



**ROBOWARS**  
Autonomous Robotics

# Rules & Regulations 2019

Revision 1 – March 9, 2019

Major changes from previous editions

- Rev 1: Behavioural changes allowed between battles of a single match (Section H3e.i)

## A. General Description (non-regulatory)

RoboWars is a sumo robot competition. Competitors pit their robots against each other in one-on-one matches. To win is simple: push your opponent's robot out of the arena. The robots must be fully autonomous: the only decision a human can make during battle is to press the ON switch!

Prizes are to be announced on the day registrations will open.

This document details all rules governing eligibility, robot design, and competition proceedings.

## B. Definitions

- B1. "RoboWars" and "Competition" refers to the RoboWars competition.
- B2. The "Rules" refers to the entirety of the present document. A "Section" of Rules is denoted by a capital letter (e.g. A, B). A "Subsection" is denoted by a letter and number (e.g. A2, B5). An "Item" is denoted by a capital letter, number and lowercase letter (e.g. D1a).
- B3. "We", "our", and "us" refers to IEEE Concordia and/or the RoboWars Committee.
- B4. "You", "your", and "yourself" refer to an eligible RoboWars Robot and its Team.
- B5. "Competitor" refers to an individual entering the Competition.
- B6. "Team" refers to one or more individuals jointly entering a Robot to the Competition. To lighten language within these Rules, a Team may consist of only one Competitor.

- B7. “Staff” and “Staff Member” refers to any on-site person under our direction at the Competition.
- B8. The “Referee” is one or more Staff members responsible for overseeing competition proceedings, supervising Battles, adjudicating and enforcing rules.
- B9. “Random” and “randomly” refers to a non-deterministic decision via software PRNG, random generator services, fair dice roll, fair coin toss or similar, unless otherwise noted.
- B10. A “Battle” is one combat round between two Robots. See G2.
- B11. A “Match” is a set of two or more consecutive Battles between the same two Robots. See G2.
- B12. “e.g.” specifies a non-exhaustive list of examples; “i.e.” specifies a restriction or exhaustive list.
- B13. Further terms are defined in the Rules as needed.

## C. Dates and Deadlines

Important competition dates are listed below. They are referred to by name in the Rules. These dates are subject to change; the most up-to-date details shall always be posted to the RoboWars website <<http://robowars.ca>>, which supersedes information in this Section..

- C1. Early Bird Registration Deadline: Friday, February 1st 2019 at 23:59.
- C2. Late Registration Deadline: Friday, March 1<sup>st</sup>, 2019 at 23:59.
- C3. Design Review: Friday, March 1st 2019 at 23:59.
- C4. Competition: Saturday, 9 March 2019, 10:00 to 18:00, location:  
Concordia University EV Building (lobby)  
1515 Saint-Catherine St W, Montreal, QC

## D. Eligibility and Registration

- D1. Team composition. A Team must:
  - D1a. Consist of one (1) to five (5) eligible Competitors; and
  - D1b. Register and bring exactly one (1) Robot to compete in the Competition.
- D2. **Eligibility of a Competitor.** To compete, an individual must:
  - D2a. Be at least 16 years of age; and
  - D2b. Register to exactly one (1) Team; and
  - D2c. Contribute to the design, construction, and maintenance of exactly one (1) Robot.
- D3. **Prize eligibility.**
  - D3a. In order to be eligible to win a prize, a Team must consist solely of Competitors who:
    - (i) are not members of RoboWars Committee and are not otherwise involved in the organization of the Competition; and this full for the full duration between 1 September 2018 and the Competition Date; and
    - (ii) are not employees or interns of IEEE, the Competition’s sponsors, IEEE Concordia’s sponsors, or a subsidiary thereof, between 1 September 2018 and the Competition Date; and
    - (iii) are not immediate family members (i.e. parent, sibling, spouse, domestic partner, or child) or household members of people falling under (i) and/or (ii).

- D3b. Any Team which does not satisfy prize eligibility criteria may compete, but will not be considered for ranking involved in the determination of prize winners.

#### D4. Registration

- D4a. Every Team must register prior to the Registration Deadline.
- D4b. Teams must register online. Details are available at <<http://robowars.ca>>
- D4c. The entry fee must be paid online for registration to be completed.
- (i) \$10 per Person, until the Early Bird Registration Deadline; or
  - (ii) \$15 per Person, before the (Regular) Registration Deadline.

#### D5. Design Review

- D5a. Competitors may submit a Design Document to the RoboWars committee for review of rule compliance to <[info@robowars.ca](mailto:info@robowars.ca)>.
- D5b. The Design Document must consist of 1 to 2 pages of text and 1 page of figures (separate pages). Figures must be numbered and referenced in the text. The text must describe the physical design of the Robot.
- D5c. A Team may submit up to 2 Design Reviews prior to the Design Review deadline in total. No submissions received after this deadline will be accepted, even if the timestamp of the received message is before the deadline (e.g. due to server outages or delivery delays).
- D5d. We will respond with potential rule violations or other rule problems within 1 week of receiving a Design Document. We will **not** provide design advice or commentary unrelated to rule compliance.
- D5e. Design Review is optional. **Whether or not you submit a Design Review, your Team is solely responsible for ensuring your Robot complies with the Rules.** Any violations that cannot be fixed prior to competing in Battles may disqualify a Robot.
- D5f. All information submitted via Design Review shall be held in strict confidence and accessed only by members of the RoboWars Committee. However, we cannot guarantee data security during transmission (e.g. during email transmission or storage on email servers).

## E. Prizes and Awards

- E1. Details regarding prizes will be released in the coming months, subscribe to the Robowars Newsletter found at [robowars.ca](http://robowars.ca) to receive details as soon as they are released

## F. The Arena

- F1. The arena is a circular ring 150 cm in diameter made of medium-density fibreboard (MDF), sitting approximately 2 to 3 cm above ground level.
- F2. The arena surface is painted gloss black, with a white 2 in. border along its periphery.
- F3. The arena surface is generally smooth but may have small irregularities. These may include a join along a diameter, if the arena is constructed from several pieces.
- F4. An opaque wall between 30 and 60 cm in height is placed around the arena, at no less than 160cm from its edge. During a Battle, no person or object may be within this wall.

## G. Competition Procedure

### G1. Tournament organization

- G1a. All Teams are randomly divided into one or more Pools.
- G1b. Each Pool plays a Round Robin phase. Match wins are tallied for each Team.
- G1c. All Teams will advance to a double-elimination phase or, if insufficient time is available, a single-elimination phase (at our sole discretion). The first round shall pair Teams from different Pools with opposed Match Point rankings within their respective pools (e.g. first of Pool #1 to last of Pool #2). Byes, if necessary, will be assigned at random.
- G1d. If there are less than six (6) Teams participating, the competition will consist only of a Round Robin tournament. Ranking is determined by each Team's total Match wins.
- G1e. If a tie prevents the determination of advancement to the next phase or the determination of ranking, a tie-breaker Match is held. This Match does not award any Match win points to any Teams, but only decides advancement or ranking.

### G2. Battles and Matches

- G2a. A Match consists up to three (3) Battles in which the same two (2) Robots compete against each other.
- G2b. A Battle is a single contest between two (2) Robots, which ends when one Robot prevails or the time limit is reached. This is governed by G4.

### G3. Pre-Match Procedure

- G3a. At the beginning of a Match, the two competing Teams are announced.
- G3b. Both Teams must be present and ready for the first battle within two (2) minutes of the first announcement. A Team's failure to appear within this time frame is considered a forfeiture of the Match. Additional delay may be permitted at the Referee's discretion.

### G4. Match procedure

- G4a. All Battles within a single Match shall be held consecutively. Each Team must be ready for each subsequent Battle immediately or forfeit the match.
- G4b. If a Robot requires maintenance (as restricted by H3e) between the Battles of a Match, they shall inform the Referee.
  - (i) Ninety (90) seconds is allotted to each Team **cumulatively for the entire Match**.
  - (ii) A Team who is waiting for the opposing Team to perform maintenance, but are not performing maintenance themselves, will not have that time counted against their own total maintenance allotment.
  - (iii) Additional delay may be permitted at the Referee's discretion, which shall always be granted to both Teams' cumulative permitted time in equal amounts.

### G5. Battles

- G5a. Before each Battle, the Referee randomly determines the starting position of each Robot. Position consists of two elements, Location and Orientation:
  - (i) Location: Each Robot is placed in one of the four quadrants of the arena, 15 cm from the edge of the arena radially.
  - (ii) Orientation: The front, left, back or right of the Robot faces the centre of the arena. To accommodate oddly shaped Robots, these orientations are defined at 90-degree angles from the front of the Robot.

- G5b. When both Robots are ready, and a Competitor from each Team is on standby near their Robot, the Referee shall signal the start of the Match. The Competitors may then activate the Robot (e.g. by physically switching an on-off switch).
- G5c. The Robots must not move within the first three (3) seconds after being activated.
- G5d. Competitors must move outside the arena wall within the three-second delay.
- G5e. The Battle shall end when any of the following conditions occur.
- (i) EARLY START: A Robot moves prior to the initial delay in G5c.
  - (ii) INTERFERENCE: A Competitor from a Robot's Team, or any part of their body, is in the arena wall during a Battle, starting from the end of the delay in G5c, and until the Referee permits Competitors to re-enter.
  - (iii) OUT OF ARENA: A Robot is a) more than 75% of the Robot area is off the arena surface, from a top view; or b) any part of the Robot has touched the floor outside the Arena. A Robot whose body is hanging off the arena, but not meeting this definition, is not considered out of the Arena.
  - (iv) INCAPACITATION: A Robot is incapable of moving itself to a different position in the arena for ten (10) seconds consecutively or when the time limit is reached.
  - (v) DEADLOCK: Both Robots are stuck in an entanglement or deadlock for ten (10) seconds consecutively or when the time limit is reached—for example, a lack of movement or a lack of change in the contact or engagement with the opposing Robot. In this situation, both Robots have Lost the Battle.
  - (vi) TIME LIMIT: Sixty (60) seconds have elapsed since the beginning of the Battle. In this situation, both Robots have Lost the Battle, unless a previous end condition applies when the time limit is reached.
- G5f. Competitors must not enter the arena, even after the end of the Battle, until permitted by the Referee. This is required to verify Strong/Weak Win scenarios (see G6).
- G5g. At the end of each Battle, the competing Teams are responsible for cleaning the ring and ensuring it is ready for the next Battle to the satisfaction of the Referee.
- G5h. All judgements shall be pronounced by the Referee(s) at their own discretion. A Battle's Competitors may appeal a judgement immediately following its pronouncement and prior to any further Battle. Decisions on appeals are left to Referee discretion.
- G5i. In the case of ambiguity during a Battle, a Referee may choose to allow the Battle to continue and retroactively make a judgement on an earlier situation within the same Battle, after inquiry or deliberations.

## G6. Scoring of Battles and Matches

- G6a. At the end of each Battle, Battle Points are awarded to each Team as defined below. Battle Points are **not** accumulated throughout the tournament, but only within each Match.
- (i) LOST (0 points): A Robot has lost the Battle if it is the first to cause the end of the battle, according to G5e, unless otherwise noted in that Item.
  - (ii) STRONG WIN (3 points): A Robot has a strong win if it is not the first to cause the end of the Battle according to G5e and **clearly** does not satisfy any end condition (excluding time delays) within the three (3) seconds after the end of the Battle.
  - (iii) WEAK WIN (1 point): A Robot has a weak win if it has not lost but does not have a strong win.
- G6b. At the end of a Match, the Battle Points from the three (3) Battles of the Match are tallied for each Team.

- (i) The Team with the most Battle Points is declared the winner of the Match.
- (ii) If both Teams are tied in Battle Points, **neither** Team wins the Match.
- (iii) If, at the end of the second (2nd) Battle of a Match, one Team is leading by four (4) or more points, then the third (3rd) Battle may be skipped at the Referee's discretion.

## H. Robot Specifications

You must build and enter one pre-constructed, fully autonomous Robot whose purpose is to push, throw, flip, drag or otherwise move your opponent out of an arena. The following section details all rules and specifications regarding this Robot; please be sure to read them carefully and refer to them as you design your robot.

- H1. **Definition of a Robot:** Robots must have a mechanism of autonomous locomotion and be capable of a taking various actions (like turning, stopping, moving forward) which appear to serve the goal of winning a Battle. Unassembled components, a pile of bricks, or an entry that is incapable of powering on do not meet this definition. A Robot which fails to meet this definition, and for which this situation cannot be rectified, shall be disqualified.
- H2. **Technical Inspection**
  - H2a. Robots must pass a Technical Inspection by Staff prior to competing in a Battle.
  - H2b. Inspection may require that the Team demonstrate, explain or justify aspects of the design as they relate to safety, security or compliance to any and all Rules.
  - H2c. **A Material Change** (see H3) **requires the Robot to pass the Technical Inspection again.** A Behavioural Change or Repair does not require this.
  - H2d. If a safety or other problem is identified in the course of the Competition, and the Team is informed of the need to rectify this problem, the Robot must pass the Technical Inspection again, even if it had previously passed.
  - H2e. The Robot belonging to the First, Second and Third place prize-winning Teams will be inspected following their last match, and their ranking is conditional on passing this inspection. Changes to the Robot between the last match and this inspection may result in disqualification.
  - H2f. Robots that fail technical inspection may not compete until the Team addresses all identified problems and passes a re-inspection. There are no limits on the number of re-inspections; however, as soon as a Team fails, inspecting Staff members will move to the next Robot to be inspected. This rule does not extend or invalidate any time limits during the course of the Competition—the Team must still adhere to time limits when requiring an inspection, and additional time remains at the Referee's discretion.
- H3. **Robot maintenance**
  - H3a. A “Material Change” is any physical change to the Robot that substantially alters its shape, weight, functionality, performance, etc. This includes any substitution of a part for a non-identical part and changing field-configurable elements to activate or deactivate hardware currently present on the Robot.
  - H3b. A “Behavioural Change” is any change that alters the Robot's behaviour and decision-making during a Battle, e.g. uploading firmware or similar for the Robot's processor, or changing a field-configurable element (e.g. switch) to alter behaviour.

- H3c. A “Repair” is any physical change that serves to restore a Robot to a functional state, as presented at the last Technical Inspection. This may, for example, consist of replacing a part with an identical part; using glue, tape, screws or other means of repairing chassis damage; or calibrating existing parts.
- H3d. **Between Matches**, Teams may maintain their Robots and perform:
- (i) Material Changes. A Technical Inspection is required after any Material Change before the Robot may enter a Battle.
  - (ii) Behavioural Changes. No additional Technical Inspection is required.
  - (iii) Repairs. No additional Technical Inspection is required.
- H3e. **Between Battles of a Match**, Teams may maintain their Robot subject to the restrictions:
- (i) Only Repairs and Behavioural Change may be performed. No Material Change may be performed, and no Technical Inspection will be performed.
  - (ii) Exception: For safety issues (e.g. sharp edges due to breakage), a Repair may be performed. **Time limits are still enforced.** In this case, a brief Technical Inspection will be performed by Staff to inspect the identified safety issues only (no Material Changes will be permitted). This Technical Inspection will not count towards time limits.
  - (iii) Failure to abide by this Item shall result in forfeiture of the Match.
  - (iv) Additional time may be granted at the Referee’s discretion.
- H3f. The Referee and other Staff members may supervise maintenance work and make inquiries with regard to the nature of maintenance tasks being performed.

H3g. **A Robot may only be maintained or manipulated by the Robot's Team members.**

- (i) If a person (Competitor or not) manipulates or alters a Robot not entered by that person's Team, that Team may be disqualified or that person may be asked to leave.
- (ii) Any Team who allows a non-Team member to maintain or manipulate their Robot may be disqualified. (If a Team requires mechanical assistance, e.g. extra hands to hold a part, they may request a Staff member's assistance.)

**H4. Safety hazards**

- H4a. The determination of what constitutes a safety hazard, per these rules, is left to Staff discretion. Any hazards to any person or Robot, or to the venue itself and its contents, not in these Rules but identified during the course of the Competition may also cause additional rules to be put into place provided it is announced to all participants.
- H4b. Staff may, at their discretion, require that any safety hazards to any person, Robot, or object at the venue be addressed. This may include requiring the full removal of the components posing the hazard, disqualification of a Robot if a danger cannot or will not be addressed adequately, and removal of materials or persons from the premises.

**H5. Size constraints**

- H5a. At the start of a Battle, a Robot in its starting position (see G5a) must fit within a box 20 cm wide by 20 cm long by 30 cm high. There are no size constraints once a Battle has begun.
- H5b. The Robots must weigh 3 kg or less. Any material used to add weight to the Robot (ballast) must be properly secured. Loose aggregates (sand, ball bearings, lead shot, etc.) are not permitted. Lead weights must be fully encapsulated.

**H6. Design generalities**

- H6a. The Robot must have a "Front Side". The Front Side must be visually identifiable and cannot change throughout the Competition. It has no further requirements.
- H6b. Robots may not interact with any person or object outside the arena.
- H6c. The Robot must not have switches, jumpers, potentiometers or other field-configurable elements (for example, a switch that alters strategy or behaviour), except:
- (i) One (1) mechanical switch or button, which powers on and/or activates the Robot at the beginning of a Battle. For this purpose, other **mechanical** devices may be permitted but must be cleared with us prior to the Competition. **Other means of activating the Robot (e.g. a wireless toggle) are not permitted.**
  - (ii) Elements contained in a chassis such as to be inaccessible before the beginning of a Battle. Altering them must comply with the Maintenance subsection H3.
- H6d. The Robot must be completely autonomous and self-contained.
- (i) A Robot cannot have any external source of communication, control or feedback (e.g. wireless connection to a handheld controller, external computer or mobile device; infrared receiver).
  - (ii) Exception: The Robot may have **wired** communication interfaces, if and only if connections exterior to the Robot are physically disconnected during a Battle.
- H6e. The Robot must not contain any combustible, corrosive, or other substances which may pose a hazard to any person, Robot or object.
- (i) Exceptions: Batteries are permitted per H11. However, lithium batteries have additional restrictions defined in H12.



## H7. Weapons.

- H7a. No weapons are permitted. Weapons are defined as any implement that may present a risk to any person handling the Robot, a risk of damage to another Robot during battle, or a risk of damage to the venue and the objects contained therein. This may include, but is not limited to, blades, spikes, fire, blunt hitting implements, or EMPs.
- H7b. No object or part of the Robot may intentionally detach from the Robot. In particular, it is not permitted to use any kind of projectile, to deposit traps or obstacles on the arena, nor deploy any object which is attached to the Robot by means of a slack string, chain, or other non-rigid connection.
- H7c. Mechanisms intended to lift, flip, thrust or otherwise move Robots are permitted provided they do not present undue risk to any Robot or person. Per this Item, it is specifically forbidden for such mechanisms to be capable of launching a 3 kg robot fully in the air (not touching the arena surface or opposing robot). Forklift points, wedges and other sharp edges are not permitted unless sufficiently blunted or rounded. Spring-loaded mechanisms should be carefully designed and may receive additional scrutiny.
- H7d. Parts that break off unintentionally (e.g. due to breakage), or appear to be at risk of doing so, may be considered safety hazards and weapons at the discretion of a Referee or a Staff member performing a Technical Inspection. (This will generally only occur if it is considered a high risk or happens repeatedly. Teams will be given an opportunity to rectify the situation in this case.) **Teams are expected to minimise the risk of breakage and unintentional detachment to people, Robots, the arena and equipment.**
- H7e. No excessively sharpened edges may be present on The Robot, this will be at the discretion of the judges and will be addressed as a Safety Hazard as described in section H4

## H8. Pneumatic systems

- H8a. Low-energy pneumatic systems are permitted.
- H8b. Any part of the Robot handling compressed air must be rated at least 40% above the peak pressure that can be present in the pneumatic system. This must be documented and verifiable at the Competition.
- H8c. No part of the system may use pressure above 50 psi. This must be visually demonstrable.

## H9. Hydraulic systems of any sort are prohibited.

- H10. Robots may not intentionally or severely damage the field. Damage includes, but is not limited to, fouling (leakage of oil, glue or other fluids), gouging, galling, puncturing, denting or scuffing.
- H10a. Rubber cast off from Robot tires is excluded from this rule.
- H10b. Damage that occurs or is at undue risk of occurring may be considered a safety hazard.

## H11. Batteries.

- H11a. Batteries must be secured such that they will not fall out in the event of mechanical shock, or if the Robot is placed in any orientation (e.g. upside-down). **Lithium batteries must additionally adhere to H12.**
- H11b. Contestants are encouraged to install a fuse, PTC or other current-limiting fail-safe set to a safe current value. **Lithium batteries must adhere to H12.**
- H11c. Batteries must be commercially purchased and in good condition. Leaking, bulging or otherwise damaged batteries are considered safety hazards.

H12. **Lithium battery restrictions:** Contestants using lithium battery technology of any type must, for safety reasons, meet the following requirements **in addition to H1 1:**

H12a. A fuse must be installed. It must:

- (i) Be any conventionally accepted device for limiting fault currents (e.g. fuse or resettable fuse/PTC, small circuit breakers).
- (ii) Interrupt current through all batteries on the system if blown. It is encouraged to use separate fuses for different batteries, or multiple fail-safe measures.
- (iii) Of a reasonable and justifiable value and speed to interrupt fault currents.
- (iv) Be removable, detachable or otherwise safely demonstrable that a “blown” (removed) fuse safely disables the passage of current from the battery.

H12b. The battery compartment must be free of sharp points and edges that risk puncturing the battery. Furthermore, the battery must be protected from any impact, crushing, piercing, slashing or other damage that may occur during a match.

H12c. Lithium batteries may only be charged using a charger designed for that purpose. A Team member must supervise a charging battery at all times. “Battery bunkers” or fireproof charging envelopes are highly recommended.

## I. Liability and Personal Conduct

### I1. Personal conduct

I1a. Competitors are expected to demonstrate respect and good sportsmanship towards fellow Competitors, Staff, these parties’ possessions and the venue.

I1b. Competitors are required to follow Staff instructions in regard to safety, acceptable conduct, or any other instructions to ensure orderly Competition proceedings.

I1c. Any Competitor who fails to follow such instructions faces penalties which may include verbal warnings, Match forfeiture, disqualification, or removal from the premises.

### I2. Liability

I2a. We shall endeavour to ensure the personal safety of our Competitors and audience, and the safety of personal property and equipment. However, we make no guarantees in this respect and will not accept liability for any personal or material injuries or damages to the maximum extent permitted by law.

I2b. Competitors are expected to respect the venue and venue property, and may be held liable in the event of damages to the venue or venue property.

I2c. Competitors assume all responsibility for the protection of any confidential information and/or intellectual property to which they have access during the course of their participating in this Competition.

I3. Copyrights: Competitors agree to grant IEEE Concordia permission to use, modify, publish, or distribute all photographs, videos, recordings or other media containing the Competitor’s likeness and that of their Robot and taken by IEEE Concordia, or any entity authorized to record such media on IEEE Concordia’s behalf, during the course of the Competition, through any and all distribution media. Competitors agree to assign any applicable copyrights for all such media to IEEE Concordia.