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RoboFetz

RULES

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0 Introduction

The goal of the RoboFetz event is to provide a thrilling and safe experience for the students of TU Wien. The following pages detail the design, build requirements, and restrictions all combat robots must comply with. The organizers reserve the right to allow exceptions to these rules in special, justified cases. For any questions about the rules, please use the following contact information:

info@robofetz.at

1 Rules

1.1 Weight Limits

Robots are classified into one of three weight classes based on their drive system or weapon type. However, combat is **not** separated by class, meaning any robot can be matched against any other. Only a single weight bonus can be awarded; bonuses from different categories do not stack.

Overview weight classes:

Class	Beer Can (515g)	Wine Bottle (775g)	Double (1030g)
Type	• Regular bots	• Flipper or grabber • Driller or heat weapons • Overhead saw • Shuffler or melty brains	• Bots with alternative locomotion • Hammer or punching bots • Autonomous bots

We encourage all participants to discuss their design concept with the RoboFetz team and explain how their robot qualifies for a weight bonus. The classification criteria are as follows:

- **Regular bots**
  The standard weight limit is 515g, the equivalent to a standard can of beer. Any robot that doesn't fit into one of the other bonus categories is considered a regular bot.
- **Flipper**
  Robots that use pneumatics, hydraulics, or springs to launch opponents into the air qualify for a higher weight limit of 775g (1.5x the standard weight). A bot that only slowly lifts and then throws an opponent out of the arena does not count as a Flipper.
- **Grabber**
  A Grabber must have at least two grappling arms to manipulate its opponent. These arms are moved in a targeted and remote-controlled manner. To qualify for the 775g weight bonus, a Grabber must either be able to lift an opponent out of the arena or use a secondary weapon system in combination with its arms to inflict damage.
- **Driller or heat weapons**
  These bots use a drill or a soldering iron-like heating element to damage opponents by cutting or melting through their armor. Robots in this category have a maximum weight of 775g.

- **Overhead saw**
  This category is for bots with a high-speed spinning weapon mounted on a movable arm. Controlled movements of the arm allow the spinning weapon to strike the opponent. which is used to strike down onto an opponent. The weight of overhead saw bots is limited to 775g.

- **Shuffler**
  Shufflers use a simple, non-wheeled method of movement based on translational motion. Typically, this involves crankshaft-driven blocks that ensure the robot's movement. Because this is considered a simple alternative drive, they receive weight bonus of up to 775g. The blocks differ significantly from regular feet.

- **Melty brains**
  A Melty Brain is a bot that uses translational drift for locomotion, meaning the entire robot spins as a weapon. By precisely controlling its drive motors, the bot can be steered accurately around the arena. Melty Brains are limited to 775g and must not have any non-rotating parts. Full control must be demonstrable at all times.

- **Bots with alternative locomotion**
  Robots using a complex drive system other than electrically driven wheels, tracks, or a simple shuffler mechanism can weigh up to twice the standard limit (1030g). This category includes robots like walkers, bristle bots, hovercrafts, and pneumatic-driven bots.

- **Hammer or punching bots**
  A Hammer Bot features a swinging, hammer-like weapon that can strike from the side or above and has no continuously rotating parts.
  A Punching Bot uses a stabbing or piercing weapon, which can penetrate the opponent’s armor by means of rapid movement of the weapon.
  Both robot types create damage like dents and holes and have a maximum weight of 1030g.

- **Autonomous bots**
  An autonomous bot must navigate, identify, and attack its opponent without any human input. Its behavior must be based on intelligent algorithms and sensor data (e.g., distance sensors, image recognition) to track, react, or avoid obstacles. Random movements or purely time-based patterns are not considered sufficiently autonomous.
  A remote-controlled, manually operated kill switch that immediately cuts all power is mandatory. In addition, a separate combat mode switch must be used to enable autonomous operation only after activation, the implementation can be software-based. The maximum permissible weight for an autonomous bot is 1030g.

1.2 Mobility

Each robot must be equipped with a drive system that provides precise and reliable control of the robot via a remote control. The robot must remain fully controllable even when its weapon is active. Autonomous functions may be added in addition to the remote control. The drive system must not cause any damage to the arena.
Entering the arena without a functional drive system will result in an immediate forfeiture of the match.

1.3 Materials

All robot parts must be 3D printed using only the following materials: PLA, PLA+, PETG, TPU, or 3D-printed resin. Exceptions to this rule are outlined in section 2. The use of special PLA variants must be discussed with and approved by the RoboFetz team prior to the event.

1.4 Weapon

Every bot must have a weapon. A weapon is defined as any system designed to inflict damage through significant kinetic energy or other destructive means. The drive system itself can be classified as a weapon if it is capable of causing substantial damage. Additionally, any mechanism designed to eject an opponent from the arena qualifies as a weapon.
Entering the arena without a functional weapon will result in an immediate forfeiture of the match.

1.5 Multiple weapons

Robots are allowed to have more than one weapon system. However, to qualify for a weight bonus based on its primary weapon, that weapon must account for at least two-thirds (2/3) of the total weight of all materials used in the robot's weaponry, that are not PLA, PLA+, PETG, TPU or resin. No extra weight allowance is given for a secondary weapon. Only a single weight bonus can be applied; bonuses from different categories do not stack.
A robot is still permitted to compete as long as at least one of its weapon systems is functional. However, fighting with a disabled weapon system will automatically result in a "massive damage" score from the judges.

1.6 Prohibited weapons

The maximum allowed voltage used for the weapon systems is 16V (4-cell LiPo), lower operating voltages are permitted.
Heat, electrical, or chemical weapons are prohibited, an exception is made for approved soldering lances. Devices designed to jam or disable an opponent's drive or control systems, such as nets, glues, or signal jammers are also not allowed. The use of any liquids, liquefied gases, liquid nitrogen, smoke bombs and lasers is prohibited.

1.7 External aids

Robots are permitted to use off-board systems for gathering information during a match, such as an external camera or a laptop running control software. This external equipment does not count towards the robot's weight limit. All off-board components must remain outside the arena's combat area and be designed for quick setup and removal between matches.

1.8 Safety

All robots must have an on-off switch. A failsafe is required to automatically deactivate any active weapons if the remote control signal is lost. The provided remote control and weapon ESC already include this feature. For autonomous bots, the remote kill switch must be armed and ready while the robot is powered on.

Furthermore, a robust mechanical lock must be used to secure each weapon when the robot is outside the arena. This weapon lock must physically prevent the weapon from activating or spinning up. It can be a pin, clamp, or other custom-made device. Generally, a weapon lock must be used whenever your robot’s weapon system and batteries are installed. Weapon locks may only be removed immediately before a match or a functional test inside the arena or test box. It must be re-installed immediately after the match or test. Removable locking devices do not count towards the robot's total weight.

The robot's battery and any onboard pressure vessels must be adequately protected.

1.9 Activation

Activating a robot's weapon system is strictly prohibited outside of the designated areas (arena or test box). Failure to comply with this rule will result in immediate disqualification.

For autonomous bots, combat mode must only be engaged after the arena is securely closed.

The safety of all concerned must be considered at all times, during the design, testing, any build or preparation sessions, the main event and any other activity involving a combat robot.

1.10 Pneumatics

The pneumatic system must use best practices, and all components must be designed for the operating pressures used.

1.11 Multi-Bots

A team may split their total weight allowance across multiple smaller robots. Each individual robot in a multi-bot team must meet the requirements for mobility, weaponry and safety. Only bots that are fully compliant on their own will be allowed to compete. The bots can be controlled by different drivers.

1.12 Decoration

Bots can have additional decoration that increases the robot's weight over the limit, subject to the following:

- The bot without the decoration cannot weigh over the 515g, 775g or 1030g limit
- The decoration itself cannot weigh more than 20g
- The decoration cannot protect the robot or serve as a weapon
- The decoration must be easy to remove
- The decoration cannot easily become a fouling hazard
- Any opposing team has the right to require removal of the decoration

2 Exceptions

As a primary rule, all robots must be constructed entirely from 3D printed materials (PLA, PLA+, PETG, TPU, or Resin). However, the components listed below are exempt and may be made from other materials. If you have an idea for an item not on this list, you must get approval from the organizers.

- Weapons: up to a total of 150g of other materials (see 2.1 for details)
- Axels and shafts
- Screws, nuts, and threaded inserts used for assembly
- Bearings
- All components from the provided electronics kit
- Other miscellaneous electrical components
- Pneumatic components
- Wires
- Springs
- Wheels and tracks
- Power transmission components (gears, belts, etc.)
- Adhesives, tape and zip ties, provided they are used for assembly and not as an external armor coating
- Decorative elements like LEDs and paint (see 1.12 Decoration)

This exemption list is not a loophole for creating armor. Using exempt components (like screw heads or pneumatic fittings) in a way that primarily serves to reinforce the robot's armor is forbidden. If a component could be replaced by a PLA part without significantly compromising the functionality of the drive, the weapon, or the structural integrity of the robot, it must be 3D printed.
The use of materials that can release toxic gases or carcinogenic dust when damaged (e.g., carbon fiber, asbestos) is prohibited.

2.1 Weapon materials

To ensure weapons are effective and durable, a bot’s weapon may be made of materials other than 3D-printed ones. The rotating or translationally moving parts of the weapon may contain **up to 150g of materials other than PLA, PLA+, PETG, TPU or resin**. The weight of weapon motors does not count towards this 150g limit. The 150g limit is the total allowance for one robot, even if it has multiple weapon systems.

3 Rule clarification and examples

This section clarifies key terms, robot types, and specific rules. The goal is to illustrate how the rules are applied in practice, helping teams avoid common pitfalls during design and construction.

3.1 What constitutes a “weapon system”

To define the scope of the 150g material allowance, let's use a driller bot as an example. The bot has a drill mounted on an arm, which a servo presses down onto the opponent.
In this case, the entire assembly - the arm and the drill bit - is considered a single weapon system. This means the arm can also be made of metal to increase its stability, as long as the total weight of all metal parts in the assembly does not exceed the 150g allowance. The weight of the drill motor and the servo do not count towards this 150g limit.

3.2 Qualifying for a weight bonus

To illustrate how the weight bonus is determined, let's use the example of a punching bot that also has two grappling arms to hold an opponent and thereby deliver better stabs. The grappling arms and the punching weapon are two separate weapon systems. A weapon system is considered the "primary weapon" if it accounts for at least two-thirds of the total non-printed material used for weaponry.

- **Classification as a punching bot**
  The punching weapon is made of 100g of metal, and the grappling arms use 50g. Since the puncher accounts for two-thirds of the total weapon metal, it is the primary weapon. This robot is classified as a punching bot and qualifies for the 1030g weight limit.

- **Classification as a grabber**
  The grappling arms are made of 100g of metal, and the puncher uses the remaining 50g. Here, the grabbers are the primary weapon, so the bot is classified as a grabber.

- **Classification as a regular bot**
  The grappling arms use 75g of metal, and the puncher uses 50g. Neither weapon meets the 2/3 threshold to be considered the primary weapon. Therefore, this robot has no primary weapon and is classified as a regular bot with no weight bonus.

- **Requirements for weapons**
  If the grappling arms are on the opposite side of the robot and do not directly support the punching weapon, they must function as a weapon on their own. To be made of metal, either as a primary or secondary weapon, the arms must be capable of lifting an

opponent out of the arena. If they cannot, they do not meet the requirements of a grabber weapon system and must be made entirely from allowed 3D-printed material.

3.3 Competing with a broken weapon

A robot may compete in battles as long as it has at least one functional weapon system.

- **Single weapon robots**
  If a robot's only weapon fails, it can no longer compete and will forfeit the match.
- **Multi-weapon robots**
  If one of several weapons fails, the robot can still compete, but with one critical condition: the remaining functional weapon must still qualify as a weapon on its own, i.e., it must be able to inflict significant damage or lift an opponent out of the arena.
- **Impact on judging**
  Competing with a disabled weapon will automatically result in a "massive damage" score from the judges.
- **Example scenario**
  A robot has grappling arms (primary weapon) and a drill (secondary weapon). The grabbers are broken beyond repair, but the drill is fully functional and can damage an opponent by itself.
  This robot is allowed to compete, but it will automatically receive "massive damage" in the judges' scoring.

Please note: No reinforcing modifications may be made retrospectively, e.g., upgrading a secondary weapon after the primary weapon has failed.

4 Tournament

4.1 Disclaimer

The RoboFetz team reserves the right to disqualify any team from the tournament at any time, for any reason, at their sole discretion. This includes, but is not limited to, failure to meet safety or technical requirements.

4.2 Tournament format

Matches will primarily be 1-on-1 duels. In some cases, depending on the tournament structure, multi-bot rumbles may occur. The tournament may include a group stage followed by a single-elimination knockout stage. The final format will be announced well in advance of the event. The organizers reserve the right to make changes to the schedule on short notice to accommodate delays or other unforeseen circumstances.

4.3 Match duration and judging

A match lasts for 3 minutes but can end early by knockout. If there is no knockout after 3 minutes, the match will go to a judges' decision. A panel of judges will score the match based on specific criteria, including Damage, Aggression, and Control. Full details on the scoring system can be found in the official judges' guide.

4.4 Repairs

Teams are permitted to repair their robots between matches, including swapping out components with spare parts. However, the robot must remain recognizable as the same machine. All spare parts used for repairs must have also passed the initial technical inspection.

4.5 Technical inspection

Before being cleared to compete, every robot must pass a technical inspection. This check will verify its weight, on-off switch, failsafe functionality, and the weapon lock. Teams must present their robot for inspection early enough to allow time to fix any potential issues.

4.6 Match start

Matches will take place at scheduled times, which will be communicated to the teams in advance. If a team is not ready to compete within 3 minutes of being called, they will forfeit the match. To be eligible to start a match, a robot must have a functional drive system and at least one functional weapon; otherwise, it is an automatic loss.