General Installation Manual

Tel: 519-343-2335 Toll Free: 1-866-838-6729
Fax: 519-343-2399
P.O. Box #1125 Palmerston, ON N0G2P0

Even more detailed info & videos online! ➔
http://multisheltersolutions.com/our-structure-options-coverings/installation-guide/

Important notes before you get started

If there is anything you do not understand in this installation guide, do not hesitate to call before you start, this could affect your warranty.

Edited August 2023

MSS is only responsible for the replacement of any defective material. This warranty does not cover labour, freight costs, disposal expenses, improper installation, improperly maintained structures, unpaid structures, damage under “Acts of God” (violent winds/tornadoes, heavy snows, etc.), or faulty product samples not returned within 30 days.

Please note, if it is evident that you did not follow these instructions as laid out, your warranty will be void. Call us with any questions before you start.

You have 30 days to report shortages or the order is considered complete If there are any parts with damage, they must be reported before assembly.

MSS endeavours to check our products before delivery; however, customers are encouraged to inspect their products as soon as possible as most manufacturing flaws are evident immediately.

There are no special tools required for assembly. Drills (either corded or cordless) should run between 1000 and 1500 r.p.m. A movable platform or scaffold equal to 75% of the peak height is suggested for safety considerations and convenience of working

PLEASE NOTE: Any italicized words in this document are words that are listed in the glossary.

We don’t sell you a shelter…We help you buy one!

40 Years of Creativity & Experience Behind Every Structure

As Canadian weather becomes more unpredictable our shelters get upgraded to stand the test!

The ridge is galvanized after being factory welded with heavy duty U-channel stubs

Peaked buildings for maximum snow and condensation shedding

Purlin clips to attach spacers & braces, Horizontally drilled holes minimize weak spots

Wirelock with stainless steel spring Inserts, included with each structure to hold the roof & end cover

Structures 8' - 19' tall

Rib Spacing Options 2' 3' 4'

Structures 10' - 35' wide Any Length Is Possible

Rectangular hoops are 30% stronger than the equivalent weight round steel

Base brackets to fasten the building to a beam, curb or wall

Roll up sides for natural ventilation and condensation reduction

We do not bend anything before we get an order!

5 Covers to Choose From			
Material	Colour	Thickness	Lifespan
Tarp	White	12mil	8-10 yrs
Tarp	Green	12mil	5-6 yrs
Plastic	Clear	7.2 mil	6-7 yrs
Plastic	White	7.2 mil	4-5 yrs
Plastic	Double	7.2 mil x 2	6-8 yrs

Specific numbers for profile heights are on our brochures and on our web site. Some minor additional upgrades may be required by local building requirements.

Installation Guide Included With Each Order

Nominal fee for delivery

Multi Shelter Solutions

Unique Solutions for your Unique Uses

MultiShelterSolutions.com

1-866-838-6729

multisheltersales@gmail.com

If you are reading this and haven't purchased a structure, here are some points to consider

1. Pick a Location: Your building must be level from side to side. If you can't excavate, we can design a variation. End to end slope is ok but if it is more than 1%, we need to know. If you are butting against a building, there may need to be some extra *hoops* in the first 12' of length. Building behind something does not provide shelter. You actually increase wind turbulence.

2. Pick a width: Most of our standard widths can easily be modified if it needs to be specific. The widest we do with engineered drawings is 30' but have supplied up to 36' wide.

3. Pick a length: Any length is possible; simply by adding *hoops* If you are building between 2 fixed points, the last *hoop* spacing can be modified to fit the spot.

4. Pick a height: We have 7 lengths of steel to pick from and do not bend anything until we get an order. Building higher will improve the snow-shedding characteristics of the building. Building higher gives more interior space close to the wall but the structure catches more wind. Since building higher catches more wind, the structure may require reduced *hoop* spacing. Building higher will be a little more costly to heat but does improve natural air circulation. Building lower will decrease snow shedding and may require closer *hoop* spacing.

5. Pick a base or foundation: The standard package comes with *Base Brackets* under each *hoop* to secure the building to a beam. This beam can be ground-mounted or on blocks, posts, slabs or shipping containers. We can supply a welded steel base rail if the structure needs to be movable. We can supply *Anchor Posts.* Each *hoop* would sit on a post that may need to be set into concrete. Please remember that there simply is no such thing as too many anchors.

6. Pick a cover: The standard covers we offer are 12 mil *tarp* (white or green) and 7.2mil (white or clear) *plastic*. White *tarp* has a typical 8-10 year life and gives summer shade and winter light. 7.2mil clear *plastic* must be used for plants. The typical life span is 5-6 years. 7.2mil white *plastic* is used where shade is important but still needs light. Typical life is 4-6 years. Doubling up on *plastic* reduces heat loss by 30%, minimizes condensation and increases life span by 50%

7. Determine ventilation: *Roll-up sides* are an economical add-on to our greenhouses or livestock shelters to provide natural ventilation. Roll-up sides are more effective when combined with end wall openings near the peak. Roof vents and exhaust fans are available options.

8. Building ends: Our package prices include covers for both ends. The installation manual gives pointers on framing Ends We can supply steel frame ends, with or without a variety of sizes and types of doors.

Table of Contents

***Check marked contents apply to your structure and titles will be highlighted throughout the booklet**

Instruction Overview

The following is an overview of the assembly process. It **must be used in conjunction with this entire manual. Location of additional info is shown. IT IS NOT A STAND ALONE RESOURCE!**

Safety is Job #1. Make sure you have the required tools and that they are in good working order! If there is something you do not understand, **please call BEFORE you alter anything**.

If it does not fit easily, in most cases there may be a simple solution. **Altering the structure without calling voids the warranty**.

1. The site you pick for your shelter **MUST** be side to side level and well drained. Moderate slope on the length is acceptable. Replacing topsoil with gravel in a non-growing application will increase drainage and minimize weeds. Building in line with the prevailing wind will create less wind action and stress on the building.

2. The base or anchoring system needs to be installed first. Please remember that our suggestions are based on years of experience but ultimately it is your responsibility to meet local requirements and/or building code requirements. There is no such thing as “too well anchored” and any extra time spent at this point is well spent.

3. Your anchoring choices are a beam with base brackets, MSS supplied *anchor posts* or wooden posts with a sill plate. The post or bracket spacing will be equal to the hoop spacing. It is critical that you understand and implement the correct procedure. (pg.13 or 16)

4. One of your *ridge* sections will have stubs at both ends. This is your starter. The person on the scaffold will hold this at the approx.-imate required height. The person on the ground will slide the top end of the *hoop* over the *ridge stub* and the bottom end over the base bracket or *anchor post*. Fasten each *hoop* to the *ridge* as you go. File down any ridge burrs and install ridge connectors before placing the ridge into position. (see pg.20 & 23)

5. Before continuing on the other *ridge* pieces the *purlins* should be attached and then the structure secured in a vertical position with two guide ropes **[Critical].** (see pg.23)

6. When the complete structure is standing, ensure the building is straight, (not leaning) secure all of the base fasteners and *purlins*. Attach all the wind bracing. (see pg.27)

7. If your building has been supplied with *roll up sidewalls*, add the framing member for the top of the roll-up now. (see pg. 42 & 43)

8. Install the *wirelock* track to the top side of the first and last *hoop*. It is best to start at the bottom and then kink it as you cross the crown. Install the cover fastener along the base as well (see pg.46-47)

9. Frame the end walls as required. Attach the cover and cut the required opening(s). It is preferable to finish the ends before putting the roof on. Please note that the end tarp goes under the wirelock channel and plastic goes into the channel. (see pg. 53)

10. If this is the first time you are covering this type of structure, **preparation is everything**! Whenever possible, roll out the cover along the side of the structure and pull it over the top from the side. Once the cover is centred pull it tight from end to end and secure it. Work from the centre of the end *hoops* toward the bottom corners. (see pg. 31-plastic or 37-tarp)

If your building has a double cover, make sure that the bottom layer has been temporarily secured at the side before pulling over the second layer. The bottom layer should be tight while the top layer should just be snug. When the cover(s) are on, fasten all the *roll-up side* wall hardware, and then lastly install the *inflator fan*.

Please ensure you use this in conjunction with the complete installation manual, photo supplement and online videos to ensure the most success for your structure installation.

As there are so many variations in our structures, we recommend you discuss your installation with a staff member if there is anything unclear or you are not sure how to alter the instructions for your specific application.

Ask BEFORE you build to avoid cancelling your warranty or running into irreversible errors.

GLOSSARY

If there is anything you do not understand, please do not hesitate to call before you start.
PLEASE NOTE: Any italicized words in this document are words that are listed in the glossary.

Anchor Post: a steel tube which is pounded into the ground to directly anchor the building. The top part is partially flattened to fit inside the hoop. (see photo 1)

Base Bracket: is a formed strip of steel that uses lag bolts to secure it to the base beam. The hoop slides over top for fastening and stability. (see photo 2)

Carriage Bolt: a bolt with a domed or round head and square shoulder

Cathedral: a shape of structure installed with the long straight side down to allow greater height when less floor space is required

Cross-tie: It is the same material as a wind brace except longer and installed horizontally. It is used to tie the left and right side of the structure together for strength and stability.

Gothic: a shape of the structure that is rounded at the base, and goes up to a peak.

Hoop: also called arch or rib, is the curved piece of rectangular tubing making up the primary framework or skeleton of the structure, either 1”x2” or 1”x3”

Inflator Fan: a small squirrel cage fan that blows continuously to maintain an air space between 2 layers of plastic (see photo 3)

Lag Bolt: a "hex" headed wood screw used when attaching a *base bracket* to wood

Pipe strap: a steel bracket fitting around the hoop used to attach wood or steel beams to the structure. A lighter & wider version of the *base bracket* (photo 1)

Plastic: is a covering for structures which can be done in a single or double layer. MSS standard is 7.2 mil and can come in either white or clear.

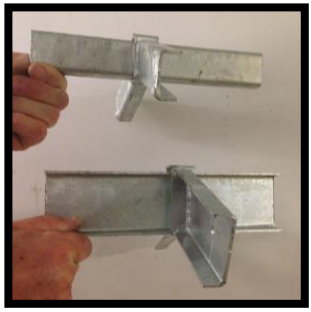
Purlin: horizontal bar (shorter than a wind brace) used for spacing and structural support between the hoops. Both ends are flattened and have a hole.

Purlin Clip: a "U" shaped bracket to attach purlins or wind braces to the hoop (photo 4)

Ridge: or spine of the structure with factory welded stubs that are used to secure the top end of the hoop.

Ridge Connector: 8" piece of "U" channel used to join 2 sections of ridge

Ridge Cross/Starter: a piece of the ridge with a pair of stubs at each end, comes preinstalled into the first ridge piece (see photo 5) Typically used to connect the first two ridges



Ridge Stub: an angle cut u-channel which is welded to the ridge steel tube. It goes into the top end of the hoop. (diagonal pieces on photo 5)

Roll up sidewall: a mechanism to allow the full-length cover of the structure to be opened up. Usually, both sides have the capacity for roll-up (see photo 6)

Sill Plate: usually a double 2x6 or 2x8 placed on top of the posts, it bridges the gap between the posts or ties the base beams together. In the case of a railroad tie, it also gives consistency to the top surface to allow level construction of the building

Speed Screw: a hex head screw that drills and taps its own hole (#14 is heavier than #12)

Tarp: is a woven form of plastic which has much greater tear resistance. MSS standard is 12mil and can comes in white only.

Wind Brace: similar tube to a purlin (although longer) and installed diagonally at each corner of the structure. The quantity per corner depends on the structure.

Wirelock Channel: an aluminum channel generally installed on the first and last hoop where the cover is inserted. It can also be used at the top and/or bottom of roll-up. (see photo 7, left)

Wirelock Insert: the "zip-zag" stainless, heat-treated steel wire used in the wirelock channel to hold the covering in place (see photo 7, right)

We will mention again, that if there is anything you do not understand as you go through this manual, please a make note and call or email the office BEFORE you start to build.

If questions come up as you're building, please contact us as soon as you can, to avoid having something go wrong with the installation that could have been prevented, and may void the warranty

Please read over the complete instructions BEFORE starting installation.

A photo "slideshow" is included at the end of the installation manual and is meant to be used **IN CONJUNCTION** with the rest of the manual and NOT to be used as a substitution.

WINTER CARE: Snow & Wind Load

Our structures are designed in a *gothic* shape with a slippery cover to be lightweight and snow resistant. This encourages the snow to slide off quickly. **This is not an industrial high snow load building.** We do our best to always point out applications where the capacity of the structure is being compromised. Extra *hoops* are an economical way to increase wind and snow load capacity.

We take pride in the sturdy shelters we manufacture and supply, but must point out that we cannot warranty against all weather conditions. Snow removal, when occasionally required, is a simple task. Uneven snow loading is deceiving since the total weight is not a problem but the lateral force can cause the *hoops* to distort.

It is rare to have any significant snow build-up on the roofs; however, unless you have built your structure with 2' or 3' *hoop* spacing, you must have provision for snow removal in certain situations.

DO NOT GO INSIDE A BUILDING WHERE THERE HAS BEEN OBVIOUS STRESS!

Be aware of these scenarios where excessive snow build-up is possible and damage could follow:

- A wet snowfall followed by dropping temperatures
- A building 90° to the prevailing wind (drifts could form on the backside of the building)
- A building attached to and situated downwind of a taller building (significant drifting)
- A building 90° to another building that has a higher roof, could cause a surge in snow weight when the snow on the upper roof slides off

Preventative measures for excessive snow build-up (where possible):

- Build structures in line with the prevailing wind
- Build structures level from side to side to create uniform shedding
- Do not attach your building to a larger existing building
- Install a heat source to melt the snow

Economical additions to increase your structure's snow resistance:

- Install cable or tubular *cross-ties* at each pair of *hoops*, to create a triangle (when using cables there is no need to put them under tension)
- Place wooden or metal support posts under the *ridge*. These can be suspended from the *ridge* with no more than ½" ground clearance. This will provide support as soon as there is a load and structure movement will not dislodge your supports.
- Use closer *hoop* spacing for the first 12' section away from another bigger building

Pointers for removing snow:

- NEVER remove all the snow from one side and then the other
- Remove the snow off the top of your building before using a machine (snow blower, etc.) along the sides
- Use a padded piece of 1x4 wood on a pole (create a "T" shape) as the best tool for **gently bumping** the inside of the cover. Watch our video on this to educate yourself on the process.

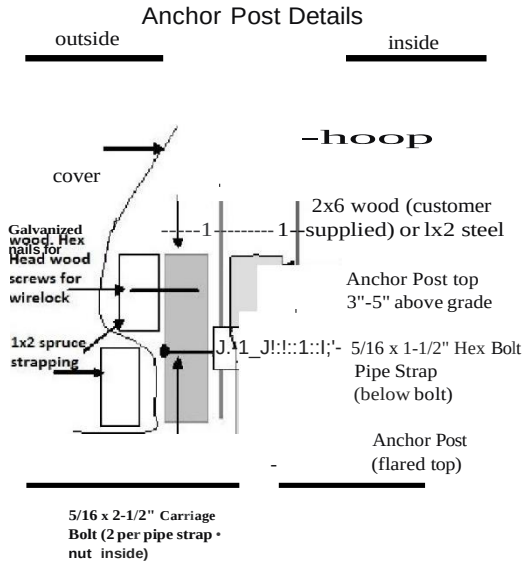
BEWARE of this sequence which creates a "worst-case scenario": Freezing rain, followed by dropping temperatures, followed by a lot of snow followed by rainfall. It is easy to triple the weight of the snow load in 30 minutes.

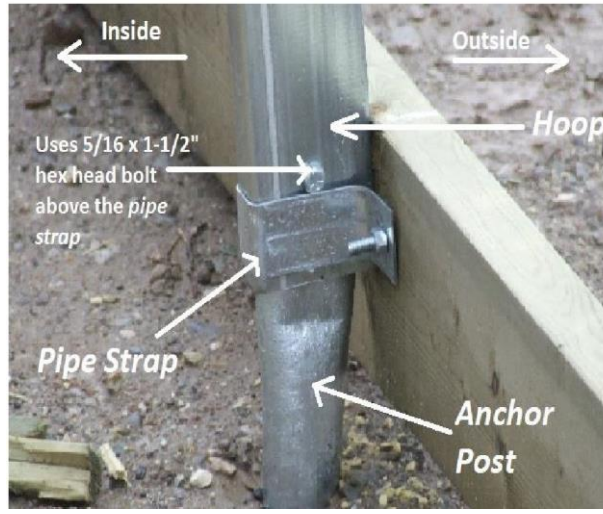
Anchor Posts

Anchor Posts* are NOT used in combination with *Base Brackets

****A word of caution**…recommendations made for anchoring are based on years of experience. Ultimately the customer is responsible to properly anchor a structure. **

***Anchor Posts* MUST BE SET into concrete when:**
• the soil has been recently excavated (within the last five years)
• it is required by the building code (use of concrete usually classifies the building as permanent)
• extremely windy and exposed areas exist (at least use on the corner posts)
• more than 10% of the *anchor post* will be out of the ground (upgrading the *anchor post* size may be needed)
• there are areas where erosion has been a problem in the past
***Anchor Posts* SHOULD NOT be used when:**
• the soil is a very heavy clay (heaving would be a constant problem)
• there is a shallow rock layer
• there are major amounts of rocks interfering with the accuracy of the *anchor post* setting
• the structure will be moved shortly (*anchor posts* must be cleaned out before reusing)
USE *BASE BRACKETS* INSTEAD IN THE ABOVE CASES


Anchor Post Details
outside
inside
-hoop
cover
2x6 wood (customer supplied) or lx2 steel
Galvanized wood, Hex nails for Head wood screws for wirelock
1x2 spruce strapping
Anchor Post top 3"-5" above grade
5/16 x 1-1/2" Hex Bolt
Pipe Strap (below bolt)
Anchor Post (flared top)
5/16 x 2-1/2" Carriage Bolt (2 per pipe strap • nut inside)


Inside
Outside
Hoop
Uses 5/16 x 1-1/2" hex head bolt above the pipe strap
Pipe Strap
Anchor Post

Setting Anchor Posts

1. Level the side to a side area where your structure is to be erected. (A small end-to-end slope is acceptable).
2. Lay the *ridge* along your string line for a quick and accurate way of marking the post spacing. (the spacing of the *posts* will be the same as the spacing of the *stubs* on the *ridge*)
3. Use the supplied post pounder/cap to protect the *anchor post* tops from the blows of the sledgehammer. *Anchor posts* can also be pushed in with the bucket of a tractor. You must still provide protection for the top of the post.
4. ***Anchor posts* will rotate as they are pounded down, this can be easily straightened with a pipe wrench (holes should face down the line). It is best to rotate them to the correct spot with about 2" to go. Then finish the job.**
5. The post top should be 3"-5" above grade.
6. If installing a 2x6 wood baseboard use *pipe straps* installed below bolt connection to the *hoop*.
7. **Having the holes of the *anchor posts* on a flat plane is CRITICAL to the straight construction of your building.**

Dealing with Damaged Anchor Posts

If a *post* top becomes burred or bends a bit, simply hit them between two hammers to bring the width down to ¾" again. If the top of the *post* is not salvageable you can cut ½" to 1" off the top without further consequence.

If you encounter a large rock, you can cut a *post* back ONLY IF there are no more than 1 or 2 per side, if it is not one of the first 3 from the end AND you are not cutting more than 1/3 off the post. Bolting the post to the side of the hoop is an option.

If you cannot conform to these criteria, give us a call for "plan B". If an *anchor post* is deflected off the intended direction, it can be bent to direct it closer to its intended location.

Base Brackets

Base Brackets* are NOT used in combination with *Anchor Posts

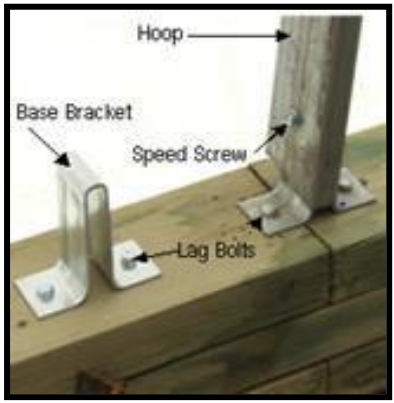
Although the building can be anchored directly into the ground, (see the option: *anchor posts*) it can sit on a slab, curb or beam or it can be elevated on some sort of a wall. *Base brackets* with *lag bolts* are supplied to fasten the building to the chosen form of foundation.

.

Please see the video online "How to Install Anchoring to the Base Beam" for further instructions

A word of caution…recommendations made for anchoring are based on years of experience. Ultimately the customer is responsible to properly anchor a structure

- The outside to outside measurement of the wall or beam should be slightly greater than the width of the building. (+3" for 1x2 *hoops* and +5" for 1x3 *hoops)*
- If the center of the *base bracket* is more than 2" from the edge, there will be a ledge where there is the potential for damage to the cover as the building is shedding snow or ice.
- The overall length of the beam or wall should also be an extra 4" unless you plan to have a solid end covering.



Base Beam

By using 3 layers of 2x6 rather than a 6x6 beam (as seen in the pic), you can create a continuous laminating effect by offsetting the layers. By trimming 1" off of the middle board, you get 2x6, 2x5, and 2x6. This creates a "pocket" where the side of the cover can be secured.

There simply is no such thing as too many anchors.

Anchoring the Beam

- With the exception of the large concrete blocks, the base needs to be anchored to prevent lateral shifting and/or uplift.
- Spiral earth anchors or T-bars can be used to anchor beams (usually 2 per pair of *hoops*). Leaning these in an alternating pattern creates extra holding capacity. When t-posts can not be 48" long, the quantity per side needs to be increased.
- **Anchors MUST be to the inside of the beam**. In case of multiple beams (stacked) the anchor must be attached to at least two layers. **Rebar through the beams does not have sufficient holding power.**
- The AVERAGE spacing of your anchors should never be more than 4' unless you are in a forest. Towards the corners, the anchors are usually closer to each other and along the middle, they can be slightly further apart.
- **There must be a minimum of 2 fasteners per post.**

Setting Wall Posts

Putting some concrete into the bottom of the hole significantly adds to the holding capacity. Posts should always be set below the frost line and have at least as much length below the surface as above.

- When auguring holes to set posts, extreme care should be exercised to pack the soil around the posts firmly.
- Spacing the posts further apart usually does not save any time or money since larger posts are required plus there is a greater need for concrete) and a heavier *sill plate* will be required.
- There should be a horizontal board on the outside of the posts just below grade. This will give extra protection against posts leaning outward.

Sill Plate

The *sill plate* bridges the gap between the posts or ties base beams together. In the case of a railroad tie, it also gives consistency to the top surface to allow for level construction of the building. If the *sill plate* is capping something else (i.e. beam) then a 2x4 is sufficient. A 2x6 *sill plate* between posts is sufficient unless the post spacing is more than 4'. Unless you are building on a beam you should add a 2x4 on the edge as a place to fasten the cover. The joints should always be offset to create extra strength.

Base Bracket placement

Place 2 parallel runs of the *base brackets* on the beam or wall. The center to center spacing between these lines is equal to the width of your building. The inline spacing is equal to the specified *hoop* spacing of the building you purchased. Each *bracket* is secured with 2 *lag bolts* which MUST be in line with the length of the building.

Corner Base Brackets

The ideal length of the base beam or sill is 1" more than the stated length of your building. Modify the 4 corner brackets as per the photo below so that each of these will have 1 vertical lag bolt & 1 horizontal lag bolt. Turn the bracket on the side and flatten with a hammer. There is also a short video on our website "Modifying corner base brackets" for additional direction
If your sill or beam is longer, none of the brackets need to be modified.

pound t-bar anchors in at diagonal intervals

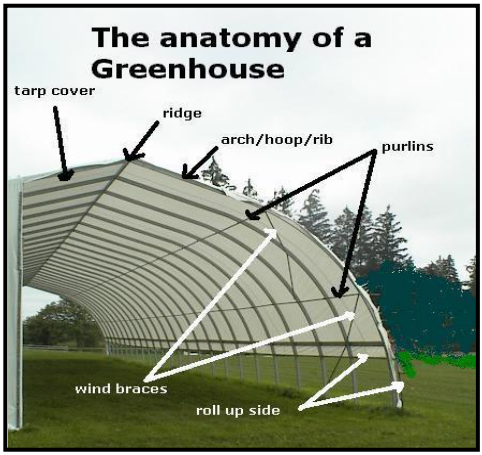
Ridge

Please note that quantities of pieces and stub spacing will vary from order to order.

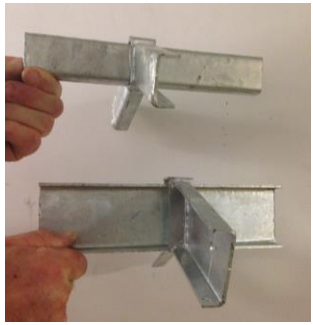
The *ridge* is the very top part (the spine) of your structure. *Stubs* are welded on every 2, 3, 4 or 6 feet according to the requirements of your **particular structure. It is onto these** *stubs* that the *hoops* will be fastened.

A few points about the *Ridge*:
It is mandatory that you report any ridge damage before starting the assembly

- Always check the top of the *ridge* for galvanizing burrs or rough edges and grind off if necessary.
- Hairline cracks in the galvanizing are surface only and no cause for concern.
- The *ridge* section with a pair of *stubs* at both ends is your *ridge cross or starter*. **The connected piece of your *starter* NEVER goes on the end.** It faces inward and connects to the open end of the next *ridge* section (see drawing and photo 4)
- For 1x2 hoops use a #14 3/4 *speed screw*. For 1x3 hoops use a hex bolt with lock nut.
- It is a good idea to reem out the holes of the 1x3 *ridge* while it is still on the ground since there may be some galvanizing slag.

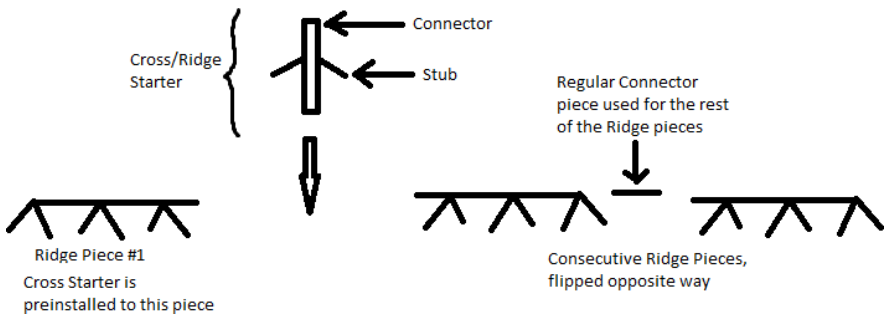


Ridge Cross/Starter



This is a piece that is supplied by MSS, **usually preinstalled**, into the first *ridge*. This *ridge* is flipped around to connect with the rest of the line of ridge pieces you will be installing.

The diagram below depicts 4’ spacing only. If you have 3’ *hoop* spacing, you will have 4 pairs of *stubs* per *ridge*; 2’ spacing has 6 pairs of *stubs* per *ridge*, and 6’ spacing has 2 pairs of *stubs* per *ridge*. Also, please note, that larger structures will have ridges in the line for connecting. If your structure is not a multiple of 12’ your starter *ridge* section will be shorter and may not have the “standard” number of *stubs* as mentioned above.



The *ridge cross/starter* is always used to join the first and second lengths of the *ridge* together. Four 14-speed *speed screws* on either side of the connection, from the bottom are used.

Ridge Joiners

When the structure is more than 24’ long there will be one *ridge connector* for each additional 12’ length of *ridge*. This connector is a 10” long galvanized piece of U-channel (same dimension as the *ridge stubs*). These connectors will be secured from the underside with four 14-speed *screws* (2 on each side of the joint).
The ridge joints may not line up perfectly and should be wrapped with duct tape to prevent cover damage since seldom is the connection perfect.
It is usually simple to secure the connector to the leading edge of the *ridge* while it is still on the ground.

Hoops

Be aware of safety and use a scaffold for putting up the larger structures, especially when building the unit on a wall.

CRITICAL NOTE:

<u>When the FIRST SECTION of the *ridge* is complete, secure with 2 guide ropes so that everything stands vertical</u>.

The guide ropes must go both ways as an inverted V and secured with some sort of anchoring post.
If you do not plumb the building NOW, it will be much more difficult later.

The curved part of the *hoop* is usually the bottom; the straight part is the top**.** For structures that have been supplied as a *cathedral* unit (for RV, boats, etc.) the curved part goes up and the long straight part goes down.

Always put *hoops* up in pairs for better balance and stability.
When you have 4 hoops installed (2 pairs) it is critical to secure the ridge with an inverted V rope in opposite directions to stabilize the ridge from the wind

For the remaining *ridge* sections:

1. Always secure to the *connector* of the next *ridge* first
2. When the next ridge is in place, secure the last pair of *hoops* first and then do the intermediate *hoops*.
3. Sometimes the end of the *hoop* has a dimple, this can be removed with pliers or the claw of a hammer.

1 x 2 Hoops with *Base Brackets*

- hold the *ridge* at the appropriate height, the short scaffold is best, but 2 step ladders will also work
- slide the top of the *hoop* over the *ridge stub* and secure with a #14-speed *screw*
- slide the bottom of the *hoop* over the *base bracket* and secure with a #14-speed *screw*

1 x 2 with *Anchor Posts*

- Always fasten the bottom first and then insert it over the *ridge stub*.
- The top of a 1 x 2 *hoop* is secured with a #14-speed *screw*.

When your building has 1 x 3 ribs

1. **Always bolt the top first**.
2. The person on the ground can move the *hoop* so that the top-hole lines up.
3. The *base bracket* or *anchor post* is done second.

Hoops for a Lean-to

- set your base beam and secure your *base brackets* to the beam at the required spacing
- attach header (2x4 or 2x6) to the wall at the predetermined height
- attach wall brackets to header slide top end of *hoop* over the top bracket and the at the end of the *hoop* on bottom bracket
- Tighten the top bracket bolts to the wall, AFTER the top of the hoop is secured to the bracket.

Purlins

Purlins are the horizontal spacers in between the *hoops* used to maintain rigidity in the structure. They are usually 1 ¼" round with both ends flattened. Be sure that the structure is standing perfectly vertical before attaching the *purlins*
(use level to determine if the building is leaning)

The holes drilled in each end are spaced at the same spacing as the *hoop* spacing. The tabs with the holes of 2 *purlins* **overlap** and are bolted to the **underside** of the *hoop* (structure). If they are installed on the **outside**, they will prevent snow from sliding off and also create drip lines.

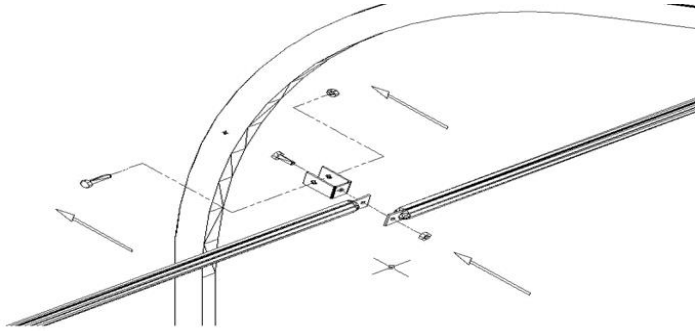
- **Before you can attach the *purlins,*** you must insert the 1" *carriage bolt* into the center hole of the *Purlin Clip* (1-1/2" C. bolt if there will be a *cross-tie*). The square shoulder of the C. bolt should nest squarely in the square hole of the bracket. This prevents the bolt from turning when you are installing the locknuts.
- **Then attach all the *purlin clips* to the *hoops*** with the 1-1/2" Hex Bolt and locknuts.
- **If your structure has 2 rows of *purlins* and** *cross-ties***, do not tighten the upper *purlin clip* at this time. You may need some wiggle room to make the *cross-tie* fit**

Notes: The smaller structures have 1 run of *purlins* per side and the larger structures have 2 runs per side. One run of *purlins* is sometimes eliminated if you are using *roll-up sides*.

Long *cross-ties* or *cross-ties* in heavy load areas will require mid support and lateral bracing.

Keep in mind that adding a *cross-tie* decreases the usable height of your building, usually by 24-36 inches but adds significantly to snow load capacity and wind rigidity.

If your building has *cross-ties* which are installed on the *purlin clip*, leave the *purlin clip* loose so that you will have a little more "wiggle" room for installing the *cross-ties* later. (see diagram below)



Wind Bracing

***Wind braces* look like *purlins* except they are about 50% longer.**

They are installed diagonally in all four corners AFTER the *purlins* have been secured. Please see how-to video online for further clarification

A note about the length of the *wind braces*

You will not likely end up perfectly at the base or the next row of *purlins* (in the case of multiple rows of *purlins*). You can cut and re-flatten the *brace* if it is too long. It is equally OK to fasten it near the base or *purlin* if the last *brace* is a bit too short. It is acceptable to secure the bottom end of the last *brace* to the base, rather than the *hoop* if this fits better

The quantity of *braces* depends on the structure size and certain construction details. Usually, the small structures have 1 per corner, mid-sizes have 2 per corner and larger structures have 3 or 4 per corner.

Purlins per side	Rib spacing	W.B. per corner
1	3’	3 x 49”
1	4’	2 x 66”
2	3’	6 x 49”
2	4’	4 x 66”

When building on a wall or in a very windy location, it may be advisable to double up on the *braces*. Structures with 3’ *hoop* spacing will have more, shorter *braces*.

- **The starting point for each row of *braces* is the connection point of the *purlin* to the last *hoop*.**
- **Each brace will aim down to the next *hoop* at approximately 45 degrees**
- **If you have 2 or 3 rows of *purlins*, you repeat the process for EACH row.**

Please note: There is no precise ending point for the wind braces. Some end on a hoop and others end at the base.

#1 – Take the lock nut off the 1” C. bolt and put it the on end of the *brace* on this bolt and replace the nut, loosely.

#2 – Secure a *purlin clip* on the other side of the *brace* with a 1” C. bolt and aim it down to the next *hoop*. Wherever it slips over the *hoop* is where you install the *purlin clip*. Drill the rib and insert a 1 ½” hex head bolt through the *hoop*. You will need a vice grip to slightly twist the end of the *brace* to make it sit flatter to the *purlin clip*.

Repeat #1 and #2 for each *brace* to complete the line of *braces*.

Repeat this process for each diagonal line of *purlins* in all four corners.

Unless your building is PERFECTLY level with the *hoops* PERFECTLY square, the *braces* will look different at the two ends (this is acceptable).

If your building has 2’ *hoop* spacing, you will be attaching to alternate *hoops*… i.e., cross over and attach to the next *hoop*.

You may also need to slightly twist the bottom tab of the *wind brace* with a vice grip to get it to sit flat. This is normal.

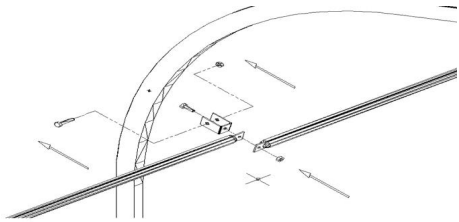
<<< 1 row

2 rows >>>

Cross-ties

Cross-ties are an inexpensive way to reinforce your structure, typically increasing the snow/wind load by 5 pounds per sq. ft. They are made from the same material as the *purlins* and *wind braces* and, depending on the width of the structure, are between 10 and 14 feet long. In cases where the *cross-ties* are not included in the package, they are available as add-ons.

They are installed under the *ridge* and span across the width of the structure from *hoop* to *hoop*. If your structure has two rows of *purlins* the *cross-ties* are fastened at the top *purlin* sharing the *purlin clip*. If your structure has one row of *purlins*, there will need to be a hole drilled above that row at the height at which the *cross-tie* is to be installed.



If your building has *cross-ties* which are installed on the *purlin clip*, leave the *purlin clip* loose so that you will have a little more "wiggle" room for installing the *cross-tie* later.

Long *cross-ties* or *cross-tie*s in heavy load areas will require mid support and lateral bracing.

Keep in mind that adding a *cross-tie* decreases the usable height of your building, usually by 24-36 inches.

When attaching the *purlins,* you must first insert a 1-1/2" C bolt into the center of the *purlin clip*. The size of the bolt is slightly longer than normal when you have *cross-ties* for your structure.

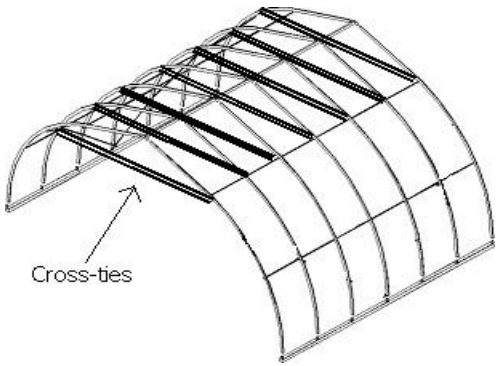
If a structure has two rows of *purlins*, the *cross-ties* will be attached at the upper row to the same bolt as the *purlins*. Make sure the *purlin* C. bolt is 1-1/4" long. You can leave the lock nut on and simply add another nut over the *cross-tie*.

If you do not have two rows of *purlins*, your *cross-ties* are much shorter and you will need to drill holes to secure the *purlin clips*.

You will need to **slightly** bend the *purlin clip* tabs down to match the angle of the bolt. **Be careful not to overbend!**

When there is a two-part *cross-tie*, there will be a threaded rod which is both the center support and the joiner. The threaded rod is suspended from the *ridge* on a *purlin clip* (double nutted). The *purlin clip* is secured to the *ridge* with two *speed screws*. There is also a nut above and below where the two parts of the *cross-tie* overlap.

***Cross-ties* are not normally supplied for the two end pairs of *hoops* since this would interfere with the end framing. They are strongly recommended to be purchased if your building is open-ended.**



Plastic Roof Covering *(In Preparation)*

Please see the how-to videos online for further clarification

Regardless of which covering will be installed on your building, the success or failure of the job, and your safety, will often be determined by the preparation and understanding of the task ahead.

The following is a checklist BEFORE you actually roll out your cover.

√ The top edge of your *ridge* should have been checked for roughness when you were installing it. Make sure these have been filed down.

√ If your building is longer than 12' the *ridge* will have one (or more) *connectors*. These should be wrapped with duct tape.

√ If your *wirelock channel* was not installed continuously over the crest, this edge should also be covered with duct tape.

√ If your building includes *roll-up sidewalls*, the mechanism for securing the cover at the top of the *roll-up* should be complete before proceeding. (It can be done later, but is significantly more complicated).

√ You will require a ladder (or another elevating device) for comfortably reaching the peak at BOTH ends of your building as well as 2 thin ropes that are a minimum length of ¾ of your cover width (to assist in pulling the cover over).

√ Your covering fasteners for the sides should be distributed along the sides (tucked against the building so as not to get in the way). If you are using spruce strapping, it saves time if you put all the screws in first. **Pre-drilling, as well as setting screws and washers will save the wood from splitting.**

√ Walk along the side of the building where you will unroll your cover. **Check for and eliminate sharp objects** (broken off weeds are especially bad). If an object can't be removed, the edges should be covered. If there is absolutely NO room to roll out the covering along with the building, give us a call to discuss "Plan B".

√ Four (or more) people to install the cover are advisable if you have never done this before. It can be done with 2 or 3 but remember, the **slower the job goes the more chance there is of the wind picking up**. A couple of extra people during the initial pulling over and squaring is helpful. These extra people can leave once the cover is tacked in place.

√ The effect of wind, even a breeze, will be magnified by the size of your cover. **You will be looking at this cover for a long time, wait an extra day if necessary.** Early morning or late evening is usually the best time of day.

√ **If your ends are covered in *plastic*, it is definitely easier to do the ends before the roof cover goes on. This is because the end *plastic* normally goes UNDER the roof *plastic*. At the very least it is recommended to have the end wall framing in place before the roof cover goes on.**

End tarp cover MUST go on first. It goes under the wirelock channel.

√ If you have a longer building and your cover has come on a cardboard core, make sure you have a pipe to unwind the roll on.

Plastic Roof Covering

It is CRITICAL that you pull on and secure your cover lengthwise BEFORE doing the sides!

Please see the how-to videos online for further clarification

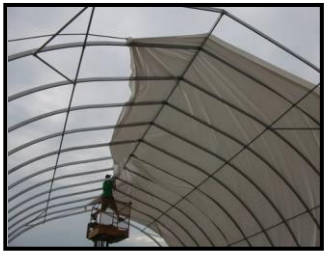
You are now ready to transform your sturdy shell into a functional shelter.

- √ ROLL your cover along the side of the building. **Do not drag** along the ground as cover may snag on something. If you are doing a double cover, roll them both out. This way the top one (clean) will become the inside layer. Avoid walking on rolled out covers.

- √ For most, determining the length and width is straight forward, but if your parts list shows a roof covering close to square, **verify that the way you have it rolled out is a** minimum of 1' longer than your building.

- √ Determine the leading-edge corners of your cover. Grab the corner, making about a 12" "tail". Wrap a rope TWICE around the tail, making a simple tight knot. Take the opposite end of each rope and go to the top of the ladders that you've leaned against the peak of the building.

- √ **ALWAYS pull the cover to the peak BEFORE the person on the ground continues pulling**. Until the whole cover has crossed the *ridge*, pull back and forth, lengthwise, in sort of a "sawing" motion.



- √ Make sure that the side that is in contact with the dirt is going to be outside, so the rain can wash it clean.

√ Continue to feed the cover over until it is centered on the building. Precision to the inch is not necessary. Judging straightness is simply a matter of eyeing a fold to one of the *purlins*. Longer covers will require someone helping it along halfway down the side.

√ Install 12" of *wire insert* at **each side of the *ridge***, unless you are positive you will not have to adjust it. Put in the rest when any adjustments are made. **Don't allow more than 6" of overhang on the cover.**

√ Go to the opposite end and pull the cover as tight as you can lengthwise. For pulling tight, **don't use anything more than human power on the cover wrapped in a short piece of 1x2 strapping**. **Having many people pulling on a hot summer day can create a problem of the cover being too tight.**

√ Install a piece of your cover fastener halfway down each side of the baseboard. Look along a crease to make sure it is straight. If your building has *roll-ups* "doing the side" refers to the top of the *roll-up*.

√ Usually, the ends of the cover have been cut squarely. **Before proceeding, verify that you have enough material for all four corners**. Make adjustments needed.

√ For a double cover, repeat the above steps paying special attention to not rubbing the rope over the cover over the *ridge*.

√ Work from the center to the ends, working the two sides simultaneously. As you approach the end you may need to pull lengthwise as well as down.

√ If the wind starts picking up, work into the wind or upwind first. If a wrinkle develops, always pull at 90 degrees to the midpoint of the wrinkle.

√ If you are putting a double cover on, only pull on the inside layer for tightness. The outside layer needs a little slack. If you are putting the cover on in extreme cold you will need to tighten the cover once you have warm weather. Excess roof cover can be trimmed to 2-3 inches once you are certain it is extra and has had a chance to settle.

Your installation will either have one cover or the other, *Plastic* or *Tarp*.

Plants need clear *plastic* to be able to grow.

Animals need shade with light, so either white *plastic* or a white *tarp* is ideal. The white *tarp* is more durable if animals will have contact with the cover, white *plastic* is more economical.

If it is a storage situation, a *tarp* is recommended in case any supplies, vehicles, equipment, hay, etc. come in contact with the cover, *tarp* has greater tear resistance and is more durable against bumps.

We have repair tape available for small nicks or cuts to either type of cover.

If you are looking for Lexan polycarbonate ends or roof cover, you will need to receive special instructions on handling and installing from Norm.

Tarp Roof Covering *(In Preparation)*

Please see the how-to videos online for further clarification

Regardless of which covering will be installed on your building, the success or failure of the job, and your safety, will often be determined by the preparation and understanding of the task ahead.

The following is a checklist BEFORE you actually rolling out your cover.

- √ The top edge of your *ridge* should have been checked for roughness when you were installing it. Make sure these have been filed down.

- √ If your building is longer than 12' the *ridge* will have one (or more) *connectors*. These should be wrapped with duct tape.

- √ If your *wirelock channel* was not installed continuously over the crest, this edge should also be covered with duct tape.

- √ If your building includes *roll-up sidewalls*, the mechanism for securing the cover at the top of the *roll-up* should be complete before proceeding. (It can be done later, but is significantly more complicated).

- √ You will require a ladder (or another elevating device) for comfortably reaching the peak at BOTH ends of your building as well as 2 thin ropes that are a minimum length of ¾ of your cover width (to assist in pulling the cover over).

√ Your covering fasteners for the sides should be distributed along the sides (tucked against the building so as not to get in the way). If you are using spruce strapping, it saves time if you put all the screws in first. **Pre-drilling, as well as setting screws and washers will save the wood from splitting.**

√ Walk along the side of the building where you will unroll your cover. **Check for and eliminate sharp objects** (broken off weeds are especially bad). If an object can't be removed, the edges should be covered. If there is absolutely NO room to roll out the covering along with the building, give us a call to discuss "Plan B".

√ Four (or more) people to install the cover are advisable if you have never done this before. It can be done with 2 or 3 but remember, the **slower the job goes the more chance there is of the wind picking up**. A couple of extra people during the initial pulling over and squaring is helpful. These extra people can leave once the cover is tacked in place.

√ The effect of wind, even a breeze, will be magnified by the size of your cover. **You will be looking at this cover for a long time, wait an extra day if necessary.** Early morning or late evening is usually the best time of day.

√ **If your ends are to be covered with *tarp* you MUST do the ends before the roof.** If your ends are covered with anything else, at least the framing should be done before doing the roof. It is easier to have the ends covered first but sometimes perfect roof covering days are scarce and should not be passed up.

√ If you have a relatively short building, spending the time to mark the center of your *tarp* (for the width) will make it considerably easier to get the cover on square and straight. Do this at both ends

Tarp Roof Covering

Please see how-tow to videos online for further clarification

It is CRITICAL that you pull on and secure your cover lengthwise BEFORE doing the sides!

You are now ready to transform your sturdy shell into a functional shelter. Please see our website for additional pointers.

- √ ROLL your cover along the side of the building. **Do not drag** along the ground as cover may snag on something.

- √ For most, determining the length and width is straightforward, but if your parts list shows a roof covering close to square, verify that the way you have it rolled out is a minimum of 1' longer than your building.

- √ Determine the leading-edge corners of your cover. Grab the corner, making about a 12" "tail". Wrap a rope TWICE around the tail, making a simple tight knot. Take the opposite end of each rope and go to the top of the ladders that you've leaned against the peak of the building.

- √ Technically there is no inside or outside, but if you pay attention to pulling the *tarp* over in a way that the side that is touching the dirt is on the outside, the rain will wash away any dirt.

- √ **ALWAYS pull the cover to the peak BEFORE the person on the ground continues pulling**. Until the whole cover has crossed the *ridge*, pull back and forth, lengthwise, in sort of a "sawing" motion. Long covers will require someone helping it along halfway down the side.

√ Continue to feed the cover over until it is centered on the building. Precision to the inch is not necessary. Judging straightness is simply a matter of eyeing a fold to one of the *purlins.*

√ Install 12" of *wire insert* at each side of the *ridge*, unless you are positive you will not have to adjust it. Put in the rest when any adjustments are made. Don't allow more than 6" of overhang on the cover.

√ Go to the opposite end and pull the cover as tight as you can lengthwise. For pulling tight, do not use anything more than human power on the cover wrapped on a short piece of 1x2 strapping. Having many people pulling on a hot summer day can create a problem of the cover being too tight.

√ Install a piece of your cover fastener (*wirelock)* halfway down each side of the baseboard. Look along a crease to make sure it is straight. If your building has *roll-ups* "doing the side" refers to the top of the *roll-up*.

√ Usually, the ends of the cover have been cut squarely. Before proceeding, verify that you have enough material for all four corners. Make adjustments needed.

√ Work from the center to the ends, working the two sides simultaneously. As you approach the end you may need to pull lengthwise as well as down. If the wind starts picking up, work into the wind or upwind first. If a wrinkle develops, always pull at 90 degrees to the midpoint of the wrinkle.

√ If the wind starts picking up, work into the wind or upwind first. If a wrinkle develops, always pull at 90 degrees to the midpoint of the wrinkle.

√ Excess roof cover can be trimmed to 2-3 inches once you are certain it is extra and has had a chance to settle. If you are putting the *tarp* on in cold weather, you will likely have to tighten the cover once you are into warm weather.

You will be given a separate set of instructions if you have chosen a gable roof vent or other ventilation options.

Roll-up sides with Standard *Inflator Fan* are our most common ventilation options and why they are included in this manual.

Please don’t hesitate to reach out if you have any questions about other options or packages you have purchased.

Roll up Side Walls

Installing the top of the *roll-up the wall* at 4' above the grade is considered average.

2' – 3' is suggested for very windy and exposed areas
5' – 6' works better for very sheltered locations.

Whichever way you choose, mark each *hoop* individually or put up a tight string line at the desired height.

Using Wood

1- Secure a *pipe strap* with a #14 *Speed Screw* to each *hoop* at this point. If the screw head is a potential rubbing point by putting it on the inside of the *hoop*, it can also be put on the long side.

2- Fasten the 2x4 along the outside of the *hoop*, to the flat tabs of the *pipe strap* with two 2-1/2" *carriage bolts*.
Hold the wood in the desired location and use the holes in the *pipe strap* as your guide to drill two holes through the wood.
Insert the *carriage bolts* from the outside with the nut inside (do not use lock nuts).

As an alternative to using the wood continuously on the outside, it can be cut to 46 ¾" long (or 1-1/4" less than the center to center of your *hoop* spacing) and fastened between the *hoops*. This makes the structure stiffer and eliminates the bump.

Rather than crossing over the end *hoop* trim the beam for length and push it inward so that it butts into the end *hoop*. This allows for an even seal of *plastic* and *wirelock* on that end *hoop*.

3- Either nail a strip of spruce strapping to the 2x4 so that it is flush to the top or fasten your *wirelock* with the wood screws provided.

Make sure the joints are offset from each other.

If you are using *wirelock*, determine where your upper eyebolts will be and instead of putting a screw there now, drill through the 2x4 (remains open for now) (see photo)

4- If you are using *wirelock* along the sides, start from the middle and work toward the ends. If you are using wood, put the screws into the strapping before unrolling the cover.

The minimum is 12 screws per 8' piece.

Putting the wood screw through a washer will increase the tightness while minimizing the risk of splitting.

If you have a **DOUBLE COVER**, in at least one place per side, you should cut off 6"-12" of the strapping, and install that piece separately. This will allow you to remove this section to let the air from the top escape to the sides at the appropriate time. Or you can run a "jumper hose" from the inflated top to the *roll-up* area to inflate the lower area when needed.

Using Steel

1- Often the 1"x2" steel tubing replaces the lower *purlin*. Drill and bolt one side of the *pipe strap*, the other side can be fastened with a #14 *speed screw*.

2- Push the end of the steel in so it butts into the end *hoop* and goes under the tab of the last *pipe strap*.

3- Fasten the *wirelock* to the side of the steel tubing with the small *speed screws*. Cut 12" off the first piece to ensure that the joints of the steel and the *wirelock* are offset from each other to add strength and rigidity to the assembly.

4- When the cover is centered over the building, begin inserting the *wire inserts* at the middle and work toward the ends.

The following applies to both steel and wood applications

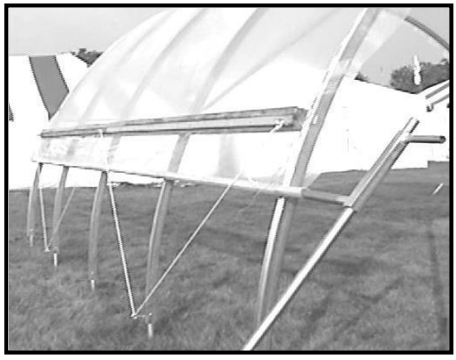
Screw in eye-bolts are supplied for wood and threaded eye-bolt with double nuts for steel

1- The first eyebolt is installed where the top of the roll-up meets the first hoop. The second eyebolt goes as close as possible to the bottom of the beam under the second hoop. For screw in eyebolts, predrill the hole with a 1" bit to prevent splitting. The next eyebolt goes up at the 3rd hoop and then down at the 4th. Continue this up and down pattern to the end.

If the top of your roll-up is 1x2 steel with wirelock, you will have threaded eyebolts with double nut and washers. You must predrill where these are going before you put plastic on and you drill through the wirelock and steel. After the plastic is installed, you push the shank through the hole, with a nut and washer on the outside of the plastic and one on the inside of the steel. Make sure the nuts are tight.

2- Sandwich the cover between the pipe and the curved aluminum strip. For now, put 2 *speed screws* per piece. It is important to have a screw wherever there is a joint in the pipe. Roll up the pipe to confirm it is rolling straight. If no adjustments are required then put the rest of the screws in (8 per 8' aluminum strip). Fasten the tube to the handle first so that no rotation of the tube is possible

3- Thread the braided rope which is supplied, continuously through all the eyebolts. This rope holds the pipe against the building during windy conditions. It is usually tightened somewhat during the winter.



Wirelock aka "wiggle wire"

(consists of a channel and insert)

Most buildings come with enough *wirelock* to be installed on top of the first and the last *hoop*. Additional *wirelock* can be purchased to run along the sidewall or to be used to attach covering to the end framing or doors if desired.

The end wall *tarp* is sandwiched between the channel and *hoop*, inserts hold the roof *tarp*)
Please see the videos online for further clarification

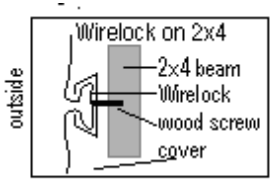
By installing the end *channel* and then removing it to install the end cover, your *channel* will be pre-bent and have the correct holes.

- Generally, the *channel* is installed on the **top** of the end *hoop* with the open side UP
- The plain *channel* does not have a front or a back, it is symmetrical.
- **Start at the bottom of the end *hoop*** and work your way up, generally centered on the *hoop*
- Secure with #12 x 3/4" *speed screws* at 12" centers, **(small head screws give less wire interference)**
- Carefully line up the ends of consecutive pieces to eliminate edges that can tear the cover
- Once you get to the top of the *hoop*, simply lean on the channel to bend it and then go down the other side
- If you must cut at the top, wrap the *ridge* with duct tape to prevent cover tears
- You will need to cut the last piece of channel to make it fit
- If your structure is butted against a building it is easier to install the *channel* on the bottom of the *hoop* (please call for some additional instructions)

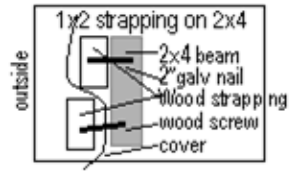
Side Wall Cover Fasteners

(you have 3 choices)

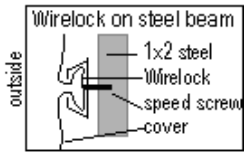
Notes: *Pipe Straps* are supplied when a structure has *roll-up sidewalls* and/or *anchor posts* options. When the baseboard (wood or steel) is fastened with *pipe straps*, the baseboard should be pushed in so that it butts into the last *hoop*



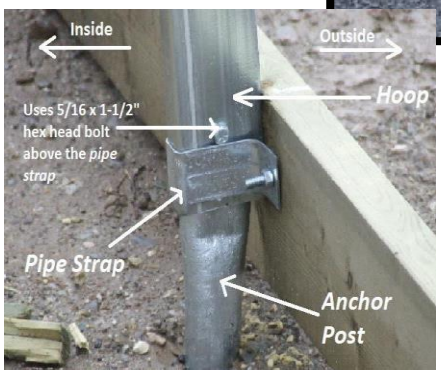
Pipe straps & fasteners and wood screws (12" centers) for the *wirelock* channel are supplied



Only *pipe straps* & fasteners are supplied. Nails and screws for strapping are not supplied. 2x4 Wood for the top of the *roll-up side* is adequate.



All required materials & fasteners are supplied. Steel #14 screws & *wirelock* (#12 screws not recommended as the base when used with the *roll-up* option)



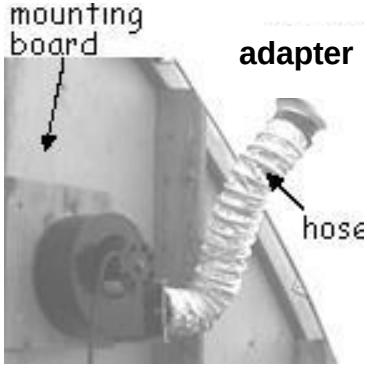
There are a few different options for *inflator fans* and the following pages cover some ideas for our standard *inflator fan*, solar power, and solar power alternative.

Please don't hesitate to reach out and ask any questions to our staff to find the right fit for your application.

There are also more videos about *roll-up sides* on our YouTube Channel, as well as more detailed articles on our website.

INFLATOR FANS

Please note solar-powered options can be obtained elsewhere if you do not have a convenient electricity source near the structure.



An *inflator fan* is a small blower which puts air in between two layers of roof cover on a greenhouse. The benefits of *inflator fans* are:

- to achieve some degree of heat efficiency (up to 30% reduction in heat loss).
- virtually eliminates condensation (by ensuring that there are no holes in the cover and making sure the edges are sealed, you will create the dead air space required)
- ensures the cover is always tight since you simply get more air during warm weather
- creates longer cover life since nothing is ever rubbing on anything.
- reduces wind stress on the structure since it acts as a shock absorber.

The best location for the *inflator fan* is the corner from which the prevailing wind comes, usually the north or west side. (suggestion only) **Usually, the unit draws inside air. If you are in a very high humidity application, it would be advisable to draw outside air.**

Most *inflator fans* come with a hanger plate rather than a mounting board. The mounting bracket of the *fan* can be fastened to the end framing or to the end *hoop*. The direction of the output is determined by convenience.

The motor shaft MUST be horizontal because of the type of bearings used.

Plug the *fan* in for a few seconds to make sure it is working properly.

The adapter is usually attached 2’ to 3’ down from the *ridge* and 1’ to 2’ in from the outside edge. A double output *fan* has the adapters secured equal distance from the *ridge*.

1. Using a pen or pencil, make a **small** hole in the **inside** layer where you wish to install the adapter.

It is CRITICAL that you make the small hole with a pen or pencil THEN stretch it bigger. This is the ONLY way the flange will be sealed!!

2. **Stretch** the hole to an approximate 2” diameter.
3. Before inserting the adaptor into the hole, make sure the wire reinforced hose is attached to the adapter. Secure the hose to the adapter with electrical or duct tape (electrical tape is best).
4. There is a notch in the flange of the adapter, hook this into the edge of the hole in the *plastic* and rotate once. The flange should now be in between the two layers of cover.
5. Slide the free end of the hose over the blower adapter. Secure with electrical or duct tape.
6. If you have to stretch the hose a lot, it is too short and the blower should be moved closer. If the hose hangs with a kink it is too long and should be trimmed.
7. Larger structures will get a dual output *inflator* which means you will repeat steps 1-6 for both sides of the *ridge*.
8. The time it takes to completely inflate will depend on the size of the structure. 4” of air space is ideal. It should not take a great deal of effort to push the outside layer against the inside layer.
9. If the air does not go over the *ridge*, undo some of the *wire inserts* and slide a 12” piece of garden hose between the two layers. This artificially creates a place for the air to move.

These motors run quite warm but are intended to run continually. There is no need to periodically oil them. When units get older, they may not always start by themselves after a power outage. The motor should not make any more sound than humming.

INFLATOR FAN ALTERNATIVE

After several requests and the changing environment, we have been experimenting with a solar collecting package to determine what is required, and the first thing that must be emphasized is that **you MUST use a squirrel cage type of fan and not a propeller type**. The propeller type can not continuously run against back pressure.

The output required will be determined by the size of the greenhouse or livestock building. Our regular 110 volt fan draws .25 amp and puts out 80 cfm.

Some small buildings can use a smaller fan and some of the bigger ones require our double output fan which gives 130 cfm. Our *inflator fan* works quite well going through an inverter. Any 12 or 24 volt fans which we have tried have been extremely noisy and therefore not feasible.

The biggest challenge which we encountered, is that the specific time the fan is needed the most for heat insulation is also the time where there is the least capacity for generating power.

We used a single solar collector and a single battery and there was simply not a large enough capacity for the battery to hold a charge when we had several consecutive cloudy days in December/January. To add another solar collector to an already fairly expensive package really becomes prohibitive and can deter you from moving forward with it.

Based on this experience, we wanted to offer an alternative that balanced the economy with feasibility. We have come up with a way where the extra roof *plastic* can be used on the inside of the structure.

This means that you **would not need the *inflator fan* but still have the effect of double *plastic*** with the air pocket for better heat efficiency. This system does require a bit of extra "fiddling" but the net cost will be a little less.

1. The structure is covered with a single layer of *plastic* just the same as you would if you were only doing a single layer.

2. Take the second piece of *plastic* inside the greenhouse and fold it double lengthwise.

3. This double *plastic* will be attached to the underside of the *ridge* using the same aluminum as you would use to fasten the *plastic* to the roll-up pipe.

4. Next remove the *purlins* from one side of the structure and after you have pushed over the *plastic*, reinstall the *purlins* under the *plastic*. You will be pushing the bolts through the *plastic*.

5. The *plastic* will be fastened with *wirelock* to the underside of the end *hoops*.

We have already had some customers try this out and are very happy with the result. Please call us with any questions or to discuss your specific application and the situation where you might use this. We would be happy to help you with your project!

Ends - *Considerations*

There are as many ways of framing an end wall as there are customers, making it virtually impossible to come up with a detailed set of assembly instructions for each case. Other than a few basic principles to keep in mind, what does the job for you is the best way

The basic choices for ends:
1. **CLOSED OR OPEN END** – The combination of some uses and structure shapes make open end(s) desirable since the entire end would be a door-way and a rectangular frame door is not big enough.

An IMPORTANT WORD OF CAUTION - Extreme caution must be exercised if the intention is one end permanently closed and the other open. If the open end is facing the prevailing wind, you are setting yourself up for problems if there is no capacity for incoming air to escape.

2. **WOOD OR STEEL FRAMING** – for most people, wood is easier to work with and less costly. The downside is that it doesn't last as long as steel. Generally, **the larger the building the larger the framing**. The larger the framing, the further it can be spaced. **Framing must also be sized to the weight it will carry** (i.e. fans, doors).

3. **COVERING TYPE** – In our packages the end covering is usually the same as the roof, either clear *plastic*, white *plastic* or woven *tarp*. These are very inexpensive but not as durable, especially when there is a lot of handling. We can also supply Lexan where appearance, long life and light transmission are important. Plywood or sheet metal can be installed where appearance, long life and non-light transmission are important.

4. CLOSED ENDS OR DOORS – Requirements are usually determined by accessibility requirements. Inside hinged or sliding doors are not restricted by snow on the ground but do require inside space to move. Sliding doors on the outside can extend past the building but are harder to seal. Roll-up *tarp* doors are low cost for the size opening they provide but are usually a little higher maintenance and cannot be sealed easily. (see separate page-Doors)

5. **OPENING REQUIREMENTS FOR FORCED OR NATURAL VENTILATION** (if required) need to be considered BEFORE starting to close an end. Fans and louvres will also limit your choices of doors.

End Walls Covering & Framing

"frame" in this segment refers to whatever material you are using for the end, NOT to the structure itself

- For **soft cover** end walls OR if the desired effect is to have the framing flush to the face of the *hoop*, refer to "A" (below) for the framing and the "D" for the covering.
- For **hard cover** end walls, refer to "A" for door posts (if required) "B" for the vertical framing, "C" for the horizontal framing and "E" for covering.

If the two center frames will be door posts, the INSIDE measurement for hinged doors is ½" GREATER than the door frame and for sliding doors, it is 2" LESS than the door frame. The vertical frames MUST be attached to a sill which is anchored or they require their own *anchor posts*.

- A. Stand the wood or steel framing member in its desired location against the INSIDE of the *hoop*. From the OUTSIDE, mark the frame along the TOP and BOTTOM of the *hoop*. Along the top line cut the frame off so that now the top is the same angle as the *hoop* at that point. On the lower line only cut 1" deep and then cut vertically. This creates a notch matching the angle of the *hoop*. Drill and bolt horizontally. Repeat as often as is required for each end.

- B. Stand the frame in its desired location against the INSIDE of the *hoop* and place a mark along the TOP of the *hoop* from the OUTSIDE. By cutting off along the line the top of the vertical will be angled the same as the *hoop*. Drill and bolt horizontally. Repeat as often as required.

- C. Horizontal frames are spaced appropriate to the cover strength. The outside end is angle cut to the angle of the *hoop* and is secured with a modified "L" bracket. Where the horizontal crosses the vertical, you drill through and bolt or attach a *pipe strap* from the inside. Where the inside end of the horizontal meets the doorstop, the doorstop can be notched or the two can be secured to each other with an "L" bracket.

- D. **If your end wall cover is *plastic*, the *wirelock* track MUST be installed on the top side of the end *hoops* BEFORE you can proceed**. The soft cover needs to be attached temporarily to the base of the end wall at both corners and both door posts (or in the center when there is no door). This will likely need to be adjusted later**. It is important to have the cover extend 6" past each side of the building**. Pull the cover over the end *hoop* and have it pulled in such a way to eliminate wrinkles. If your end wall cover is *plastic*, install just enough of some *wire inserts* to hold it in place. If you have wood framing, you can secure the excess cover, temporarily with pieces of wood strapping.

  If your end wall is ***tarp*, the *wirelock* track MUST NOT be on the end *hoops*** If your end wall cover is *tarp*, install the *wirelock channel* now on top of the *tarp*, starting at the base and working up and over the *ridge* to the other base. For additional tips to installing a *channel* or *insert* check the Roof Covering page. DO NOT cut window and door openings until the end is fully secured. Cut an "X" across the opening to create flaps that can be wrapped around the framing.

- E. Hard cover end material is almost always attached vertically to the horizontal frames. **Do not go into the ground with the cover as it will either absorb moisture or be affected by frost related heaving.** Corrugated sheeting must be overlapped one bubble. The top end of the covering needs to be sealed with silicone, excess roof cover or a curved flashing which would be sandwiched between the *hoop* and the *wirelock channel*.

Door Options

Hinged and sliding doors should be made from welded tubular framework to keep them light and resistant to twisting. MSS's door jig can make up to 6'x12' doors and can be doubled for up to 12' wide opening. The door cover is usually the same as the rest of the end although with a *plastic* covered end consider going with something solid (plywood, sheet metal, fiberglass, etc.) Welded door frames are usually, but do not have to be, rectangular in shape

1. HINGED DOORS should ALWAYS have the hinges off-set in such a way that the door can swing all the way open. The door post to which the hinge is secured should be at least a 4x4. A doorstop strip should be part of the header so that the door cannot swing through. The opening for hinged doors should be ½" bigger than the door. Hinged doors are susceptible to problems related to frost related shifting

2. **SLIDING DOORS** should be 1"-2" bigger than the opening to allow for sealing. The track should be fastened to the side of the header and be 50% longer than the width of the door. If the track extends more than 2' past the curve of the building, the end should be supported. It is usually desirable to slide a double door in one direction rather than splitting it because sealing the middle against drafts is very difficult.

3. **ROLL UP DOORS (hard cover)** should usually be installed by the door manufacturer. They will tell you what opening and framing is required. The weight of the door is usually not a problem for the structure.

4. **ROLL UP DOORS (soft cover)** should have two cross members attached to the *tarp* to prevent it from blowing inward. One is attached at the bottom and one in the middle. The middle one is attached to the cranking mechanism. There are also two verticals standing in front of your door posts with a space of 3" to prevent the door from billowing outward. Not being able to seal the edges is the main issue with this system.

5. **ACCORDION DOORS** are available up to 16’ wide. There is much more substance to these doors than option #5, since there is a cross member every 2’ sliding in a fixed track. The winch to crack this up is usually inside the structure but can be done outside as well.

6. **END WALL REMOVAL** is an option if the intention is to seal up the building for the winter and then have total access for the remainder of the year. Installing an extra *wire insert* in the *wirelock channel* will allow simple removal of the end while numbering the framing pieces will simplify the re-assembly.

PHOTO INSTALLATION SUPPLEMENT

We've created this slide show to assist IN COMBINATION with the installation manual. It is NOT MEANT to replace reading the manual and is an additional supplement only.

Please note, our smaller buildings will have fewer and smaller parts.

This shows installation with *base brackets*, NOT *anchor posts.*

Please see installation manual for further *anchor post* instruction. This 24′ x 24′ structure was standing in 4 hours with a team of 4 people.

2 & 33 show base & *base bracket* installation
3-18 shows getting the structure standing
19-32 shows *purlin* and *wind brace* installation
34-36, 57-58, 64-68 shows *roll up side* installation
37-55 shows putting the cover on
50-56, 59-63 shows fastening the cover
69-72 shows anchoring the structure down with T-bars

We hope that this visual **IN ADDITION to the installation manual** can help make the process smoother for you.

Please note that the "scaffold" which is being used in these pictures is a permanent deck which is part of the trailer. Even though it measures 6' x 16' and provides considerable space for good footing for the step ladder, it would have been safer to use a taller scaffold.

<u>It is your responsibility to work safely.</u>

#1: Consult installation manual

#2: measure and lay out the base (*base bracket* installation shown) and prepare scaffolding

Anchor the beam now.
Refer to pictures 70, 71, and 72

#3: while person 1 holds the *ridge* have person 2 swing a *hoop* upside down to person 1

#4: flip the *hoop* right side up and slide it into the middle *ridge stub*

#5: get one pair of *hoops* standing attached to the middle *ridge stubs* before continuing

#6: continue with the next pair in the same manner as 3-5

#7: slide the *hoop* into the *ridge stub*

#8: continue with the next pair in the same manner as 3-5

#9: continue with the next pair in the same manner as 3-5

#10: use a rope to secure the section until the rest is complete

11-secure the rope for stabilizing the structures

#12: fasten the *hoops* to the *ridge*

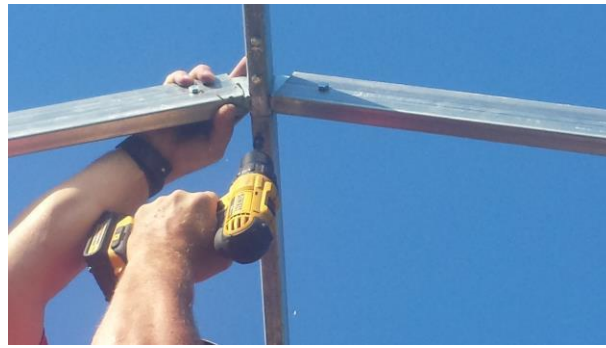
#13: make sure you are securing each *hoop* to the *ridge stub* before continuing

#14: connect the next section of *ridge* to the *ridge starter* at the end of the previous *ridge* section

#15: connect the next section of *ridge* to the *ridge starter* at the end of the previous *ridge* section

#16: make sure all *hoops* are fitting properly and secure

#17: wrap the joints of the *ridge* with duct tape



#18: secure the two sections of *ridge* together

#19: IMPORTANT *wind braces* are the longer pipes, *purlins* are the shorter ones

#20: fasten a *purlin* to the *hoops* for stabilization

#21: *purlins* fastened with *purlin clips* to the *hoop*

#22: connect *wind braces* into the same *purlin clip* as the *purlins*

#23: The bottom end of one *wind brace* is tied to the top end of the next *wind brace* using the *purlin clip* already there

#24: connect *wind braces* into the same *purlin clip* as the *purlins*

#25: secure the *purlins* along the line before completing *wind brace* fastening

#26: secure the *purlins* along the line before completing *wind brace* fastening

#27: complete the second row of *purlins*

#28: tighten all fasteners to attach the *wind braces*

#29: complete *wind brace* fastening

#30: complete *wind brace* Fastening

#31: *wind brace* lining up, not perfect, where it lands is good

#32: completed *wind brace* fastening

#33: put the #14 *speed screw* in the bottom of the hoop into the *base bracket*

#34: measure for the *roll up sides*

#35: attach the wood for *roll up sides* at the end *hoop*

#36: attach the wood for *roll up side*

#37: lay out the covering

#38: unfold the covering, ensuring there are no sharp objects around

#39: mark the center point on the cover

#40 & #41: lay out the covering

#42: all hands on deck, prepare to lift the cover onto the structure

#43: pulling the cover over from the side, everyone takes a point of the cover to spread it out evenly

#44: lift it up, being careful not to snag on anything

#45: more hands make it easier

#46: ensure cover is centered

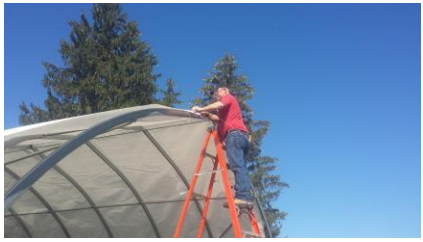
#47: pull the cover over

#48: almost done, make sure all is even and straight

#49: pull to the end of the structure

#50: pull tight and start *wirelock* at the *ridge*

#51: pull the cover tight as the *wirelock* is going in



#52: start putting in *wirelock* at the *ridge* first

#53: put *wirelock* on both sides at the top

#54: keep the cover tight as you are working your way down with the *wirelock*

#55: alternate view

#56: ensure the screws are in the 1x2 to prepare for fastening the cover to the base

#57: put the wood at the top of the roll up

#58: hold the cover tight as you are installing the wood

#59: sandwich the cover between the 1x2 to secure

#60 & #61: complete this sandwiching technique for both sides of the structure

#62 & #63: completed cover fastening

#64: roll the cover around the roll up *pipe strap*

#65: fasten to the pipe, sandwiching the cover between

#66: complete attaching

#67: roll it up and make sure it rolls evenly

#68: finish fastening the cover to the pipe

#69-pound t-bar anchors in at diagonal intervals


#70 & 71: pound t-bar anchors in at diagonal intervals

#72: fasten the t-bar anchors to the base beam to secure

Remember: There's no such thing as too many anchors!

Install anchors prior to structure assembly

This is a GENERAL example done for a trade show, you must adjust it for your own structure and requirements

Thank you for your Multi Shelter Solutions purchase.

We would love to see photos of your finished structure!

Email them to multisheltersales@gmail.com and we will include yours and your company name if we share them on our social media!

Please note, if it is evident that you did not follow these instructions as laid out, your warranty will be void. Call us with any questions before you start.