

Instructions

B3.7.1: 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.

B3.7.2: 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 Frame Documentation Package (max size 10 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

When submitting this document, print/convert it to PDF format; the maximum acceptable file size is 10 MB.

B3.7.3: 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is received more than five (5) days late it will be classified as "Not Submitted" and your team will be removed (withdrawn) from the event.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

Instructions:

On the following pages, insert the following information as a screenshot, photo, or scanned image. Add as many pages as 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.

BAJA SAE ROLL CAGE SPECIFICATION SHEET

2019 BAJA SAE COMPETITIONS

SCHOOL NAME Universidad Autonoma de Ciudad Juarez CAR NUMBER 112

The competition in which you are competing: BAJA SAE California 2019

**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 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.

1. Academic year the cage was constructed? 2018-2019
2. Material Type (i.e.: 4130): 4130 OD: 1.25in Thickness: .065in
3. Primary Welder: Hugo Olivares Welding Method used: Mig
Type of Filler Material: ER20-S6 Shielding Gas Used: 75% Argon, 25 % CO2
4. Equivalency calculations if needed (attach to this sheet).
5. All welds and/or other attachment methods must be checked for integrity. Faculty advisor and team captain are requested to do destructive testing on sample joints that represent the integrity of similar welds on their frame.

Date of inspection: 1/5/2019

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
KNOWLEDGE DEEM IT TO BE ACCURATE.**

TEAM CAPTAIN: Jose Angel Muñoz _____
(SIGNATURE) (DATE)

FACULTY ADVISOR: Jesus Silva _____
(SIGNATURE) (DATE)

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



2019 Roll Cage Documentation Package

2) Material Invoice(s)

AIRCRAFT SPRUCE & SPECIALTY CO.

P.O. BOX 4000 - 225 AIRPORT CIRCLE, CORONA, CA 92878
 CUSTOMER SERVICE (800) 861-3192 FAX(951) 372-0555
 TOLL FREE ORDER LINE (877) 477-7823

1206238
 UNIVERSIDAD A. DE CIUDAD JUAREZ
 JOSE MUNOZ
 PLUTARCO ELIAS CALLES 1210*
 FOVISTE CHAMIZAL CHIHUAHUA
 MEXICO , R.F.C: UAC731101JT5*

GERMAN CAMARILLO
 729 ESMERALDA ARMENDARIZ
 EL PASO, TX 79932

NOTE: ANY SHORTAGES MUST BE REPORTED WITHIN 10 DAYS

BACKORDERED PRODUCTS WILL SHIP AS SOON AS AVAILABLE

ORDER NO.		INVOICE NO.	CUST P.O. NO.	SHIP VIA	TERMS		DATE SHIPPED	
2295277		456339		UPS FREIGHT	CREDIT CARD		12/13/16	
QUANTITY SHIPPED	BACK ORDERED	DESCRIPTION		PRICE	DISCOUNT	NET PRICE	TAX	EXTENSION
1		01-01133 METAL CERTIFICATION		15.00		15.000		15.00
1		01-01133 METAL CERTIFICATION		15.00		15.000		15.00
1		01-01133 METAL CERTIFICATION		15.00		15.000		15.00
2		24' MILL 03-04300-10 4130 STEEL TUBE 3/4"X.035 10FT		36.50		36.500		73.00
2		24' MILL 03-04600-10 4130 STEEL TUBE 3/4"X.065 10FT		43.50		43.500		87.00
		THANK YOU FOR YOUR ORDER						
8		24' MILL 03-06100-10 4130 STEEL TUBE 1"X.035 10FT		39.50		39.500		316.00
4		24' MILL 03-06400-10 4130 STEEL TUBE 1"X.065 10FT		37.50		37.500		150.00
10		24' MILL 03-07800-10 4130 TUBE 1-1/4"X.065 10FT		38.50	10%	34.650		346.50
1		ESTIMATED FREIGHT CHARGE		165.00		165.000		165.00
SUBTOTAL		TAX	MISC.CHARGE	FREIGHT	PAID WITH ORDER		BALANCE DUE	
1182.50		0.00	0.00	0.00	1182.50		0.00 USD	

INDIOSRACING.UACJ@GMAIL.COM
 915 471 34 08

WAIVER OF LIABILITY & INDEMNIFICATION AGREEMENT

Inasmuch as Aircraft Spruce has no opportunity to supervise the manufacture, installation, or maintenance of the parts supplied by it, nor any opportunity to participate in the design or manufacture of the various certified and homebuilt aircraft in which its parts are utilized, the purchaser by placing this order and accepting merchandise from Aircraft Spruce agrees that all material purchased will be used solely at the purchaser's risk and that the purchaser will indemnify and hold Aircraft Spruce, its owners and employees, free and harmless from loss, liability, or damage resulting from claims brought by reasons of any alleged failure or defect of any part or parts supplied by Aircraft Spruce

School Name:

Universidad Autonoma de Ciudad Juarez

BAJA SAE® 2019 Roll Cage Documentation Package

3) Material Certification(s)



PRODUCT CERTIFICATION
SALES ORDER - LINE / RLS
139508 - 1 / 3

SHIP TO

Irwin International, Inc.
Div. Aircraft Spruce-West
P.O. Box 4000
225 Airport Circle
Corona, CA 92878
USA

WORK ORDER A39508
HEAT NUMBER 596431
MELT SOURCE Benteler Steel & Tube-Germany



CUSTOMER P.O.	CUSTOMER PART	QUANTITY	LADING NO	CERT ID / REV	CERT DATE							
M58758	03-07800	2,688.0 ft	00086193	01	06/05/2016							
PART DESCRIPTION H12500650J002												
OD: 1.2500" Max: 1.2550" Min: 1.2500"												
Wall: 0.0650" Max: 0.0710" Min: 0.0590"												
Length: 24.00' / 0.00' Lgth Tol: +/- 1/8"												
Spec: Mil-T 6736B Seamless Aircraft												
Grade: 4130												
Finish: Cond N												
CERTIFICATION REQUIREMENTS												
This material was Eddy Current tested and conforms to the requirements of ASTM A-450.												
This material is stress relief annealed. The final annealing temperature was 1150 degrees fahrenheit.												
The Grain size is determined and reported by the raw material supplier in accordance to ASTM E-112.												
This raw material was magnetic particle inspected by the raw material supplier in accordance to AMS 2640J and/or ASTM E-1444, and rated as Frequency, and Severity to AMS 2301, latest revision.												
Yield is determined by using the 0.2% offset method.												
Chemical Analysis												
C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V	Ti	Al	Sn
.320	.54	.006	.002	.270	.11	.17	.88	.18	.005	.002	.034	.010
Physical Properties												
Freq.	Severity	Grain Size										
.029	.015	9										
Mechanical Properties												
TEST	UNITS	#TESTS	HIGH	LOW	AVERAGE	STD-DEV						
Tensile	Psi	4	126100	123400	124400	1288						
Yield	Psi	4	96100	91700	94375	1952						
Elongation	%	4	21	18	19	1						
TEST	RESULT											
Decarb/OD	Pass											
Total ID/OD decarb	Pass											
TEST	UNITS	#TESTS	HIGH	LOW	AVERAGE	STD-DEV						
Rockwell C	Rc											
Rockwell B	Rb	4	104	103	104	1						

I certify that the results are a true and correct copy of the records prepared and maintained by Plymouth Tube Company, Eupora in compliance with the requirements of the cited specification. Chemistry is as reported by the Steel supplier. This test report cannot be reproduced or distributed except in full without the written permission of Plymouth Tube. Product free from hazardous materials.

Shawn A. Houser
Quality Assurance

School Name:

Universidad Autónoma de Ciudad Juárez

BAJA SAE® 2019 Roll Cage Documentation Package



PLYMOUTH TUBE CO USA®

212 Industrial Park Road, Eupora, Mississippi 39744
 Phone: (662) 258-2420 Fax: (662) 258-2075

PRODUCT CERTIFICATION

SALES ORDER - LINE / RLS
139508 - 1 / 3

SHIP TO

Irwin International, Inc.
 Div: Aircraft Spruce-West
 P.O. Box 4000
 225 Airport Circle
 Corona, CA 92878
 USA

WORK ORDER: A39508
 HEAT NUMBER 596431
 MELT SOURCE Benteler Steel & Tube-Germany



CUSTOMER P.O.	CUSTOMER PART	QUANTITY	LADING NO	CERT ID / REV	CERT DATE
M58758	03-07800	2,688.0 ft	00086193	01	06/05/2016
PART DESCRIPTION	H12500650J002				

Additional Specification(s)

AMS-T6736 B, AMS 6360M

**This test report data is for the heat Chemistry Stated above.
 Drawn in the USA**

End of Certification

I certify that the results are a true and correct copy of the records prepared and maintained by Plymouth Tube Company, Eupora in compliance with the requirements of the cited specification. Chemistry is as reported by the Steel supplier. This test report cannot be reproduced or distributed except in full without the written permission of Plymouth Tube. Product free from hazardous materials.

Grant E. Younger
 Quality Assurance

BAJA SAE® 2019 Roll Cage Documentation Package



PLYMOUTH TUBE CO. USA®

212 Industrial Park Road, Eupora, Mississippi 39744
 Phone: (662) 258-2420 Fax: (662) 258-2075

PRODUCT CERTIFICATION

SALES ORDER - LINE / RLS
 139507 - 1 / 2

WORK ORDER A39507
 HEAT NUMBER A160585
 MELT SOURCE Steel Dynamics - USA Melt/Mfg

SHIP TO

Irwin International, Inc.
 Div. Aircraft Spruce-West
 P.O. Box 4000
 225 Airport Circle
 Corona, CA 92878
 USA



CUSTOMER P.O.	CUSTOMER PART	QUANTITY	LADING NO	CERT ID / REV	CERT DATE							
M58758	03-06400	5,448.0 ft	00086193	01	06/05/2016							
PART DESCRIPTION H10000650J003												
OD: 1.0000" Max: 1.0050" Min: 1.0000"												
Wall: 0.0650" Max: 0.0710" Min: 0.0590"												
Length: 24.00' /0.00' Lgth Tol: +/- 1/8"												
Spec: Mil-T 6736B Seamless Aircraft												
Grade: 4130												
Finish: Cond N												
CERTIFICATION REQUIREMENTS												
FAR BAA (FAR 52.225-1 Buy America Act Supplies); DFARS 252.225-7001 By America Act & Bal. of Payments Program FAR TAA (FAR 52.225-5 Trade Agreements)(Paragraph 1,3,4,5)This material was Eddy Current tested and conforms to the requirements of ASTM A-450.The Grain size is determined and reported by the raw material supplier in accordance to ASTM E-112. This raw material was magnetic particle inspected by the raw material supplier in accordance to AMS 2640J and/or ASTM E-1444, and rated as Frequency, and Severity to AMS 2301, latest revision. Yield is determined by using the 0.2% offset method.												
Chemical Analysis												
C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V	Ti	Al	Sn
.30	.55	.006	.006	.27	.17	.15	1.03	.23	.004	.001	.026	.009
Physical Properties												
Freq.	Severity	Grain Size										
.000	.000	7										
Mechanical Properties												
TEST	UNITS	#TESTS	HIGH	LOW	AVERAGE	STD-DEV						
Tensile	Psi	6	114400	113300	113833	468						
Yield	Psi	6	100700	96800	98433	1554						
Elongation	%	6	20	16	18	2						
TEST	RESULT											
Decarb/OD	Pass											
Total ID/OD decarb	Pass											
TEST	UNITS	#TESTS	HIGH	LOW	AVERAGE	STD-DEV						
Rockwell C	Rc											
Rockwell B	Rb	6	103	102	103	0						

I certify that the results are a true and correct copy of the records prepared and maintained by Plymouth Tube Company, Eupora in compliance with the requirements of the cited specification. Chemistry is as reported by the Steel supplier. This test report cannot be reproduced or distributed except in full without the written permission of Plymouth Tube. Product free from hazardous materials.

Sean Young
Quality Assurance

BAJA SAE® 2019 Roll Cage Documentation Package



PLYMOUTH TUBE CO. USA®

212 Industrial Park Road, Eupora, Mississippi 39744
 Phone: (662) 258-2420 Fax: (662) 258-2075

PRODUCT CERTIFICATION

SALES ORDER - LINE / RLS

139507 - 1 / 2

WORK ORDER A39507
 HEAT NUMBER A160585
 MELT SOURCE Steel Dynamics - USA Melt/Mfg

SHIP TO

Irwin International, Inc.
 Div. Aircraft Spruce-West
 P.O. Box 4000
 225 Airport Circle
 Corona, CA 92878
 USA



CUSTOMER P.O.	CUSTOMER PART	QUANTITY	LADING NO	CERT ID / REV	CERT DATE
M58758	03-06400	5,448.0 ft	00086193	01	06/05/2016

PART DESCRIPTION H10000650J003

Additional Specification(s)

AMS-T6736 B, AMS 6360M

This test report data is for the heat Chemistry Stated above.
Drawn in the USA

End of Certification

I certify that the results are a true and correct copy of the records prepared and maintained by Plymouth Tube Company, Eupora in compliance with the requirements of the cited specification. Chemistry is as reported by the Steel supplier. This test report cannot be reproduced or distributed except in full without the written permission of Plymouth Tube. Product free from hazardous materials.

Gregory J. Young
 Quality Assurance

4) Supporting Calculations:

Steel 1018

Bending stiffness and bending strength of tubing used of 1018 of 1 inch diameter.
Modulus of elastic E= 205Gpa = (29732 k.s.i.)

Outer Diameter = 1 in= 25.4mm
Wall thickness = .120in=3.048mm
Inner diameter = 25.4-3.048*2=19.304
c=25.4/2=12.7
SY=Yield strength = 365 Mpa= (52.93 k.s.i.)

$$I = \frac{\pi(D^4 - d^4)}{64} = \frac{\pi(25.4^4 - 19.304^4)}{64} = 13615.25 \text{ mm}^4$$

$$\text{bending stiffness} = E \cdot I = 205 \cdot 13615.25 = 2.7911e6 \text{ N-mm}$$

$$\text{bending strength} = \frac{S \cdot I}{c} = \frac{365 \cdot 13615.25}{12.7} = 3.91304e5 \text{ N-mm}$$

Chromoly 4130

Bending stiffness and bending strength of tubing used 4130 of 1 inch diameter.

Modulus of elastic E= 205Gpa = (29,732 k.s.i.)

Outer Diameter = 1 in = 25.4mm
Wall thickness = .065 in =1.651mm
Inner diameter = 25.4-1.651*2 = 22.098mm
c = 25.4/2 = 12.7
SY=Yield strength = 678 Mpa = (98.336 k.s.i.)

$$\text{Area Moment of inertia, } I = \frac{\pi(D^4 - d^4)}{64} = \frac{\pi(25.4^4 - 22.098^4)}{64} = 8726.4331 \text{ mm}^4$$

$$\text{bending stiffness} = E \cdot I = 205 \cdot 8726.4331 = 1.788918e6 \text{ N-mm}$$

$$\text{bending strength} = \frac{S \cdot I}{c} = \frac{678 \cdot 8726.4331}{12.7} = 4.65867e5 \text{ N-mm}$$

Comparison:

Bending stiffness= Steel 1018= 2.7911e6 chromoly 4130= 1.788918e6
Bending strength= steel 1018 = 3.9130e5 chromoly 4130= 4.65867e5
Percent different= 100*(4.65867e5-3.9130e5)/ 3.9130e5 = 19.05%

Chromoly 4130

Bending stiffness and bending strength of tubing used 4130 of 1.25 inch diameter.

Outer Diameter = 1.25 in = 31.75mm
Wall thickness = .065 in = 1.651mm
Inner diameter = 31.75-1.651*2 = 28.448mm
c = 31.75/2=15.875
SY=Yield strength = 650 Mpa = (94.375 k.s.i.)

$$\text{Area Moment of inertia, } I = \frac{\pi(D^4 - d^4)}{64} = \frac{\pi(31.75^4 - 28.488^4)}{64} = 17551.21411 \text{ mm}^4$$

$$\text{bending stiffness} = E \cdot I = 205 \cdot 17551.21411 = 3.59799e6 \text{ N-mm}$$

$$\text{bending strength} = \frac{S \cdot I}{c} = \frac{650 \cdot 17551.21411}{15.875} = 7.18632e5 \text{ N-mm}$$

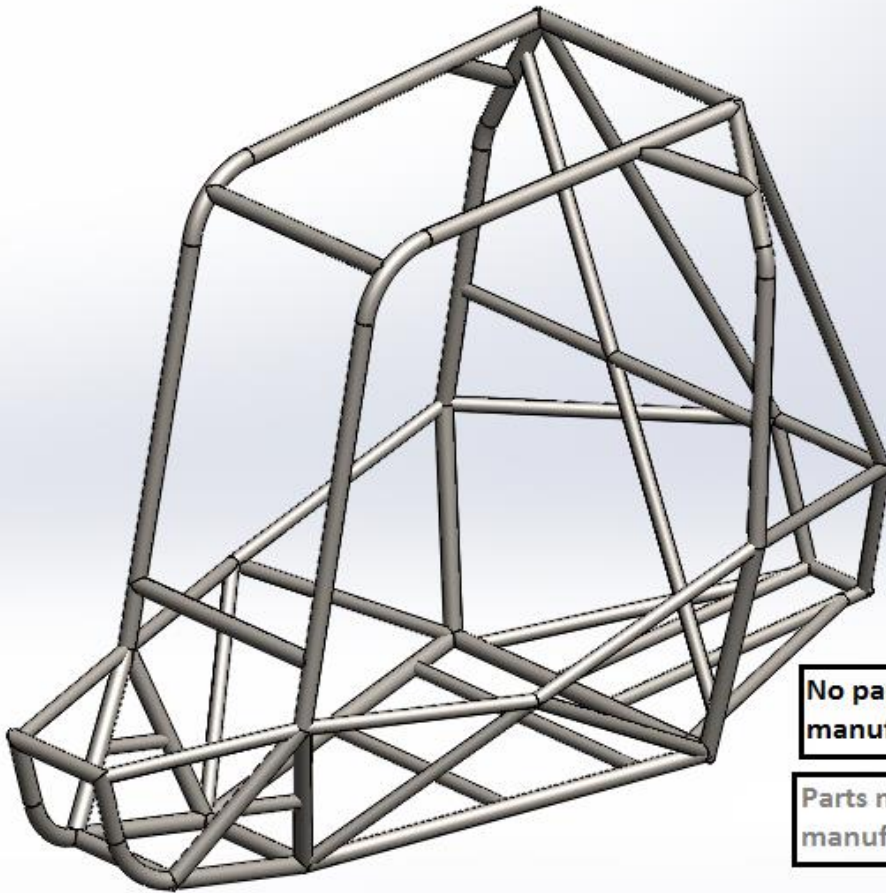
Comparison:

Bending stiffness= Steel 1018= 2.7911e6 chromoly 4130= 3.59799e6
Percent different= 100*(3.597e6 -2.7911e6)/2.7911e6 = 28%
Bending strength= steel 1018 = 3.9130e5 chromoly 4130= 7.18632e5
Percent different= 100*(7.18632e5 -3.9130e5)/ 3.9130e5 = 83.6%

School Name:

Universidad Autónoma de Ciudad Juárez

5) Diagram highlighting what parts of the frame were outsourced or professionally fabricated. An image is required even if no parts were outsourced or professionally fabricated.



No part subcontracted or
manufactured professionally.

Parts marked in gray were
manufactured by students

Active Windows