

Documentation Checklist: FSAE and Baja SAE Tube Structures
Preparing and Submitting Documents to VR3 for Review and RFQ
Aug 2026

The purpose of this checklist is to identify and correct the most common problems with preparing documents suitable for producing profiled tube components.

This is based on 'SOLIDWORKS' CAD but is equivalent to any 3D 'solid body' modeling/documentation requirements.

1. Are the following 3 files available to review the tube structure configuration and submit a proposal?
 - ☐ 3D CAD model of the tube structure
 - ☐ Pdf version of the assembly drawing (with balloon numbers and material list)
 - ☐ Excel spreadsheet of the material list

*Sample documents are available from our website
 *VR3 will review and submit a proposal/quotation IF the above documents are suitable
2. 3D Solid Model CAD Files
 - ☐ Have you reviewed our '[3D Modelling Guideline](#)' document for tube structures?
 - ☐ 3D CAD file must be created as 'solid body' features; not surfaces, splines or non-geometric features.
 - ☐ Are the sketches 'fully defined'? This will avoid many problems.
 *Avoid under defined import data or 'fixed point' definitions on sketches and design constraints.
 - ☐ Is frame geometry defined in multiple, bite-sized sketches?
 *Divide layout sketches into multiple 2D and 3D sketches for a more stable CAD model.
 - ☐ Add one tube member at a time. Avoid using one structural member to create multiple tube members. This will cause problems downstream when trims or updates and revisions are applied.
 *It is pay now or pay later regarding the time required, especially when design changes are applied downstream
 - ☐ Ensure all tubes have clearly defined centerlines (i.e.: check view option 'temporary axis' in SOLIDWORKS).
 - ☐ Are all tubes modelled to available stock tube sizes?
 *Outside diameter and wall thickness match available material chart 'inch' sizes
 *These tubing materials are available in nominal inch sizes only, not metric sizes.
 - ☐ Use the 'combine' command to join straight tube segments into a single body / cut list item.
 - ☐ Does the number of cut list items equal the number of tube components?
 - ☐ The 'weldment/assembly' version of the 3D CAD model is preferred for review purposes.
 *It is easier and quicker to review the trims, bend features and manufacturing details.
 *Individual part files are preferred after the configuration is 'approved for manufacture'
 *Individual part files cannot be checked by VR3. We only manufacture 'as supplied'
 - ☐ Native SOLIDWORKS files are preferred. Parasolid (*.x_t) or step (*.stp) formats are alternatives.
3. Bend Features (the most challenging aspect of tube structures):
 - ☐ Have you reviewed our bend guideline document?
 - ☐ Are the bend features modelled in defined planes? (i.e.: consecutive centerlines of straight sections intersect)
 - ☐ Do the bend centerline radii (clr) match our bend dies?
 - ☐ Is the tube wall thickness suitable for the selected bend radius of each tube?
 - ☐ Is there a minimum 4.50" of straight section between consecutive bends?
 - ☐ Is there a minimum of 4.50" from the deepest cut in the end notch to the tangent of the first bend?
 - ☐ Can mating tubes intersect onto the straight section instead of nesting onto the bend feature? (will result in better fit)
 - ☐ Has the 'combine' feature been applied to each bent tube at the end of the design tree after all trims?
 - ☐ Are formed tubes verified symmetric as desired?

Note: *Keep the bend features as simple as possible, especially considering this is a one off project.
 *If our constraints are met, complex bend feature can be beneficial to the design configuration.
 *Although we do a good a job of producing bends in multiple planes, simpler is better.
 *Packaging and shipping can get more expensive because of awkward and bulky shapes.

4. Trim Features:

- ☐ Have tubes been trimmed one at a time in a similar sequence as the tubes are added?
*It is best to trim tubes immediately as the tubes are added as structural members.
*i.e.: add a structural member for a single tube part, trim this tube, add next structural member, trim to existing tubes, and repeat for the entire model
- ☐ Do any tubes ends have missing trims? (use the body selection filter and check all tubes front to back)
*It is much easier to avoid missing trims when the above process of adding trims as you go is used.
- ☐ Are there any 'hollow node' style trims, or extra trims / scallop cutouts? These must be avoided!
*Refer to the VR3 sample SOLIDWORKS model for a demonstration of ideal trimming scenarios ([VR3.ca](#))
- ☐ GTAW / TIG welding thin wall tube structures do not require weld gaps. Do not apply weld gaps amounts on trim features to produce the easiest to assemble and most stable welded tube structure.

5. Square Tube Modelling Details:

- ☐ Ensure square tubes are modelled with 'concentric' corner radii.
*This represents the actual tube better and results in a better tool path.
- ☐ Ensure cutouts or end features are offset from the corner radii by .010" or more.
- ☐ See our 3D modelling guidelines for more information on square tubes ([VR3.ca](#)).

6. Weldment / Assembly Drawing:

- ☐ Has our sample drawing been reviewed?
- ☐ Is each tube **CLEARLY** identified with a balloon number?
*If you cannot find a tube on your drawing, neither can we.
*Please ensure the arrows point to a distinct location on each tube.
* DO NOT point arrows to the end points of members at multi-tube nodes/clusters.
- ☐ Is the material list / cut list added to the assembly drawing with ItemNo, quantity, Material Size, and Length columns?
- ☐ Do the material size descriptions (tube OD and wall thickness) match the actual 3D model?
- ☐ Is the scale and proportion legible when printed on 8.5" x 11" or 11" x 17" paper?
- ☐ Assign a drawing number, description (project, part), date and revision level to the document.
- ☐ Save/print this drawing as a pdf document.

7. Material List:

- ☐ Has our sample excel BOM spreadsheet been utilized?
*It is used to determine part order quantities, and material type.
- ☐ Clearly indicate the material specification for the parts.
*4130N is the most commonly used, and has the widest range of OD's and wall thicknesses.
*C1020 DOM is a second choice but available in fewer diameters and only .065" and .095" wall thickness.
- ☐ Does the total number of tubes match the SolidWorks cut list items (solid bodies)?
- ☐ Is additional or spare tubing material required? Fill in the extra lines on the material list.
- ☐ Use the automated 'cell formulas' of the sample spreadsheet. Learn to use these and do not manually override formulas or data.
- ☐ Identify / indicate any tubes or components that are 'supplied by others'.
- ☐ Increase the quantities to show the total required parts for spares, test pieces or extras that may be required.
- ☐ Add suspension tubes, bracket tubes, or extra material required all to the same sheet of this excel BOM material list. (The best value is one order / one shipment.)

8. Drawings and Documents

- ☐ Are the CAD files, drawings and documents assigned a unique number and revision level or date?
- ☐ Is the school name and project description, date/revision clear and unique?
- ☐ Are left / right tube parts assigned separate part numbers? These are usually unique parts and are not interchangeable.
*100% identical parts can have multiple quantities. This applies to square ended tube features or other simple 2D features.

9. Order Processing Information:

- ☐ Is a purchase order number / approval required to be issued by the university/school/institution?
- ☐ Has funding been approved by the school?
- ☐ Have the correct people fill out the provided shipping and billing form and return it to us promptly. We cannot ship your order without this detailed information.

Tubing Material Supply Note:

- VR3 supplies the tubing material for all jobs.
- Sending material (4130N tubing) is typically not a good choice.
- We have gone this route before. It is very inconvenient and costs us extra time and money.
- Paperwork to cross the border is a nuisance.
- Shipping and handling may cost more than the material.
- We will end up with additional customs (border crossing) paperwork bill(s).
- Manufacturing and scheduling delays will be significant.
- We prefer/need full or long lengths of material. We do not pre-cut tubing before notching.
- Free material is often left over material, likely shorts and possibly damaged.
- It takes us more time to sort out and confirm material.
- We maintain traceability of all our purchased materials and cannot mix lots of material from various sources.
- We carry most sizes of 4130N tubing up to 2.000" OD ready to manufacture.
- If a mistake is made with bending tubes, it is our time, material, and expense not yours if we supply the material.
- Whether 2" or 200 feet is required, we usually have enough material in stock in all common FSAE / Baja sizes.
- Our pricing is based on supplying material, cutting and bending services as a complete kit with very good value for one-off student projects.