

Appendix 99 – Archived

SECTION 2 -ROLL CAGE SPECIFICATIONS - June 1st 2013 to December 31st 2015

All vehicles, regardless of date of manufacture, must be fitted with a roll cage. These specifications apply to all vehicles registered (issued a WCMA logbook) **From June 1st 2013 to December 31st 2015**. Cars registered before this time may continue to compete with their previous roll cage, however it is recommended to upgrade to the following specifications.

FIA approved roll cages with dash bar are permitted. Refer to the FIA International Sporting Code, [article 253-8](http://www.fia.com/sport/Regulations/sportcoderegs.html) available at <http://www.fia.com/sport/Regulations/sportcoderegs.html> (Appendix J).

All vehicles, regardless of date of manufacture, must be fitted with a FIA approved roll cage, SCCA roll cage (with dash bar), or a roll cage conforming to the following specifications:

- a) The top of the roll bar shall be at least 5.08 cm (2") above the top of the competitor's helmet or as close to the roof as possible. The top of the roll bar shall be no more than 25.4 cm (10") behind the competitor's helmet when the competitor is in the normal driving position.
- b) It is highly recommended that any part of the roll cage structure which may be struck by the competitor's helmet in a serious impact be covered with a flame-retardant energy absorbing material.

1 - Construction Materials

- a) The main hoops and primary bracing should be constructed from round, mild steel, DOM type tubing. Chrome molly tubing such as 4130, may be used but is not recommended. ERW tubing is not allowed.
- b) Aluminum and composite materials are prohibited construction materials for roll cage structures.
- c) All cages must have a 0.476 cm (3/16") diameter inspection hole drilled in a non-critical area of each main hoop, fore and/or aft supports (as applicable), and front hoop (as applicable).
- d) Minimum tube size and wall thickness are as follows for vehicle weights including competitor:

<i>Vehicle Weight</i>	<i>Tubing size (outer diameter x wall thickness)</i>
Up to 1700 lbs	1.375" x 0.080"
1701 lbs – 2699 lbs	1.500" x 0.095"
	1.625" x 0.080"
2700 lbs and up	1.500" x 0.120"
	1.750" x 0.095"
	2.000" x 0.080"

2 - Fabrication

2.1. Bends

One continuous piece of tubing must be used for the main hoop with smooth continuous bends and no evidence of crimping or wall failure. The radius of bends in roll cages (measured at centerline of the tubing) shall not be less than three (3) times the diameter of the tubing, A similar piece shall be used for the other main hoop or hoops. A figure of each hoop configuration is provided to illustrate the acceptable basic configurations:

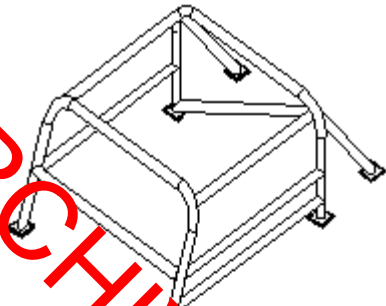


FIGURE 3
MAIN HOOP / PARALLEL FRONT HOOP

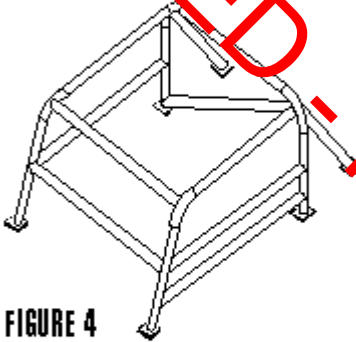


FIGURE 4
MAIN HOOP / TWO SIDE HOOPS

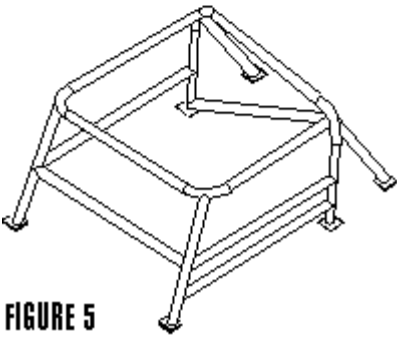


FIGURE 5
MAIN HOOP / TOP HOOP

2.2. Main Hoops

All **hoops** should start as close as possible to the floor of the vehicle and come as close as possible to the sides of the vehicle for maximum competitor protection.

Ovality: Maximum allowable ovality is 8% of the nominal pipe diameter. Ovality is measured as the variation between the maximum and the minimum dimension of the pipe in one location per figure 1.

**Formula for ovality:**

$$(A - B) / C = 0.08 \text{ maximum}$$

Notes:

A = maximum measurement

B = minimum measurement

C = nominal diameter

In the case of tube frame vehicles, the roll cage structure must be attached to the chassis with suitable webbing or gusseting to distribute loads over as wide an area as possible.

In the case of unit body vehicles, it is recommended procedure to attach the four ends of the main hoop tubes into L shaped plates at the junction of the floor and rocker panels rather than just to a plate on the floor. Additionally, it is highly recommended that all cages be tabbed into the basic body structure at least every 60.96 cm (24") or where possible.

2.3. Bracing

- a) In the case of the twin lateral hoop design, the front and rear hoops shall be joined by a piece of equal dimensioned tubing on each side.
- b) Rear stays must attach to the rear hoop no lower than 20.32 cm (8") from the top of the hoop and at an angle no steeper than 35 degrees from vertical. These rear stays must be made from a straight piece of tubing and be attached to a suitably stiff or reinforced area. A diagonal brace must be fitted from near the top of the hoop to a position near the opposite corner of the hoop. This brace must be as straight as possible.
- c) Side protection bars must be attached between the front and rear hoops on both sides of the vehicle. These bars should be attached to the front hoop no higher than 30.48 cm (12") off the floor and on the rear hoop and no higher than 60.96 cm (4") off the floor. The competitor's side must be fitted with at least two side protection bars which follow as closely as possible the outline of the door. NASCAR style multiple anti-intrusion bars are highly recommended.
- d) A bar joining the two outer members of the front hoop near steering column level is required.

3 - Mounting Plates

- a) The four lower hoop tubes must be connected to plates welded or bolted to the frame or floor of the vehicle.
- b) On unit body vehicles, all plates shall be at least 129 square cm (20 square") in area. The minimum thickness of these plates shall be 0.20 cm (.080") in the case of weld on plates and .1875 for bolt on types. Bolt on types shall have a minimum of three 0.952 cm (.375") grade 5 bolts fastening each plate and must have a backup plate of equal size and thickness on the other side of the floor with the bolts passing through both plates and the floor.
- c) Vehicles with frame type construction must use plates of at least 51.6 square cm (8 square") area and 0.1875 thickness regardless of whether they are bolted or welded.

4 - Welding

- a) It is essential that all welding be of the highest possible quality. Slag welds, poor arc and gas welds are NOT acceptable. It is highly recommended that only certified people carry out arc welding on roll cages. TIG or MIG are the preferred welding processes. Cages with unacceptable welding will not be passed.

5 - Gusseting

- a) It is important that loads be distributed over as wide an area as possible especially in the case of cages on space frame type vehicles. Gussets or tie-in tubes must be used at main tube junctions of the roll cage members. Gussets should also be used when it is not possible to weld all around a tube because of body interference. Gusset thickness should be at least the same as the tubing wall thickness they are attached to. *Each gusset shall extend in length for a minimum of one pipe diameter in both directions from the center point of the gusset.*

6 - Removable Type Cages

- a) Removable roll cages may be fitted to vehicles only if their construction and design allow them to meet the strength requirements of the designs above.
- b) Where tubes join, a double shear type mating tab may be used. Where such a tab is used, the tube joining this tab shall have a small piece of tubing welded perpendicular to its length for the bolt to pass through to prevent crushing of the main tube. Tabs shall be at least 3.49 cm (1.375") wide and 0.476 cm (.1875") thick and must be welded to one of the main tubes. When single bolts are used to fasten tubes, they must be of at least 1.11 cm (.4375") diameter and grade 8 material.
- c) Sliding tube type junctions may also be used if they meet the following criteria:
- d) Wall thickness of the joining tube shall be a minimum of 0.30 cm (.120").
- e) Length of this tube shall be a minimum of 7.62 cm (3") on either side of the splice.
- f) Attachment shall be made using two bolts on each side of the splice 90 degrees to each other passing straight through the tubing. Grade 5 bolts of at least 9.52 cm (.375") diameter shall be used here. Splicing tubes may be slid either inside the main tubing or over the outside.
- g) Alternate joint designs may be approved at the discretion of the scrutineer.
- h) Basic design and fabrication of removable type cages must conform to the specifications for non-removable type cages.

7 - Alternate Designs

- a) Alternate cage designs may be approved by the scrutineer provided the competitor can produce stress analysis data from a certified professional engineer stating that the roll over structure is capable of withstanding the following loads applied simultaneously to that structure:
 - 1.5 (x) lateral
 - 5.5 (x) fore/aft
 - 7.5 (x) vertical(x) is the weight of the car in race trim with the driver aboard and full fuel tank. Calculations shall assume the all up race weight of the vehicle with competitor.
- b) The certificate shall be accompanied by a drawing or photograph of the roll cage.

8 - Increasing Roll Cage Height

- a) The old main hoop shall be cut off near the chassis mounting and either a new main hoop of equal tube size or a section of equal sized tubing may be added
- b) Inner tubing shall be used to mate all sections together.
- c) All braces should be a minimum distance of 6 inches from the top of the hoop.
- d) The inner tubes shall be rosette welded at three points near the top and three points near the bottom.

9 - Old roll cage specs (archived)

- a) The main hoops and primary bracing should be constructed from round, mild steel, ERW or DOM type tubing. Chrome molly tubing such as 4130, may be used but is not recommended.
- b) Aluminum and composite materials are prohibited construction materials for roll cage structures.
- c) All cages must have a 0.476 cm (0.1875") diameter inspection hole drilled in a non-critical area of each main hoop, fore and/or aft supports (as applicable), and front hoop (as applicable).
- d) Minimum tube size and wall thickness are as follows for vehicle weights including competitor:

Under 1500 lbs	3.49 cm X 0.24 cm (1.375" X .095")		
Under 2500 lbs	3.81 cm X 0.24 cm (1.500" X .095")	or	3.49 cm X 0.30 cm (1.375" X .120")
Over 2500 lbs	3.81 cm X 0.30 cm (1.500" X .120")	or	4.44 cm X 0.24 cm (1.750" X .095")