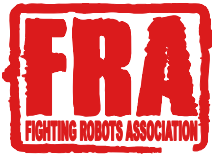


Build Rules

International Build Rules and Regulations

2017 Edition



Latest Version

The most up to date revision of this document can always be found at:
<http://www.fightingrobots.co.uk/>

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1. General

1.1 Participation

All participants build and operate Robots at their own risk. Fighting Robots is inherently dangerous. There is no amount of regulation that can encompass all of the dangers involved. Please take care to not hurt yourself or others when building, testing and competing. Compliance with all event rules and competition regulations is mandatory. It is expected that competitors stay within the rules and procedures of their own accord and do not require constant policing.

1.2 Loopholes

If you have a robot or weapon design that does not fit within the categories set forth in these rules or is in some way ambiguous or borderline, please contact the Fighting Robots Association. Safe innovation is always encouraged, but surprising the event staff with your brilliant exploitation of a loophole may cause your robot to be disqualified before it ever competes.

1.3 Safety Inspections

Each event has safety inspections known as Tech checks. It is at the inspector's sole discretion that your Robot is allowed to compete. As a builder you are obligated to disclose all operating principles and potential dangers to the inspection staff.

1.4 Activation

Robots must only be activated in the arena, testing areas, or with expressed consent of the event organiser and the safety officials. All activation and de-activation of robots must be completed from outside the arena barrier or within specially designated areas. You must never enter the arena with live robots without the express permission and supervision of the event organiser.

1.5 Safety Covers

All Robots not in an arena or official testing area must have secure safety covers over any sharp edges and pinch hazards. Safety covers must be designed in such a way that they cannot be dislodged unintentionally.

1.6 Locking Bars

All weapons must be secured using a locking bar. The locking bar must be designed in such a way that it can quickly and easily be installed or removed without touching the weapon. The design must ensure that the weapon cannot be fired during the activation process.

1.7 Tethers

All high-speed weaponry with a single linkage, such as axes and flippers, must carry a suitable tether to ensure moving parts cannot break free from the chassis during operation.

1.8 Carrying Cradles

All robots not in an arena or official testing area must be raised on their carrying cradles in a manner so that their motive power cannot cause movement if the robot were turned on, or cannot roll or fall off a pit table. Runaway robots are VERY dangerous.

1.9 Restrictions

In some situations, the safety inspection team may deem it necessary to place restrictions on your robots operation for safety purposes. It is entirely your responsibility that these restrictions are adhered to at all times.

1.10 Power Tools

It is expected that builders will follow all basic safety practices such as gloves and goggles when operating any machinery. The use of welders, grinders and other equipment that may produce smoke, debris or other harmful substances is only permitted in dedicated workshop areas. Please take care of yourself and others around you.

2. Weight Classes

2.1 Weight Classification

- Antweight: Maximum 150g
- Beetleweight: Maximum 1.5kgs
- Featherweight: Maximum 13.6kgs
- Lightweight: Maximum 30kgs
- Middleweight: Maximum 55kgs
- Heavyweight: Maximum 110kgs

2.2 Legged Robots

Legged Robots or “Walkers” can weigh up to twice the specified weight in all classes. A walker must employ moveable legs to support its weight. Each leg must have at least 2 degrees of freedom. Robots with rolling or sliding mechanisms will not be classified as walkers.

2.3 Consumables

Maximum weight includes all consumables.

2.4 Safety Equipment

Maximum weight does not include safety covers or locking bars that are removed when the robot is activated.

2.5 Interchangeable Panels

If interchangeable panels or weapons are used, the weight is measured with the heaviest set-up in place.

3. Mobility

3.1 Methods

All Robots must have (easily visible mobility) in order to compete. Methods of mobility include:

3.1.1 Rolling

Rolling on wheels or the whole robot rolling.

3.1.2 Walking

Walking such as linear actuator operated legs.

3.1.3 Shuffling

Shuffling mechanisms such as rotational cam operated legs.

3.1.4 Ground Effect

Ground effect air cushions such as a hovercraft

3.1.5 Jumping

Jumping and hopping (although the height may be limited by each event due to arena safety constraints)

3.1.6 Flying

Flying (helium balloons, multirotors, etc.) (Currently flying robots are not allowed unless prior approval by the event has been granted.)

3.2 Restrictions

Event organisers may impose additional restrictions on robots for the safety of the event.

4. Radio control requirements

4.1 Frequencies

4.1.1 Permission

Transmitters must not be turned on at, or near events for any purpose without obtaining explicit permission from the event organiser.

4.1.2 Regulation

Radio systems used at events MUST comply with restrictions put in place by local regulatory bodies and applicable laws. For the UK this is OFCOM. Where a special licence is required for operation of radio equipment the event organiser must be informed and the license must be available for viewing at the event.

4.1.3 Interference

Radio systems MUST NOT cause interference to other frequency users.

4.1.4 Digital Spread Spectrum

Commercial Digital Spread Spectrum 2.4GHz is recommended for combat robotics in all weight classes.

4.1.5 Allowed Frequencies

For use in robots, the following frequencies are allowed:

	AW	BW	FW	LW	MW	HW
IR	✓	✓	X	X	X	X
27/40MHz AM/FM	✓	✓	X	X	X	X
40MHz FM Digital	✓	✓	✓	✓	✓	X
2.4GHz DSS	✓	✓	✓	✓	✓	✓
459MHz Digital	✓	✓	✓	✓	✓	✓

Please note that events may have additional restrictions on allowable frequencies.

Symbols:

AW = Antweight	✓ = Allowed Frequency	X = Disallowed frequency
MW = Middleweight	BW = Beetleweight	FW = Featherweight
	HW = Heavyweight	LW = Lightweight

IR = Infra-Red remote control systems – For use with Antweights Only

27/40MHz AM/FM = PPM radio systems e.g. Futaba Skysports 4

2.4GHz DSS = Digital Spread Spectrum radio systems e.g. Spektrum DX6

40MHz FM Digital = 40MHzPCM radio systems e.g. Futaba Fieldforce 6

459MHz Digital = Radio systems using 459MHz Modules

4.1.6 Special Exceptions

Use of disallowed frequencies may be permitted in limited circumstances for example if running an armoured radio control car or for older machines providing safe control can be demonstrated. This will be limited to non-competition fights.

4.2 Failsafes

4.2.1 Dangerous Systems

All systems that are deemed to be 'dangerous' (normally the drive and weapons) must have a 'failsafe' device. This MUST bring the systems to a pre-set 'off' or 'zero' position if the transmitter signal experiences interference or is lost. These devices must failsafe when the receiver battery is low or if power is completely lost.

4.2.2 Types of Devices

The failsafe(s) may take the form of plug-in commercial devices; electronic circuitry incorporated into receivers, or other devices. It may also consist of digital switches, which return to pre-set off position on loss of power. Care must be taken in the selection of devices to ensure they meet the requirements specified above.

4.2.3 Built-in Devices

Some receiver failsafes such as PCM do not store the pre-set positions and will take a few seconds from first turning on to receive these settings from the transmitter. This type of failsafe MUST be set correctly to ensure the safe operation of the robot and are strongly discouraged.

4.2.4 Setting Failsafes

Care must be taken to ensure that the failsafe(s) are set correctly.

Particular attention must be taken with programmable failsafe(s) that may be overlooked when transferring receivers between robots or when altering the trim (zero position) on sticks that may affect the 'off' or 'zero' position. With newer receivers it may be necessary to 'bind' your receiver to program the pre-set failsafe positions.

4.2.5 Servo Control

Care must be taken when using servo/ pot/ micro-switch interfaces, as these will remain in their last position with loss of power leaving the weapon active. Additional precautions must be taken when these interfaces are in use.

4.3 Failsafe Light (Advisory)

In addition to the main power light a separate light may also indicate if the robot is in "failsafe", "off" or "zero" position.

4.4 Remote Kill (Advisory)

Robots may incorporate a "remote kill" that brings the robot's failsafe device(s) to the pre-set 'off' or 'zero' position via a switch on the transmitter. This is to allow for de-activation of robots from outside a fully enclosed arena and prevent accidental operation of controls.

4.5 Operation

All device(s) MUST operate to the tech checker's satisfaction before the robot will be allowed to compete.

4.6 Crystals

Where used, spare crystal pairs must be available for each Radio Control set involved in running the robot.

4.7 Changeable Frequencies

Frequencies must be easily changeable e.g. where crystals are used they must be accessible, particularly on the receiver, so that a change of frequency can easily take place.

4.8 Output Power

Transmitter output power must not exceed that specified by the local regulatory body or any applicable laws.

4.9 Home Built

If you are using a home built remote control system, you must first clear it with the event organiser and declare it during 'Tech Check'. Home built remote control systems are not recommended.

4.10 Power Switch

Radio equipment may be operated independently of the removable link, providing that no dangerous systems can be operated with the link removed.

4.11 Reserved Frequencies

The event may have reserved frequencies for testing, safety and arena effects that you may not use.

4.12 Telemetry

Radio telemetry is permitted on 433MHz and 2.4GHz. Please check with the event organiser if you are using radio telemetry.

5. Autonomous/ Semi-Autonomous Robots

Robots that do not require human input for one or more of their functions.

If you are bringing an autonomous robot or a robot with significant autonomous functions please contact your event organiser in advance.

5.1 Remote Operation

Any autonomous function of a robot, including drive and weapons, must have the capability of being remotely armed and disarmed.

5.2 Disarming

While disarmed, the robot is not allowed to function in an autonomous fashion.

5.3 Light

In addition to the required main power light, robots with autonomous functions must have an additional clearly visible light, which indicates whether or not it is in autonomous mode.

5.4 Deactivation

When deactivated the robot must have no autonomous functions enabled, and all autonomous functions must failsafe to off if there is loss of power or radio signal.

5.5 Timeout

In case of damage to components that remotely disarm the robot, the robot will automatically deactivate 4 minutes after being activated.

6. Electrical Power

6.1 Deactivation

Robots must incorporate a way of removing all power to weapons and drive systems (systems that could cause potential human bodily injury) that can be activated easily without endangering the person turning it off.

6.1.1 Removable Link

The main power cut-off MUST be a removable link, which must NOT be in place unless the robot is in the arena or under the supervision of a technician. A key or switch is not allowed.

6.1.2 Accessibility

The link must be positioned in a visible part of the robot's bodywork, fitted away from any operating weaponry or drive, and this position must be clearly marked.

6.1.3 Covers

The link may be fitted under a cover, but the cover must be able to be opened without the use of tools.

6.1.4 Kill Switch

If the robot uses an internal combustion engine(s), the "Power" cut-off must take the form of a clearly labelled "Kill" switch. See Section 7 for further details on engines.

6.1.5 Inverted Link

Robots in the heavyweight class that are capable of being driven inverted, having a removable link fitted that is only accessible when the robot is the right way up, must have a duplicate link fitted in the opposing panel, so as to allow the robot to be disarmed when inverted.

6.2 Cabling

Cabling must be of sufficient grade and suitably insulated for maximum operational current.

6.3 Exposed Components

Current must not be carried through exposed components.

6.4 Power Light

Robots must have at least one surface mounted non-filament power light that is illuminated when the main link is fitted. The power light may be any colour but must be non-flashing and in contrast with the surroundings.

6.5 Activation

The robot must be capable of being activated and de-activated by way of the removable link from outside an arena. (e.g. in a "bullpen" over a low wall).

6.6 Voltages

Voltage must not exceed 75V for direct current or 50V for alternating current except where prior approval from the event organisers has been confirmed. Note that batteries may have a higher voltage during charging and care must be taken not to exceed these limits.

7. Batteries

For assistance in selecting batteries please contact the Fighting Robots Association.

7.1 Protection

Batteries must be adequately protected within the body shell and securely fixed to minimise the chance of being punctured or coming loose during combat. In addition, packing such as high density foam is recommended to reduce the shock of impacts.

7.2 Terminals

Battery terminals must be protected to prevent short circuits.

7.3 Permitted Types

The only permitted batteries are ones that cannot spill or spray any of their contents when inverted. Standard car and motorcycle wet cell batteries are prohibited.

7.4 Approved Battery Chemistry

	AW	BW	FW	LW	MW	HW
NiCd (Nickel-cadmium)	✓	✓	✓	✓	✓	✓
NiMH (Nickel-metal Hydride)	✓	✓	✓	✓	✓	✓
Pb (Sealed Lead Acid)	✓	✓	✓	✓	✓	✓
LiFePo4 (Lithium Iron Phosphate)	✓	✓	✓	✓	✓	✓
LiPo (Lithium Polymer)	✓	✓	✓	✓	✓	✓

7.5 Maximum Cell Count (series) and voltage

	Number of Cells (series)	Vnom	Vmin	Vmax	Vtotal
NiCd (Nickel-cadmium)	30	1.2v	0.9v	1.9v	36v
NiMH (Nickel-metal Hydride)	30	1.2v	0.9v	1.9v	36v
Pb (Sealed Lead Acid)	18	2.0v	1.5v	2.4v	36v
LiFePo4 (Lithium Iron Phosphate)	12	3.3v	2.8v	3.6v	39.6v
LiPo (Lithium Polymer)	12	3.7v	3.0v	4.2v	44.4v

Vnom – Nominal cell voltage during discharge
 Vmin – Minimum cell voltage
 Vmax – Peek cell voltage during charging
 Vtotal – Nominal pack voltage during discharge

These values are taken as an approximation. Always check the manufacturers specification.

7.6 Parallel Cells

Batteries cells may be connected in parallel to increase capacity and discharge current. Caution must be taken with NiCd and NiMH as these cells may only be connected in parallel during discharge.

7.7 Charging

Improper charging may result in fire and/ or explosion.

7.7.1 Design

Only chargers specifically designed for the battery chemistry may be used. Chargers will be inspected during the Tech Check to ensure correct operation.

7.7.2 Rate of Charge

The rate of charge must not exceed the manufacturer's specification. Note that high charge rates will decrease battery life and performance.

7.8 Pb (SLA), NiCd, NiMH and LiFePo4

The following battery types can be used without any specific precautions although care must be taken when any battery particularly during charging:

- Pb (Sealed Lead Acid, SLA), non-spillable gel type.
- NiCd and NiMH
- LiFePo4 (Lithium Iron Phosphate)

7.8 LiPo

Lithium Polymer batteries have specific limitations and extra precautions which must be adhered to.

7.8.1 Charging

LiPo batteries **MUST** be balance charged to prevent damage occurring to the cells. Chargers that do not incorporate an integrated balancing circuitry are not permitted.

7.8.2 Voltage Cut-out (Advisory)

The robot may be fitted with an under voltage cut-out or alarm set at or higher than the battery manufacturer's recommendation to prevent the batteries from becoming damaged by over-discharge.

7.8.3 Fusing

A fuse rated below the maximum burst discharge of the battery **MUST** be fitted. The maximum burst discharge current is calculated by multiplying the C rating by the capacity. E.g. 25C 2200mAh = 55 Amp

7.8.4 Extra Equipment

Roboteers using LiPo batteries must provide a LiPo sack.

7.8.5 Inspection

LiPo batteries must be removed from the robot, inspected and placed into a LiPo sack prior to and during the charging process.

7.8.6 Charging

Lithium batteries must not be left unattended at any time during the charging process. Leaving batteries unattended while charging will be considered a serious breach of pit safety and may result in you and your robot being removed from the event. Event organisers may provide a dedicated area for charging.

7.8.7 Damage

LiPo batteries showing any evidence of damage or swelling must immediately be placed a LiPo sack and removed to a safe, well-ventilated area such as outdoors. Note that LiPo fires occur rapidly and there is a serious risk of personal injury. Use extreme care when handling any battery that shows signs of damage.

8. Internal Combustion Engines

Note: Please check that your event allows internal combustion engines.

8.1 Fuel Capacity

Fuel capacity is limited to 500ml (17floz).

8.2 Fuel Tanks

8.2.1 Plastic

Fuel tanks separate to the engine must be made of an acceptable type of plastic (e.g. nylon).

8.2.2 Metal

If the tank is integral to the engine assembly and is metal, the cap must be plastic or a plastic "pop off" seal fitted.

8.2.3 Protection

The tank must be adequately protected from puncture.

8.3 Fuel Lines

All fuel lines must be of the correct type and held with the correct type of fittings. They must be routed to minimise the chances of being cut.

8.4 Return Spring

A return spring must be fitted to the throttle of all internal combustion engines to return the throttle to "idle" or "off" in the case of servo breakage or failure. This is in conjunction to any failsafe device.

8.5 Clutch

The output of any engines connected to weapons or drive systems must be coupled through a clutch which will de-couple the motor when it is at idle. This does not include motors used for generators and hydraulic pumps.

8.6 Remote Shut-off

All engines must have a method of remotely shutting off.

8.7 Leaks

Any robot with liquid fuel and oil must be designed not to leak when inverted. Minor leakage may be tolerated, however if it affects other robots or becomes a large clean-up issue you will be banned.

8.8 Non-standard Types

Use of internal combustion engines other than standard piston type (e.g. turbines etc.) must be pre-approved by the Fighting Robot Association.

9. Pneumatics

9.1 Allowed Gases

Pneumatic systems must use Carbon Dioxide [CO₂] or Air.

9.2 Maximum Pressure

The maximum pressure at any point within a pneumatics system must not exceed 1000psi (68bar).

9.3 Cylinders

The compressed gas must be stored in a commercially manufactured gas cylinder of appropriate design, specification and certification. Except where the maximum storage pressure is less than 50psi (3.4bar).

9.4 Burst Disc

The gas cylinder must incorporate a burst disc rated below the maximum test pressure of the bottle. Except where the storage pressure is less than 50psi (3.4bar).

9.5 Manual Isolation Valve

Gas cylinders charged to pressures of greater than 50psi must incorporate a manual isolation valve that can be operated from outside of the robot.

9.6 Remote Isolation Valve

Where the manual isolation valve is not integral to the gas cylinder (for example: the gas is normally released as soon as the cylinder is screwed into the mating pneumatic connection) must have an additional remote isolation valve accessible from outside of the robot.

9.6.1 Position

Any remote isolation valve must be positioned to minimise the pipe length between it and the cylinder. This pipe length must fully vent before the cylinder is fully unscrewed from the pneumatic connection.

9.7 Rating

All pneumatic components used with pressures greater than 50psi (3.4bar) must be rated or tested to at least the maximum pressure available in that part of the system. You may be required to provide documentation or certification to support this.

9.7.1 Custom Components

Custom made components, or parts operating above the suppliers maximum working pressure, must be independently tested and certified at 120% of the maximum system pressure available at that point.

9.7.2 Hydraulic Components

Components originally designed for hydraulics use will be de-rated by 50% for pneumatics use.

9.8 Pressure Relief Device

A pressure relief device must be installed in each part of the pneumatics system where a different operating pressure is used.

9.8.1 Rating

Pressure relief devices must have a rating of 1000psi (68bar) or 110% of the pneumatic component with the lowest 'maximum working pressure' rating protected by that particular pressure relief device, whichever is the lower.

9.8.2 Low Pressure Systems

Pneumatic systems employing pressures less than 50psi or systems employing air compressors that have a maximum output pressure lower than the pneumatic component with the lowest 'maximum working pressure' do not require a pressure relief device.

The pressure relief device(s) dictate the maximum pressure available in that part of the pneumatics system. The pressure relief device(s) must have a flow rate capacity that exceeds the maximum flow rate that can be expected under 'over pressure' conditions. Any attempt to falsify the pressure settings of pressure relief device(s) will be considered as gross misconduct by the FRA and may result in expulsion.

9.8.3 Full Pressure Systems

Non-regulated pneumatic systems or pneumatic systems where the regulator is not directly attached to the gas cylinder require that a 1000psi pressure relief device is fitted.

9.8.4 Regulated Systems

Regulated pneumatic systems that operate at less than 235psi (16bar) and where the regulator is directly attached to the gas cylinder do not require a 1000psi pressure relief device before the regulator. The regulator must be rated to 120% of the gas bottle burst disc pressure. A pressure relief device is required down-stream of the regulator rated at 110% of the component with the lowest 'maximum working pressure' rating.

9.9 Pressure Relief Devices

Pressure relief devices must be readily accessible and must be removable for testing purposes.

9.10 Mounting

All pneumatic components must be securely mounted and adequately protected within the body shell. Any component storing gas (i.e. gas cylinders, buffer tanks etc.) must be secured in such a way as it cannot escape the robot even if suffering a rupture.

9.11 Gauges (Advisory)

Pneumatic pressure gauges and pressure test points are not a requirement but may be requested by some event organisers.

9.12 Dump Valve

All pneumatic systems must incorporate a pressure dump valve accessible from outside of the robot. This dump valve will quickly and reliably exhaust all gas downstream of the gas cylinder isolation (or remote isolation) valve including systems with a maximum operating pressure of less than 50psi (3.4bar).

9.12.1 Normally Open

The dump valve must be left open at all times when the robot is not in the arena or testing areas. Where non-return or quick exhaust valves are used, pay particular attention to ensure no part of the system is left pressurised.

9.13 Removable Cylinders

Gas cylinders must be readily removable for inspection and refilling. You must ensure that your gas cylinder connection is compatible with the event organiser's filling stations, or that you have suitable adapters available.

9.14 Heaters and Boosters

Pneumatic systems using heaters or pressure boosters are not permitted.

9.15 Pressure Equipment Directive

Pneumatic components manufactured from 1 June 2002 must carry a CE mark. Pneumatic components 'custom made' since 30 May 2002 must carry a label indicating their non-conformity with the 'Pressure Equipment Directive' and their non-availability for sale. Components manufactured prior to 30 May 2002 are not necessarily required to carry a CE mark.

10. Hydraulics

10.1 Pressure

Hydraulic system pressure (In the actuator or cylinder) must be limited to 10,000psi by way of a maximum pressure relief valve.

10.2 Test Point

A hydraulic test point is a mandatory fitment to allow verification of a robot's maximum system pressure. A team will need its own test gauge and hose.

10.3 Storage Tanks

Hydraulic fluid storage tanks must be of a suitable material and adequately guarded against rupture.

10.4 Standards

Hydraulic fluid lines and fittings must be to British Standard (BS) and/ or to European DIN specifications.

10.5 Ratings

Hydraulic fluid lines and fittings must be capable of withstanding the maximum working pressures used within the robot.

10.6 Protection

Hydraulic fluid lines must be routed to minimise the chances of being cut or damaged.

10.7 Accumulators

Hydraulic accumulators (pressurised oil storage devices) are banned in whatever form they may take.

10.8 Bleeding (Advisory only)

Care needs to be taken when building a hydraulic system that consideration is given to bleeding the system of air. Trapped air in the hydraulic system will degrade the performance of the system and may make a robot run afoul of rule 10.7.

10.9 Power Sources

For power sources (other than electric motors/ petrol engines) please consult the Fighting Robots Association for advice as to suitability.

11. Rotational weapons or full body spinning robots

Full body spinning robots with an eccentric mass, are excluded from this section unless they spin over 500 revolutions per minute.

11.1 Stopping Time

The spinning element of any rotational weapon must spin down to a full stop in under 60 seconds.

11.2 Limits

Rotational weapons exceeding any TWO of the three limits below must be submitted for review and be pre-approved by the event organiser.

11.2.1 Weight

The spinning element is more than 20% of the robots total weight. (This includes any directly coupled motor components rotating on the same axis).

11.2.2 Speed

The spinning element spins above 500 RPM.

11.2.3 Size

The spinning element is greater than 500mm in diameter.

12. Springs and flywheels

12.1 Springs

Any large springs used for drive or weapon power must have a way of loading and actuating the spring remotely under the robot's power.

12.1.1 Deactivation

Under no circumstances must a large spring be loaded when the robot is out of the arena or testing area. These devices must be made safe before removing the robot from the arena or testing area.

12.1.2 Small springs

Small springs like those used within switches or other small internal operations are excluded from this rule. In addition, springs used in robots less than 5 kilos may be excepted from this rule. Please contact the Fighting Robot Association for clarification.

12.2 Flywheels

Flywheels or similar kinetic energy storing devices must not be spinning or storing energy in any way, unless inside the arena or testing area. These devices must be made safe before removing the robot from the arena or testing area.

12.2.1 Remote Deactivation

There must be a way of generating and dissipating the energy from the device remotely under the robot's power to allow safe activation and deactivation of the robot.

12.3 Failsafe

All springs, flywheels, and similar kinetic energy storing devices must fail to a safe position on loss of radio contact or power.

12. Weapon Restrictions

The following weapons and materials are forbidden from use: Note: Some of the listed items may be allowed for effects but not as weapons. If you have an application of these items which you feel may be allowed, please contact the Fighting Robot Association.

12.1 Invisible Damage

Weapons designed to cause invisible damage to the other robot. This includes but is not limited to:

12.1.1 Electricity

Electricity as a weapon such as Tesla coils, Van-der-Graaf generators, stun guns, or cattle prods.

12.1.2 Radio Frequency

Radio Frequency jamming equipment or similar devices.

12.1.3 Radio Frequency Noise

Radio Frequency noise generated by an IC engine. Use shielding around sparking components.

12.1.4 Electromagnetic Fields

Electromagnetic fields from permanent or electromagnets, which affect another robots electronics.

12.2 Stopping Combat

Weapons or defences, which tend to stop combat completely, of both (or more) robots. This includes, but is not limited to the following:

12.2.1 Entanglement

Entanglement devices such as nets, fishing line, cables, string, glues or tapes, which require the match to be stopped and the robots separated. (If this occurs the 'entangler' forfeits the match)

12.3 Rotating Weapons

The speed of any rotating weapons - e.g. circular saws, carbon or steel cutting discs - must not exceed the manufacturer's specification. The manufacturer's specification must be available for inspection.

12.4 Hardened Blades

Commercially manufactured, hardened steel blades that may shatter are not allowed.

12.5 Blade Length

Commercial blades - e.g. bayonets - must not exceed 20cm in length.

12.6 Untethered Projectiles

Projectiles must have a tether capable of stopping the projectile at full speed and be no longer than 2.5m.

12.7 Heat and Fire

Heat and fire are forbidden as weapons, (however some events may allow limited fire effects). This includes, but is not limited to the following:

12.7.1 Generated

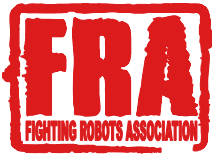
Heat specifically generated to damage an opponent

12.7.2 Flammables

Flammable liquids or gases

12.7.3 Explosives

Explosives or flammable solids such as DOT Class C devices, Gunpowder, Cartridge Primers or Military Explosives, etc.



12.8 Smoke and Light

Smoke and light based weapons, which impair the viewing of robots by an Entrant, Judge, Official or Viewer. (You are allowed to physically engulf your opponent with your robot however.) This includes, but is not limited to the following:

12.6.1 Smoke or Dust

Large quantities of smoke or dust. Limited smoke effects may be allowed by some events.

12.6.2 Lights

Lights such as external lasers above Class 2 (1mw) output and bright strobe lights, which may blind the opponent.

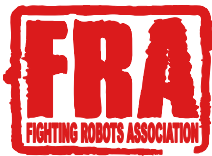
12.9 Hazardous Materials

Hazardous or dangerous materials are forbidden from use anywhere on a robot where they may contact humans, or by way of the robot being damaged (within reason) contact humans. If unsure please contact the Fighting Robot Association.

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