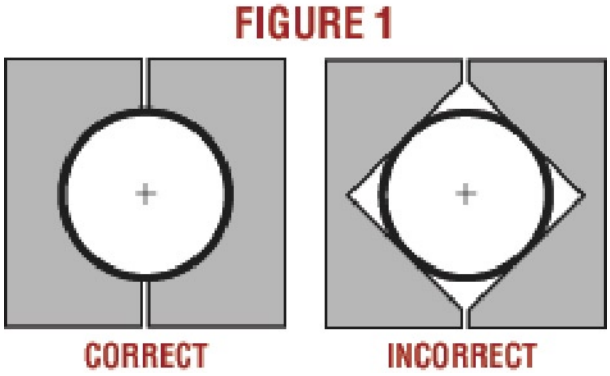
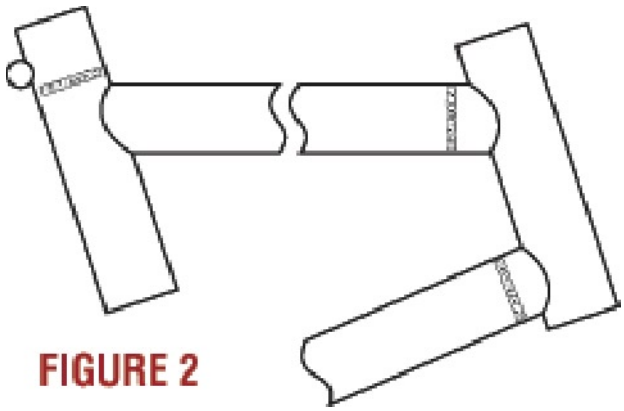
# Fabrication Instructions for 6061 and 7005 Tube Sets

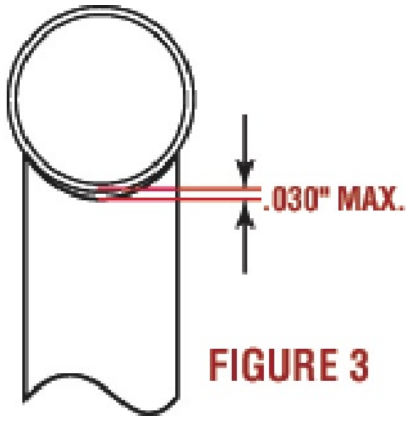
**Handling**
Extra care should be taken when clamping tubes. Your Easton set has very thin walls that are easily dented or damaged if clamped too tight or incorrectly held. We recommend using metal holding blocks that have the exact diameter of the tubes being machined. V blocks, if clamped tight enough for machining, will damage tube. (Figure 1)




**Cutting**
Cutting off material from the stamped ends of main tubes is not recommended. See tube layouts for wall contour. Chain and seat stays may be cut from both ends. However, trim no more than 1" from the tip-ends of TaperWall stays. Stamped ends of top and down tube connect to head tube. Stamped end of seat tube connects to seat cluster. (Figure 2) Use matched diameter holding blocks mentioned in handling section. (Figure 1)




**Mitering**
Use a hole saw or equivalent to miter tube ends. Fits should be machined to close tolerances. Maximum gaps in fitting tubes together is .030". (Figure 3)




Filling or bridging gaps will result in weak joints as high stresses are generated when the weld pulls the joint together. The smaller the gap, the lower the stress, the stronger the joints. Again, use holding blocks mentioned in handling section. (Figure 1)

Aluminum can be machined dry or with a water based aluminum cutting lubricant. If oil-based lubricants are used, extra care will be needed for weld cleaning preparation.

**Bottle Mounts**
Threaded rivnuts should be used for water bottle mounts. Easton tubes are too thin in the center sections to safely weld on bottle mounts. Use extra care when drill bit breaks through tube to avoid denting the opposite wall. (Figure 4)

**Cable Stops**
Cable stops can be riveted or welded on the thick wall sections only. Easton does not recommend welding or riveting mounts on the under side of the down tube. (Figure 5)

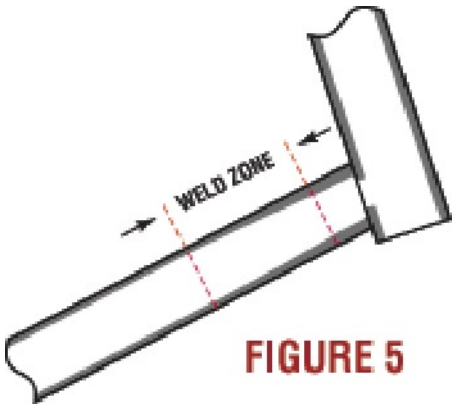


FIGURE 5

**Venting Tubes**
Vent holes must be drilled in various places to allow air to escape while welding. A hole size of 1/8" is sufficient to vent tubes.

Maximum recommended hole size is 1" diameter in head tube and bottom bracket. Using holes larger than 1" to save weight in these thick wall tubes will cause severe distortion after welding. Also, extra large holes can weaken overall strength of the joint, especially at the connection of the head tube to down tube. Use extra care to center large vent holes with the tube. (Figure 6)

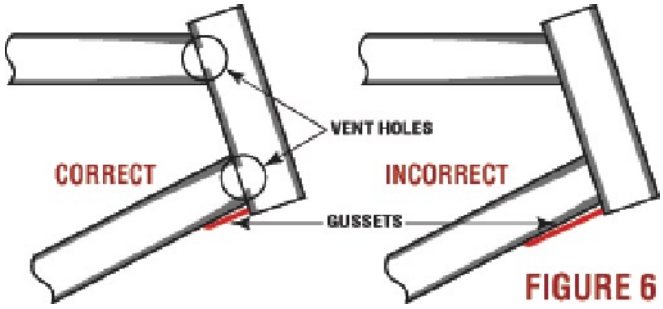


FIGURE 6

**Bottom Brackets**
Easton bottom brackets are not supplied threaded. The reason for this is that distortion from welding will cause the bottom bracket to ovalize and require chasing and facing bottom bracket threads with a tap and facing tool (even if an expandable plug is used, some distortion is expected). While this seems like an acceptable fix, it is not.

When a bottom bracket is chased to re-round and repair threads, material is removed and thread engagement is reduced, significantly weakening the thread. This will often cause bottom brackets to squeak or to work loose.

When bottom bracket cups are removed repeatedly for servicing, it is possible to strip out the threads completely and ruin the entire frame. Easton bottom brackets have sufficient material added to the inside diameter to allow for re-rounding and threading after welding.

**Gussets**
Due to the extreme amount of taper walling in Easton tubes, gussets are not normally needed. If gussets are used, refer to tube layouts to insure that gussets do not extend beyond thick wall sections. (Figure 6) If gussets do extend beyond thick wall section, the joint will actually become weaker than the same joint without gusset.

**Seat Tube**
Reaming of the seat tube is very important to insure that the seat post can be held securely without over-tightening. Over tightening can cause the seat tube to crack and fail. A sliding fit of .001"-.002" larger than seat post size will yield good results. If expandable plugs are used, distortion will be less, but reaming will still be required.

**Fixturing**
Frame should be built in an accurate fixture. Tacking in a fixture and removing frame for final welding is acceptable. Bottom bracket, head tubes and seat post (end of seat tube) should be welded with an expandable brass, bronze or copper plug. This will minimize warpage from welding and also limit the possibility of burn through which would interfere with final machining.

Tubes should be held firmly with clamp blocks that match the tube diameter. Avoid using clamps that either squeeze tube tightly or have a point contact. Clamps with only point contact will likely dent or mark tubes when heat from welding is applied.

**Cleaning**
Cleaning tubes before welding is the most important step to insure weld beads are not only cosmetically appealing but also structurally sound. Aluminum forms a tough oxide coating that interferes with welding. Because this oxide coating forms so quickly, cleaning should be done just prior to welding. Cleaning can be done chemically, mechanically or both. Weld-prep acids must be rinsed thoroughly or acid and residue will contaminate weld. Follow directions listed by manufacturer. Mechanical cleaning should be done with

either stainless steel wool or a stainless steel brush. Scotch-Brite pads also do an excellent job. Never use a power sander or sand paper. If an oil base lube is used, extra care must be taken to insure all traces of oil are removed.

**Welding**
Weld beads should be done in one pass. Starting and stopping should be kept to a minimum. The starting and stopping point of weld beads should be on the sides of the frames, never on the vertical axes.

Avoid welding over a previously welded joint. This will further weaken the joint by building stress and damage the tube by creating a larger heat affected zone. Welding over tacks is acceptable. Tacks should be small and on the sides of the frame never on the vertical axis of the frame. Keep the weld beads to reasonable size. Extra large weld fillets require excessive heat and damage the tube. Weld fillets should blend smoothly into the tubes. Welds should not burn through tubes as this will always weaken the joints. This damage is easily visible from the inside. Some distortion is to be expected. If burn through is unavoidable, due to thin sections being welded, a secondary continuous purge attachment is necessary to provide a gas shield on interior of tube.

***Weld fillers for 7005:***
Use 5356, 5180 or 5183 fillers for welding 7005 frames.

***Weld fillers for 6061:***
Use 4043 filler wire for painted 6061 frames. Use 5356 filler for anodized 6061 frames

**Solution Heat Treatment for 6061**
(Note: Standard processing of 7005 does not require solution heat treatment after welding.) Soak for 30 minutes at 980 degrees F. Quench in water or water/glycol mix. Quenching water temperature should never exceed 100 degrees F. This process is performed only after entire frame is welded together.

**Aligning**
***Alignment of 7005 frames:***
Minor alignment after welding should be performed as soon as possible while material adjacent to the weld is in its softest state. 7005 age-hardens rapidly making alignment much more difficult as time advances. As tubes re-age-harden the force necessary to straighten the frame increases. This can lead to damage to either the tube or the weld that will not be easily detected and can shorten the life of the frame. Less than 6 hours is the recommend time frame for alignment. If frames are built in subassemblies, alignment should be done on each subassembly within 6 hours.

***Alignment of 6061 frames:***
Frames should be aligned within 8 hours of quench. Longer delay times will not only make alignment more difficult, but higher residual stresses will be locked in, and fatigue resistance will be reduced.

**Age**
***Artificial age for 7005 frames:***
Age 6 hours at 200 degrees F (± 10 degrees F) plus 4 hours at 320 degrees F (±10 degrees F). This process must be performed by the builder on all Easton 7005 tube sets.

***Artificial age for 6061 frames:***
Delay material at room temperature for a minimum of 72 hours after quenching. Age for 8 hours at 350 degrees F (± 10 degrees F)

**Finishing**
If weld beads are to be filed smooth, use extreme care to file only the weld beads and not the tubes. Undercutting the tubes will weaken the tubes. All scratches from filing should be removed with progressively finer grits of emery paper finishing with 400 or 600 grit wet. Aluminum weld joints are very sensitive to stress risers. Scratches from filing or sanding are stress risers and create a place for fatigue cracks to start. Scratches at tube joints will dramatically weaken the frame. Even fine sanding should be done across the weld.

Polishing tubes and welds to a bright finish provides an excellent surface to minimize the chances of crack initiation. (Note: 7000 series aluminum corrodes quicker than 6000 or 5000 series aluminum, so a protective finish is recommended.)

Anodizing, painting and powder coating provide excellent protection. Shot peening per mil spec 13165 provides the very best result for improving fatigue strength. This surface can be painted or anodized.

**Powder Coating**
Consult Easton for powder coating information. Due to the high temperatures needed for some powders and multiple coats of others, frame strength could be compromised.