

How to bend tubing

by **PaulE** on January 8, 2006

Table of Contents

intro: How to bend tubing	2
step 1: Build the jig	2
step 2: cut the lumber	2
step 3: Don't bend like this.	3
step 4: Ready to bend	3
Related Instructables	4
Advertisements	4
Comments	4

intro: How to bend tubing

Here I show how to bend aluminum tubing. This is basically documentation of how I built a new bow rail for my sailboat.

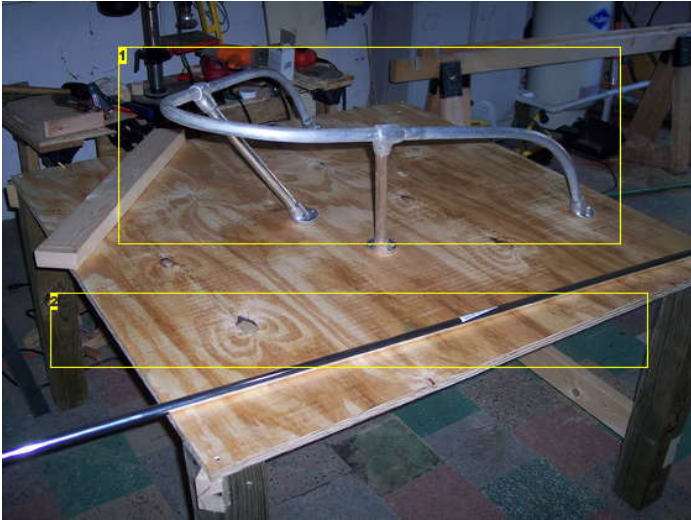


Image Notes

1. The old bowrail
2. polished aluminum tubing

step 1: Build the jig

Here (2nd image) I trace the curve that I want on some scrap lumber. This scrap will be used to build the bending jig. I'm just using a couple of old 2x4's. You wood should be somewhat thicker than the diameter of the tube you wish to bend.

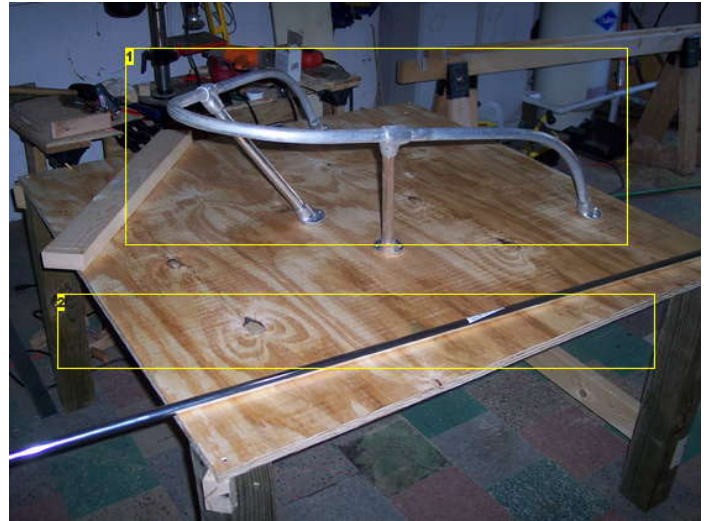


Image Notes

1. The old bowrail
2. polished aluminum tubing

step 2: cut the lumber

Here just cut out the traced jig. Use a bandsaw if you have one. I don't so I just used a jigsaw. Cut the jig to be little smaller than the desired curve. This will allow for the spring action of the tubing.

Since I used two pieces of 2x4, I made a little gusset to hold the two together (2nd pic).

Hint: Add a little bevel inward on the bottom of the cut. This will keep the tubing from slipping out later.

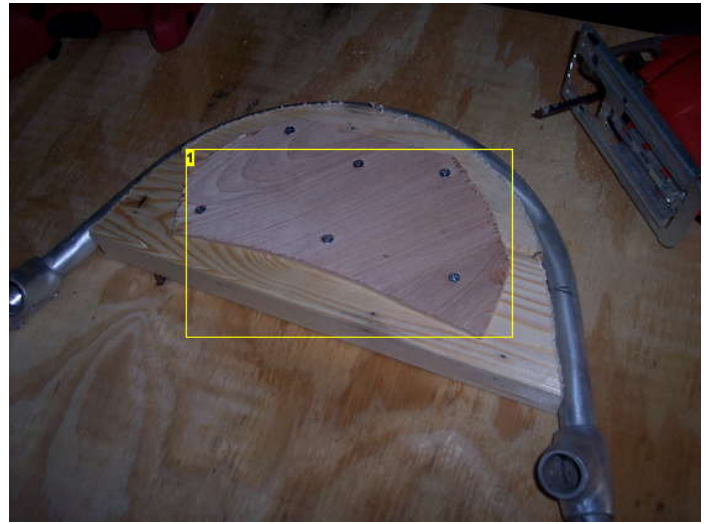


Image Notes
1. Gusset make from scraps

step 3: Don't bend like this.

If you do this, then you will almost certainly get a kink in the tubing.

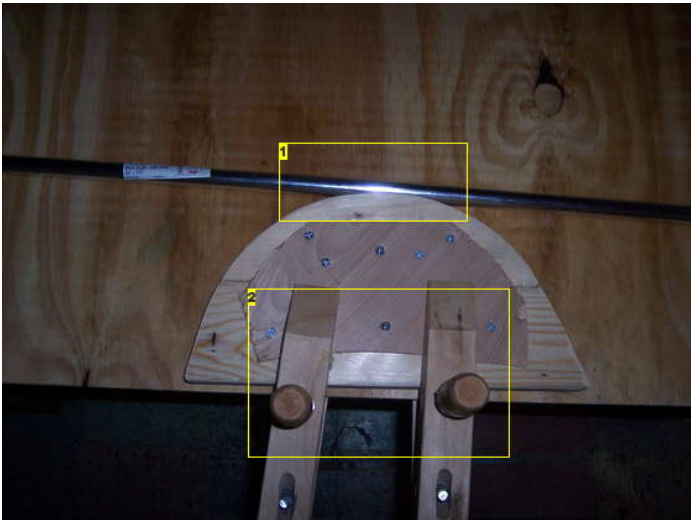


Image Notes
1. Tube will kink here
2. Jig clamped to table

step 4: Ready to bend

Here you can see that I take a piece of the scrap cut earlier and attach it to the table to complete the jig. You will want to bend from one side only while ensuring the tubing is supported while bending. You may want to practice with some cheap aluminum conduit to get the hang of it. When you are ready, get the polished stuff.

Have fun.

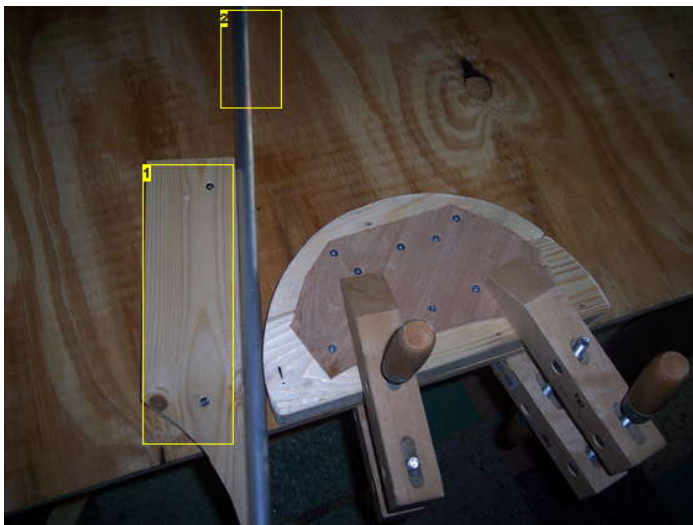


Image Notes

1. scrap attached to table to support the tubing
2. grab this end to bend

Related Instructables



Hair band by Turrean



Conductive Thread inside a Fabric Bias Tube aka Tubes of Conductiveness by Lynne Bruning



Nitro Powered RC Hovercraft by Jnkyrdguy



Fairly dry-bag by aerohydro



Decorative Window Banner Dressing by blakelock



Cheap steampunk ballpoint pen. by fatalfall11



Utility Belt for Arts and Crafts Materials by xmsmoonx



No Weld Recumbent - Modifications by tmherrin

Comments

[48 comments](#) [Add Comment](#)



dlfynrdr says:

I want to make a bicycle handlebar like the one shown in this pic. Would this be a good technique to do it with? Can anyone suggest what thickness of aluminum to use? Thanks, in advance

Feb 18, 2008. 8:13 PM [REPLY](#)





Rishnai says:


It would definitely be a cost-effective way to do it, but beware about getting enough force to make the bends out by the grips. You'll have to bend with a longer tube and then cut to length for sure. Also, getting that compound bend (down and then real near to it, towards you), will require careful bracing when you build your jig. I learned that the hard way when I was bending conduit to run electricity to my swamp cooler and had to make some funky bends like that. I did the actual bending a different way, but I found I had to build a bracing jig all around the bend I had just made and then begin my next bend. It was the only way to keep the angle intact, and have a stable force to bend against.


Mar 23, 2008. 9:49 PM [REPLY](#)

As for aluminum thickness, unless your old handlebars have collapsed in some way, use that thickness. Otherwise, I would use electrical conduit. It's cheap, handy, and relatively easy to bend. I wouldn't use it for apehangers or if I was going to put a lot of weight on my hands while I ride, but for that style, conduit should be fine.

 **drevt** says: Mar 28, 2008. 7:53 PM [REPLY](#)
Great instructable! I have two questions though: I am looking at making mtb bars, out of steel preferably, and I'm wondering if a) it would be possible to bend steel using this method, and b) would it be possible to make a jig that would allow the middle section of the handlebars straight for ease when fitting it onto the stem (sort of like these)?

 **sti390** says: May 28, 2007. 8:18 PM [REPLY](#)
What is the max size of pipe(diameter) I'm able to bend it over the jig?


 **Rishnai** says: Mar 23, 2008. 9:51 PM [REPLY](#)
Without heat? I guess that depends on how sturdy your jig mount is, how strong you are, and how thick the walls on your chosen tubing are. Of course, if you get some tubing home and find you can't bend it, heat with a propane torch (don't light your jig on fire) and then bend. Make sure you evenly heat everything that you want to have bent evenly, and the sky's really the limit.


 **PAUL E** says: May 28, 2007. 9:45 PM [REPLY](#)
Not sure. I used 3/4 inch tubing. I would guess that as long as the jig is bigger that you would be ok. Honestly, this was a one off kind of thing (I was simply making a new bow rail). I am very surprised at the amount of discussion.

 **Punkguyta** says: May 22, 2007. 7:28 AM [REPLY](#)
I bend metal with my hands.


 **jongscx** says: Mar 10, 2008. 7:43 PM [REPLY](#)
yeah? well I do it with my mind...

 **dallesasses** says: Jul 4, 2006. 2:44 PM [REPLY](#)
How about just going and buying the right size conduit bender?


 **Paulcet** says: May 24, 2007. 9:08 PM [REPLY](#)
Conduit benders are fixed-radius, but with the wood form it can be any radius you want, even varying radius.


 **DiamondBack** says: Sep 22, 2006. 10:25 AM [REPLY](#)
a conduit bender bends pipe. While you can get aluminum pipe, this how-to talks about bending tubing. If you were to attempt to bend tubing in a pipe bender, you would end up putting a serious kink in the tubing - rendering it unattractive, and useless

But, doing this rail WITH conduit, and the conduit bender, might be a viable alternative. Polish it up with 2-3 grades of emery cloth, and it could look quite attractive

 **PAUL E** says: Sep 7, 2006. 6:27 AM [REPLY](#)
If I were doing more than one little thing, I would wholeheartedly agree. However, the bow rail only required 3 bends in one piece of tubing. Using scraps in the garage seemed the way to go.

 **betthehammer** says: Apr 9, 2007. 2:49 PM [REPLY](#)
Add a torch and this is a good way to bend steel tubing/pipe also...

 **sdallesasse** says: Mar 31, 2007. 10:41 AM [REPLY](#)
Great subject. From experience I can see that you are on the right path. You have almost everything component that is included in a commercial tubing / conduit bender. You have the shoe / form and the hook / scrap block. The only thing you need is a follow bar. Some sort of item to squeeze the tubing to the form / shoe to keep it from kinking. In hand benders this is accomplished by using the ground / floor. I think that if you wanted to use your jig that is pictured, all you need is a reinforced slot that would be parallel to the jig and just wide enough to allow the tubing to fit. Then you would need some sort of metal bar that you could pull along this slot to squeeze the tubing to the form.

 **pojken** says: Dec 8, 2006. 10:22 AM [REPLY](#)
I've seen how trumpet guys do it - they fill it with water and then freeze it. Problem is, how would you freeze it unless it's winter outside. Any how, that's another alternative if you're looking for one.



Cabofixe says:

I just wanted to make a clarification on here. The trumpet guys don't use water because it freezes into ice and isn't bendable. Also pure water expands when it freezes and can crack or break tubing when it freezes. They use a soap/water mixture because it can still bend. And doesn't expand as much.

Mar 10, 2007. 5:24 PM [REPLY](#)



handymann says:

you can bend it just as effectively by packing the aluminum tubing with sand tightly packed into the inside of the tubing, then do the rest as the instructions say

Jan 2, 2007. 4:57 AM [REPLY](#)



Paule says:

good idea. When its not winter (or if you're in Florida like me) I bet you could dump some dry ice on it and wrap it in visqueen or a similar plastic for a few minutes.

Dec 8, 2006. 12:22 PM [REPLY](#)



Ribs says:

Why would you want to fill it with anything at all?
wouldnt that just make it harder to bend?

Aug 6, 2007. 10:36 AM [REPLY](#)

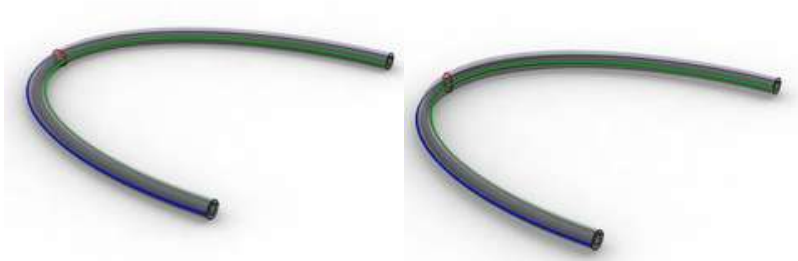


ELF says:

Because when you bend it, the "outside" (blue line) of the curve has to be longer than the "inside" (green line). If you don't fill it, it will of natural reason deform in the profile (red circles) when you bend it...
This may cause collapse, which is what I THINK is what they mean by kink.
Illustration 1 is of a tube bent with something filling the inside of the tube, to force a constant volume, and thereby force the tube to stay in shape.
illustration 2 is of the tube without filling. Notice the red profile cut half-way.

Aug 13, 2007. 6:01 PM [REPLY](#)

Hope that helps :)



Ribs says:

Thanks a lot that makes more sence now. and it is kink i think.

Aug 15, 2007. 5:47 AM [REPLY](#)



such_momjeans says:

The Ghost in our old house frightens the kids when they get up to pee in the middle of the night. I made lighted paths from their rooms to the bathroom that they can turn on from bedsides, should nature call...

Nov 23, 2006. 9:44 AM [REPLY](#)



bub4280 says:

The brass wind instrument makers used pitch to fill the tube prior to bending. Easier to find and cheaper than wood's metal. low cadmium content, too. Nice earthy smell, too.

Feb 22, 2006. 11:08 PM [REPLY](#)



sparks says:

would paraffin work? i wondered aloud....not that i have a problem with sand.

Sep 13, 2006. 10:10 PM [REPLY](#)



ruzter says:

I did some experiments using this method on 1 inch .065 wall aluminum tubing. At a radius of 6 inches it worked with a bit of flattening of the tube but no prob. At a 3.5 inch radius the tube kinked both with a flat profiled bending surface or a half round grove surface. Just in case anyone wanted to know some of the limitations. Note I didn't trying heating the tubing before bending.

Feb 12, 2006. 7:32 PM [REPLY](#)



bowakowa says:

Did you try the sand filling or only the jig?

Jun 20, 2006. 7:17 PM [REPLY](#)



PaulE says:

The tube was left empty, I just pulled it around the jig.

Sep 7, 2006. 6:32 AM [REPLY](#)



PaulE says:

I think with small diameter bends that you would need some kind of roller to keep the tubing very tight against the form. (Kind of like the commercial benders)

If you were making a circular (fraction of) bend, you could drill a hole at the center of the radius and bolt a metal bar there. then you could have a metal or wood roller bolted in a position just outside the form.

You'll probably need to add some extra to it for leverage.

However, I think at this point, it may be more economical to just buy a bender unless you were trying to get a very specific radius of bend.

One nice thing about the big bends on a wood form is you can make bends with a continuously changing radius.

Feb 15, 2006. 10:04 AM [REPLY](#)



gord says:

i had a piece of 1 1/4" od aluminum with 3/32" wall. my muffler shop would not even try to bend it. i filled the pipe with dry sand and taped the ends. went back and they offered to bend it for free if it did not break on a 77 degree bend. needless to say i did not pay and the old timer who did the bending was totally amazed..

Aug 10, 2006. 12:43 AM [REPLY](#)



KansasJack says:

Great work, PaulE. I'm sure you saved a ton of money making this item yourself. What kind of boat are you working on? I'm in the process of restoring a sailboat as well. Check out my boat projects at www.extremeboatmakeover.com when you get a chance.

Feb 15, 2006. 3:16 PM [REPLY](#)



PaulE says:

Your boat looks very nice.

Mine's a Compac 16. I've had to strip it down to the hull belowdecks and rebuild everything.

Apr 28, 2006. 8:23 PM [REPLY](#)



Reaper says:

Great little compression bender there. As others have mentioned, packing sand in the middle of the tube will help reduce deformation. Freezing water in aluminium won't! The other big thing to a good job is get a bending grade of aluminium. The difference is in the alloy and the temper - some bends better than others, check with your aluminium supplier, they should be able to point you in the right direction.

Mar 20, 2006. 2:38 AM [REPLY](#)



JWilly48519 says:

Hardly seems worth it to re-invent the wheel regarding bending methods. You can buy quite good tube-bending rigs of either the U-mandrel or spring-slip-on type for not very many \$\$ these days. I rather like the spring-slip-on type for doing complicated one-off hand bends with varying radii around simple ungrooved wood forms...the spring keeps the tubing round and unkinked, so it just bends.

Feb 16, 2006. 4:57 AM [REPLY](#)



ruzter says:

But that defeats the purpose of a DIY site! ;) Good info though...

Mar 17, 2006. 10:40 PM [REPLY](#)



ruzter says:

Nice info! I plan to use this with the addition of routing a half round groove on the bending surface of the jig for the tube to sit in to help any kinking issues

Feb 4, 2006. 1:15 PM [REPLY](#)



Trunin says:

Another great way to bend the tube is to fill it with sand. (Make sure that you have a good fill with no air pockets) Cap the ends and you can bend all day with no kinks. You can do the same thing with water, however even a small air bubble will allow the tube to fail.

Jan 22, 2006. 9:59 PM [REPLY](#)



peaceman says:

Where does one find Fusible Alloy 158/163 that is mentioned above? Is there any concern with fumes related to the alloy melting? Thanks

Jan 13, 2006. 9:25 AM [REPLY](#)



wiml says:

It has cadmium and lead in it, both of which are kind of toxic / carcinogenic ...

Jan 21, 2006. 1:24 AM [REPLY](#)



PaulT says:

What you have done is good, clean and simple, congratulations. There is another alternative to a sand filling. It's called Fusible Alloy 158/163 which melts at 70 degree C. Melt it with boiling water, fill the tube, cool it, bend it, remelt and purge it with boiling water when finished. Reusable. Great for small diam. tubes. Used mostly in fire systems, that little link that releases ceiling water spray when temperature is reached.

Jan 12, 2006. 9:43 PM [REPLY](#)



PaulE says:

Jan 14, 2006. 9:23 AM [REPLY](#)

Thanks. truth be told, I didn't have any troubles bending the tube while hollow. However, the "Fusible Alloy" (after googling) looks pretty interesting. I could think of a lot of other uses for it. Especially emergency repairs. Through my googleing, I found it difficult to find a price for the stuff. I would think to fill an 8ft tube that I'd need quite a bit.



wiml says:

Jan 21, 2006. 1:21 AM [REPLY](#)

You can get it in smallish quantities from Small Parts Inc.: <http://www.smallparts.com/products/descriptions/lma.cfm>

One of the uses they list is for bending tubing, but they're usually talking about much smaller tubing than yours. Even though it's reusable I think it'd be pretty expensive.

(FWIW, this is similar to Wood's metal, mentioned by PaulT, but I think Wood's metal is only one specific alloy, and SPI has a range of alloys with different melting points.)



peaceman says:

Jan 19, 2006. 9:54 AM [REPLY](#)

Thank you very much, I'll check it out.



PaulT says:

Jan 15, 2006. 10:28 PM [REPLY](#)

Fusible Alloy 158/163 is a very old meta circa 30's - 40'sl. It's common name then was Woodmetal. The code numbers simply denote the temperature range and there are several temperature ranges. I have checked the supplier here in Australia and they feel Fry's Metals in PA may help. I have checked the web for Fry's and concur. I have also checked the MSDS sheet for fume concerns. It seems safe enough and attracts a recommendation for a dust respirator. Hope this helps.



willgord says:

Jan 10, 2006. 6:11 AM [REPLY](#)

You fill the tube with sand, compact it some, then bend it. The sand helps prevent kinks.



kiteship says:

Jan 9, 2006. 3:06 PM [REPLY](#)

you can leave the tube ends unplugged while freezing to allow for expansion. This method might be tricky for those of us who only have freezing temps inside our freezers! I can vouch for the sand-filled approach. Drive in substantial plugs (whittled wood) to contain the sand. Practice on scrap to decide how "wet" you want your sand (more water content = more aggressively it will remain round, but also be harder to bend), and how hard you want it tamped.



BCohen says:

Jan 9, 2006. 9:39 AM [REPLY](#)

I've also heard, though never tried, freezing water in the tube. Would probably work best for smaller diameter, and shorter, tubes.



PaulE says:

Jan 9, 2006. 10:14 AM [REPLY](#)

I would think the expansion from freezing might break the tube. Of course, I've never tried it.



guiome says:

Jan 9, 2006. 6:36 AM [REPLY](#)

Well done.
In order to keep the tube section circular you can also fill the tube with compact sand.