Thunderbolt Mk III
Chapter IV
Fabricating the Cross-Member Assembly

Version 1.0

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Introduction

This chapter provides instructions on building the Cross-Member Assembly. This assembly includes the Cross-Member Tube and the Left and Right Knuckle Bulkheads.

The Cross-Member assembly comes in two different widths; the Standard wheel track which is ~32 inches wide and the Narrow track width is only ~29 inches wide. Each width option requires different types of Knuckle Bulkheads to maintain the 17 inch width of the seat. Therefore, it is important to know which configuration is desired prior to construction. Refer to Chapter I for additional information.

To perform this section, a muffler tube bending machine must be used to bend the 2 inch tubing, regardless of which option is chosen. 2 inch tube bending is called out in Chapter III. Therefore, it is best to consolidate efforts and have all tubes (cross-member and main tubes) bent on the same visit.

Required Materials

The following materials are required for this chapter:

- 2" diameter tubing 25 inch length with a wall thickness of ~.073 to .083 inches using 6061/7005 aluminum. For the narrow wheel track version use only a 22.5 inch length
- 2 ea. 8.0" x 4.25" x.180" thick 5052 aluminum
- 5356 Aluminum welding rod
- 2 ea. Seat Base Tubes (P/N 40001)

Required Tools

The following tools are required to conduct this section:

- 13”to 17” Drill Press with Vise
- 2” SAE Hole Saw
- 7/8” SAE Hole Saw
- 3/8” SAE drill bit (.375")
- Hack saw, metal band saw, or Shear
- Misc. files, emery cloth and de-burring tool
- 6” Dial Caliper
- Bending Brake

Objective

This section covers the following accomplishments:

- Bend and Trim the Cross-member Tube.
- Fabricate the Knuckle Bulkhead sheet-metal parts as called out in the drawings.
- Set-up and weld the Bulkheads to the Cross-member tube.
- Inspect the complete assembly for accuracy using the acceptance criteria.

The following components will be fabricated in this chapter:

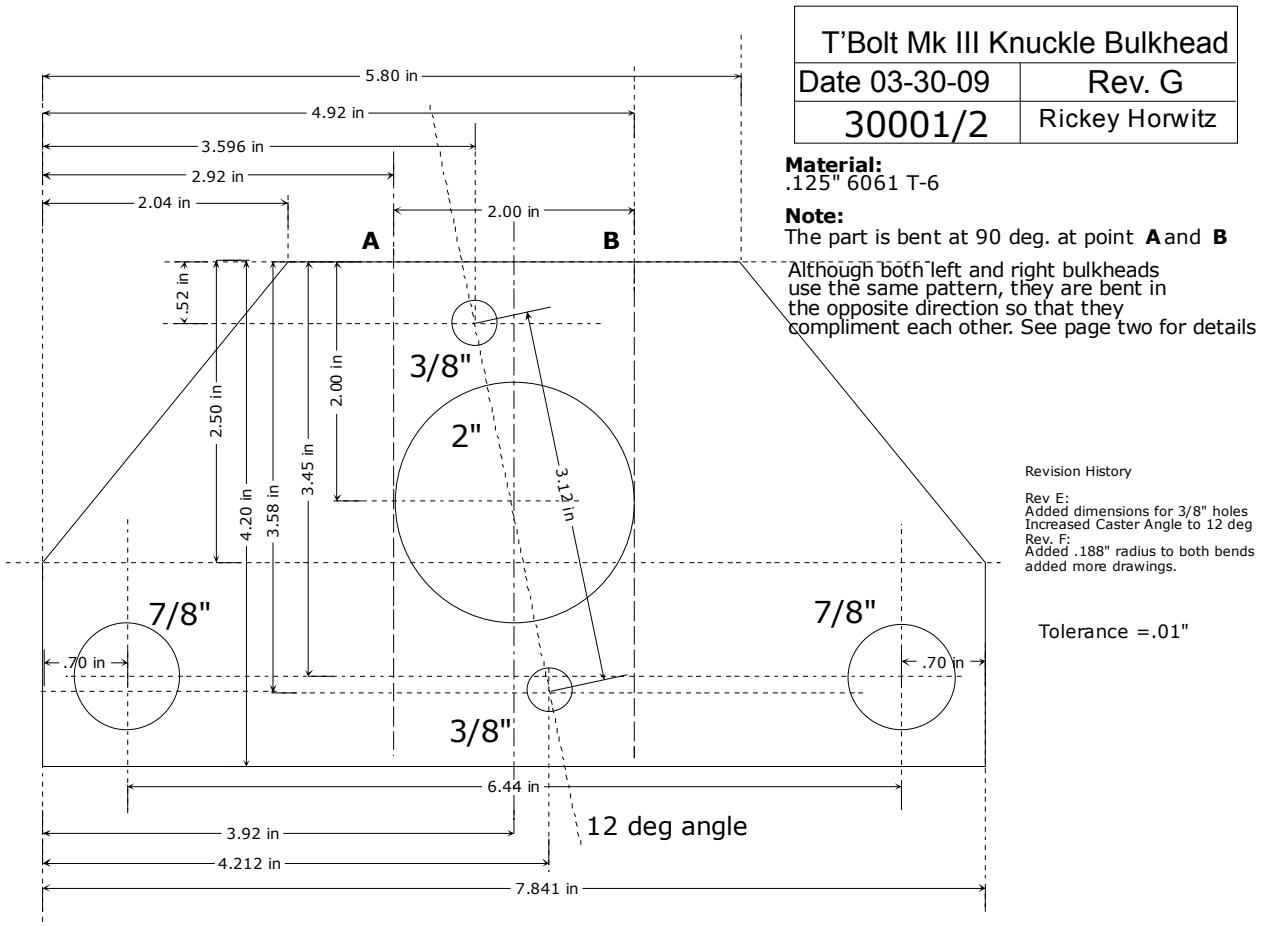
Part Number	Part Name	Qty	Reference Drawing File
30001	Knuckle Bulkhead, Left	1	Bulkhead.PDF
30002	Knuckle Bulkhead, Right	1	Bulkhead.PDF
30003	Narrow Track Knuckle Bulkhead, Left	1	Bulkhead.PDF
30004	Narrow Track Knuckle Bulkhead, Right	1	Bulkhead.PDF
30005	Std Cross-Member Tube	1	Crossmember.PDF
30006	Narrow Track Cross-Member Tube	1	Crossmember.PDF

Fabricating the Knuckle Bulkheads

Material Required
2 ea. 8.0" x 4.25" x.180" thick 5052 Aluminum

Left Knuckle Bulkhead shown

Above is an example of a standard Knuckle Bulkhead. The Narrow Track version is narrower in width (no surprise) placing the seat tubes closer to the wheels (hence maintain same seat width). This reduced clearance excludes the use of direct knuckle steering. Again, it is imperative to know which design option will be used.



Refer to the Knuckle Bulkhead PDF file for a full-page drawing

Note

Depending on the tools used, the two 3/8" holes on the bulkhead may be drilled after the assembly has been properly formed. The offset of the holes represent the 12°Caster.

- Although both left and right bulkheads use the same pattern, they are bent in the opposite direction so that they compliment each other.
- When bending this part, it is best to heat up the part with a blowtorch to anneal the aluminum. This will prevent it from cracking.
- Both bends are 90 degrees.

Depending on the tools used, the two 3/8" holes on the bulkhead may be drilled after the assembly has been properly formed.

T'Bolt Mk III Narrow Track Knuckle Bulkhead	
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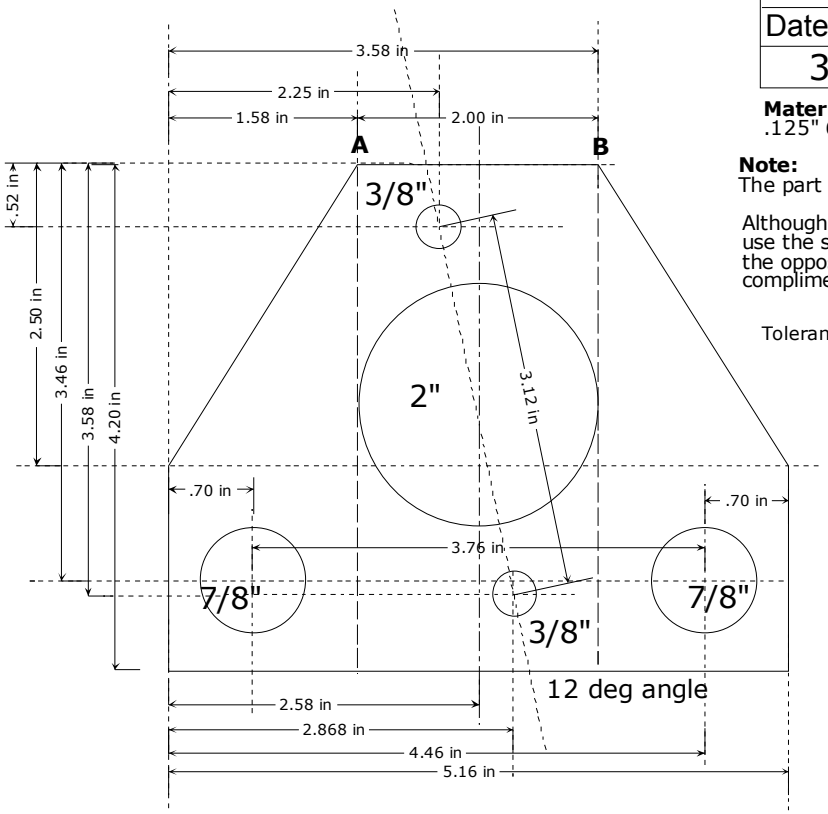
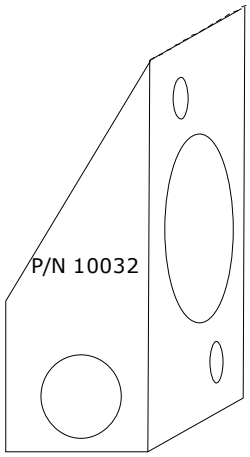
Material:
.125" 6061 T-6

Note:
The part is bent at 90 deg. at point **A** and **B**

Although both left and right bulkheads use the same pattern, they are bent in the opposite direction so that they compliment each other. See page two for details

Tolerance =.01"





Shown above is the narrow wheel track Knuckle Bulkhead.

Note

Depending on the tools used, the two 3/8" holes on the bulkhead may be drilled after the assembly has been properly formed. The offset of the holes represent the 12˚Caster.

The finished part should resemble the photo below:

Fabricating the Standard Cross-Member Tube

Note

If the Narrow Wheel Track option is desired go to the next section

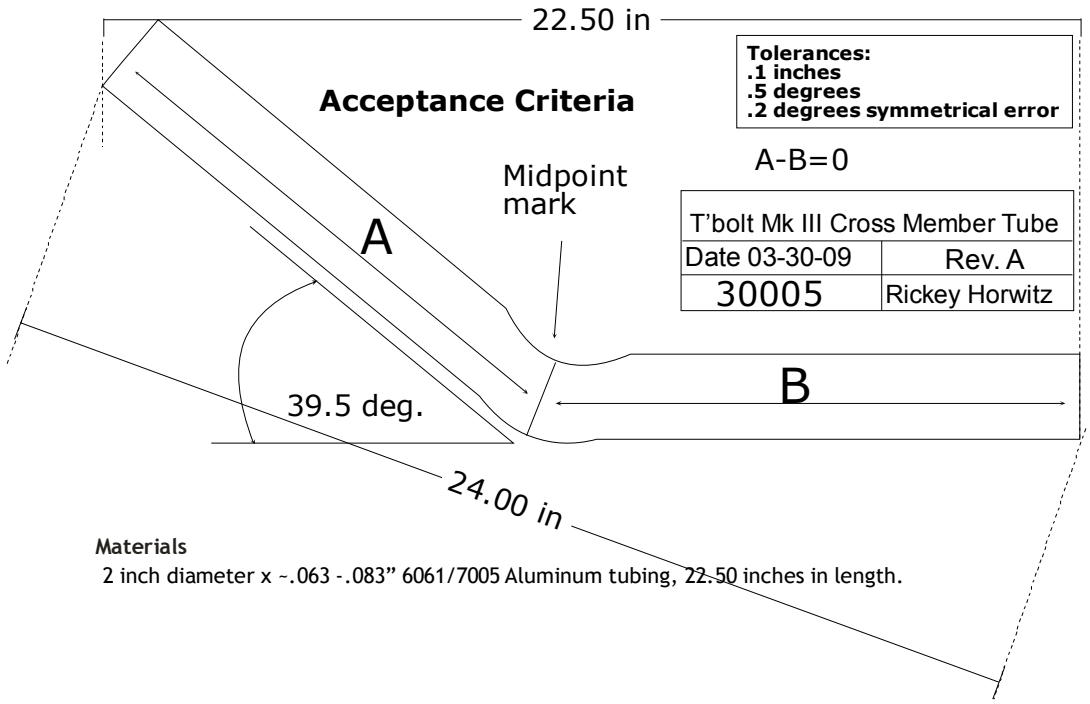
Parts/Materials:

2 inch diameter x ~.063 -.083" 6061/7005 Aluminum tubing, 25.00 inches in length.

Instructions

- Using a Sharpie pen, place a line at the mid point (12.5 inches) of the tube. This line should encompass 360 degrees around the tube.
- Using a muffler tube bender select the 2-inch diameter, 4 to 6 inch radius dies.
- Bend the tube at 39.5 deg. Since a fractional degree is difficult to maintain +/- .5 degrees
- Remove the formed tube and check it using a compass or go/no-go gage. Re-bend as needed.
- Using the mid point line (drawn earlier), measure and mark 12.4" at both ends.
- Trim both ends at 90 degrees at both 12.4" marks.
- Using the acceptance criteria in the following illustrations, check the part for accuracy and conformity.

Cross Member Tube Fabrication
Standard Width Wheel Track Only



Fabricating the Narrow Wheel Track Cross-Member Tube

Note

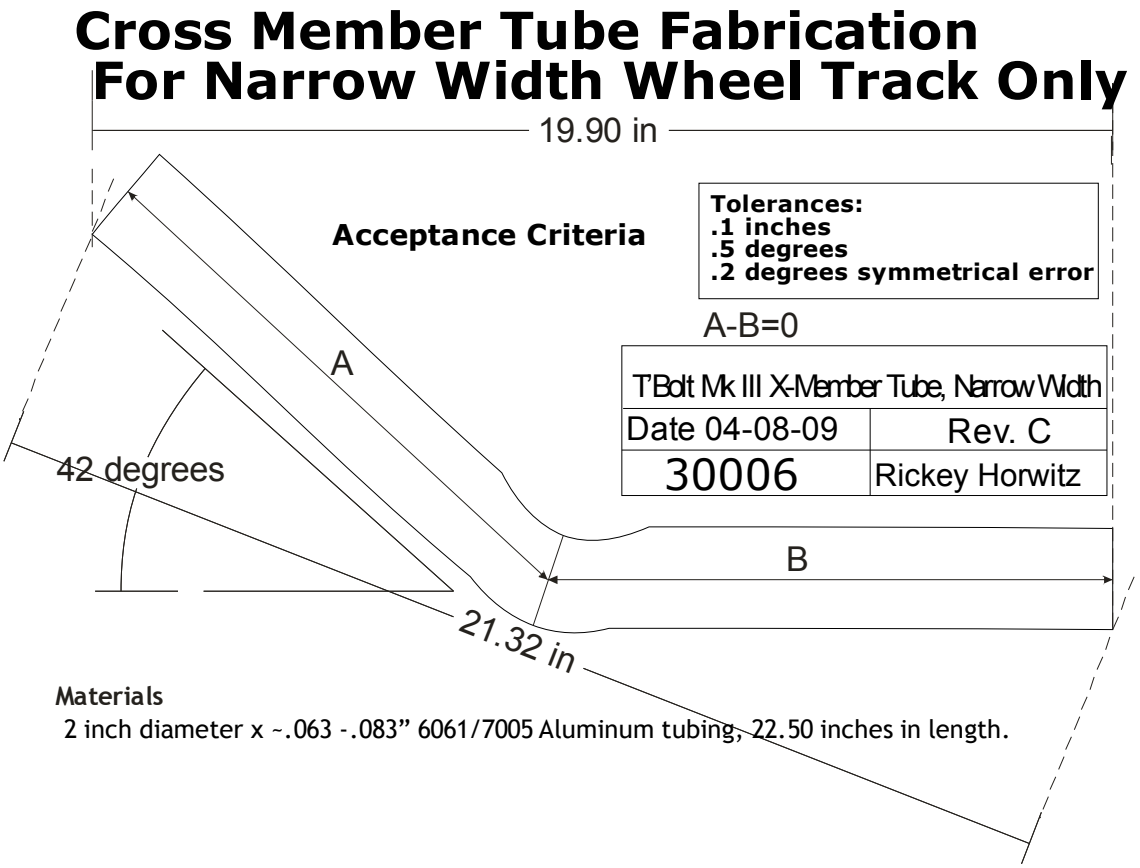
If the Standard Wheel Track option is desired go to the previous section

Parts/Materials:

2 inch diameter x ~.063 -.083" 6061/7005 Aluminum tubing, 22.5 inches in length.

Instructions

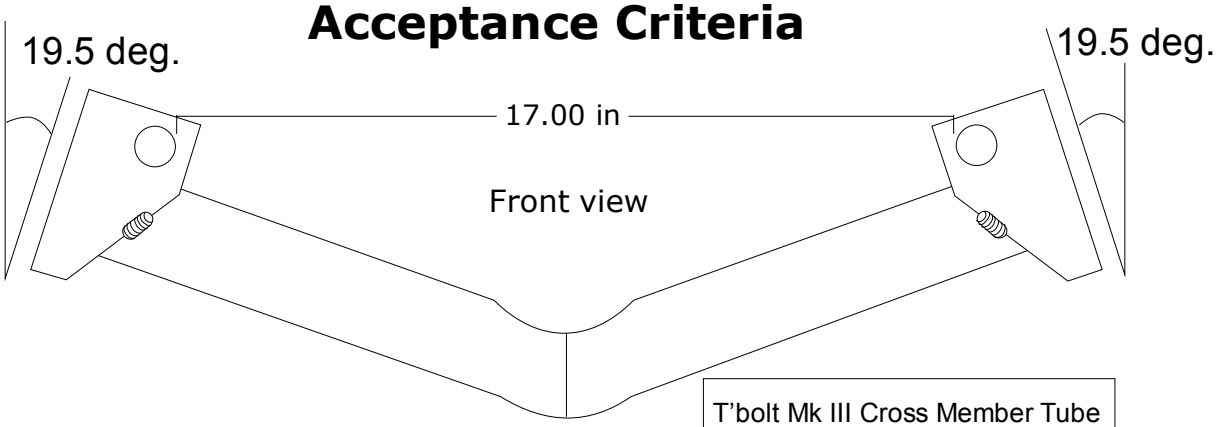
- Using a Sharpie pen, place a line at the mid point (11.25 inches) of the tube. This line should encompass 360 degrees around the tube.
- Using a muffler tube bender select the 2-inch diameter, 4 to 6 inch radius dies.
- Bend the tube at 42 deg.
- Remove the formed tube and check it using a compass or go/no-go gage. Re-bend as needed.
- Using the mid point line (drawn earlier), measure and mark 11.05" (11 inches should be fine) at both ends.
- Trim both ends at 90 degrees at both 11 inch marks.
- Using the acceptance criteria in the following illustrations, check the part for accuracy and conformity.



Instructions
Fit both left and right bulkhead assembly to the Cross-member tube as shown in the Acceptance Criteria drawings below.

Cross Member Tube Fabrication
Standard Width Wheel Track Only

Acceptance Criteria



T'bolt Mk III Cross Member Tube	
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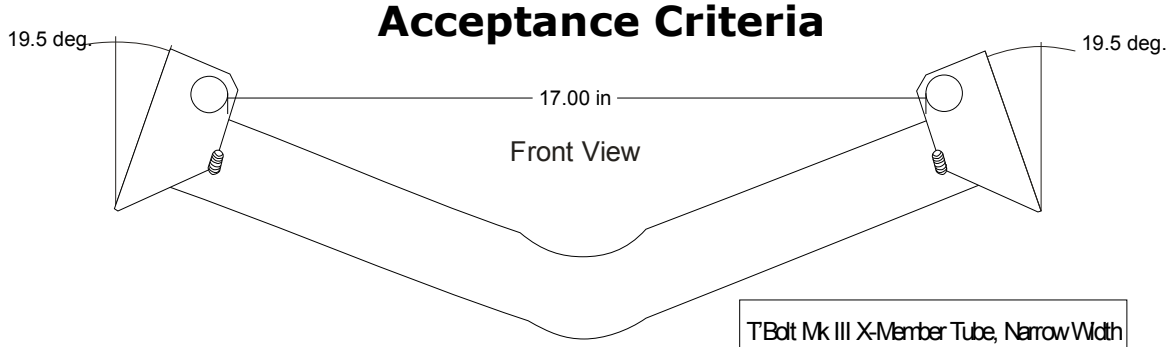
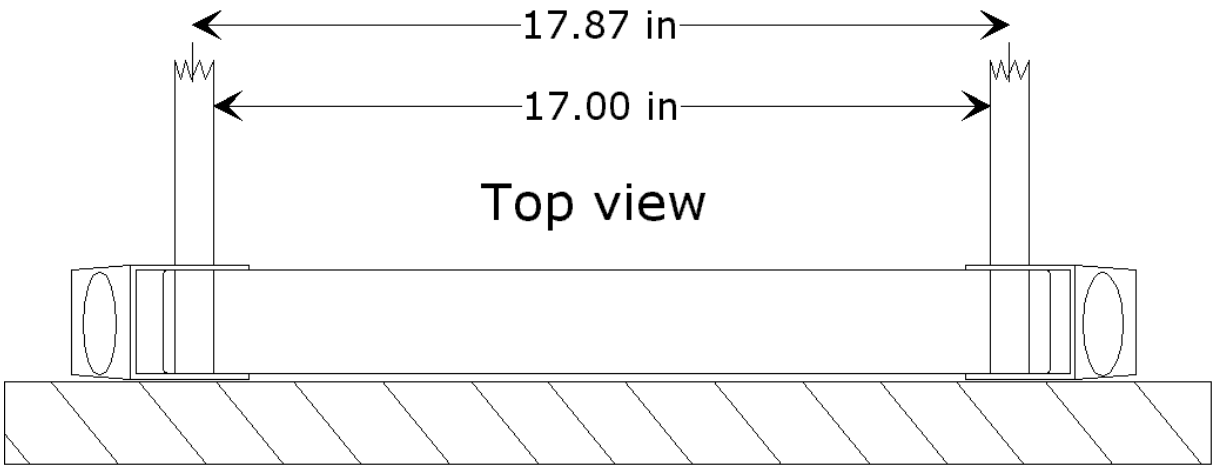
Cross Member Tube Fabrication
For Narrow Width Wheel Track Only

Acceptance Criteria



T'Bolt Mk III X-Member Tube, Narrow Width	
Date 04-08-09	Rev. C
30006	Rickey Horwitz

- Place the assembly down on a flat even surface so that both bulkheads remain flush on this surface.
- Using the two Seat Base Tubes (P/N 40001), install into each of the Knuckle Bulkheads. These 15.5" tubes are cut in Chapter V.
- Using the seat tubes as alignment indicators, adjust both Knuckle Bulkheads so that the tubes run parallel at both planes. Refer to the illustration below:



- Using the dimensions shown above, ensure that the alignment matches. Both tubes should be parallel with each other, and should maintain a 90° relationship to the bench at both planes.

Cross-Member Assembly Welding Instructions

The components fabricated in this chapter will now be prepared for welding. At this moment, we should have the following parts fabricated ready to fit and weld.

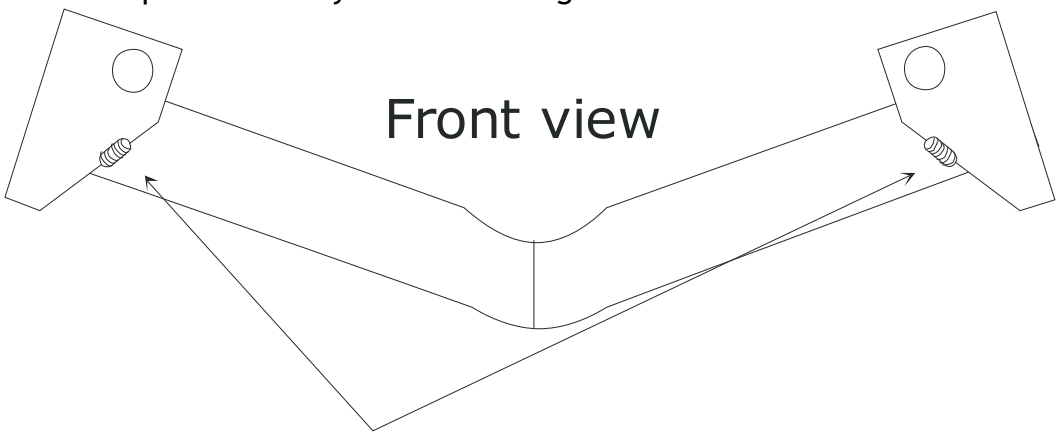
1 ea. Cross-Member Tube
1 ea. Left Knuckle Bulkhead
1 ea. Right Knuckle Bulkhead

Assumptions
You know how to TIG weld. You have plenty of welding supplies on-hand including Argon and 5356 Welding Rod.

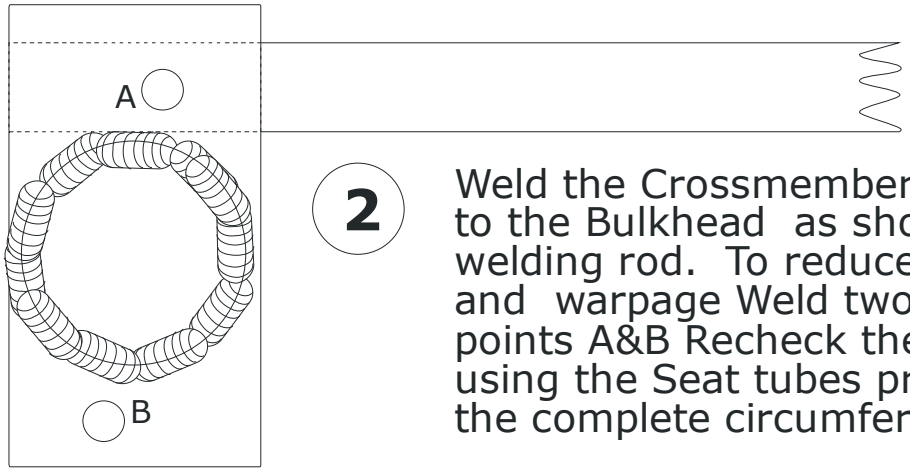
Caution
The bench top may be combustible. During welding, it is possible that this surface can burn or catch on fire. Ensure that a fire extinguisher is on hand at all times.

All Safety precautions have been observed. No combustibles near or around the welding area expect for the Jig Fixture.

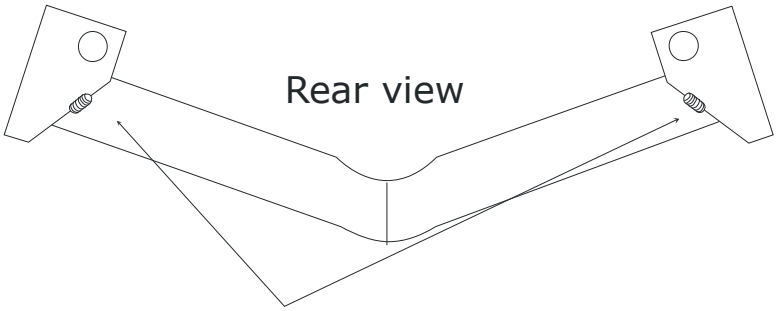
Preparations
Ensure all joints are flush and are free of contamination. All tube ends and Bulkhead surfaces must be prepared prior to welding by scrubbing with a wire brush. An oxide forms on aluminum after an hour. Therefore, it is important to perform this step immediately before welding.



1 Assembly should be placed flat on table. Weld a .5" -.75" (13-19 mm) bead at these two points. using 5356 welding rod.



2 Weld the Crossmember tube to the Bulkhead as shown using 5356 welding rod. To reduce distortion and warpage Weld two tacks at points A&B Recheck the alignment using the Seat tubes prior to welding the complete circumference.



3 Assuming that the alignment is correct at step (2), Rotate the assembly so that the rear side is exposed. The two beads welded in step (1) will prevent the assembly from lying flat. Weld a .5" -.75" (13-19 mm) long bead at these two points using 5356 welding rod.

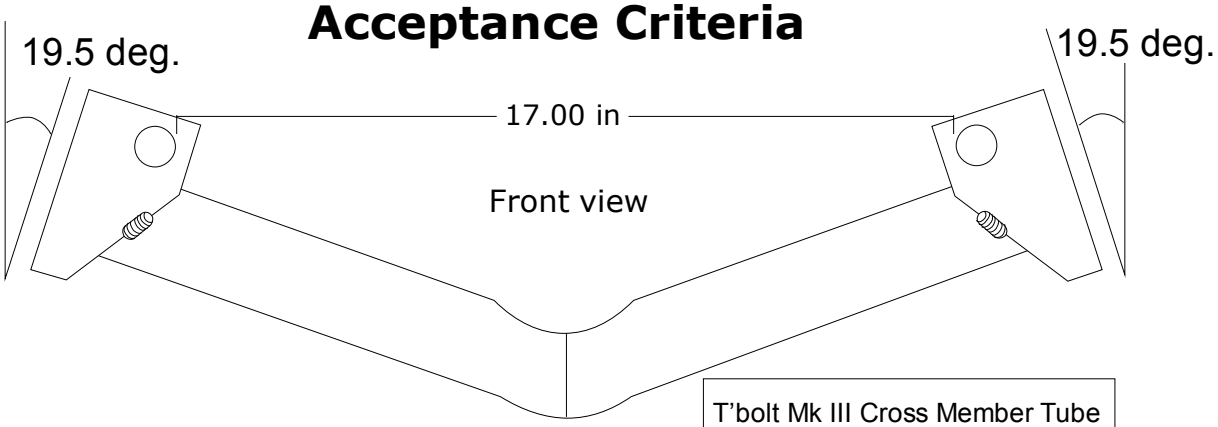
Final Inspection

Re-insert both Seat Base Tubes. Ensure that both tubes are parallel with each other and maintain a 90° relationship with the bench top.

Refer to the acceptance criteria below to ensure that the assembly is built properly

Cross Member Tube Fabrication
Standard Width Wheel Track Only

Acceptance Criteria



T'bolt Mk III Cross Member Tube	
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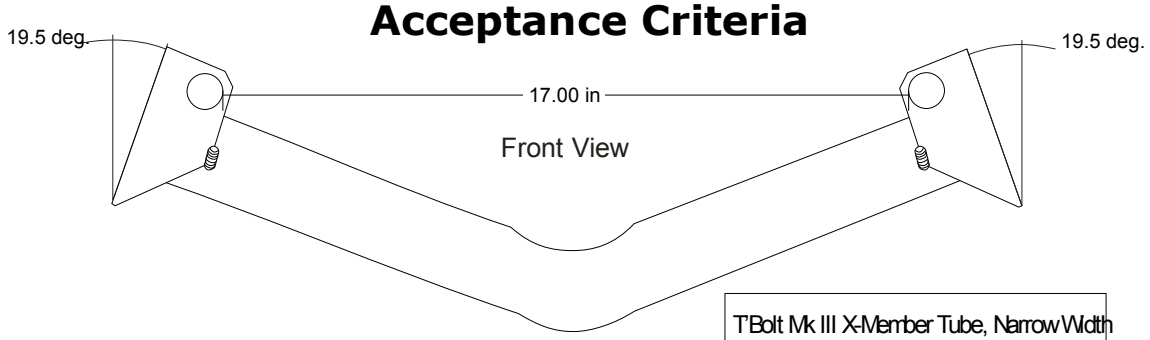
Cross Member Tube Fabrication
For Narrow Width Wheel Track Only

Acceptance Criteria



T'Bolt Mk III X-Member Tube, Narrow Width	
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Conclusion

At this point, we should have a completed Cross-Member Assembly.

