HOOP BENDING INSTRUCTIONS for

Models Dy-20, C-20, EC-20 & PF-20 Hoop Bending Tools

Inventers and pioneers of these amazing Greenhouse bending tools,

Regardless of which model 20 ft bender you have purchased, the bending steps remain the same. The only change is that you are bending more tubing per bending stroke on the longer benders, as the PF 20 is the fastest bending tool. The DY 20 being the shortest is slower but if you are only bending a few hoops it gets the job done. The EC or C is our medium production bender and spans the gap between commercial and the homeowner serving both requirements.

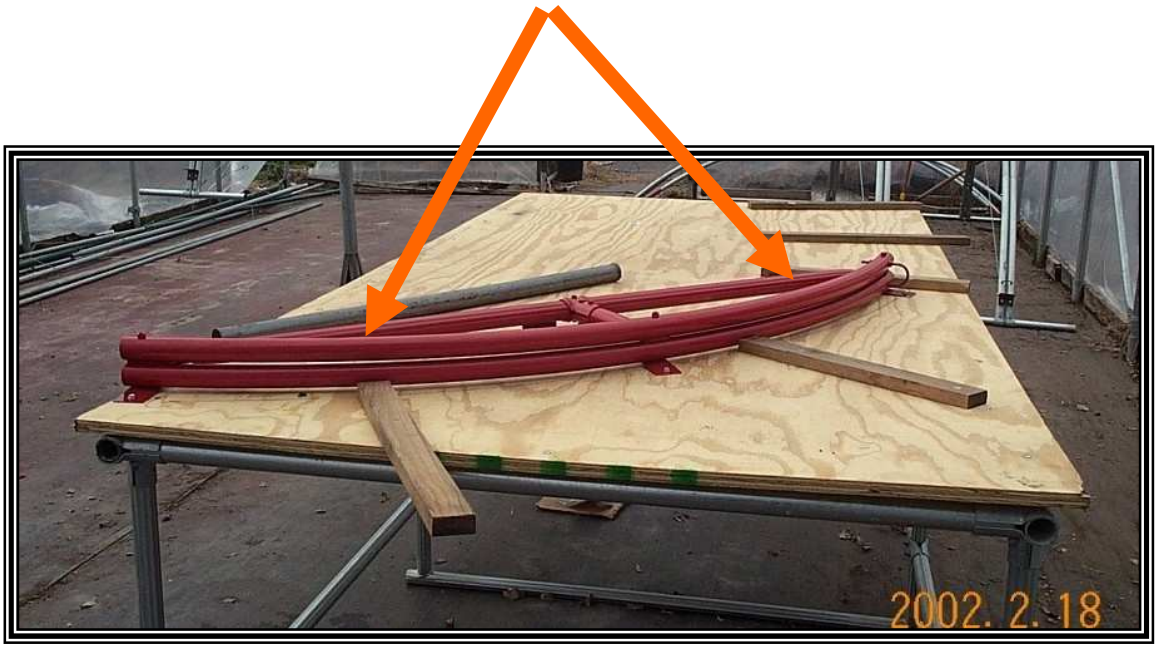
Ecommerce Websites

www.buildmyowngreenhouse.com

Email info@hoopbenders.net or herbs@lostcreek.net
Phone 903-497-1158

Mounting Your Hoop Bender

Horizontal Mounting For All "DY" & "C" series mount using two ¼" bolts in the 2 holes drilled & provided here. We offer an optional vertical leg kit for all C-Series



IMPORTANT: PLEASE READ ALL INSTRUCTIONS BEFORE BEGINNING

Optional vertical leg set for all the C-Series Hoop Benders. Eliminates need for a table, allows vertical bending motion and faster hoop production. Sold separately. Leg set will not work with DY, MH or RC Series Benders)

The “DY” & “C” Series can be mounted either in the horizontal or vertical position to any stable suface.
The PF- Series comes equipped with its own set of legs, however we do offer the PF in bending heads only which can be mounted horizontal the same as the DY and C series
The vertical position usually takes less time and materials to mount the bender and produces hoops much faster,

Photo shows mounting points for both the “C” series and the “DY”
We recommend mounting your bender on a 4’x8’ plywood table as shown above or any similar surface. The table legs must be secured to the ground or floor to prevent the table from twisting during the bending of your hoops. The following photos show just how creative some of our customers are, in mounting the bender both ways.

Note in the horizontal mount notice the 1”x2” wood strips which are fasten to the table top, these wood strips are very important to keep the tubing on a level plane to the bender body, they may be positioned as needed to support the tubing in this correct level with simple drywall screws to allow moving/ adjust them if necessary later, they are not used in vertical mount position. All models of benders can be mounted horizontal using either two ¼” carriage bolts inserted through the two predrilled holes.

A simple frame of 2x4s with a sheet of plywood nailed to it forms a low cost table by simply sliding it into a pickup bed and is quickly moved to storage when finished.

Vertical mounting can also be preformed several different ways without a lot of cost and labor. The picture above is an ingenious mounting configuration sent in by another customer if you have a tractor with a front bucket, if not you get the ideal. Another quick vertical mount is simply two post with the bender bolted to them see drawing below.

General Bending Instructions

To start with purchase only enough tubing to build one or two test hoops.

It is very important to understand how the metal alloy makeup of different tubing affects the finished hoop size. Example: 1 3/8" by 17 gage fence tubing purchased from store "A" may produce a larger or smaller finished hoop width than the same size and gage tubing purchased at store "B". This may not occur often, however sometimes the difference in hoop size is dramatic. Our hoop benders are designed to produce the desired hoop width "**assuming that the tubing you purchased is within the average metal alloy hardness which is the case most of the time.**

Because below or above average alloys are in fact appearing "Rarely" on the market, we strongly advise you to purchase only enough tubing to bend two test hoops before purchasing all the required tubing.

Calculating The Amount Of Tubing Required For Your Hoop House

Determine the spacing of the hoops. Hoops should not be spaced more than 4 feet apart. Although you can space them closer if desired.
Example if you plan for a 20'x 36' greenhouse, then the spacing between hoops is four feet. The greenhouse length is 36 feet divided by 4 ft. hoop spacing equals 9 each 4 ft. spaces, this is the spaces required to equal 36 feet in length. Plus one extra hoop to begin measuring from; equals 10 hoops required to construct a 36 foot long hoop house having hoops spaced at 4 feet apart.

Simply Put

Number of hoops required equals the greenhouse length divided by the hoop spacing plus one (1 hoop). As each 20 ft. hoop requires three (3 ea) 10'6" lengths you would need thirty lengths of 17 or 16 gage 1 3/8" fence tubing, each being 10' 6" long, refer to the tube orientation page preceding this chapter for tube preparation before bending.

10' 6" lengths of tubing is the most common length found at suppliers. If you purchase 10'6" lengths all of the tubes will have a swaged end "**Smaller"** on one end not on the other. The small end will slide into the large end of next tube after they are bent, without the need of special connectors. However, in the event it is only available in 21 ft. lengths. Purchase two 21 foot lengths of tubing for each hoop you build. For each hoop cut two 21 footer's in half, you will then have four 10' 6" lengths of tubing "SECTIONS". The hoop only requires three sections. You will use the two sections that have swaged ends and one section that has no swaged end. Set the forth section aside for now you will not use them for hoops. I will show you later how to connect all those forth sections together to use as straight purling in your hoop house

Very Often I am ask…Can I bend 21 foot lengths?

Yes if the bender is table mounted, however you will have to build a 21 foot long table in a curve and level with the bending plane of the bender. That's a lot of extra work & cost and the results are seldom good.

Controlling a 21 ft length while bending it is to say the least a nightmare and will 99% of the time end up in disaster and a very long wine bottle cork screw. Most factory made hoops are made using 10' 6" or shorter lengths. Please take my word for this.

Our benders are fixed radius (not adjustable) First a little information on the properties of this metal tubing you will be working with. RULE # 1…Metal like many materials will rebound (spring back) after being bent.

This rebound is directly influenced by the hardness of the metal and to a lesser extent on its thickness and over all size. With this in mind we have built each of these benders to produce its designated hoop size provided that you are bending the gauge and diameter pipe size we recommend.

We are often ask, "will your bender bend smaller, larger, heavier or thinner tubing" The answer is yes it will bend many other gauges and even diameters, however if you do so there is no way I can tell you what the finished radius of the material will be.

EXAMPLE if you purchased a "DY-20" bender which produces a 12 foot wide hoop using the tubing we recommend for that hoop, but you instead choose to bend 3/4 inch diameter EMT electrical tubing you may not get a 20 foot wide hoop and if it did it would be to weak to use as a greenhouse.

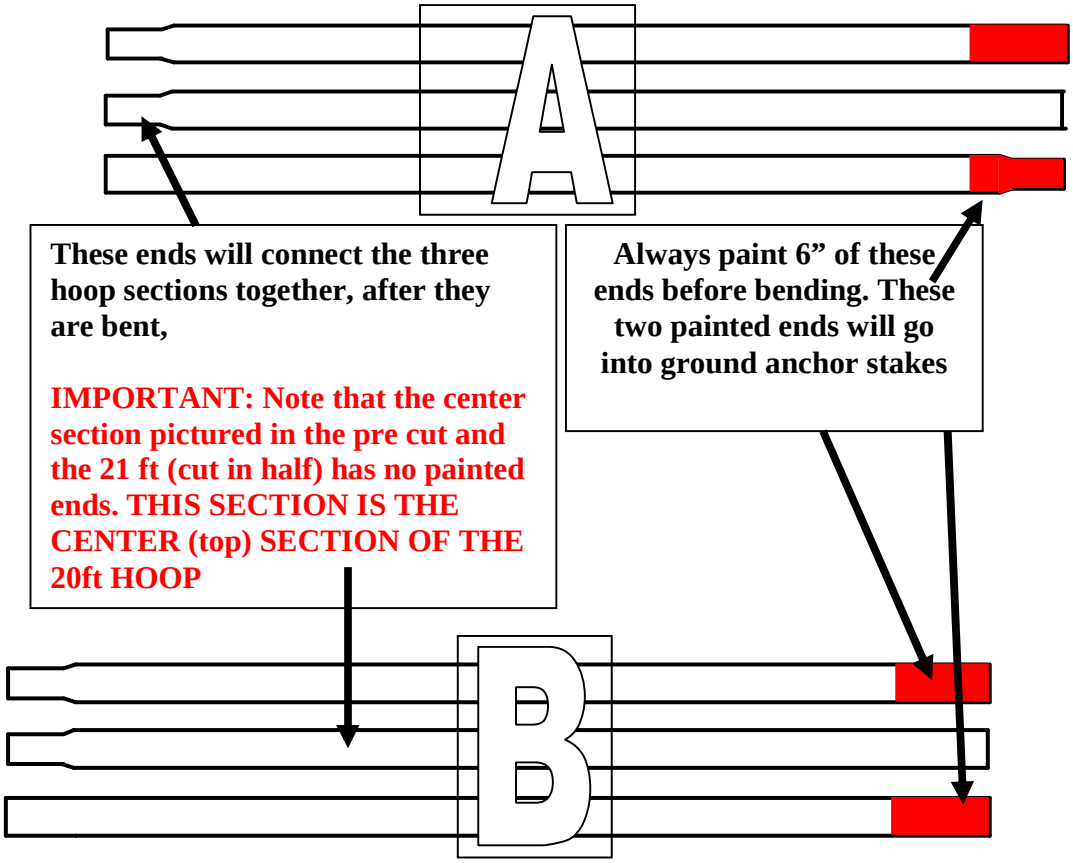
The rebound of any other tubing affects the finished radius which in this case may produce a much smaller radius than desired. So please, unless you just want to experiment, use the tubing we recommend for your bender and greenhouse.

Pre-Bending Tube Orientation

Tube Orientation for 20 ft. Hoops

NOTICE: The swaged (small ends) on all 1 3/8" fence tubing

"A" Using factory pre-cut 10' 6" lengths, 1 3/8" 17 or 16 ga.



"B" Using factory 21 ft. lengths 1 3/8" 18 or 17 ga. cut in half.

Important Note: If you used 21 ft lengths of tubing to build the 20 hoops, you will have had to purchase two 21 footers for each hoop built. This leaves you with one un-swaged 10'6" length left over after cutting them in half and building each hoop, and used the three section layout for using 21 footers. Don't worry, you can these extra lengths for the three purlins. Too connect these unswaged lengths, cut 8" lengths of 1"emt tubing (Get it at any hardware store), slide 4" inside one tube and fasten with tech screw, now slide the next tube over the remaining 4" of the emt and fasten it with tech screw, what you've just done is make your own swaged end, This can be used for connecting any unswaged 1 3/8" fence tubing.

Using C-20 or Dy-20 Benders

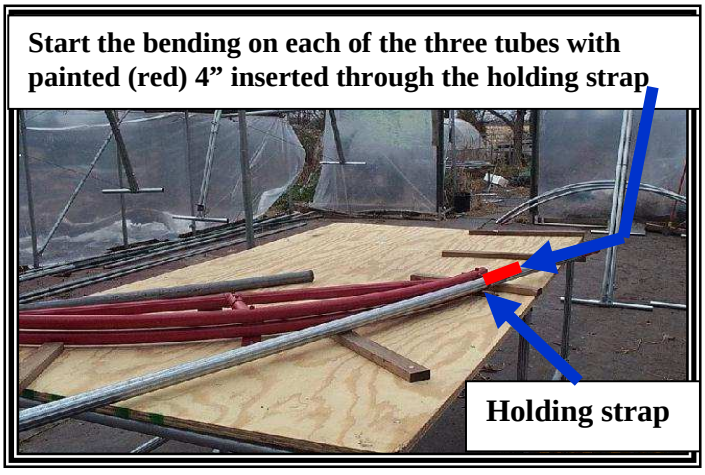
Bending tubing for a 20 foot wide greenhouse.

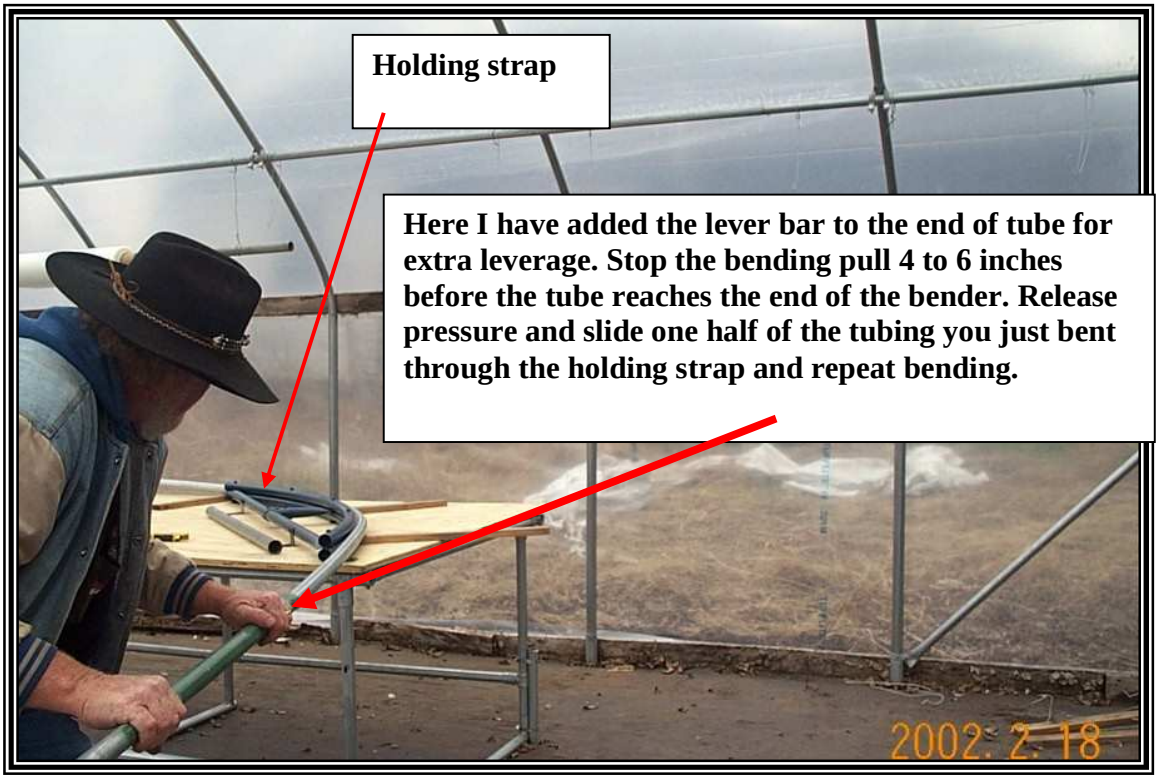
With the bender mounted to a stable platform described in mounting instructions. Determine the spacing of the hoops. Hoops are spaced 4, 5 or 6 feet apart, although you can space them closer if desired. 4 ft being used most often. **The following is a repeated Example** If you plan for a 20'x 36' greenhouse, then the best spacing is four feet apart so 36 ft. (the greenhouse length) divided by 4 ft. (the hoop spacing) equals 9, this is the spaces number of 4 ft spaces required, not the hoops required. So the total hoops required for a 20x36 is 10 hoops. Simply put; the number of hoops required equals the greenhouse length divided by the hoop spacing, in this case its 36 ft length divided by 4 ft spacing, plus one (1 hoop.). As each 20 ft. hoop requires three (3 ea) 10'6" lengths you would need 30 lengths of either 17 or 16 gage by 1 3/8" od chain link fence tubing top rail tubing, refer to the tube orientation page above for tube preparation before bending.

IMPORTANT:

During the manufacture of this tubing, one end is swaged (made smaller) sometimes the machines that perform this job causes the swaged end to cant (tilt) slightly to one side. By looking down the length of tubing while turning it slowly you will be able to determine if your tubing has this slight cant. If it does mark or note the direction of can't. Then when you begin the bending process make sure that the cant direction is pointed in the same direction as you are pulling (bending) the tube.

Start the bending on each of the three tubes with painted (red) 4" inserted through the holding strap



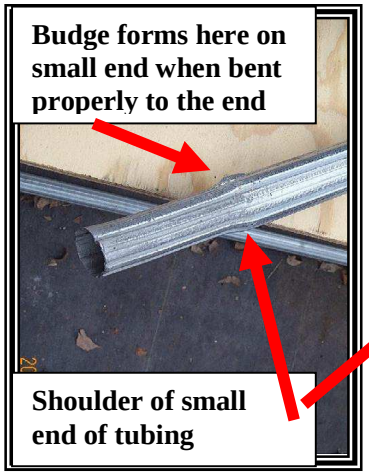


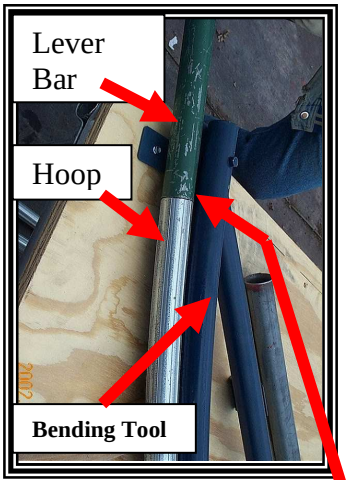
Always start the bending with the painted ends inserted through the holding strap. In the case of bending the 20 ft. wide hoops you will push the painted ends of the two side section tubes 4 inches past the holding strap then begin bending

Let's start with one pipe section, pick one tube with a small (Swaged) end painted. Push through strap 4 inches. Pull the tubing around the bender, bend the tubing all the way around the bender STOPPING the bending pull about 4 inches before reaching the end of the bender, release pressure and slide one half (1/2) of the tubing you just bent through the holding strap, CAREFUL never push more than one half of the previous bent portion thru the holding strap between strokes. Doing so will cause flat spots in your hoop.

All table mounted (horizontal mounted) fasten 1x2 inch wood strips to the table as shown in most all photos. These will hold the bent tubing level with the bender. 1x2s are a common size wood. Their true measurement is ¾" X 1 ½" without them your hoop section will resemble a cork screw (not desirable for greenhouses) adding the small end lever bar into the tube when needed as you near the end of the tube being bend, be sure that the last pull, at the junction where the lever bar slides onto tubing makes contact with the bender itself about 4 to 6 inches before you reach the end of bender, this is the last bending stroke on thst end of the tube. A slight raised ridge can be felt or seen on the outside curve 3 ¼ "from the end of tube. Some people may need a second person on the out put side to help insure the bent portion remains on the 1x2 wood strips between bending strokes.

Now let's do the other side section with the large painted end. Look down the length of the tubing as you would when checking the straightness of a wood 2x4. Look as you rotate the tubing to see if the small (unpainted) end is canted to one side slightly. Make a note of or mark the direction of this canted small end. Push the painted large end through the holding strap 4 inches. Then bend this tubing as you did for the first tubing. As you near the end of tubing (the last 12 to 16 inches), with large end of the lever bar slide over the small end of the tube, making sure that the connection junction of the tube and lever bar will contact bender about 4 to 6 inches before the end of the bender same as before. HOWEVER AND THIS IS THE ONLY DIFFERENCE BETWEEN FINISHING OFF THE LARGE END AND FINISHING OFF THE SMALL END, AND IT IS VERY IMPORTANT THAT YOU FOLLOW THIS STEP. Pull the lever bar steadily and slowly around the bender when finishing off the bending at the small ends. As the lever bar nears the bender on this last pull you will fell a slight give in the lever bar. STOP, release pressure. Slide the lever bar back off of the small end of tube using your thumb feel of the shoulder of the small end along the inside of the curve, you should feel a slight budge on the inside of the curve at the shoulder. If a slight budge is not present then slide lever back onto tube and bend a little more, always being on the alert and stopping when you feel any give in the tubing, stop and recheck for budge. When this budge is present you have bend the tubing as far as it can be bent, (It's Complete) do not bend more. Now both side sections are completed. The last (center) hoop section has no painted ends because it connects to the two side sections. Bend the center section same as the side sections, except after bending the section all the way to one end, remove from bender, turn it 180 degrees (end for end) push it back thru the strap and finish off bending the other end as well. NOTE: If necessary both side sections can be inserted back into the bender and both of those painted ends can be finished off the same as the center section. This step can reduce the hoop width a little if needed.



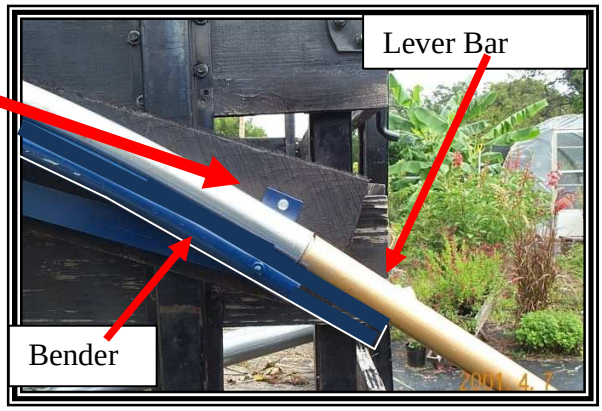


Budge shown above, tubing shown is armadillo Brand tubing and is fluted tubing not smooth as is most.

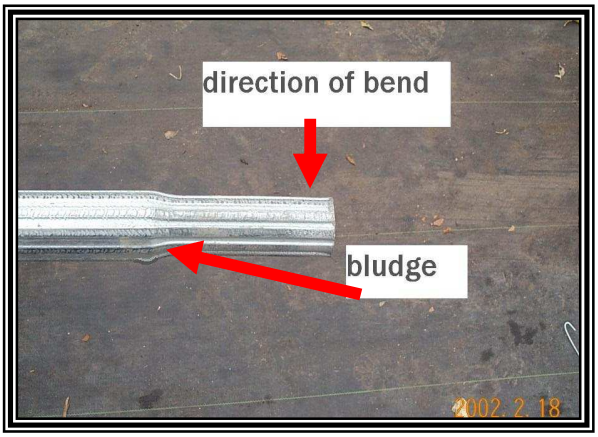
Lever bar show pulled back from small end of tube to better show the shoulder of small end

Bending stokes must end before the tubing reaches the end of the bender. Here we are finishing of the last stroke on the end of hoop & the junction makes contact with the bender HERE

Ridge forms here, when finishing off the large end of tubing. It is created by the tip of small end of lever bar inserted into large end of tubing and bending pressure brings the two into contact with the bender body.



Budge forms on inside of curve when finishing off bending the small ends



20 ft wide hoops must be 12 to 36 inches wider across the base than the Installed Width.

After bending the hoops, connect the sections together laying flat on the ground and measure across the base. Example if your bending a 20 ft wide hoop using any of our 20 ft benders, then the hoop needs measure at between 20'6" to 23 feet across the base, when the three sections are connected and laying flat on the ground, This extra width is necessary because the hoops must be compressed inward to install into the ground anchor tubes. This is referred to as "post tension" which strengthens and smooths out the hoops.

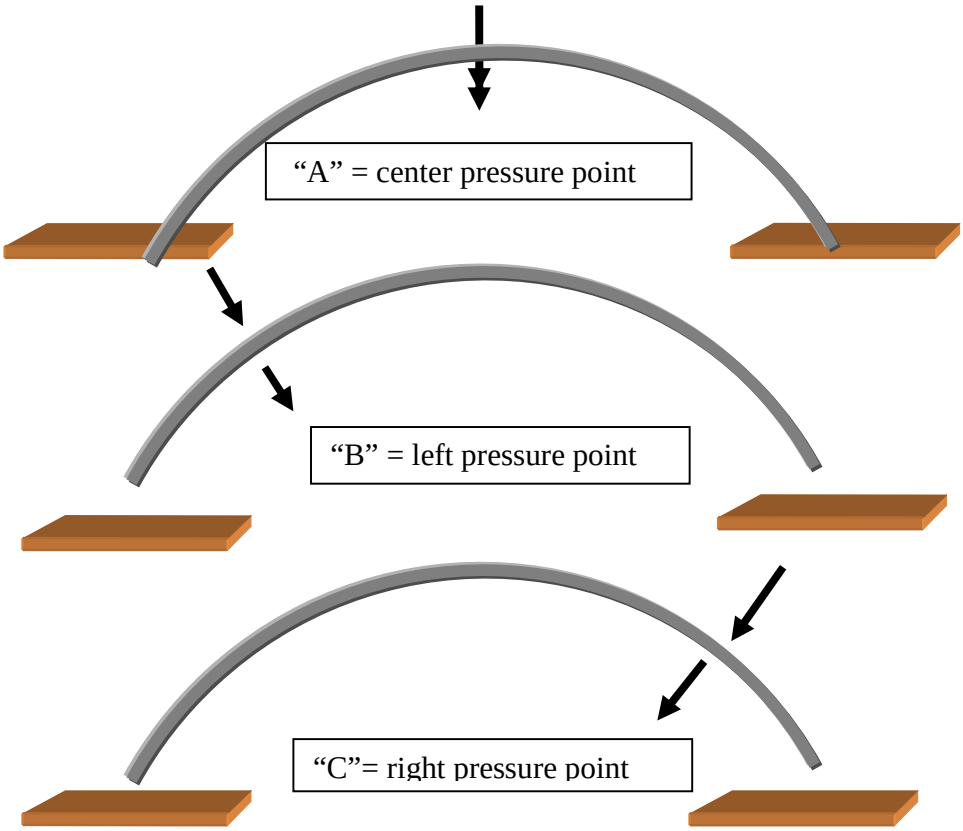
To start with purchase only enough tubing to build one or two test hoops.

The reason for this is simple; some tubing these days, can be made from a softer base metal. Because tubing springs back (rebounds) after being bent, tubing made from softer metal than normally does not spring back as much after bending, which can result in a hoop that is under size. EXAMPLE: If your hoop is to be a 20 ft wide hoop. As discussed on the previous page, your finished width after bending must be between 20'6" and 23 feet wide. The extra two or three feet will be compressed inward when installed into the post anchors. Let's say you bent the hoop and its 19 1/2 feet wide. The hoop must never be pulled outward to install, it must always be compressed inward. So what do you do about this problem?

Actually there is a fast and simple method to get the hoop out to the the needed uncompressed width of 13 foot, so it can then be compressed and installed as the required 20 ft hoop. We refer to this method of resizing as "Tune Out" it has been proven to work every time and produce good hoops. Never attempt to resize a hoop by any other method other than the following method, the result will be "well let's say not good".

The hoop tune out method is the same regardless of number of hoop sections in your hoop, one hoop section is 10'6" long, 20 ft wide hoops will have 3 sections.

If your first test hoop measurement is less than 20 feet loose on the ground. Take the sections apart and spring out both section's as follows. Place two small wood planks or thick cardboard on the ground so that each is positioned under the ends of a hoop section. While holding the section at the center (point "A") shown below, push the center of section down about two inches and release. The wood planks allow the hoop to slide outward as you push downward. Now move to point "B" on the same section, pushing downward about two inches, at the angle shown by arrows. Now move to point"C" and repeat this step again.Resize each of the three sections. Reassemble the sections and measure the width. The hoop will be wider now, if it still is a little narrow repeat the three point spring out steps above, reassemble and check hoop width. When the target width is achieved mark this hoop and use it as a pattern for resizing all other hoops hoop's. It is not necessary for all of the next hoop sections to match the pattern exactly, just as long as they or close, within a few inches. When all are compressed and installed they will all look exactly the same.



The three pressure points are the same on all 10’ 6” long hoop sections. Applying pressure at these three points on each section and by allowing the ends to slide freely when pushing down, each section will uniformly be resized into wider hoops. After a few hoop sections this method will resize a section in about 20 seconds each. AGAIN, NEVER attempt to resize using any other method or press down in more places other than the three points shown above.

Now you have successfully completed one complete bending one complete hoop. So now let’s put it together. Choose a level spot of ground and place the two hoop halves flat with the two painted end pointing away from you, slide the two un-painted ends together and using a #10 X ¾” tech (self drilling) screw secure the two halves together as shown below. The photos are of a 10 ft hoop but all hoop sections regardless of hoop size are assembled the same way..

Anchor Stake Layout

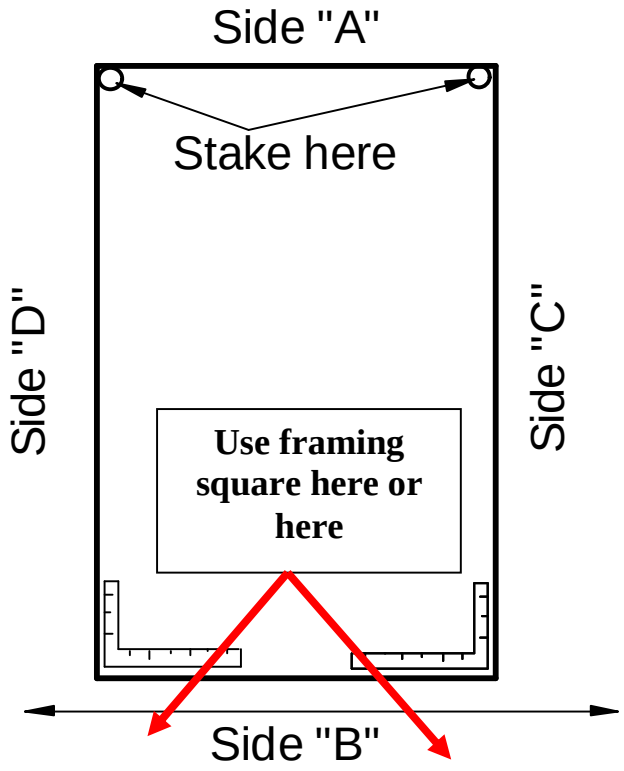
This hoop is designed to use 32 foot wide greenhouse poly covering. The hoops are made using 16 or 17 gage by 1 3/8” O.D. fence tubing and anchor ground stakes extending not more than 6 inches above ground.
Anchor stakes must not exceeding 36” extended above ground. Doing so exposes your greenhouse to potential structural failure. If you use stakes taller than 6” above ground, that changes the covering requirement and 32 foot poly will not cover it. Alternate ways to piece the side in are covered later in these instructions.

Most Greenhouses will lay out the stakes using a string line. Stakes can be driven into the ground or anchored in concrete. If driving, use stakes that are 12 “ longer than needed, drive them in tight then cut them off level with the others. Driving caps can be purchased but my experience is that you still mess up the stake tops on many of them leaving you having to cut it anyway but ending up with a short stake.. NOT GOOD

An alternate method for smaller in ground anchored greenhouses is simply build a sand box with 2x4s, level it, square it, then drive the stakes inside the sand box, using the box as a guide for stake spacing and alignment. Install hoops in stakes, fasten with tech screws from inside the greenhouse opposite the 2x4. After hoops are installed drill through the 2x4, stake & hoop and bolt them all together using ¼"x4" carriage bolts or skip the drilling and use longer tech screws

Here I am setting up a 10' X 16' ground work.

The treated 2x4s are cut to length and ends are fasten together forming what is similar to a large sandbox for the kid's.



Side "A" is anchored with the two permanent 1 5/8" Tubing stakes, and then temporally fastened to the stakes.

Then side "B" is then shifted to the left or right while holding a framing square in either of the two corners of "B/D" or "B/C". Shift "B" until B/D or B/C is square. Then drive stakes into corners B/D & B/C

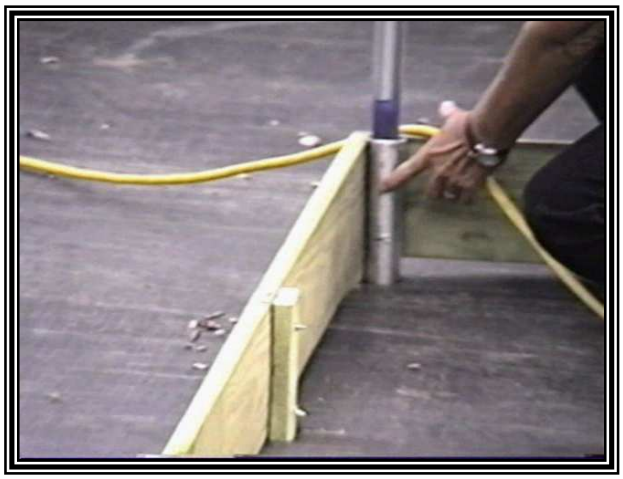
Ground stakes are made of 1 5/8” fence post cut to 30 inch lengths. Loose soil may require longer stakes. As you can see we have already installed the ground cloth in a large area inside and out side of greenhouse. The ground is sloping towards this corner. After installing the 1 5/8 inch ground stakes I leveled the wood frame then blocked the frame up where needed to keep it level. Next step is to install the hoops.

Installing the last 1 5/8 “ pipe stake corner stake.

Wood stakes at end frame, both ends

Installing the last hoop. Hoops should be inserted into the 1 5/*’ ground stakes 6 inches, then a #10 by 1 ½” long self drilling screw is run through the wood into the 1 5/8” metal stake and hoop. This screw locks the frame in level position as well as connect the hoop to the stake. Two treated wood stakes at each end serve to stabilize the end frame boards. They are permanent so use treated wood.

Install the self drilling (Tech) screws from outside wood into the 1 5/8” stake and hoop



Pushing the hoop down into the 1 5/8” O.D ground stake. Here you can see the top of painted end. Top of paint is 6”

The gap at front right corner will be filled in with treated wood later, leaving a screened outlet hole for water to escape the greenhouse. On longer house you may want to install stakes using a string line and level then hoops and add the wood band last.

Attaching The Purlin

Attach the purlin at each end by flattening out the ends then bending the flat portion of tubing up about 30 degrees, drilling a 5/16 hole and using a band clamp made for 1 3/8" fence tubing. If you can not locate these fence clamps just make the purlin 1 3/8" longer on each end, flatten as shown, Holding the flat portion under the hoop and drill 5/16 hole thru the hoop and flatten end of purlin, then bolt with 2" X 5/16 bolt.

A simple stainless steel hose clamp is used to connect all hoops to the purlin except for each end hoop, which is bolted.

However we recommend using factory purlin clamps on greenhouse especially larger 16 ft or wider houses

Corner Sway Braces

Here we have prepared the cable braces. Which are regular 1/8” steel cable from the lumberyard folded into a loop at each end and clamped wit a 1/8” cable clamp also found at the lumberyard.

Here we are using those handy 1 3/8” fence band clamps. Any chain link fence supply can order these clamps if you can’t find them. Also some success has been noted using heavy metal plumbers tape with holes punches in it. Or solid tubing braces can be used, cut the tubing to desire length flatten the ends and tech screw it to the inside of hoops at the four corners. In place of the cables

Here the cable brace has been clamped securely to the bottom of the first hoop back from each corner.

Here we are attaching cable to the end hoop at one end. Tighten the band clamp securely on the lower cable end at left and just sung up the band clamp at end hoop, leave some slack it cable for now. Install cables on opposite end same way

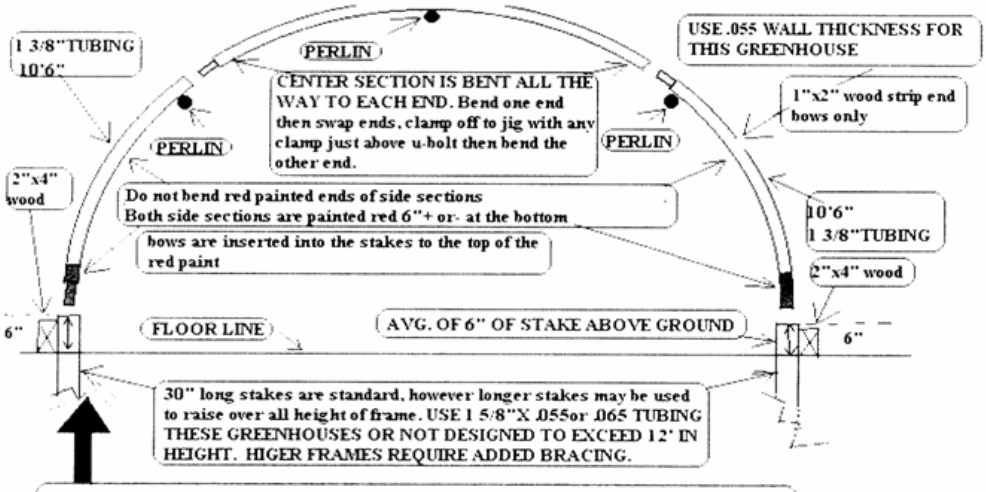
Purlin must be installed before proceeding in case you skipped that step. All four corner cables are installed and our frame is out of plumb (leaning) to the right. We have left slack in all cables. To pull the frame to the left (into a plumb position she taps the band clamp upwards until cables on this end become tight. Continue to tap both band clamps upward, this will pull the frame to the left. Watch the cables on the other end as you do this and make sure they always have slack in them. Once the frame is plumbed tap the clamps up until cable is taught on the other end. CAUTION DO NOT OVER TIGHTEN THE CABLES. You can damage the end hoops. Just get the good and snug.

Sway braces can be made from the same tubing as used in the hoops, flatten the ends and bolt them in same locations as the cable braces, You will need to plumb up the ends first.

End Wall Framing

Here are a few photo examples of end wall framing with wood
These are all from our customers using our benders and system.

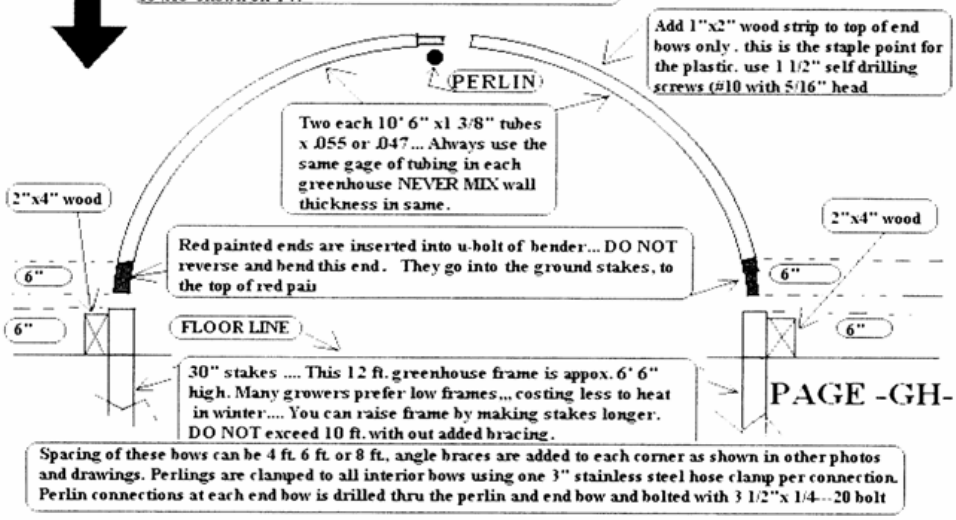
Wood framing is attached to end hoops with a number of different methods, usually simply bolted wit ¼” carriage bolts or lag screws



Basic 20 ft. coldframe/ greenhouse

Basic 10ft. and 12ft. coldframe greenhouse

NOTE 10' houses use the same lay out, except for the portable 10'x10' shown on TV.



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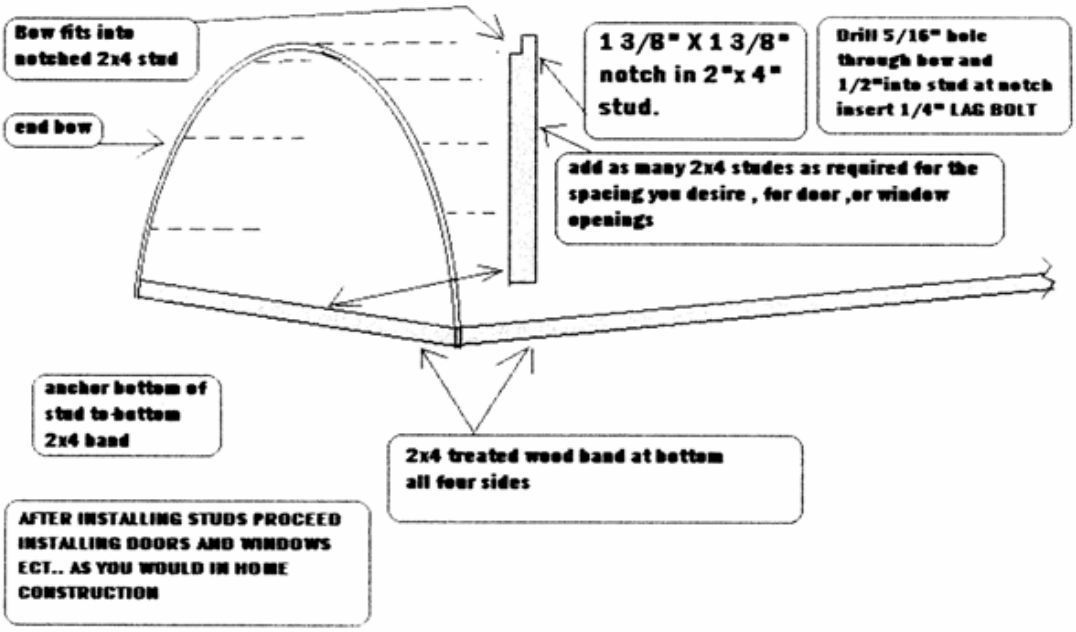
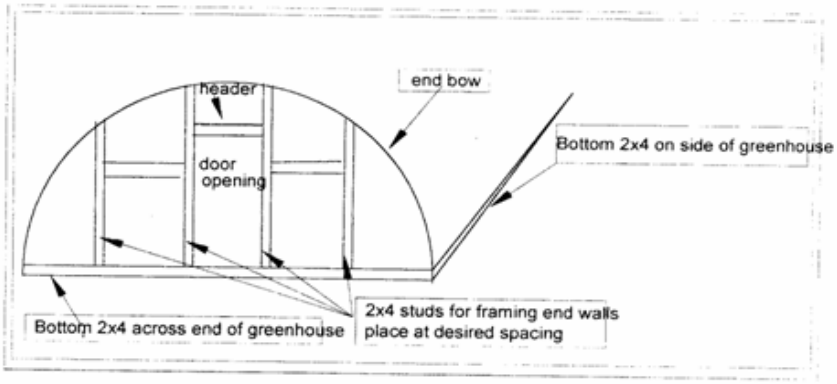
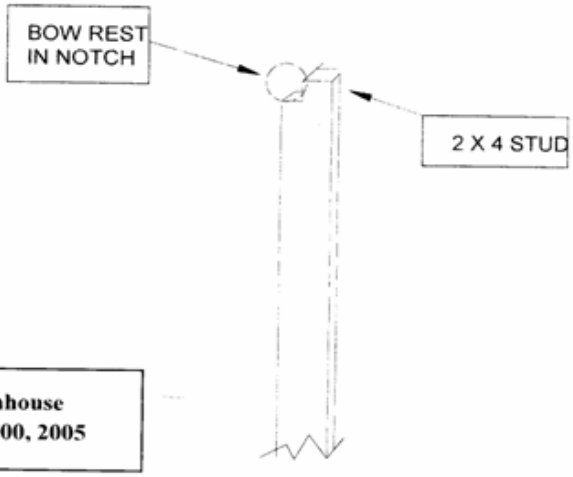
Spacing of these bows can be 4 ft. 6 ft. or 8 ft., angle braces are added to each corner as shown in other photos and drawings. Perlings are clamped to all interior bows using one 3" stainless steel hose clamp per connection. Perlin connections at each end bow is drilled thru the perlin and end bow and bolted with 3 1/2"x 1/4---20 bolt

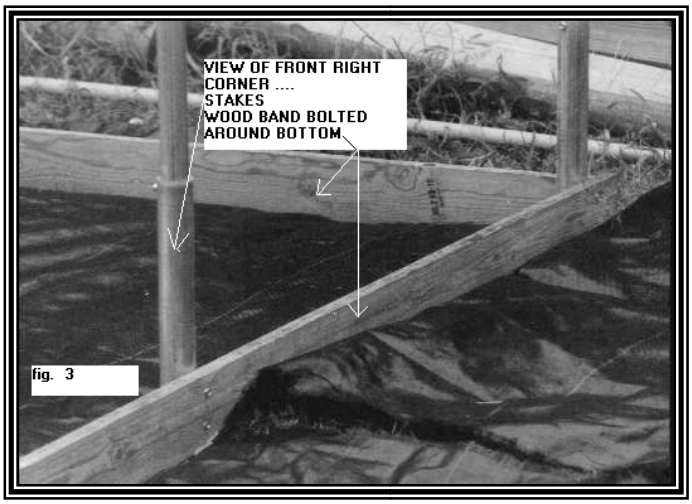






EW-1

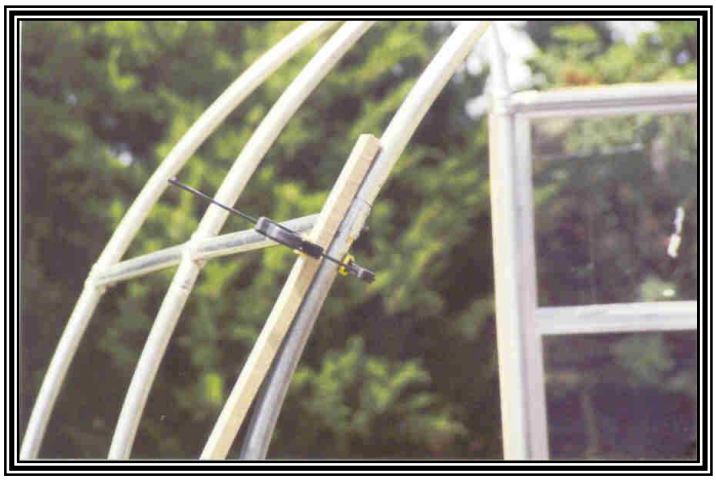
END WALL FRAMING USING TREATED WOOD



Close up of wood 2x4 band.

Clamps can be used to hold 1x2 wood strips as the are bent around the end hoops. Remember only the end hoops get the 1x2 strips. If wood is hard to bend, you can kerf the strip. This is simply cutting across the strip about 1/3 through every 1 to 2 inches.

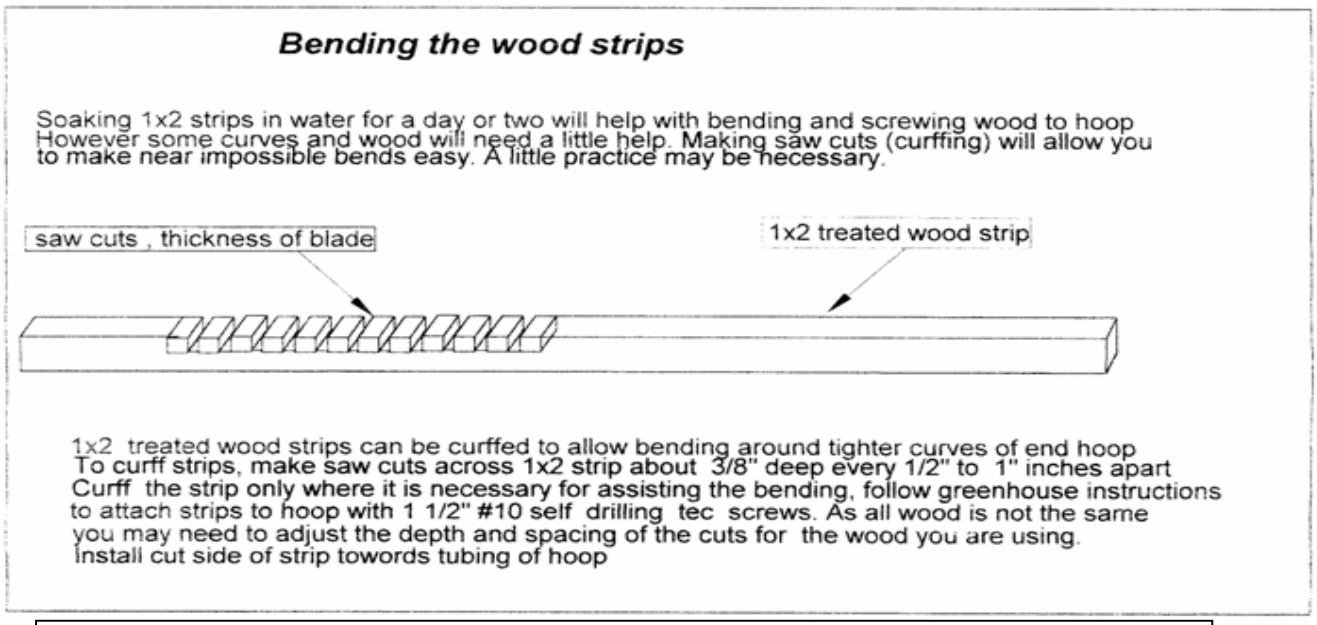
This is such a good example of GH construction I had to add it again. Note also the earth grade work inside the frame work. Slightly raised above outside grade.



Close up of bar clamp aiding installing strips. I soaked these strips in a nearby pond for several days before installing them so I did not need to kerf them.

Bending the strip all the way down to the 2x4 base board.

Kerfing Wood Strips For Easier Bending Use Only If Necessary



The kerfing spacing will vary from wood types and densities, cross cuts 1/3 of the way through about every 1 to 2 inches along the entire length when using regular treated pine 1x2 works fine. Be sure to purchase 1x2s with out knots if possible, if this is a problem purchase a 12 foot long 2x8 treated board (one with as few knots as possible then rip ¾ inch thick slices from it, to produce your own 1x2s. Many times this is better because starting with a good board you can discard any sections having knots. Be sure if you kerf the strips to kerf it from end to end at uniform spacing and depth. NOTE pre-drill holes every 12 inches through the strips before starting the self drilling screws, you only pre-drill the wood not the metal frame, if you don't the screw head will bottom out against the wood before it has a chance to drill itself into the frame. Install the kerfed cuts down onto the metal hoops attach with #10 by 1 ½"tech screws

Installing Poly Covering

This is the direct staple method which I use and prefer.

There are basically two ways to install the UV (Ultra Violet) resistant poly covering on your greenhouse. About half of the commercial greenhouses use the simple fold it and staple it method and that is the method I will describe. However there are several different channel lock methods available, the most widely use of these is the "wiggle wire" which is used by pulling the poly over a small channel which has been fasten to the wood bands then a zig zag shaped wire is worked into the channel, locking the poly securely in place. I don't use any of these channel lock methods because #1 they cost more that the wood bands, which must be installed anyway for supporting the channel, #2 While channel locks provide quick installation they tend to damage the poly for more than acceptable, "in my view".

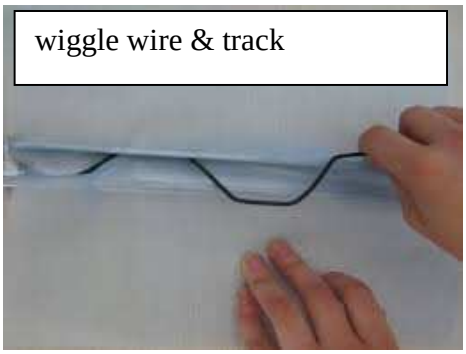
Trim off any excess poly you need about 12 inches to fold several times.

Folder about 5 times

Fold and roll the poly as you pull it snug across top of GH, then staple.

Staple every 3 inches using ½" long staples. Here we are using a hammer stapler.

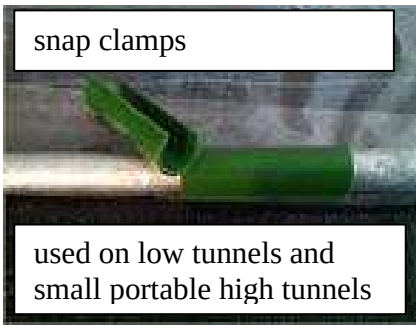
There are many different Poly Latching systems on the market from Wiggle Wire poly lock to Aluminum track lock Most all of these must be installed over the top of wood frame for strength. Snap clamps are only recommended for smaller 10x10 or 12x12 portable garden units and are not recommended for larger in ground units. For use of our plastic snap clamps on small units please refer the specific unit you are building



wiggle wire & track

1 3/8” band clamp

purlin clamp recommended for all high tunnels

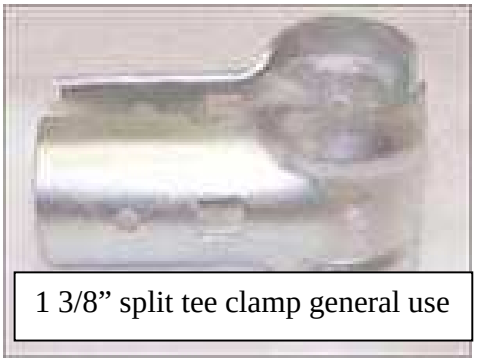


snap clamps

used on low tunnels and small portable high tunnels

welded connectors for small portable units

#10 x 5/16 x ¾ tech screws



1 3/8” split tee clamp general use

Lever Bar

Lever bar's will wear and bend and will need to be replaced from time to time depending on the hardness of the tubing being bent. This is very simple to do. Just use the desired length of new 1 3/8" OD tubing 17 to 18 gage thicknesses. It can be longer than the one shipped with this bender if desired.

Cut new lever bar the desired length, remove the short, small 1 1/8" OD pipe from the end of the old lever bar and slide it into one end of the new lever bar tube. Attach the two together with a single tec screw in the same manner as the old lever bar. Be sure to leave the smaller pipe protruding from the lever bar 3 ¼"

You can also quickly strengthen the lever bar even more by adding a short section of one inch O.D. EMT tubing (electrical metal tubing) found at any hardware stores. This should be inserted into the other end of the lever bar opposite end of the smaller short pipe.

The EMT should be recessed into the opposite end of lever bar 3 ¼"