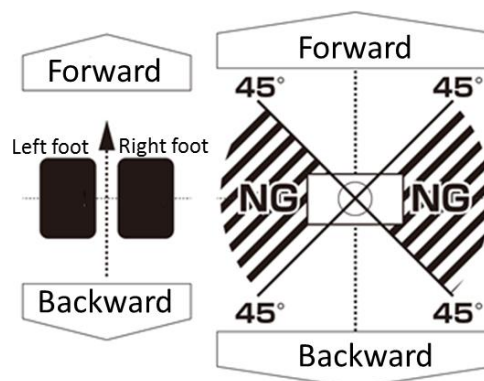
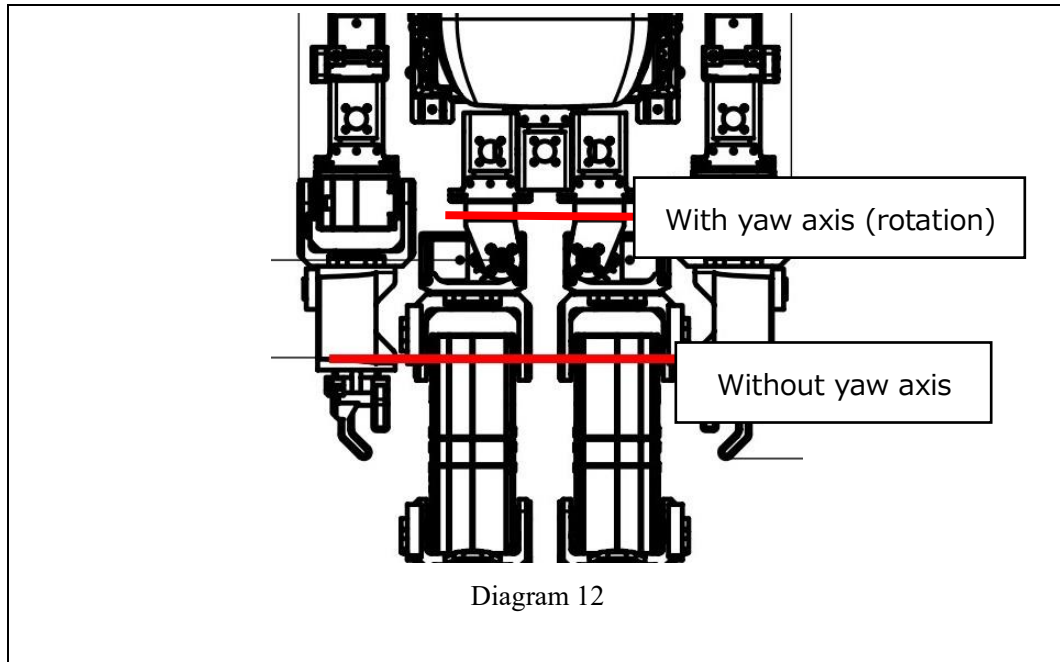


Diagram 11



### 8.5.3 Sacrifice attacks

- (a) Attack moves in which a part of the robot other than the feet touch the ring just before or after attacking the opponent are called “sacrifice attacks,” and It is not a valid attack, it is a slip.
- (b) Even if you defeat the opponent with a valid attack, if your own machine collapses at the same time, it will be slip.

#### **Explanation 24**

Extensive use of slipping and sacrifice attacks will be subject to yellow cards.

When attacking from below, a hand touching the ring, etc. is regarded as intentional. Be aware though that it may also be regarded as a sacrifice attack.

### 8.5.4 Owaza (“bold attack”)

- (a) Attacks to attract spectators are called “Owaza,” or “bold attacks.” Owaza can take up to 2 downs. Owaza decisions are made by the referee, but they require the consent of most judges.
- (b) The attacks that the opponent fly higher than the waist of the own robot is taken as an Owaza.
- (c) If the robot falls your opponent with a kick that is higher than own waist position, it is an Owaza.
- (d) Own robot rotates 180 degrees or more, and the attacks to defeat the opponent during the rotation is Owaza.



- (e) For the Owaza, it is excluded from the lateral attacks and sacrifice attacks. However, crouching attacks are prohibited.
- (f) Owaza with lateral attacks or sacrifice attacks includes overtime, same attacks can be used only once in one game regardless of whether it is valid or invalid.

**Explanation 25**

Owaza are specifically defined as follows with the names commonly used in martial arts. However, they are not limited to these moves; the decision of the referee and judges is given precedence.

In addition, it is necessary that Qwaza must be clearly distinguishable by referee.

Attacks that will be targeted in the left and right front and rear are regarded as the same.

\*Owaza are still not clearly defined and are left up to the judgment of the referee and judges. In the case of a new Owaza, or if the referee cannot make a clear decision, the referee and judges make the decision. The following are "OWAZA" and the number of downs. You should consider the risk that a move may not be recognized as Owaza before taking up the challenge.

- Back-drop -----2 downs
- Shoulder throw -----2 downs
- Leg sweep -----2 downs
- Overhead throw -----2 downs
- Forward rotation kick -----1 down (Backward rotation kick and Side rotation kick are also 1 down)
- High kick -----2 downs

However, it may be 1 down depending on the degree of difficulty of the technique.

**Explanation 26**

If there is a mistake in the judgment of the referee or if you feel doubt about the judgment, please inform the judge (not the referee) when the game stops. For example, it is better to offer after the signal of "waiting" "stop" of the referee. The operator raises his / her hand and in large loud voice please offers the judge "objection".

The judge will stop the watch and deliberate the content. If it is not decided, the judging committee chairperson will finally judge it.

The decision will be confirmed at the end of the match. It will not be covered after that.

There will be more than two judges for fairness.

**• Explanation 27 About C ring**



The same game rules are also applied to the C ring set outside the venue. Also, please use according to the instructions of the safety manager to ensure the safety of participants and visitors.

• **Explanation 28 About ROBO-ONE Kendo**

The competition rules of ROBO-ONE Kendo are summarized in a separate volume. In the future, robot standards will be standardized, so you can easily participate in ROBO-ONE Kendo too.

• **Explanation 29 Signal of referee**

The referee signals for the following purposes. Also, the referee's voice may not be heard, so the gesture has been clarified.

Please remember.

· Start = "Hajime" or "Fight": Signal when starting the game, starting after stopping, starting after waiting.

Raise a palm vertically and lower it from top to bottom.

· Wait = "Mate" or "Wait": Signal for interrupting the game

Point a palm toward the operator or robot and push it forward.

· Stop = "Yame" or "Stop": Sign of the game finish

Open both hands and raise above.

· Fight = "Fight": a cue to encourage fighting. It is also used after getting up from the slip.

Put palms forward and encourage the fight with both hands.

· Down = "Down": In case of falling due to a valid attack

Point with index finger.

· Slip = "Slip": In case of collapse other than effective attack

Put a hand forward and shake left and right twice.

· Standing = "Standing": When stopping in a standing state or judging that it entered closed loop.

Bend the elbow at a right angle and raise your hand.

· Standing Down = "Standing Down": 3 seconds after the call of "Standing".

Same as down, "point with index finger."

· Ring out = "Ring out": When the robot falls off the ring.

Point to the ring side by hand.

· Time out = "Time out": When time approved

Make a letter T with your right and left hand.

· Ready? = "Ready?": To confirm that you are ready

Point to the operator.

· Break = "Break": When instructing to leave 1 m or more.



Put hands forward and open the gap.

- Torque off = "Torque off": When instructing torque off of robot

Open hands and move it down.

- Power off = "Power off": When instructing to turn off the power.

Cross hands.

- Winner Red / Blue Corner = "Winner is red / blue": When declaring a winner

Raise hand on the winner's side.

- Bold attack = "Owaza": declare a bold attack.

Make a letter O with both hands.

- Owaza Failure = "Owaza failure": Declare a failure of a Owaza.

After making the letter O with both hands, shake a hand.

- Stand away = "Stand away": when putting distance by the other's getting up etc.

Same as Break, "Put hands forward and open the gap."

- Walking check = "Walking check": Declare to perform walking check.

After pointing at the robot, pose to walk with two fingers.

- Stand up = "Stand up": Instruct to stand up.

Open both hands and move up from the bottom.