



*Scottish  
Cartie  
Association*

## Cartie Technical Specification

### Revision History

Version	Date	Notes
1.0	25 Jan 2013	Derived from 2012 Cairngorm Specification

The most recent revisions are [highlighted in blue](#).



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## 2. DISCLAIMER

No expressed or implied warranty of safety shall result from publication of or compliance with this specification.

This specification is not a guarantee against injury or death to any participant, spectator or official.

Event organisers should satisfy themselves that this specification is appropriate for their needs.

Event organisers shall be allowed to impose any further restrictions and to permit deviations from any of these specifications. Any deviations from this specification are left to the discretion of the event organisers. No expressed or implied warranty of safety shall result from any such deviation from this specification.

### 3. RULES SUMMARY

	Section	Roadster	Streamliner
Maximum Length	7	2500mm	2500mm
Maximum Width	7	1500mm	1500mm
Minimum Track	7	700mm	700mm
Maximum Weight	7	65Kg	100Kg
Maximum Tyre Diameter	7	20" nominal	20" nominal
Minimum Tyre Width [at organiser's discretion]	7	44mm	44mm
Number of Wheels	8	4	4
Brakes	9	May not act on the tyres or the road surface. Must be possible to operate brakes while keeping both hands on the steering control.	
Steering	10	Front wheel steering only. Solid mechanical linkage only (e.g. rack & pinion or "go-kart" type). No "rope and plank" steering, etc.	
Driving Position	11	Seated, reclined or supine with feet first only. Head first is not allowed. Feet must be at least 150mm behind the front of the cartie.	
Bodywork	12	Not allowed. The driver must be fully visible from front, above, and both sides.	Allowed.
Roll Bars	12	Required only if a harness is fitted or if part of the vehicle is higher than the hips of the driver, otherwise optional.	Required.
Harness	12	If roll bars fitted: 4 or 5 point harness required If no roll bars fitted: not allowed	4 or 5 point harness required
Batteries	12	No wet lead acid batteries. No Li-Ion or Li-Po batteries rated above 6.0 Watt hours.	
Warning Horn	12	Required.	
Mirrors	12	Required if vision to rear and/or sides is otherwise restricted.	
Ballast	13	15Kg maximum. Must be solid. Must be securely bolted to the chassis. May not be altered after scrutineering.	
Towing	14	Must have a permanent load bearing towing eye at the front and a tow rope guide at the rear. Tow rope, shackle and M10 clip hook required.	
Protective Clothing	15	Full face motorcycle helmet, gloves, boots and heavy duty overalls or better. <b>No open face helmets.</b>	Full or open face motorcycle helmet, gloves, boots and heavy duty overalls or better.

## 4. INTRODUCTION

This document describes a specification for two classes of single seat gravity powered racing vehicles;

1. **Roadster:** This is a simple racer with no aerodynamic body parts. It can be fitted with roll bars and a harness at the discretion of the competitor. It can be seen as the “entry level” gravity racer with technical requirements that are relatively low and can be achieved quickly and easily by teams starting out in the sport. However, these racers can still be very fast and competitive and may even beat more advanced machines on some courses.
2. **Streamliner:** This is a more advanced racer with streamlined bodywork. Because the driver is wholly or partially enclosed, a harness must be worn and roll bars must be fitted. A streamliner is any cartie that is not classified as a roadster.

The specification is intended for use in two ways;

1. It can be used “as is” as a comprehensive technical specification for gravity powered soapbox racing.
2. It can, provided the license conditions are complied with, be adapted, modified or used in whole or in part by event organisers to derive a new technical specification that is appropriate for their needs.

## 5. APPLICATION AND INTERPRETATION

In all matters relating to the interpretation of these rules, the decisions of scrutineers and event organisers will be final.

Competitors intending to exploit any apparent loopholes or ambiguities in order to gain an unfair advantage or to avoid having to comply with its spirit or intent are strongly advised to discuss their plans with the Technical Officer for the event well in advance in order to avoid disappointment.

Should a vehicle fail to conform to this specification on a technicality, the organisers may allow it to take part provided that they are satisfied that all safety related conditions have been met. Such vehicles will not be eligible for any race prizes. The decision to exercise this option is entirely at the discretion of the organisers and is intended to apply only to minor non-conformance to specifications that are not safety related (e.g. vehicle dimensions, etc.). Gross technical non-conformance without prior agreement or failure to reach the minimum safety standards will result in the vehicle being excluded from the event.

These rules apply only to the construction of the vehicles. They do not specify to how any competition involving these vehicles is conducted. Event organisers are free to run their own events as they see fit and make their own decision on matters such as age limits, whether or not pushing is allowed, how many people must be in a team, whether multiple drivers are allowed, etc.

This specification and specifications derived from it should not be used in isolation. It should be supported by a competent Risk Assessment and Safety Plan carried out by the event organisers.

## 6. PROPULSION

The vehicle must not be fitted with any devices that provide motive power to the vehicle.

Note that this does not preclude event organisers, at their discretion, from allowing external pushing by team members or event marshals at the start line or at any point on the course if necessary.

## 7. DIMENSIONS AND WEIGHT

- Maximum overall length: 2500mm
- Maximum overall width: 1500mm

- Minimum track: 700mm
- Maximum weight of vehicle:
  - Roadster: 65Kg
  - Streamliner: 100Kg
- Maximum wheel diameter: 20 inches (nominal)
- Minimum tyre width: 44mm\*

The track is the measured width between centres of tyres where they contact the ground. The track may be different on front and rear axles, but both must conform to the minimum specified above.

A tolerance of 5% shall be allowed on the measurement of the maximum weight. **Any** deviation over this margin will be classed as a failure to meet the technical requirements.

Wheel diameter includes the fully inflated tyre and is taken from the nominal diameter as marked on the tyre.

\* The minimum tyre width rule is at the sole discretion of the event organisers, but is *strongly recommended* for events where heavy braking from in excess of ~45mph is likely to be required. Owing to the misleading nature of nominal tyre widths as marked on tyres, the *actual measured width* of the tyre should be used for the purpose of assessing compliance with this specification. Competitors will be informed if they are required to comply with this rule.

## 8. WHEELS AND TYRES

There must be four wheels located symmetrically about the centreline of the vehicle, as a matching front and rear pair.

All wheels must be in load bearing contact with the road during normal operation.

Tyres must be pneumatic.

Tyres must be in good condition with no visible cracks in the sidewall or tread and must not be inflated above or below their rated pressure range.

Wheels and tyres must conform to the dimensions shown in rule 7.

Wheels with plastic spokes are not allowed.

## 9. BRAKES

The vehicle must have braking on at least 2 wheels on the same axle.

The brakes must be capable of holding the vehicle, with the driver on board, stationary on a dry horizontal road surface against a horizontal force exerted on the front towing eye as specified in the following table;

Cartie Weight without driver (Kg)	Brake Force (KgF)
<b>Up to 50</b>	50
<b>51 – 75</b>	60
<b>76 – 105</b>	70

The brakes must be designed such that failure of the brake operating on one wheel does not result in complete failure of the braking system.

The primary brakes must not act on either the tyres or on the road surface.

The primary brakes should be designed such that they can be operated effectively while keeping both hands on the steering controls.

## 10. STEERING

Steering must be by the front wheels only.

The steering must not; be overly sensitive, have excessive free play, or any characteristic tending to promote instability.

There must a rigid mechanical linkage or gearing in the steering so that large inputs produce relatively small steering outputs. **The steering ratio<sup>1</sup> must be at least 2.0**, and should ideally be far greater than this.

For the avoidance of doubt;

- "Rope and plank" steering is not allowed.
- "Feet on the front axle" steering is not allowed.
- "Lean" steering (e.g. skateboard) is not allowed.
- Differential braking or "skid" steering is not allowed.

## 11. DRIVING POSITION

Only conventional seated, reclined or supine<sup>2</sup> driving positions are allowed.

Prone<sup>3</sup> or head first driving positions are not allowed.

## 12. BODYWORK AND SAFETY FEATURES

### 1. General

There must be no sharp edges or protrusions either inside or outside the vehicle.

No glass, Perspex or other materials that would shatter or cause injuries to drivers or spectators in the event of a crash can be used in the construction of the vehicle.

Any steering column, brake lever or other protrusion must be designed and fitted such that puncture injuries cannot happen.

No items (e.g. tools, etc.) may be carried loose within the vehicle. All items must be securely stowed.

There must be no weaponry or items that can be propelled or released from the vehicle (e.g. water, spikes, paintballs, ballast, tools, etc.)

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<sup>1</sup> Steering Ratio is the ratio between the turn of the steering wheel (in degrees) or handlebars and the turn of the wheels (in degrees). See [http://en.wikipedia.org/wiki/Steering\\_ratio](http://en.wikipedia.org/wiki/Steering_ratio) for details.

<sup>2</sup> 'Supine' means lying on the back with the face up. See [http://en.wikipedia.org/wiki/Supine\\_position](http://en.wikipedia.org/wiki/Supine_position).

<sup>3</sup> 'Prone' means lying on the front with the face down. See [http://en.wikipedia.org/wiki/Prone\\_position](http://en.wikipedia.org/wiki/Prone_position).

## 2. Driver Protection

### Forward Impact Protection

All classes of racer must have an impact resistant structure at least 150mm forward of the driver's feet which is sufficient to offer protection to the driver in the event of a frontal collision. The forward roll bar can, if suitably positioned, fulfil this requirement as well.

### Roll Bars

Roll bars must be fitted if any of the following are true;

1. The vehicle is classified as a streamliner.
2. Any part of the vehicle other than the seat back, upper parts of the wheels and the steering wheel/bar together with a central supporting column for this is higher than the hips of the driver when he/she is seated normally in the vehicle.
3. A harness is fitted.

If roll bars are fitted, there must be;

- A Main Roll Bar: A substantial hoop above or to the rear of the driver's head. It must be in a suitable position to protect the head, neck and spine of the driver should the vehicle become inverted or topple on to its side and must be wide enough to protect the driver's shoulders. It must be **diagonally braced both laterally and fore and/or aft**.
- A Forward Roll Bar: A substantial hoop above or forward of the driver's hands. It must be braced fore and/or aft.

The top most points of the two roll bars shall describe a line which is at least;

- 50mm above the helmet of the tallest driver in the team when he/she is seated normally in the vehicle.
- 25mm above the driver's hands when they are at the highest point on the steering controls.

In addition, for any vehicle first raced after 2012:

- The main roll bar should be constructed of Cold Drawn Seamless Carbon Steel tube with a minimum diameter of 25mm and a minimum wall thickness of 2.5mm. They must be made in one piece without joints. Their construction must be smooth and even, without ripples or cracks. The tubing must be bent by a cold working process and the centreline bend radius must be at least three times the tube diameter. If the tubing is ovalised during bending, the ratio of minor to major diameter must be 0.9 or greater.
- Roll bars may be welded or bolted to the chassis. Each roll bar must be attached to the chassis by at least 4 mounting points (one at each end of the roll bar and one at the end of each diagonal brace). When bolts are used, there must be at least 2 x M10 bolts or 3 x M8 bolts, of minimum M8 grade 8.8 at each mounting point.

*While this is only mandatory for new vehicles, it is strongly advised that existing vehicle be upgraded to this standard where practical.*

### Harness

If roll bars are fitted, the vehicle must also be fitted with a minimum 50mm width safety harness designed for automotive use. The harness must be attached to the roll bar or chassis as per the manufacturer's instructions.

- If the driving position is seated and predominantly upright or slightly reclined, then a **four** point harness or better must be worn. A five point harness is strongly advised.



- If the driving position is reclined, then a **five** point harness or better must be worn.

The harness, if required, shall be correctly fitted and worn by the driver at all times when the vehicle is in motion, *including when being towed*. The harness shall be fitted so that the minimum roll-over clearances detailed above are maintained if the vehicle is inverted.

All anchor points should be placed in accordance with the harness manufacturer's instructions. In the absence of these instructions, the upper anchor points should be neck width apart and no more the 200mm below shoulder height.

### 3. Bodywork

#### Roadster

No bodywork is allowed for vehicles in the Roadster class. The driver must be entirely visible from the front, from above and from both sides.

The use of transparent materials to evade this rule is not permitted.

#### Streamliner

A Streamliner is any cartie that does not conform to the Roadster specification – i.e. weight over 65Kg or bodywork fitted.

### 4. Access

Bodywork and controls must not impede the driver in exiting the vehicle unaided. Access for first aid teams in the event of an accident must be considered.

Any doors or hatches required for driver access must be readily operated from both inside and outside the vehicle without the use of tools. Handles, latches, etc. for access points must be clearly marked.

Bodywork must not prevent scrutineers being able to check the integrity of roll bars, steering linkages, tyres, wheel bearings and wheel security. Vehicles must be presented at scrutineering with these items exposed.

### 5. Visibility and Warning

The driver must have good all round vision, including to both sides and the rear. If necessary, mirrors should be fitted in order to achieve this.

The vehicle must have a clearly audible warning device. It must be possible to operate this device while keeping both hands on the steering control.

The bodywork and helmet must not unduly affect the driver's hearing or vision.

### 6. Batteries

If batteries are used to power the horn or any other electrical equipment, they shall be securely fitted.

The following battery types are not permitted;

- Lithium Ion and Lithium Polymer batteries (this does not apply to small devices with internal batteries rated 6.0 Watt Hours or less)
- Wet lead/acid batteries

Gel filled sealed lead acid batteries are allowed.

## 13. BALLAST

Vehicles may carry no more than 15Kg of ballast. All ballast must be solid, and it must be securely bolted to the vehicle. It may not be altered after scrutineering.

The driver may not carry any ballast on their person.

## 14. TOWING

### 1. Tow Points

**Vehicles must be fitted a permanent towing eye at the front and a tow rope guide at the rear.**

#### Front Towing Eye

The front towing eye must be;

- clearly visible and easily accessible
- made of;
  - steel bar of at least 10mm diameter
  - or –
  - steel plate with appropriate hole for an M10 clip hook so long as the minimum 10mm all round thickness is retained
- of size and location such that a M10 clip hook can be easily attached to it
- permanently attached during the course of the event

#### Rear Tow Rope Guide

Vehicles must have a tow rope guide at the rear through which the tow rope can be passed to stop it from fouling on the wheels of the cartie. This does not need to be load bearing and will not be used as a tow point. It is to stop the tow rope from moving from side to side during towing.

The rope guide must be;

- clearly visible and easily accessible
- directly in line with the front towing eye

It should be possible to quickly and easily pass the tow rope through it (e.g. a snap hook or similar).

The towing eye and tow rope guide must be positioned to allow the tow rope to pass freely to the rear of the vehicle without fouling the wheels, the steering or the brakes, and should allow sufficient clearance that the rope is not damaged by the road surface.

### 2. Tow Rope

**Each team shall provide at least one tow rope sufficient to allow between 2.5m and 3.0m separation between the rear of their vehicle and the tow point of the following vehicle.** Typically this means that the tow rope will need to be between 5m and 6m long. The tow rope shall be either;

1. A 14mm polypropylene rope eye spliced at both ends
- or
2. A BSEN1492 compliant duplex lifting sling rated to at least 1 ton

In addition, each team shall provide;

- At least one 1 ton rated D or bow shackle
- At least one M10 clip hook

The rope, shackle and, clip hook must be securely stowed in the vehicle when not in use and easily accessible to the event crew when needed for towing. Towing equipment must be stowed in such a way that it cannot interfere with the normal operation of the vehicle.

## 15.CLOTHING

The driver's body and limbs must be fully covered by suitable abrasion resistant clothing such as; heavy duty overalls, a karting suit, motorcycle leathers or similar. Sturdy footwear and abrasion resistant gloves must be worn.

A properly fitted neck support is strongly advised at all times when competing or when being towed.

The driver must wear a helmet at all times when competing or when being towed. The helmet must at least comply with, and carry the appropriate markings for, any one of;

- BSI 6658-85
- BSI 2495-77
- EN 22.05
- DOT FMVSS 218
- SNELL M2005, M2010, SA/K2005 or K-98
- ACU Approved

Drivers of Streamliner class carties may wear an "open-face" or "full- face" helmet. Drivers of Roadster class carties must wear a "full-face" helmet.

The helmet must be in good condition and worn to the manufacturers recommendations.

For the avoidance of doubt; skateboard helmets, mountain bike helmets, cycle helmets, riding hats, saucepans, Tupperware containers, Viking helmets (whether fitted with horns or not), etc. are not acceptable. Only proper motorsport/motorcycle helmets are allowed.