

3v – 5/9ths 1-1/4" Pipe Dome Kit Assembly Instructions



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Parts List

Located on the underside of every hub you will find impressions that identify the hub as far as identification of which pipe is associated to each location in the hub. (ie. "A", "B", "C", "D") The Illustrations in this manual may differ from the purchased kit based on the strut type (ie pipe or wood) but still apply to the construction.

PART#	DESCRIPTION	QTY
3v1	5 PIPE HUB	6
3v2	6 PIPE HUB (Multi Colored)	30
3v3	6 PIPE HUB (Red)	10
H3v2L	BASE ROW HUB A (Multi Colored)	5
H3v2R	BASE ROW HUB B (Multi Colored)	5

H3v3	BASE ROW HUB C (Red)		5
TH1210	SCREW	6	660

Required Resources

- Minimum 2 People
- 1-1/4" Schedule 40/80 Pipe for Pipes (See <u>Pipe Preparation</u> section below for sizing and quantity)
- Measuring Tape
- Ground Stake
- String (appropriate amount based on size of dome)

- Spray Paint or other ground marking method for base row layout
- Colored Spray Paint or other marking method for Pipes
- Power Drill with #3 Phillips Bit
- Scaffolding (appropriate amount based on size of dome, highest point will be ½ the desired diameter plus any riser wall)
- Step Ladder(s)

NOTE: Natural Frequency only provides the hub connectors and accessories for construction. The guides herein related to site preparation, riser walls, sheathing/paneling/covering are for information purposes only related to the interaction and relationship to our hub connectors and are not a substitute for expert advice on construction methods of these subjects.

Site Preparation Guide

- 1. Choose an area where you would like the dome to be constructed. Things to keep in mind for site selection are:
 - a. Sun Exposure/Shade Considerations based on dome use/function
 - b. Water runoff
 - c. Grade angle
 - d. Window Locations
- 2. Clear the area of rocks, foliage, grass or any other item that may interfere with leveling or the functionality of the dome
- 3. Determine Site Preparation and Anchoring method, this could include:

a. Crushed Stone

A crushed stone base, 4-5" deep, is one of the best ways to prepare your site. Be sure and use "crushed" stone as opposed to "pea" stone. 1/2" is a good diameter and is relatively inexpensive. Place your dome in the center of the pad leaving a minimum of 1' perimeter of stone around the shed. When digging out the area to accept the stone, start at the lowest area and establish the grade by digging down 4-6". You can now excavate the rest of the site keeping in mind the site should be level when finished.

b. Sono Tubes

Also known as concrete piers are great for a strong anchor

c. Wooden Post

Typically 4x4 posts placed in the ground, this method is a great way to provide a strong structure that is easily framed too. It is important to use pressure treated timbers for the posts.

d. Cement Slab

A cement slab is one of the more expensive ways to prepare your site, however if done correctly it can also be the best. A slab will keep the dome level and prevent grass and weeds from growing both under and around it. It also offers many options for anchoring the dome.

e. Ground

You may also decide to simply place your dome directly on the ground. It is important that the shed has pressure treated timbers used where there is contact with the ground

f. Riser Wall

See next section below.

4. Prepare the site using recommended processes depending on method chosen

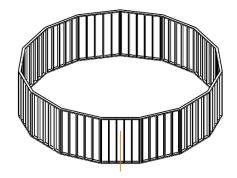
Riser Wall Guide

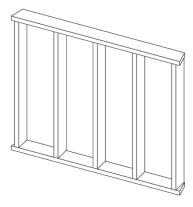
Riser Wall Pipe Length		1 "x"	2 "Y"
(inches)		QTY 20	QTY 10
	12	30 3/8	27 1/2
t)	13	32 7/8	29 13/16
) e	14	35 3/8	32 1/8
(feet)	15	37 15/16	34 7/16
~	16	40 7/16	36 11/16
Ш	17	43	39
	18	45 1/2	41 5/16
=	19	48 1/16	43 9/16
DIAMETER	20	50 9/16	45 7/8
	21	53 1/8	48 3/16
Ш	22	55 5/8	50 7/16
OOME	23	58 3/16	52 3/4
Q	24	60 11/16	55 1/16
	25	63 1/4	57 3/8
	26	65 3/4	59 5/8

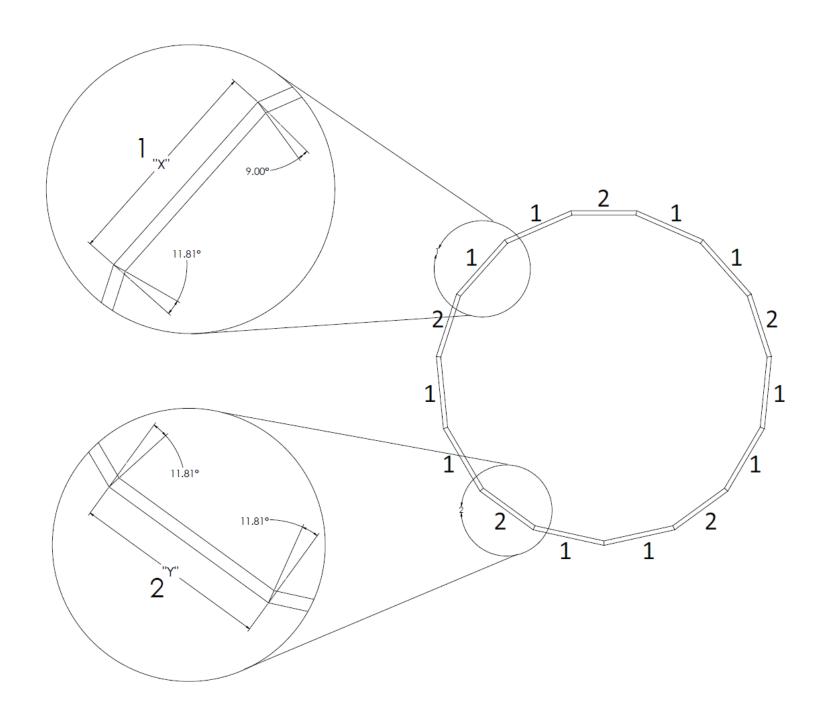
In general the use of a riser wall is to gain vertical height. That raised addition helps create vertical walls for doors, cabinets, windows, sinks etc. Riser Walls can be constructed from poured concrete, cinder block or wood.

Sizing for the riser wall top and bottom boards can be found on the supplied table for each individual dome diameter which represents the diameter to the outside of the framing members.

- The outer points of each board should lay on a scribed circle the diameter of the dome to be constructed
- Each horizontal board cut to the "X" or "Y" length below must be tapered in accordance with the graphic on the next page.
- The "1" Boards will be utilized twice, but must be flipped over to make the angles match (ie, the 11.81 degree cuts must always meet up and the 9 degree angles must always meet up)
- Each section can be built individually by constructing a bottom and top board with studs 16" or less apart and the length which accomplishes the height of the wall you are constructing
- Once all sections are constructed, combine them in the order outlined by the graphic on the next page and fasten together by bolting and install mending plates at the seams







3v Pipe B Pipe C Pipe D Pipe A (inches) (inches) (inches) (inches) 80 20 Quantity 30 35 19 1/2 23 1/4 12 26 1/8 27 1/2 21 7/16 25 9/16 28 5/8 30 1/8 13 23 7/16 27 7/8 14 31 1/8 32 13/16 25 7/16 30 3/16 33 11/16 35 7/16 15 27 3/8 32 7/16 36 3/16 38 1/16 16 **JOME DIAMETER** (feet) 29 3/8 34 3/4 40 3/4 17 38 3/4 31 3/8 37 1/16 41 1/4 43 3/8 18 33 5/16 39 5/16 43 13/16 46 1/16 19 35 5/16 41 5/8 46 5/16 48 11/16 20 43 15/16 48 7/8 51 5/16 37 5/16 21 46 3/16 39 1/4 51 3/8 54 22 48 1/2 53 15/16 56 5/8 23 41 1/4 50 13/16 56 7/16 59 1/4 24 43 1/4 45 3/16 53 1/8 61 15/16 25 59 64 9/16 47 3/16 55 3/8 61 1/2 26

Pipe Preparation

Using the table to the right, find the diameter of the dome you are constructing in the first column. Then follow that number to the right to find the length of pipes. The numbers are rounded to the nearest 1/16th of an inch.

The quantity of each length of board is shown in the second row

Gather your pipe material* and ensure that your saw is set to 90 degrees

Cut the appropriate quantity listed in the second row of the table for each length, keep them separated into two piles.

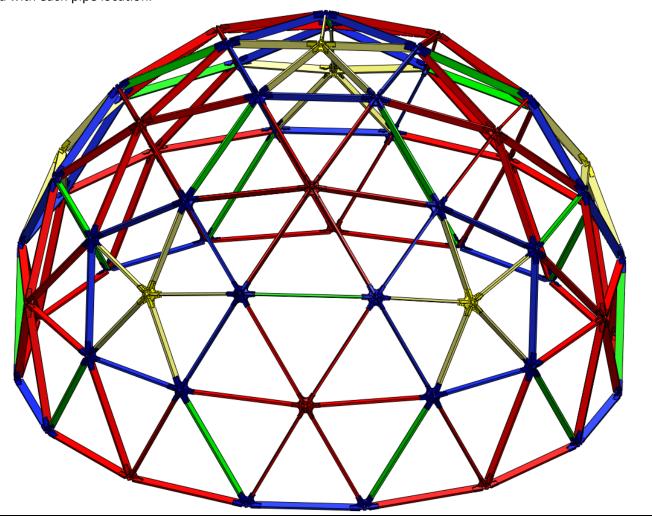
*NOTE: check that the cut and uncut ends are free of protrusions or anything that would prevent it from butting up to the hub connector.

Label the pipes so that they can be easily identified, simply by scribing an "A", "B", etc or apply spray paint/marker to both ends of the pipes while they are stacked. These colors will correspond to the markings on the hub connectors.

- <u>Amber (Yellow) for Pipe A</u>
- Blue for Pipe B
- <u>Crimson (Red) for C</u>
- <u>D</u>ark Green for <u>D</u>

Hub & Pipe Location Identification

- The primary method for identifying the pipe locations and assembly order is that each pipe location has a colored mark located on it that identifies the type of pipe to be used in that location. Locations where "A" pipes go will have a yellow (Amber) marking; the locations where "B" pipes go will be labeled with a blue marking, "C" labels go with red and "D" labels match to green pipes.
- Lastly, in the case that a colored mark is missing, the type of pipe that is to be used in each pipe location on the connector is also embossed in the part near the center and aligned with each pipe location.



ILLUSTRATED LAYOUT

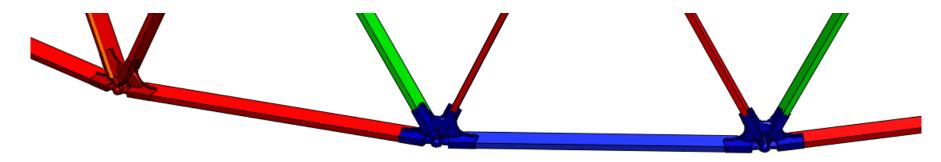
Dome Frame Construction

Special Considerations:

• When mating a pipe to a hub, always make sure that the end of the pipe "bottoms out" in the hub pipe slot, this ensures the correct dimensions are held throughout construction and will help with consistent panel sizing.

Instructions:

- 1. Once the site is prepared and level, locate the middle of the site and drive a stake in until about 2" is visible above the ground. Place a screw in the middle of the stake leaving about 1/4" of the screw above the top of the stake.
- 2. Map out the radius of the dome you are building by hooking a tape measure/string to the screw in the stake and stretch it out to the determined radius. Using some method (i.e. spray paint, scribe, etc) mark the site as you walk around keeping the tape measure/string taught. Complete marking all the way around creating a circle with the full diameter of the desired dome outside dimension.
- 3. Check that the scribed circle is correct by re-measuring several locations.
- 4. Choose a Base Row outside hub connector to begin with. There is a pattern to follow for choosing. It starts with an all C (Red) hub, then a C (red to the left, then a C (Red) to the right, then repeat around the rest of the dome. (SEE THE ILLUSTRATED LAYOUT)

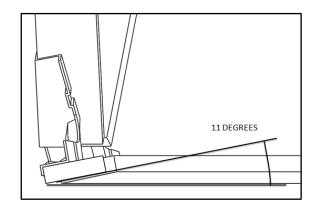


5. Place the hub so that the outside of the hub lines up with the scribed line. *ALL hubs and pipes should be in the INSIDE of the circle.*

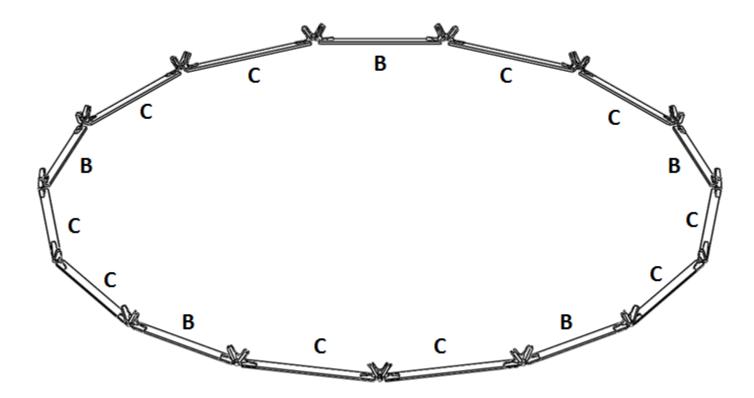
Note: If using the provided self-tapping screws, it is important to not over tighten them if using PVC pipe. Over tightening may cause the pipe to strip and an inadequate fastening would result. If stripping becomes a consistent problem due to soft pipe material, pre-drilling the hubs will help prevent it.

6. Starting with either side of the hub, insert the first pipe, matching the color (See color reference under Pipe Preparation) on the hub to the matching colored pipe, until it butts up. Fasten with 2 opposing screws or bolts, one in the top and the bottom.

7. Slide the next hub, making sure the color markings match the pipe, onto the opposite end of the pipe and fasten. NOTE: The nature of the 3v Dome causes the base row to be assembled at 11 degrees from flat. See figure below. This is due to the fact that over half sphere is being constructed. This space must be shimmed to the base structure to properly support the dome structure.



8. Following the colors (Reference the ILLUSTRATED LAYOUT), continue adding hub connectors and pipes, fastening as you go. Continue around the circle, until you reach the hub you started with, completing the 1st horizontal or base row.

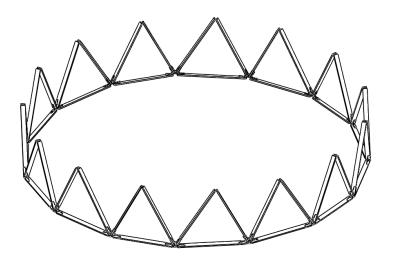


9. Using a tape measure, check that the hubs are all equal distance from the center stake, pushing or pulling the hubs into position as you go around. Keeping it round and correct to the diameter, makes assembly easier as you get to the upper connections.

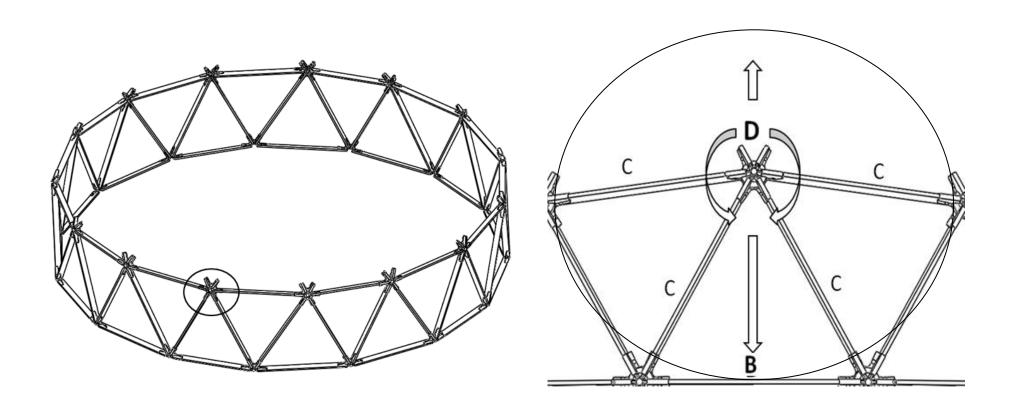
- 10. If attaching to a riser wall, this is a good time to attach it. Utilize the best method based on the type of substructure and strut type. Some options are listed below. An anchor point should be positioned just outside the edges of each connector on both sides as well as the center of the strut between the two hub connectors.
 - a. Concrete Pipe straps w/concrete screws/anchors
 - b. Riser Wall Pipe straps
 - c. Ground -ground anchors, spikes, U-shaped rebar

NOTE: A good anchoring system is very important in developing the overall strength of the dome

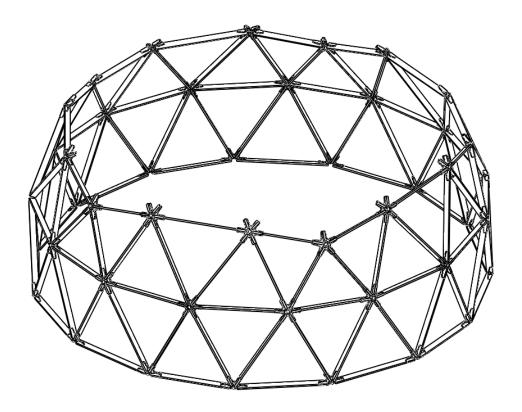
- 11. Following the colors on the connectors, insert the correct vertical pipes from two base row hubs and join them with the correct hub. Fasten as shown below. The holes for the side screws are not drilled due to some customers preferring to use their own bolt through hardware here, must be drilled using a 1/4" drill bit, one low on the hub and the other higher
- 12. Continue around until all vertical pipes are installed. When necessary, support any hanging pipes until both ends are supported so undue forces are not put on the connectors which may bend or break them. The true strength of a geodesic dome comes from the completed structure and care must be taken until all pieces are in place.



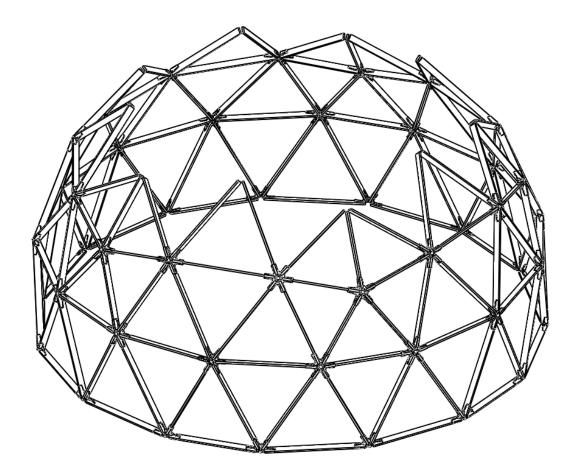
13. Now start to install the hubs to the vertical pipes per the colors, fastening along the way. Anywhere there are two C (Red) pipes coming up from the base together the O3v3 hubs which install at their ends and have all "C" (Red) pipes must be oriented per the detailed diagram below with the B marking facing the "B" pipe below it. Failure to orient the hub correctly will result in an incorrect assembly.



- 14. Insert the correct horizontal pipes between the newly installed hubs and fasten to form the 1st horizontal row.
- 15. Continue around until all vertical pipes are installed in the second row. When necessary, support any hanging pipes until both ends are supported so undue forces are not put on the connectors which may bend or break them. The true strength of a geodesic dome comes from the completed structure and care must be taken until all pieces are in place.

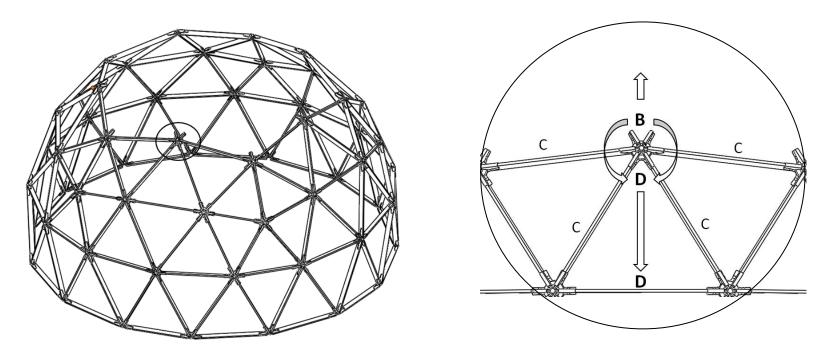


16. Now is a good time to test fit the sheathing panels if utilizing any. **Refer to the Panel Guide below.** To ensure a correct fit, the panels should create an expansion/contraction gap and be sized so that the edge of each panel is kept approximately 1/16th of an inch from the center of the pipe. If they do not fit correctly, check that the pipe lengths are correct and that the panel dimensions match the table. It is recommended that all panels be measured to fit each section prior to cutting.

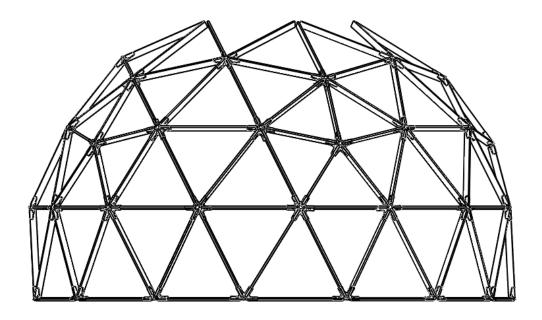


17. Continue around until all vertical pipes are installed in the third row. When necessary, support any hanging pipes until both ends are supported so undue forces are not put on the connectors which may bend or break them.

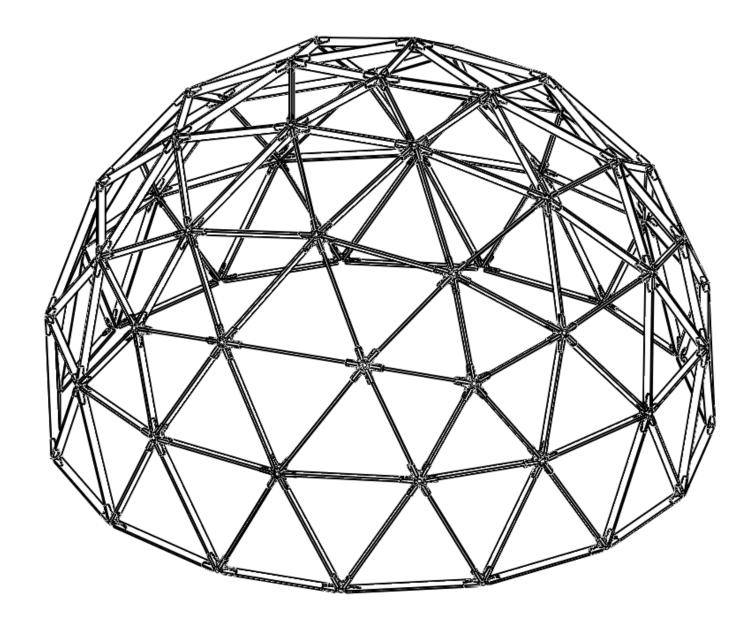
18. Now start to install the hubs to the vertical pipes per the colors, fastening along the way. Anywhere there are two C pipes coming up from the base together the O3v3 hubs which install at their ends and have all "C" (Red) pipes must be oriented per the detailed diagram to the right with the D marking facing the "D" pipe below it. Failure to orient the hub correctly will result in an incorrect assembly.



- 19. Once all hubs are attached to the vertical pipes and supported, install the horizontal pipes to complete the third row.
- 20. Again, continue around adding and fastening vertical pipes to the fourth row. When necessary, support any hanging pipes until both ends are supported so undue forces are not put on the connectors which may bend or break them.



- 21. Once all hubs are attached to the vertical pipes and supported, install the horizontal pipes to complete the fourth row.
- 22. For the last time, continue around adding and fastening vertical pipes to the fourth row. Support any hanging pipes so undue forces are not put on the connectors which may bend or break them.
- 23. Once you've started to add the final 5 pipes, fasten the "keystone" hub to the first board and add each additional pipe, butting up tight to the hub and fastening along the way until the dome frame is completed.



- 24. Add additional side fasteners and check that all fasteners are tight.
- 25. Once all fasteners are installed, the dome is completed and can now be finished with covers, doors, etc to suit your application.

Sheathing Guide

There are many ways to cover a geodesic dome, a few of the more common are listed below with notes specific to their application on a Natural Frequency dome. This section acts as a guide to different methods and does not attempt to outline a "how to" process. There are a lot of great resources on this matter, it is suggested that once you have chosen a method, that you take the time to educate yourself on the process

- Plywood/Shingles
 - a. Using the Panel Guide included in this manual, cut a panel to test fit in the location to ensure a good fit. The same panel can be used in several locations to ensure that repeating the dimensions will provide a good fit.
 - b. Once you have confirmed that the panel is sized correctly, cut the allotted number of panels needed.
 - c. Using 16D Nails, hammer a nail in the center of the pipe at each end near the hub, leaving the head of the nail higher than the thickness of the paneling. These nails will act to establish the expansion gap between the panels.
 - d. Snap chalk lines along the center of each pipe to act as a guideline when placing the panel.
 - e. Install Natural Frequency sheathing spacers or other .25" thick shim along the pipe to support the panel between hubs
 - f. Position the panel and fasten it to the pipes and hubs.
 - g. Repeat for the remaining panels
 - h. Once completed, shingle using a conventional process
- Shrink Wrap
 - Shrink Wrap is applied by draping the sheet over the dome structure and applying heat with a hand-held propane powered heat gun.
 Zipper doors, vents, fans and more can all be applied to the heat shrink plastic for a quick covering method.
- Tarp, Canvas, Screen
- Plexiglas/Polycarbonate Panels

Caution: When using a flexible cover like a tarp, canvas or film, ensure that it is pulled tight and cannot come loose. A loose cover can allow water to accumulate which could result in excessive weight on the dome in a manner unintended. If too much water is allowed to pool, the dome structure risks damage or collapse. Natural Frequency will not warranty any connectors which are damaged in this way.

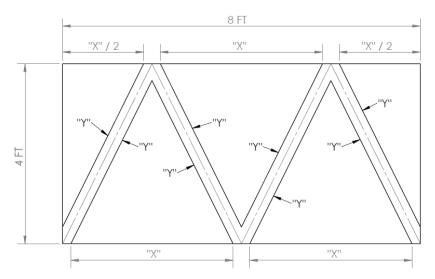
www.geodesicdomekits.net



Paneling Guide

**As stated, this is meant to be a guide and all measurements should be checked on the actual structure prior to cutting material, variances in pipes including twisting, bending and length as well as base row layout may cause the need for slight changes to the guide dimensions below or between individual panels.

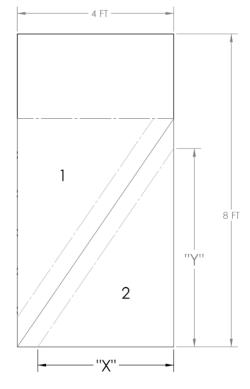
This guide outlines the general procedure of cutting the panel triangles used for a 3v Dome. Always account for overlap on the pipes and an expansion gap between panels. Additionally, since the hubs go on the outside of the pipes, they sit higher than the pipe. So if you plan to panel them, it is recommended that you fill that gap with 3/16"-1/4" thick material over the top of the pipe wherever you plan to fasten the panel to the pipe. Natural Frequency offers our SHEATHING SPACER Kit which contains lengths of "U" shaped material which accomplishes this.



As a general rule, the panel side dimension should be 7" longer than the pipe that it would be covering. Always check prior to cutting.

Using the methods depicted, a 4'x8' sheet of panel material (i.e. tongue & groove plywood, etc) you can yield from 1 to 3 Other methods and layouts are possible and may work better for in different applications.

The size of the dome will dictate whether you can use full panels as shown on the left, or will have to assemble panels from two halves as shown on the right.



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(Certain state laws do not allow the exclusion or limitation of certain damages. If these laws apply, some or all of the above exclusions or limitations may not apply to you, and you may have additional rights to those contained herein. In such states, Natural Frequency's liability is limited to the greatest extent permitted by law.)

- 12. TRADEMARKS AND TRADENAMES. You acknowledge and agree that all brand names, trade names, and trademarks incorporated onto or associated with the Product (collectively, the "Marks") purchased hereunder are the exclusive property of Natural Frequency and that you shall not acquire any rights in any of the Marks by purchasing the Product. You shall not make any use of the Marks at any time except as otherwise authorized in writing by Natural Frequency.
- 13. PROPRIETARY INFORMATION/NONDISCLOSURE. You acknowledge and agree that any knowledge or information, including drawings, designs, specifications, plans, and data, that Natural Frequency may have disclosed or may hereafter disclose to you incident to the placing and filling of an Order shall, at all times, remain the exclusive property of Natural Frequency, and you shall acquire no interest in, or right with respect to, such proprietary information unless otherwise stated in writing by Natural Frequency. You further acknowledge and agree that such proprietary information constitutes valuable, special, and unique business assets of Natural Frequency and that you shall not now or at any time in the future use any such information in any manner or disclose any such information to any person or entity, except as expressly permitted in writing by Natural Frequency.
- 14. GOVERNING LAW AND JURISDICTION. ALL MATTERS ARISING OUT OF OR RELATING TO THESE TERMS AND CONDITIONS OR YOUR PURCHASE OF PRODUCT SHALL BE GOVERNED BY THE LAWS OF THE STATE OF NORTH DAKOTA, WITHOUT REGARD TO CONFLICTS OF LAWS RULES. EXCLUSIVE JURISDICTION OVER AND VENUE OF ANY SUIT WILL BE IN THE STATE COURTS LOCATED IN RANSOM COUNTY, NORTH DAKOTA OR THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF NORTH DAKOTA LOCATED IN BISMARK, NORTH DAKOTA. 15. ENTIRE AGREEMENT. These terms and conditions together with the Order constitute the parties' entire agreement relating to the subject matter hereof and supersede all prior or contemporaneous oral or written communications, proposals, and representations with respect to such subject matter. No modification to these terms and conditions will be binding unless in writing and signed by each party. 16. NO WAIVER. No waiver of any provision of these terms and conditions or delay by either party in enforcement of any right hereunder shall be construed as a continuing waiver or create an expectation of non-enforcement of that or any other provision or right. 17. SEVERABILITY. In the event any provision herein should be held unenforceable by a court of competent jurisdiction, such court is hereby authorized to amend such provision so that it will be enforceable to the fullest extent permitted by law, and all remaining
- provisions shall continue in full force without being affected, impaired, or invalidated thereby in any way.

 18. NO ASSIGNMENT. You agree that you may not to assign or transfer any of your rights arising out of or related to these terms and conditions or your purchase of Product.
- 19. ATTORNEYS FEES. You agree that if you fail to timely pay to Natural Frequency any sums due hereunder and Natural Frequency sues to collect such sums, you will be liable for reasonable attorney's fees so incurred by Natural Frequency
- I hereby agree to order the Product at the stated costs and have read and agree to the TERMS AND CONDITIONS, incorporated herein under this reference. I understand that Natural Frequency reserves the right to change, discontinue or substitute materials. I understand that the Product delivered will consist of all hub connector parts and pieces, as well as fasteners, but does not include any foundational work, pipes, covers, doors, windows, lighting, electrical, steps, etc. from Natural Frequency or its delivery personnel, unless otherwise stated.

