



Removable Rollcage Specification v3.0

Copyright ANDRA 2018

Contents

1.0	About This Specification.....	3
2.0	Introduction	4
3.0	Removable Rollcage Definition	4
3.1	Removable Rollcage Registration	5
4.0	Materials	6
5.0	Design and Fabrication of an ANDRA Specification Removable Rollcage.....	7
6.0	Rollcage Classification	9
6.1	Single Roll Over Hoop	9
6.2	Four Point Rollcage	10
6.3	Six Point Rollcage	11
6.4	No Rollcage Required.....	12
7.0	Rollcage Components	12
7.1	Main Hoop	12
7.2	Rear Stays.....	12
7.3	Additional Rear Stay Mounting Design	13
7.4	Taxi Bar.....	15
7.5	Taxi-Bar Bracing	15
7.6	Side Intrusion Bar.....	17
7.7	Forward Supports.....	17
7.8	Forward Support Reinforcement.....	18
7.9	Roof Support and Diagonals	20
7.10	Additional Tubing.....	20
8.0	Rollcage to Chassis Mounting	21
9.0	Crush Tubes.....	23
9.1	Mounting Pad Designs	23
10.0	Rollcage Joints.....	25
10.1	Double Tab Clevis Joint	25
10.2	Taper Lock Joint	26
10.3	Sleeve Joints.....	27
10.4	CAMS Joint J-50.....	28

1.0 About This Specification.

This document is the official Removable Rollcage Specification of the Australian National Drag Racing Association Ltd (ANDRA), the preeminent controlling body of drag racing in Australia, recognised by the Confederation of Australian Motor Sport (CAMS) and the Federation Internationale de l'Automobile (FIA). The validity of this specification as an official ANDRA publication will be noted by ANDRA Stewards Hearings, Tribunals and the Australian Motor Sports Appeal Court (AMSAC).

Published by the Australian National Drag Racing Association Limited, 11 McInnes Street, Ridleyton SA 5008. Requirements published in this book are effective from [May 1st, 2018](#).

[All changes to requirements of the ANDRA Removable Rollcage Specification v2.01 are highlighted by blue text in this new ANDRA Removable Rollcage Specification v3.0.](#)

The requirements published in this specification remain in effect until suspended or revised by the ANDRA Board. Announcement of such changes will be notified in writing to all ANDRA Divisional Councils and posted on the ANDRA website giving at least 28 days' notice on implementation of a change, or immediately in the case of urgent safety amendments.

ANDRA holds all rights to events and competition run under the ANDRA Championship structure, and any international event run under its jurisdiction within Australia. ANDRA reserves the right to confer or allocate those rights to ANDRA Member Tracks or other parties recognised by ANDRA, within the limits and requirements of the ANDRA Constitution, ANDRA Policies and Procedures and the requirements as covered by this specification, as approved by the ANDRA Board.

ANDRA is a member of the FIA Drag Racing Commission (FR), the SFI Foundation (US), the Australian Automotive Aftermarket Association (AUS), Standards Australia (AUS) and the Speciality Equipment Marketing Association (US).

ANDRA authorises the downloading and reproduction of a copy of the whole or any part of the ANDRA Removable Rollcage Specification only from ANDRA's website at www.andra.com.au and only for the purpose of planning, conducting or competing in a motorsport event sanctioned (or to be sanctioned) by ANDRA.

Any reproduction, adaptation, communication to the public or any other act comprised in the copyright(s) in the ANDRA Removable Rollcage Specification for any purpose in respect of any motor sport event not sanctioned (or to be sanctioned) by ANDRA is expressly prohibited unless previously authorised in writing by ANDRA's [General Manager](#).

Diagrams and wording in this specification are also Copyright of CAMS and the FIA. Any unauthorised use is expressly prohibited.

© Australian National Drag Racing Association Ltd. 2018. This work is copyright. Apart from any use as permitted under the Copyright Act 1968, no part may be reproduced by any process without permission.

2.0 Introduction

All ANDRA specification removable rollcages that begin fabrication [after May 1st, 2018](#) should comply with the applicable requirements in this document.

This design specification is intended for a full-bodied car with a stock or modified/OEM floorpan with a firewall and with an OEM frame or Uni-Body construction, used in ANDRA drag racing competition to a performance limitation of 8.00 seconds for a 1/4 mile ([or 1/8 mile equivalent](#)). This specification is concerned only with the protective characteristics of the driver area and its adjoining structure in the event of a crash, and not with racing performance properties.

A representation of compliance with this specification is not an indication, nor an assurance that the rollcage will provide adequate driver protection in all situations of a vehicle crash. However, it is suggested that rollcages which do not comply with the design information given, may not perform their intended function nor might they provide adequate protection to a driver in a crash situation.

This specification is advisory only. There is no agreement between ANDRA, or any other party to be guided by it and its use by any association, organisation, manufacturer or individual is entirely voluntary. ANDRA will not accept any responsibility for consequences resulting from its application.

This specification is in addition to the ANDRA Rulebook. All applicable requirements and specifications in the ANDRA Rulebook must also be followed.

Prior to fabricating a removable rollcage, you are encouraged to contact ANDRA Technical at technical@andra.com.au with any questions you may have regarding the specifications.

ANDRA understand that there is a vast array of vehicles competing under its sanctioning and that due to this; a removable rollcage design may require tailoring to a certain vehicle. If there is a requirement to diverge from these specifications, please contact ANDRA Technical prior to the design stage of the build. Any divergence from these specifications requires written permission to do so by ANDRA Technical prior to removable rollcage fabrication. No retrospective permission will be granted if a removable rollcage that does not comply with these specifications is fabricated without prior written permission granted by ANDRA Technical, this is the case even if a vehicle, and rollcage, has passed an ANDRA Pre-Technical or Technical Inspection.

3.0 Removable Rollcage Definition

Any rollcage that has a removable component is deemed to be a removable rollcage and should comply with this specification.

3.1 Removable Rollcage Registration

3.1.1 ANDRA has replaced the requirement for a rollcage Pre-Technical Inspection with a Removable Rollcage Registration Process.

3.1.2 Once the removable rollcage is complete (and prior to the vehicle's Technical Inspection) pictures of the removable rollcage must be sent with the removable rollcage registration form to ANDRA Technical.

Emailing digital copies to technical@andra.com.au is the preferred method.

3.1.3 Together the pictures must cover all components of the removable rollcage and be detailed enough to allow viewing of the full structure, including all joints and mounting points.

3.1.4 Removable rollcage registration must take place in the following circumstances;

- a) Application for a new Logbook.
- b) Fitment of a removable rollcage to a vehicle that has an existing Logbook.
- c) After a vehicle incident where the Technical Inspection sticker has been removed.
- d) Modification of a removable rollcage.

3.1.5 The removable rollcage design is reviewed by ANDRA Technical.

- a) If approved, ANDRA Technical will advise the person whom sent the information (member / customer / fabricator) they can proceed with arranging the Technical Inspection and a Removable Rollcage Registration ID Number (sticker) is issued. Approvals can also be emailed to the relevant Division Director.
- b) If not approved, ANDRA Technical advises of the area/s whereby the removable rollcage does not meet the necessary minimum requirements.

3.1.6 The Technical Inspection is arranged by the member / customer.

- a) The Removable Rollcage Registration ID Number must be noted on the Technical Inspection form.
- b) The Technical Inspection is approved / signed off by the Technical Inspector.

3.1.7 It is the vehicle owner's responsibility to ensure that the removable rollcage is unmodified from its registration document specification.

- a) Any post-Technical Inspection modification to a removable rollcage must be approved by ANDRA Technical in writing prior to the modification taking place.
- b) Modifications to the removable rollcage after registration are treated as a new removable rollcage.
- c) Submission of pictures and an updated removable rollcage registration form are also required.

4.0 Materials

A removable rollcage may be fabricated from either 4130N Chromoly to 4130N-MIL-T-6736B specification or 350 MPa minimum yield stress Mild Steel.

Table 1.

Minimum Specification of Materials Used in ANDRA Removable Rollcages	
Rollcage Component	Specification: All Chromoly 4130N-MIL-T-6736B specification.
All Rollcage Tubing	1 5/8" x 0.083"
Forward Support Reinforcement	1 5/8" or 1 1/2" x 0.083"
Mounting Pads/Plates	3mm gauge 4130N Chromoly or 3mm gauge, 350N/mm ² minimum tensile strength Mild Steel plate.
Bolts	M8, ISO (SAE) Class 8.8 or greater. The class must be clearly stated on the bolt.
Nuts	Size appropriate for bolt, ISO (SAE) Class 8.
Sleeved Joints	4130N Chromoly.
Double Tab Clevis Joint Tabs	5mm gauge 4130N Chromoly or 5mm gauge, 350N/mm ² minimum tensile strength Mild Steel.
Specification: All Mild Steel Minimum Yield Stress 350KPa.	
Main Hoop	1 5/8" x 0.120" or 1 3/4" x 0.102"
Main Hoop Diagonal Braces	1 1/4" x 0.102"
Rear Stays (without Stiffening Tubes)	1 5/8" x 0.120"
Rear Stays (with Stiffening Tubes)	1 1/2" x 0.102"
Rear Stay Stiffening Tubes	As per Rear Stays
Taxi Bar	1 1/2" x 0.102"
Back-set Taxi Bar Supports	1 1/2" x 0.102"
Side Intrusion Bars	1 1/2" x 0.102"
Forward Supports	1 5/8" x 0.120" or 1 3/4" x 0.102"
Forward Support Reinforcement	1 5/8" x 0.120" or 1 3/4" x 0.102"
Windscreen Brace	1 5/8" x 0.120" or 1 3/4" x 0.102"
Roof Braces	1 1/2" x 0.102"
Mounting Pads/Plates	3mm gauge 4130N Chromoly or 3mm gauge, 350N/mm ² minimum tensile strength Mild Steel plate.
Bolts	M8, ISO (SAE) Class 8.8 or greater. The class must be clearly stated on the bolt.
Nuts	Size appropriate for bolt, ISO (SAE) Class 8.
Sleeved Joints	Must be a near interference fit with the tube being held within. Minimum gauge 0.102"
Double Tab Clevis Joint tabs	5mm gauge 4130N Chromoly or 5mm gauge, 350N/mm ² minimum tensile strength Mild Steel.

5.0 Design and Fabrication of an ANDRA Specification Removable Rollcage

- 5.0.1 All removable rollcages must be fabricated by an established fabricator or a person with relevant skills and experience in metal fabrication and welding.
- 5.0.2 It is recommended that all welds be performed by a holder of an AS1796 Certificate [No. 2 and No. 7](#) or international equivalent.
- 5.0.3 Removable rollcages must be designed and fabricated so that, when correctly installed, they substantially reduce body shell deformation and so reduce the risk of injury to occupants, in the event of a crash.
- 5.0.4 The fabricator must label each rollcage with the manufacturer's name and serial number, as well as the date of manufacture. Such identification [should](#) be on the driver's side leg of the Main Hoop facing the front of the vehicle. The identification must be clearly legible at all times and not covered by any component that may inhibit the visual inspection of the identification information.
- 5.0.5 Longitudinally, the rollcage [should](#) be entirely contained between the mounting points of the front and rear suspension elements carrying the vertical loads.
- 5.0.6 No rollcage tube may carry fluid.
- 5.0.7 No section of a rollcage may be electroplated.
- 5.0.8 All rollcage tube components must be fabricated from one single piece of tube.
- 5.0.9 No rollcage tube may unduly impede the egress of the occupant(s) from the vehicle or the use of any controls including foot pedals.
- 5.0.10 All tubing must be bent by a cold working process.
- 5.0.11 The bend radius centreline must be at least three times the outside diameter (OD) of the tube being bent.

e.g. If 1 5/8" (41.3mm) OD tube is being bent the minimum bend centreline radius is 123.9mm.
- 5.0.12 If tubing is ovalised during bending, the ratio of thinnest OD to original OD must be 0.9 or greater.

e.g. if using 1 5/8" (41.3mm) tube the minimum tube diameter within the bend, must be no less than 37.17mm.
- 5.0.13 The surface of the tube must be smooth and even, without ripples or cracks.
- 5.0.14 When measuring from the end of a bend in a tube, the end of the bend is defined as where the tube returns to its original diameter and is circular in section.
- 5.0.15 The minimum distance between the end of one bend and the start of another bend in the same plane is two times the tube OD.

- 5.0.16 The minimum distance between the end of one bend and the start of another bend in differing planes is three times the tube OD.
- 5.0.17 The minimum distance to the start of a bend from the end of a tube is two times tube OD.
- 5.0.18 All welds on 4130N Chromoly material must be by the Gas Tungsten Arc (TIG) welding process. MIG welding may be used on Mild Steel material.
- 5.0.19 Compatible filler rods should be used in the welding of 4130N Chromoly. Examples of compatible filler metal that could be used, dependent upon desired strength and ductility, are ER80SD-2, ER70S-2 & ER70SD-6.
- 5.0.20 To prevent carbide precipitation, excessive heat must not be applied to 4130N Chromoly.
- 5.0.21 To prevent embrittlement, 4130N Chromoly must not be allowed to cool quickly.
- 5.0.22 It is recommended that pre-weld heating and post-weld stress relief be undertaken on 4130N Chromoly which has a gauge of greater than 1/8", 3.2mm.
- 5.0.23 If welding of 4130N Chromoly is undertaken in an ambient temperature of 15°C or below it is recommended to preheat the area to be welded.
- 5.0.24 If welding of 4130N Chromoly is undertaken in an ambient temperature of 15°C or below, it is recommended that the weld is cooled in a controlled manner.
- 5.0.25 Fillet size must be a minimum of the sum of the gauges of the two components being welded. e.g. 2.1mm gauge tube to 3mm pad, weld fillet must be a minimum of 5.1mm.
- 5.0.26 No excessive grinding of a weld is allowed.
- 5.0.27 All welds must be continuous (not stitched) around the whole circumference of a tube.
- 5.0.28 Where the welding of a joint will produce a fully sealed tube section, a relief hole should be drilled into the tube, within the welded section, to allow gasses to escape. The diameter of the hole should be approximately two times material gauge.

6.0 Rollcage Classification

6.1 Single Roll Over Hoop

6.1.1 A Single Roll Over Hoop (Figure 1) is the minimum rollcage specification that is required in the following vehicles;

- a) Cars with unmodified construction and a fixed steel roof.
Slower than 1/4 mile ET of 10.00 seconds (or 1/8 mile equivalent) but faster than 1/4 mile ET of 10.99 seconds (or 1/8 mile equivalent).
Excluding Modern Street Cars slower than 1/4 mile ET of 10.00 seconds (or 1/8 mile equivalent).
- b) Cars with modified structural construction slower than 1/4 mile ET of 11.00 seconds (or 1/8 mile equivalent) but faster than 1/4 mile ET of 11.99 seconds (or 1/8 mile equivalent).
- c) Street registered Open Cars slower than 1/4 mile ET of 11.00 seconds (or 1/8 mile equivalent) but faster than 1/4 mile ET of 12.99 seconds (or 1/8 mile equivalent).

Modified: A Unibody Car with modifications to the rear floor, rear wheelwells or boot floor.

6.1.2 A Single Rollover Hoop must have the following components, in the positions illustrated in Figure 1, as a minimum;

- a) One Main Hoop
- b) Two Rear Stays
- c) One Taxi Bar
- d) One Intrusion Bar

6.1.3 A single Side Intrusion Bar on the driver's side is the minimum acceptable only if no passenger is present. If a passenger is present, then a Side Intrusion Bar is also required on the passenger's side of the vehicle.

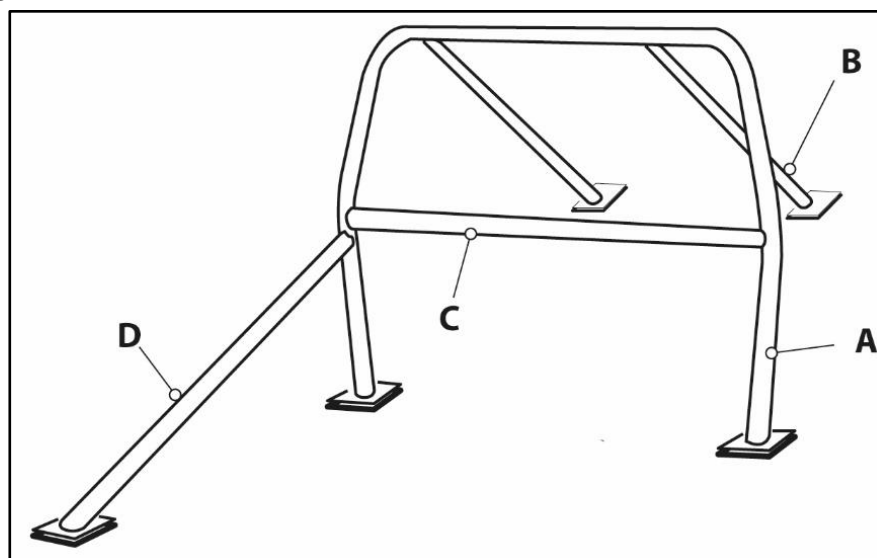


Figure 1

6.2 Four Point Rollcage

6.2.1 A Four Point Rollcage (Figure 2) is the minimum rollcage specification that is required in the following vehicle;

a) A Utility vehicle with a 1/4 mile ET of 8.00 seconds or slower.

6.2.2 A Four Point Rollcage must have the following components, in the positions illustrated in Figure 2, as a minimum;

- a) One Main Hoop
- b) One Diagonal Brace (in two sections)
- c) One Taxi Bar
- d) Two Side Intrusion Bars
- e) Two Forward Supports
- f) One Roof Support

6.2.3 Figure 2 component G: Roof Braces are a requirement if the rollcage has a removable Roof Support.

6.2.4 A back-set Taxi Bar may be fitted to a Four Point Rollcage, as per Figure 7, component C.

A back-set Taxi Bar must be fitted with Taxi Bar Upper Supports (Figure 7, components H2). It is recommended to also fit Taxi Bar Lower Supports (Figure 7, components H1) to a back-set Taxi Bar.

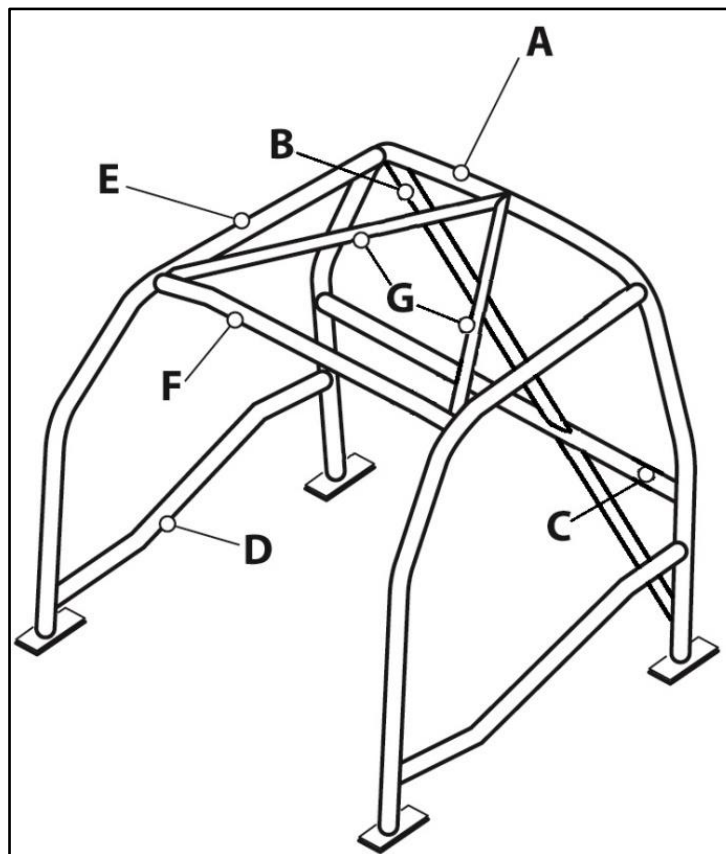


Figure 2

6.3 Six Point Rollcage

6.3.1 A Six Point Rollcage (Figure 3) is the minimum rollcage specification that is required in the following vehicles;

- a) All vehicles not previously listed under Four Point Rollcage or Single Roll Over Hoop with a 1/4 mile ET of 11.00 seconds or quicker (or 1/4 mile ET of 10.00 seconds for Modern Street Cars).

Modern Street Cars: Street registered, sedan-based vehicle (and derivatives such as Coupes, Utilities and Station Wagons etc) built after 01JAN2008 and with a compliance identification plate dated 01JAN2008 or later.

6.3.2 A Six Point Rollcage must have the following components, in the positions illustrated in Figure 3, as a minimum;

- a) One Main Hoop
- b) Two Rear Stays
- c) One Taxi Bar
- d) Two Side Intrusion Bars
- e) Two Forward Supports
- f) One Roof Support

6.3.3 Figure 3 G: Roof Braces are a requirement if the rollcage has a removable Roof Support.

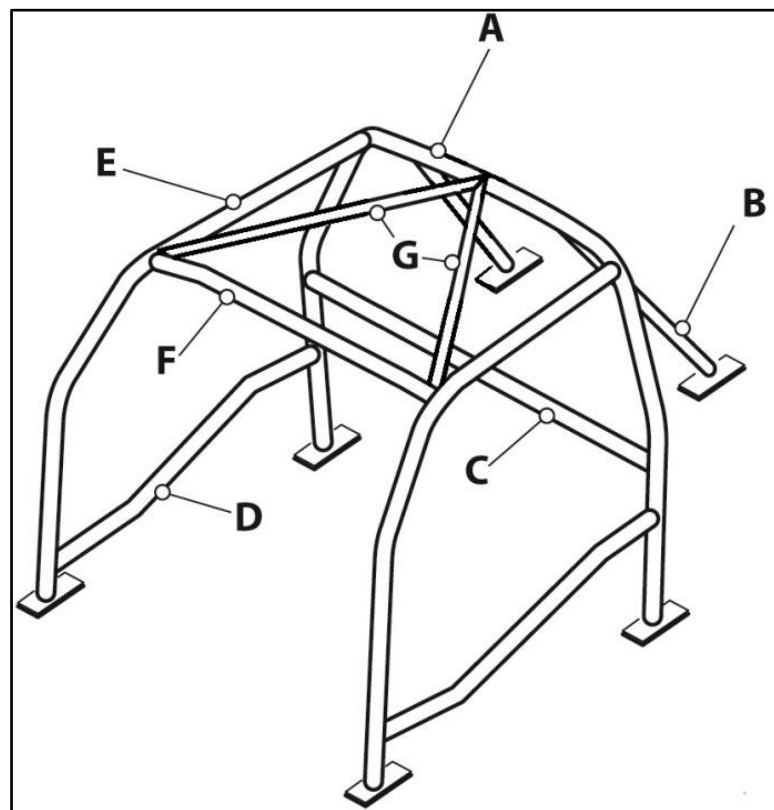


Figure 3

6.4 No Rollage Required

6.4.1 The following vehicles do not require a rollage;

- a) Street registered Open Cars with a 1/4 mile ET of 12.99 seconds (or 1/8 mile equivalent) or slower.
- b) Open Competition Cars, certified by and complying with relevant CAMS regulations, with a 1/4 mile ET of 11.00 seconds (or 1/8 mile equivalent) or slower.
- c) Unmodified Cars, with a fixed steel roof, with a 1/4 mile ET of 11.00 seconds (or 1/8 mile equivalent) or slower.
- d) Modern Street Cars with a 1/4 mile ET of 10.00 seconds (or 1/8 mile equivalent) or slower.

[Modified: A Unibody Car with modifications to the rear floor, rear wheelwells or boot floor.](#)

[Modern Street Cars: Street registered, sedan-based vehicle \(and derivatives such as Coupes, Utilities and Station Wagons etc\) built after 01JAN2008 and with a compliance identification plate dated 01JAN2008 or later.](#)

7.0 Rollage Components

7.1 Main Hoop

- 7.1.1 In no case must the driver's helmet centreline be behind the centreline of the Main Hoop.
- 7.1.2 The Main Hoop must be placed rearwards of any occupant's head, when their seat is in the rearmost position, to a maximum horizontal distance of 6" (150mm) between the rear of the helmet and the front of the Main Hoop tube.
- 7.1.3 In closed vehicles, the Main Hoop must follow, as close as is practical, the profile of the vehicle's interior.
- 7.1.4 There must be a minimum of 3" (76mm) clearance between the top of the driver's helmet and the bottom of the Main Hoop tubing or the top of the Main Hoop tube must be within 1" (25mm) of the roof/headliner in the area above the driver's helmet.

7.2 Rear Stays

- 7.2.1 [In a Single Rollover Hoop, where possible, Rear Stays should be straight.](#)
- 7.2.2 In a Six Point Rollage, where possible, Rear Stays should be straight.
- 7.2.3 If Rear Stays are bent, a Stiffening Tube (Figure 7 component K) must be fitted perpendicular to and in-between the Rear Stays within 100mm (4") of the bend in the Rear Stay.

- 7.2.4 If the Rear Stay Stiffening Tube is not positioned within 100mm (4") of the top of the rear window then a Rear Roof Support Tube must be fitted, perpendicular to the Rear Stays, within 100mm of the top of the rear window.
- 7.2.5 The Rear Stay Stiffening Tube must have a maximum of two bends and be straight in side view.
- 7.2.6 No bend in the Rear Stay Stiffening Tube may exceed 20 degrees.
- 7.2.7 The Rear Roof Support Tube must have a maximum of two bends and be straight in side view.
- 7.2.8 No bend in the Rear Roof Support Tube may exceed 20 degrees.
- 7.2.9 A Rear Stay must be mounted onto the vehicle structure at its rear termination by an approved Mounting Pad and Mounting Plate.
- 7.2.10 A Rear Stay must make an angle of between 30-60 degrees from horizontal at its rear termination / attachment point (e.g. the Mounting Pad).
- 7.2.11 A Rear Stay must be connected to the Main Hoop at the top horizontal Main Hoop tube, within 100mm of the upper Main Hoop bend.
- 7.2.12 Each vehicle requires a minimum of two Rear Stays.

7.3 Additional Rear Stay Mounting Design

- 7.3.1 It is desirable to fix the rear end of the Rear Stays to a substantial chassis component. To do this, Rear Stays can be split in design, as per Figures 4 and 5.
- 7.3.2 Split Rear Stay fabrication involves the fitting of Mounting Plates on the rear parcel shelf, with a supporting structure under the parcel shelf, which is mounted to a substantial chassis component between the front and rear suspension elements carrying the vertical loads.
- 7.3.3 Mounting Plates must be designed and fabricated following the diagrams in Figures 10-16 and the associated description in the Rollcage to Chassis Mounting section of this document.
- 7.3.4 The supporting structure under the parcel shelf may be designed and fabricated in one of two ways;
 - a) Two straight support tubes each connected to the underside of the Parcel Shelf and a substantial chassis component.
 - b) Two straight support tubes, with cross bracing, each connected to the underside of the parcel shelf and a substantial chassis component. The cross bracing must be welded to the supports no further than 100mm from the ends of the support tubes.

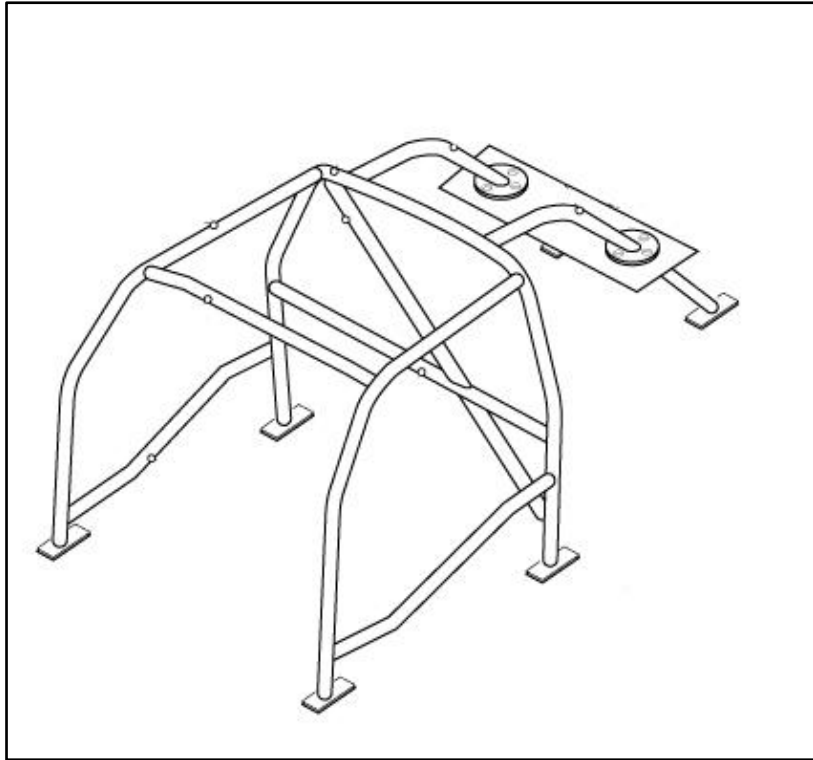


Figure 4

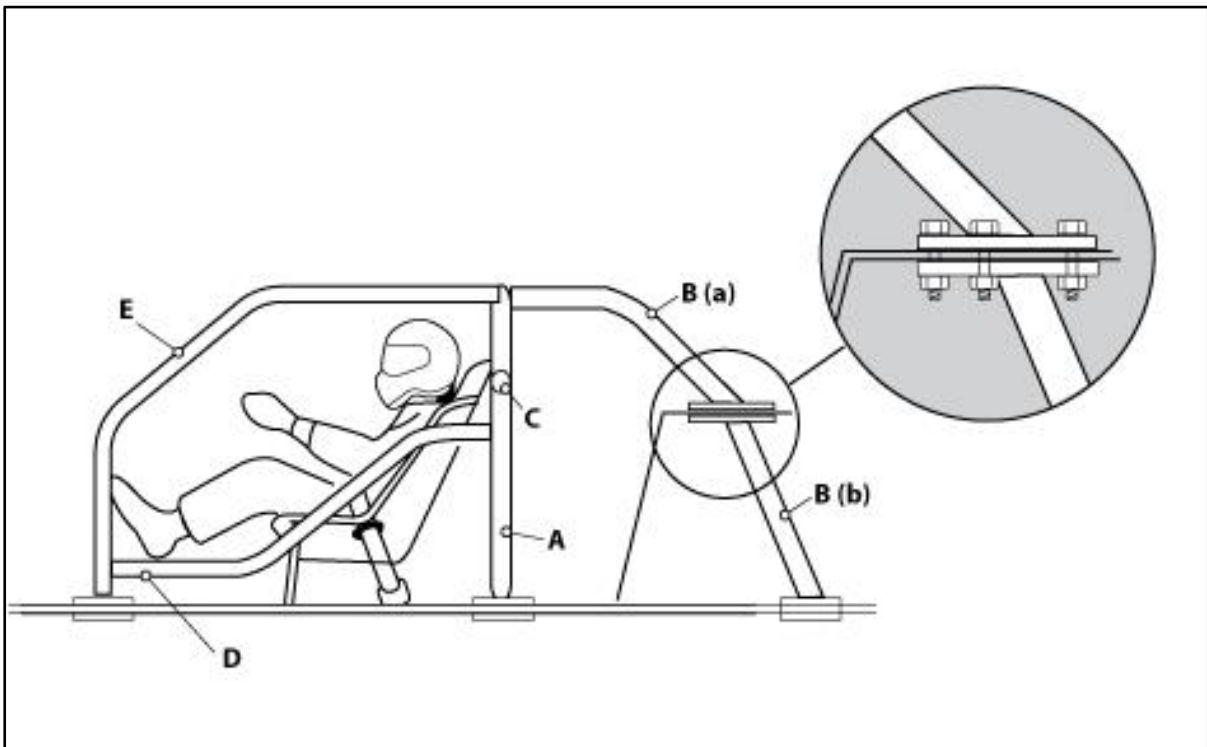


Figure 5

7.4 Taxi Bar

- 7.4.1 A Taxi Bar must be fitted between the uprights of the Main Hoop.
- 7.4.2 The Taxi Bar must be positioned horizontally such that it passes behind the driver between their shoulder height and the lowest point of their shoulder blades.
- 7.4.3 [Harnesses may be mounted to a removable Main Hoop, but not a removable Taxi Bar.](#)

7.5 Taxi-Bar Bracing

- 7.5.1 In a Four Point Rollcage, a straight Taxi Bar must be reinforced with a Diagonal Brace as per Figure 6, component G.
- 7.5.2 The Diagonal Brace must be fitted between the Main Hoop horizontal tube behind the driver and the opposite Main Hoop vertical tube, via the Taxi-Bar.
- 7.5.3 The upper connection of the Diagonal Brace to the Main Hoop must be no further than 100mm from the end of the Main Hoop upper bend on the driver's side of the vehicle.
- 7.5.4 The lower connection of the Diagonal Brace to the Main Hoop must be no further than 100mm from the Main Hoop Mounting Pad on the opposite side of the vehicle.
- 7.5.5 Passengers are not allowed in the vehicle unless two Diagonal Braces are present in a cross formation to the dimension specifications above.
- 7.5.6 An alternative to a Diagonal Brace is the fitting of a Diagonal Member between the two Rear Stays.
- 7.5.7 The Diagonal Member must be straight.
- 7.5.8 The Diagonal Member must be joined to the driver's side Rear Stay no further than 100mm from the Rear Stay to Main Hoop joint.
- 7.5.9 The Diagonal Member must be joined to the Rear Stay on the opposite side no further than 100mm from the Rear Stay mounting point.
- 7.5.10 Passengers are not allowed in a vehicle with a Diagonal Member fitted between the two Rear Stays unless two Diagonal Members are fitted in a cross formation to the dimensions specified above.
- 7.5.11 If the Taxi Bar is back-set (Figure 7, component C) two Taxi Bar Upper Supports fixed to the horizontal section of the Main Hoop and the Taxi Bar are required (Figure 7, components H2).
- 7.5.12 It is also recommended to use Taxi Bar Lower Supports that are fixed to the Taxi Bar and the floorplan or transmission tunnel (Figure 7, components H1).

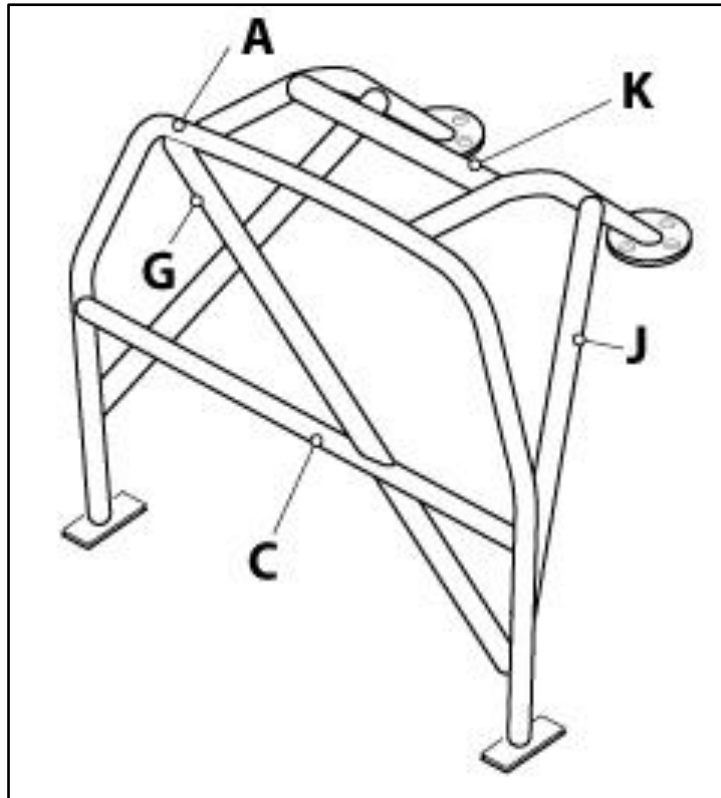


Figure 6: Component J is additional and optional. Component K is required if Rear Stays are bent. Component G is required in a 4 Point Rollcage but optional in a 6 point Rollcage.

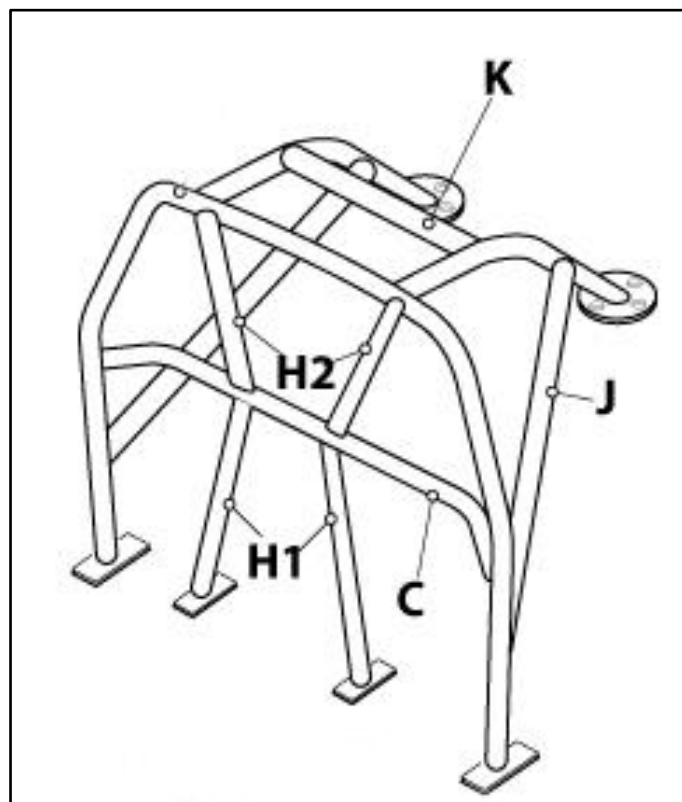


Figure 7: Component J is additional and optional. Component K is required if Rear Stays are bent. Components H2 are required if the Taxi Bar is back-set (C), Components H1 are recommended but optional.

7.6 Side Intrusion Bar

- 7.6.1 A Side Intrusion Bar must be designed and fabricated to ensure that it does not unduly impede egress from the vehicle when it is in place.
- 7.6.2 A Side Intrusion Bar must pass the driver's/passenger's body midway between their shoulder and elbow when seated in racing position.
- 7.6.3 A Side Intrusion Bar must be as straight as is practical, both laterally and vertically.
- 7.6.4 A Side Intrusion Bar must have its forward connection to a Forward Support tube no higher than half the height of the door opening.

7.7 Forward Supports

- 7.7.1 A Forward Support must be connected to the Main Hoop no further than 100mm from the upper Main Hoop bend on either side of the vehicle.
- 7.7.2 A Forward Support must follow the vehicle's body line across the top of the front window and the A-Pillar as close as is practical.
- 7.7.3 There must only be one bend in the vertical section of a Forward Support.
- 7.7.4 A Forward Support must be fixed to the chassis with a Mounting Pad and Mounting Plate that conforms to the specifications in sections 8.0 and 9.0.

7.8 Forward Support Reinforcement

- 7.8.1 If dimension 'A' in Figure 8 is greater than 200mm, it is recommended that Forward Support Reinforcement be fitted.
- 7.8.2 The Forward Support Reinforcement may be bent, on condition that it is straight in side view and that the angle of the bend does not exceed 20 degrees.
- 7.8.3 The Forward Support Reinforcement must have its upper attachment no further than 100mm from the Roof Support to Forward Support joint (Figure 8, component X), welded 360 degrees around the tube.

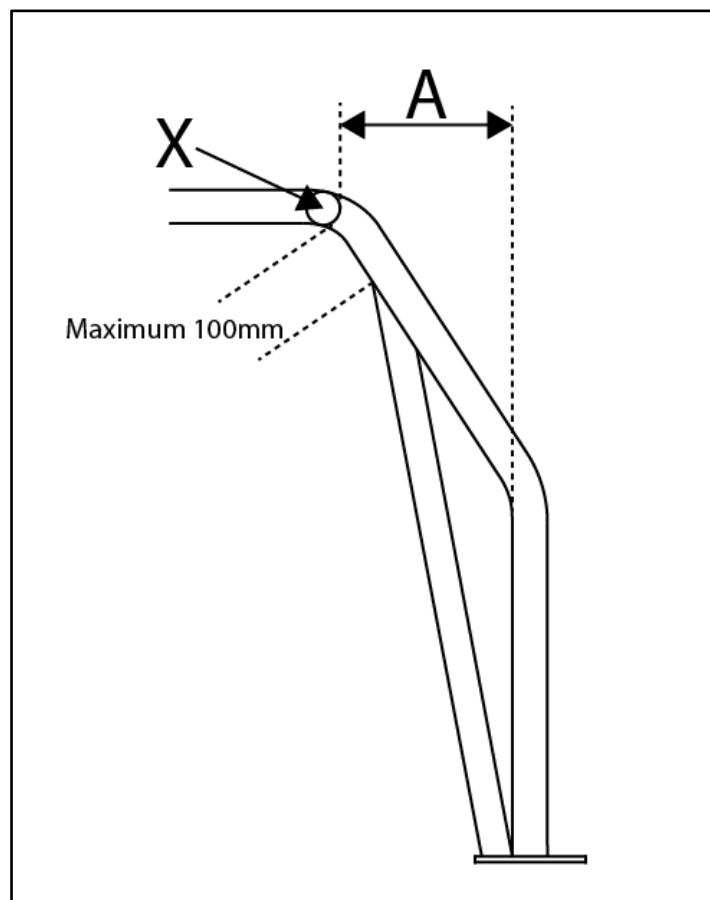


Figure 8

7.8.4 The Forward Support Reinforcement should have its lower attachment in one of the two suggested configurations or as per the designs presented in the ANDRA Removable Rollcage Specification v2.01. (Figure 9 & 10 below)

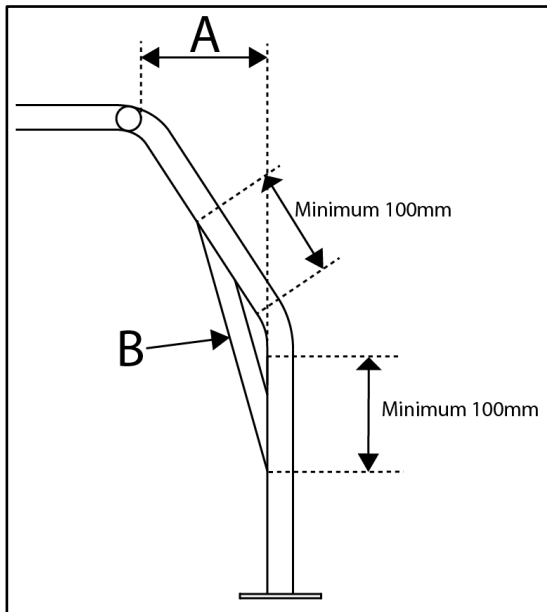


Figure 9

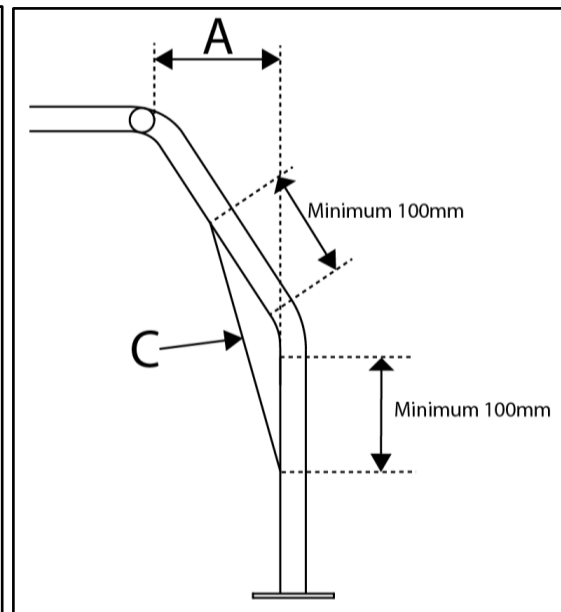


Figure 10

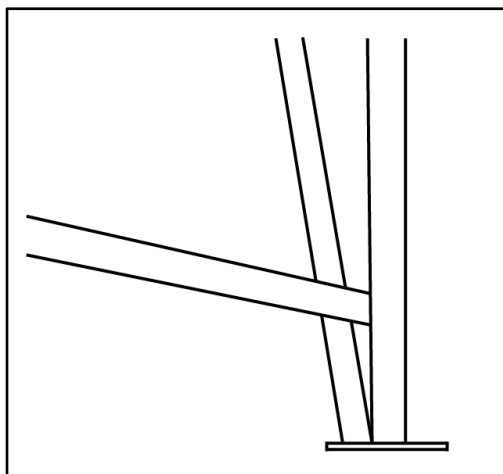


Figure 11

Configuration 1 (Figure 11).

The centreline of the Forward Support Reinforcement tube must be coincident (intersect) with the centreline of the Forward Support tube and the centreline of the Side Intrusion Bar tube at a single point. Welded 360 degrees around the tube.

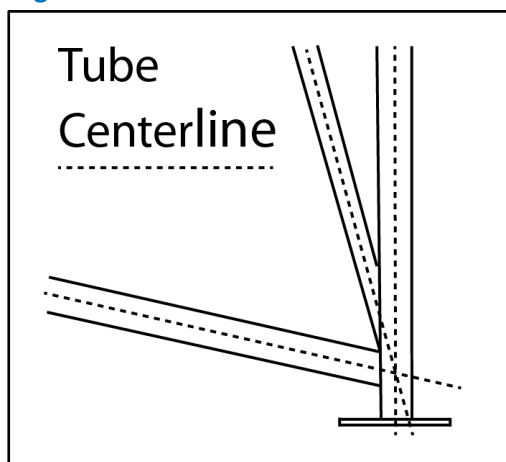


Figure 12

Configuration 2 (Figure 12).

Attached to the Mounting Pad of the Forward Support no further than 100mm from the Forward Support tube to pad connection. If the Forward Support Reinforcement tube intersects the Side Intrusion Bar it must be split in several parts. The Forward Support Reinforcement Tube may be placed either side of the Side Intrusion Bar.

7.9 Roof Support and Diagonals

- 7.9.1 A Roof Support Tube must be fitted to a Four Point and a Six Point Rollcage.
- 7.9.2 A Roof Support Tube must be connected to a Forward Support no further than 100mm from the upper bend in the Forward Support Tube.
- 7.9.3 The Roof Support Tube must have a maximum of two bends and be straight in side view.
- 7.9.4 No bend in the Roof Support Tube may exceed 20 degrees.
- 7.9.5 If the Roof Support Tube is removable, Roof Diagonals (Figures 2 and 3, components G) must be fitted.
- 7.9.6 Roof Diagonals must be fitted in either a forward or reverse V configuration between the Roof Support and Main Hoop horizontal section.
- 7.9.7 The angle between the "V" Roof Diagonal tubes must be as great as is practical.

7.10 Additional Tubing

- 7.10.1 The addition of tubing that reinforces a removable rollcage is encouraged.
- 7.10.2 Additional tubing is such as Figure 7, component J.

8.0 Rollcage to Chassis Mounting

- 8.0.1 Mounting Plate: A metal plate welded to the car.
- 8.0.2 Mounting Pad: A metal plate welded to the rollcage tube.
- 8.0.3 Mountings for the Main Hoop, Rear Stays and Forward Supports must comprise of a Mounting Pad welded to the tubing which is then bolted to an approved Mounting Plate.
- 8.0.4 Mounting Plates may be of any shape, provided the minimum width and area dimensions are maintained or exceeded.
- 8.0.5 All points where a removable rollcage mounts to a vehicle must be reinforced with a Mounting Plate of at least 120cm², 19 in² (square inches) in surface area which must be in contact between the Mounting Plate and bodyshell.
- 8.0.6 If the mounting type requires two plates, one beneath the floor and one on top, the lower plate must be larger or smaller than the upper plate by at least 20mm all around the upper plates' perimeter. The minimum surface area specification must be maintained or exceeded by both plates.
- 8.0.7 It is preferential to have the gauge of the pad/plate material as close as possible to that of the material to which it is welded to, whilst staying within the minimum gauge specification.
- 8.0.8 Mounting Plates must be designed and fabricated such that they can withstand minor deformation during a roll over, the Mounting Plates must not be designed and fabricated so that they shear through the supporting chassis/body material during a roll over.
- 8.0.9 Mounting Plates must be fabricated to reinforce the material which they are welded to.
- 8.0.10 A Mounting Plate must be attached to the body (including transmission tunnel) of a vehicle as close as possible to the chassis beams or a substantial chassis component.
- 8.0.11 Mounting Plates **should** be stitch welded to the vehicle around their whole perimeter. Appropriate stitch sizes are 1" weld with a 1" gap.
- 8.0.12 Mounting Pads must meet the sizing dimensions as per Table 2 below.

Table 2

Mounting Pad Location	Minimum Surface Area	Minimum Single Dimension
Forward Support	100cm ² / 15.5 in ²	75mm / 3"
Main Hoop	100cm ² / 15.5 in ²	75mm / 3"
Rear Stays	60cm ² / 9.3 in ²	75mm / 3"
Additional Supports*	100cm ² / 15.5 in ²	75mm / 3"
Side Intrusion Bar**	100cm ² / 15.5 in ²	75mm / 3"

* e.g. Taxi Bar Lower Supports "H2"

** Single Roll Over Hoop only.

- 8.0.13 Tube to Mounting Pad welding must be continuous (not stitched) around the whole circumference of the tube.

- 8.0.14 All corners of Mounting Pads and Plates must be radiused to a minimum of 30mm radius.
- 8.0.15 There must be a minimum of three bolts in each Mounting Pad or Plate.
- 8.0.16 The distance from the centre of a bolt hole to the edge of a Mounting Pad or Plate must be a minimum of two times the bolt hole diameter.
- e.g. if using M8 bolts the distance from the centre of a bolt hole to the edge of the Mounting Pad or Mounting Plate must be a minimum of 16mm.
- 8.0.17 The distance from the centre of the bolt holes to the tubing on a Mounting Pad must be a minimum of two times the bolt hole diameter.
- e.g. if using M8 bolts the distance from the centre of the bolt holes to the tubing must be a minimum of 16mm.
- 8.0.18 Bolt hole internal diameter (ID) must be a maximum of 0.2mm greater than the bolt OD.
- 8.0.19 Bolt hole centres must not be less than 60 degrees from each other, as measured from the tube axis at the level of the Mounting Pad, Figure 13.
- 8.0.20 Bolts must be fitted with nylon insert nuts that must be replaced with new nuts after each removal; alternatives to this are to use a spring washer and a semi-permanent nut locking adhesive or captively weld the nuts to the lower Mounting Plate.
- 8.0.21 Nuts / bolts must be appropriately torqued to the manufacturer's specification, ensuring that they do not come undone in normal operation or in the instance of a crash.
- 8.0.22 Nylon insert nuts must not be tightened or loosened with a powered tool.

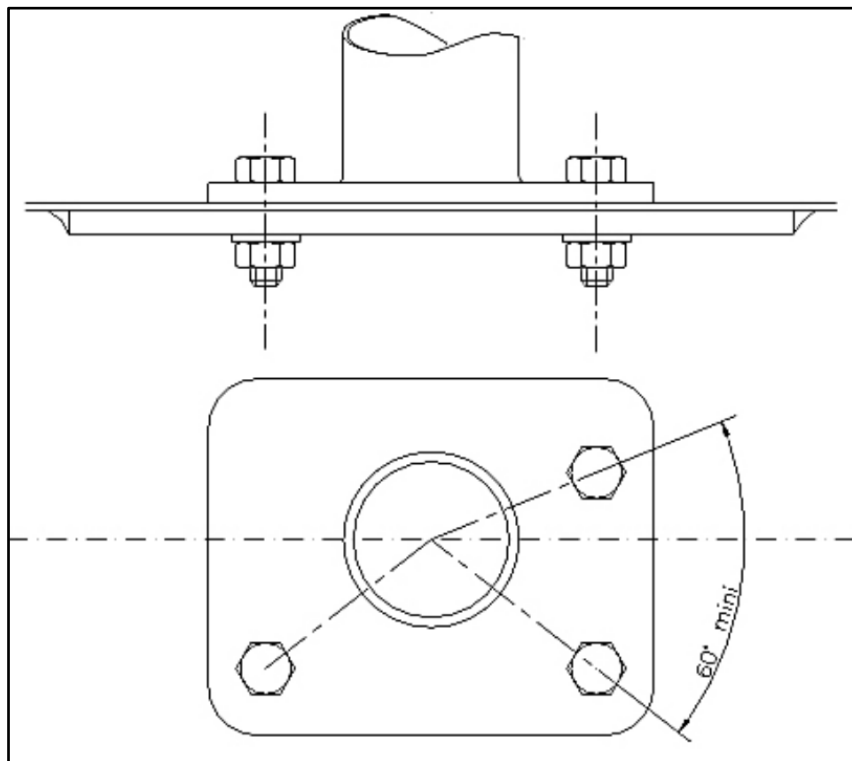


Figure 13

9.0 Crush Tubes

- 9.0.1 Where a removable rollcage mounting bolt passes through a hollow section a Crush Tube must be used.
- 9.0.2 A Crush Tube must be welded within the hollow section at both ends.
- 9.0.3 The ID of the Crush Tube must be no more than 2mm greater than the OD of the mounting bolt.
- 9.0.4 The OD of the Crush Tube must be, as a minimum, the same as the diameter of the head of the bolt which passes through it.
- 9.0.5 Figure 19 shows the use of a Crush Tube through a hollow section.

9.1 Mounting Pad Designs

- 9.1.1 A Mounting Pad must be fabricated to one of six designs as per Figures 14 – Figure 20.
- 9.1.2 Bolts shown in Figures 16 – 19 are external to the rollcage tube.
- 9.1.3 The sides of the raised hollow section Mounting Plate, Figure 17, may be fully enclosed with a welded plate of the same material specification as the Mounting Plate.

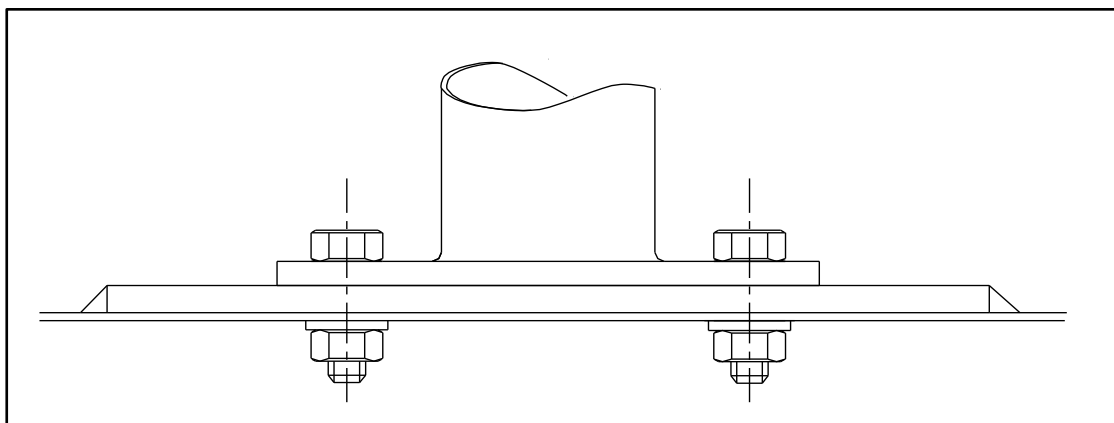


Figure 14

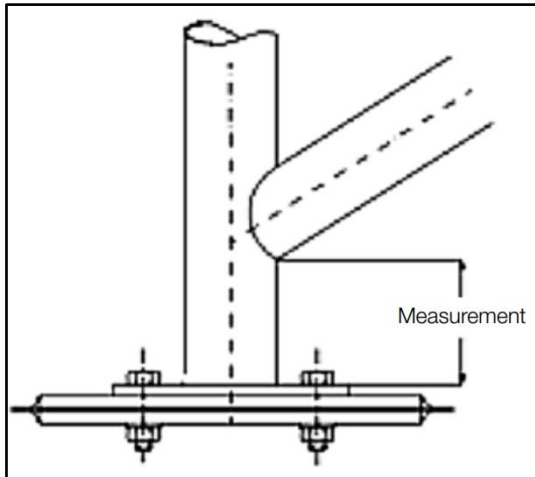


Figure 15

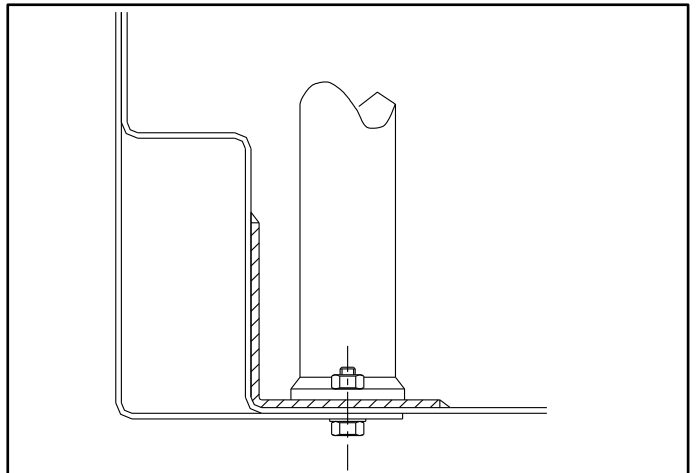


Figure 16

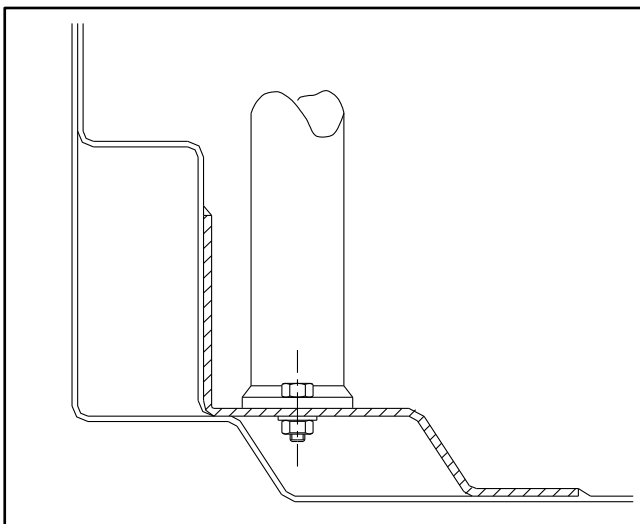


Figure 17

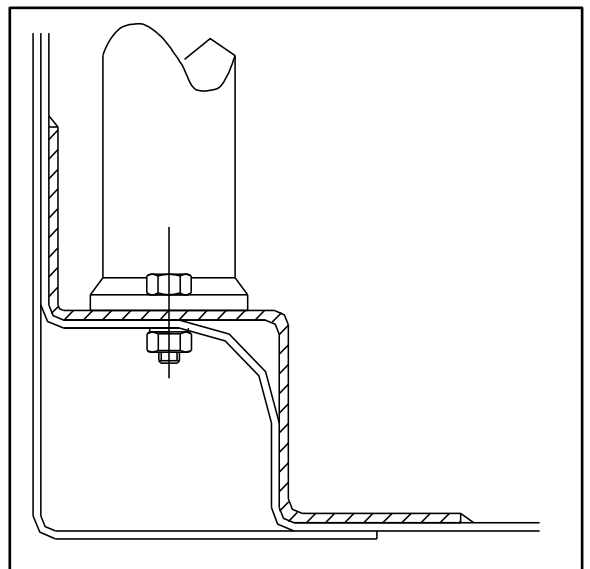


Figure 18

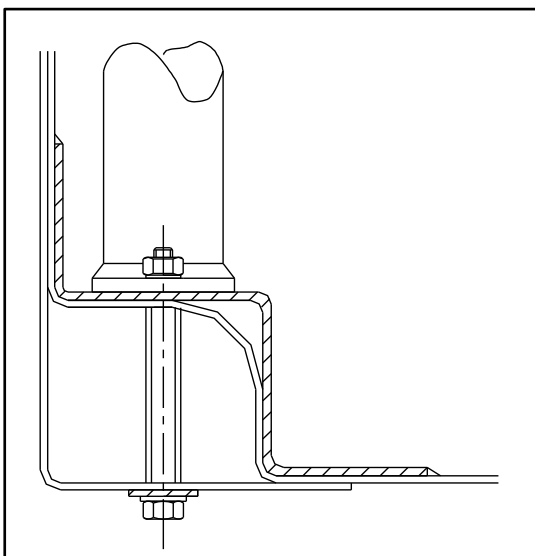


Figure 19

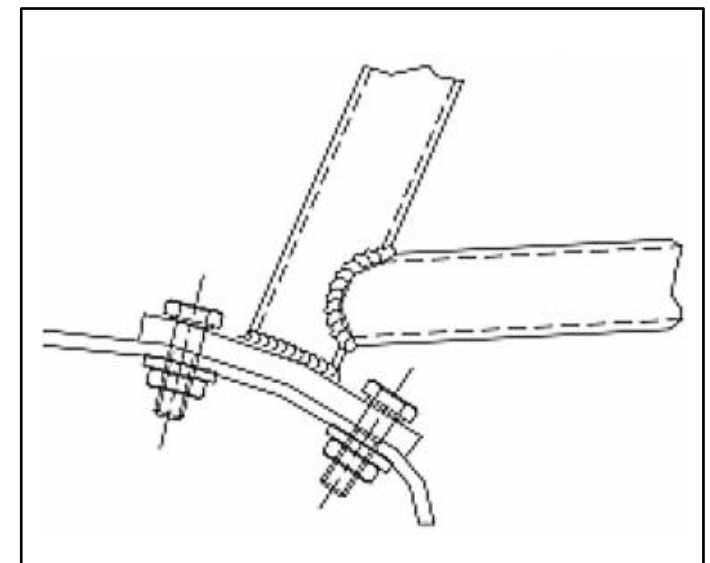


Figure 20

10.0 Rollcage Joints

10.0.1 Joints within a removable rollcage may be fabricated to one of the designs in Figures 21-25.

10.0.2 Figure 21, Double Tab Clevis Joint, is the only joint allowed to join a Side Intrusion Bar to the Main Hoop and Forward Support tube (except for all joints listed in the ANDRA Homologated Joints Document).

10.0.3 An alternative to these joints is an ANDRA homologated joint. Details of ANDRA homologated joints can be found at <http://www.andra.com.au/technical/policies.html>

10.0.4 ANDRA also allow 'Dismountable' joints as homologated by the FIA.

10.1 Double Tab Clevis Joint

10.1.1 The bolt used in a Double Tab Clevis joint must be vertical in orientation.

10.1.2 The clevis must be a snug fit in-between the double tabs.

10.1.3 Bolts must be fitted with nylon insert nuts that must be replaced with new nuts after each removal; alternatives to this are to use a spring washer and a semi-permanent nut locking adhesive or captively weld the nut to one of the tabs.

10.1.4 Nuts / bolts must be appropriately torqued, to the manufacturer's specification, ensuring that they do not come undone in normal operation or in the instance of a crash.

10.1.5 Nylon insert nuts must not be tightened or loosened with a powered tool.

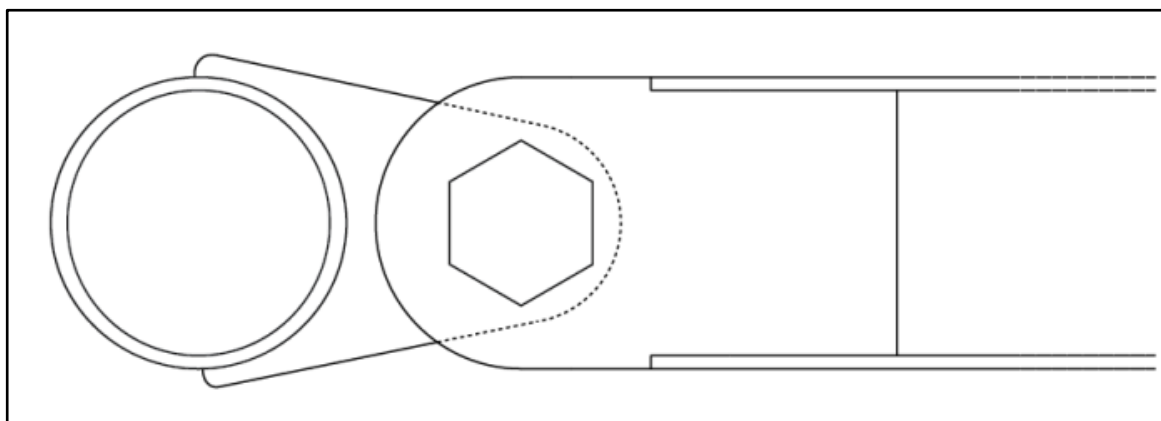


Figure 21: Double Tab Clevis viewed vertically downwards.

10.2 Taper Lock Joint

- 10.2.1 All Taper Lock components, excluding bolts, must be fabricated from 4130 or 4140 Chromoly to AISI or alternate applicable standard.
- 10.2.2 The OD of the Taper Lock tube insert must be an interference fit with the ID of the rollcage tube housing it.
- 10.2.3 The thread length, measured longitudinally within the Taper Lock tube insert, must be a minimum of 25mm.
- 10.2.4 Bolts used must be minimum of ISO (SAE) Class 8.8 and M12 in size and of a length to ensure that the bolt protrudes from the Taper Lock tube insert when fully tightened to manufacturer's torque specification.
- 10.2.5 Bolts must be appropriately torqued, to the manufacturer's specification, ensuring that they do not come undone in normal operation or in the instance of a crash.
- 10.2.6 The Taper Lock tube insert must be welded to the rollcage tube in one continuous (not stitched) weld, fully surrounding the whole circumference of the tube.
- 10.2.7 The Taper Lock tube insert must also be spot welded at four points around the tube with each point being 90 degrees to each other (Rosette welding).
- 10.2.8 The corresponding insert which passes perpendicularly through the rollcage tube, must be welded to the tube withholding it in one continuous (not stitched) weld around the full circumference of the insert on each side of the tube.

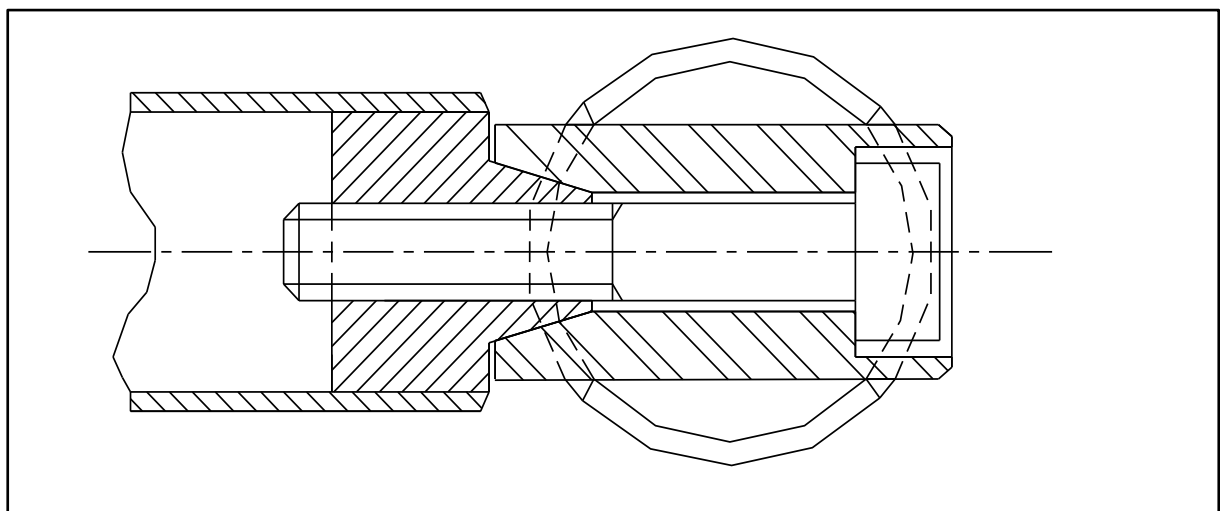


Figure 22: Taper Lock Joint

10.3 Sleeve Joints

- 10.3.1 A sleeve must be fabricated from the same material specification as the rollcage tube within it, excepting its ID.
- 10.3.2 A sleeve must have an ID no greater than 0.4mm (1/64") than the rollcage tube OD within it.
- 10.3.3 The tubes within a Double Butted Sleeved Joint must butt-up against each other within the sleeve.
- 10.3.4 A tube in a Sleeved Tee joint must butt to the face of the adjoining tube within the sleeve.
- 10.3.5 The minimum distance;
- from the sleeve end to the bolt hole in a Sleeve Joint is 18mm.
 - between bolts in a Sleeve Joint is 36mm.
 - between a central sleeve bolt and the end of the sleeved tube is 18mm
- 10.3.6 Bolts must be orientated at 90 degrees to each other.
- 10.3.7 Bolts must be fitted with nylon insert nuts that must be replaced with new nuts after each removal; alternatives to this are to use a spring washer and a semi-permanent nut locking adhesive or captively weld the nuts to the sleeve.
- 10.3.8 Nuts / bolts must be appropriately torqued, to the manufacturer's specification, ensuring that they do not come undone in normal operation or in the instance of a crash.
- 10.3.9 Nylon insert nuts must not be tightened or loosened with a powered tool.

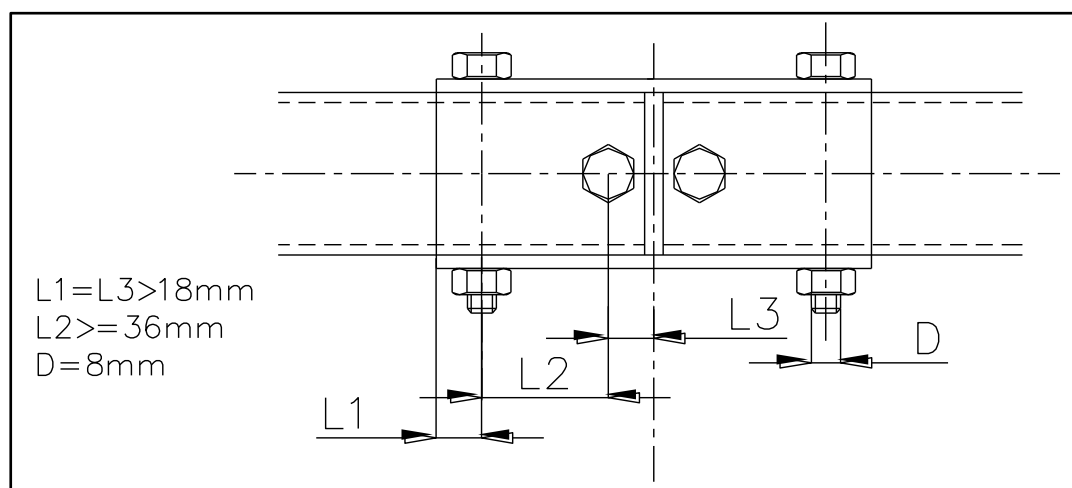


Figure 23: Butted Sleeve Joint

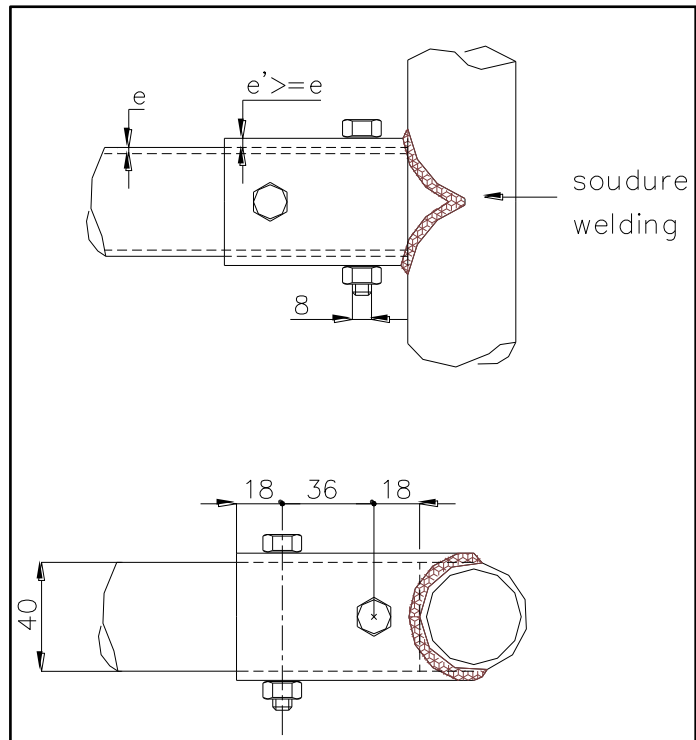


Figure 24: Sleeved Tee Joint

10.4 CAMS Joint J-50

10.4.1 CAMS J-50 joint is only to be used to connect a removable Side Intrusion Bar to a Main Hoop tube and/or Forward Support tube.

10.4.2 Bolts must be fitted with nylon insert nuts that must be replaced with new nuts after each removal; alternatives to this are to use a spring washer and a semi-permanent nut locking adhesive or captively weld the nut to one of the tabs.

10.4.3 Nuts / bolts must be appropriately torqued, to the manufacturer's specification, ensuring that they do not come undone in normal operation or in the instance of a crash.

10.4.4 Nylon insert nuts must not be tightened or loosened with a powered tool.

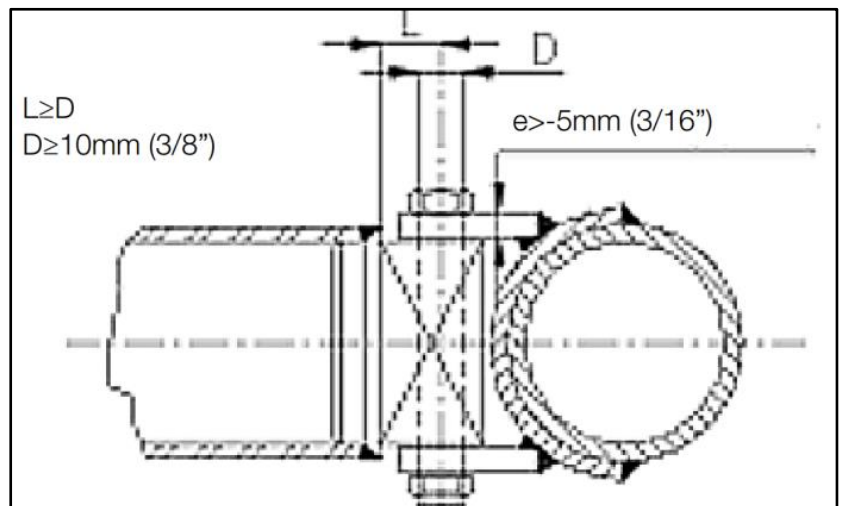


Figure 25: CAMS Joint J-50 viewed vertically downwards