

**NH  
RL**

**BOT**  
**BOT DESIGN**  
**DESIGN**



230118

# WEIGHT CLASSES

NHRL offers 3 different weight classes to compete in; 3lb, 12lb and 30lb. All robots must be at or below the maximum weight listed for their respective weight class at the start of the fight. In any given class, additional weight allowances may be allotted to entrants that meet certain criteria.

## NON-TRADITIONAL MOTION BONUS

Any robot that falls outside the definition of a “Traditional Motion System” qualifies for the Non-Traditional Motion Bonus. NHRL classifies Traditional Motion Systems as a robot that relies on rotational motion of a component in contact with the ground as its method of locomotion around the arena. This includes all forms of wheels (round, non-circular, spoked, or offset axis) as well as continuous tread, track or belt driven systems. This also includes any robot that uses unpowered rotating objects (wheels, drums, rollers, ball bearings, etc.) as a means of friction reduction with the ground.

## MULTIBOT BONUS

Any competitor with multiple independent robots fighting under a single name qualifies for the Multibot Bonus. Each bot in a Multibot must have independent active control and be capable of influencing the fight. Only the heaviest bot in a multibot must have an active weapon. Additionally, for a multibot to benefit from the Non-Traditional Locomotion Bonus, only the heaviest segment of the bot needs to meet the criterion to qualify for the weight bonus.

The weight of any segment of a multibot may not exceed 110% of the ‘base weight’ for its respective weight class, except in the beetleweight class. If the bot also qualifies for the Non-Traditional Locomotion Bonus, the additional weight may also be factored into the base weight.

For example, the heaviest segment of a 12 pound multibot may not exceed 13.2 lbs. However, if the robot also qualifies for the shuffler weight bonus, the maximum weight of the heaviest segment increases to 19.8 lbs (18lbs x 110%).

Competitors may choose to forgo their multibot bonus so long as their robot still meets the base weight for their weight class.

Any active cameras or recording equipment on the bot do not count towards the robot’s weight, but must be approved during safety inspection by an event organizer or head referee.

Weight Class	Non-Traditional Locomotion	Multibot	Absolute Maximum
3lb	+2 pounds	+1 pounds	6 pounds total
12lb	+6 pounds	+3 pounds	21 pounds total
30lb	15 lbs	+8 pounds	53 pounds total



# BATTERIES AND POWER

Bots must have an easily accessible master power cutoff in the form of a switch or removable link. The power cutoff must be accessible without disassembling the robot in any way. The power cutoff must be able to be deactivated in no more than 15 seconds.

Nominal battery voltage may not exceed 60 volts for 3lb bots, or 75 volts for 12lb and 30lb bots. It is understood that a fully charged battery pack will have an initial voltage above its nominal Voltage.

Any robot system that produces voltages above the robot's battery voltage limit must be approved by NHRL and may require additional inspection. Email [hello@nhrl.io](mailto:hello@nhrl.io) to discuss your design!

Battery charging must be done safely! Batteries may be charged within your robot, except for robots with flame or heat-based weapons. Unsafe charging procedures may result in a penalty via the demerit system.

## SAFE CHARGING PRACTICES:

- Inspect batteries for damage or puffiness before charging.
- A team member must be present while a battery is charging.
- Balance charge leads must be used for any OTS battery that has them.
- Keep a sand bucket or liposafe bag nearby.
- Set an appropriate charge rate based on your battery.

*While not a requirement, it is a good practice to make sure your robot has enough power to be idle for up to 3 minutes prior to the start of your fight.*

# ROBOT CONTROL SYSTEMS

Robot controls and communication systems must pass a failsafe test. In the event of signal loss or transmitter power-down, the bot's drive system must stop within 30 seconds and weapons must come to a complete stop within 60 seconds.

All robots and multibots must have a dedicated receiver(s).

Autonomously controlled robots are allowed, but they must still retain a radio control module that can remotely activate and deactivate the robot.

# SIZE REQUIREMENTS

- 3 pound robots must be able to fit into a 30x 30 x 24 inch box.
- 12 and 30 pound robots must be able to fit into a 36 x 36 x 36 inch box.
- In the case of a multibot, all segments of the robot **must** fit within the box size **together**.
- Once the match begins, robots are allowed to expand or contract to any size.



# WEAPONS

All entrants must have an **active weapon**. An active weapon is defined as a weapon or mechanism that operates independently from the robot's drivetrain or means of locomotion.

"Mellybrains" (bots that can show controlled movement while spinning at rapid speeds), and "Gyro Walkers" (bots that use spinning masses or weapons to generate inertia to induce translational motion) are exempt from this rule. "Thwackbots," (robots which use momentum created by the robot's drivetrain to 'actuate' an otherwise unpowered weapon) do not qualify as having an active weapon.

In a multibot, only the heaviest bot is required to have an active weapon.

## WEAPON LOCKS

**All weapon systems must have a lock** that stops their actuation, extension, expansion, rotation, ignition, etc. Weapons that move or rotate must have a lock or be constrained such that movement is restricted in all directions. Weapons that shoot a projectile or gas must have physical means to prevent firing AND block the expulsion of a projectile. Additionally, all means of fuel storage must be designed to default to the closed position if damaged or removed from the robot.

## ADDENDUM ON SPECIFIC WEAPON CLASSIFICATIONS

**Flame and heat-based weapons are allowed.** This includes but is not necessarily limited to flamethrowers and low or medium-power rocket motors. Robots with flame and heat based weapons must be able to self light and self extinguish. In the case of signal/communication loss with the transmitter, flame and heat based weapons must self-extinguish in 30 seconds.

3lb robots are allowed up to 8 ounces of fuel. 12lb and 30lb robots are allowed 16 ounces of fuel. Consumable fuel and gasses **do** count towards your overall robot weight.

NHRL allows the use of propane, butane and other fuel sources that are gaseous at STP (standard temperature and pressure). Fuels cannot be self-oxidizing and flame systems must not include additional oxidizing systems (e.g. oxy acetylene torches and similar).

Matches may be stopped and your robot disqualified if cage equipment, cameras or safety gear, is being damaged by fire.\*

**Rocket motors (also referred to as rocket engines) are allowed.** NHRL permits the use of any commercially available NAR-Certified rocket motor below size F class (EX: Estes, Aerotech, etc.). **Any design that involves a rocket motor of F class or higher, or that is homemade may be allowed with special permission via the Design Approval Process.**

Rocket motors must be constrained via a tube or clamp mechanism that retains a majority of the motor's outside surface and back. Additionally, the peak thrust of your rocket should not be enough to lift your robot off the ground.

Rocket motor igniters must not be installed until the robot is in the cage. Robots must be powered on prior to ignitor installation to prevent any unexpected signal that might trigger on startup. During igniter installation, the robot must be positioned such that the engine is facing into the cage.



**Drive systems and weapons powered by internal-combustion engines are allowed.** Combustion engines may be manually or electrically started during load in, provided they do not cause the weapon to move. Consumable fuel and gasses **do** count towards your overall robot weight.

**Projectile weapons, both tethered and untethered are allowed.** A fired projectile's maximum speed may not exceed 150 miles per hour. Additionally, a tethered projectile must not be designed in a way that is likely to become entangled with the opposing robot.

**Modular weapon systems are allowed.** Modular weapon systems are defined as mechanisms, subsystems, or subassemblies that are interchangeable between fights. For example, a modular weapon system may allow a competitor to choose between a horizontal spinner and a vertical spinner configuration between fights.

No more than 50% of a robot's weight may change between configurations. Additionally, all configurations of the robot must qualify for the same weight bonuses.

Designs that utilize pneumatics, hydraulics and subsystems using airbags are allowed, but must be approved by NHRL staff through the Design Approval Process.

## THE NHRL DESIGN APPROVAL PROCESS

Any design that falls outside the parameters outlined in the NHRL Competition Handbook, OR that includes airbags, pneumatic or hydraulic systems **MUST** be approved by NHRL Staff.

To receive approval or discuss your robot design, please email [hello@nhrl.io](mailto:hello@nhrl.io) at least 3 weeks prior to the competition. We cannot guarantee that any proposal sent later will be approved in time for the competition.

Your email should include sufficient information to communicate/demonstrate your design intent. This can be in the form of hand sketch, pictures, video, CAD models, or written word, etc. During the approval process, builders may be asked to provide additional details as necessary.

## SPARE ROBOTS & BATTERIES

Due to the fast pace of the competition, bringing multiple copies of your robot is allowed and encouraged at NHRL. Spare robots must be as close to exact copies of the original as possible. All copies of spare robots must pass safety inspection before competing.

For any robot with modular weapon systems OR multiple armor configurations, all spare robots must be compatible with each modular system or armor configuration interchangeably.

NHRL highly encourages competitors to bring spare batteries! Builders are only guaranteed 20, 25 or 30 minutes in between matches dependent upon their weight class for repair and recharge, which may not be enough to fully recharge a battery. In order to assist with this, NHRL will gladly lend you a spare battery for your robot. Simply email [hello@NHRL.io](mailto:hello@NHRL.io) at least 3 weeks before the competition, and provide us with a link or information about your battery. NHRL has a strong preference for XT style connectors XT90/60/30s.



## DESIGN RESTRICTIONS

Fabric, foam, and other ablative armor is allowed. However, ablative armor must not be designed in such a way that it presents a likely entanglement risk. The decision of what is a likely entanglement risk is up to the discretion of NHRL.

Entanglement devices are not permitted. An entanglement device is defined as a component, subsystem or armor configuration that is designed to be entangled in the rotational or moving parts of an opponent.

- Liquids expelled from the robot are not permitted; However, liquids expelled from a robot that become gaseous shortly after leaving the robot and/or before hitting the opponent are permitted. Expelled liquids must be gaseous at STP conditions.
- Electrical and shock weapons such as tasers and cattle prods are not permitted.
- Weapons that primarily act by obstructing visibility are not permitted; However, weapons that produce smoke or fog as a by-product of their attack (i.e. rocket motors) are allowed.

Any weapon that directly targets or that may result in harm to those outside the cage is not permitted. This includes, but is not limited to lasers, high luminosity or strobing lights, or excessively loud noises.

## THE SPIRIT OF THE COMPETITION

*Have a unique, groundbreaking, wacky or super-secret design that isn't covered by the rules? At NHRL, we love creative and fun designs that push the boundaries of what can be done in combat robotics. If you are unsure if your robot design qualifies, please contact us at [Robot@nhrl.io](mailto:Robot@nhrl.io). NHRL Staff would be more than happy to chat with you! We would rather see new and interesting bots fight than disqualify them!*

Event Organizers, Safety Inspectors, or Head Referees may disqualify any robot that has been designed in such a way that skirts or violates the spirit of the competition, whether intentionally or unintentionally. See Spirit of the Rules above.

