

# RoboJackets LEGO® Sumo Rules

## Introduction

Two robots compete in a head-to-head match following the basic system of traditional human sumo matches. Robots are not allowed to use weapons other than a wedge and are not allowed to flip each other. The sole purpose is a pushing match between the two robots to force the other from the arena.

## Acknowledgements

Rules were modified from <http://robogames.net/rules/all-sumo.php> and we thank them for graciously allowing us to use their rules as a model.

## Definitions:

**Yuhkoh point:** A point

**Dohyo:** Sumo Ring

**Dohyo Interior:** The playing surface surrounded by and including the border line. Anywhere outside this area is called the dohyo exterior.

**Dohyo Exterior:** There should be a space appropriate for the given class outside the outer edge of the ring. This space can be of any color, and can be of any material or shape as long as the basic concepts of these rules are not violated. This area, with the ring in the middle, is to be called the "ring area". Any markings or parts of the ring platform outside the minimum dimensions will also be considered in the ring area.

**Shikiri Lines:** (starting lines) consist of two painted parallel brown (or equivalent for absorption of IR light) lines centered in the ring with appropriate width and spacing for the given class. The separation distance between the lines is measured to their outside edges.

## Robot Requirements

- **Weight:** The weight of the vehicle must not exceed the maximum weight designation for its class.
- **Size:** A robot must fit within a square of the appropriate dimensions for the given class. A robot may expand in size after a match begins, but must not physically separate into pieces, and must remain a single centralized robot. Robots violating these restrictions shall lose the match. ~~Screws, nuts, and other robot parts with a total mass of more than 5 grams falling off from a robot's body shall cause the loss of the match.~~ Pieces may accidentally fall off the robot during regular match play, but no parts should be purposely detached.

- **Power Source:** Vehicles must be electrically powered by 6 AA batteries or the LEGO® rechargeable battery packs.
- **Locomotion Style:** Vehicles must use ground-based locomotion. This includes wheels, treads, legs, etc. At no point should the robot lose contact with the competition field.
- **Motor Limit:** The number of motors should not exceed 4.
- **Control Style:** ~~Robots can be controlled in two different forms~~
  - ~~RC control: The robot is remotely controlled using whatever means necessary.~~
  - **Autonomous control:** Any mode of control can be used as long as it is fully contained in the robot. It cannot receive any external user input other than start signal.
- **Components:** All bots must be made from LEGO Mindstorms parts. There is no restriction on what series of parts you use. For example, both NXT and EV3 and any corresponding parts are legal.
  - Your robot must be made entirely of LEGO-manufactured elements in original factory condition. Paint, tape, glue, oil, etc. are not allowed.
    - Exception 1: LEGO string and tubing may be cut to length.
    - Exception 2: Marker may be used for ownership identification, for marks in hidden areas only.
  - **REGULAR ELEMENTS:**
    - You may use as many non-electric LEGO elements as you like and they may be from any source or set.
      - Exception 1: Factory-made wind-up/pull-back “motors” are not allowed.
      - Exception 2: Pneumatics and spring suspension parts are not allowed.
  - **ELECTRIC ELEMENTS:**
    - You may use as many motors and sensors as your MINDSTORMS™ brick can plug in without modification.
    - You may use any combination LEGO-manufactured Mindstorms or HiTechnic manufactured, Lego certified, sensors.
    - LEGO wires and converter cables are allowed as needed.
- **Physical Constraints:**
  - **Height:** under 50 cm
  - **Width:** less than 23cm
  - **Length:** less than 23cm
  - **Weight:** less than 2.2 lbs (1 kg)

Class	Height (cm)	Width (cm)	Length (cm)	Weight (lbs)
Autonomous and RC	50	15	15	2.2

# Robot Restrictions

- Jamming devices, such as IR LEDs intended to saturate the opponents IR sensors, are not allowed.
- Parts that could break or damage the ring are not allowed. Do not use parts that are intended to damage the opponent's robot or its operator. Normal pushes and bangs are not considered intent to damage.
- Devices that can store liquid, powder, gas or other substances for throwing at the opponent are not allowed.
- Any flaming devices are not allowed.
- Devices that throw things at your opponent are not allowed.
- Sticky substances to improve traction are not allowed. Tires and other components of the robot in contact with the ring must not be able to pick up and hold a standard 3"x5" index card for more than two seconds.
- Devices to increase down force, such as a vacuum pump or magnets, are not allowed.
- All edges, including but not limited to the front scoop, must not be sharp enough to scratch or damage the ring, other robots, or players. In general, edges with a radius of greater than .005", as would be obtained with a unsharpened .010" thick metal strip, should be ok. Judges or competition officials may require edges that they deem too sharp to be covered with a piece of tape.
- Final safety decision will remain with the officials during the competition. If at any point they believe there is a safety risk, the robot will be disqualified even if it meets all of the requirements as stated in these rules.

# Dohyo Specifications

- The ring shall be circular in shape and of the appropriate dimensions for the given size class.
- Shikiri lines (starting lines) consist of two painted parallel brown (or equivalent for absorption of IR light) lines centered in the ring with appropriate width and spacing for the given class. The separation distance between the lines is measured to their outside edges.
- The border line is marked as a white circular ring of a width appropriate for the given class on the outer edge of the playing surface. The ring area extends to the outside edge of this circular line.
- There should be a space appropriate for the given class outside the outer edge of the ring. This space can be of any color, and can be of any material or shape as long as the basic concepts of these rules are not violated. This area, with the ring in the middle, is to be called the "ring area". Any markings or parts of the ring platform outside the minimum dimensions will also be considered in the ring area.
- **Field construction**

- The field will be made out of a sheet of wood with a thickness greater than 1cm.
- The white lines B
  - Behr “ultra pure white”
- The black interior
  - Behr “Black BLACK”
- The Shikiri Lines
  - Behr “Construction Zone”
- Dimensions
  - Dohyo (outer white circle)
    - Height: 2.5 cm
    - Diameter: 77cm
    - Material: Laminate wood
  - Shikiri Lines (orange lines)
    - Width: 1cm
    - Length: 10cm
    - Separation: 10cm
    - Border Width: 2.5cm

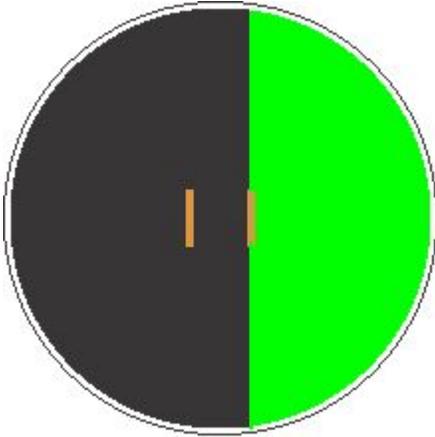


	Dohyo Construction and Painting			Shikiri Lines			
Glass	Height (cm)	Diameter (cm)	Material	Width (cm)	Length (cm)	Separation (cm)	Border Width (cm)
Autonomous and RG	2.5	77.0	Laminate Wood	1	10	10	2.5

# Competition Protocol

- **Operators:** Only a single operator can approach the ring at a time; other team members can watch from the audience viewing area.
- **Match:**
  - One match shall consist of 3 rounds, within a total time of 3 minutes, unless extended by the judges.
    - The time elapsed after the judge announces Yuhkoh and before the match resumes will not count toward the 3 minutes.
    - The time elapsed after a judge announces to stop the match and before the match resumes.
  - The team who wins two rounds or receives two "Yuhkoh" points first, within the time limit, shall win the match. A team receives a "Yuhkoh" point when they win a round. If the time limit is reached before one team can get two "Yuhkoh" points, and one of the teams has received one Yuhkoh point, the team with one Yuhkoh point shall win.
  - When the match is not won by either team within the time limit, an extended match may be fought, during which the team who receives the first Yuhkoh point shall win. Alternatively, the winner/loser of the match may be decided by judges, by means of lots, or by a rematch.
  - One Yuhkoh point shall be given to the winner when the judges' decision was called for or lots were employed.
  - The match shall be stopped and a rematch started under the following conditions
    - The robots are entangled or orbiting each other with no perceivable progress for five seconds, **for example, when the two robots get stuck in a pushing match**. If it is unclear whether progress is being made or not, the judge can extend the time limit for observable progress for up to 30 seconds.
    - Both robots move, without making progress, or stop (at the exact same time) and stay stopped for five seconds without touching each other. However, if one robot stops its movement first, after five seconds it will be declared as not having the will to fight. In this case the opponent shall receive a Yuhkoh, even if the opponent also stops. If both robots are moving and it isn't clear if progress is being made or not, the judge can extend the time limit up to 30 seconds.
    - If both robots touch the outside of the ring at about the same time, and it can not be determined which touched first, a rematch is called.
- **Start:**
  - Upon the judge's instructions, the two teams bow to each other in the outer ring, approach the ring, and place a robot within their half of the ring on or behind the Shikiri line. (A robot or a part of a robot may not be placed beyond the front edge

of the Shikiri line toward the opponent. Note that is not required that a robot be placed directly behind the Shikiri line; it may be offset to the side, as long as it is behind an imaginary line collinear with the Shikiri line.) See below figure, robots can start anywhere in the green area.



- When the judge announces the start of the round, the teams start their robots, and after a five second pause the robots may start operating. During these five seconds, players must clear out of the ring area.
  - The operator can start the robot by whatever means they deem necessary as long as it takes a minimal amount of time
- The match stops and resumes when a judge announces so.
- The match ends when the chief judge announces so. The two teams retrieve the robots from the ring area, and bow.
- **Yuhkoh (points):**
  - One Yuhkoh point will be awarded when
    - A team legally forces the body of the opposing robot to touch the space outside the ring, which includes the side of the ring itself.
    - The opposing robot has touched the space outside the ring on its own.
    - Either of the above takes place at the same time that the end of the Match is announced.
    - When a wheeled robot has fallen over on the ring or in similar conditions, Yuhkoh will not be counted and the match continues.
    - When judges' decision is called for to decide the winner, the following points will be taken into considerations
      - Technical merits in movement and operation of a robot
      - Penalty points during the match
      - Attitude of the players during the match
- Penalties
  - Severe penalties will result in immediate forfeit and the violator will be ordered to clear out and will not be honored with any rights. A severe penalty will be given if

- A player utters insulting words to the opponent or to the judges or puts voice devices in a robot to utter insulting words or writes insulting words on the body of a robot, or performs any insulting action.
- Minor penalties will result in the loss of a Yuhkoh point and will be given out if
  - A part of the player's body is in the ring at the start or during the match.
  - Demand to stop the match without appropriate reasons.
  - Takes more than 30 seconds before resuming the match, unless the judge announces a time extension.
  - Starts operating the robot within five seconds after the chief judge announces the start of the match.
  - Does or says that which disgraces the fairness of the match.

## Revision History

Version	Date	Change Summary
1.0	2018/12/29	Initial Release
1.1	2019/1/22	Narrowed scope to only LEGO robots



