Technical Regulations

Version 2.2

(2.1 Changes indicated in purple)
(2.2 changes indicated in red)

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These Regulations subject to change at any time.
BattleBots® has no affiliation with any other robotic sports organization.

Table of Contents

1.0 Introduction

1.1 Defining Documents and Information

Multiple documents and sources of information define the requirements for participating in the sport of BattleBots. All BattleBots participants must be familiar with the contents of these documents and sources.

1.1.1 BattleBots Technical Regulations

The BattleBots Technical Regulations ("Tech Regs") define the requirements specific to BattleBot design and construction.

1.1.2 BattleBots Builder's Guide

A supplement to the Tech Regs is the BattleBots Builder's Guide, which contains suggestions and recommendations for building and testing BattleBots.

1.1.3 BattleBot Tournament Rules and Procedures

The BattleBots Tournament Rules and Procedures (TR&P) document defines the rules and procedures for a safe, fair and efficient BattleBots Tournament.

1.1.4 Other Documents

There may be other BattleBots documents that provide additional information. These additional documents will be posted on the BattleBots website and/or e-mailed to competition entrants.

1.1.5 BattleBots Website

The BattleBots website contains general information on BattleBots and also makes available copies of this and other documents.

1.1.6 E-Mail Communications

BattleBots Inc. may issue e-mail messages to current and former entrants to provide event and/or competition-specific information on a timely basis. Be sure to check your e-mail regularly if you have entered a BattleBots competition.

1.1.7 Responsibility

It is the sole responsibility of every BattleBot designer, builder and/or entrant to verify that they are referencing the last-updated version of any BattleBots document available on the BattleBots website.

1.2 Safety/Warning Notice

Building and operating BattleBots can be dangerous. Do not build or operate a BattleBot unless you are qualified to do so, or are supervised by a responsible and qualified adult. BattleBot owners are solely responsible for their BattleBot whether or not it complies with the rules of BattleBots Inc. or has been inspected for safety or otherwise by BattleBots Inc. The BattleBot owners' responsibility includes all matters of safety, condition, design, conformity to law, operation, merchantability and fitness for use and for any particular purpose.

1.3 General Definitions

1.3.1 BattleBots Inc.

"BattleBots Inc." refers, collectively, to the incorporated entity, all its officers, employees and authorized agents.

1.3.2 BattleBots Executive Officers

"BattleBots Executive Officers" have jurisdiction on all BattleBots matters, as follows:

a. BattleBots CEO – Has overriding authority on all BattleBots matters.

b. BattleBots President – Has overriding authority on all BattleBots matters, unless specifically overridden by the BattleBots CEO.

c. Authorized Proxy – The BattleBots CEO or President may authorize certain persons to have specific Executive Officer rights for a specific time period. Any such authorization must be specified in writing from the BattleBots CEO or President.

1.4 Rules Interpretation

Interpretation of all BattleBots rules, procedures and regulations are governed as follows:

1.4.1 Applicability

These Technical Regulations supercede all previous rules and regulations regarding BattleBots design and construction.

1.4.2 Overlapping/Conflicting Requirements

A reasonable effort is made to ensure that all requirements in BattleBots documents are self-consistent. However, in case of an inconsistency:

a. If two or more requirements in this or any other BattleBots document appear to overlap, then the effective requirement will be the combination of all of the overlapping requirements.

b. If two or more requirements in this or any other BattleBots document appear to conflict, then the effective requirement will be the most restrictive of the conflicting requirements.

1.4.3 Additional Restrictions

At the discretion of BattleBots Executive Officers, additional regulations and restrictions may be applied to all BattleBots, or to all BattleBots in a specific Weight Class.

1.4.4 Final Authority

BattleBots Executive Officers have the final authority over the interpretation of the rules, procedures and regulations in this and all other BattleBots documents.

1.4.5 Change Publication

Any changes or special interpretations of these Technical Regulations will be published on the official BattleBots website.

1.4.6 Request Forms

If a BattleBot will employ certain specific design features, a Request Form must be submitted to BattleBots Inc. for advance acceptance. These Tech Regs specify those cases where a Request Form is required. The different Request Forms are posted on the BattleBots website.

Any Request Form must be received by BattleBots Inc. by the date specified in any BattleBot entry document, or at least four weeks (28 days) in advance of the beginning of the Tournament, whichever is earlier. Completed and signed forms must be sent to BattleBots Inc. at the address specified in "1.5 Contacting BattleBots".

The most up-to-date revision of each Request Form must be used. If a Request Form is required, it must be sent in prior to each competition at which the BattleBot is entered, even if a Request Form was sent in for a prior competition.

Request Forms are evaluated on a case-by-case basis and acceptance is not automatically granted. Moreover, acceptance does not in any way imply or guarantee approval of the BattleBot at any BattleBots Safety/Technical Inspection.

1.5 Contacting BattleBots

For all questions, comments, requests and clarifications regarding the rules, regulations and procedures in this or any other BattleBots documents, contact BattleBots Inc. at the following:

Address: BattleBots Inc.
701 De Long Avenue - Unit K
Novato, CA 94945

Phone: (415) 898-7522

Fax: (415) 898-7525

E-mail: rules@battlebots.com

Website: http://www.battlebots.com/

2.0 General Requirements

2.1 BattleBot Weight Classes

BattleBots are classified into four Weight Classes as follows:

- Lightweight
- Middleweight
- Heavyweight
- Super Heavyweight

BattleBots outside the defined Weight Classes may make special exhibition arrangements with BattleBots Inc.

2.2 Weight Class Limits

Non-walking BattleBots Weight Classes are defined by minimum and maximum weights, as follows:

Weight Class Designation	Measured Weight	
	More Than	Maximum
Lightweight	25.0 lbs.	60.0 lbs.
Middleweight	60.0 lbs.	120.0 lbs.
Heavyweight	120.0 lbs.	220.0 lbs.
Super Heavyweight	220.0 lbs.	340.0 lbs.

If a BattleBot's measured weight reads exactly on a specified limit, it will be classified into the lower Weight Class. As an example, a BattleBot whose weight reads exactly 60.0 pounds will be classified as a Lightweight, since it weighs a "Maximum" of 60.0 pounds, and is not "More Than" 60.0 pounds.

If a BattleBot qualifies as a Walker (a "StompBot"), it is allowed an additional weight advantage. Refer to "3.2 Walking BattleBots (StompBots)".

2.2.1 Lower Weight Limits

If a BattleBot is under the lower weight limit for the Weight Class in which is it entered, ballast must be added to the BattleBot to bring its weight up to the minimum specified.

2.2.2 Modular Designs

If a BattleBot is of a modular design, allowing components to be exchanged, then:

- **a.** The weight of the heaviest configuration will determine the Weight Class designation of the BattleBot.
- **b.** The weight of the lightest configuration must not be less than that allowed for the Weight Class as determined by **2.2.2.a** above.

2.3 Weight Limit Regulations

2.3.1 Weight Limit Enforcement

BattleBot weight limits, as defined in "2.2 Weight Class Limits", will be strictly and uniformly enforced.

Refer to the latest version of the BattleBots Tournament Rules and Procedures document for information on the exact weighing procedures.

2.3.2 Items Included in Weight

A BattleBot is weighed in its battle-ready configuration. Safety covers and safety restraints will be removed. However, the following items must be on-board:

- **a.** Any fluids or gasses, as allowed on a BattleBot.
- **b.** Any cosmetic features such as dolls, artificial plants, etc.
- **c.** Any accessory systems such as Internet feeds, telemetry systems, etc.
- **d.** Any cameras and audio equipment, except as specified in "2.3.3 Excluded Weight".

2.3.3 Excluded Weight

Some items are excluded when determining the weight of the BattleBot. They are:

- **a.** BattleBots-approved, media-supplied remote camera and/or audio systems.
- **b.** Official BattleBots win pogs for previous battles fought and won by the BattleBot.

The items described must be removable in case of any weight check dispute.

2.4 Dimensional Limits

The size of a BattleBot primarily affects its access to the BattleBox arena and the allocation of pit space. The following conditions apply:

2.4.1 Maximum Size

In order to allow efficient entry to and exit from the BattleBox, a BattleBot must meet the following size-limit requirements:

- **a.** In its pre-battle configuration, the BattleBot must be able to be moved on its transport cart up the entrance ramp of the BattleBox and through the 8-foot by 8-foot entry door.
- **b.** With all of its moveable parts fully open, extended, inflated and/or unfolded, the BattleBot must be able to be moved through the 8-foot by 8-foot BattleBox exit door and down the exit ramp.
- **c.** Moving the BattleBot into or out of the BattleBox must not require any assembly or disassembly of the BattleBot.
- **d.** In its pre-battle configuration, any BattleBot or MultiBot cluster must fit entirely inside the 8-foot by 8-foot red or blue BattleBox starting square.

2.4.2 Large-Size BattleBots

If a BattleBot has a length greater than 5 feet or a width greater than 4 feet, the BattleBot may require special consideration when assigning the Pit Area location. If the BattleBot will be larger than 5' x 4', notify BattleBots Inc. as specified in "1.5 Contacting BattleBots".

2.5 Construction Materials

There are restrictions on the types of materials that may be used to construct a BattleBot.

2.5.1 Allowed Construction Materials

The types of materials that can be used to construct BattleBots are far too varied and numerous to be enumerated in these Technical Regulations.

Generally, most type of metals, plastics, elastomers, and composites may be used unless they are specifically restricted or prohibited, or the material used poses a safety risk due to toxicity or other safety-related reasons.

2.5.2 Restricted-Use Construction Materials

The following materials are allowed, but only with certain restrictions:

- **a.** Any Lead (Pb) metal must not be exposed on the exterior of the BattleBot in any position where it can be readily damaged by another BattleBot or by any arena hazards.
- **b.** Rigid plastic foams (e.g., PVC, Polystyrene, Polyurethane) must not be exposed on the exterior of the BattleBot in any position where they can be damaged by another BattleBot or by any arena hazards.
- **c.** Exposed permanent magnets are allowed provided that they are firmly attached to the BattleBot using adhesive (e.g., epoxy, silicone) or some mechanical means (e.g., screws).
- **d.** Expanding liquid foam must not be used anywhere in a BattleBot where it encapsulates or otherwise obscures any wiring, plumbing or other non-structural part of the BattleBot.
- **e.** Any Magnesium metal sheet used in a BattleBot must not be less than one-eighth of an inch (1/8") thick.

2.5.3 Construction Materials Not Allowed

For toxicity or other reasons, the following materials are specifically disallowed and cannot be used on a BattleBot.

- **a.** Beryllium metal.
- **b.** Boron fibers.
- **c.** Depleted Uranium.
- **d.** Radioactive materials.
- **e.** Asbestos.
- **f.** Unbonded or unwoven composite fibers (fiberglass, carbon, etc.).
- **g.** Unsintered metal powder of any type.
- **h.** Metal shavings or "wool".
- **i.** Decayable organic substances.
- **j.** Reactive metals (e.g. Lithium, Sodium).
- **k.** Non-fibrous silicon-based glass.
- **l.** Mercury metal.

Note: Beryllium-Copper alloys, wood and leather may be used.

2.5.4 Materials Questions

If there are questions on BattleBot construction materials, check with BattleBots Inc. as specified in "1.5 Contacting BattleBots" before beginning construction.

2.6 Non-Construction Substances

Only certain non-construction-material substances can be carried aboard a BattleBot.

2.6.1 Lubricants

Certain lubricants can be carried aboard a BattleBot if they are used for on-board lubrication purposes only. They are:

- **a.** Non-toxic greases for bushings, bearings and gearboxes.
- **b.** Oil for Fuel-Powered Engines.
- **c.** Oil for chains and gearboxes.
- **d.** Solid or solids-based lubricants for bearing and chain lubrication.

2.6.2 Gasses

Only those gasses as are specified in "8.2.1 Allowed Gas Types" may be carried on-board a BattleBot.

2.6.3 Hydraulic Fluid

Only hydraulic fluid as specified in "9.2.2 Hydraulic Fluid Type" may be carried on-board a BattleBot.

2.6.4 Flammable Liquids

Only fuels as specified in "7.3.2 Allowed Fuels" may be carried on-board a BattleBot.

2.6.5 Battery and Capacitor Electrolytes

Dilute acids and alkalis can be used only in electrical batteries and capacitors. Battery types are subject to the restrictions defined in "6.3 Allowed Battery Types".

2.6.6 Other Substances

Substances other than those specified in this section **2.6** may be allowed to be carried on-board a BattleBot. This will require the submission of an Advance Acceptance Request form to BattleBots Inc. as defined in "1.4.6 Request Forms".

2.7 Power Systems

2.7.1 Types of Power Systems

The only types of power systems that can be used in a BattleBot are:

- **a.** Electric motors, as defined in "6.8 Electric Motors".
- **b.** Fuel-Powered engines, as specified in "7.0 Fuel-Powered Engines".
- **c.** Pneumatics, as defined in "8.0 Pneumatic Systems".
- **d.** Hydraulics, as defined in "9.0 Hydraulic Systems".
- **e.** Mechanical, as defined in "10.0 Mechanical Energy Storage Systems".

2.7.2 Number of Power Systems

There is no limit on number of power systems that can be used on a BattleBot, providing that each system complies with all BattleBots rules and regulations.

2.8 Safety Covers

Safety Covers are intended to protect people around a BattleBot from injuring themselves on a part of the BattleBot. Safety Covers are considered to be part of the overall BattleBot design.

2.8.1 Where Required

Safety Covers must be used on all external sharp points and all external cutting edges on the exterior of a BattleBot.

2.8.2 Sharp Point Protection

Covers over sharp points must be designed such that a person can press the palm of their hand against the covered point with a force of at least ten (10) pounds, and not receive any injury.

2.8.3 Cutting Edge Protection

Covers over cutting edges must be designed such that a person can rub the palm of their hand over the covered edge while pressing down with a force of at least four (4) pounds, and not receive any injury.

2.8.4 Attachment Requirements

All Safety Covers must meet the following attachment requirements:

- **a.** Covers must be attached using a positive securing method such as a wire loop, bungee cord or other mechanical retention system.
- **b.** The attachments must be made such that any cover will not be pulled or pushed off by a force of up to two (2) pounds applied in any direction at any point on the cover.
- **c.** Covers cannot be retained using friction, an adhesive, adhesive tape or any other method that can deteriorate with repeated use.

2.8.5 Removal and Installation

Covers must be designed such that their removal and installation can be accomplished within the time limits, and also comply with the safety requirements specified in "5.0 BattleBot Activation and Deactivation".

2.9 Safety Restraints

Safety Restraints are removable attachments to the BattleBot intended to protect people from injuring themselves as the result of movement of an exterior part or section of a BattleBot. Safety Restraints are considered to be part of the overall BattleBot design.

2.9.1 Where Required

Safety restraints are required to protect against the following types of hazards:

- **a.** Pinch Hazards, where a body part (such as a finger) can be squeezed between BattleBot external parts that can freely move relative to one another.
- **b.** Motion Hazards, where the driven movement of a weapon or other BattleBot part can strike a person with injurious force. This specifically includes any spinning weapon.

2.9.2 Pinch Hazard Protection

A pinch hazard restraint must consist of either:

- **a.** A cover or guard that prevents placing any body part in the area of the pinch hazard.
- **b.** A pin, block, chain or similar restraint, which prevents relative movement of the pinching parts.

2.9.3 Motion Hazard Protection

A motion hazard protection device must consist of either:

- **a.** A pin, block, chain or other similar restraint that will prevent significant movement of a hazardous part, even if that part is being driven by its actuation system at maximum power.
- **b.** A method of physically disconnecting the actuator from the hazardous part.

2.9.4 Restraint Retention

All restraints must be designed and installed such that they satisfy the following requirements.

- **a.** Restraints must be attached using a positive securing method such as a wire loop, bungee cord, locking pin or other mechanical retention system.
- **b.** A force of up to two (2) pounds applied in any direction to any point on the restraint will not cause the restraint to move significantly or to come off.

c. Moving the BattleBot in any position, including upside down, will not cause a restraint to lose its effectiveness.

d. Restraints cannot be attached using friction, an adhesive, adhesive tape or any other method that can deteriorate with repeated use.

"Vise-Grip" type pliers and C-clamps cannot be used for safety restraints.

2.9.5 Removal and Installation

Restraints must be designed such that their removal and installation can be accomplished within the time limits, and also comply with the safety requirements specified in "5.0 BattleBot Activation and Deactivation".

2.10 Cradle or Dolly

The BattleBot must be equipped with a cradle or dolly that supports the BattleBot's wheels, tracks or other motion-producing parts away from any floor, table or other horizontal supporting surface, as required in the BattleBots Tournament Rules and Procedures document.

2.11 External Control Equipment

With certain restrictions, a BattleBot Team may employ external accessory equipment located outside the BattleBox as part of its combat control, location or targeting system.

2.11.1 Equipment Restrictions

External control equipment must, at a minimum, meet all the following requirements:

a. It can be set-up easily within two (2) minutes prior to a Match.

b. It can be removed easily within two (2) minutes after a Match.

c. It does not interfere with another contestant or with any BattleBots personnel.

d. It does not significantly interfere with the live audience's visibility.

e. It complies with all the requirements of "2.13 Lights and Sound" and "4.0 Radio Control".

2.11.2 External Equipment Request

External Control Equipment that complies with the requirements of "2.11.1 Equipment Restrictions" may be allowed, but requires the submission of an Advance Acceptance Request form to BattleBots Inc. as defined in "1.4.6 Request Forms".

2.12 Autonomous BattleBots and Components

Autonomous BattleBots or autonomous components on a BattleBot are allowed, provided that:

2.12.1 Radio-Control Override

The BattleBot's radio control system can be used to override and stop any and all BattleBot and weapon system autonomous motion.

2.12.2 Fail-Safe

All BattleBot motion and weapon systems, whether autonomous or controlled, must comply with the specifications of "4.1.2 Radio-Controlled Fail-Safe".

2.13 Lights and Sound

Limitations on the uses of lasers, lights and sound sources on a BattleBot are as follows:

2.13.1 Disconnection

If the BattleBot contains any type of artificial light or sound source, there must be a method of easily and safely disconnecting the light and/or sound producing components.

2.13.2 Class I Lasers

Class I lasers can be used on a BattleBot without restriction.

2.13.3 Non-Class I Lasers

Lasers brighter than Class I can cause eye damage. Thus:

a. Lasers mounted on a BattleBot are limited to Class II, with an output of less than 1 mW, regardless of the frequency spectrum of the light.

b. Class II lasers must be securely mounted and pointed such that their beams strike the ground no more than four feet (4') away from an edge of the BattleBot, when the BattleBot is resting on the ground in battle-ready configuration.

Note: Some handheld laser pointers are Class IIIa, and therefore cannot be mounted on a BattleBot.

2.13.4 BattleBot Lights

Any lighting installed on a BattleBot must comply with the following:

a. No very bright lights may be installed on a BattleBot. Lighting may be used, provided that it is not distracting to other contestants or to BattleBots Officials.

b. Low-brightness strobe lights may be installed on a BattleBot, provided that they are not distracting to other contestants or to BattleBots Officials.

c. Ultra-violet lights ("Black Lights") primarily emitting at wavelengths shorter than 400 nm cannot be installed on a BattleBot or used as any part of a BattleBot's combat system.

2.13.5 Sound

A BattleBot cannot use any extremely loud and/or low frequency sound source.

The sound level emitted from an operating BattleBot cannot exceed one-hundred-twenty A-weighted decibels (120 dB(A)) as measured at ten feet (10') from the BattleBot in any direction.

2.13.6 Questions

If there are any questions regarding the use of lights or sound on a BattleBot, contact BattleBots Inc. as specified in "1.5 Contacting BattleBots".

3.0 Special BattleBots Configurations

3.1 MultiBots

3.1.1 MultiBot Definition

A MultiBot is defined as BattleBot composed of two or more individual detached segments that compete together as a single BattleBot.

3.1.2 Number of Segments

A MultiBot must have at least two (2) segments. There is no specific limit on the maximum number of segments as long as all segments comply with the requirements of "4.0 Radio Control" and "5.3 Activation/Deactivation Requirements".

3.1.3 Weight Class

The Weight Class designation of a MultiBot is determined by weighing all of the individual segments together.

3.1.4 Segment Weights

There are no specific restrictions on the relative weights of the MultiBot segments.

However, the judging of a match involving a MultiBot may depend upon the relative weights of the segments. Refer to the latest version of the BattleBots Tournament Rules and Procedures document for the MultiBot judging criteria.

3.1.5 Size Requirements

To comply with the requirements of "2.4.1 Maximum Size", the combined segments of a MultiBot must be able start a match completely within either the red or the blue BattleBox starting square.

3.1.6 Autonomous MultiBot Segments

If any MultiBot segment is autonomous, it must conform to the requirements of "2.12 Autonomous BattleBots and Components".

Note: It is not required that each MultiBot segment be independently controlled.

3.1.7 Rules Applicability

All applicable rules for BattleBots design and construction apply to each individual MultiBot segment separately.

All limits, such as weight, fuel capacity, pneumatic storage, etc, apply to the combination of all MultiBot segments.

3.2 Walking BattleBots (StompBots)

A BattleBot that uses certain methods of locomotion may qualify as a "StompBot" and be allowed an additional weight advantage. Non-wheeled BattleBots that do not qualify as StompBots may be entered, but are not given any weight advantage.

3.2.1 StompBot Definition

A BattleBot may be considered a StompBot if it satisfies all the following criteria:

- **a.** The drive mechanism for the BattleBot locomotion is powered solely by linear hydraulic or pneumatic actuators or by certain actuators driven by rotary electric motors. Any electric actuator must operate such that the reversal of motion requires reversal of the rotary electric motor.
- **b.** All BattleBot parts that touch the ground for locomotion or support must move forward and backward in a reciprocating motion relative to the center-of-gravity of the BattleBot.
- **c.** All BattleBot parts that touch the ground for locomotion must be actuated such that they can potentially be moved vertically (up-and-down) without any horizontal (forward-and-backward) movement. Likewise, horizontal movement must be potentially possible without vertical movement.
- **d.** When the BattleBot is moving along the ground, no part of the BattleBot weight is supported on the ground by any type of rolling or skidding mechanism.

Linear electric motors cannot be used as part of the locomotion method of a StompBot.

3.2.2 Specific Exclusions

If the locomotion drive system of a BattleBot contains any crankshafts, rotary camshafts, or non-reversing rotary electric actuators, it will not qualify as a StompBot.

3.2.3 StompBot Acceptance

Even if a BattleBot appears to satisfy the requirements of "3.2.1 StompBot Definition" and "3.2.2 Specific Exclusions", the proposed design must in addition be accepted by BattleBots Inc. to qualify as a StompBot. Request for acceptance requires the submission of an Advance Acceptance Request form to BattleBots Inc. as defined in "1.4.6 Request Forms".

3.2.4 StompBot Weights

Any BattleBot accepted as a StompBot is allowed to be exactly 20% heavier than a non-StompBot in the same Weight Class, as follows:

StompBot Weight Class	Measured Weight	
	More Than	Maximum
Lightweight	30.0 lbs.	72.0 lbs.
Middleweight	72.0 lbs.	144.0 lbs.
Heavyweight	144.0 lbs.	264.0 lbs.
Super Heavyweight	264.0 lbs.	408.0 lbs.

StompBot weight limits are subject to all the constraints of "2.2 Weight Class Limits" and "2.3 Weight Limit Regulations".

3.3 Hopping/Jumping BattleBot

A hopping or jumping BattleBot is allowed with the following restrictions:

3.3.1 Maximum Jump Height

The maximum height that a BattleBot can reach on a jump can not exceed six feet (6'), measured from the ground to the lowest point of the BattleBot chassis structure at the peak of the jump.

3.3.2 Maximum Jump Length

The maximum length that a BattleBot can jump is ten feet (10'), measured from the leading edge portion of the BattleBot both before and after the jump.

3.3.3 BattleBox Damage

The landing of a hopping/jumping BattleBot must not materially damage the BattleBox floor or walls, such that repairs would be required for the next scheduled Match to proceed.

3.4 Ground-Effect Machines

Ground-effect machines are supported by a cushion of air entrapped beneath a plenum. Such machines are allowed if they meet the following requirements:

3.4.1 Lift Method

Any lift from the ground is provided by an air cushion, and not directly by an external moving aerodynamic device (e.g., a rotor). Partial support by wheels or other rolling devices is allowed.

3.4.2 Maximum Lift Height

The maximum height from the ground to the primary solid bottom of the BattleBot, with the lift fan(s) operating at maximum speed, must not exceed twenty percent (20%) of either the length or width of the air cushion plenum.

3.5 Powered Flight

A BattleBot cannot move using powered flight. Moveable or fixed aerodynamic devices may be used for cooling and control, but are not allowed to provide lift in the absence of ground effects.

4.0 Radio Control

4.1 BattleBot Control

All BattleBot movement and weapons operation must be controlled and predictable.

4.1.1 Radio Control

All primary control and fail-safe communications to a BattleBot must be via a radio link. The use of light wave (e.g., infrared), sound or tethered control is not allowed.

4.1.2 Radio-Controlled Fail-Safe

All BattleBots must have a robust radio fail-safe system that electronically or mechanically shuts off all motion-system and weapons power within one (1) second after the transmitter is switched off, or otherwise stops transmitting.

Note: This fail-safe is required in addition to the other Master Switch requirements specified in this document.

4.2 Hobby R/C Equipment

For BattleBot control, commercially-available "hobby" Radio Control (R/C) equipment can be used as follows:

4.2.1 Allowed Frequencies

The following R/C frequencies (channels) may be used:

a. 27 MHz band (channels 1 thru 6).

b. 75 MHz band (channels 61 thru 90).

c. 50 MHz (channels RC00 thru RC09). An FCC Amateur license is required.

d. 53 MHz. An FCC Amateur license is required.

e. 40 MHz band. European ground-vehicle remote-control.

4.2.2 72 MHz Frequencies Prohibited

Radio Control equipment operating in the 72 MHz band (channels 11 thru 60) is expressly prohibited and cannot be used in any way on a BattleBot.

4.2.3 Synthesized Frequencies

Synthesized-frequency R/C equipment is allowed provided that it complies with the requirements of "4.2.1 Allowed Frequencies".

4.2.4 Multiple-Frequency

To minimize the problem of frequency conflicts, non-frequency-synthesized R/C equipment must be designed to allow the changing of frequency crystals.

Such BattleBots entries must have two (2) or more sets of frequency crystals that allow operation on at least two different frequencies.

4.2.5 Control Methods

Hobby R/C transmitters use either Amplitude Modulated (AM) or Frequency Modulated (FM) transmission. Different types of control methods are allowed or disallowed as follows:

a. Amplitude Modulated (AM) R/C equipment cannot be used on any BattleBot in any Weight Class.

b. FM Pulse-Position Modulation (FM/PPM) and Intelligent Pulse Decoding (FM/IPD) R/C equipment may be used for BattleBots in the Lightweight class only.

c. All Middleweight, Heavyweight and Super Heavyweight BattleBots using hobby R/C equipment must use Pulse-Code Modulation (FM/PCM).

4.3 IFI Robotics Controllers

BattleBots Inc. allows and recommends the use of 900 MHz robot controller systems by IFI Robotics (IFI).

4.4 Custom Radio Control Equipment

Custom-made radio control transmission or telemetry equipment may be allowed if it can demonstrate that, at a minimum, it meets the following requirements:

4.4.1 Restrictions

Custom equipment must comply with the following:

- **a.** Equipment that uses the 27, 40, 50, 52 or 75 MHz frequency band cannot require more frequency channels than specified in "4.5.3 Number of Frequencies".
- **b.** The equipment cannot use any frequency band disallowed by FCC rules.
- **c.** The equipment cannot use the 802.11b ("Wi-Fi") transmission protocols in the 2.4 GHz frequency band.
- **d.** If the equipment's frequency band is restricted to FCC licensed users, all BattleBot Operator(s) must have the appropriate license(s).

4.4.2 Interference

Custom radio equipment must comply with the following:

- **a.** It does not cause interference with any event communications and broadcast equipment.
- **b.** It is not susceptible to interference from any event communications and broadcast equipment.
- **c.** It does not interfere with the operation of commercially-available "hobby" remote controllers.
- **d.** It does not interfere with the operation of IFI robot controller systems.

Refer also to the BattleBots Tournament Rules and Procedures document for operational rules involving custom radio equipment.

4.4.3 BattleBots Authority

Notwithstanding the other requirements of this section **4.4**, BattleBots Inc. has the sole discretion and final authority to determine if Custom Radio Equipment interferes with either event communications/broadcast equipment, commercially-available "hobby" R/C transmitters, or IFI Robotics controller systems.

4.5 Controlling a BattleBot

4.5.1 Number of Operators

A BattleBot may be controlled by multiple Operators. The number of Operators is limited to the number of members allowed on the Pit Crew for that BattleBot.

Refer to the latest version of the BattleBots Tournament Rules and Procedures document for information regarding Pit Crew members.

4.5.2 Controlling Devices

There is no specific limit on the number of manual controlling devices as long as all radio transmission uses no more frequencies than defined in "4.5.3 Number of Frequencies".

Note: Using any transmitter in "trainer mode" (with an attached control box) is allowed.

4.5.3 Number of Frequencies

The limits on the number of frequencies that may be used by commercial "hobby" R/C equipment are:

- **a.** A single BattleBot using R/C equipment may be controlled using a maximum of two (2) different R/C frequencies.
- **b.** A MultiBot cluster using R/C equipment may be controlled using a maximum of three (3) different R/C frequencies.

5.0 BattleBot Activation and Deactivation

5.1 BattleBot Safety

The design of a BattleBot must be such that at any time when the BattleBot is not in combat or being tested, it must be completely safe and non-hazardous to all personnel and objects in the vicinity of the BattleBot.

Moreover, the process of activating or deactivating a BattleBot must be accomplished in a reasonably short time with minimal risk to anyone performing the Activation or Deactivation, or to anyone else in the vicinity of the BattleBot.

5.2 BattleBot States

Except when it is being converted from one state to another, a BattleBot must always be in one of two states: Deactivated or Activated.

5.2.1 Deactivated State

A BattleBot in its Deactivated State must, at a minimum, meet the following requirements:

- **a.** All Radio Control transmitters are off.
- **b.** All sharp points and edges are covered with the required Safety Covers.
- **c.** All pinch or weapons-motion hazards are constrained with Safety Restraints.
- **d.** All primary-power electrical Master Switches are switched off.
- **e.** All pneumatic system Shut-Off Valves are closed and all Purge Valves are open.
- **f.** All hydraulic system Bypass/Bleed Valves are open.
- **g.** All Fuel-Powered Engines are not running.
- **h.** All spring-loaded devices are released or otherwise disarmed.
- **i.** Any secondary-power switches are switched off.

5.2.2 Activated State

A BattleBot in its Activated State is defined as being in battle-ready condition, as it would be just prior to the start of a Match.

5.3 Activation/Deactivation Requirements

Notwithstanding any other restrictions and regulations in this or other BattleBots documents, a BattleBot will be required to demonstrate the following:

5.3.1 Activation

With the BattleBot on the ground in a completely Deactivated State, the following Activation steps must be performed in less than sixty (60) seconds.

- **a.** Any secondary-power switches are switched on.
- **b.** All radio control transmitters and receivers are turned on.
- **c.** All primary-power electrical Master Switches are switched on.
- **d.** All pneumatic system Purge Valves are closed and Shut-Off Valves opened.

e. All hydraulic system Bypass/Bleed Valves are closed.

f. All Fuel-Powered Engines are started and running at Idle Speed, as defined in "7.2.2 ICE Idle Speed".

g. Safety Covers are removed.

h. Safety Restraints are removed.

5.3.2 Critical Deactivation

Starting with the battle-ready, Activated BattleBot on the ground in any stable position (including upside-down), the following Critical Deactivation steps must be performed in less than thirty (30) seconds:

a. All primary-power electrical Master Switches are switched off.

b. All pneumatic system Shut-Off Valves are closed and Purge Valves are opened.

c. All hydraulic system Bypass/Bleed Valves are opened.

d. All Fuel-Powered Engines are stopped.

e. All radio control transmitters are turned off.

The time limit includes any time that may be required to right an upside-down BattleBot in order to gain access to switches or valves.

5.3.3 Final Deactivation and Safing

With all of the Critical Deactivation steps completed, the following safing steps must be performed in less than thirty (30) seconds

a. All Safety Restraints are re-installed.

b. All Safety Covers are re-installed.

c. Any secondary-power switches are switched off.

5.3.4 Activation/Deactivation Sequence

The BattleBot must be designed such that:

a. There will be no powered movement of the BattleBot or its weapons during the "5.3.1 Activation" process, regardless of the order in which the Activation steps are performed.

b. There will be no powered movement of the BattleBot or its weapons during the "5.3.2 Critical Deactivation" process, regardless of the order in which the Deactivation steps are performed.

5.3.5 Activation/Deactivation Conditions

The following are required conditions for Activation and Deactivation:

a. During the Activation and Deactivation processes there must be absolutely no powered movement of the BattleBot or any of its weapons systems as a result of the Activation or Deactivation.

b. Activation and Deactivation cannot each require more than one (1) person.

c. The Activation and Deactivation sequences must be performed without a person placing any body part within two inches (2") of the path of any weapon system or other part of the BattleBot that can be moved under power.

d. If the BattleBot utilizes a cylindrical pneumatic weapon actuator with a piston that strikes the rod-cap, Activation and Deactivation must not require a person to place any body part in the path of any parts that would come loose if the rod-cap separates from the actuator.

e. The Activation and Deactivation sequences must not require a person at any time to stand on one foot or otherwise balance in any unstable position.

f. The Activation and Deactivation sequences must be performed without a person placing any body part more than two inches (2") inside the external frame of the BattleBot.

g. Activation and Deactivation must be accomplished without the removal of any panels, covers, fasteners or other parts from the BattleBot. Hinged or sliding covers may be used for access provided that securing of the cover does not use any kind of threaded fasteners (screws, bolts, nuts). Captive quarter-turn Dzus or Camloc fasteners may be used to secure a cover, provided that the fasteners use only a slotted-style head.

5.3.6 Activation/Deactivation Tools

The tools used for Activation and Deactivation must meet the following requirements.

a. A maximum of two (2) special tools or devices can be used for the Activation and Deactivation of the BattleBot. There must be at least one spare set of any such tool(s).

b. If Activation or Deactivation requires the insertion of the tool through any hole in the BattleBot's external shell or armor, and the switch or valve being accessed is not mounted to the external armor or frame at the insertion point, the hole must provide a minimum of one-quarter inch (1/4") clearance on all sides of the tool while it is inserted in the hole.

c. Activation and Deactivation cannot require the use of a flashlight or any other supplementary light source.

d. With one exception, any tool used for Activation and Deactivation must not be powered, either with batteries or using external AC power. The only exception is that a battery-powered electric motor may be used for starting Fuel-Powered Engines as provided for in "7.7.4 Portable Starters".

5.3.7 MultiBot Requirements

For the purposes of Activation and Deactivation, the combined MultiBot segments are considered to be a single BattleBot and must collectively meet the Activation and Deactivation time limits and other conditions defined in this "5.3 Activation/Deactivation Requirements".

5.4 Spinning Parts

5.4.1 Spinning Part Fail-Safe

If the BattleBot has any spinning parts, it must be demonstrated that with any part spinning at maximum speed, shutting off the remote-control transmitter will cause that spinning part to lose all drive power as specified in "4.1.2 Radio-Controlled Fail-Safe".

5.4.2 Spin-Down Time

When power is removed from a spinning part on a BattleBot, the design and construction of the BattleBot must be such that the part will spin down to a full stop within forty-five (45) seconds after drive power is removed.

Spin-down time is measured by first bringing the spinning part up to its maximum speed. The radio-control transmitter is then shut off and timing begins from the moment the transmitter is shut off. Timing ends when the spinning part has completely stopped.

Note: The spin down time limit will be strictly enforced both in Safety/Tech Inspection, during any re-inspections, and during competition.

6.0 Electrical Power

6.1 BattleBot Electrical Systems

A BattleBot has two general types of electrical systems: Primary-Power and Secondary-Power.

6.1.1 Primary-Power Systems

Primary-Power electrical systems are used to move the robot and directly or indirectly to actuate any weapons systems. The characteristics of the primary-power systems are that they require large batteries and have high power-consumption rates.

6.1.2 Secondary-Power Systems

All BattleBots have some kind of low-voltage Secondary-Power system to operate their radio control receivers. This system may either use a separate battery or it may convert voltage from the Primary-Power System.

6.2 Standard Voltage Limitations

The standard voltage limitations for electrical systems in a BattleBot depend upon whether the voltage is provided by a Direct Current (DC) or Alternating Current (AC) power source.

6.2.1 DC Voltage

The nominal DC voltage in a BattleBot can be up to 48 Volts. The maximum allowed measured DC voltage, with all electrical systems activated, measured from any point of highest potential to the point of lowest potential, is **56.0 volts**.

6.2.2 AC Voltages

The minimum/maximum peak AC voltages in a BattleBot with all electrical systems activated are –80 to +80 volts. That is, an AC voltage-meter must read no more than **56.5 volts rms**.

6.2.3 Voltage Transients

During BattleBot operation, switching transients may cause the voltage values to temporarily exceed the specified limits. This is allowed provided that the transients are the result of normal system operation and are not specifically generated to increase the average voltage level.

6.2.4 Charging Unit

The maximum output voltage of any external battery charging unit on a BattleBot cannot exceed **70.0** volts, when the charger is turned on and being used to charge batteries.

6.2.5 Voltage Conversion Devices

A BattleBot cannot use any voltage-conversion devices to generate higher voltages than those specified in "6.2.1 DC Voltage" or "6.2.2 AC Voltages".

Step-down converters may be used to generate lower-than-nominal voltages.

6.3 Allowed Battery Types

Only certain type of batteries can be used in a BattleBot, as follows:

6.3.1 Sealed Lead Acid

Lead-Acid batteries can be used on BattleBots, provided they are of a sealed and leak-proof type, and have all the following characteristics:

- **a.** They can be used in any position.
- **b.** There are no filling caps for checking or adding battery fluid.
- **c.** They are described in their specifications as using an "Absorbed" or "Stabilized" or "Gelled" electrolyte, or are described as using "AGM" construction.
- **d.** They are specified by the manufacturer or distributor as being "Leak Proof".

Note: A battery specified as "spill-proof" or "non-spillable" does not necessarily comply with the above specifications; it must be "Leak Proof" also.

If a battery is not marked as "Leak Proof", written documentation may be required to show that the battery uses AGM or gel-cell construction.

6.3.2 Nickel-Cadmium

Commercially-available, rechargeable Ni-Cad batteries can be used on a BattleBot.

6.3.3 Nickel-Metal Hydride

Commercially available, rechargeable Ni-MH batteries can be used on a BattleBot.

6.3.4 Lithium-Ion

Commercially available, rechargeable Li-Ion batteries can be used on a BattleBot. Batteries containing Lithium metal are specifically not allowed.

6.3.5 Alkaline

Commercially available Alkaline batteries may be used on a BattleBot only for the secondary-power system.

6.3.6 Questions on Battery Models

To confirm if a specific battery model is allowed to be used in a BattleBot, contact BattleBots Inc. as specified in "1.5 Contacting BattleBots".

6.4 Primary-Power Batteries

To minimize arena fouling, all primary-power batteries in a BattleBot must be mounted and protected as follows:

6.4.1 Battery Mounting

Batteries must be securely mounted and located such that they are enclosed within the frame of the BattleBot.

6.4.2 Battery Hold-Down Materials

Any hold-downs for Ni-Cad, Ni-MH or Li-Ion batteries must use electrically insulated materials capable of withstanding moderately high heat. Plastic tie-wraps cannot be used to retain these types of batteries.

Note: Secondary-power batteries may be constrained with tie-wraps.

6.4.3 Battery Heating

Because of battery heating during operation, Ni-Cad, Ni-MH and Li-Ion batteries must be thermally insulated from any pneumatic system component as defined in "8.10.5 Pneumatic Component Insulation".

6.4.4 Battery Insulation

To prevent hazardous battery short-circuiting, battery packs composed of individual battery cells must be assembled and insulated such that no single cell in the pack can be accidentally shorted out.

6.5 Capacitor Use

Capacitors may be used in either the primary-power or secondary-power electrical system. However all electrolytic-type capacitors must be securely mounted and located such that they are enclosed within the frame of the BattleBot.

6.6 Primary-Power Wiring

Primary-power electrical wiring in a BattleBot must to conform to the following:

6.6.1 Wiring Type

Multi-stranded wiring must be used for connecting the primary-power batteries to the input of any Master Switch.

All wiring must be insulated using primarily the factory-applied insulation and/or heat-shrink tubing.

Small sections of wire may be insulated with quality electrical tape. Using other types of tape (e.g., duct tape, masking tape) for insulation is not allowed.

6.6.2 Electrical Insulation

All exposed terminals and bare wire-ends from the primary-power batteries to the input of any Master Switch must be covered with electrical insulation. This insulation may be electrical tape, Silicone RTV, or "Liquid Electrical Tape", and must be attached such that it cannot be easily penetrated or knocked off.

6.6.3 Wire Securing

All electrical wiring from the primary-power batteries to the input of any Master Switch must be attached to or supported by the BattleBot structure such that impact or vibration should not cause damage to the wiring or terminals.

6.7 Electrical Power Deactivation

All BattleBots with primary-power electrical systems must have a method of completely deactivating such systems.

6.7.1 Primary-Power Master Switch

Any primary-power electrical system must have a Master-Switch cut-off that meets all of the following requirements:

- **a.** It must be completely mechanical and operate directly to make or break the circuit, without any electronic components.
- **b.** It must be an enclosed type, so that any electrical arcing will occur on the interior of the switch.
- **c.** It must directly shut off power from the primary-power batteries. It cannot indirectly shut off power using a relay or contactor.
- **d.** It must be a two-position switch that is stable in both the ON and OFF positions. Momentary-operation and push-on/push-off Master Switches are not allowed.
- **e.** If a primary-power battery is connected to a conductive BattleBot chassis, the switch must be located such that power is cut between the battery and the chassis.

A removable link may be used in lieu of a Master Switch if the removable link complies with all of the above requirements for a Master Switch.

6.7.2 Activation/Deactivation Requirements

Master Switches must be designed and installed such that the BattleBot meets all of the access time and safety requirements defined in "5.3 Activation/Deactivation Requirements".

6.7.3 Secondary Power Switch

If a BattleBot uses "hobby" R/C equipment, as defined in "4.2 Hobby R/C Equipment", it must have a on-off switch that allows switching on and off the secondary-power electrical system independently of the primary-power Master Switch. An insulated removable link (i.e., a connector) may be used in lieu of a switch.

Any secondary-power switch must be designed and installed such that the BattleBot meets all of the access time and safety requirements defined in "5.3 Activation/Deactivation Requirements".

6.7.4 Number of Switches

Multiple Master Switches can be used, consistent with all other requirements in this and other BattleBots documents.

6.7.5 Bypass Switches Prohibited

A BattleBot cannot contain an alternate switch or any other device that bypasses or otherwise compromises the effect of any primary-power Master Switch.

6.8 Electric Motors

6.8.1 Electric Motor Types

Electric motors used on BattleBots can be of any type, including DC or AC, brushed or brushless, permanent magnet, series or parallel wound.

6.8.2 Motor Cooling

Electric motors may be cooled as follows:

- **a.** Internal and/or external air cooling is allowed.
- **b.** Cooling using an attached heat sink is allowed. However, the heat sink must not be, or have a direct connection to, any pneumatic or hydraulic component.
- **c.** Open-cycle vapor cooling of a motor using stored CO_2 is allowed provided that the CO_2 system complies with all the requirements of "8.0 Pneumatic Systems".

Liquid cooling of electric motors is not allowed.

6.8.3 Mounting Position

Any motor and its associated heat sink(s) must be insulated from any pneumatic system component as defined in "8.10.5 Pneumatic Component Insulation".

6.9 Generators and Alternators

Generators and Alternators can be used on a BattleBot, provided that their voltage output complies with the limitations defined in "6.2 Standard Voltage Limitations".

6.10 Electromagnets

Externally-mounted electromagnets can be used on a BattleBot, provided that:

- **a.** Any electromagnet is powered only by a DC voltage, which may be switched on and off, or reversed in polarity.
- **b.** If any electromagnet is repeatedly switched on and off, the maximum switching frequency must be less than **10.0 Hz** (10 times per second).
- **c.** The control electronics for any electromagnet must not interfere with any BattleBot radio control signals or with any event communications equipment.

6.11 High DC Voltage

Any DC Voltage above the limits specified in "6.2.1 DC Voltage" is considered to be a "High DC Voltage". High DC Voltage may be accepted in a BattleBot provided that the BattleBot fully complies with certain specific additional requirements.

Design and construction of a safe High DC Voltage system requires specific engineering expertise. Do not attempt to build such a system unless you are qualified to do so.

6.11.1 Not Allowed in Lightweight

BattleBots in the Lightweight class are not allowed to use DC voltages higher than that specified in "6.2 Standard Voltage Limitations".

6.11.2 Maximum High DC Voltage

The nominal High DC Voltage in a BattleBot can be up to 96 volts. The maximum allowed measured High DC Voltage, with all electrical systems activated, measured from any point of highest potential to the point of lowest potential, is **112.0 volts**.

6.11.3 Transient High Voltages

It is understood that control of brushless DC motors requires the generation of switched DC voltages. However, the peak generated voltage values, with the exception of high-frequency switching transients, must not exceed the maximum allowed voltage potential as defined in "6.11.2 Maximum High DC Voltage".

6.11.4 Battery Packs

All batteries used in a High DC Voltage system must be arranged into electrically separate insulated packs, with the following characteristics:

- **a.** The voltage for any pack cannot exceed a nominal 48 volts (**56.0 volts** maximum).
- **b.** Each pack must be designed so that it is possible to inspect the batteries to confirm that they conform to the requirements of "6.3 Allowed Battery Types".
- **c.** All electrical connections from the pack must employ high-current "push-and-lock" or circular-plug plastic connectors.

6.11.5 Recharging

- **a.** The maximum output voltage of any High DC Voltage external battery charging unit for a BattleBot cannot exceed **70.0** volts, when the charger is being used to charge batteries.
- **b.** Each High DC Voltage battery pack must be recharged individually; connecting battery packs in series for recharging is not allowed.

6.11.6 High Voltage Wiring

All High DC Voltage wiring must conform to the following:

- **a.** Wiring must be multi-stranded and insulated using the factory-applied insulation and/or heat-shrink tubing. Small sections of wire may be insulated with quality electrical tape.
- **b.** Exposed terminals and bare wire ends must be covered with electrical insulation. This insulation must be attached such that it cannot be easily penetrated or knocked off.
- **c.** The wiring must be completely contained within the BattleBot behind protective panels. In no case can the wiring be on, or outside, any exterior portion of the BattleBot.
- **d.** The wiring must be attached to or supported by the BattleBot structure such that impact or vibration should not cause damage to the wiring or terminals.

6.11.7 DC-Isolated Chassis

No part of a High DC Voltage system can have a DC electrical connection to the BattleBots chassis.

6.11.8 No Liquids

Any BattleBot using High DC Voltages cannot also have any liquid substances on board, other than electrolytes used in batteries and electrolytic capacitors.

6.11.9 High DC Voltage Request

Use of High DC Voltage in a BattleBot requires the advance submission, and BattleBots Inc. acceptance, of the specific High DC Voltage Request form as defined in "1.4.6 Request Forms".

6.11.10 Special Voltage Approval

Voltages higher than 96 Volts nominal may be accepted in special cases where an Entrant is able to demonstrate that they have previously constructed safe robotic systems at the higher voltage, and if BattleBots Inc. determines that no competitive advantage is gained by using the higher voltage. Contact BattleBots directly.

7.0 Fuel-Powered Engines

7.1 Internal Combustion Engine

The only type of fuel-powered engine that can be installed on a BattleBot is an Internal Combustion Engine (ICE). Any engine that burns fuel outside of an enclosed combustion chamber cannot be used in a BattleBot.

7.1.1 ICE Definition

An Internal Combustion Engine is defined as an engine that repeatedly burns small quantities of fuel in one or more internal combustion chambers in order to produce continuous rotary motion and power on an output shaft.

7.1.2 Number of ICE's

A BattleBot may use one or more ICE's, provided that each engine complies with "7.2 ICE Engine Requirements".

7.2 ICE Engine Requirements

7.2.1 Engine Cooling

Internal Combustion Engines must be of the air-cooled type only. External liquid cooling is not allowed.

7.2.2 ICE Idle Speed

The Idle Speed of any ICE must be less than one-half (1/2) the maximum operating speed of the engine under normal load at full throttle.

7.2.3 Fuel Pumps

Electrically-powered fuel pumps of any kind cannot be used on a BattleBot.

Mechanical fuel pumps are allowed provided that any pump is mounted directly to the engine and is mechanically driven directly from the engine.

Note: Pumps driven pneumatically using crankcase compression are considered to be mechanically driven.

Any external fuel line from the fuel pump to the engine must meet the following requirements:

- **a.** It must be rated for at least the maximum output pressure of the fuel pump.
- **b.** It must be a single continuous hose from the pump to the engine.
- **c.** It must meet all of the requirements for fuel lines as specified in "7.4.5 Fuel Lines".

7.2.4 Engine Exhaust Restrictions

Exhaust from the engine is subject to the following:

- **a.** Engine exhaust must not be directed toward any fuel or oil supply tank, any fuel or oil line, or any pneumatic or hydraulic component on the BattleBot.
- **b.** Any engine exhaust system component must be insulated from any pneumatic system component as defined in "8.10.5 Pneumatic Component Insulation".
- **c.** Any engine exhaust system component must be located at least two inches (2") away from any fuel tank or fuel line on the BattleBot, or be at least one inch (1") away with a metal heat shield securely mounted midway between the fuel tank/line and the exhaust system.
- **d.** The exhaust must not be vented to the interior of a fully-enclosed BattleBot.

7.2.5 Supercharging and Turbocharging

Superchargers and turbochargers cannot be used on a BattleBot ICE. All ICE intake air must be at or below ambient pressure.

7.2.6 Jet/Turbine Engines

Turbo-Shaft, Turbo-Jet and Pulse-Jet engines cannot be used in a BattleBot.

7.2.7 Combustion-Enhancing Gasses

Using combustion-enhancing gasses is specifically prohibited. The only types of gasses that may be stored on a BattleBot are those specified in "8.2.1 Allowed Gas Types".

7.3 Liquid Fuel Restrictions

7.3.1 Purpose of Liquid Fuels

Liquid fuels may be carried aboard a BattleBot solely for the purpose of powering ICE's. There are additional restrictions on the types and quantity of fuel, as defined below in "7.3.2 Allowed Fuels" and "7.3.3 Fuel Quantity Limits".

7.3.2 Allowed Fuels

The only fuels that can be used on a BattleBot are:

- **a.** Unleaded Gasoline, as generally available from commercial distributors.
- **b.** Diesel fuel, as generally available from commercial distributors.
- **c.** A blend of Unleaded Gasoline, Methanol (optional) and lubricating oil. The blend cannot contain more than 40% Methanol by volume.
- **d.** Glow-plug 2-stroke fuel blends, as generally available at hobby supply outlets. Such blends must not contain more than 10% Nitromethane or 40% Methanol by volume.

7.3.3 Fuel Quantity Limits

The total quantity of fuel that may be carried aboard a BattleBot is based on the Weight Class designation only. The fuel limits are the total for each BattleBot, not for each engine.

Weight Class Designation	Fuel Limit
Lightweight	6.0 fl. oz.
Middleweight	8.0 fl. oz.
Heavyweight	12.0 fl. oz.
Super Heavyweight	16.0 fl. oz.

The fuel limits include any lubricating oil blended into the fuel.

7.4 Fuel System

The storage of liquid fuels on board a BattleBot is subject to the following safety constraints:

7.4.1 Number of Fuel Tanks

There must be no more than one fuel tank for each engine on a BattleBot. One fuel tank feeding two or more engines is permissible, provided the tank and its installation meet all of the requirements specified in this section **7.4**.

7.4.2 Fuel Tank Size

The fuel tanks on a BattleBot must be designed or modified such that, when all tanks are filled to their maximum capacity, they do not contain any more fuel than is allowed for the designated Weight-Class of the BattleBot.

7.4.3 Pressurized Fuel Tanks

Pressurized fuel tanks are not allowed. All fuel tanks must be either vented to atmospheric pressure, or else must be of an unpressurized bladder type.

7.4.4 Fuel Tank Safety

Fuel tanks must be meet the following standards:

a. Rigid, vented fuel tanks must be made of metal, fiber composite, or molded impact-resistant plastic.

b. Bladder-type fuel tanks must be enclosed in a conformal rigid container made of metal, fiber composite, or molded impact-resistant plastic.

c. Fuel tanks must be located such that they are reasonably protected within the body of the BattleBot.

d. Fuel tanks must be mounted such that they can withstand a force in any direction equal to ten (10) times the weight of the fuel stored, without damage to the tank or its mounting.

e. Fuel tanks must be mounted away from any heat-producing components of the BattleBot. Tanks must specifically comply with the specifications of "7.2.4 Engine Exhaust Restrictions".

7.4.5 Fuel Lines

Fuel lines from the tank(s) to the engine(s) must meet the following standards:

a. The fuel line material must be compatible with the type of fuel being used.

b. No fuel line can be exposed on the exterior of the BattleBot. All fuel lines must be on the interior of the BattleBot, or else must shielded by metallic protective armor that completely covers the fuel line.

c. The ends of all fuel lines, including at valves and manifolds, must be secured with either a screw-on pressure fitting, a screw-type hose clamp, at least two wraps of stainless-steel safety wire, or a properly-sized spring-type hose clamp.

d. Any valves or manifolds on the fuel line between the fuel tank and the engine must be attached to or supported by the BattleBot structure.

e. Fuel lines must be constrained to prevent vibration or impact loading from breaking the fuel line or from tearing a fuel line loose from its fittings.

f. Fuel lines must be routed away from any heat-producing components of the BattleBot.

7.4.6 Fuel Vent Systems

All fuel vent systems must be designed such that they will not continuously leak fuel if the BattleBot is inverted.

7.4.7 Fuel Filling Access

Gaining access to, and adding fuel to any tank must not require placing any body part in the path of any battery-powered moveable part of the BattleBot.

7.4.8 Excess Fuel Drainage

The location of the fuel tank and the design of the BattleBot must be such that any fuel spillage during the refueling process will result in the excess fuel draining immediately to the ground below the BattleBot. There must be no puddling of any quantity of excess fuel inside the BattleBot.

7.5 Lubrication Oil

7.5.1 Oil Sumps

If an ICE contains an integral oil sump, the venting system must be designed such that oil will not continuously spill out if BattleBot is inverted.

7.5.2 External Oil Tanks

External oil tanks are allowed solely for the purpose of providing lubricating oil to 2-stroke engines with integral oil injection systems, provided that:

a. Any external oil tanks must meet the same requirements as fuel tanks as described in "7.4.4 Fuel Tank Safety" and "7.4.6 Fuel Vent Systems".

b. Oil lines from any external tank to any ICE must meet the same requirements as fuel lines as described in "7.4.5 Fuel Lines".

7.6 ICE Fail-Safe Operation

7.6.1 Radio Fail-Safe

Any ICE installed in a BattleBot must be configured such that if the signal from the radio-control transmitter is lost, the engine will either shut off (cease producing power) or return to Idle Speed within one (1) second of signal loss.

7.6.2 Automatic Mechanical Disconnect

Any ICE installed in a BattleBot must utilize a centrifugal clutch or other mechanical mechanism such that, while the engine is running at Idle Speed, there is no movement of any BattleBot component driven by that engine.

If the mechanical disconnect system is radio controlled, it must automatically revert to a disconnected configuration if the radio control signal is lost.

7.7 ICE Starting

There are specific requirements for starting an Internal Combustion Engine.

7.7.1 Start-Up Time

Any ICE must be able to demonstrate that, with the engine cylinder head temperature at or below 100º Fahrenheit, it can be reliably started in thirty (30) seconds or less.

The use of starting fluids or gasses (e.g., Ether) is not allowed.

7.7.2 Start-Up Movement

When an ICE is started, there must be no powered movement of any part of the BattleBot as a result of the engine starting.

A removable restraint may be used to prevent movement on start-up, provided that the restraint meets all of the requirements of "2.9 Safety Restraints". Upon removal of the restraint, there must no powered movement of any part of the BattleBot.

7.7.3 Built-In Electric Starters

Built-in electric starters may be used on ICE's, provided that their installation conforms to the requirements of " 6.6 Primary-Power Wiring" and "6.8 Electric Motors".

7.7.4 Portable Starters

An external electric starter can be used for starting ICE's if the starting apparatus meets all the following requirements:

a. The starter, including batteries, must be sufficiently portable that a single individual can easily transport it.

b. All electrical terminals and wiring must be completely electrically insulated.

c. Activation of the starting motor must use an enclosed momentary-type electrical switch that is spring-loaded to the OFF position.

7.7.5 Access to Starting

Gaining access to, and starting any ICE must not require placing any body part within two inches (2") of the path of any weapon system or other powered moveable part of the BattleBot.

8.0 Pneumatic Systems

8.1 Pneumatics Overview

Pneumatics involve the storage, use and control of pressurized gas to power actuators.

8.1.1 Cautions

Pneumatic systems can be very dangerous if not designed, constructed and tested properly. Moreover, damage caused by BattleBots competitions can render any pneumatic system unsafe.

8.1.2 Designer/Builder Responsibility

It is ultimately the responsibility of each BattleBot designer and builder to ensure the safety of their pneumatic system design.

If the designer and/or builder is not knowledgeable about all aspects of pneumatic systems, he or she should not attempt to use them in a BattleBot.

8.2 Compressed Gas Restrictions

There are restrictions on the type and use of gasses in a BattleBot pneumatic system.

8.2.1 Allowed Gas Types

The following gasses are the only types that can be stored or used in a BattleBot:

a. Nitrogen (N_2), in compressed gaseous form only.

b. Carbon Dioxide (CO_2) may be stored in liquid or gaseous form, provided that the pneumatic system is designed to safely use liquid CO_2 .

8.2.2 Maximum Storage Pressure

The maximum pneumatic pressure that can be stored on a BattleBot is as follows:

a. **2,500 psi** is the maximum N_2 pneumatic pressure that may be stored anywhere aboard a BattleBot at any time. A lower storage pressure may be used.

b. **1,000 psi** is the maximum CO_2 pneumatic pressure that may be stored anywhere aboard a BattleBot at any time.

c. **150 psi** is the maximum pneumatic pressure that may be stored aboard a BattleBot if any fuel for an IC Engine (see "7.3.2 Allowed Fuels") is also stored on the BattleBot.

8.2.3 Volume/Weight Limits

Depending upon the type of gas used, there are restrictions on the total amount of gasses that may be stored on a single BattleBot or on a MultiBot cluster. The maximum amount is different for each Weight Class, as shown. In the following table:

- "Maximum N_2 Volume" indicates the total volume of Nitrogen that may be stored, in standard cubic feet at standard temperature and pressure.
- "Maximum CO_2 Weight" indicates the total weight of Carbon Dioxide that may be stored.

Weight Class Designation	Maximum N_2 Volume	Maximum CO_2 Weight
Lightweight	12.0 cu. ft.	20.0 oz.
Middleweight	30.0 cu. ft.	3.0 lb.
Heavyweight	60.0 cu. ft.	6.0 lb.
Super Heavyweight	90.0 cu. ft.	9.0 lb.

Note: The limits on the amount of N_2 are based on the total volume of the gas. There is no requirement that the gas be stored at the maximum allowed pressure.

8.2.4 Maximum Storage per Tank

No single storage tank on board a BattleBot may store more than one-half (1/2) the maximum allowed volume/weight as specified in the table of "8.2.3 Volume/Weight Limits".

8.2.5 Using Both N_2 and CO_2

If a BattleBot uses both N_2 and CO_2, the quantities of each will be limited to half the amount allowed for the specified Weight Class designation.

8.2.6 Maximum Actuation Pressure

250 psi is the maximum pneumatic actuation pressure that may normally be used on board a BattleBot. For non-Lightweight BattleBots, a higher actuation pressure may be used provided that certain strict standards are met. Refer to the section "8.12 High-Pressure Pneumatics"

8.2.7 Powered Pneumatic Pump

A powered pneumatic pump (compressor) may be used to provide or augment on-board pneumatic pressure. This is allowed provided that:

- **a.** There is a pressure-relief valve for each compressor, rated for a flow rate of at least one-hundred-twenty percent (120%) of the compressor output.
- **b.** The pressure-relief valve is set to no more than one-hundred-twenty percent (120%) of the compressor's output pressure.
- **c.** Each compressor is rated for a pressure output equal to or greater than the compressor's pressure-relief valve.
- **d.** The maximum output pressure of the compressor is less than that defined in "8.2.6 Maximum Actuation Pressure".

8.3 Pressure Tank Requirements

All pneumatic pressure tanks, whether used as primary storage, or as an expansion tank, must meet the following requirements:

8.3.1 N_2 Tanks

Storage tanks containing N_2 must be commercially-available, DOT-approved and rated for at least one-hundred-twenty percent (120%) of the maximum pressure to be stored in that tank. The maximum rating must be clearly readable on each tank.

8.3.2 CO_2 Tanks

CO_2 tanks must be all-metal, commercially-available, DOT-approved and rated for at least one-hundred-twenty percent (120%) of the maximum allowed pressure for CO_2 as defined in "8.2.2 Maximum Storage Pressure". The maximum rating must be clearly readable on each tank.

Fiber-wound CO_2 tanks are not allowed.

Note: CO_2 tanks need not be removable for weighing. However, at a BattleBots Tournament, all CO_2 tanks will be deliberately underfilled to allow for the resolution of the scale used. Refer to the BattleBots Tournament Rules and Procedures document for more information.

8.3.3 Tank Manufacture/Test Date

For new pressure tanks, or for tanks with finite lifetimes, the date of manufacture must be clearly indicated on the tank. Otherwise, the tank must have a current hydro-test date (per DOT standards) indicated on the tank.

If no date is indicated on the tank, official written documentation will have to be provided of the date of manufacture and/or hydro-testing.

8.3.4 Pressure Relief

Each pressure tank must be equipped with a burst disc or ASME certified pressure relief device appropriate for the maximum pressure rating of the tank.

The pressure relief exit must be positioned in such a way that it will relieve pressure away from the direction of any persons refilling the tank.

8.3.5 Pressure Tank Damage

Any pressure tank must not have any external damage that in any way compromises its structural integrity. Such tanks cannot ever be used to store pressurized gas aboard a BattleBot.

8.3.6 Custom Pressure Tanks

All pneumatic pressure storage tanks must be commercially manufactured, distributed and sold. Custom-made or modified pressure tanks are prohibited.

8.4 Pressure Regulators

Pneumatic pressure regulators are not specifically required except in the Lightweight class. Any BattleBot using a regulator must conform to the applicable requirements specified below in this section **8.4**.

8.4.1 Lightweight Pressure Limit

Lightweight class BattleBots with pneumatic systems are required to have pressure regulators set at or below the maximum actuation pressure for Lightweights, as defined in "8.2.6 Maximum Actuation Pressure".

8.4.2 Regulator Lock-Down

If a regulator is adjustable and its maximum setting exceeds the limit specified in "8.2.6 Maximum Actuation Pressure", then the regulator adjustment must have a position locking method that prevents the regulated pressure from increasing due to vibration or shock. The locking method must be mechanical and cannot use any kind of adhesive tape.

8.4.3 Regulator Mounting

A pressure regulator may be directly attached to a primary pressure storage tank, or it may be attached to the BattleBot chassis. If the regulator is not mounted to a tank, it must be positively secured to the BattleBot structure.

8.4.4 Connection to Regulator

If a regulator is not mounted directly on a pressure storage tank, any connecting hoses and associated manifolds must be rated for the maximum pressure stored in the associated tank. These connecting components must conform to the requirements defined in "8.9 Pneumatic Components".

8.5 Shut-Off Valves

Each individual pressure storage tank on a BattleBot must have a method to isolate the high-pressure gas stored in the tank. The requirements are as follows:

8.5.1 Regulator Shut-Off Valve

If a regulator attached to a pressure storage tank contains an integral shut-off valve, that is an acceptable shut-off valve implementation.

Adjusting the regulator pressure is not acceptable as a Shut-Off Valve implementation.

8.5.2 Dedicated Shut-Off Valve

If a regulator shut-off valve is not used:

a. A separate dedicated shut-off valve is required for each individual pressure storage tank, mounted to the tank, or between the tank and the regulator.

b. The shut-off must be manually operated and must not require the disconnecting of any hoses or fittings. Electrically operated shut-off valves cannot be used.

c. Each shut-off valve must be rated for the maximum pressure used in its associated pressure storage tank.

Unscrewing or rotating a tank to shut off pressure is not acceptable.

8.5.3 Remote Shut-Off Valve

If the shut-off valve is not mounted directly to the pressure storage tank:

a. The valve must be mounted as close as is practical to its respective pressure storage tank.

b. The valve must be connected only by a single continuous pipe or hose from the pressure storage tank fitting to the shut-off valve fitting.

c. The pipe or hose is considered to be a part of the pressure tank and must be armored to the same standards as the tank, as described in "8.10.6 Pressure Tank Protection".

d. If a flexible hose is used, it must be secured and/or restrained such that impacts and other combat loads will not stress the hose fittings.

8.5.4 Shut-Off Valve Access

Access to all shut-off valves must be such that the BattleBot will comply with the access, total time and safety conditions for pre-Match Activation, and post-Match Deactivation, as defined in "5.0 BattleBot Activation and Deactivation".

8.6 Purge Valves

Any BattleBot pneumatic system must have a method to relieve all gas pressure in the system downstream of the Shut-Off valve(s).

8.6.1 Regulator Combination Valve

If a regulator attached to the pressure storage tank contains an integral combination shut-off/purge valve, that is acceptable, provided the shut-off action is fully complete before the purge action begins.

8.6.2 Purge Valve Operation

Any dedicated purge valve must be manually operated. Electrically operated purge valves are not allowed.

Any purge valve must operate such that it remains open and venting in the purge position. Spring-closure purge valves are specifically prohibited.

8.6.3 Purge Valve Location

Purge valves may be located anywhere in the pneumatic system, provided that their combined activation relieves all pressure in the pneumatic system downstream of the shut-off valve even if any electrically-controlled actuator valve is stuck in any position.

Any purge valve must be located such that on venting, the vented gas is directed away from the person operating the valve.

8.6.4 Purge Valve Access

Access to all purge valves must be such that the BattleBot can comply with the access, total time and safety conditions for pre-match Activation, and post-match Deactivation, as described in "5.0 BattleBot Activation and Deactivation".

8.7 Pressure Reliefs

To minimize the safety risk to BattleBots participants and crew:

8.7.1 Pressure Relief Requirements

Any BattleBot pneumatic system must have ASME pressure reliefs installed downstream of the pressure regulator or Shut-Off Valve, as necessary, to limit pressure on the actuation side of the pneumatic system.

8.7.2 Pressure Relief Setting

Downstream pressure reliefs must start relieving pressure at no more than one-hundred-twenty-five percent (125%) of the pressure rating of the lowest-rated component in that part of the pneumatic system.

8.8 Pressure Test Points

A BattleBot pneumatic system must have a method of quickly and easily checking all system pressures at any point in the pneumatic system.

8.8.1 Tank Pressure

Every pressure storage tank must have a pressure gauge or test point fitting which allows reading the unregulated gas pressure in that tank.

A single gauge or test point may be used to measure the pressure in more than one tank, provided that each tank has a separate Shut-Off Valve.

8.8.2 System Pressure

If the pneumatic system contains a regulator, there must be at least one pressure gauge or test point fitting downstream of the regulator, which allows reading the regulated system pressure.

If there is no regulator, there must be at least one pressure gauge or test point fitting downstream of the Shut-Off Valve.

8.8.3 Pressure Gauge Specifications

Each pressure gauge must indicate a minimum of one-hundred-twenty percent (120%) and a maximum of three-hundred percent (300%) of the maximum pressure that the gauge is measuring.

8.8.4 Test Point Fittings

If a gauge is not used at a pressure test point, a Stauff SMK-20, SMK-15, SMK-12, or directly compatible fitting, is allowed in lieu of the gauge.

8.8.5 Pressure Test Accessibility

Design and placement of the gauges and/or test points must allow quick and safe reading of the pressure values. Specifically:

- **a.** Accessibility of the gauges and/or test point fittings must be such that it requires no more than one (1) minute to read all test point pressures on a battle-ready BattleBot.
- **b.** Gaining access to and reading of the test-point pressures must not require placing any body part in the path of any weapon system or other powered moveable part of the BattleBot.
- **c.** Reading of any gauge must not require the use of mirrors or other special devices. Use of a flashlight is acceptable.
- **d.** Each gauge must be positioned such that the indicating face of the gauge is not inclined more than thirty degrees (30°) from perpendicular to the normal gauge viewing position.

8.9 Pneumatic Components

8.9.1 Component Ratings

All primary pneumatic components on the BattleBot, including tanks, regulators, valves, and actuators must be clearly marked as rated for the pressures being used in the pneumatic system.

If any pneumatic component is not visibly marked for inspection, the BattleBot Entrant must supply the necessary data sheets to prove that it is properly rated for the pressures being used.

8.9.2 Component Damage

If a pneumatic component is damaged in any way that compromises its structural integrity, then that component must not be used in a pressurized BattleBot pneumatic system.

8.9.3 Custom Components

If any custom-made or custom-modified component is used in the BattleBot's pneumatic system, the Entrant will be required to:

- **a.** Supply data sheets and/or computations and/or certified hydro-testing results to prove that the component is properly designed.
- **b.** Demonstrate at any Safety/Tech inspection that the component performs reliably and safely.

As specified in "8.3.6 Custom Pressure Tanks", custom-made or modified pressure tanks are prohibited.

8.9.4 Custom Component Request

Request for custom pneumatic component acceptance requires the submission of an Advance Acceptance Request form to BattleBots Inc. as defined in "1.4.6 Request Forms".

8.9.5 Pneumatic Heaters Not Allowed

No active heating system, on board or external, can be used for pressure tanks, expansion tanks or any other components of a BattleBot's pneumatic system.

Fans are allowed to blow ambient air across pneumatic components.

8.9.6 Pressure Boosters

A pressure booster (intensifier) is a component designed to raise the system operating pressure. Using pressure boosters anywhere in a pneumatic system is not allowed.

8.10 Component Installation and Mounting

The minimum requirements for the installation and mounting of pneumatic components are:

8.10.1 Pressure Tank Securing

Each pressure storage tank must, at a minimum, be secured to the BattleBot structure as follows:

- **a.** The tank must be constrained at multiple points, such that a load on any part of the tank will be taken primarily by the hold-down, not the tank structure.
- **b.** The tank cannot be constrained primarily at the outlet "neck" or at any attached shut-off valve or regulator.
- **c.** Vibration or impact inertial shock will not cause release of the securing method.

Tie-wraps, adhesive tape or other non-reusable tank hold-downs are not allowed.

8.10.2 Pneumatic Component Mounting

Pneumatic components must be mounted in such a way as to minimize the hazard created when part of the pneumatic system is damaged. The specific requirements are:

- **a.** Other than hoses and piping, any pneumatic system component, such as a valve, gauge or manifold, must be secured to the BattleBot structure.
- **b.** Where necessary, a flexible connecting hose must be constrained to prevent vibration or impact loading from applying a bending force to any fittings.

c. Where necessary, a hose or pipe must be curved or looped to prevent strain on the hose or pipe and its fittings due to expansion and contraction during operation.

8.10.3 Pneumatic System Loads

No part of a pneumatic system may be used as a structural part of, or be subject to any significant loads from, the BattleBots chassis.

Note: It is understood that pneumatic actuators will be subject to loads due to the actuator operation.

8.10.4 Actuator Mounting and Installation

Pneumatic actuators must be mounted and installed as follows:

a. Pneumatic actuators must be mounted such that all actuation loads are taken by specifically designed load points, and not by any pneumatic fittings attached to the actuator.

b. Pneumatic weapon actuators and their attachment points must be designed such that they can withstand repeated maximum pressure operation of the actuator without any significant structural degradation.

c. If the piston of a cylindrical weapon actuator strikes the rod-cap during its operation, there must be a restraint, shield or other containment method that will retain or capture any parts that would come loose if the rod-cap separates from the actuator.

8.10.5 Pneumatic Component Insulation

All pneumatic components must be insulated against sources of heat as follows:

a. For electric motors and non-Lead-Acid batteries, a free-air space of at least one-eighth inch (1/8") between any part of the heat-producing component and any part of the pneumatic system.

b. For electronic motor controllers, a free-air space of at least one-quarter inch (1/4") between any part of the controller and any part of the pneumatic system.

c. For any fuel-powered engine exhaust pipe or muffler, at least one-half inch (1/2") of free air space, with a metal heat shield securely mounted midway between the exhaust pipe and the pneumatic component. Exhaust pipes/mufflers mounted more than two inches (2") from all pneumatic components require no heat shield.

8.10.6 Pressure Tank Protection

Any pneumatic pressure storage tank must not be directly exposed at any point on the outside or underside of the BattleBot, regardless of the position of the weapons or of any other moving part of the BattleBot.

The tank must be protected on all sides with removable armor consisting of a minimum of a single layer of one or more of the following:

a. **1/4-inch** thick polycarbonate plastic.

b. **3/16-inch** thick glass, carbon or aramid fiber composite.

c. **1/8-inch** thick 6061-T6 or stronger Aluminum.

d. **3/32-inch** thick Steel or Titanium.

The armor must not be wrapped tightly around the tank, but must be generally spaced a minimum of one-quarter inch (1/4") from the tank on all sides.

The external armor of a BattleBot may qualify as part or all of the pressure tank protection, provided that it meets the specified material and thickness requirements.

8.11 Pressure Tank Filling Connections

To provide for safe and efficient filling of pressure tanks:

8.11.1 Standard Filling Connection

All BattleBots with pneumatic systems must be designed to be filled using a standardized quick disconnect fitting. The fitting should either be installed integral to the pneumatic system, or on an adapter made for connecting to the BattleBot's pressure tank(s).

The standardized fitting is a Foster (www.couplers.com) FST-series 12MPS straight-through 1/8" male thread Stainless Steel quick disconnect plug fitting. The exact equivalent plug fitting from other manufacturers (Parker, Hansen etc.) is also acceptable.

Note: The 12MPS or equivalent fitting is commonly available from paintball supply outlets. The fitting is usually described as a "quick disconnect". Only the plug (male) part is needed, but it must be made of Stainless Steel.

8.11.2 Filler Installation

BattleBots-provided filling equipment will use the sleeve (female) part of the standardized quick-disconnect fitting. In order to allow safe and controlled filling, a shut-off valve must be used on the BattleBot's filling line, so that the line is not under tank pressure when coupling or uncoupling the quick-disconnect fitting.

8.11.3 Filling Access

If a BattleBot does not use removable tanks, access to the BattleBot for filling must not require the BattleBot to be held or supported in any unstable position.

8.12 High-Pressure Pneumatics

Any BattleBot pneumatic system that operates above **250 psi** actuation pressure is considered to be using "High-Pressure Pneumatics".

The design and operation of High-Pressure Pneumatics requires a high level of skill, experience, engineering and craftsmanship. Do not attempt to build such a system unless you are qualified to do so.

High-Pressure Pneumatics may be accepted in a BattleBot provided that the BattleBot fully complies with certain specific additional requirements.

8.12.1 Not Allowed in Lightweight

BattleBots in the Lightweight class cannot qualify for High-Pressure Pneumatics and must use regulators set no higher than specified in "8.2.6 Maximum Actuation Pressure".

8.12.2 Maximum Pressure

1000 psi is the maximum pressure allowed to be used for actuation in a High-Pressure Pneumatic system.

8.12.3 Accumulator Tanks

All High-Pressure Pneumatic accumulator or expansion tanks must be protected using the same standards as defined in "8.10.6 Pressure Tank Protection".

8.12.4 Actuator Protection

All High-Pressure Pneumatic actuators must be protected using the same standards as defined in "8.10.6 Pressure Tank Protection" regardless of the position of the actuator.

8.12.5 Purge Valves

A High-Pressure Pneumatic system must contain a purge valve that allows a fully-charged pneumatic system to be completely discharged (including storage tanks) within sixty (60) seconds.

Any purge valve used in a High-Pressure Pneumatic system must be manually operated and cannot use any kind of quick disconnect. The valve must operate such that it remains open and venting in the purge position.

8.12.6 High-Pressure Pneumatics Request

The use of the High-Pressure Pneumatics in a BattleBot requires the advance submission, and BattleBots Inc. acceptance, of the specific High-Pressure Pneumatics Request form as described in "1.4.6 Request Forms".

9.0 Hydraulic Systems

9.1 Hydraulics Overview

Hydraulics involve the pressurization and control of a liquid to power linear and rotary actuators.

9.1.1 Cautions

Hydraulic systems use very-high-pressure liquid and can be dangerous if not designed and constructed properly. Moreover, damage caused by BattleBots competition can render any hydraulic system unsafe.

9.1.2 Designer/Builder Responsibility

It is ultimately the responsibility of each BattleBot designer and builder to ensure the safety of their hydraulic system.

If the designer and/or builder is not knowledgeable about all aspects of hydraulic systems, he or she should not attempt to use them in a BattleBot.

9.2 Hydraulic System Requirements

Hydraulic systems used in a BattleBot are subject to the following requirements:

9.2.1 Maximum Hydraulic Pressure

a. The maximum hydraulic pressure used anywhere on board a BattleBot cannot exceed **5000 psi**.

b. If an accumulator or other pressure storage tank is used anywhere in a hydraulic system, the maximum pressure in that tank cannot exceed **2500 psi**.

9.2.2 Hydraulic Fluid Type

Any hydraulic fluid used in a BattleBot must be non-flammable, non-corrosive, have moderate-to-low toxicity, and be rated for the maximum pressure used in the hydraulic system. The maximum temperature rating of the fluid must be at least 200º Fahrenheit.

9.2.3 Hydraulic Pressure Source

All hydraulic pressure in a BattleBot must be generated on-board by one or more hydraulic pumps driven by Electric Motors or Fuel-Powered Engines.

9.2.4 Pressure Regulation

Any hydraulic pump must have a pressure-relief valve that limits the output pressure of the pump to the appropriate limit specified "9.2.1 Maximum Hydraulic Pressure", and which bypasses any excess hydraulic fluid at low pressure to a storage reservoir. The relief valve must be able to pass a flow rate of at least one-hundred-twenty percent (120%) of the pump's output capacity.

9.2.5 Hydraulic Fluid Storage

Hydraulic fluid must be stored aboard a BattleBot as follows:

a. The hydraulic fluid must be stored in a hydraulic reservoir tank that is not pressurized to more than **35 psi**.

b. The hydraulic reservoir must be located such that it is reasonably protected within the frame of the BattleBot.

c. Any vent system for the hydraulic reservoir must be designed such that the tank will not continuously leak hydraulic fluid if the BattleBot is inverted.

9.3 Hydraulic System Components

Each component in a BattleBot hydraulic system is subject to the following restrictions:

9.3.1 Standard Components

Using standard rated hydraulic components is strongly encouraged. Certain custom components are allowed with restrictions.

9.3.2 Standard Component Ratings

Only rated standard hydraulic components can be used on a BattleBot. Thus:

a. Hydraulic components used on the BattleBot, including pumps, accumulators, valves, manifolds, hoses, couplings and actuators must be clearly marked as rated for the pressures being used in the hydraulic system.

b. If any hydraulic component is not clearly marked and visible for inspection, the BattleBot Entrant must supply data sheets that prove that the component is properly rated for the pressures being used.

9.3.3 Component Damage

If any pressurized hydraulic component is damaged in any way that compromises its structural integrity, then that component must not be pressurized in a BattleBot hydraulic system.

9.3.4 Accumulators and Pressure Boosters

Any hydraulic accumulators and pressure boosters must be commercially manufactured and distributed. Custom-made or modified accumulators or pressure boosters are specifically prohibited.

9.3.5 Other Custom Components

If any custom-made or custom-modified component is used in the BattleBot's hydraulic system, the entrant will be required to:

a. Supply data sheets and/or computations to prove that the component is properly designed.

b. Demonstrate at any Safety/Tech Inspection that the component performs reliably and safely.

9.3.6 Custom Component Request

Request for use of custom hydraulic components requires the submission of an Advance Acceptance Request form to BattleBots Inc. as defined in "1.4.6 Request Forms".

9.4 Component Installation and Mounting

The requirements for the installation and mounting of hydraulic components in a BattleBot are:

9.4.1 Component Mounting

Hydraulic components must be mounted as follows:

a. Any hydraulic pump must be positively secured to the BattleBot structure or to the drive motor.

b. Other than pumps and hoses and piping, any hydraulic component, such as a valve, gauge or manifold, must be positively secured to the BattleBot structure.

c. Where necessary, flexible hydraulic hoses must be constrained to prevent vibration or impact loading from applying a significant bending force to any fittings.

d. Where necessary, hydraulic hose and piping must be curved or looped to prevent strain on the hose, piping or fittings due to expansion and contraction during operation.

9.5 Hydraulic Accumulator Requirements

Any hydraulic accumulators used on a BattleBot must meet the following requirements:

9.5.1 Disallowed in Lightweight

Hydraulic accumulators cannot be used in Lightweight class BattleBots.

9.5.2 Pressure Rating

Any accumulator must be rated for at least the maximum pressure allowed for hydraulic systems with accumulators, as defined in "9.2.1 Maximum Hydraulic Pressure". The maximum rating must be indicated on the accumulator such that it is clearly readable.

9.5.3 Accumulator Volume Limits

If an accumulator or other volume-building device is used in a BattleBot hydraulic system, the maximum pressure-storage capacity is limited for each Weight Class, as shown in the table below. In the table, "Maximum Accumulator Volume" refers to the total actual volume of all hydraulic pressure-accumulation systems on the BattleBot.

BattleBots Class Designation	Maximum Accumulator Volume
Lightweight	N/A
Middleweight	80 cu. in.
Heavyweight	140 cu. in.
Super Heavyweight	220 cu. in.

9.5.4 Pressure Relief

Any accumulator must be equipped with a dedicated pressure relief device set to the accumulator limit specified in "9.2.1 Maximum Hydraulic Pressure", or the maximum pressure rating of the accumulator, whichever is less.

9.5.5 Accumulator Securing

Any mounting systems for hydraulic accumulators must meet the following minimum criteria:

- **a.** The accumulator must be securely mounted to the BattleBot structure.
- **b.** The accumulator must be constrained at multiple points, such that a load on any part of the accumulator will be taken primarily by the mounting, not the accumulator.
- **c.** The accumulator is not mounted primarily at the connection "neck".

9.5.6 Hydraulic Accumulator Request

Use of any hydraulic accumulator requires the advance submission, and BattleBots Inc. acceptance, of the specific Hydraulic System Request form as defined in "1.4.6 Request Forms".

9.6 Hydraulic Pressure Boosters

A hydraulic pressure booster (intensifier) is a component designed to raise the operating pressure of the system.

9.6.1 Disallowed in Lightweight

Pressure boosters cannot be used in a Lightweight Class BattleBot.

9.6.2 Limitations on Use

Using a pressure booster anywhere in a hydraulic system may be allowed provided that it does not raise the system pressures above the limits specified in "9.2.1 Maximum Hydraulic Pressure".

9.6.3 Pressure Relief

Any pressure-booster must be equipped with a dedicated pressure relief device set to either the maximum limit specified in "9.2.1 Maximum Hydraulic Pressure", or the maximum pressure rating of the pressure booster, whichever is less.

9.6.4 Pressure Booster Request

Use of any hydraulic pressure booster requires the advance submission, and BattleBots Inc. acceptance, of the specific Hydraulic System Request form as defined in "1.4.6 Request Forms".

9.7 Bypass/Purge Valves

Any BattleBot hydraulic system must use one or more bypass/purge valves to relieve all pressure in the hydraulic system. The minimum requirements are:

9.7.1 Bypass/Purge Valve Type

Any bypass/purge valve must be manually operated and must be rated for the maximum allowed pressure of the hydraulic system.

Note: Electrically operated bypass/purge valves are not allowed.

9.7.2 Bypass/Purge Valve Locations

Bypass/purge valves may be located anywhere in the hydraulic system, provided that their combined activation relieves all pressure in the hydraulic system.

9.7.3 Accumulator Bypass/Purge Valve

If the hydraulic system uses any accumulators, then each accumulator must have a dedicated bypass/purge valve.

9.7.4 Valve Access

Access to all bypass/purge valves must be such that the BattleBot can comply with the access, total time and safety conditions for pre-match Activation, and post-match Deactivation, as described in "5.0 BattleBot Activation and Deactivation".

9.7.5 Fluid Storage

All hydraulic fluid released by any bypass valve must be directed to the low-pressure storage reservoir on-board the BattleBot. There must be a fixed, no-leak connection from any bypass valve to the reservoir.

9.8 Pressure Test Points

BattleBot hydraulic systems must have a method of quickly and easily checking all hydraulic system pressures.

9.8.1 System Pressure

Any hydraulic system must have at least one pressure gauge or test point that allows reading the operating hydraulic system pressure.

9.8.2 Accumulator Test Point

If the hydraulic system uses any accumulators, then each accumulator must have a separate dedicated test point.

9.8.3 Pressure Booster Test Point

If the hydraulic system uses any pressure boosters, then each pressure booster must have a separate dedicated test point.

9.8.4 Pressure Gauge Specifications

Each pressure gauge must indicate a minimum of one-hundred-twenty percent (120%) and a maximum of three hundred percent (300%) of the maximum pressure that the gauge is measuring.

9.8.5 Test Point Fittings

If a gauge is not used at a test point, a Stauff SMK-20 or directly compatible fitting is allowed in lieu of the gauge. If a Stauff-compatible fitting is not used, it is the responsibility of the individual BattleBot Team to provide the appropriate gauges compatible with the test fittings of their BattleBot. The gauges must comply with the requirements specified in "9.8.4 Pressure Gauge Specifications".

9.8.6 Pressure Test Accessibility

Design and placement of the gauges and/or test points must allow quick and safe reading of the pressure values. Specifically:

a. Accessibility of the gauges and/or test points must be such that it requires no more than one (1) minute to read any test point pressure on a battle-ready BattleBot.

b. Gaining access to and reading of the test-point pressures must not require placing any body part in the path of any weapon system or other powered moveable part of the BattleBot.

c. Each gauge must be positioned such that the indicating face of the gauge is not inclined more than thirty degrees (30°) from perpendicular to the gauge viewing position.

10.0 Mechanical Energy Storage Systems

10.1 Mechanical Storage Methods

Mechanical energy can be stored as either potential energy or kinetic energy.

10.1.1 Potential Energy

Potential energy is stored using the deformation of an elastic medium. Pneumatics stores energy in a compressed gas. A spring stores energy by distorting a solid material.

10.1.2 Kinetic Energy

Kinetic energy is stored in the movement of a mass. Kinetic energy can be stored in a flywheel, or in a fast-moving "ramming" BattleBot.

10.2 Pneumatics

Regulations for pneumatic systems are described in "8.0 Pneumatic Systems".

10.3 Large Springs

Large Springs are capable of storing a great deal of energy, which can be released very quickly. Thus, there are specific requirements on the use of Large Springs in a BattleBot.

10.3.1 Large Spring Definition

A Large Spring is defined as any spring, or grouped combination of springs, that requires, at any point of its extension or compression, more than twenty (20) pounds of force to extend or compress the spring.

10.3.2 Deactivated Spring

Any Large Spring used on a BattleBot must be installed such that, in its Deactivated (unarmed) position, it is not exerting a force of more than five (5) pounds on any component of the BattleBot.

10.3.3 Arming Mechanism

Any BattleBot part powered by Large Spring must not be manually armed. All arming must be done via a remote-control method using a power source on-board the BattleBot.

10.3.4 Release Mechanism

Any Large Spring remote-controlled release mechanism must require a specific command from the remote transmitter to release an armed BattleBot part powered by a Large Spring.

10.3.5 Release Fail-Safe

Any Large Spring remote-controlled release mechanism must be designed such that, upon loss of transmitter signal, any armed BattleBot part powered by a Large Spring will not be released.

10.3.6 Safety Release

A safety mechanical release mechanism must be provided for releasing the spring force of any Large Spring with the following conditions:

- **a.** A single person must be able to activate a mechanism that releases the spring force.
- **b.** It must require no more than thirty (30) seconds to release the spring force.
- **c.** Releasing the spring force must not require placing any body part in the path of any weapon system or other powered moveable part of the BattleBot.

A special tool can be used to release the spring force. If such a tool is required, an additional spare tool must be made.

10.4 Flywheels

The amount of energy that can be stored by a flywheel is primarily constrained by the strength of the material used in its construction. However, flywheels can also take a considerable amount of time to absorb that energy ("spin up").

10.4.1 Flywheel Definition

A Flywheel refers to any heavy spinning part, or collection of parts, used on or within a BattleBot, where the inertia of the part(s) stores a substantial amount of energy. This includes the spinning exterior of a "Spinner" BattleBot.

Note: Small, thin saw blades and small rotary cutters are not considered to be Flywheels.

10.4.2 Flywheel Power

A Flywheel on a BattleBot cannot be used as a primary power source. That is, the Flywheel must be spun-up using another power source (batteries, fuel, compressed gas) stored on the BattleBot.

10.4.3 Flywheel Use Restrictions

A Flywheel may be used in the following ways:

- **a.** Directly as an impact or cutting weapon.
- **b.** Indirectly to drive an impact or cutting weapon.
- **c.** To gyroscopically stabilize or control the BattleBot.
- **d.** As an energy-storage device to drive a generator, pump or actuator.

A Flywheel may not, either deliberately or inadvertently, be used as a fragmentation weapon, whereby the explosion of a Flywheel is used to damage an opponent.

10.4.4 Flywheel Spin-Up

Notwithstanding any additional requirements in the BattleBots Tournament Rules and Procedures document, BattleBots Inc. will not allow any Flywheel to be spun up except in the BattleBox or in a designated Test Area.

10.4.5 Flywheel Safety and Spin-Down

Any Flywheel used on or within a BattleBot must comply with all the safety and spin-down time requirements defined in "5.4 Spinning Parts".

10.4.6 Flywheel Structural Design

BattleBots Officials reserve the right to exclude any BattleBot whose Flywheel structural design, in their determination, poses a safety risk to BattleBots participants, crew or spectators.

10.4.7 Flywheel Deactivation

All external Flywheels must have Safety Restraints, as defined in "2.9 Safety Restraints".

11.0 BattleBot Weapons

11.1 Weapon Design

11.1.1 Weapon Safety

Except when the BattleBot is in combat or is being tested, a BattleBot weapon system must be completely safe and non-hazardous to all personnel and objects in the vicinity of the BattleBot.

11.1.2 Weapon Activation and Deactivation

All weapons Activation and Deactivation must comply with all the specifications of "5.3 Activation/Deactivation Requirements".

11.1.3 Multiple Modular Weapons

A Modular Weapon is defined as a weapon, powered or unpowered, that can be added and removed from a BattleBot in a short period of time.

A BattleBot may be approved for using multiple Modular Weapons, providing that:

- **a.** Each BattleBot/Weapon combination complies with all the requirements of this section **11.0** and all other applicable BattleBots Rules and Regulations.
- **b.** The combined time for adding and removing each Modular Weapon from the BattleBot is less than thirty (30) minutes total.
- **c.** The weight of the BattleBot with any Modular Weapon attached does not exceed the maximum allowed for the BattleBot's Weight Class.

11.1.4 Damage to BattleBox

All BattleBots weapon systems must be designed such that, during normal operation, they will not materially damage the BattleBox floor, such that repairs would be required for the next scheduled Match to proceed.

11.2 Entanglement Devices

A BattleBot cannot use any device specifically designed to entangle a competitor BattleBot.

11.2.1 Entanglement Device Definition

An Entanglement Device is a substance, material or passive mechanism that, by itself, is not sufficient to cause any damage directly, but serves only to foul the mechanisms of another BattleBot.

11.2.2 Entanglement Device Types

Entanglement Devices include, but are not limited to the following:

- **a.** Any type of net.
- **b.** Fishing Line, string, rope, etc.
- **c.** Non-metallic chain or cable.
- **d.** Ball Bearings or marbles.
- **e.** Adhesive-coated tape.
- **f.** "Liquid String" toy products.
- **g.** Metal filings or "wool".
- **h.** Blankets, tarps or other flexible coverings.

11.2.3 Metal Chains and Cables

The classification of metal chains and cables as an Entanglement Device depends on their length and how they are used.

- **a.** A metal chain or cable will not be considered an Entanglement Device if its extended length, measured from any BattleBot attachment point, is less than twelve inches (12").
- **b.** A chain or cable exceeding the length defined in **11.2.3.a** may be considered an Entanglement Device, depending upon the extended length, the stiffness and/or the attachment point(s).

11.2.4 Grappling Hooks

A grappling hook weapon by itself is not considered an Entanglement Device. A metallic cable or chain holding a grappling hook may be considered an Entanglement Device, depending upon how it conforms to the classifications defined in "11.2.3 Metal Chains and Cables".

11.3 Projectile Weapons

Projectiles can be used as a weapon on a BattleBot, provided they are restrained by a tether:

11.3.1 Projectile Definition

A Projectile is defined as any part of the BattleBot that is forcibly ejected away from the BattleBot, where the kinetic energy of the part is intended to inflict damage on an opponent.

11.3.2 Tether Requirements

Any projectile must be connected by a tether to the structure of the BattleBot as follows:

- **a.** The tether and its attachments must be of sufficient strength and durability such that they can restrain the fired projectile without sustaining any damage, even after multiple firings.
- **b.** The length of the fully-extended tether, as measured from the attachment point on the BattleBot to the tip of the projectile, must be less than eight feet (8').

11.4 Forbidden Weapons

In addition to any other restrictions in these Regulations, the following weapons cannot be used:

11.4.1 Electricity

Electricity or electric fields cannot be used directly as weapon. This includes, but is not limited to:

- **a.** Stun guns and cattle prods.
- **b.** Radio jamming equipment.
- **c.** Electro-Magnetic Pulse output.

11.4.2 Liquids

No type of liquid may be used as a weapon. This includes, but is not limited to:

- **a.** Water or water-based liquids.

b. Liquefied gasses.
c. Chemicals or corrosives.
d. Foaming liquids.
e. Glues or adhesives.

11.4.3 Explosives

No type of explosive or rapidly burning substance may be used as, or in, a weapon. This includes, but is not limited to:

a. DOT Class C devices.
b. Gunpowder or cartridge primers.
c. Military explosives.
d. Sodium Azide.

11.4.4 Flammable Liquids and Gasses

No type of flammable liquid or gas may be used as, or directly in a weapon. This includes, but is not limited to:

a. Gasoline, Alcohol, Ether, etc.
b. Propane, Butane, Acetylene, etc.

11.4.5 Visual Obstruction

No weapon can be used to impair the vision of an opponent BattleBot's Operators. This includes, but is not limited to:

a. Heavy smoke, intentionally created.
b. Lights or lasers directed at the Operators.

11.4.6 Heat/Cold

No weapon can use heat or cold specifically generated to damage an opponent. This includes, but is not limited to:

a. Flame throwers.
b. Plasma torches.
c. Liquefied or solidified gasses.

11.4.7 Non-Combustible Gas

A BattleBot cannot deliberately use a non-combustible gas to disable an opponent's fuel-burning engine.

11.4.8 Explosive Flywheel

Using a fragmenting flywheel as a weapon is considered to be using projectiles without restraining tethers, and is thus not allowed.

11.4.9 Mutually-Destructive Weapon

A Mutually-Destructive Weapon is designed with the intent that attacking an opponent will also disable the attacking BattleBot.

A BattleBot cannot deliberately use a battery, fuel tank, pneumatic tank, hydraulic accumulator or any similar component as a Mutually-Destructive Weapon.

11.5 Smothering or Covering

A BattleBot can use a weapon designed to partly or completely cover (smother) an opponent. However, any covering weapon must be a rigid (or semi-rigid) shell that can be controlled to release the opponent at will.

Use of tarps, blankets or other flexible means of covering will be considered Entanglement (see "11.2 Entanglement Devices").

11.6 Laser or Light Homing

A BattleBot Team can use a laser or other (non-coherent) light source to "paint" a target BattleBot, provided that the light source complies with the following:

11.6.1 Hand-Held Lasers

Hand-held targeting lasers are limited to Class IIIa or below, regardless of the color spectrum of the light.

11.6.2 Non-Coherent Lights

Non-coherent targeting light sources must not be so bright that their reflection from a polished-metal BattleBot will distract or blind any Operators, Referees or Judges.

Ultra-violet light sources cannot be used in BattleBots, as specified in "2.13.4 BattleBot Lights".

11.7 Airbags/Balloons

A BattleBot may use airbags or balloons as a weapon, providing that:

- **a.** The inflation of any airbag is accomplished using a pneumatic system that complies with the standards defined in "8.0 Pneumatic Systems".
- **b.** The maximum volume of any airbag is 33.5 cu. ft. (a 4-foot sphere).
- **c.** A deflated airbag/balloon is not used as an Entanglement Device.

Note: Automotive airbag inflators are specifically prohibited since they use Sodium Azide.

12.0 BattleBot Appearance

12.1 External Appearance

The exterior appearance and design of a BattleBot must project the image of BattleBots as an aggressive yet “clean” sporting activity. Therefore, the appearance of a BattleBot must conform to the following:

12.1.1 BattleBot Name

The name of the BattleBot must be written on the outside of the BattleBot in letters at least one-half inch (1/2") high. The position of the lettering must be such that the name is readable when the BattleBot is in its normal pre-battle configuration with all safety covers and restraints installed.

12.1.2 Suitable for TV

The BattleBot exterior surfaces cannot contain any words, pictures or graphics that cannot be broadcast on national network or cable television.

12.1.3 Suitable for Children

The BattleBot exterior surfaces cannot contain any words, pictures or graphics that are not suitable for viewing by young children.

12.1.4 Non-Offensive

The BattleBot design and exterior surfaces must not embody any form, words, pictures or graphics that impugn religious organizations, racial groups or nationalities, or are publicly indecent or offensive.

12.1.5 Pneumatics Indicator Sticker

Any BattleBot that operates with a pressurized pneumatic system is required to have 1.5" x 3" bright orange stickers clearly visible on both the top and bottom of the BattleBot. BattleBots will supply the stickers at the Tournament.

12.2 Advertising and Graphics

Advertising displayed on a BattleBot must conform to the following:

12.2.1 Good Taste

All advertising on a BattleBot must be in good taste, as determined by BattleBots Officials.

12.2.2 Safety Devices

Any stickers or appliqués must not interfere with the use or operation of any safety devices used on the BattleBot.

12.2.3 Advertising Conflicts

Advertising must not conflict with BattleBots Inc., its affiliates, its sponsors, or its affiliates' sponsors in any way.

12.3 BattleBots Rights

BattleBots Inc., at its sole discretion, reserves the right to require removal or modification of any logos, signage or other materials or designs that it determines are offensive or in conflict with the regulations of "12.1 External Appearance" and "12.2 Advertising and Graphics".

12.4 Appearance Questions

If there are questions on the external appearance of a BattleBot, request a clarification from BattleBots Inc. as specified in "1.5 Contacting BattleBots".