Robotic Event Safety

Minimum regulations for running safe Robotic Competition, Demonstration and Displays

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Robotic Event Safety
Fighting Robots Association South Africa
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Contact

The most up to date revision of this document can always be found at:
http://www.robotwarz.co.za/
Here you can also find contact details for the F.R.A. executive and the F.R.A. forum.
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Document Aims

Introduction

With the ever-growing popularity of robotic events in the UK USA and now China, the issue of safety is frequently a topic of discussion. Whilst no serious accidents have occurred at independent events to date, as the power and performance of the robots has increased the chances of an accident have increased accordingly. With so many events being organised, it is difficult to know what level of safety is required and how it should be implemented.

This document has been contributed to by a number of experienced robot teams and event organisers. Their robots between them represent the majority of weapon types used in robotic combat and the event organisers have considerable first hand experience of the safety issues likely to arise from the presence of combat robots. The current custodians of this document are the Fighting Robot Association of South Africa. In conjunction with the original safety committee SPARC and with contributions from the roboteer community at large, they are continuing to develop this guide as the sport moves forward. If you would like to comment, or have suggestions for this document please contact the F.R.A.

What is the purpose of this document?

The guidelines exist to help maintain the current good safety record at independent events, and to provide a standard way of classifying event types. They are not intended to prevent any event from taking place, but are intended to make those who run events take safety seriously. In short the purpose is to ensure the safety of roboteers, organisers and audience members alike.

Who is this document intended to assist?

This document is intended to assist all persons involved in the organisation and running of robotic events, and the roboteers who attend them. It will allow the organisers to put best practice in place and to understand what is required of an arena in which a robotic event may take place. It details what types of robot should be safe to run and it allows roboteers to tell at a glance whether they can safely run their robot at an event. It also provides a source of information and support for event organisers through the F.R.A, who have a dedicated team in place to get events off the ground in a safe manner.

Why do I need to adhere to these guidelines?
For event organisers:

Gives an idea of what the roboteers will expect from an arena.
Correctly advertising your event grade will attract suitable robots for the arena you construct.
When followed, the guidelines will contribute to the safety of your event.
Will allow the event to be targeted at specific robots or groups of robots.
The event grade tells your prospective audience what types of robots they are likely to see, and thus what sort of action they can expect.
By following these guidelines you are likely to get many more robots attending Well organised events are usually well attended.
Roboteers and audience members expect high safety standards.

For roboteers:
Gives an idea of what kind of arena can be expected at an event.
Will reduce the likelihood of turning up at an event and then not being able to run due to an insufficient arena.
Allows you to see at a glance if you can run your robot and its weaponry at an event.
Event organisers, other roboteers and audience members expect high standards of safety, and to know what other robots and roboteers will be running at an event.
Poorly organised events can be avoided.
Roboteers can operate their robot only at those events with a suitable grading.
These guidelines must be self-enforced by the entire robotic community to be successful.

Event Grading and Arena Classifications
It should be noted that there is a distinction between arena classification and event grading.
For example, it is possible to have grade 6 events with a class 1 arena, if some aspect of nonarena safety does not meet the criteria for a grade 1 event. An event and arena will always be classified on its worst feature, for instance a full polycarbonate box with all Class 1 safety features in place, but with only a wooden floor, would be classified as Class 2.
A detailed list of requirements is shown in the table following the summaries below.

Arena Classifications

* Some weaponry types may require additional restrictions. Please contact the F.R.A. For further information.

Class 1 Arena

A Class 1 arena is capable of containing all Featherweight, Lightweight, Middleweight, Heavyweight and Super Heavyweight robots built to the rules. It will consist of a full polycarbonate outer enclosure with each sheet being securely supported on all sides, including the roof. The polycarbonate will be at least 10mm thick. The floor must have a continuous layer of sheet steel (in addition to any other materials used) sufficient to resist any weapon penetration. A fixed inner steel barrier of at least 500mm high capable of withstanding all weapon penetration a distance of at least 500mm is required between the arena and the outer polycarbonate wall. An exclusion zone of at least 1m separates the outer polycarbonate wall from the crowd barrier. There is a gated entry for external activation of robots sited away from public areas.

Class 2 Arena

A Class 2 arena is capable of containing all Featherweight, Lightweight, Middleweight and most* Heavyweight robots built to the rules. It will consist of full polycarbonate walls with each sheet being securely supported on all sides. It will have a substantial polycarbonate roof to capture shrapnel. The polycarbonate will be at least 6mm thick for the side walls and at least 5mm thick for the roof. The floor will consist of Tarmac, concrete, plywood or M.D.F. (Medium Density Fibreboard). A fixed inner steel barrier of at least 500mm high capable of withstanding most* weapons separates the steel inner barrier from the outer polycarbonate wall. The inner barrier construction should consist of a metal kick plate, 250mm high from the bottom of the arena floor and have a substantial bar at a height of 500mm. A distance of at least 300mm is required between the arena and the outer polycarbonate wall. An exclusion zone of at least 1metres separates the outer polycarbonate wall from the crowd barrier. There is a gated entry for external activation of robots sited away from public areas.

Class 2F Arena

A Class 2F arena is capable of containing all Featherweight robots built to the rules. It will consist of full polycarbonate walls with each sheet being securely supported on all sides. It will have a substantial polycarbonate roof to capture shrapnel. The polycarbonate will be at least 6mm thick for the side walls and at least 5mm thick for the roof. The floor will consist of Tarmac, concrete, plywood or M.D.F. (Medium Density Fibreboard). A fixed inner steel barrier of at least 150mm high, capable of withstanding all weapons separates the steel inner barrier from the outer polycarbonate. The inner barrier construction should consist of a metal kick plate, 150mm high from the bottom of the arena floor and a substantial polycarbonate barrier to a height of 300mm. A distance

of at least 900mm is required between the arena and the outer polycarbonate wall. An exclusion zone of at least 1 metres separates the outer polycarbonate wall from the crowd barrier. There is a gated entry for external activation of robots sited away from public areas. Subject to written guarantee from the event organiser of full compliance, one heavy weight robot can be used in a demonstration mode at any one time.

Class 3 Arena

A Class 3 arena can support most* Featherweight, Lightweight, Middleweight and most Heavyweight robots, but as it does not have any real protection against flying shrapnel great care must be taken with weapon types run.
Spinning weaponry of any sort is not permitted in a Class 3 arena and all axe weaponry must have a “safety tether” fitted in order to run. The arena will consist of full polycarbonate walls with each sheet being securely supported on all sides. It will have a substantial fabric style roof to capture shrapnel. The polycarbonate will be at least 6mm thick for the side walls. A fixed inner steel barrier of at least 500mm high, with the inner barrier consisting of a 5mm minimum thickness steel kick plate, 250mm high from the bottom of the arena floor and a substantial bar at 500mm. There is a gated entry for external activation of robots sited away from public areas.

Class 3F Arena

A Class 3F arena can support most* Featherweight robots, but as it does not have any real protection against flying shrapnel, great care must be taken with weapon types run.
Spinning weaponry of any sort is not permitted in a class 3F arena, and all axe weaponry must have a “safety tether” fitted in order to run. The arena will consist of full polycarbonate walls with each sheet being securely supported on all sides. It will have a substantial fabric style roof to capture shrapnel. The polycarbonate will be at least 6mm thick for the side walls. A fixed inner steel barrier of at least 150mm high capable of withstanding most* weapons separates the steel inner barrier from the outer polycarbonate. The inner barrier construction should consist of a 5mm minimum thickness metal kick plate, 150mm high from the bottom of the arena floor and a substantial polycarbonate barrier to a height of 300mm. A distance of at least 900mm is required between the arena and the outer polycarbonate screen. An exclusion zone of at least 1 metres separates the outer polycarbonate from the crowd barrier. There is a gated entry for external activation of robots sited away from public areas. Subject to written guarantee from the event organiser of full compliance, one heavy weight robot can be used in a demonstration mode at any one time.

Class 4 Arena - Demonstration Only

A Class 4 arena is not suitable for combat competition and robots should be used under heavily controlled conditions only. Only featherweight,

Lightweight, Middleweight and Heavyweight robots with lifters, low powered flippers or passive weaponry may be used.
High power flippers, spinners and axe weapons cannot be operated in this class of arena due to the lack of any real protection against flying shrapnel.
The arena consists of polycarbonate sheeting on all open sides.
Polycarbonate sheeting must be from floor level to a minimum height of 2 metres. A fixed inner steel barrier of at least 500mm high, with the inner barrier consisting of a 5mm minimum thickness steel kick plate 250mm high from the bottom of the arena floor and a substantial bar at 500mm. A distance of at least 2.5 metres is required between the inner barrier and the crowd barrier. The crowd barrier must be separated from the polycarbonate by a distance of at least 1 metres. The floor will consist of Tarmac, concrete, plywood or M.D.F. (Medium Density Fibreboard). There is gated entry for the external activation of robots.

Class 5 Arena - Demonstration Only

A Class 5 arena is not suitable for combat competition and robots should be used under heavily controlled conditions only. Only Featherweight, Lightweight, Middleweight and Heavyweight robots with lifters or passive weaponry may be used, as this class has no Robotic Event Safety protection against flying (flipped) robots or debris. Flippers, spinners and axe weapons cannot be operated in this class of arena. The arena consists of a substantial fixed inner barrier of at least 500mm high capable of withstanding any impact from the robots. The floor will consist of Tarmac, concrete, plywood or M.D.F. (Medium Density Fibreboard). An exclusion zone of at least 5 metres separates the inner barrier from the crowd. There is gated entry for the external activation of robots.

Event Grading

** It is suggested that event organisers contact the FRA for assistance with staffing requirements.

Grade 1 Event

A Grade 1 event requires a Class 1 arena. At this grade of event a great deal of effort must be put into the safety of all participants, and the quality of the arena construction.
There should be great care taken over fire restrictions and access for both the spectators and roboteers and risk assessments should be in place. A dedicated and knowledgeable safety officer in consultation with the health and safety executive must be on site at all times, and all staff must be carefully selected**. All pit and tech check items must be in place and rigorously enforced. Essentially due to the cost of a Class 1 arena, this calibre of event is the domain of large budget commercial events, such as those funded by television companies.

Grade 2 Event

A Grade 2 event requires a Class 1 or 2 arena. At this grade of event a great deal of effort must be put into the safety of all participants, and the quality of the arena construction. There should be great care taken over fire restrictions and access for both the spectators and roboteers and risk assessments should be in place. A dedicated and knowledgeable safety officer in consultation with the health and safety executive must be on site at all times, and all staff must be carefully selected**. All pit and tech check items must be in place and rigorously enforced. Although this level of event is most likely to be put on by a large commercial organisation, it would not be impossible for a dedicated noncommercial team to achieve.

Grade 3 Event

A Grade 3 event requires a Class 3 arena or better. There should be great care taken over fire restrictions and access for both the spectators and roboteers and risk assessments should be in place. All staff must be carefully selected**. All pit and tech check items must be in place and rigorously enforced, and a very high standard of safety is expected. Restrictions on weaponry used must be enforced in such an event. This level of event would most often be organised by a charitable or educational institution where some budget is available and is relatively easily achievable for any dedicated team.

Grade 4 Event

Although a high standard of safety is still expected as regards to TX control and pit safety the staffing required** will be lower and a dedicated safety officer is not necessarily required. As with all public events where robots are active care must be taken with fire access and restrictions. Restrictions on weaponry used must be enforced in such an event. It is possible for a charitable organisation to put on this grade of event, and to do such on a small budget.

Grade 5 Event

Although a high standard of safety is still expected as regards to TX control and pit safety the staffing required will be minimum** and a dedicated safety officer is not necessarily required. As with all public events where robots are active care must be taken with fire access and restrictions. Restrictions on weaponry used must be enforced in such an event. It is fairly easy for a school P.T.A. to organise an event of this grade on a strict budget.

Grade 6 Event

A Grade 6 event is any event where safety standards are not sufficient to operate robots.

By definition middleweight and heavier robots should only be on static display at all Grade 6 events. Featherweight should only be run with their weapons in a “safe” and inactive state. Events with Class 1-5 arenas can still be classified as a Grade 6 if an important safety feature such as TX control is neglected or overlooked. If the aim of your event is to have robots operating, then you

should not seek to organise a Grade 6 event.

Event Grading/ Arena Classification Table

The table below summarises the requirements for each class of arena. Note that if an arena does not satisfy some items, it will be re-classified.

It would be expected that the event would have the capability and materials to repair the arena should it be damaged. If this capability does not exist then any damage could force the downgrading of the arena.

[Ad] Advised but not required.

F.R.A REQUIREMENTS	**Class 1**	**Class 2**	**Class 3**	**Class 4**	**Class 5**	
Arena	Liability Insurance	⎫	⎫	⎫	⎫	⎫
Exclusion Zone	⎫	⎫	⎫	⎫	⎫	
Crowd Control Barrier	⎫	⎫	⎫	⎫	⎫	
Arena Floor	⎫	⎫	⎫	⎫	⎫	
Reinforced Floor	⎫					
Separation Zone	⎫	⎫	⎫			
Fixed inner Barrier	⎫	⎫	⎫	⎫	⎫	
High Fence	[Ad]	[Ad]				
Entry Gate	⎫	⎫	⎫	⎫	⎫	
External Activation	⎫	⎫	⎫	⎫	⎫	
Entry Pen	[Ad]	[Ad]	[Ad]	[Ad]	[Ad]	
Polycarbonate Walls	⎫	⎫	⎫	⎫		
Net Roof	⎫					
Polycarbonate Roof	⎫	⎫				
Protected Driver Position	⎫	⎫	⎫	⎫	⎫	

F.R.A REQUIREMENTS	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
Event	Technical	⎫	⎫	⎫	⎫	⎫

	Checks				
Transmitter Control	⎫	⎫	⎫	⎫	⎫
Pit Safety Items	⎫	⎫	⎫	⎫	⎫
Allocated Pit Area	⎫	⎫	⎫	⎫	⎫
Dedicated Safety officer	⎫	⎫	⎫		
Fire Access/restrictions	⎫	⎫	⎫	⎫	⎫

Arena Barriers and Zones

The picture below shows in simple terms the placement and order of arena barriers, and the separate zones they encompass. Not all barriers or zones are required for each class; to see what is required, refer to the table above.

High Fence/ Polycarbonate Wall
Exclusion Zone
Crowd Control Barrier
Substantial Fixed Inner Barrier
Crowd
Separation Zone
Arena

Definition of Terms

Liability Insurance – Any event requires public liability insurance. Many organisations that may run an event will already have it, however it must be confirmed with the insurer that the operation of robots (self propelled vehicles) is included and that everyone involved or watching is covered. If you would like help or advice on your insurance, please contact the F.R.A.

Exclusion Zone – A space around the arena that the crowd may not enter, separating the crowd from any barrier that a robot could come into contact with. The necessary size will vary greatly, but generally the bigger the better. The suggested minimum for Class 1, 2 and 3 arenas is 1.5 meters, and for Class 4 arenas, it is 4 metres.

Crowd Control Barrier – This barrier keeps the crowd out of the exclusion zone. It is usually a physical barrier such as a fence. Where there is supervised seating only (as often happens at the televised events), an implied barrier can be used, such as a line of tape. Where children are present it is essential that the exclusion zone is actively maintained and therefore a simple rope barrier is not recommended. It should never be possible for a

robot to come into contact with the crowd control barrier.
Separation Zone – A space between the two types of barriers that a robot may come into contact with. It is to be found only in Class 1, 2 and 3 arenas. In practice its purpose will normally be to allow access around the arena.
Arena Floor – A solid and flat Tarmac, Concrete, Plywood or m.d.f arena floor surface (not chipboard or hardboard). There should be no fixings or edges protruding from the surface.
Reinforced Floor – The floor structure should contain a continuous layer of steel sheet sufficient to prevent penetration by powerful weapons.
Fixed Inner Barrier – A fixed barrier of at least 500mm high surrounding all sides of the arena that a robot cannot pass through. Fixed does not mean the barrier has to be physically attached to the ground. Fixed does mean that the barrier cannot be knocked over, and if it moves at all it should move a minimal amount under impact only. The barrier should not bend significantly, and a continuous steady push (from a heavyweight robot from a standing start should not move it. The suggested minimum standard is a substantial braced scaffolding frame, with a maximum separation between each parallel bar that prevents any robot being forced through. An impact
barrier is required at arena level, which could be made from thick steel.
High Fence – A fixed barrier of at least 6 feet high surrounding all sides of the arena that a robot cannot pass through. Fixed does not mean the barrier has to be physically attached to the ground. Fixed does mean that the barrier cannot be knocked over, and if it moves at all it should move a minimal amount under impact only. The barrier should not bend significantly, and a continuous steady push (from a heavyweight robot) from a standing start should not move it. This barrier is intended to restrain a flying flipped robot and as such should not be used as the crowd control barrier, however it can be used as the inner wall in combination with some form of impact shield at arena floor level. The suggested minimum standard is 6-foot high
building site fencing, with a scaffolding supporting frame such that the fence cannot be knocked over, in which there are no gaps that a robot could be forced through at any height.
Polycarbonate – Securely fixed polycarbonate screens of at least 8 feet high (standard sheet size) from arena floor level surrounding the entire arena, with no gaps. It is capable of containing fast moving and heavy shrapnel. Fixed does not mean the barrier has to be physically attached to the ground, but does mean that the barrier cannot be knocked over and if it moves at all, it should move a minimal amount under impact only. This barrier is intended to restrain a flying flipped robot and should not be used as the crowd control barrier because there is potential for movement. It must be placed at least 1metre from the outside of the arena wall, but must remain a separate entity to it (to prevent damage to the polycarbonate). The suggested minimum

standard is a single thickness of 10mm solidly mounted on a substantial frame that supports all edges of each sheet. Alternatively, a single thickness of 6mm may be used in combination with a fixed fence of the same height.
For a Class 1 arena two layers of 10mm thick polycarbonate would be expected.
Protected Driver position – A raised and stepped platform which should be of a sturdy construction capable of holding up to 9 people comfortably at one time. It should have an unobstructed view of the entire arena floor. For Class 1 and 2 arenas it should be set back from the arena inner barrier by no less than 1 metre and must be screened from shrapnel with no less then 6mm thick polycarbonate (whether part of the arena “polycarbonate walls” or as separate screening). It should have a substantial polycarbonate or net roof capable of withstanding penetration from shrapnel. For class 3 and lower arenas, where the likelihood of shrapnel is less, it should be set back from the arena “inner barrier” by no less than 1.5 metres.
Net Roof – A net covering the entire arena that is capable of containing large shrapnel. The net is attached around the tops of all the walls with no gaps. The suggested minimum standard is a cricket net combined with a tarpaulin.
Polycarbonate Roof – A fixed polycarbonate screen covering the entire arena that is capable of containing fast moving and heavy shrapnel. Fixed in this context means that the screen is attached around the tops of all the walls with no gaps. The suggested minimum standard is a single thickness of 6mm solidly mounted on a substantial frame that supports all edges of each sheet.
Entry Gate – An easily removable or hinged section of the arena wall(s) that allows robots to be placed in and removed from the arena, without presenting a safety hazard to people carrying them. It must be sufficiently strong that it will contain the robots within the arena.
External Activation – It should be possible to activate robots from outside the fixed inner arena barrier, either by reaching through or over the arena barrier, or preferably by the use of a gated bullpen. In other words no one should ever be standing inside the arena inner barrier with an activated robot at ant time unless being supervised by the Arena Marshal.
Entry Pen – An area attached to the arena and gated on 2 sides where the robot can be “penned in” for activation and deactivation purposes. The gate on entry side (as opposed to arena side) should be no higher than 500mm so as it can be easily reached over for access to removable links and dump valves. Although not required by any class of arena these are strongly advised on Class 1, 2 and 3 arenas, as they will confine any run away robots to an easily controlled space.
Technical Checks – Inspection of robots by an agreed FRA safety representative, checking removable link, dump valves failsafe functionality

and FRA robot build rules.
The technical check is to confirm correct operation and presence of failsafe and other safety devices. If a robot fails this test then under no circumstances must it be allowed to run. If you would like help or advice on your technical checks, please contact the F.R.A.

Transmitter Control – Controlled allocation of transmitter frequencies to avoid frequency clashes and subsequent interference. This helps stop robots receiving signals that do not originate from their own transmitter and contributing to keeping the robots under operator control at all times. This would normally take the form of a manned table with a peg board and transmitter pegs. However at events with less than 10 radio controlled models and/or robots present, a chalk board is satisfactory. If
you would like help or advice on your transmitter control, please contact the F.R.A at: safety@robotwarz.co.za

Pit Safety Items – Tables provided must be sturdy enough to comfortably hold 200KG. Robots in the pits or on display should have all safety guards in place as required by the rules at all times. All motive method (wheels, tracks, legs etc.) should be lifted clear of the surface by standing the robot on a sturdy cradle upon which the robot can be safely carried. The only time that a robot is activated with its motive method on a surface is inside the arena – if a robot inadvertently ends up outside the arena it must be deactivated by way of the removable link, as safely and quickly as possible.

Allocated Pit Area – A sufficiently large area with good access to the arena, where the roboteers can set up, charge and repair their robots. It is expected that mains electricity will be provided and for the higher classes of event, tables on which to place the robots. The suggested minimum spacing for tables is 1.5 metres.
Additionally the pits should be supervised by experienced staff and cordoned off from public access. The pits should be regarded as a “working environment” where all “health and safety at work” laws are complied with. (Please see http://www.healthsaftey.gov.za/ for further details). If you would like help or advice on setting up your pits area, p ease contact the F.R**.**A.

Dedicated Safety Officer – An experienced safety officer should be present who is aware of the issues raised by running robots in combat. Local Health and Safety should be alerted to the event and a risk assessment submitted in writing. For classes 1 and 2, there should be a Health and Safety officer on site who can be consulted on safety issues. If you would like help or advice on your dedicated safety officer, please contact the F.R.A.

Fire Access and Restrictions – Your local fire safety authority should be consulted on walkways, capacity restrictions, extinguishers and fire access points.

Robot Weaponry Classification Table

[R] Restrictions may apply. Please consult the F.R.A.

Event Grade	1	2	3	4	5	6
Disabled Weapons	✓	✓	✓	✓	✓	
Sharp Edges	✓	✓	✓	✓	✓	
Fixed Spikes	✓	✓	✓	✓	✓	
Wedges/Scoops	✓	✓	✓	✓	✓	
Exposed Wheels	✓	✓	✓	✓		
Electric Lifters	✓	✓	✓	✓		
Pneumatic Lifters	✓	✓	✓	✓		
Hydraulic Lifters	✓	✓	✓	✓		
Hydraulic Crushers	✓	✓	✓	✓		
Electrical Crushers	✓	✓	✓	✓		
Pneumatic Crushers	✓	✓	✓	✓		
Flippers	✓	✓[R]	✓[R]			
Rotating Cutters	✓	✓[R]				
Bludgeoning Devices	✓	✓[R]	✓[R]			
Active Spikes	✓	✓				
Spinning Discs	✓	✓[R]				
Cutting Saws	✓	✓[R]				
Chainsaws	✓	✓[R]				
Pneumatic Axes	✓	✓[R]	✓[R]			
Electric Axes	✓	✓[R]	✓[R]			
Full Body Spinners	✓	✓[R]				
Petrol Power	✓	✓[R]	✓[R]			

Definition of Weaponry

* “Throwing” in this context is defined as the ability of a lifter or flipper to cause the object or robot it is lifting to lose contact with both the lifter or flipper and the ground. A lifter can lift the object or robot such that it loses contact with the ground and then subsequently drops back to it, or simply lift and roll the object or robot over. Conversely a flipper is capable of causing the object or robot to fly through the air as a projectile, even if it does not do this every time it is used.

Disabled Weapons – Any robot with an active weapon can disable or remove it to run in lower classified arenas. Disabling entails pinning key moving components (discs, arms), removing key electrical connections (such as motor cables and valve wires) and discharging pressure reservoirs in both pneumatic and hydraulic systems such that there is absolutely no way that the weapon can be activated. Please contact the F.R.A for further advice.

Sharp Edges – Purposely sharpened edges that would require a sharp edge cover.

This also covers many other weapons that have been disabled such that a robot may run in a lower class of arena. Most robots will have such an edge once their weapons are disabled. The danger presented is from impact and as such a barrier is required to separate this kind of weapon from a crowd.

Fixed Spikes – Sharpened ramming spikes that are fixed. This also covers some other weapons that have been disabled such that a robot may run in a lower class of arena. The danger presented is from impact and as such a barrier is required to separate this kind of weapon from a crowd.

Wedges/ Scoops – Angled surfaces that run close to the ground with the aim of getting underneath an opposing robot. These do not have to be fixed but they must not be powered. The danger presented is from impact, and as such a barrier is required to separate this kind of weapon from a crowd.

Exposed Wheels – Not strictly a weapon, any robot capable of climbing a barrier due to it having large diameter wheels, external wheels or tracks. The danger this presents is that if a robot were to go out of control, it could drive out of the arena and towards the crowd if the barrier is not high enough.

Electric lifters – An electrically powered lifting mechanism (e.g. linear actuator) that is not capable of throwing* another robot of half the maximum weight. These weapons could lift an opposing robot out of the arena if the barrier is not high enough.

Pneumatic Lifters – A pneumatically powered lifting mechanism that is not capable of throwing* another robot of half the maximum weight. This is likely to include only low pressure small bore pneumatic systems. These weapons could lift an opposing robot out of the arena if the barrier is not high enough.

Hydraulic Lifters – A hydraulically powered lifting mechanism that is not

capable of throwing* another robot of half the maximum weight. These weapons could lift an opposing robot out of the arena if the barrier is not high enough.

Hydraulic Crushers – A hydraulically powered mechanism designed to pierce, cut or crush. Most crushers are capable of lifting opponent robots either through accident or design; e.g. built in lifting mechanisms or the opponent getting stuck on the arm of the crusher. A sufficiently high barrier is required to prevent the opponent from getting dropped outside the arena.

Electrical Crushers – An electrically powered mechanism designed to pierce, cut or crush. See Hydraulic Crushers.

Pneumatic Crushers – A pneumatically powered mechanism designed to pierce, cut or crush. See Hydraulic Crushers.

Low power flippers – A powered lifting mechanism (normally but not exclusively pneumatic) that is capable of lifting or rolling another robot of half the maximum weight. There is a risk with all flippers of throwing debris or the flipper mechanism itself becoming detached and being thrown, hence a high polycarbonate wall or safety tether may be required. Restrictions may vary from event to event please consult the event organiser or F.R.A. for further details.

High power flippers – A powered lifting mechanism (normally but not exclusively pneumatic) that is capable of throwing* another robot of half the maximum weight.

Certain flippers can throw an opposing robot many feet in the air and hence an inner barrier, polycarbonate sheeting and roof is required to contain these robots. There is a great risk with high power flippers of throwing debris or the flipper mechanism itself becoming detached and being thrown, hence a high polycarbonate wall and roof must be present when operating these weapons. Restrictions may vary from event to event
please consult the event organiser or F.R.A. for further details.

Rotating Cutters – A rotating cutting device that may use a commercial or noncommercial drill, tank cutter, milling cutter or turning tool for example fitted either as a dedicated weapon or to a moving part of the drive system. These could come loose and hit someone; hence a high polycarbonate wall is required.

Bludgeoning Devices – A heavy mass that is able to swing in one plane or more and hit an opponent whether passive or powered. The danger presented is from the bludgeoning device breaking loose and hitting someone, hence a high polycarbonate wall or safety tether may be required. Restrictions may vary from event to event please consult the event organiser or F.R.A. for further details.

Active Spikes – A spike that moves under power relative to the chassis of the robot.

The danger presented is from the spike/ rod/ piston etc. breaking loose and hitting someone, hence a high polycarbonate wall is required.

Spinning Discs (Spinners) – A disc with teeth (normally only a few teeth) that is intended to store energy and then cause damage by the transfer of that energy to the opponent. The danger presented is from flying shrapnel, either as parts of the opponent or parts of the disc, its teeth, or the disc in its entirety. Often there is a large amount of stored energy and any shrapnel produced may be fast moving and heavy, hence a high polycarbonate wall is required. Restrictions may vary from event to event please consult the event organiser or F.R.A. for further details.

Cutting Saws – A round saw that is not intended to store energy and causes damage by cutting into the opponent. It would generally have many small teeth or an abrasive edge surface. The danger presented is from flying shrapnel, either as parts of the opponent or parts of the saw; hence a high polycarbonate wall is required.

Restrictions may vary from event to event please consult the event organiser or F.R.A. for further details.

Chainsaws – A cutter using a chain blade. The danger presented is from flying shrapnel; hence a high polycarbonate wall is required. Restrictions may vary from event to event please consult the event organiser or F.R.A. for further details.

Pneumatic Axes – A pneumatically powered axe mechanism that may be fitted with a sharpened axe head or a blunt mass. The danger presented is from an axe head breaking loose or from shrapnel caught by an axe and thrown; hence a high

polycarbonate wall. A safety tether is required. Restrictions may vary from event to event please consult the event organiser or F.R.A. for further details.

Electric Axes – An electrically powered axe mechanism that may be fitted with a sharpened axe head or a blunt mass. The danger presented is from an axe head breaking loose or from shrapnel caught by an axe and thrown; hence a high polycarbonate wall and a safety tether is required. Restrictions may vary from event to event please consult the event organiser or F.R.A. for further details.

Full Body Spinners – These use a large proportion of the bodywork as a spinning mass and therefore in general possess a higher stored energy than is usually involved with a spinning disc. Protruding teeth or masses on chains may be used to transfer energy to the opponent. The danger presented is from flying shrapnel, as parts of the opponent or parts of the disc, its teeth, or the robot in its entirety. With full body spinners there is usually a very large amount of stored energy and thus any shrapnel produced is likely to be fast moving and heavy, hence a complete polycarbonate box is required. Additionally the extra energy contained in a full body spinner could penetrate

the floor of an arena (e.g. if flipped). Restrictions may vary from event to event please consult the event organiser or F.R.A. for further details.
Petrol power – Use of internal combustion engine either as motive or weaponry power. The risk is of spillage of fuel and fire. Some venues may have restrictions in place that prohibit the use of I.C engines. Restrictions may vary from event to event please consult the event organiser or F.R.A. for further details.
“Safe comedy weapons” have been discussed and the very valid point was raised, how do you enforce safe? It is too easy to cover an axe head with foam rather than remove it – and the axe shaft/pivot may still break.
Rubber discs – rubber will grip and tear. There is therefore large potential for flying shrapnel both from the disk itself, and potentially from parts pulled off an opponent.
A polishing wheel could also potentially grab sharp edges and rip parts off an opponent.

Get Involved!

If you would like to make comments or suggestions for amendments to this document, please contact us. We are always looking for suggestions to improve on this document and it is only with input from the community that we will be able to develop these guidelines further.