BUILD RULES
SEASON 8
1. GENERAL

1.1 Participation
All participants build and operate Robots at their own risk. Robot Wars is inherently dangerous.

1.2 Event Rules
Compliance with all event rules is mandatory. It is expected that competitors stay within the rules and procedures of their own accord and do not require constant policing.

1.3 Safety Inspections
Robot Wars will be operating safety & rule compliance checks prior to any robot competing or testing during the event [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 Cardinal Safety Rules
Failure to comply with any of the cardinal safety rules set out below by Robot Wars may result in expulsion from the event or worse, injury and death.

1.5.1 Activation
Proper activation and deactivation of robots is critical. Robots should only be activated in the arena or testing areas with expressed consent of Robot Wars and it’s safety officials. All activation and de-activation of robots must be completed from outside the arena barrier or within specially designated areas.

1.5.2 Weapon Restraints
All Robots not in an arena or official testing area should have secure safety covers over any sharp edges and restraints on any active weapons or pinch hazards.

1.5.3 Carrying Cradles
All robots not in an arena or official testing area should 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 the pit tables.

1.5.4 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.

1.5.5 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 not permitted in the pits area and is only permitted in dedicated workshop areas.

2. WEIGHT CLASSIFICATION

2.1 Weight Limit
The maximum weight limit allowed is 110kg.

2.2 Legged Robots
Legged Robots [Walkers] may have an extra 25kg weight allowance bringing the total to 135kg. 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 (Shufflers) will be given a 10kg weight allowance bringing the total to 120kg. For clarification please disclose as much information about your robots drive mechanism during the application stage.

2.3 Consumables
Maximum weight includes all consumables such as CO2 gas.

2.4 Safety Equipment
Maximum weight does not include safety bars, straps, or similar equipment used to immobilize moving arms or weapons and that are removed during competition.

2.5 Interchangeable Weapons
If interchangeable weapons are used, the weight is measured with the heaviest set-up in place. Please see rule 12.11 for interchangeable weapon & armour restrictions.

2.6 Size Limit
Robots must not exceed these dimensions. This includes all over hangs and weapons when in the retracted position. Eg. An axe retracted may not exceed these limits however in its 'fired' position it may extend past these dimensions.
Overall Length 2 metres
Overall Width 1.5 metres
Overall Height 1.2 meters

3. MOBILITY

3.1 Methods
All Robots must have controlled 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.

3.2 Restrictions
Robots are not permitted to use exposed rotating aerofoil, rocket or jet propulsion methods.
4. RADIO CONTROL REQUIREMENTS

4.1 Frequencies
4.1.1 Regulation
Radio systems used at Robot Wars MUST be commercially available & comply with restrictions put in place by local regulatory bodies and applicable laws.

4.1.2 Interference
Radio systems MUST NOT cause interference to other frequency users.

4.1.3 Allowed Frequency
At Robot Wars, only the 2.4ghz DSS (Digital Spread Spectrum) frequencies are allowed.

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 should also 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 could also consist of digital switches, which return to pre-set off position on loss of power. Care should be taken in the selection of devices to ensure they meet the requirements specified above.

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

4.4 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 Robot Wars 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 should have no autonomous functions enabled, and all autonomous functions should 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
All 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, test arena or under the supervision of Robot Wars Officials. A key or switch is not permitted. If there is more than one link they must be positioned adjacent to each other.

6.1.2 Accessibility
The link must be positioned in a visible part of the robot’s bodywork which is accessible for a Robot Wars Marshal when standing behind the arena barrier. The link must be 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 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
All robots must have at least one surface mounted non-filament power light that is illuminated when power is supplied to the robot (i.e. when the link is in). The power light can be any colour but must be non-flashing and be in contrast with it’s surroundings.
6.5 Activation
The robot must be able to be activated and de-activated by way of the removable link from outside the arena.

6.6 Voltages
Voltage must not exceed 75V for direct current or 50V for alternating current. 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 Robot Wars.

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
NiCd (Nickel-cadmium)
NiMH (Nickel-metal Hydride)
Pb (Sealed Lead Acid)
LiFePo4 (Lithium Iron Phosphate)
LiPo (Lithium Polymer)

7.5 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.

7.6 Charging
Improper charging may result in fire and/ or explosion.

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

7.6.2 Rate of Charge
The rate of charge must not exceed the manufacturer’s specification.

7.7 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. (e.g. Yuasa, Hawker)
NiCd and NiMH
LiFePo4 (Lithium Iron Phosphate)

7.8 LiPo Batteries
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 should 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.

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. Robot Wars may provide a dedicated area for charging.

7.8.7 Damage
LiPo batteries showing any evidence of damage or swelling must immediately

8. 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.

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 should be designed not to leak when inverted.

8.8 Non-standard Types
Use of internal combustion engines other than standard piston type (e.g. turbines etc.) are prohibited.

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 shall 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 its mating pneumatic connection) must have an additional remote isolation valve accessible from outside of the robot.
9.6.1 Position
Any remote isolation valve shall be positioned to minimize 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 certified 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 Robot Wars 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 should 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
Pneumatic pressure gauges and pressure test points are not a requirement.

9.12 Dump Valve
All pneumatic systems must incorporate a pressure dump valve accessible from outside of the robot. This dump valve shall 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 shall be left open at all times when the robot is not in the arena or testing areas. Particular attention should be made that where non-return or quick exhaust valves are used, no part of the system is left pressurized.

9.13 Removable Cylinders
Gas cylinders must be readily removable for inspection and refilling. You should ensure that your gas cylinder connection is compatible with Robot Wars filling stations.

9.14 Heaters and Boosters
Pneumatic systems using heaters or pressure boosters are not permitted. Heating any pneumatic components, including prior to competition, is strictly prohibited.

9.15 Pressure Equipment Directive
Pneumatic components manufactured from 1 June 2002 shall carry a CE mark. Pneumatic components ‘custom made’ since 30 May 2002 shall 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 Power Sources
Power sources may only be in the form of electric motors or petrol engines.

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 Specifications
If you intend to create a rotational weapon you must provide the exact specification of the weapon in your Robot wars application form. The requirements include the following:
- Weapon mass, including all rotating components such as gears and sprockets
- Weapon RPM
- Weapon 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 robots power.

12.1.1 Deactivation
Under no circumstances should 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.

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 robots power to allow safe activation and deactivation of the robot.
12.3 Failsafe
All springs, flywheels, and similar kinetic energy storing devices should fail to a safe position on loss of radio contact or power.

13. 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 should be allowed, please include this in your application.

13.1 Active Weapons
All robots must incorporate an active offensive weapon which is designed to damage, immobilise or seriously affect the operation of the opponent's robot. Weapon specifications must be included on your application form for approval.

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

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

13.2.2 Radio Frequency
Radio Frequency jamming equipment or similar devices.

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

13.2.4 Electromagnetic Fields
Electromagnetic fields from permanent or electromagnets, which affect another robot's electronics.

13.3 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:

13.3.1 Entanglement
Entanglement devices such as nets, fishing line, cables, string, glues or tapes and any similar devices.

13.4 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.

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

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

13.7 Heat and Fire
Heat and fire are forbidden as weapons. This includes, but is not limited to the following:

13.7.1 Generated
Heat specifically generated to damage an opponent

13.7.2 Flammables
Flammable liquids or gases

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

13.8 Smoke and Light
Smoke and light based weapons, which impair the viewing of robots by an Entrant, Judge, Official or Viewer. This includes, but is not limited to the following:

13.8.1 Smoke or Dust
Large quantities of smoke or dust. Limited smoke effects may be allowed.

13.8.2 Lights
Lights such as external lasers and bright strobe lights, which may blind the opponent.

13.9 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 Robot Wars.

13.10 Weapon Restraints
All high speed weapons (eg. all pneumatic and rotational weapons) must incorporate a secure restraint that locks the weapon in a safe position. The restraint may incorporate locking pins and bars but must be secured in such a way that it cannot be removed inadvertently. The design should ensure that the weapon cannot be fired during the activation process.

13.11 Interchangeable Weapons
Robots with interchangeable weapons are permitted under the following conditions.

13.11.1 Weapon Type
All interchangeable weapons must comply with rule 13.1

13.11.2 Weapon Application
All interchangeable weapons must be submitted on the Robot Wars application and are subject to approval.

For technical queries, rules clarifications & advice please contact Mentorn TV – robotwarstechnical@mentorn.tv