BAJA SAE® 2025 Roll Cage Documentation Package

Instructions

On the following pages, insert the following information as a screenshot, photo, or scanned image. Add as many pages are necessary; making certain that your information is ***CLEAR and READABLE***!

Log on to www.bajasae.net and click My Team Document Submissions. There will be a slot for "Frame Design Pre-Check- Roll Cage Documentation" for each competition. If your frame will not (and does not) change between competitions, you may upload this exact same document for each competition. If your design changes significantly, you should submit an updated document. The National Tech Inspector frame specialists will review your submission and mark it as "Accepted" or "Rejected" on CdsWeb. Questions or feedback will be provided for rejected submissions.

Rules Reference:

B.3.7 - Roll Cage Documentation Package

B.3.7.1 - Required Documents

Required documents for the Roll Cage Documentation Package include: Roll Cage Specification Sheet & material documentation (invoices, certifications, calculations, etc.) and a single isometric view diagram of the frame highlighting professional fabrication.

B.3.7.2 - Document Submittal

1) Download the form and template from bajasae.net download section (Note: All files that are uploaded must be in a PDF format)
2) Upload the Roll Cage Documentation Package (max size 5 MB)
    a. Roll Cage Specification Sheet
    b. Invoice of roll cage material
    c. Material Test of Certification
    d. Any Required Calculation per rule B.3.2.16 - Roll Cage Materials
    e. A diagram highlighting any parts of the frame that were outsourced or professionally fabricated

B.3.7.3 - Process

Documents will be reviewed by the National Technical Inspectors on a first come first serve basis. Typical review period will be 30 days after submittal. After review, feedback will be given to teams. If the submission is rejected by the National Technical Inspectors, the team must correct the error noted in the rejection and continue to resubmit the Roll Cage Documentation Package, until they are marked Accepted. It is the responsibility of teams to submit complete documents by the appropriate deadlines. If teams have additional questions, they will need to use other resources to find the answers or wait until competition.

Note: If a team's initial Roll Cage Documentation Package is received more than five (5) days late it will be classified as "Not Submitted" and your team will be removed (withdrawn) from the event. Documents do not need to receive a Pass Judgement in order to satisfy this requirement.

BAJA SAE ROLL CAGE SELF-AUDIT

SCHOOL NAME Withywindle University **TEAM NAME** Hobbits On Wheels

Failure to fill out this sheet will result in a REJECTED submission without further explanation.

Purpose: To streamline the approval process, teams are required to self-certify their submission meets requirements. If the reviewer finds an issue they may reply **only with the Item number** from this self-audit.

Item #	Requirement	Team Initial
1	All sheets have been filled out professionally (legible documents ex)	TB
2	Invoice/Packing list contains sufficient Primary Material to build a **full** roll cage (quote not accepted)	TB
3	All pages of each Primary Material cert are included	TB
4	All relevant values have been highlighted on invoice, material certification and calculations	TB
5	Values are consistent throughout document (ex material strength on reference, cert and calculations match)	TB
6	Material certifications are dated within 6 years of Jan 1 of the competition year.	TB
7	Material yield strength used is **minimum** for material type (supplying source material recommended)	TB
8	Roll Cage drawing includes all required members with named points labeled	TB

BAJA SAE ROLL CAGE TRACEBILITY SHEET
2025 BAJA SAE COMPETITIONS

SCHOOL NAME Withywindle University **TEAM NAME** Hobbits On Wheels

This Roll Cage will be competing in:

- ☐ BAJA SAE Arizona Car Number: _____
- ☒ BAJA SAE Maryland Car Number: 321
- ☐ BAJA SAE Carolina Car Number: _____

If a **Team** is competing with different roll cages at different events, submit additional documentation packages via the Rules Portal

The Traceability & Technical sheet MUST be completed and submitted in accordance with the competition rules. Failure to do so will result in penalty.

Purpose: The purpose of this sheet is to facilitate verification of roll cage materials/construction, and to provide a means of tracking the age of older vehicles. This is being done in the interest of good engineering practice and confirming the fabrication techniques of the team.

History: This roll cage

- ☐ Was completely manufactured in the 2025 Academic Year
- ☐ Was manufactured in a previous Academic Year and no modifications have been made
- ☒ Was manufactured in a previous Academic Year with modifications made in the 2025 Academic Year

Elaborate on previous manufacturing history (if applicable)

All previous Roll Cage approval packages must be attached to the end of this submission

Roll Cage initially manufactured for 2019 season. Roll Cage aft of RRH replaced for 2022 season using material purchased in 2021. No changes have been made since that time.

CAPTAIN: Bring Signed Copy ADVISOR: Bring Signed Copy
(INITIALS)

BAJA SAE ROLL CAGE TECHNICAL SHEET
2025 BAJA SAE COMPETITIONS

SCHOOL NAME Withywindle University **TEAM NAME** Hobbits On Wheels

Primary Material Type	OD	Thick-ness	Material Type Minimum Yield Strength	Invoice Date	Qty purchased
1018	4.563in	2.28in (solid)	365 MPa	1/24/22	60 ft

Welder	Welding Method	Filler Material	Shielding Gas
Tom Bombadil	GTAW	ER705-2	100% Argon

All welds and/or other attachment methods must be checked for integrity. Faculty advisor and team captain are required to do destructive testing on sample joints that represent the integrity of similar welds on their frame. Testing and inspection must occur before roll cage fabrication is started.

Date of inspection: January xx, 20XX

NOTE: It is extremely important that such an inspection be made to ensure the welds have good penetration and joints are completely welded.

WE HAVE EXAMINED THE ABOVE INFORMATION AND TO THE BEST OF OUR

TEAM CAPTAIN: Bring Signed Copy (SIGNATURE) Bring Signed Copy (DATE)

FACULTY ADVISOR: Bring Signed Copy (SIGNATURE) Bring Signed Copy (DATE)

Bring a signed and completed copy of this form with you to technical inspection FOR EACH COMPETION your team is entering.

PRIMARY MATERIAL INVOICE

HIGHLIGHT ALL RELEVENT VALUES (LIMIT 5 PAGES)

Totter Steel Supply
24 Baja Lane
Warrendale, PA 15096

INVOICE

INVOICE # 100
DATE: JUNE 1, 2023

TO:
Withywindle University
Tax Exempt

Delete this image and replace it with your own

SALESPERSON	P.O. NUMBER	REQUISITIONER	SHIPPED VIA	F.O.B. POINT	TERMS
Counter	Verbal		Pick Up	Pick Up	Due on receipt

QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
3	1018 Steel Round – 4.563" Dia – 17/24' RL	$120	$360

SUBTOTAL	$360
SALES TAX	-
SHIPPING & HANDLING	-
TOTAL DUE	$360

Make all checks payable to Totter Steel Supply
If you have any questions concerning this invoice, contact us

THANK YOU FOR YOUR BUSINESS!

PRIMARY MATERIAL CERTIFICATIONS

HIGHLIGHT ALL RELEVENT VALUES (LIMIT 10 PAGES)

PROVIDE ALL PAGES (IN ORDER)

Steel Certificate of Test

1835 Dueber Ave. S.W.
Canton, Ohio 44706
ID #0551093-1

TIMKENSTEEL

Page 1 of 2

1/24/2022

SOLD TO: Northlake Steel Corporation
5455 Wegman Drive
Valley City, OH 44280 USA

SHIP TO: Northlake Steel Corporation
5455 Wegman Drive
Valley City, OH 44280 USA

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Customer Order: P-55066
Mill Order: 16529-F (2265890)
Customer Part Number: HR-1018-4.563X480
Heat Number(s): Y7676

Description of Material

DIAMETER: 4.563 in (115.900 mm)
Shape: RD
Prod Type: BAR
Sales Type: 1018
Int Quality: COMMERCIAL
Condition: HOT ROLL

Specification

- JOHN DEERE JDQ89 02/13/2012 EXCEPT AS NOTED
- ASTM E 45 Rev. 18a 06/01/2018 METHOD A
- ASTM E 112 Rev. 13 (REAPPROVED 2021) 11/01/2021
- JOHN DEERE JDM A1 12/01/1987
- JOHN DEERE JDS-G223 08/28/2020 EXCEPT AS NOTED
- JOHN DEERE JDM A0 QL-2 07/26/2018 EXCEPT AS NOTED
- ASTM A 576/A 576M Rev. 17 11/01/2017 EXCEPT AS NOTED
- ASTM A 29 / A 29M Rev. 20 07/01/2020 EXCEPT AS NOTED
- SAE J403 Rev. JUN2014 06/01/2014

Chemistry Information

	%C	%Mn	%P	%S	%Si	%Cr	%Ni	%Mo	%Cu	%Al	%B	%Ca
SPEC Ladle Min:	.15	.60			.15							
SPEC Ladle Max:	.20	.90	.040	.030	.35	.15	.15	.06	.35		.0005	.0020
Y7676 Ladle:	.17	.80	.007	.009	.26	.06	.08	.02	.25	.012	.0001	.0004

Testing of elements performed at TimkenSteel Chemistry Labs except where noted.

Metallurgy Information

SPEC: Chemistry (Info Only)
Heat Y7676 DI SAE J406: 0.540
SPEC: Chemistry CR+NI+MO 0.300 Max
Heat Y7676 CR+NI+MO: 0.160
SPEC: Grain Size SIZE 5/FINER
Heat Y7676 SIZE: 7
SPEC: MacroEtch Std SURFACE 4 Max RANDOM 4 Max CENTER 4 Max
MACROETCH RATINGS EQUAL TO OR BETTER THAN STATED REQUIREMENTS BASED ON PERIODIC TESTING.

When shipping document is attached it becomes part of this certification.

We certify the above materials have been inspected and tested in accordance with the methods prescribed in the governing specifications and consistent with our Standard Commercial Terms and Conditions for Sale, Manufacture, and Shipping, which are incorporated into and made part of this certification. The results of such inspections and tests conform with the applicable requirements including the purchase order, specification(s) and exception(s). This certificate or report shall not be reproduced except in full, without the written approval of TimkenSteel Corporation.

Notarized: _____ by
NOTARY PUBLIC

Lisa Bucklew, METALLOGRAPHER

ENTERED

TimkenSteel Corporation

PRIMARY MATERIAL CERTIFICATIONS

HIGHLIGHT ALL RELEVENT VALUES (LIMIT 10 PAGES)

PROVIDE ALL PAGES (IN ORDER)

Steel Certificate of Test

1835 Dueber Ave. S.W.
Canton, Ohio 44706
ID #0551093-1

TIMKENSTEEL

Page 2 of 2

1/24/2022

Customer Order: P-55056
Mill Order: 16529-F (2265890)

Customer Part Number: HR-1018-4.563X480
Heat Number(s): Y7676

Metallurgy Information

SPEC: Hardness ASTM E10 (Info Only) UOM BRINELL LOCATION MID

Heat	Piece#		L	UOM
Y7676	3505442	HARDNESS	139	BRINELL
	3505442	LOCATION MID		BRINELL

SPEC: NonMet JK A THIN 4.0 Max A HEAVY 3.0 Max B THIN 4.0 Max B HEAVY 3.0 Max C THIN 3.0 Max C HEAVY 2.0 Max D THIN 2.0 Max D HEAVY 2.0 Max

JK TYPE NONMETALIC INCLUSION RATINGS EQUAL TO OR BETTER THAN STATED REQUIREMENTS BASED ON PERIODIC TESTING.

SPEC: Tensile ASTM E8 (Info Only) STRENGTH UOM PSI GAUGE LENGTH 4 x Diameter SPECIMEN SIZE .505" SHAPE ROUND DIRECTION LONGITUDINAL TEMPERATURE ROOM LOCATION MID PROD QUAL HEAT 1018

Heat	Piece#	Tensile Strength	UOM	.2% Yld Strength	Elong%	Gauge Length	%Red	Specimen	Direction	Temp	Location
Y7676	3505441	68,345	PSI	40,720	31.8	2 IN	60.5	.505" RD	LONG.	RT	MID

All Hardness and Tensile testing performed at TimkenSteel Metallurgical Lab except where noted.

Heat Y7676 Melt Source: USA
Manufacturing: USA
Heat Y7676 - Strand Cast Process
REDUCTION RATIO - 11.4:1

MATERIAL WAS ELECTRIC FURNACE MELTED, VACUUM DEGASSED AND LADLE REFINED

In reference to Section 1502 ("Conflict Minerals") of the Dodd-Frank Wall Street Reform and Consumer Protection Act, no tantalum, tin, tungsten or gold was intentionally added to this material.

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ENTERED

EQUIVALENCY CALCULATIONS

HIGHLIGHT ALL FINAL ANSWERS (LIMIT 2 PAGES)

Bending Stiffness

Definitions:

E = Modulus of Elasticity (205 GPa for all steels)

I = Second Moment of Area for the structural cross-section

Requirement Definitions: 25.0mm x 3.00mm, 1018

D_o = 25.0mm

D_i = 19.0mm

I = $(\pi/64)*(D_o^4-D_i^4)$
= $(\pi/64)*(25.0^4-19.0^4)$
= 1.28E+04 mm^4
= 1.28E-08 m^4

$K_{b,req}$ = E*I
= (205GPa * 1.28E-08 m^4)
= 2.62E+03 $N*m^2$

Design Definitions: 31.8mm, 1018

D_o = 115.9mm

I = $(\pi/64)*(D_o^4-D_i^4)$
= $(\pi/64)*(115.9^4-0^4)$
= 2.82E+06 mm^4
= 2.82E-06 m^4

$K_{b,req}$ = E*I
= (205GPa * 2.82E-06 m^4)
= 5.78E+05 $N*m^2$

Material Specification Minimum Yield Strength - Tested values **not** accepted

Bending Strength

Definitions:

S_y = Yield Strength (minimum specification value)

C = Distance from the neutral axis

Requirement Definitions: 25.0mm x 3.00mm, 1018

S_y = 365MPa

C = 12.5mm
= 0.0125m

$S_{b,req}$ = $(S_y * I)/C$
= (365MPa * 1.28E-08 m^4) / (0.0125m)
= 3.74E+02 N*m

Bending Strength

Definitions:

S_y = Yield Strength (minimum specification value)

C = Distance from the neutral axis

Design Definitions: 31.8mm x 2.11mm, 1018

S_y = 365MPa

C = 58.0mm
= 0.0580m

$S_{b,req}$ = $(S_y * I)/C$
= (365MPa * 2.82E-06 m^4) / (0.0580m)
= 1.77E+04 N*m

Enter your calculations for the Primary Members in your design

BAJA SAE ROLL CAGE GEOMETRY SHEET
2025 BAJA SAE COMPETITIONS

Geometry Verification:
Enter geometry in the table below.
Double click table to edit

Delete this data and replace it with your own

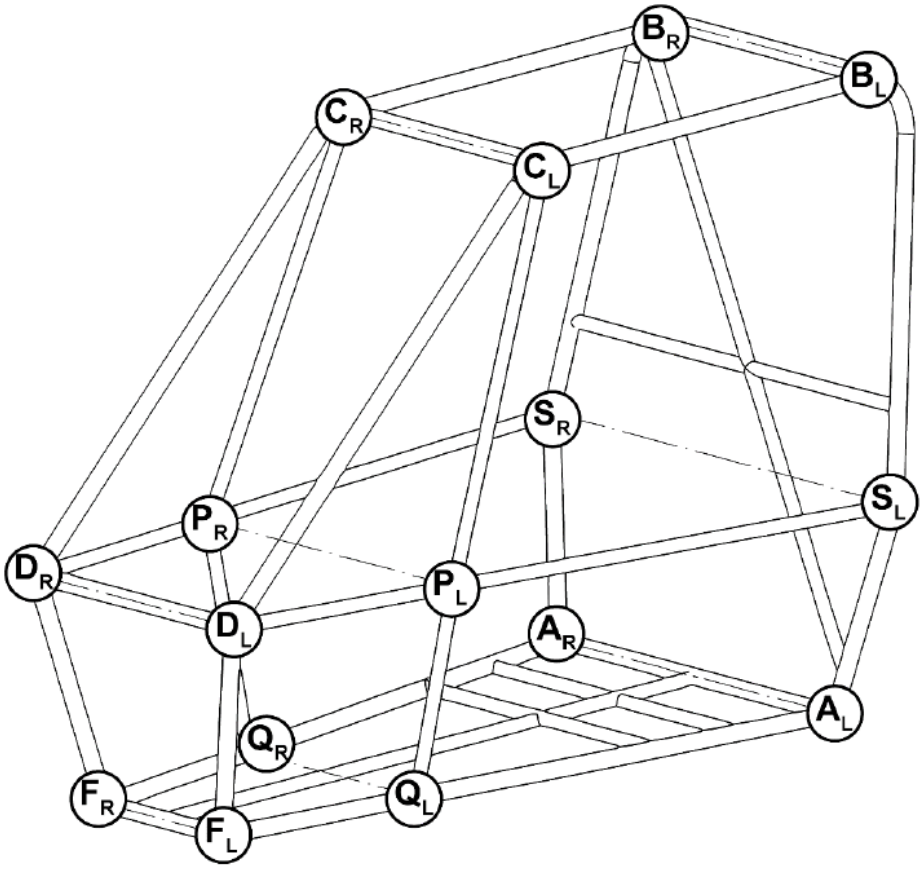
Points	Distance (in)	Primary/Secondary	Straight/Bent	Assessment
B-C	20.00	Secondary	Bent	**Primary Required**
C-D	25.00	Primary	Straight	**Acceptable**
D-F	30.00	Secondary	Bent	**Primary Required**
A-S	35.00	Primary	Straight	**Acceptable**
S-B	40.00	Secondary	Bent	**B.3.2.4 Support Required**
Front Braced Only				
C-P	42.00	Primary	Straight	**B.3.2.4 Support Required**
D-P				**Fill in cells**
F-Q				**Fill in cells**
Q-P				**Fill in cells**
Q-A				**Fill in cells**
S-P				**Fill in cells**
Rear Braced Only				
F-A				**Fill in cells**
E-F				**Fill in cells**
G-E				**Fill in cells**
D-G				**Fill in cells**
A-R				**Fill in cells**
D-S				**Fill in cells**
R-S				**Fill in cells**
B-R				**Fill in cells**

One of these boxes may say “Support Required”. Support not needed due to 3rd vertex exception in B.3.2.13.2

ROLL CAGE DRAWING

ISOMETRIC VIEW, ALL REQUIRED MEMBERS
LABEL ALL NAMED POINTS
(INCLUDING FRONT/REAR BRACING)

Delete this image and replace it with your own



Instructions – Professional Fabrication and Manufacturing

On the following page, please indicate using the check boxes lines if any of the listed tubes were outsourced for fabrication. Furthermore, please indicate the number of welded joints that were professionally completed on the frame. Every team must submit the form on the following page with their roll cage documentation, even if they did not have any professional fabrication or manufacturing work completed on their frame.

Rules Reference:

Article 5 - Vehicle Eligibility

A.5.1 - Student Created

The vehicle and associated documentation must be conceived, designed, manufactured, and fabricated by the team members without direct involvement from professional engineers, faculty, or professionals in the off-road and racing communities

A.5.2 - Kit Vehicles Prohibited

Vehicles fabricated from a kit or published designs are ineligible to compete. Vehicles which have been professionally fabricated will be disqualified from the competition or receive a penalty.

A.5.3 - Frame

Teams must manufacture and fabricate their frame and all components of the frame. If a team does not have access to machine shop facilities with the necessary equipment to complete this work or a portion of the work, this situation must be documented on the professional fabrication and manufacturing form. This form is part of the Roll Cage documentation package.

A.5.3.1 – Tubes

Any tube(s) that are professionally fabricated must be indicated in the cost report.

A.5.3.2 - Welding

Any tubes that are professionally welded must be indicated in the cost report.

A.5.4 - Prefabricated Subassemblies

These rules do not exclude the use of prefabricated or modified sub-assemblies made up of commonly available components.

A.5.5 - Penalties

Teams violating any of the rules in this article will receive a penalty, which depending on the severity of the infraction, could include disqualification from the competition

BAJA SAE Professional Fabrication and Manufacturing
2025 BAJA SAE COMPETITIONS

SCHOOL NAME Withywindle University **TEAM NAME** Winners

This sheet MUST be completed and submitted in accordance with the competition rules. Failure to do so will result in penalty.

Purpose: The purpose of this sheet is for the teams to declare any and all frame members that were professionally fabricated and or professionally welded.

1. Tubes professionally fabricated (cut, bent, or notched)? **Yes** **No** (Circle answer, if no question 2 can be skipped)

   Please mark each tube that was professionally fabricated.

   RRH ☒ RHO ☒ FBM ☐ ALC ☒ BLC ☒ CLC ☒ DLC ☒ FLC ☒ LFS ☒

   LDB ☐ SIM ☐ FAB ☐ USM ☐ RLC ☐

2. Mark the equipment that the team does not have access to use for frame fabrication that required them to outsource the component?

   Tube Bender ☒ Tube Notching/Radiusing Equipment ☐ Tube Angle/Straight Cut Equipment ☐

3. Were any weld joins on the frame professionally welded? **Yes** **No**

   If yes, please answer the following questions.

   Number of joints professionally welded: _____

   Name of Welder:_____

WE HAVE EXAMINED THE ABOVE INFORMATION AND TO THE BEST OF OUR KNOWLEDGE DEEM IT TO BE ACCURATE.

TEAM CAPTAIN: Bring Signed Copy (SIGNATURE) Bring Signed Copy (DATE)

FACULTY ADVISOR: Bring Signed Copy (SIGNATURE) Bring Signed Copy (DATE)

Bring a signed and completed copy of this form with you to technical inspection FOR EACH COMPETION your team is entering.