DIGITIGRADE STILTS

COMPLETE BUILD GUIDE WITH TEMPLATES

PART 2
ASSEMBLY

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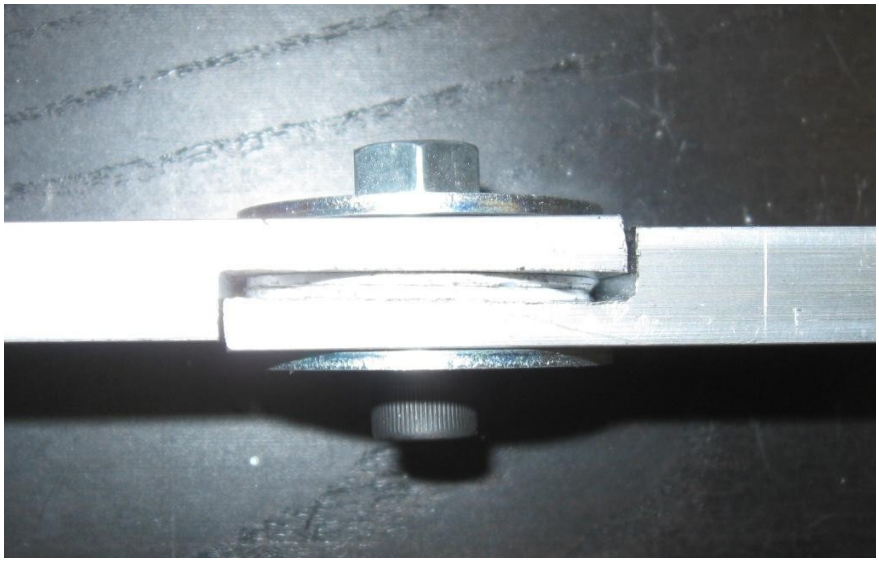
Please read the entire set of instructions before beginning the project build.

The reader assumes all the responsibility for the construction and use of this build/project.

This build represents a large number of hours of work for an independent builder / artist, please do not redistribute.

Assembly

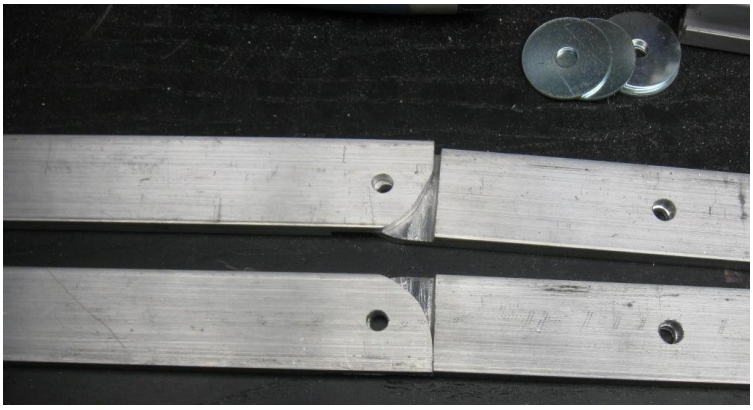
Begin by assembling the leg support pieces. There will be 4 assemblies at the end, 2 left side and 2 right side supports. These are assembled at the knee joints with the lower leg supports facing nearest to the leg and the rounded part of the joint facing the back of the leg.



Finished Knee Joint

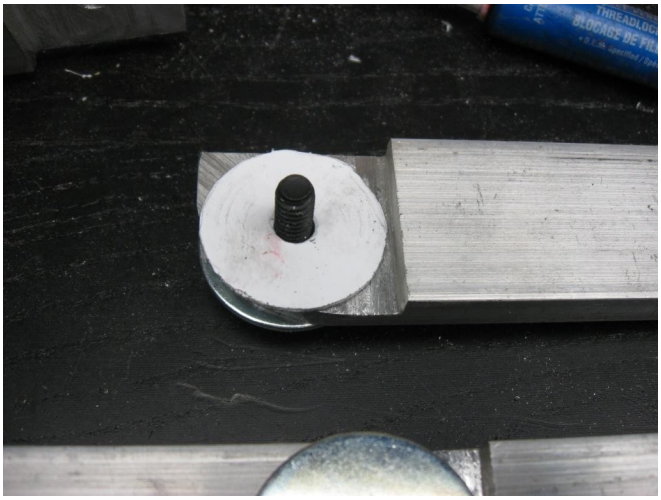
You will use a 1/4 20 by 1 inch bolt, 2 nylon washers, 2 fender washers and a standard nut for the joining. The threads of the bolt will be sealed with a Loctite sealer as specified in the materials section. This sealer is necessary to prevent the nut from coming off which could lead to injury. The nut is only tightened until it is snug. You need to allow for the joint to pivot around the bolt but not wobble. This is also where the nylon washers come into play. They are used as a bearing surface to prevent binding and wear.

Begin at the outside and place a fender washer on the bolt then the upper thigh piece followed by the 2 fender washers then the lower leg piece and the inner fender washer then finally the standard nut.

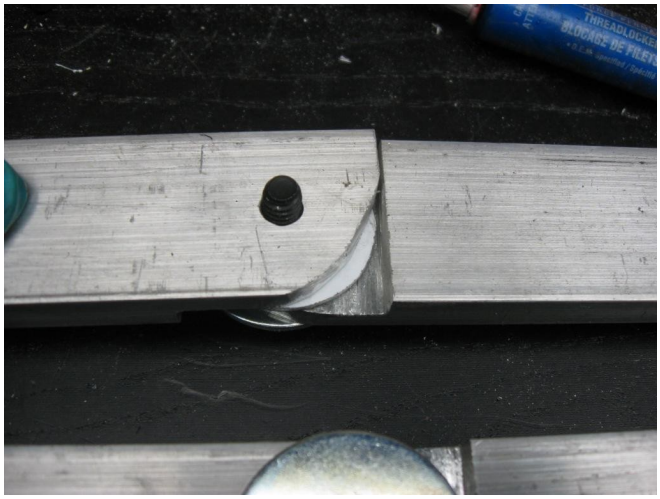


Supports ready for assembly

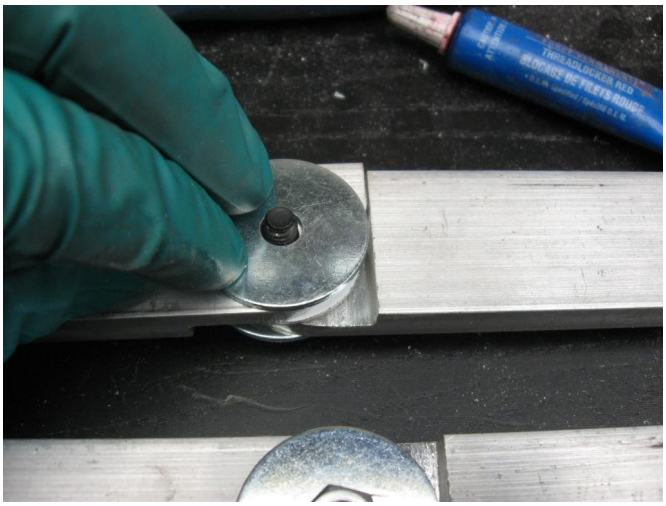
Washer and bolt installed in thigh support



One nylon washer installed, Need Two!

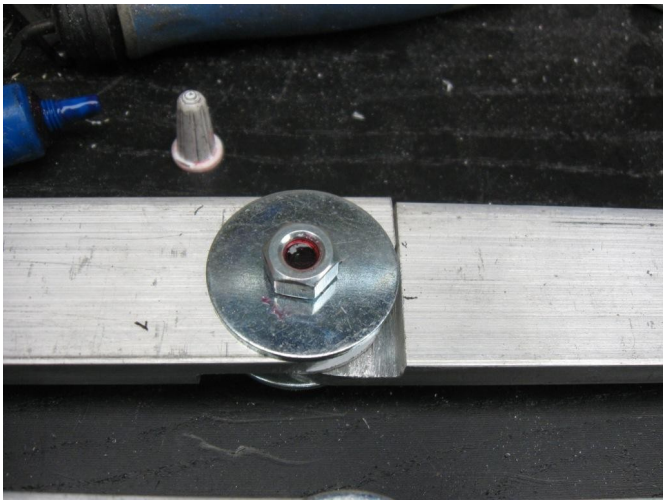


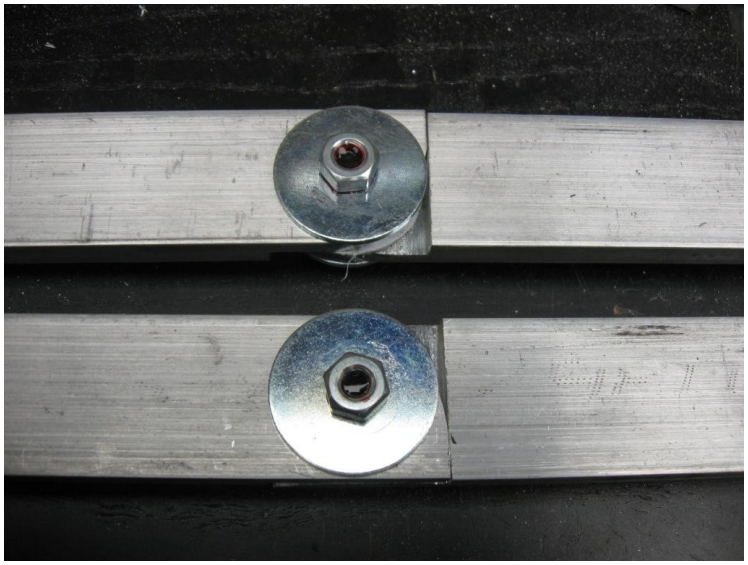
Lower support piece added



Inner fender washer installed

Thread sealer added


Inner nut installed

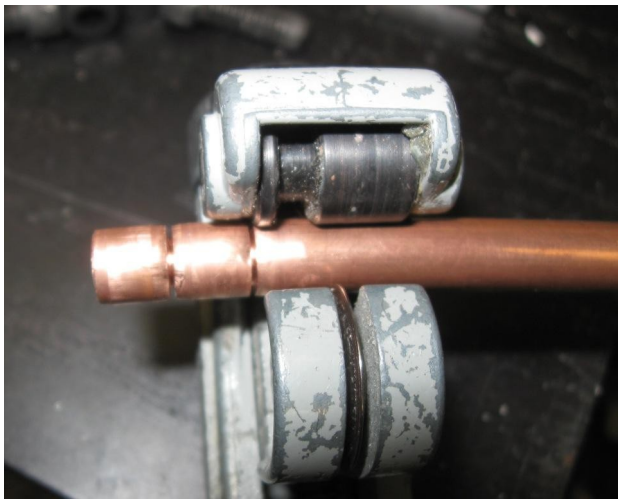


Left and Right supports completed

IMPORTANT NOTE: The bolts shown are too short and need to be replaced with ones that show at least 1 thread past the end of the nut. You may have to cut the bolt with a hack saw after the assembly is complete. You need the bolts as short as possible to prevent the possible contact with the side of your leg.

Plastic Brace Supports

If you were not able to find 1/4 inch bushings then you will have to make your own by cutting 5/6 inch tubing at 1/4 inch intervals as shown.

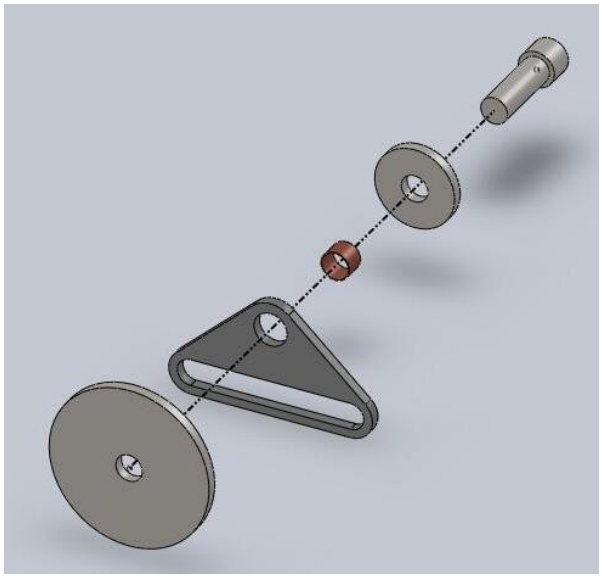


Cutting 5/16 inch copper tubing
With a tubing cutter

If you use a tubing cutter be sure to not cut all the way through he tubing as this will cause the inside of the tubing to protrude and prevent the bolt from being inserted easily. Just cut most of the way through then bend the tubing at the cut and it will come apart.

Next is to install the formed Sintra plastic supports. Begin at the top and position the plastic between the aluminum supports the push the Tee Nuts in the 19/64 holes that were drilled in the plastic from the inside of the plastic. These will seat fully as you tighten the support bolts.

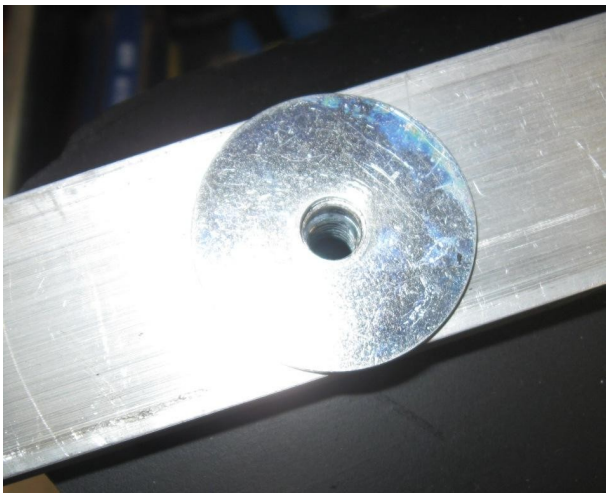
Using the assembly scheme shown below, install the support bots in the supports from the aluminum side. There are 8 bolts total for each leg. The support bolts on the outside of the leg will be used for the base of the support straps that were made in a previous step. The support strap assemblies should be installed on the outside of the leg on each brace; this will make tightening the brace to your leg quite a bit easier.



Support bolt assembly

Placing Tee Nut in Sintra

Bolt with bushing

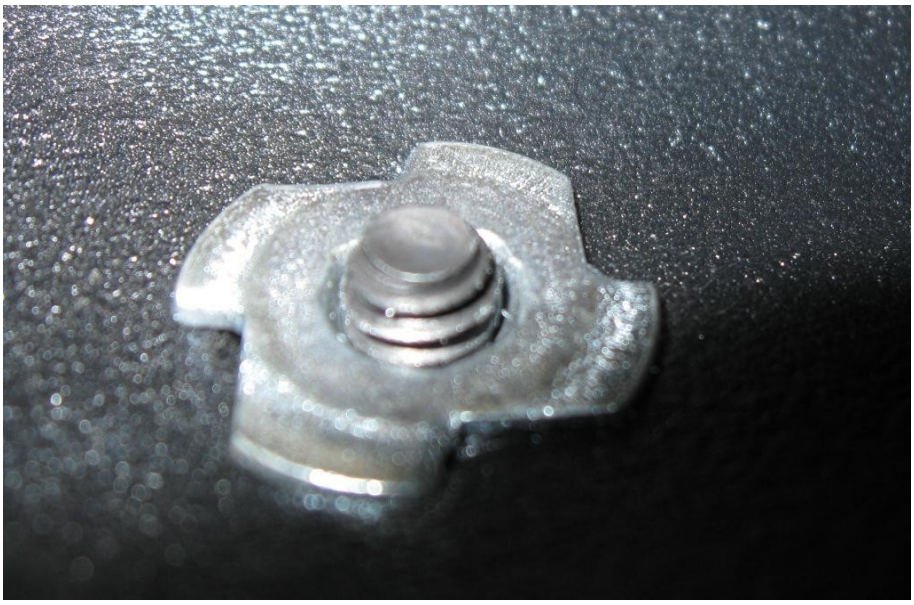


Fender washer on support

Strap with Tri Guide on outer leg support

Strap fastened to support

As mentioned previously the bolt will pull the Tee nut into the Sintra material creating a tight fit. The Tee Nut will also tighten into the aluminum support pieces, locking them into place.



Fastened Tee Nut with bolt shown on inside of Sintra

Repeat this procedure for each bolt position. There are 8 in total. The Tee Nut will bite into the Sintra and the bolt will protrude no more than shown. The bolt shown here may create a chafe point if the brace is worn with thin pants. You can cover this with foam tape to prevent injury. Ideally the bolt will not protrude at all. A long bolt can be shortened by adding an additional washer before the outer fender washer.

Brace assembly shown without straps or Tri Guides

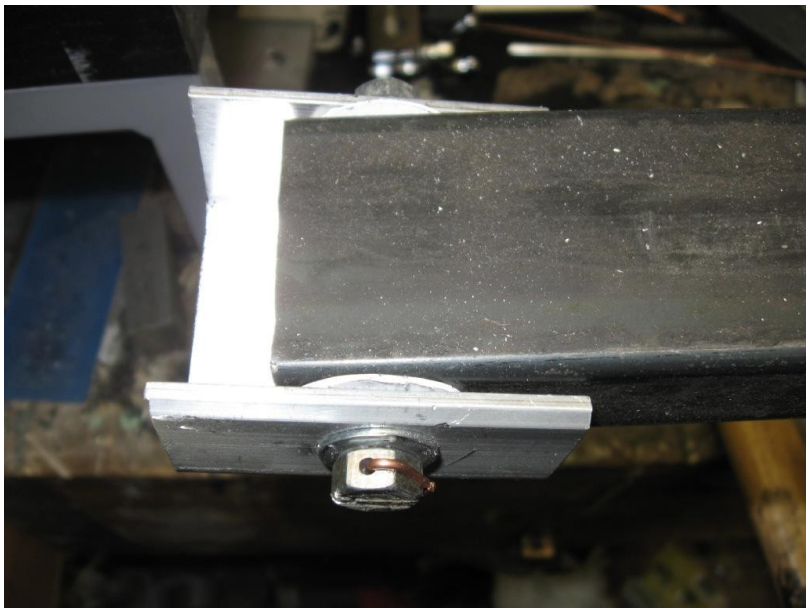
Front of brace without straps or Tri Guides

Check for clearance and fit.

There should be about 1 inch clearance on either side of your knee. This is checked by placing the assembly on your leg. It should stay in place by the clamping action of the Sintra plastic pieces. If there is not enough space of if there is binding at the knee this will be taken care of when the assembly is in the final fit stage. If you notice that the support pieces contact your ankle bones this is normal and will be corrected in a later step.

Assembling the Foot Pieces

Beginning at the front of the foot assembly, you will install the foot; this is held in place by a single 3 inch 5/16 bolt that goes all the way through. There are also nylon fender washers between the aluminum of the foot and the steel of the foot support. The foot will pivot freely on the foot support and can be “locked” in place by tightening the foot bolt. It is optional but you can drill a hole through the foot bolt nut and lock it in place by using a small bit of wire. This is not necessary but a tighter foot will help you balance better and if the bolt is locked in place it will not loosen over time. You can also cut the protruding bolt off with a hack saw to make it flush with the end of the nut.



Foot assembly with lock wire

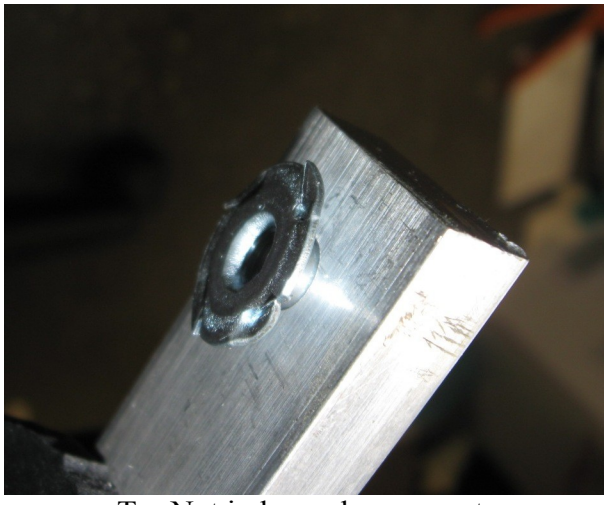
Next you will place the ankle support assembly. This is accomplished using two 5.5 inch 5/16 bolts through the ankle support, the ankle support block, the foot support, the other ankle support block and finally the other ankle support. The entire assembly is tightened and the nut is thread locked using Loctite. The ankle support blocks shown in the pictures were from a prototype design and you should use the solid ones shown in the drawings.

The 19/64 inch drilled hole in the ankle supports will be used for the toe strap and should be positioned facing the front of the assembly. You will have to prepare 8 Tee Nuts by flattening the prongs. These will be used for the ankle supports and for the toe strap anchors.

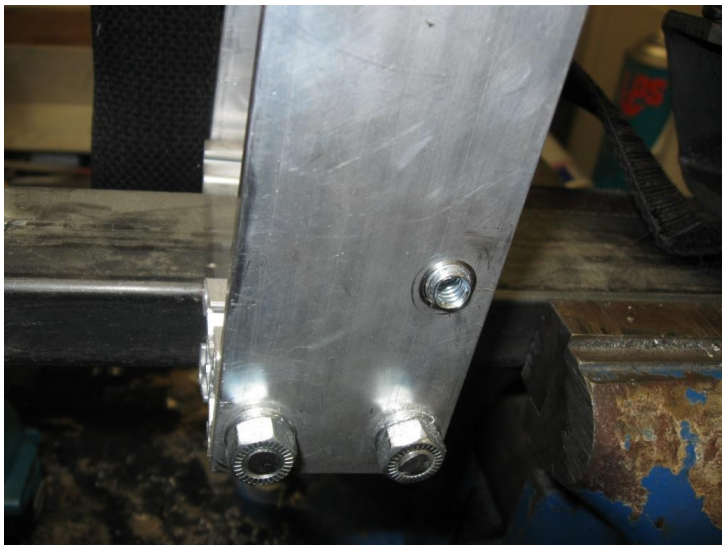

Grip the Tee Nut Prongs with pliers to flatten

Normal VS Modified Tee Nuts

Position the modified Tee Nuts in the lower 19/64 inch hole facing outward in each ankle support. The upper hole is for the ankle pivot bolt and the remaining Tee Nut is placed in the 19/64 inch hole that is the lowest hole in the lower leg support with the flange on the inside of the support.

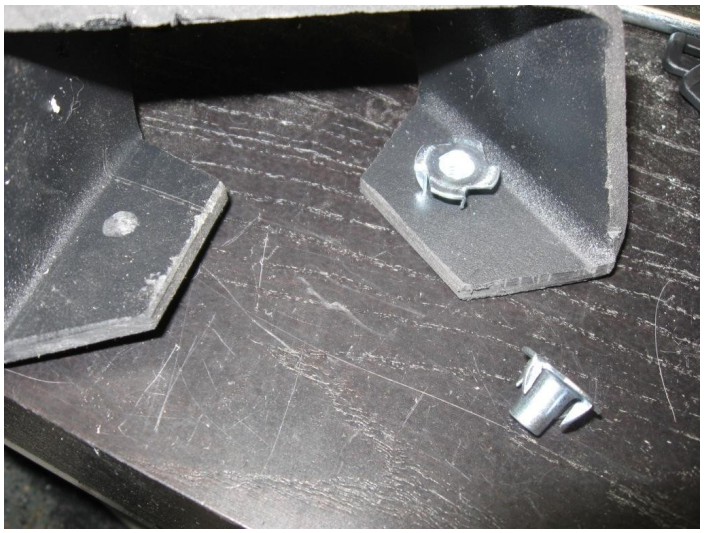


Tee Nut in lower leg support



Tee Nut in ankle support

Assemble the toe clips with Tri Guides using a Tee nuts and bolt assemblies that are similar to the ones used to connect the plastic braces to the metal brace supports. You will not need to use a copper busing here as the Tee Nut will protrude through the Sintra far enough to create a pivot. You will also need to use a shorter (.5 inch long) 1/4 inch bolt.



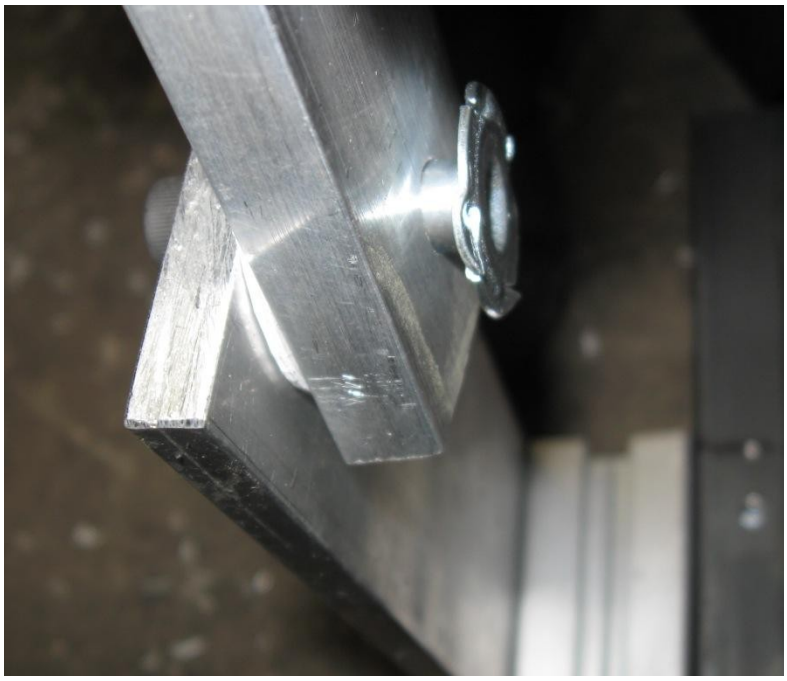
Placing Tee Nuts in toe clips

Tri Guides on toe clips

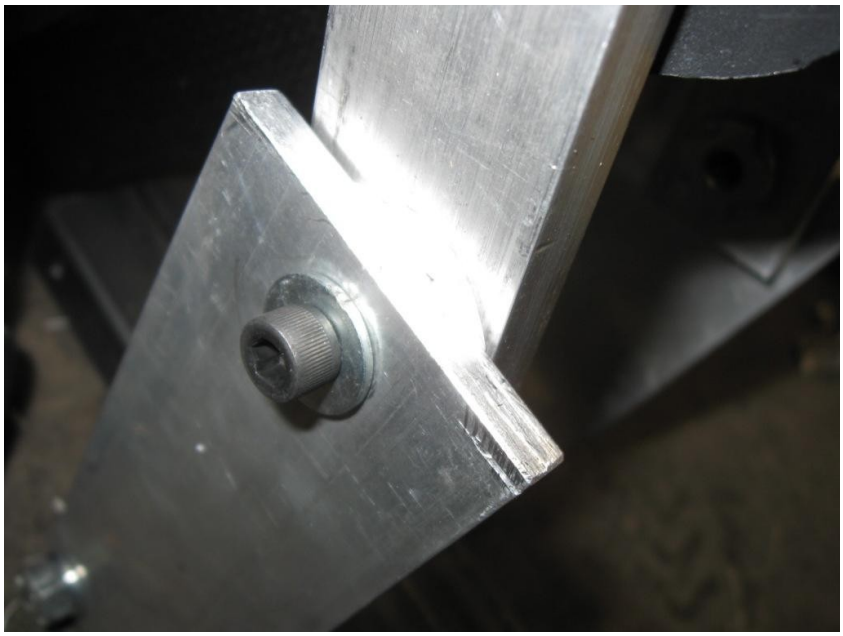
Position your shoe between the uprights of the ankle support with the toe facing the front of the assembly and your ankle joint directly in line with the ankle pivot point of the ankle support. Place the toe clip snugly over the front of the shoe and mark its position. This is to find the place to drill the hole for the toe clip support. For a US size 10 shoe it is approximately 7.75 inches from the front ankle support bolt. By using the mark that you just made, locate the center of the 2 inch wide foot support steel then mark and drill a hole for a 5/16 inch bolt. This is the fastener for the toe clip. Fasten the toe clip down using a 2 inch 5/16 bolt and a large fender washer with a nut on the bottom.

Toe Clip Fastened in place

You will now attach the leg braces and supports to the foot assembly. This is accomplished using a 1/4 inch by 1 inch bolt. You will use a nylon spacer between the ankle support and lower leg support and fender washer between the bolt and the lower leg support.



Inside of Ankle Support before Tightening the Bolt



Outside of ankle support

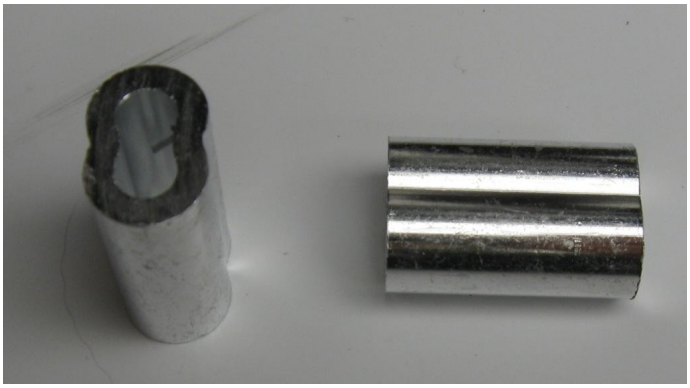
Completed foot assembly

Completed assembly shown with shoe

The last step in the leg brace is the making of the cable support that joins the foot to the thigh. This support cable will allow your upper leg to take your weight and reduce fatigue on your ankle.

The cable used here is a 3/16 inch steel aircraft cable. You will also need to use a 5/16 inch turnbuckle. The turnbuckle should have a weight rating of at least twice your body weight. A standard steel turnbuckle should have a weight rating of around 800 lbs but check to be certain. Begin by placing your completed stilt assembly in a “Z” configuration with the lower leg support in a vertical position along with the thigh support and foot both in a horizontal position. This will give you a nominal cable length needed.

Begin by creating a tight loop in one end of the cable with a cable sleeve. The sleeve is meant to be attached with a special tool but squashing it flat with a hammer will suffice. It is not quite as pretty but it will still work. The cut end of the cable should be just inside of the sleeve which will prevent fraying and possible injury. The loop is approximately 1 inch in diameter.

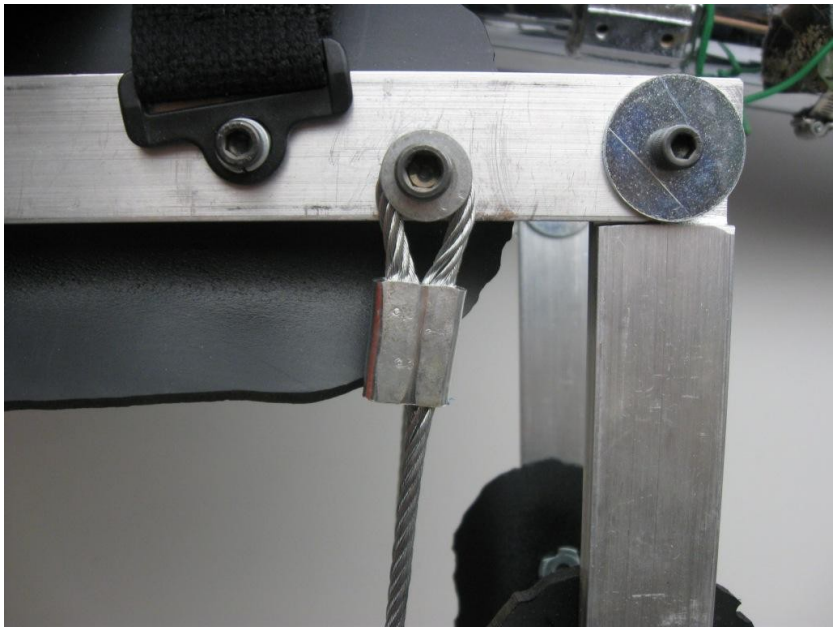


Aluminum cable sleeve

Correct cable loop with sleeve flattened

Incorrect cable loop with frayed cable.

Attach the loop to one side of the thigh support using a 5/16 bolt with a large washer on the head side of the bolt as shown.



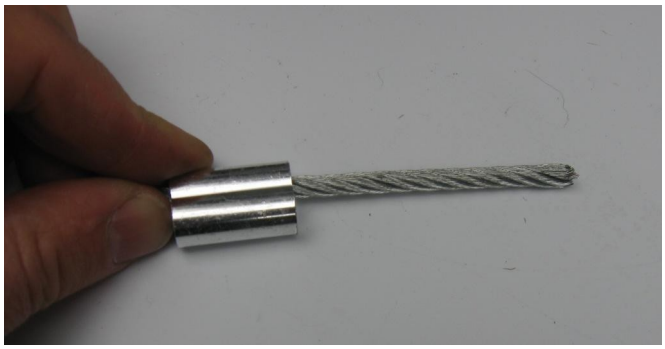
Foot support cable

Extend the turnbuckle to its half way point and feed the other end of the cable through one eye of the turnbuckle. Place the other eye of the turnbuckle in the cutout of the foot support as shown and place a 3 inch 5/16 bolt through the assembly to hold it in place. Pull the other end of the cable tight up to the cable support bolt on the other side of the thigh brace and make a 1 inch loop around the bolt at that location. Mark the cable at 1 inch below the bolt towards the loose end of the cable.

You will need to tightly wrap the cable at the desired cut mark with some electrical tape then cut it directly through the electrical tape with a hacksaw. The tape will prevent fraying. Now using another sleeve, make your cable loop and flatten the sleeve. Attach the cable loop to the open thigh support bolt and tighten the bolt.

Cable loop with marking tape

Cutting cable with hacksaw



Cable in sleeve

Sleeve shown installed then flattened

The turnbuckle can now have its bolt tightened. Adjusting the turnbuckle will allow you to adjust the foot support angle which controls the height of the stilt. You will also be able to adjust any slack as the cable stretches over time.

Installing cable and turnbuckle assembly

Final assembly

Final Fitting

Final fitting will be accomplished using the heat gun to adjust the Sintra plastic pieces. Begin by heating one Sintra piece at a time along the aluminum brace from the outside of the plastic. Be sure to heat only the Sintra, if you apply heat to the nylon straps or Tri Guide pieces they could melt and deform also. After about 1 minute the plastic will become pliable enough to form by hand as before. You will gently fold the piece outward

as shown. Hold until it cools, again about 1 minute. This final heating and forming will remove any pinch points from the plastic and allow you to put on the braces a lot easier. This heating of the Sintra will also allow the plastic brace pieced to relax which should take care of any chafe points at eth thigh and knee.

Final forming by heating the thigh brace

Outer edge of thigh brace formed

Outer edge of thigh brace formed

Repeat this process for the remaining plastic brace pieces. The toe clip is already formed fully so you will not need to heat this part any further.

Completed Stilts ready to wear

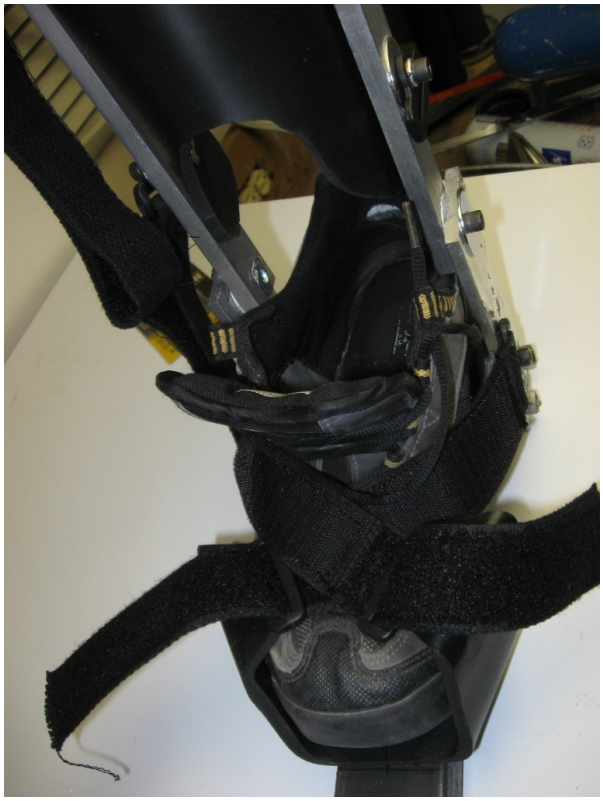
Final Notes:

You will have to learn to walk again but this process should be quite a bit shorter than the last time you had to learn. The key here is to find you new balance point. The foot of the stilt will pivot freely if it was not tightened significantly which will make balancing more difficult. It is usually advisable to have someone help you when you initially use the stilts, failing this you can use a taller than normal walking stick as an assistant. You should be able to be walking unassisted within about a half an hour. Be sure to practice walking for many hours before you plan on going out.

Getting into the stilts is fairly simple. Begin by sitting on a bench that is at about your waist height. Place your shoes in the stilts but leave them undone. Remove the heel turnbuckle bolt and swing the turnbuckle and cable out of the way. Place you foot inside of the loop of the cable and slide your foot into your. Press the lower leg support onto your lower leg followed by the thigh support. Tie your shoe and fasten the foot straps over the top of your shoe. Fasten the lower leg straps then replace the turnbuckle and heel bolt. Fasten the thigh support straps and lean forward to stand up.

The braces will limit your movement somewhat but they will allow you to stand upright with greatly reduced fatigue. You will also be around a foot taller than you were before.

The proper way to wear the stilts is shown in the following pictures.

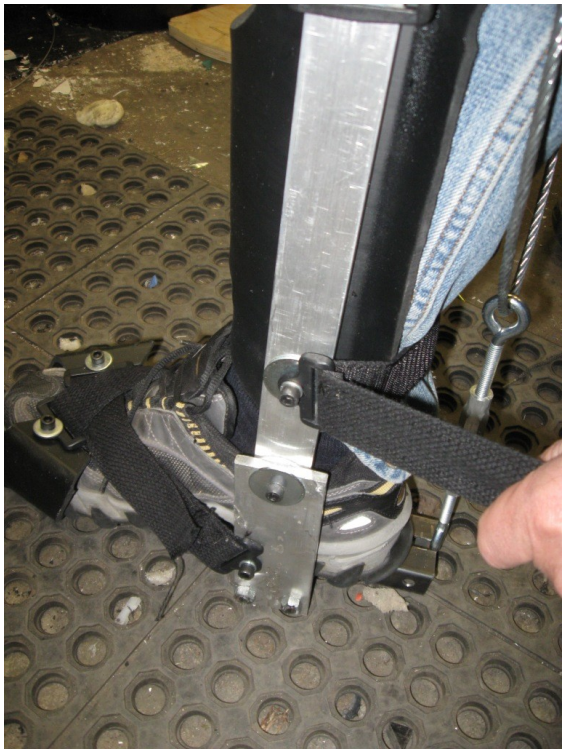


Shoe placed in toe clip

Placing leg through cable assembly

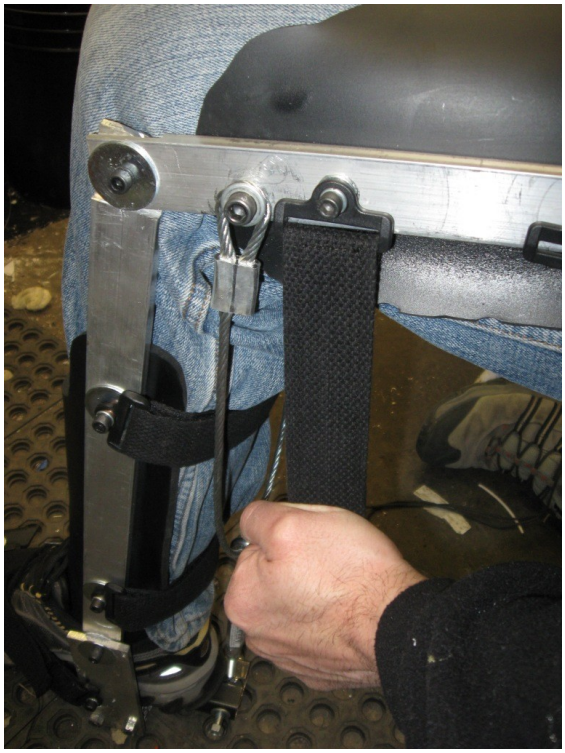
Sliding foot into shoe

Tightening the foot straps




Tightening the lower leg straps


Installing the Achilles (heel) bolt




Tightening the thigh straps


Proper wearing of the stilt, ready to stand.