University of Wyoming | Extension

August 2025 | B-1387

# A Users' Guide to Building a 22-ft Diameter 2V Geodesic Dome

## A CONSTRUCTION MANUAL FOR ANYONE

Figure 1. 22-ft 2V geodesic dome constructed in Fort Laramie, Wyoming, in 2021. Photo: Jeff Edwards

UNIVERSITY OF WYOMING | Extension

B-1387: A User's Guide to Building a Complete 22-ft. Diameter 2V Geodesic Dome: A Construction Manual for Anyone

August 2025

Jeff Edwards
University of Wyoming Extension
2753 State Highway 157
Lingle, WY 82223
Jedward4@uwyo.edu
(307) 837-2956

Editors:
Tanya Engel, University of Wyoming
Brooke Ortel, University of Wyoming

Design and photos (unless otherwise indicated):
Tanya Engel, University of Wyoming
Jeremy Cain, University of Wyoming

**Acknowledgments:** The author would like to acknowledge Ted Craig Wyoming Department of Agriculture (Retired) for finding funding since 2009 and indulging these projects, being an idea sounding board, relaxing his tolerances and tolerating my less than exactness, and always showing up for lunch. Thanks to my students and coworkers who participated, sweated, and supplied lunches and sports drinks for all. Thanks to those individuals who dared to use the draft version of this manual and provided corrections/edits/suggestions. To Jed Polly, intern (2024), my hope is that you learned the entire process and can build one with your family and that my yelling of instructions and harassment was a good trade for the fish, peace. Thanks also to Dr. Jerry Erschabek for his many hours of assistance on the prep of dome kits. Jerry is visible in many of the images as a stand-in and one of the hand models, he was willing to do nearly anything asked of him (within reason). Although he will never learn how to paint without making a mess, his assistance and conversation was greatly appreciated.

# CONTENTS

# GEODESIC DOME CONSTRUCTION MANUAL

This manual describes one method for the complete construction and assembly of a passive enclosed space/season extending 22 foot diameter 2V geodesic dome structure. This manual was created to provide instruction to all who have the interest and ability to build their own structure. Geodesic dome structures are perfect for challenging climates; they are sturdy, hold up to snow load, are wind and hail resistant, and are very useful in extending the season while allowing individuals to grow their own food.

Since 2018, the University of Wyoming Extension, in conjunction with the Wyoming Department of Agriculture, has been conducting geodesic dome build workshops throughout the state. We started this endeavor because we found that prefabricated kits can be very expensive, and the assembly instructions can be difficult to follow. Because we can't be everywhere at once, we offer this manual for your use.

## GEODESIC ORIGINS

The word "geodesic" has Greek origins. "Geo" means earth, particularly its spherical shape, and "desic" means to measure. The literal translation of geodesic is "to measure the earth." Leonardo Da Vinci investigated and designed self-supporting structures that could be assembled without lashing individual pieces together. Some of his designs included dome structures of this style.

More recently, German engineer Walther Bauersfeld (1879–1959) was credited with building and patenting the first modern geodesic dome. However, due to the Second World War and prejudices towards Germans, the design was "rediscovered" in 1948 by Richard Buckminster Fuller, an American architect who coined the term geodesic dome and popularized them.

## GEOMETRY AND RESOURCES

In contrast to traditional construction that uses mostly squares and rectangles, dome construction requires the use of various triangles sizes and multiple compound angles. Remember high school geometry? Most don't. Fortunately (what would we do without the Internet), there are apps available to help. For example, Geometryx for Android phones can be used to calculate strut length and angles. The website http://www.domerama.com/calculators/2v-geodesic-dome-calculator/ can assist in calculating the dimensions for any size geodesic dome, including basic lengths, angles, and generating a materials list (but that is done for you in this manual). Because many of us don't think or have tape measures in decimals, you may need to use a decimal feet to fractional inch calculator, https://www.spikevm.com/calculators/decimal-feet.php.

One term you will run across when researching domes is "frequency". This refers to the repetition of the pattern of triangles used to approximate the surface of a dome or sphere. Just remember, the higher the frequency, the greater the number and pattern of different-sized triangles.

You'll see 2V, 3V, 4V, 5V, 6V to describe the frequency of different domes. The 2V (2 frequency) is the least complex, making it the least expensive, and also the least round. By contrast, a 6V (6 frequency) dome uses more triangle sizes, is more complex, is more rounded, and is a much stronger structure.

You might come across terms like "connectors," "hubs," or "couplers." These aren't necessary for building a dome, but using hubs can make things a lot easier. Hubs simplify the connections of the struts and eliminate all compound angles. Plus, they offer a lot of forgiveness during final assembly. In this manual, we use PVC water pipe cut into 3-1/2 inch sections as hubs (but we'll get into more detail on that later!).

Dome size is on a sliding scale and can be modified to fit any space. This manual demonstrates how to prepare and assemble the parts for a 22-foot diameter 2V (2 frequency) dome with 10 sides and approximately 355 square feet of farmable space. We provide instructions for building the dome on a 16 inch tall base wall, but you can adjust the height of the base wall to meet your project's needs, whether you need it taller or shorter (Maximum base wall height of 48-inches).

The 22 foot 2V dome is preferred as it maximizes the growing space using 8 foot lumber with minimal waste.

The parts and pieces for this structure can be prepped by one person for assembly in about 30 hours. Final on-site assembly takes approximately 8 hours and at least 4 people.

Prepping the structure involves cutting and drilling the PVC hubs, cutting struts; installing 3/8-inch × 2-1/2-inch hanger bolts on both ends of all the struts; prefabricating the door, door frame, vent frames, dome base sections; lath prep, and painting or staining all the parts and pieces (not necessarily in that order).

Final on-site construction includes the layout and attachment of the prefabricated base pieces, connecting the studs to the hubs, installing the prefabricated door, installing the vent frames and vents, and affixing the polyethylene tarp.

**Words of advice:** Before you begin building make sure your site is level. And, at a minimum 7 days before construction begins, call 811 for a check of the site's underground utilities.

If you build the parts and pieces in one location and must transport the dome to a job site, all the parts and pieces for a completed 22 foot 2V dome, will fit in a ½-ton extended cab pickup with an 8 ft bed.

University of Wyoming Extension's geodesic dome schools occur around the state. If interested in seeing one of our domes, there are many in Casper. Other locations include Baggs, Sundance, Douglas, Riverton, Lander, Laramie (UW Campus), Arapahoe, Ethete, Evanston, Fort Washakie, Guernsey, Wheatland, Afton, Torrington, and Fort Laramie. The Fort Laramie project shown on the cover is the model for the dome constructed using this manual.

Loaded truck with materials for a complete workshop. Photo: Jeff Edwards

In 2024, the dome program evolved the process from workshops to schools and as a class, we can begin with raw materials and finish a dome with raised beds inside and out that is ready to use in about 20 hours. All by following the techniques described in this manual.

This manual includes QR codes linked to video clips which will hopefully provide clarity on some of the tricky bits.

# CHAPTER 1 – LEGAL STUFF

## BUILDING PERMITS AND POTENTIAL ISSUES WITH MUNICIPALITIES

For the most part municipalities are fairly forgiving for these types of structures. However, rules and regulations are constantly changing and in 2024 these projects began to hit some roadblocks particularly with building permits (lack of) and local inspectors (not everyone is excited about this project as you might be). It is always a good idea to go to your municipality and discuss what you want to build.

Document(s) have been added to the appendix that should address any municipalities concerns. Your neighbors on the other hand are an entirely different discussion.

## SITE PREP

Choosing the location is an important aspect of the project: it should be a clear space, it can have some shade but shouldn't be full shade, check for overhead clearances, remove branches that may interfere with the structure. Afternoon shade could be a benefit.

**At a minimum, call 811 a week prior to the project.** 811 is the national call before you dig utility line locator service. An individual will be assigned to visit the site who will check and clear the location of all utilities. This should be done prior to any work. If the site you have chosen is over utility lines you may want to consider moving the structure to a new location.

The site should at least be flat...flat is good. Level and flat are better. Remember to level a site at least 1-foot in diameter larger than the structure.

## DISCLAIMERS

Information presented in this document is only one way (my way) of building a dome. Most people who build domes discuss the need for exactness; however, my experience has shown that **consistency** between similar parts is more important. Tolerances to within 1/8th of an inch are acceptable—this will be noted in the text. Your tolerances may be stricter than mine but my experience is that the methods and dimensions discussed and demonstrated in this manual work and provide a quality product. My accomplice Ted Craig, from the Wyoming Department of Agriculture (retired), has learned from these projects that his tolerances can relax. If Ted can relax a bit, so can you.

Manuals can be...let's face it, dry, so to make this a little more interesting, you might find nuggets of irreverent humor, snark, or sarcasm in the text—particularly if it seems the number of steps for the task are excessive. If you have read this far...let it be known that I have a particular set of skills—I am an entomologist who enjoys building ag-related structures and educating others how to repeat what I am doing. I am not a trained carpenter. I believe that anyone willing to try can follow this manual and build a similar structure and will be happy with the end result. If you have any questions about the instructions that can be clarified with a phone call, please call me at (307) 837-2956.

# CHAPTER 2 – ITEMS TO CONSIDER

## ADDING IRRIGATION AND RAISED BEDS

Originally, the dome workshops were intended to teach people how to build geodesic domes. Once the project was over, the recipients of the domes were turned loose to grow produce as they saw fit. It was frustrating to see finished projects a year or two post build to find that they weren't being used for growing crops. Since the original goal (to create a consistent repeatable workshop to educate others) was so successful, the goal now is that of a school which includes the instruction on how to build domes but also includes the creation of spaces that are ready to plant when the dome school is finished. This was done by making structural additions in 2024 to include irrigation systems and raised beds both inside and out.

The original iteration of this dome manual was just the dome itself, old images and measurements concerning construction are still included as you may simply just want to build the dome.

However, notes have been added/inserted to the text where significant alterations to the sidewalls have been made including instructions for the incorporation of an irrigation system and raised beds. Updated images have been included where appropriate.

As of the 2025 printing, all materials for a 22-ft or 14-ft diameter dome are about $2,800. Using included suggestions for raised beds and irrigation inside and out adds about $2,000. Purchasing soil for your raised beds is approximately $1,500 – hopefully soil purchase can be avoided by using your own soil/compost.

Finally, "your individual results may vary" and you may find more cost-efficient ways to build a dome with raised beds and irrigation. The materials list is constantly updated. This project incorporates some of the most inexpensive (yet structurally sound) ways to build a geodesic dome with raised beds with irrigation.

## MATERIALS

You will find that many of the materials listed for this dome a readily available from your local lumber yard. I give my local lumber yard the list of things they can supply and have them deliver—*but check their work*—particularly the total number of items delivered. Other more specific items for this project were ordered from suppliers listed in Table 1, page 7. Also, specific suppliers are referenced as these items are the materials being used in this manual. However, remember the suppliers list is not exhaustive—listing does not imply endorsement, nor does omission suggest prejudice. Minimum material strength requirements have been included in the materials list where necessary to ensure structural integrity. Alternate materials meeting the prescribed minimums can be used as substitutes. Additional suppliers of the woven poly cover can be found in Appendix A, page 210. It should be noted that the structural analysis and stamped calculation package included in the appendices of this manual have been compiled based on the geometry and construction methodology described herein. Deviations from the manual have not been considered and are not covered by the contents of the stamped package found in the appendix.

# MATERIALS LIST

**2025 Updated materials list:** There are similar items contained in each table (fence pickets, pine, and pressure treated lumber etc.,). To build the complete package (dome, beds, and irrigation) and get the correct total amounts of materials, sum similar items across tables (similar items have been color coded, also read any foot notes with the tables as totals are listed there).

**Table 1. Material List for 22-ft Geodesic Dome**

| COUNT | DESCRIPTION | SOURCE |
|---|---|---|
| 32[1] | **Fence pickets** used as lath to attach cover. 5-inch (W) X 68.5-inch (H) X 3/8-inch (D) Fence pickets (Natures Composites -Torrington, WY) | https://www.naturescomposites.com/ Can be very difficult to communicate with. |
| 6 | **ALTERNATIVE PICKET SOURCE:** (Packets of 7 pickets (7X6) =42) Natures composite #1 5-inch X 6-1/2-ft X 3/8-inch Fence pickets are available from Home Depot as Home delivery only and are significantly more expensive - but (yay bonus) shipping is included in the price. | https://www.homedepot.com/p/Natures-Composites-Composite-Fence-and-Gate-Picket-Square-Top-Timber-Brown-Brown-3-8in-x-5in-x-5-3-4ft-7-Pack-300TB069SQ-7PK/328286620?MERCH=REC-_-fbr-_-328286620-_-0-_-n/a-_-n/a-_-n/a-_-n/a-_-n/a |
| 1,296[2] | Square feet of 6-mil **Woven Polyethylene cover** (36-ft X 36-ft) (J & M Industries) Call to get correct size. J&M May have pieces from other projects that will fit. The polyethylene tarp should have a minimum tear strength of 24 lb. | https://www.jm-ind.com/products/custom-fabrication/solarig/ Local Sales Rep Brad Uthe - email address: BUthe@jm-ind.com |
| 48 | Square feet of 6-mil **Woven Polyethylene cover** (4-ft X 12-ft) (J & M Industries) Call Sales Rep to get correct size. J&M May have pieces from other projects that will fit. The polyethylene tarp should have a minimum tear strength of 24 lb. | |
| 4 | 30-inch X 30-inch **Aluminum Shutter** (FarmTek) Product number 105113 | https://www.farmtek.com |
| 4 | Solar Powered Liberty **Louvre Opener** (FarmTek) Product number 105109 | https://www.farmtek.com |
| 10 | Linear Ft. 3-inch dia. **SCH80 PVC water pipe** (not electrical conduit) Material for twenty six (26) 3-inch X 3.5-inch hubs) Must specify "water pipe" for crush strength (CPVC4120-05 3-inch SCH80 CORZANO ASTF441 370 PSI WP@73degreesF 90 PSI WP@ 180degreesF) The PVC or CPVC should have a minimum tensile strength of 7000 psi. | Ferguson Pipe - there are on-line sources as well. |
| 2 | Gallons your choice stain or paint | Local Source |

1 32 – Biocomposite Pickets are required for the Dome only. A total of 42 pickets are required for the dome and raised beds.

2 Order two separate sheets. The large piece is for the dome, the smaller piece is for the door and top vent. Trust me it is easier this way.

| COUNT | DESCRIPTION | SOURCE |
|---|---|---|
| 80[3] | 2-inch X 4-inch X 8-ft **Douglas fir** No. 2[4] or better (Structure, door, framing, vent frame) | Local Source |
| 65[5] | 2-inch X 4-inch X 8-ft **Pressure Treated** (Wall base and bottom of door frame) No. 2 or better[6] | Local Source |
| 1[7] | 4-ft X 8-ft sheet 3/8-inch or 1/2-inch **Pressure Treated Plywood (PTP) panel** for door frame | Local Source |
| 60 | Square feet (36-Wide X 20-ft long) 20X20 mesh window screen, pet resistant (for durability) | Local Source |
| 4 | 4-inch **Hinges** (Door Hardware zinc plated) | Local Source |
| 2 | 4-inch **bale type latches** (Door hardware zinc plated) | Local Source |
| 170 | 3/8-inch **Ny-lock Nuts** (zinc plated) | Local Source |
| 130 | 2-1/2-inch X 3/8-inch **Hanger Bolts** (zinc plated) | Local Source |
| 1 | 8 oz bottle **Gorilla (TM) glue Original Expanding** Formula (not yellow wood Glue) | Local Source |
| 20 | 3/8-inch X 5-inch **Hex head bolts** (zinc) Attached Dome to base wall | Local Source |
| 20 | 3/8-inch X 4-inch **Hex head bolts** (zinc) Attach base wall sections together | Local Source |
| 80 | 3/8-inch fender washers | Local Source |
| 4 | 2.5-inch poly paint brushes | Local Source |
| 2 | Gallons of stain (2 different colors) | Local Source |
| 1 | Pound 5-inch **BTX (Exterior) torx head wood screws** | Local Source |
| 10 | Pounds #9 3-inch **BTX (Exterior) torx head wood screws** | Local Source |
| 5 | Pounds #8 1 1/2-inch **BTX (Exterior) torx head wood screws** | Local Source |
| 1 | Pint PVC Primer | Local Source |
| 1 | Pint PVC Glue | Local Source |
| 2[8] | 20-ft 3/8-inch **rebar** cut into 2-ft lengths | Local Source |

3 80 - Pine 2x4's for Dome only. A total of 100 - Pine 2x4's are required for dome and raised beds.

4 Other acceptable lumber species include Southern Yellow Pine, No.1 (Non-Dense) or better, and Hem-Fir, No.2 or better. All three species can be readily sourced. The calculated capacity in the appendices of this book are applicable for all three lumber species and minimum grades.

5 65 – Pressure Treated 2x4's for Dome only. A total of 110 – Pressure Treated 2x4's are required for the dome and raised beds.

6 Other acceptable lumber species include Southern Yellow Pine, No.1 (Non-Dense) or better, and Hem-Fir, No.2 or better. All three species can be readily sourced. The calculated capacity in the appendices of this book are applicable for all three lumber species and minimum grades.

7 This is building the 2025 version, if you want to build the dome base using PT plywood you will need 6 sheets total.

8 Double this amount if installing exterior raised beds.

**Table 2. Materials list for Interior and Exterior Raised Beds**

| COUNT | DESCRIPTION | SOURCE |
|---|---|---|
| 10 | **Fence pickets** used as lath to attach cover. 5-inch (W) X 68.5-inch (H) X 3/8-inch (D) Fence pickets "Seconds"(Natures Composites -Torrington, WY) See notes above | https://www.naturescomposites.com/ |
| 1200 | sq. ft. minimum **Weed barrier** (30X30 is 900 sq. ft. however, need an additional 60 square feet each time you overlap the weed barrier). | https://www.greenhousemegastore.com/products/dewitt-weed-barrier-20-year-4-1oz?variant=42701277921479 |
| 50 | **Ground cover anchor pins** – There are many sources for these | https://www.greenhousemegastore.com/products/ground-cover-anchoring-pins?pr_prod_strat=pinned&pr_rec_id=6f3753eb7&pr_rec_pid=7482815086791&pr_ref_pid=7482816856263&pr_seq=uniform |
| 20 | 2-inch X 4-inch X 8-ft **Douglas fir** (Raised bed tops) | Local Source |
| 45 | 2-inch X 4-inch X 8-ft **Pressure Treated** (Raised Bed Studs and Base wall) No. 2 or better[9] | Local Source |
| 6[10] | Rolls (n)-inch wide x 50 ft. **Roof Valley Tin** (metal) Raised Bed Liner | Local Source |
| 5 | Pounds **3-inch BTX (Exterior) torx head wood screws** | Local Source |
| 5 | Pounds **1-1/2-inch BTX (Exterior) torx head wood screws** | Local Source |
| 2 | 20-ft 3/8-inch **rebar** cut into 2-ft lengths | Local Source |

9 Other acceptable lumber species include Southern Yellow Pine, No.1 (Non-Dense) or better, and Hem-Fir, No.2 or better. All three species can be readily sourced. The calculated capacity in the appendices of this book are applicable for all three lumber species and minimum grades.

10 For demonstration purposes of this manual the RVT width is 20-inches – If the RVT width you use is different remember to adjust the height of the wall and raised bed studs. See Table 6 "Valley Tin Width (inches)" on page 15.

**Table 3. Materials list for Irrigation in raised beds**

| COUNT | DESCRIPTION | SOURCE |
|---|---|---|
| 150 | Linear feet ½-inch **drip tape** (Drip works Irritec P1 Emitter Tape) | https://www.dripworks.com/irritec-p1-emitter-tape-1000-roll?gad_source=1&gclid=CjwKCAjw34qzBhBmEiwAOUQcF-q-jsQDXvftWk8CDPiKCBUk-3sovGYgYh7FqMtwHBzrke0qKcTyRRoCyz8QAvD_BwE |
| 40 | 5/8-inch **Drip Tape end plugs** | https://www.dripworks.com/tape-end-plug |
| 40 | Tape Loc x ½-inch MPT w/**Valve** | https://www.naturescomposites.com/ |
| 150 | Linear feet ¾-inch **black poly pipe** | Local Source |
| 10 | ¾-inch Barb Insert Polypropylene **90-Degree Elbow Fitting** | Local Source |
| 20 | 3/4-inch Barbed slip **Tee fittings** | Local Source |
| 20 | ¾-inch **Barb** Insert Polypropylene x ¾-inch Male **Pipe Thread Adapter Fitting** | Local Source |
| 20 | ¾-inch PVC SCH 40 Slip x ¾-inch Slip x ¾-inch Female Pipe Thread **Tee Fitting** | Local Source |
| 40 | PVC 90-Degree ¾-inch x Slip x ½-inch Female Pipe Threaded **Elbow** | Local Source |
| 20 | PVC Schedule 40 **Reducing Tee** ¾-inch slip x ¾-inch slip x ½-inch Female Pipe Thread | Local Source |
| 100 | ¾-inch Stainless Steel (SS) **pinch connectors** | Local Source |
| 15 | Linear feet ¾-inch **SCH 40 PVC pipe** | Local Source |
| 1 | Orbit 62061Z, 1-Outlet Hose **Watering Timer** | Local Source |
| 1 | ¾-inch Female **Hose** Thread X ¾-inch Female **Pipe** Thread **Adapter** | Local Source |

## USEFUL TOOLS

- Accurate miter saw with a solid stop
- Reciprocating saw, i.e. Sawzall®, with 6-inch wood cutting blade
- Table saw
- 3/8-inch hanger bolt driver — This is critical for driving hanger bolts into the cut ends of 2×4s. The hanger bolts fit into the ends of the hubs. Source: Amazon, Home Depot, or maybe your local lumber yard. (See image page 46.)
- Drills
- 1/8-inch drill bit
- 1/4-inch drill bit
- 9/32-inch drill bit
- 3/8-inch × 6-inch drill bit
- 7/16-inch × 6-inch drill bit
- Screw guns
- T20 and T25 Torx® bits
- 10-foot ladder
- 20-foot extension ladder
- 9/16-inch ratcheting box end wrenches
- Hammer
- Mallet
- 4-foot level
- Tape measure
- Pencil
- Speed square
- Crystal Clear Gorilla Tape® (not packing tape) — used for fixing oops in the skin
- Hearing protection
- Safety glasses
- Patience
- Extra hands

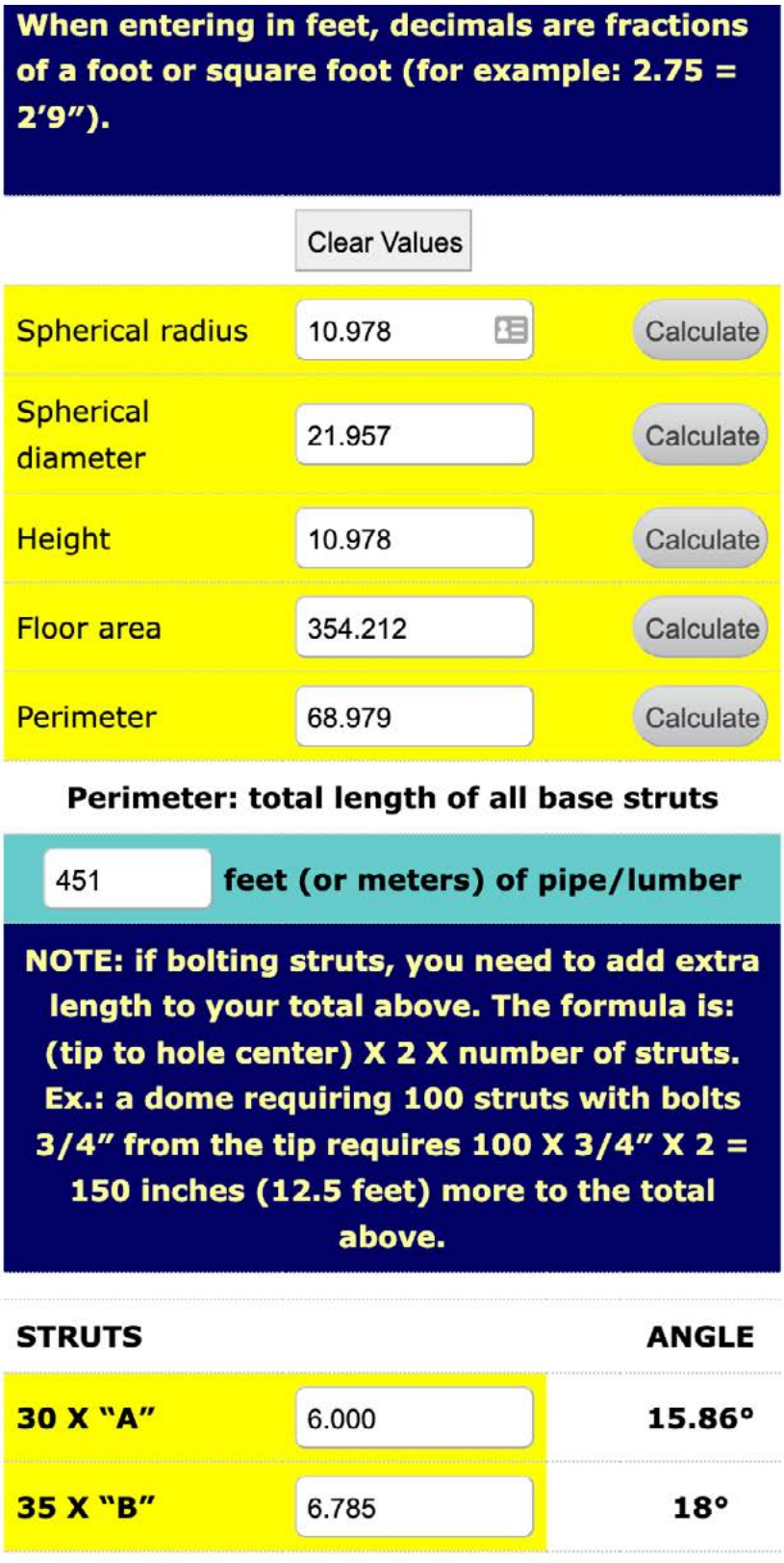
## THE NUMBERS

For those of us who are mathematically challenged or struggled with geometry or if you would like to build a dome that is not 22-ft in diameter, consult the Domerama website: http://www.domerama.com/calculators/2v-geodesic-dome-calculator/. For this manual we are building a 22 ft. dome.

To understand where the measurements come from, scroll down to the STRUTS section of the website.
To work with meaningful measurements, enter "6" in the field for STRUT "A" and click the calculate button. All the critical details of the dome will be calculated in feet. If you are using the website, a 6 ft. STRUT "A" length gives us a 21.957 ft. diameter dome. (See spherical diameter from the Domerama website.)

Once the lengths for the struts have been calculated, we can continue with additional calculations to determine the dimensions for all the parts and pieces and create a cut sheet for the project.

Next, use this website (or similar) https://www.spikevm.com/calculators/decimal-feet.php to convert fractional feet to inches. 21.957 = 21 feet, 11 and 121/250 inches—which




Screen capture from Domerama.com of the 2V geodesic dome calculator.
Photo: Courtesy domerama.com

is excessively strict for tolerances. It can be rounded to 21 feet, 11-1/2 inches (or rounded further to a "22-ft diameter dome").

Convert the lengths of STRUTS A and B to inches:

- Strut A = 6 ft. = 6 × 12 inches = 72 inches
- Strut B = 6.785 ft. = 6 ft., 9-7/16 in. = 81-7/16 in. Believe it or not, Strut B can be rounded up to 81-1/2 in. (Doing this might pop something in your brain if your tolerances are tighter than mine—but it will be okay. Just ask Ted.)

Reduce the length of each strut by the hub diameter:

- Since we are using a 3-inch ID (inside diameter) which is a 3-1/2-inch OD (outside diameter) SCH80 hub at the intersection of each strut, 3-1/2 in. must be subtracted from the total length of Strut A and Strut B.
- Therefore, the actual length of Strut A = 68-1/2 in. and Strut B = 78 in.

Now that the strut lengths have been determined the cut sheet can be finalized.

## USING THE CUT SHEET

Use the cut sheet, Table 4, page 14, to get an understanding of all the parts and pieces.

Different pieces can be cut anytime; however, cutting the longest pieces first allows the possibility to correct any issues with the lumber (knots, splits, or warps). It also allows mis-cut boards (measure twice) to be cut into smaller lengths (minimizing the "oops" factor and the possible waste of lumber).

You will notice in Table 4 of the Cut sheet that the Base vertical supports ("studs") length is listed as 14-1/4-inches bolded and noted with an asterisk.

This is the explanation of the (*): This measurement may not be 14-1/4-inches. The original iteration of the dome base wall height was 16-inches with 10-inch stud length (original structures also used pressure treated plywood as the exterior cover for these walls). Now that we have moved to using Roof Valley Tin to cover the base walls and raised beds, it is easier to match the wall height to the Roof Valley Tin than to cut the Roof Valley Tin to match the walls height. 14-1/4-inches is the stud length for a wall height of 20-1/4-inches. Table 6 lists the different stud lengths required for various Roof Valley Tin widths.

# CUT SHEET

**Table 4. Cut sheet for the 22-ft 2V geodesic dome.**

| Item | Length (inches) | Count | Material Details | Cut Angle (degrees) |
|---|---|---|---|---|
| **Hubs** | | | | |
| Hubs | 3-1/2 | 26 | 3-inch ID SCH80 Water pipe | 0,0 |
| **Base Wall Parts** | | | | |
| Base Bottom Rail | 81-1/2 | 10 | Pressure Treated | 18,18 |
| Base Top Rail | 81-1/2 | 10 | Straight Douglas-Fir, No.2 | 18,18 |
| Base Wall Spacer | 76 | 10 | Straight Douglas-Fir, No.2 | 18,18 |
| Base vertical supports ("studs") | **14-1/4*** | 51 | | 0,0 |
| **Struts** | | | | |
| Strut "B" 18 degrees | 78 | 10 | Pressure Treated | 18,18 |
| Strut "B" 18 degrees | 78 | 23 | Straight Douglas-Fir, No.2 | 18,18 |
| Strut "A" 16 degrees | 68-1/2 | 32 | Straight Douglas-Fir, No.2 | 16,16 |
| **Door and Door Frame Parts** | | | | |
| Footer | 45-1/4 | 1 | Pressure Treated | 0,0 |
| Inside Door Frame | 78 | 2 | Straight Douglas-Fir, No.2 | 0,0 |
| Outside Door Frame | 79-1/2 | 2 | Straight Douglas-Fir, No.2 | 0,0 |
| Door Header A | 45-1/4 | 1 | Straight Douglas-Fir, No.2 | 0,0 |
| Door Header B | 42-1/4 | 1 | Straight Douglas-Fir, No.2 | 0,0 |
| Doors | 36-3/4 | 8 | Straight Douglas-Fir, No.2 | 0,0 |
| Door Brace | CTF | 8 | Straight Douglas-Fir, No.2 | 45,45 |
| Door Hinge & Latch supports | CTF | 10 | | 0 or 45 |
| Door Frame attachment (sides) | 82-1/2 | 2 | 1-3/4-inch X 1-3/4-inch (ripped 2X4 in half) | 0,0 |
| Door Frame attachment (header) | 39-1/4 | 1 | | 0,0 |
| Door Jamb | 78 | 1 | | 0,0 |
| **Vent Frame Parts** | | | | |
| Vent Frame | 31-1/4 | 32 | Straight Douglas-Fir, No.2 | 0,0 |
| Outside Vent Frame | 37-1/2 | 4 | Straight Douglas-Fir, No.2 | 0,0 |
| Vent Studs | 16 | 8 | Straight Douglas-Fir, No.2 | 0,0 |
| **Lath Strips** | | | | |
| Lath for Strut A | 68-1/2 | 32 | 3/8-inch X 5-inch X 68-inch Bio composite Lath | 0,0 |
| Lath for Strut B | 78 | 23 | | 0,0 |
| Lath for Door | 36-3/4 | 8 | | 0 or 45 |
| Lath for Door braces | CTF | 8 | | 0 or 45 |
| Lath for door hinge and latch supports | CTF | 4 | | 0 or 45 |
| Lath for Vents frame inside | 31-1/4 | 16 | | 0,0 |
| Lath for Vents frame outside | 37-1/2 | 4 | | 0,0 |
| Base lath for Skin attachment[11] | 81-1/2 | 10 | 81-1/2-inch X 3-inch strip (from pressure treated panel) | 0,0 |

11 These will only be available when building the dome without raised beds option.

**Table 5. Cut Sheet for the 22-ft 2V Geodesic Dome Raised Beds.**

| Item | Length (inches) | Count | Material Details | Cut Angle (degrees) |
|---|---|---|---|---|
| **Outside Raised Beds** | | | | |
| Top rail | 105 | 9 | Pine | 18,18 |
| Bottom Rail | 105 | 9 | Pressure Treated | 18,18 |
| Studs | 17-1/4* | 71 | | 0,0 |
| Top Rail at door | 30 | 2 | Pine | 0,45 |
| Bottom rail at door | 30 | 2 | Pressure Treated | 0,45 |
| Top rail 10th Wall (Door opening) | 32-7/8 | 2 | Pine | 18,45 |
| Bottom rail 10th wall (Door opening) | 32-7/8 | 2 | Pressure Treated | 18,45 |
| Studs for RB at door and 10th wall | 17-1/4* | 24 | | 0,0 |
| **Inside Raised Beds** | | | | |
| Principal Wall Sections Top Rail | 57 | 7 | Pine | 18,18 |
| Long Wall Top Rail -CTF | TBD | 2 | | 0, TBD |
| Short Wall Sections - CTF | TBD | 2 | | 0, TBD |
| Principal Wall Sections Bottom Rail | 57 | 7 | Pressure Treated | 18,18 |
| Long Wall Bottom Rail - CTF | TBD | 2 | | 0, TBD |
| Short Wall Sections - CTF | TBD | 2 | | 0, TBD |
| Studs | 17-1/4* | 38 | | 0,0 |
| **Inside Center Raised Bed** | | | | |
| Top Rail | 26 | 10 | Pine | 18,18 |
| Bottom Rail | 26 | 10 | Pressure Treated | 18,18 |
| Studs | 17-1/4* | 30 | | 0,0 |
| *** Length will vary depending on the width of Roof Valley Tin for this instance the RVT is 20-inches wide. See Table 6 below.** | | | | |

**Table 6.**

| Valley Tin Width (inches) | Stud Length (inches) Dome Base wall | Stud Length (inches) Raised Beds | Cubic Yards of Soil to fill all beds |
|---|---|---|---|
| 24 | 18.25 | 21.25 | 35.5 |
| 20 | 14.25 | 17.25 | 28.9 |
| 18 | 12.25 | 15.25 | 27.3 |
| 16 | 10.25 | 13.25 | 24.0 |
| 14 | 8.25 | 11.25 | 21.9 |

## SUGGESTED CUT ORDER

1. Top and bottom rails for base wall
2. Strut B
3. Base wall spacer
4. Strut A
5. Base vertical supports (the studs for the base wall).
6. Base side panels (exterior cover sheets)
7. Base lath for skin attachment
8. Hubs
9. Lath strips (primary lengths for struts A and B—smaller pieces will be cut to fit the door and vents during the skinning process)
10. Door and door frame parts (lumber)
11. Vent frame parts (lumber)

*Again, the suggested cut order is longest to shortest pieces. Measure twice.*

# CHAPTER 3 – LET'S BEGIN

## PREPPING FOR IRRIGATION SYSTEMS AND INSTALLING WEED BARRIER

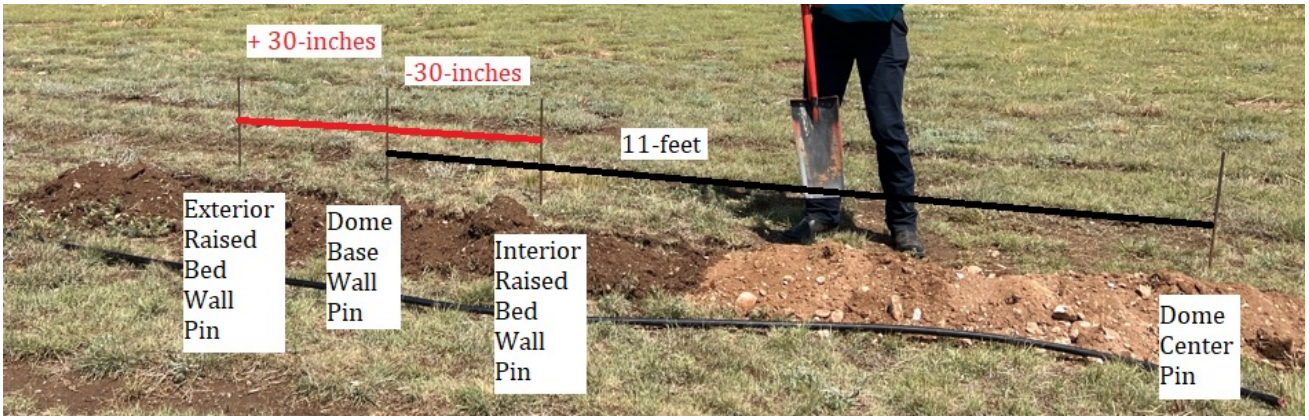
- Be sure to contact your municipality about your intent to build and receive all approvals.
- Identify the dome location on your property.
- Call 811 to clear the location of utilities.

### Suggested Tools List

- Tape measure
- Shovel or trenching shovel
- Razor knife or poly pipe cutting tool
- Rubber Mallet
- Tool to tighten worm drive clamps – this could be a flat blade, Phillips, or Hex head driver OR
- Stainless-Steel clamp pinch tool

## IN-GROUND IRRIGATION SYSTEM

Mark the center of the dome (use one of the rebar pegs from the material list and drive it in the soil with a mallet about 6-inches deep). Measure in a straight line 11-feet away from the center pin in the direction of your nearest water source. Drive a second rebar pin into the soil at 11-ft away from the center pin. This second pin is approximately where the outside wall will sit. From the dome wall marker pin place, a third pin 30-inches in toward the center, and a 4th pin an additional 30-inches out/away from the exterior wall pin. Pin 3 is approximately the location of the interior raised bed wall; the 4th pin is approximately the location of the exterior raised bed wall. Avoid placing the irrigation trench where the door opening is planned.



Dig a trench about the depth of a shovel from the center pin to about 12-inches beyond the 4th pin. Do not dig up the pins (you will be using them later, but the pins will be used to keep you in-line while you dig and serve as reference points for the irrigation system).

1. Roll-out enough poly pipe from the center of the structure to the end of the trench (12-inches beyond the outer raised bed wall marker.

2. Insert a ¾-inch 90-degree barbed elbow into an end of the ¾-inch black poly pipe out the center of the dome and secure with a worm drive clamp or a stainless-steel pinch clamp.

3. Cut a 24-inch piece of poly pipe and attach to the other side of the barbed elbow (this is the riser pipe). Cover the open end of the riser pipe with tape to keep dirt from entering the system. This riser will supply water to the center raised bed.

youtu.be/iGsqnaJfSrw

4. Lay the poly pipe in the trench, riser placed vertically at the center point rebar pin and run the poly pipe towards the exterior end of the trench.

5. At the 3rd pin **out from the center** (the dome base wall) measure 15-inches toward the center of the structure.

6. Cut the poly pipe at this location using a razer or poly pipe cutting tool.

7. Insert clamps on both ends of the pipe in the trench, insert a ¾-inch barbed Tee into the cut pieces and attach both ends with the clamps, tail of the Tee pointed up.

8. Cut a second 24-inch section of pipe, place a clamp over the end, insert the vertical portion of the Tee and clamp creating a second riser. This Riser will supply water to the inside raised beds.

9. Tape the top of the second riser.

10. Measure 15-inches from the base wall pin **out towards** the 4th pin and repeat steps 5-8 from above, creating a 3rd riser. This riser will supply water to the outside raised beds.

11. Cut the poly pipe in the trench about 12-inches beyond the outside raised bed pin and tape the end.

12. Hold the risers vertically and backfill the trench with soil and tamp back into place. Do not backfill soil where the terminal end of the pipe is located beyond the exterior raised bed wall.

13. Remove the rebar pins.

# WEED BARRIER INSTALLATION

## Suggested Tools List

- Tape measure
- Razor Knife OR Scissors
- A windless day

Regardless of your weed barrier type or dimensions, you will need to layout approximately 30-ft X 30- ft of weed barrier fabric (WBF) to cover the soil under the dome. This is equivalent to 900 sq. ft. Why so much if my footprint is only 22-ft? If you add external raised beds all the way around the structure you are increasing the exterior footprint by 6-ft (approximately 3 feet all the way around). When accounting for the full size of the dome and raised beds, a 30-ft X 30-ft square will allow you a 1-ft margin of error on the sides.

1. Lay the WBF out parallel to the backfilled irrigation trench.

2. Cut access holes for the irrigation risers and place the irrigation risers through the WBF.

3. Using WBF landscaping pins fasten the WBF to the soil. You may need to drive these in using a mallet. Take care not to bend them.

4. Overlap the WBF with the next run by at least 12-inches. Lay out the fabric and pin in place.
5. Repeat until all 30-ft X 30-ft are covered.

6. Use enough pins to hold the WBF in place and make sure it is secure if you must leave the job site. Otherwise, it might not be there when you get back.

# RAISED BEDS

Information on raised beds will be included as the manual proceeds but note, raised bed walls are built the same as base walls (but without a spacer on the top rail) for the dome. Stud length and finish height are dependent upon the width of the Roof Valley Tin you are using to line the raised beds.

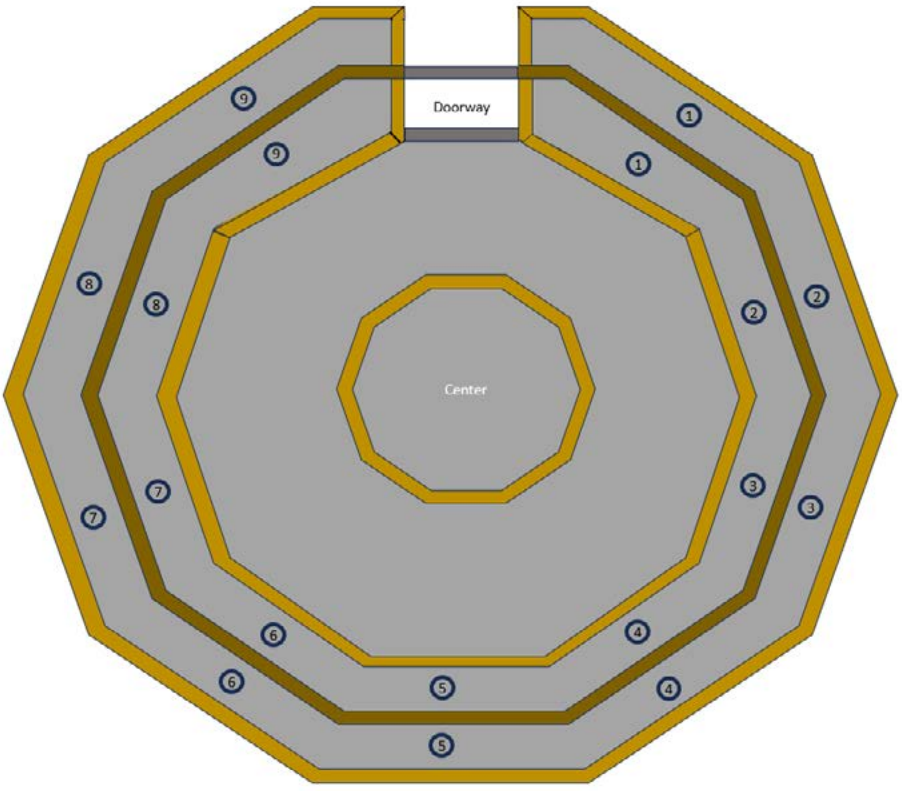
# IRRIGATION MANIFOLD PREP

## Suggested Tools List

- Tape measure
- Marker/Pencil
- PVC cutting tool
- PVC Pipe Cleaner
- PVC Glue

Irrigation manifolds can be built at any point.

Manifolds are placed at the beginning of each bed and allow independent control of the irrigation of individual beds. The valves of the manifolds can be opened or closed depending on the crop being grown or if the bed is fallow.




As a point of reference, each wall section from point to point inside or outside the dome is considered an independent bed. There are 9 interior raised beds, 9 exterior raised beds and 1 bed in the center of the dome.

Therefore, there are a total of 18, 2-valve manifolds for the interior and exterior raised beds and one 4-valve manifold for the center raised bed.

## 2-Valve Manifolds

1. Using a PVC pipe cutting tool, cut 36, 6-inch-long pieces of the ¾-inch SCH 40 PVC.

2. Apply PVC pipe cleaner to the outside 1.5-inch of both ends of the pipe and let dry.

3. Apply PVC pipe cleaner to the inside (slip end) of 36, ¾-inch slip X ½-inch threaded SCH 40 PVC 90's and let dry.

4. Apply PVC pipe cleaner to the inside (slip end) of one of the, ¾-inch slip X ¾-inch slip X ¾-inch threaded SCH 40 PVC Tees and let dry.

5. Working quickly (to keep the PVC glue from setting on you)...start with a ¾-inch slip X ¾-inch slip X ¾-inch threaded SCH 40 PVC Tee, apply glue to the inside of the one slip end of the ¾-inch slip X ¾-inch slip X ¾-inch threaded SCH 40 PVC Tee and to the exterior of one end of a 6-inch SCH 40 ¾-inch pipe section.

6. Insert the glued end of the ¾-inch pipe into the glued slip end of the ¾-inch slip X ¾-inch slip X ¾-inch threaded SCH 40 PVC Tee and give the pipe a ¼ turn/twist, hold in place until the glue sets (about 20 seconds).

7. Repeat steps 5 and 6 for the opposite slip end of the PVC Tee and a second piece of 6-inch PVC pipe. Your work should look like this [image right].

8. Repeat steps 5-7 another 17 times.

9. Using one of the sections built in the previous steps and again working quickly apply PVC glue to the inside (slip end) of one, ¾-inch slip X ½-inch threaded SCH 40 PVC 90.

10. Orient this piece on a flat work surface.

11. Glue on the 90 elbows so that the threads of the 90 elbows are at a 90-degree angle away from the ¾-inch threaded opening of the Tee.

12. Repeat steps 9-11 until all 2-valve manifolds are completed.

## 4-Valve manifold

The 4-valve manifold is built in the same manner as the 2-valve manifolds. Beginning at the center Tee and moving out to a ¾-inch slip X ¾-inch slip X ½-inch female threaded reducing Tee on both sides and attaching one, ¾-inch slip X ½-inch threaded SCH 40 PVC 90 to both ends. Be sure to orient the Tees and 90s at right angles to the center Tee.

## Manifolds are built now what?

Locate the drip irrigation supplies, thread the Tape Loc x ½-inch MPT w/Valves into the end 90s of the of each manifold and tighten (this is soft material and can strip easily (right Jed?)). You may want to use pipe tape on the threads. Also, add two more valves to the 4-valve manifold middle Tees.

In each of the manifolds thread a ¾-inch Barb Insert Polypropylene x ¾-inch Male Pipe Thread Adapter Fitting into the central Tee and tighten (again may want to use pipe tape). Manifolds are complete. Set them to the side for installation later.

# DOME PARTS PREP—CUTTING MATERIALS

## TOOLS

- Electric miter saw with hard stops to determine accurate (consistent) length
- Table saw
- Circular saw
- Straight edge
- Speed square
- Tape measure
- Pencil
- Hearing protection
- Safety glasses

## CHECK FOR SQUARE

Before we really begin, it is a good idea to check your saw blades for square. There are many tools to do this including some apps for your phone. Make the necessary adjustments now, including installing new blades.

## BASE WALL TOP AND BOTTOM RAILS

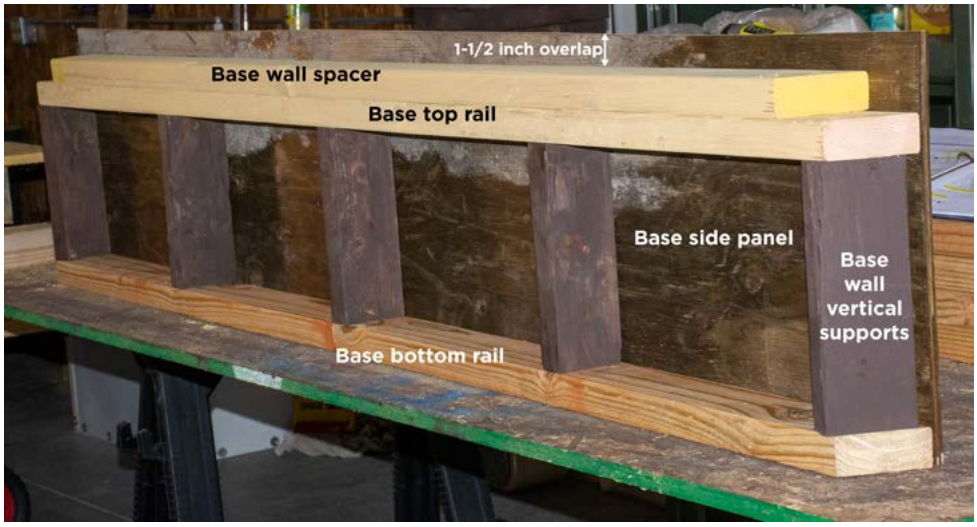



Figure 3. One assembled base wall section. The plywood side (base side panel) is on the exterior of the geodesic dome. The image represents the base wall when building the dome without raised beds

Sections of this manual will begin by showing an image of the completed part, section, or structure, so you can orient yourself with what each section of the manual is attempting to accomplish. An image will also be included at the end of each section.

**2025 construction method updates**

1. Pressure treated plywood (PTP) is no longer attached to the exterior of the base of the dome as described in this section. The PTP has been replaced with Roof Valley Tin (RVT). For about the same price as the PTP sheeting you can cover both sides of the dome base wall and the interiors of the raised beds. Using this method, no soil will contact any pressure treated wood. Installation of the RVT is directly to the structure after the dome frame is finished and the raised beds installed.

2. For the base wall, all pieces including the base bottom rail, base top rail, base wall spacer, and the studs for the base wall are cut from pressure treated 2-inch X 4-inch X 8-ft (2X4's). Covering them on the inside and outside with RVT prevents soil exposure and rot as it will be very difficult to replace any of these pieces once the dome is in production.

**NOTE:** Wall and raised bed stud length will change and vary by width of available RVT see chart. Total wall height will be ¼-inch taller than the RVT is wide, this allows for some play when attaching the RVT to the raised beds and dome base wall.

**Table 6.**

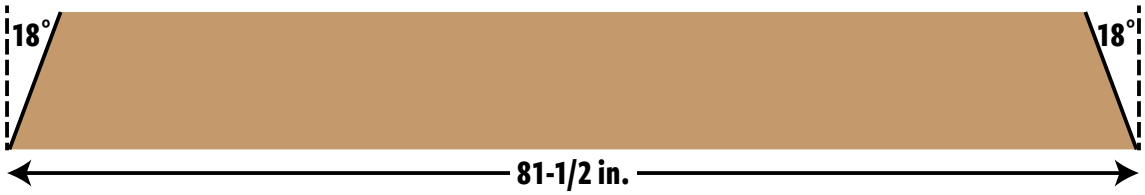
| Valley Tin Width (inches) | Stud Length (inches) Dome Base wall | Stud Length (inches) Raised Beds | Cubic Yards of Soil to fill all beds |
|---|---|---|---|
| 24 | 18.25 | 21.25 | 35.5 |
| 20 | 14.25 | 17.25 | 28.9 |
| 18 | 12.25 | 15.25 | 27.3 |
| 16 | 10.25 | 13.25 | 24.0 |
| 14 | 8.25 | 11.25 | 21.9 |

1. To start cutting base wall, top and bottom rails, set your miter saw cut angle left or right of center to 18 degrees.


2. Set your length stop at 81-1/2 inches.
3. Lay a 2×4 board with wide side down on the saw and make the first cut near the end as possible (discard the first cut end as scrap).

4. Flip the board vertically 180-degrees toward the saw and push the first angle cut to the 81-1/2 inch stop.

5. Make the second cut and try to avoid knots in the wood at the ends. Your cuts should be so the board is a trapezoid.




6. Check the measurement of the cut board, along the long edge (point to point). If not correct, adjust the miter saw stop so the length is accurate. If it is the correct length, repeat this procedure and cut a total of **10 base top rails** using straight pine and cut **10 more** using pressure-treated lumber **for the base bottom rails**.

**Note:** If building structure with raised beds, make both the top and bottom rails using pressure treated lumber.

## STRUT B

1. Leave the left/right angle set at 18-degrees.
2. Reset the miter saw stop length at 78-inches for Strut B.
3. **Cut 33 Strut B's**. Save the longer cut scrap ends for base wall vertical supports (used later for the wall studs, page 53).
    - Cut 23 Strut Bs from straight pine 2X4's and 10 strut Bs from pressure treated 2X4's. These 10-pressure treated Strut Bs will be the bottom of the dome and are attached to the base wall. Using pressure treated will add longevity to the structure by reducing rot and the need for later replacement.

    ***Note:*** *You might have noticed footnote 5 from the cut sheet, page 14, mentions that cutting 33 struts is two less than the 35 Strut B's required by the Domerama.com calculator. This is because two struts are removed from the location where the door is mounted and are used in the upper sections of the dome. So there is no need to make the extras. For a visual reference, refer to the cover image.*

4. Stack and spray paint the cuts ends **BLUE**.

    *Why? You will handle these pieces many times before final assembly. Color coding will assist you in easily identifying which part you are working with.*

## BASE WALL SPACERS

Spacers allow a 1-1/2-inch space for the hubs to clear the top rail of the base wall and adjustment in the fit of the dome onto the base wall.

1. Leave the left/right angle of the miter saw set at 18-degrees.
2. Reset the stop at 76 inches and **cut 10 base wall spacers.** Spacers are cut from pressure treated lumber.

3. Stack the spacers and spray paint the cuts ends **YELLOW**.

4. Save the cut scrap ends for base vertical supports.

## STRUT A

1. Set your miter saw left or right of center to **16 degrees**.
2. Set your length stop at 68-1/2 inches.
3. Cut **32 Strut A's**, using regular pine lumber.

   ***Note:*** *As noted in footnote 3 on the cut sheet, page 14, the calculator indicates that 30 Strut A's are required. This project requires 32 strut A's. 30 Strut A's will get fitted with hanger bolts and the remaining 2 will be used to assist in mounting the door to the dome, and will replace the Strut B's removed from the doorway. See page 139.*

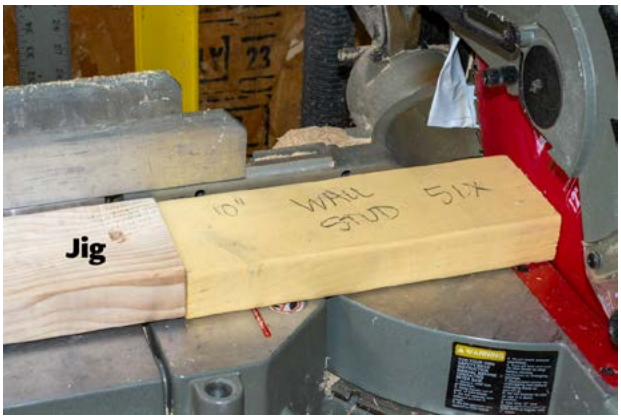
4. Stack and spray paint the cuts ends **RED**.

5. As with the previous cut pieces, save the cut scrap ends for base wall vertical supports.

## BASE WALL VERTICAL SUPPORTS (STUDS)

1. Set your miter saw angle at **0 degrees**.
2. Set your length stop at 10 inches. (Stud length will vary based on width of Roof Valley Tin see table on page 26.)

   ***Note:*** *You may need to use a spacer jig between the stop fence and the piece you are cutting to safely cut a piece as small as 10 inches.)*




3. **Cut 51 studs** from the scrap material created from the cuts of the base top rails, base spacers, and the struts. These 51 studs are for the base wall only. Additional studs will be cut when building raised beds. Raised bed studs will be different length, see Table 6 on page 26.

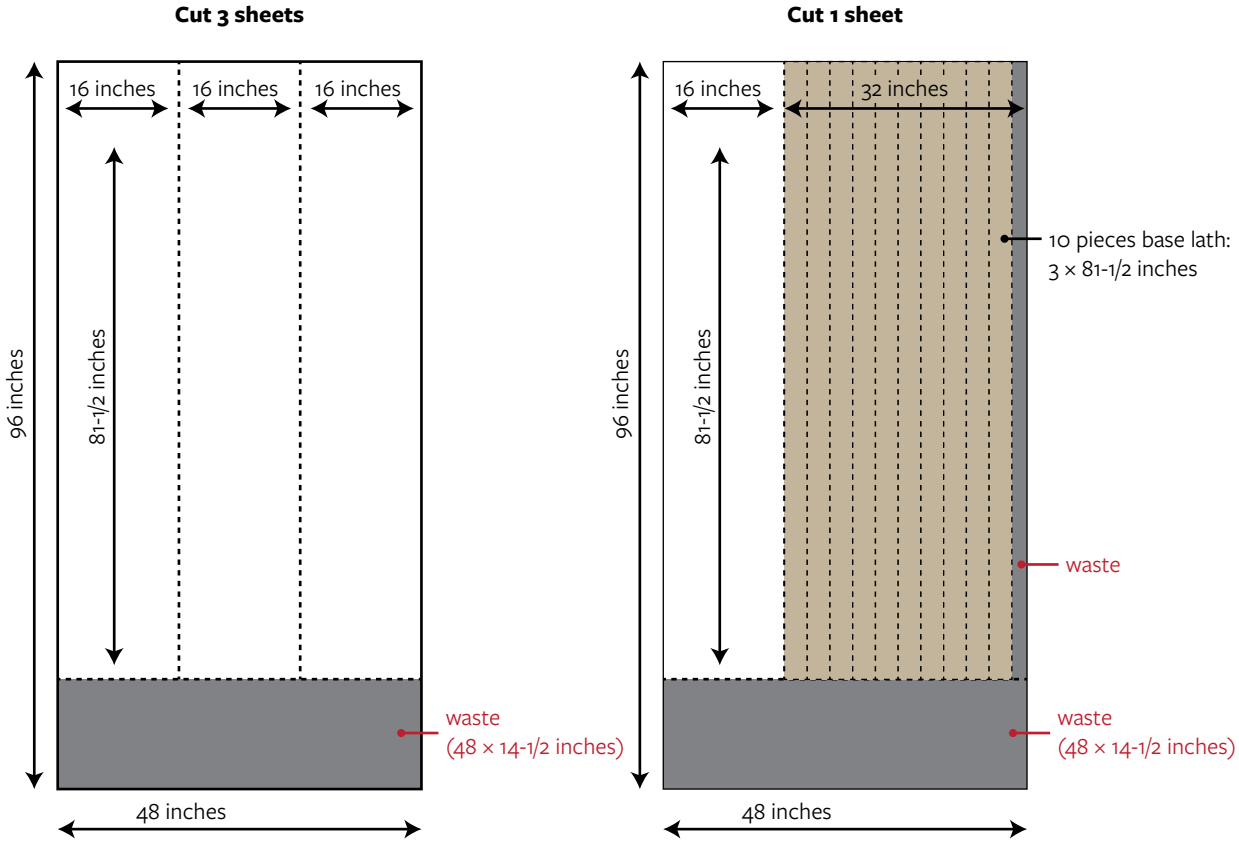
## BASE SIDE PANELS (IF NOT BUILDING RAISED BEDS)

1. Save back one sheet of the five exterior sheeting sheets (only if not including raised beds). This saved sheet is used in the framing of the door, see page 143.
2. For the remaining 4 sheets of exterior sheeting, use a table saw or circular saw and cut the length of each sheet down from 96 in. to 81-1/2 in. long. The trimmed piece (14.5 × 48-inches) is waste and not used in the geodesic dome build. See page 33 for a cutting diagram.

3. Next, rip 3 of the trimmed exterior sheets from step 2 into three 16-in. wide sections for a total of 9 pieces that are 81-1/2-inches × 16-inches.

4. Rip one more 81-1/2-inch × 16-inch piece from the from the fourth sheet.

*There should be a total of 10 pieces 81-1/2-inches × 16-inches. Use the remaining piece that is 81-1/2-inches × 32-inches for the base lath (next section).*




## Cutting Exterior Sheeting Summary

1. Set aside 1 sheet for door framing.
2. Trim remaining 4 sheets to be 81-1/2 inches long.
3. Cut 3 of the shortened 81-1/2-inch sheets into thirds (each piece 16 inches wide).
4. From the 4th sheet cut one piece 16 inches wide.
5. The remaining 81-1/2 x 32 inch piece from the 4th sheet will be cut into base lath — 10 pieces, 3 inches wide x 81-1/2 inches long.

# BASE LATH FOR SKIN ATTACHMENT

1. Use the remaining 81-1/2-inch-long × 32-inch-wide piece of exterior sheeting and rip it into 10 strips which are 81-1/2-inches long × 3 inches wide.

   *These will be used as the lath strips over the plastic at the base during final construction.*


## HUBS

This section just addresses cutting the pipe into hub sections.  More on drilling holes can be found in the hub jig section on page 37.

1. Set the angle at 0 degrees on the miter saw.
2. Set the length stop at 3-1/2 inches.
3. Cut the entire length of pipe into individual 3-1/2-inch hubs. You will need 26 hubs for one structure.

   *Allow the saw to stop after each cut before lifting the blade as this PVC pipe has the tendency to kick-back if the blade is still spinning. The last piece can be tricky to cut—watch those fingers!*

## LATH STRIPS

Lath is used to attach the woven polyethylene **tarp** to the completed structure and can be cut from a variety of materials (ripped 2×4s, plywood, etc.,). Lath derived from natural products will need to be painted and predrilled prior to assembly, natural products also tend to split and rot, shortening the lifespan of the structure. It has been shown that using **biocomposite** products (plastic + organic material) such as fence pickets are more durable for this type of project. They don't need painted, do not split or rot, and hold up for many years. (Our source is Nature's Composites, in Torrington, Wyoming.) These have been #2 grade and have been significantly cheaper than #1 grade (If you live anywhere in Wyoming it is worth the gas to pick them up in person).  Number 1

grade are available from Home Depot as a ship to you option only https://www.homedepot.com/p/Natures-Composites-Composite-Fence-and-Gate-Picket-Square-Top-Timber-Brown-Brown-3-8in-x-5in-x-5-3-4ft-7-Pack-300TB069SQ-7PK/328286620?MERCH=REC-_-fbr-_-328286620-_-0-_-n/a-_-n/a-_-n/a-_-n/a-_-n/a there are 7 pickets in a package (you will need 6 packets of 7 for a total of 42 pickets for the entire project). Picking them up in person has historically been less than $80.

- If using the fence pickets from Nature's Composites, use a table saw to rip them into 1-1/2-inch-wide strips. Each picket will yield 3 lath strips (and a narrow waste strip).
- You need 126 1-1/2 × 68-inch strips. These are used on the door, door frame, every strut, and the vent frames.
- Cutting biocomposite products is hard on saw blades and generates a lot of sawdust. It is recommended to cut outside where the material can be used as mulch if a vacuum system is not in place. Also wear safety glasses and a dust face mask.

## DOOR AND DOOR FRAME PARTS AND VENT FRAME PARTS

Reference the door schematic, page 68, and cut 2×4s to the described lengths as listed in the cut sheet. Set aside the door pieces and the vent pieces in separate locations.

## THE PAINTING OR STAINING

Painting or staining can occur at anytime and is the most time-consuming process as everything must be painted or stained and allowed to dry. For the workshops we have been conducting, staining generally occurs now. Color choices and medium are up to you. We have found it helpful to paint/stain everything one color except all of Strut A. All Strut A's should be paint/stained a different color from the Strut B's (thus 2 gallons of different colored paint/stain in the materials list). If the parts and pieces are painted/stained in this manner, assembly is much simplified and communication with others will be clearer when needing a specific part during the final construction of the dome.

# CHAPTER 4 – ENOUGH PREP, LET'S BUILD STUFF

## PARTS PREP: PRE-ASSEMBLY OF DOME COMPONENTS

### RECOMMENDED TOOLS

- Hub jigs, see below
- Hanger bolt jig, see page 40
- Hanger bolt driver
- 7/16 drill bit
- 9/32 drill bit
- Power drill
- Power driver
- T20 and T25 TORX bits
- Gloves
- Eye protection
- Hearing protection

## JIGS

**Note about the jigs mentioned through this manual**: We developed several jigs which allow us to be consistent and quick in the production of parts and pieces.

## HUB JIG AND DRILLING THE HUBS

The **5-hole** and **6-hole hub jigs** were built by a local welder/machine shop and cost approximately $65 each. The hub jigs consist of 1/4 inch wall thickness × 3 1/2 inch ID steel pipe with either 5 or 6 holes 7/16 inch in diameter drilled equidistant around the perimeter of the center of the jig. The jig slips over the hub and is held in place with a 3/8 inch bolt which passes through a hole in the wall of the jig where a 3/8 inch nut has been welded to the outside of the jig sidewall. Once the hub is inserted into the jig, the bolt is tightened against the hub.

Use the jig holes as guides and drill 7/16-inch holes in the correct hole combination:

- 4-hole and 6-hole hubs using the 6-hole jig.
- 5-hole hubs using the 5-hole jig.
- You will need to drill ten (10) 4-hole hubs (4-hole hubs are created using the 6-hole jig, drill any 4 consecutive holes); ten (10), 6-hole hubs; and six (6), 5-hole hubs. Individuals who have received an early version of the manual have opted not to use metal jigs, but purchase a 3-inch pipe union, ground out the center ribbed stop. Thus, creating a jig from the union. It will not be as durable as metal jigs but cheaper for single project use and it is genius if building one or two domes.

| Holes | Hub Count |
|---|---|
| 6 | 10 |
| 4 | 10 |
| 5 | 6 |

Holes are slightly over-sized at 7/16-inch, but this allows the 3/8-inch hanger bolts a little movement and easier installation in the hubs.

The hub jigs are a worthwhile investment that you will appreciate.

We recommend wearing a glove to hold the jig while drilling the holes in the hubs as the drill can bind and rip the jig out of your hands and do some serious damage.

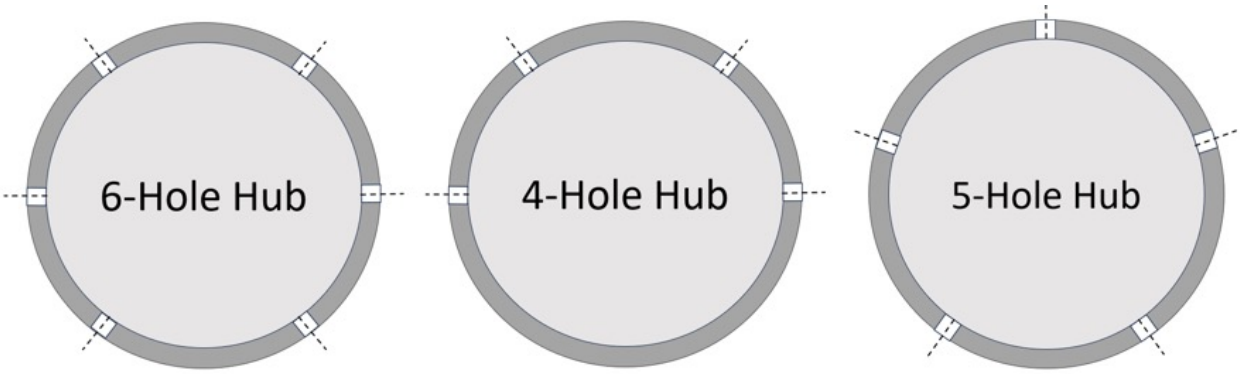
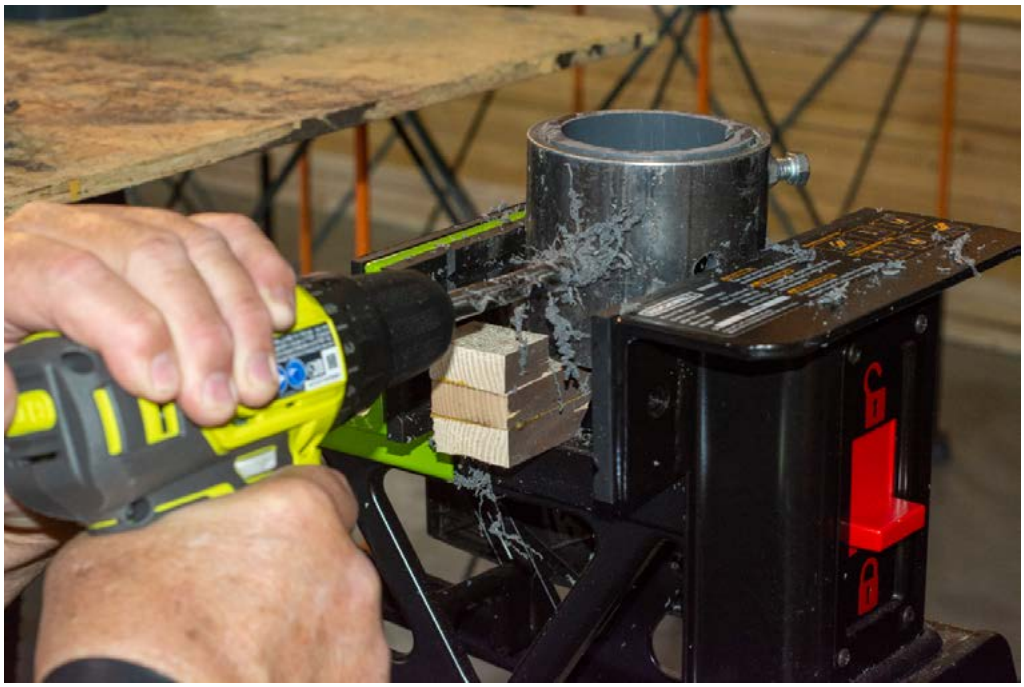



Figure 4. Schematic of drilling patterns and hole locations in various hubs.

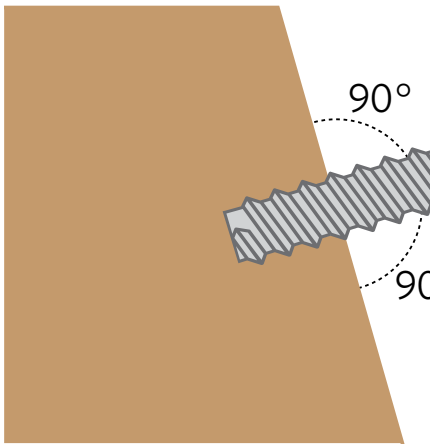

RYOBI



Or, use a large-mouth vice like a Jawhorse™ to hold the hub while drilling the holes. We have also found that placing them on the ground and holding them with your feet while drilling holes keeps them from jumping around as well.

## HANGER BOLT JIG

A single 3/8-inch × 2-1/2-inch hanger bolt is driven into the center of the cut face at 90-degrees in both the cut ends of each of the struts.




Remember you must find center of all the struts (126 times). To do this consistently and easily, build a jig which centers the location of the pilot hole in the cut end of the strut. We built our

hanger bolt jig with scrap lumber, scrap siding, and a 1-inch-long × ½-inch-wide steel bushing with a 5/16-inch center hole.

## TO BUILD THE HANGER BOLT ALIGNMENT JIG

1. Make an 18-degree cut on a scrap piece (face 1) and a second 18-degree cut parallel to the first cut, 1-inch (face 2) from the first cut.

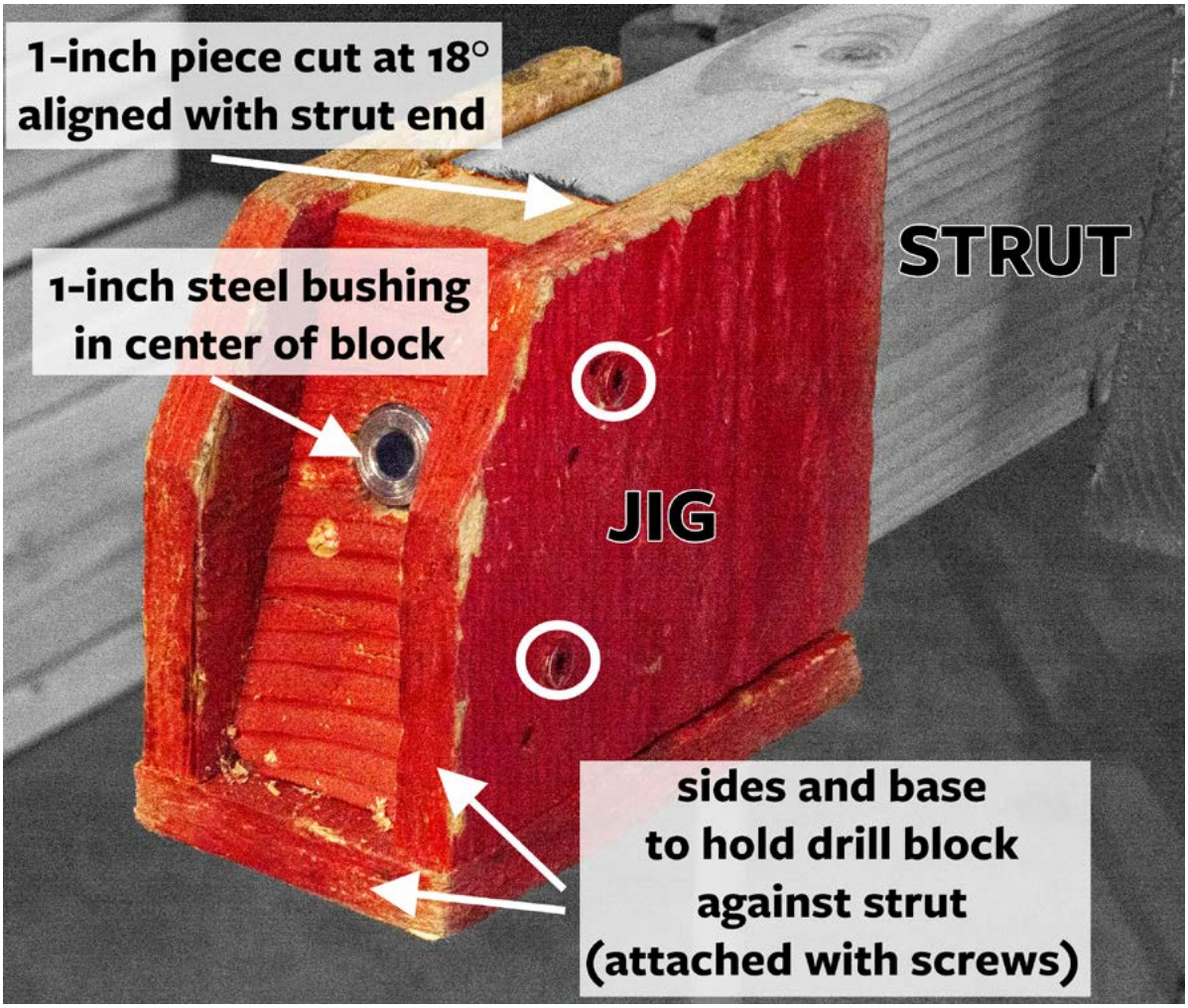

2. The center of face 1 was determined using one of the two methods described on page 43, and marked.
3. The piece of lumber was placed onto a drill press (flat on face 2) so that face 1 was the side being drilled.

4. The center point was drilled all the way through the 1-inch piece of lumber using a ½-inch drill bit.

5. The steel bushing was driven using a hammer into the drilled hole (the fit should be snug).


6. Next, flip the scrap piece so that face 1 is in contact with the cut end of any strut B, align left to right and top (the top is the "point" of the cut) to bottom.

7. Next, attach scrap siding pieces (use screws, glue, or brads) to the wide sides of the jig and the top of the jig. These pieces will help keep the jig aligned on center of the cut face of the struts.



## FINDING CENTER WITHOUT A JIG

If you choose not to build a hanger bolt alignment jig, center can be found in a variety of ways.

**Mathematically**. Measure the width of the cut face divide this number in half, using a pencil draw a mark across the face at the ½ mark. Measure the length of the cut face, divide this number in half and using a pencil draw a second mark across the face at the calculated point. Center should be where the lines intersect.

**With a straight edge (Easier).** Using a straight edge lay across the cut face from one corner to opposite corner and using a pencil draw a line. Repeat from the other corner to its opposite and using a pencil draw a second line that intersects on the face in an X. The cross of the X should be center.

## USING THE JIG

1. You can use this jig for both Strut B and Strut A even though Strut A is cut at 16 degrees. Again, tolerances. If the thought of this really bothers you, build a second jig with a 16-degree angle.

   **Important:** *Remember two Strut A's are used in the door framing process and do not need drilled or fitted with hanger bolts—set them aside.*

2. To use the jig, slide it onto a cut end of a strut, make certain the cut end is lined up and in full contact with the inside face of the jig—you may need to use a rubber mallet to knock it in place. Drill a 9/32 inch pilot hole through the steel bushing and into the end of the strut. Depth should be the length of the bit but not through the top edge of the strut. The pilot hole should be in the center of cut end of the strut and at 90 degrees to the face of the strut. Repeat the drilling process using the jig in both ends of the cut faces of 30 strut A's and all 33 strut B's.

## HANGER BOLT INSTALLATION

Once all struts have been drilled on both ends, use a power driver with a **3/8-inch hanger bolt driver** to install a 3/8-inch × 2-1/2-inch hanger bolt into both ends.

1. To do this, run the power driver in forward and thread the 3/8-inch hanger bolt into the 3/8-inch hanger bolt driver.



2. Dip the opposite end of the hanger bolt into expanding Original Gorilla Glue8. Only a small amount is needed, but it is necessary*.


*Nylock® nuts are used to attach the hanger bolts to the PVC hubs. The Gorilla™Glue prevents the hanger bolt from backing out of the strut – if you ever need to remove the Nylock® nut (it happens).

3. Drive the hanger bolt into the predrilled center hole in the end of the strut so that all of the course threads are in the wood and approximately 1-inch of the fine threads of the hanger bolt remains sticking out, see page 48.

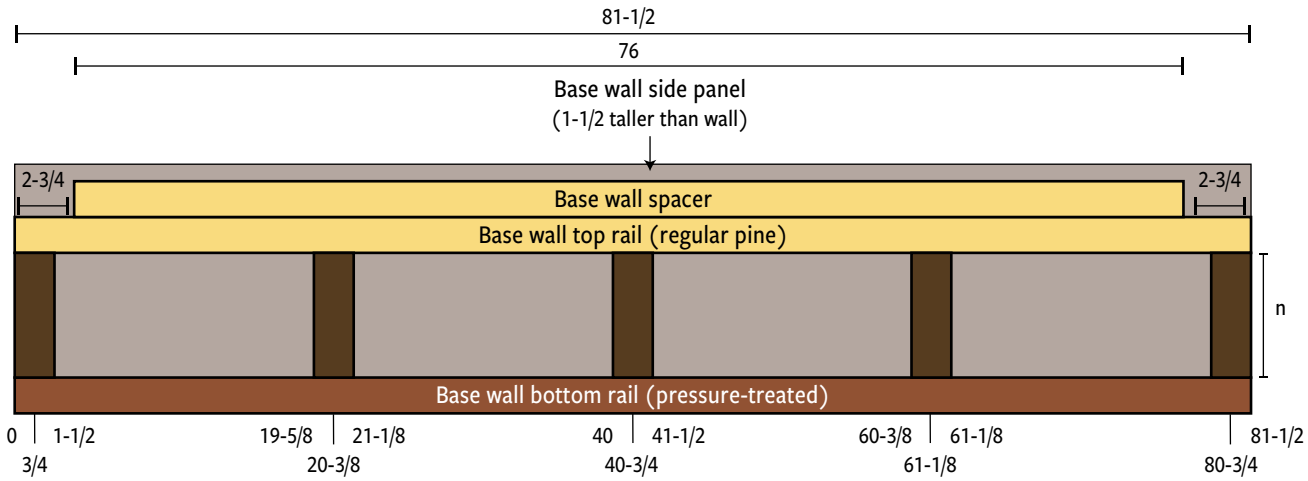

4. Switch the driver to reverse and remove the hanger bolt driver from the hanger bolt.

5. Repeat hanger bolt installation process the opposite end and on both remaining ends of all predrilled struts A and B.

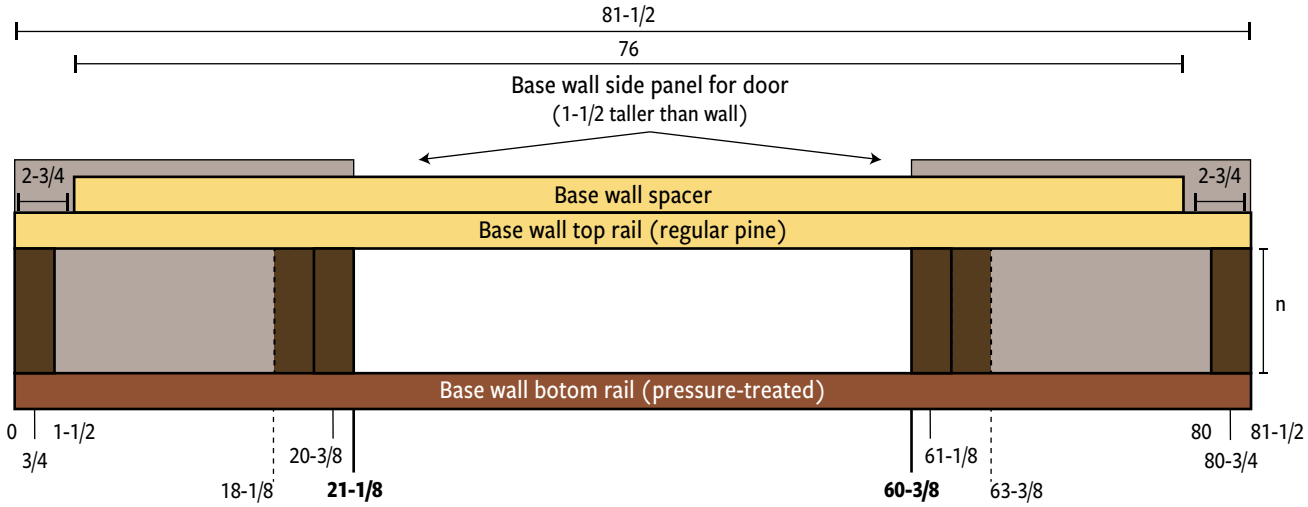
# BUILDING BASE WALLS

Base walls are optional but useful when placing raised beds inside or outside the structure. You will build 10 base walls. Nine are identical and the 10th is similar but has spacing to accommodate mounting the dome's door.

**Base Walls (build 9)**




**Base Wall for Door (build 1)**




**Reminder:** the above drawings are used as reference if you are not installing raised beds and using wooden exterior panels. If raised beds are planned, the Top Rail spacer, bottom rail, and studs are cut from pressure treated lumber and the exterior sheeting is replaced with roof valley tin and installed later, not pressure treated plywood as these diagrams show.

## MEASURING AND MARKING STUD LOCATION

1. Pair a straight pine top rail with a pressure-treated bottom rail.
2. Place both pieces on a flat work surface so that the narrow 81-1/2-inch edge for both pieces is up. To help orient the pieces this long edge (now up) is the base wall outside edge.

3. Match the cut ends so they are flush and using a tape measure and pencil, measure from the left or the right end and place marks at 20-3/8, 40-3/4, and 61-1/8-inches on the outside edge of either the top rail or the base rail.

4. Using a speed square and pencil, draw a complete line across the outside edge face of both 2×4s at the marks indicated above in step 3.
5. Rotate the top board 90 degrees away from you and the bottom board 90 degrees toward you.

6. Using the speed square and pencil, transfer the outside edge marks to the wide side of each the bottom and top rail (now facing you). These marks indicate the centerline of the of the studs in the base wall. The side now facing you for the top rail (straight pine) is the top (sky) side and the side of the bottom rail (pressure-treated) facing you is the bottom (ground) side.

## SCREW PLACEMENT

1. The next step applies to both the top rail and the bottom rail.
2. Using a power driver fitted with a T25 TORX bit, "start" **two** 3-inch screws 3/4-inch from both ends and along each the lines drawn at 20-3/8, 40-3/4, and 61-1/8 inches.

**"Start"** *means to drive the screws straight into the board but not through the board (there should be about 2-1/2-inches of screw remaining to drive in). There should be 10 screws started in each the top rail top face and the bottom rail bottom face.*

## ADDING STUDS

1. Again, rotate the two rails 90 degrees, the top (furthest) one away from you and the bottom (closest) one towards you—the current side up for both the top rail and the bottom rail should be the inside face of the base wall.
2. Push the rail furthest from you about 12 inches away from the closest rail.
3. Locate your stud stack. They might look like or are being used as a Jenga™ stack of painted blocks, there should be 51 of them.

4. Take 5 studs from the stack and place between the rails near the locations of the started screws.

youtu.be/ECKZGo97s_4

5. Starting with the rail closest to you, align a stud so it is centered on one of the lines (at 20-3/8, 40-3/4, or 61-1/8 inches) opposite of where the screws are located (skinny side up). It is important to make sure the bottom edge of the stud (touching the work surface) is flush with the bottom edge of the rail you are attaching it to and that it is in line with the center line—this will allow the exterior sheeting to be mounted to a flat surface.

6. Hold in place and using the power driver, drive the remaining portion of the first screw through the rail into the stud.
7. Drive the second screw through the rail into the stud.
8. Repeat at the remaining inside (not the ends) locations (20-3/8, 40-3/4, or 61-1/8 inches).
9. For the ends—the wide face of the stud **is flush** with the 18-degree end cut of the rail (mounted on an 18-degree bias and not 90 degrees as were the other 3 studs) and flush with the outside surface. Drive both screws into the end studs. All 5 studs should be attached to the pressure-treated 2×4 base.
10. Stand the base wall section vertically to attach the top rail. To do this, rotate the base rail with studs attached 90 degrees towards you. You should be able to see the top of all 5 studs.

11. Pick up the other rail and rotate it 90 degrees towards you so screw side is up and place on top of the studs.

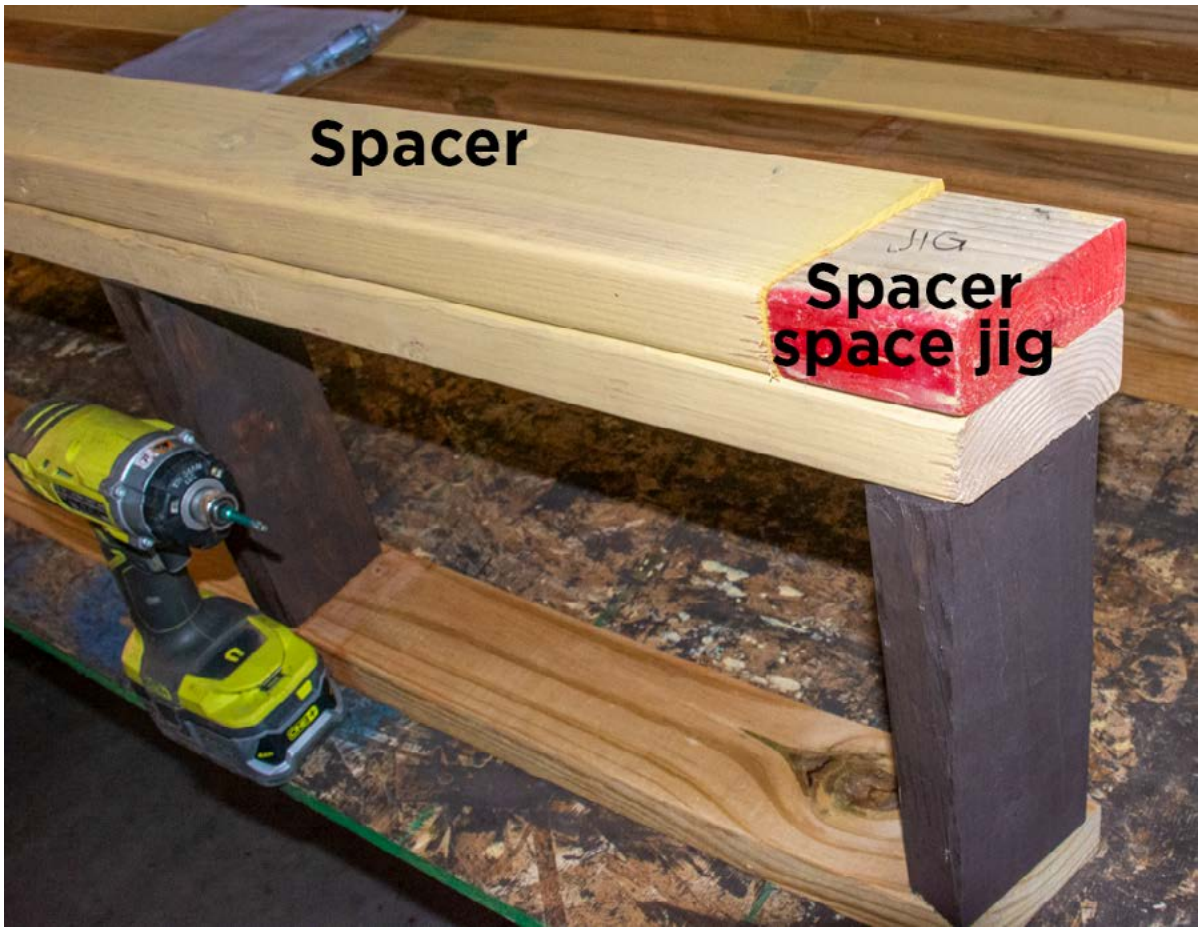
12. Start at the center stud, align so that stud is centered on the line and drive one of the screws through the rail into the stud.


13. Move to one of the ends, make certain the stud is flush with the cut end of the rail and flush with the outside face and drive the 2 screws into the stud.
14. Go to the opposite end of the base wall and repeat.

15. Align and drive the remaining screws through the rail into the respective studs.

## ADDING SPACER TO THE TOP RAIL

1. Depending on how the base wall was laid out you may need to rotate the base wall frame on the work surface so that it is sitting on the bottom (pressure-treated) rail.
2. Locate the spacer stack (ends are painted yellow—there are 10 of them).




3. Place a spacer 2×4 on top of the top rail wide side up—match the long side of the spacer with the long side of the top rail. The long side is the outside. Set the spacer so that there is a 2-3/4-inch "space" from both the cut ends of the top rail.

   ***Note:*** *A jig can easily be made (the spacer space jig ☺) from scrap 2×4 to get this spacing correct on each wall panel. The spacer space jig is a 2-3/4 inch wide piece with 18° cuts on both ends and in the shape of parallelogram.*

4. Attach the spacer with two 3-inch screws in both ends and the along the line of the middle stud (6 screws total).

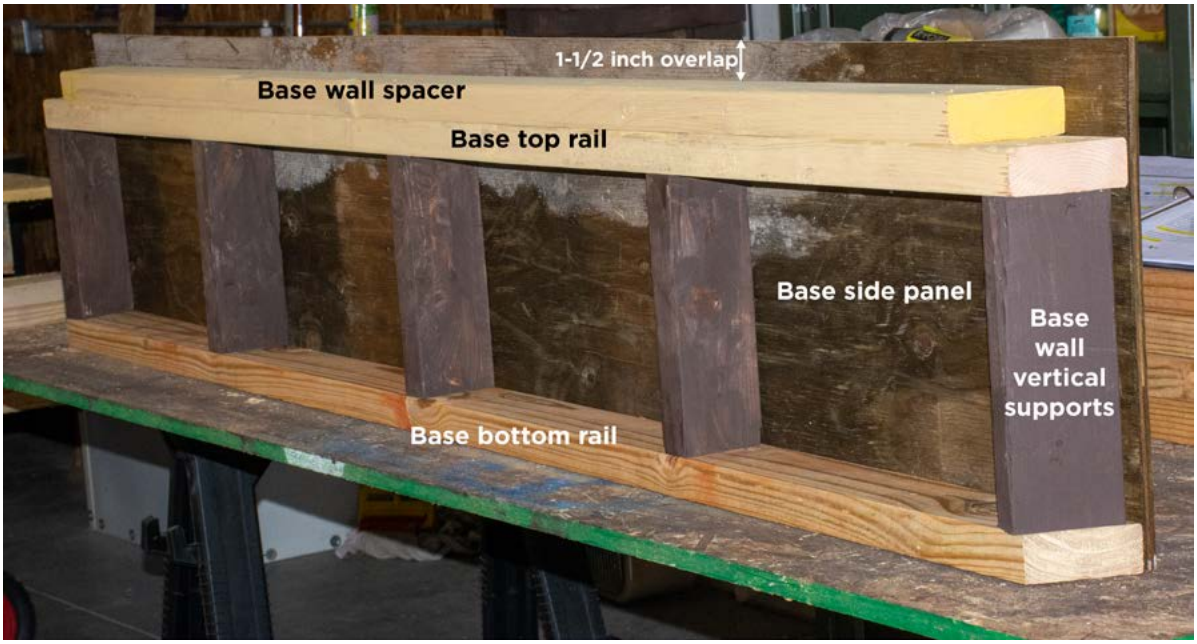
youtu.be/krYTZj_y4Bk

## ADDING THE SIDING PANEL

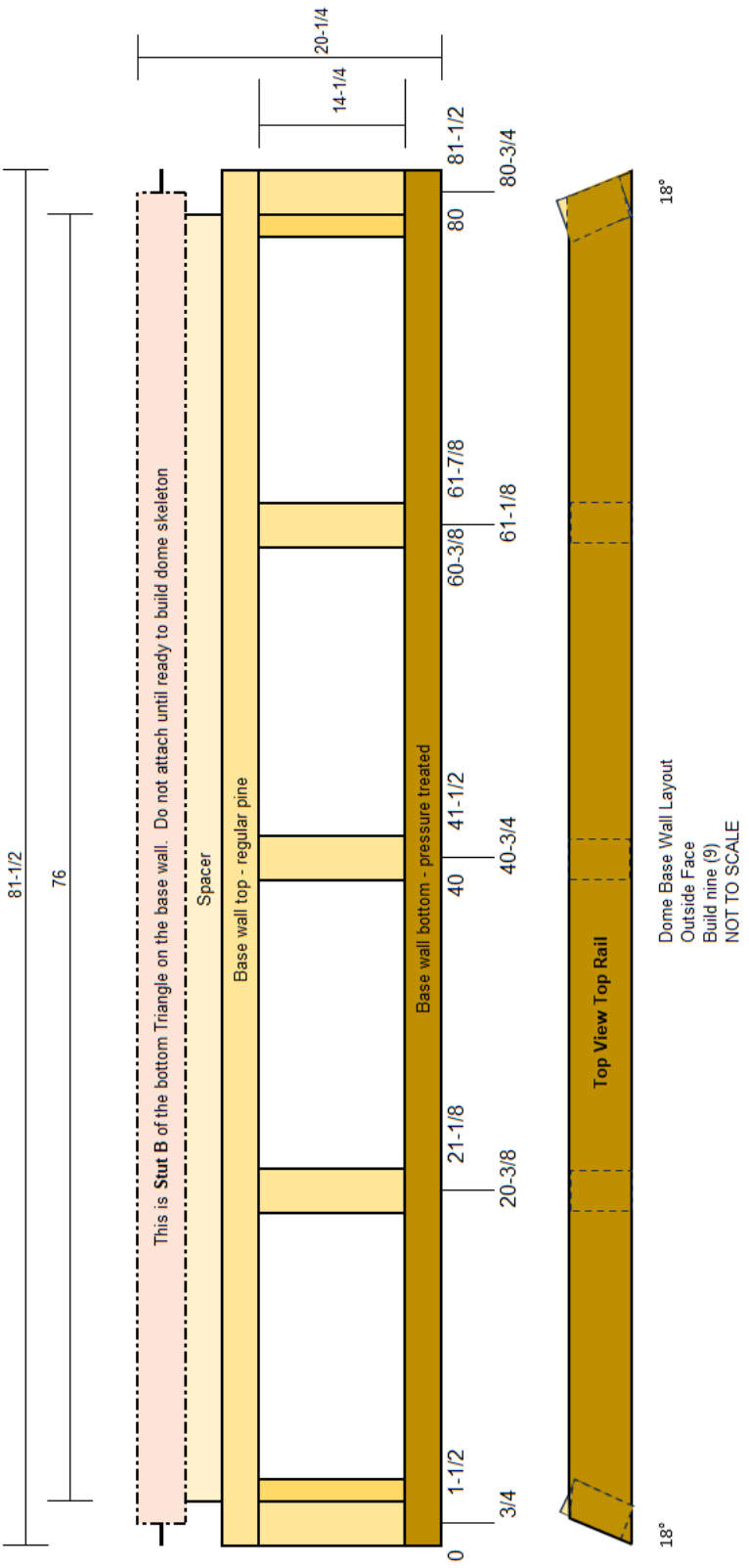
(*Can skip this section if using RVT to line base walls and raised beds go to the next section "**THE 10TH WALL OR BASE WALL PANEL FOR THE DOOR**"*)

1. Lay the side wall so the inside face (the short side) is resting on the work surface.
2. Locate the 81-1/2-inch × 16-inch siding panels.

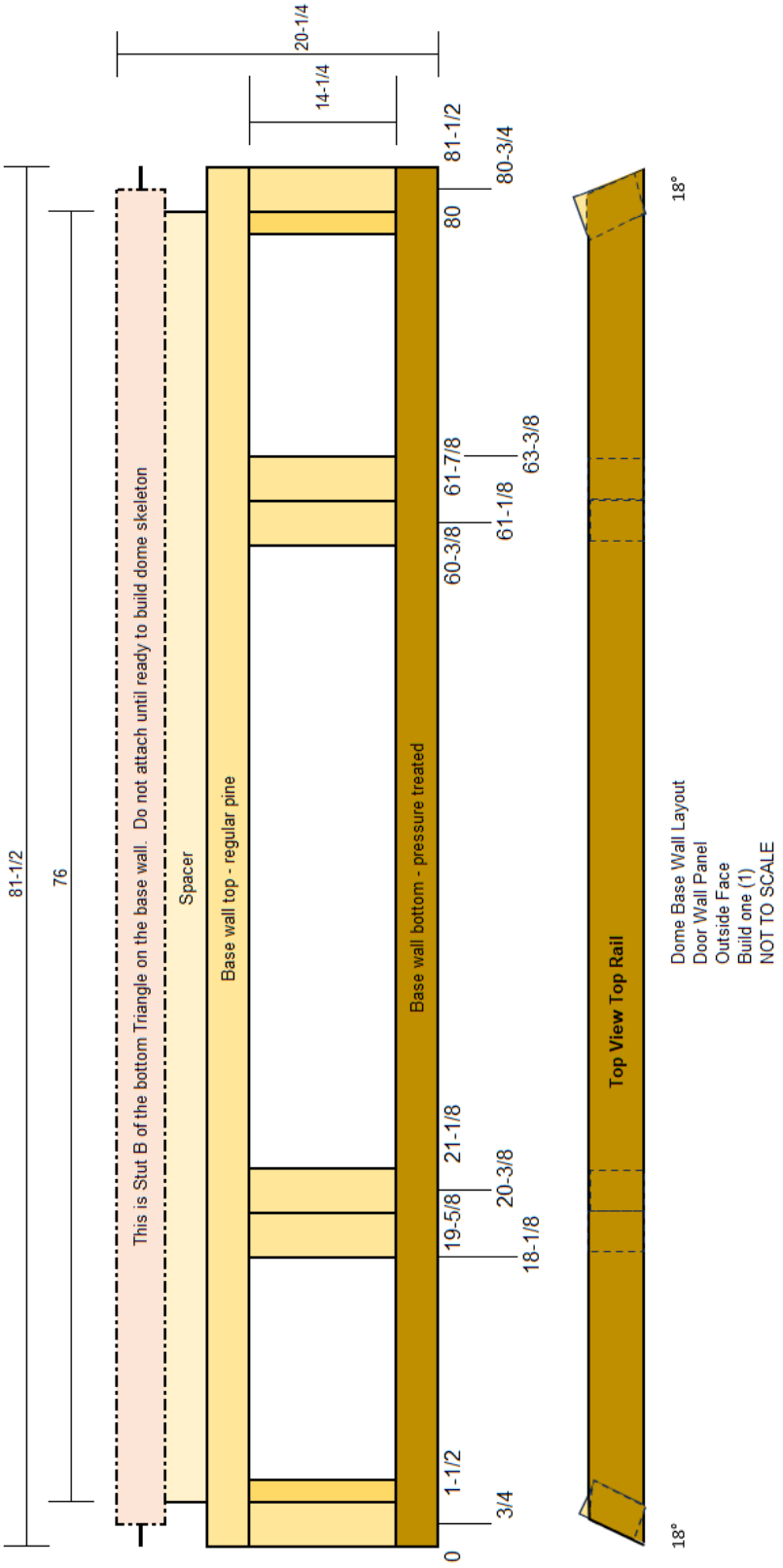
3. Align the side panel onto the wall section so that the long edge is flush with the bottom base (pressure-treated) edge and ends even with the cut ends of the top and bottom rails and attach with 1-1/2-inch screws using a T20 bit and power driver. Place three screws through the panel into the base wall frame in line with each of the five stud locations.
4. You will note there should be 1-1/2-inch of the side panel extending past the spacer on the top rail—this will hold the first course of Strut B's in place during final construction.



5. REPEAT steps 1–4 for a total of 9 base wall sections.



## THE 10TH WALL OR BASE WALL PANEL FOR THE DOOR

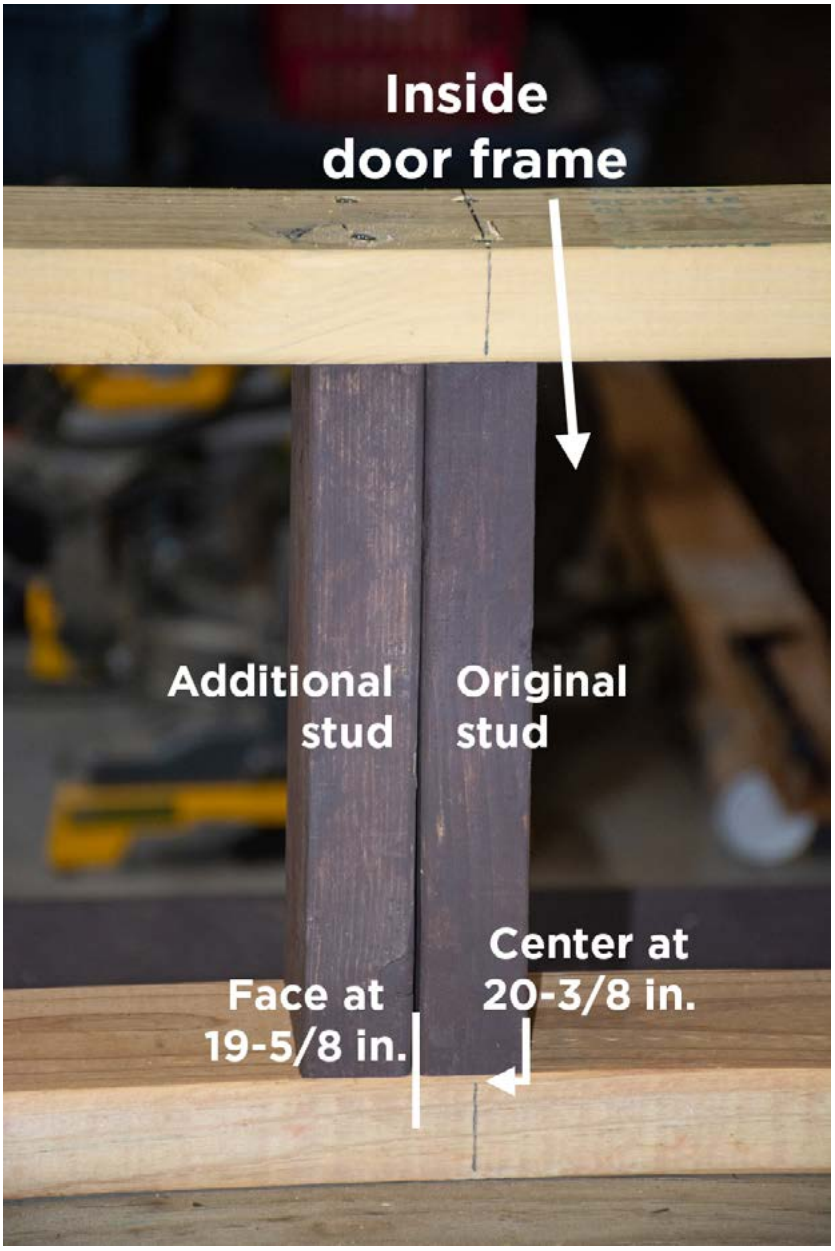


1. Repeat all of step 1, “Building Base Walls,” page 49 ; however, omit the mark at center (40-3/4 inches).

2. Repeat all of step 2, “Building Base Walls,” page 49 Do not place screws at 40-3/4 inches on either the top or bottom rails.


3. Repeat all of step 3, “Building Base Walls,” page 49 . Do not place a stud at center.
4. The opening between the studs matches the opening for the inside of the door frame.

5. Looking from left to right, position and attach using 3-inch screws an additional stud so that it is tight against the left face of the stud at 20-3/8 inches and to the right of (and tight against) the stud at 61-1/8 inches. These double studs will align with the two vertical supports of the door frame.




The stud with the pencil mark on the top and bottom rail pointing to it is centered at 20-3/8 or 61-1/8 inches (the original wall stud location) the stud on the left (no pencil marks) in this image is on the inside of the wall studs at either end (inside the door walkway). It should be positioned facing the outside end stud and set in place at 19-5/8 inch, flush to the other stud which is centered at 20-3/8. Replicate this on both ends. See base wall schematic page 49.

Adding the siding panels for the door side wall section

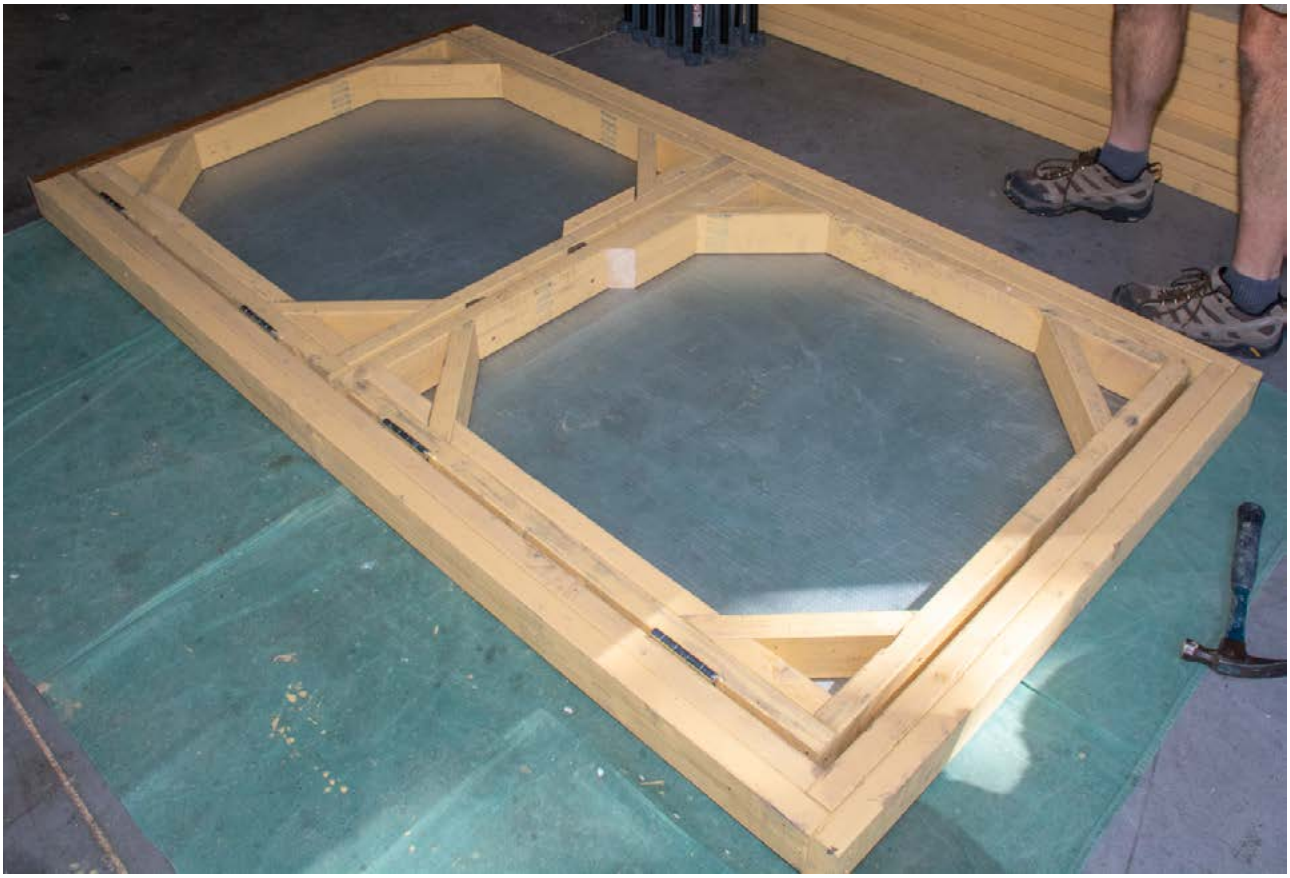
(*Can skip this section if using RVT to line base walls and raised beds*)

1. With the door wall panel laying on the work surface (inside down), measure the distance from the outside edge top rail point to the opening on the inside of the stud centered at 20-3/8—it should be at 21-1/8 inches.
2. Using a circular saw or chop saw cut the indicated length from the last siding panel.
3. Align the panel so it is flush with the inside face of the door stud, the bottom of the base rail, and the outside edge of the top and bottom rails.

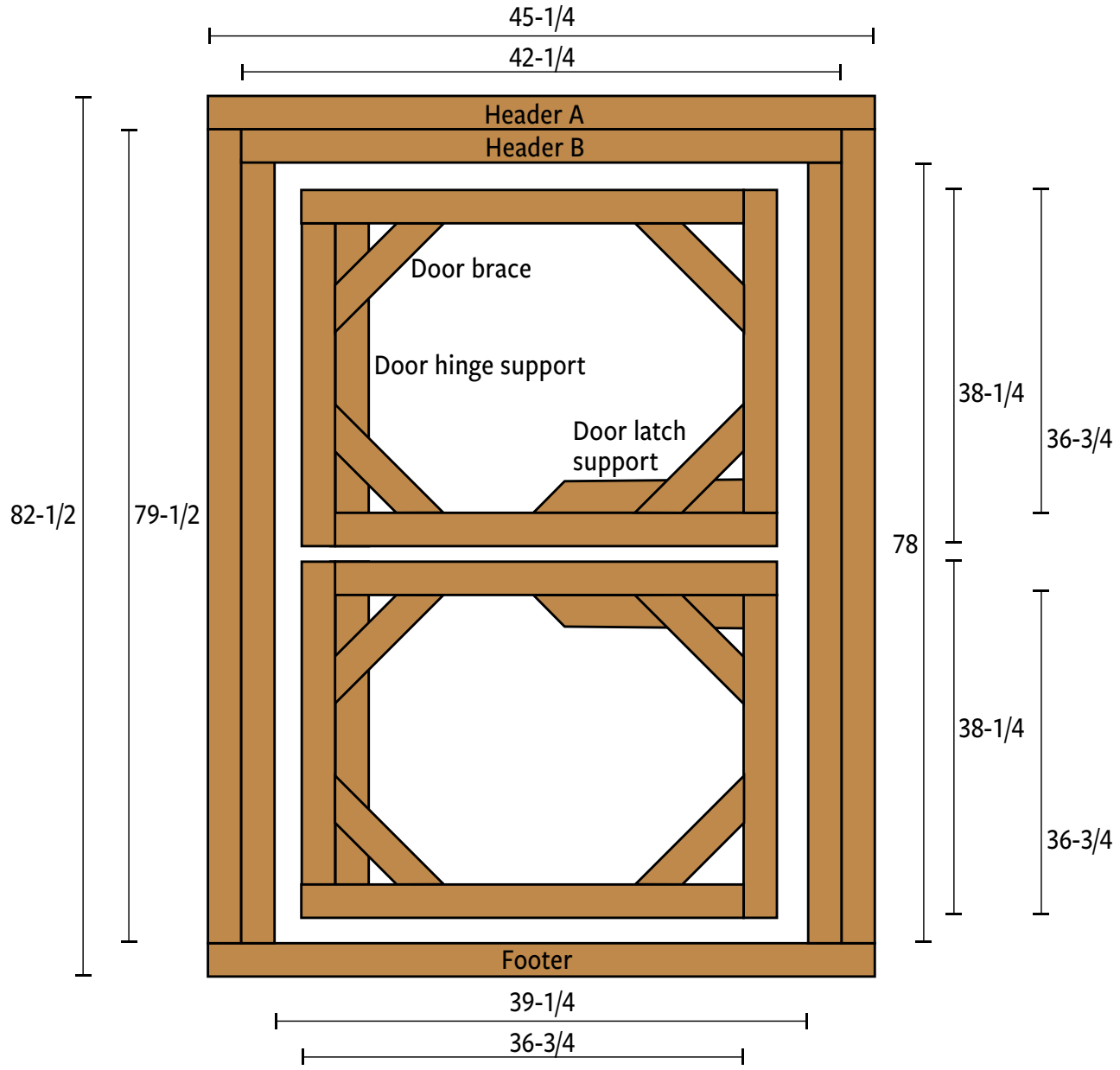

4. Attach the panel using 1-1/2-inch screws.
5. Repeat steps 1–4 for the other side of the door.

## BUILDING DOOR FRAME AND DOOR

Specific details concerning the door and door frame were briefly mentioned in the earlier text. For the UW Extension projects, workspace can be limited. We have found that by completing the above steps, then bundling and moving all the previous parts and pieces out of the way it is easier to cut all pieces and complete the door at this point in a project. We generally, inspect and sort off straight pieces of lumber while creating the base wall and struts, paint/stain them, and reserve these pieces for the door and door frame. There are many styles of doors you can build—we choose to build a split door, also known as a Dutch door, where the top half operates independently from the bottom half. The top half can remain open to allow air flow while the bottom can be closed to keep unwanted pests from entering. We have also found that building a door and door frame on a hard flat surface yields a higher quality result.

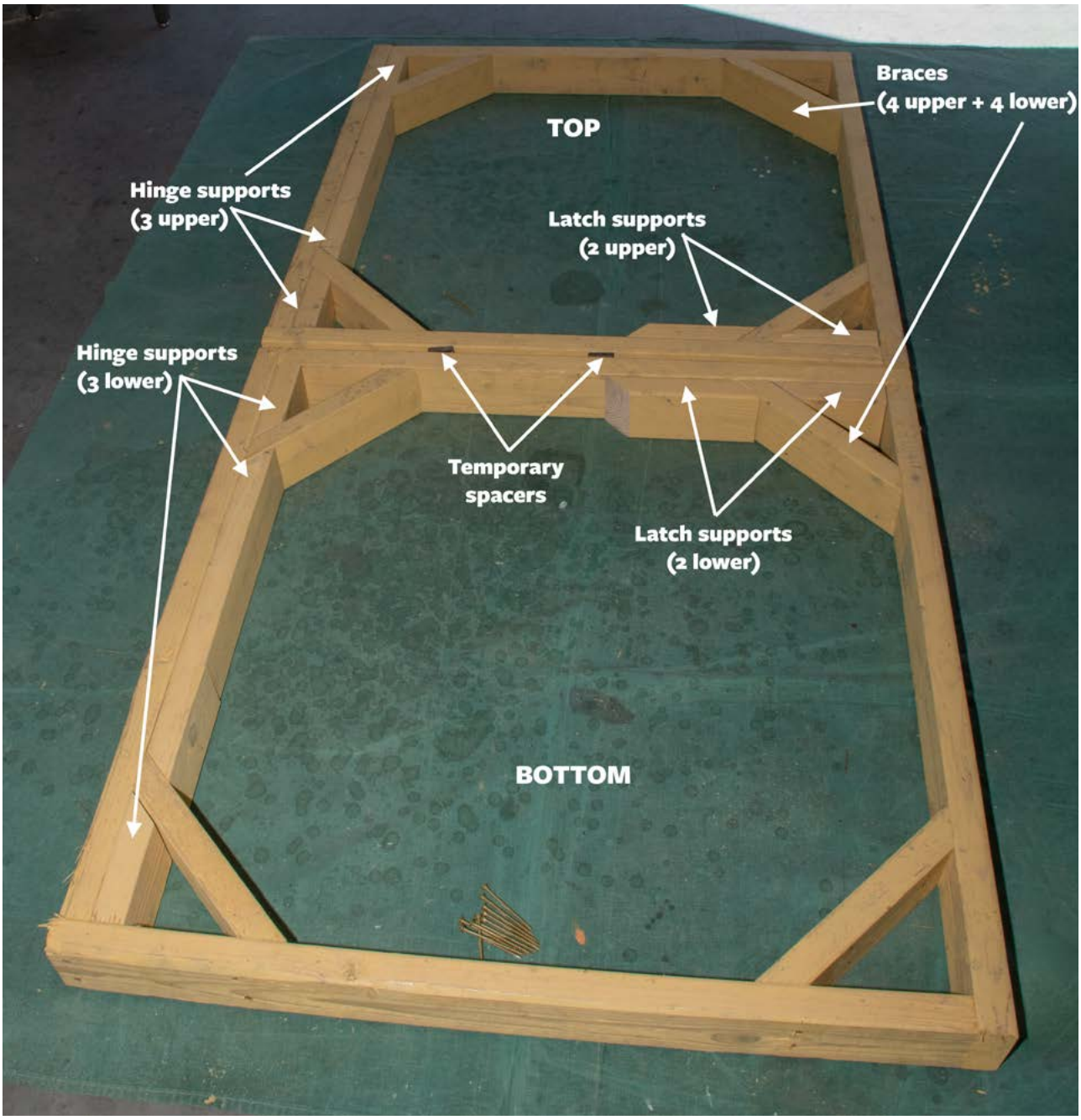


# DOOR SCHEMATIC



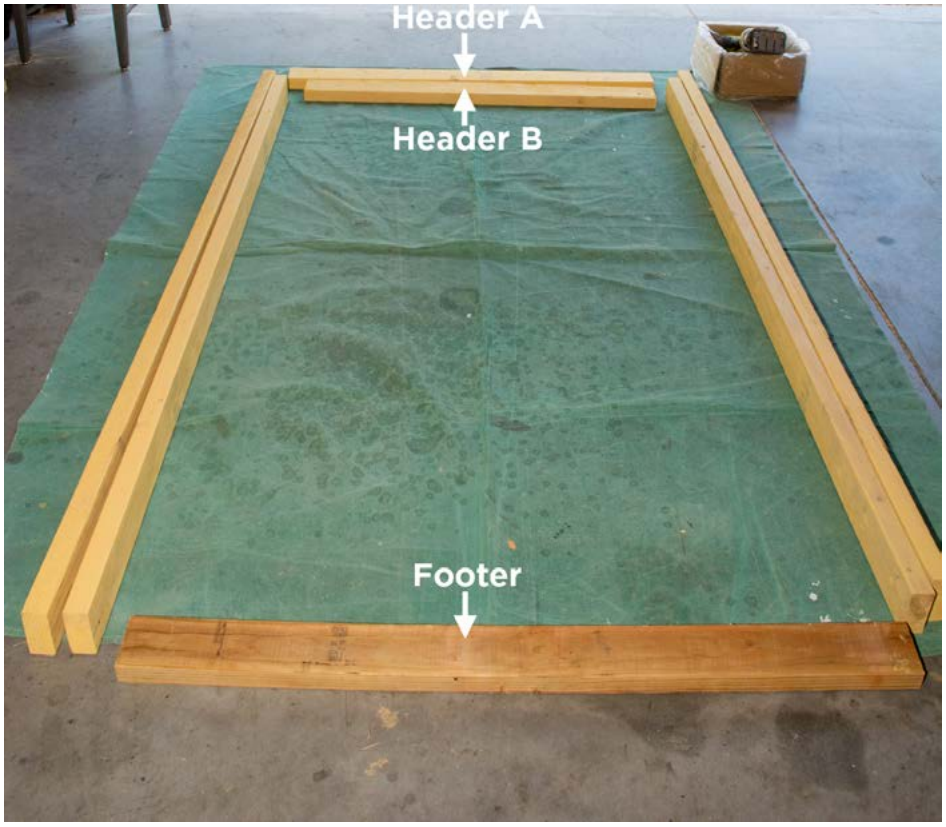

See cut sheet page 14 for length and piece count. Note: Diagram not to scale

**Check cut sheet for piece length and count.**


Braces
(4 upper + 4 lower)
TOP
Hinge supports
(3 upper)
Latch supports
(2 upper)
Hinge supports
(3 lower)
Temporary
spacers
Latch supports
(2 lower)
BOTTOM

## DOOR FRAME

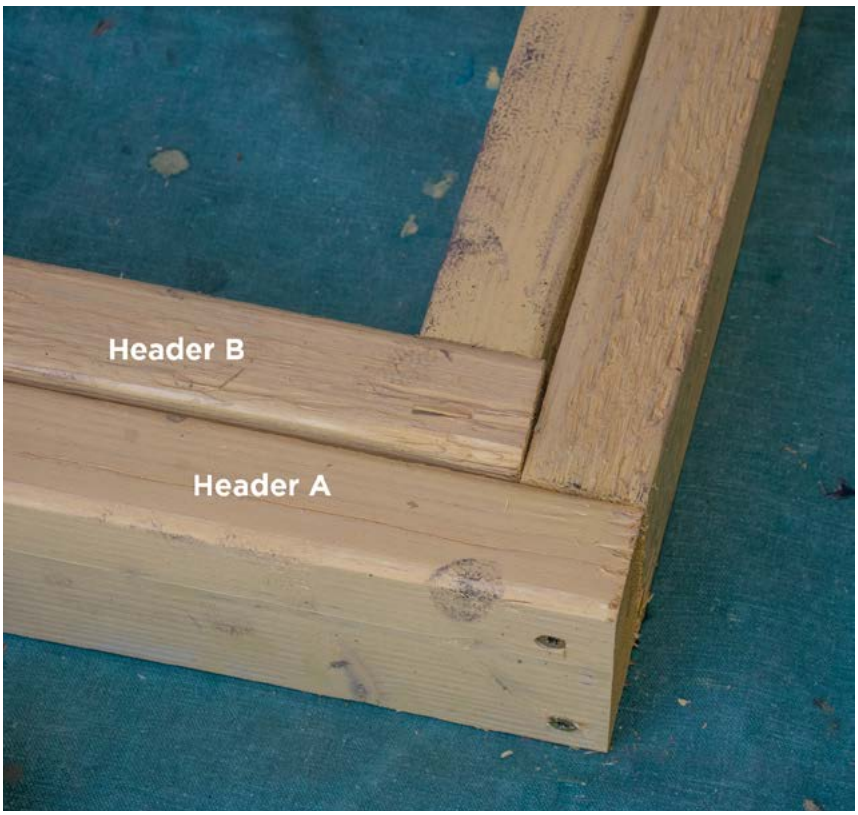
1. Layout the door frame pieces as per the schematic, page 68, on a large flat surface (concrete floor is preferred).




2. Rotate Header A, Header B, and the pressure-treated footer 90 degrees so that one of the wider non-edge surfaces is flat on the concrete.
3. In the side facing you, start two 3-inch screws 3/4 inch from the end of Header A. Repeat on the opposite end of Header A.

4. Repeat—start two 3-inch screws 3/4 inch from the ends in Header B and the footer.

5. Rotate Header A, Header B, and the pressure-treated footer back to the narrow side touching the work surface (90 degrees, screws away from the door frame).
6. Align one cut edge of Header B so that the edge is flush with the outside edge of the corresponding door frame piece and drive the screws into place, repeat on the opposite end of Header B.

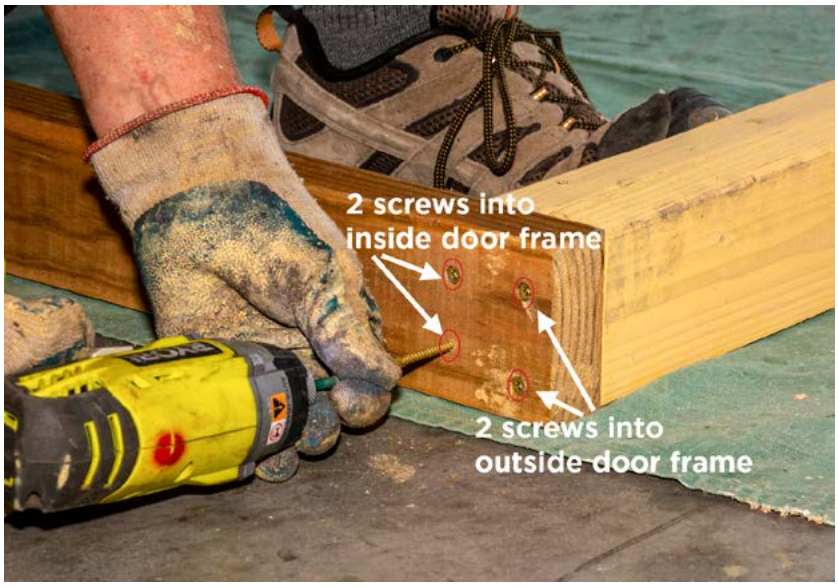


7. Repeat for Header A and its corresponding door frame pieces—Header B and door frame sides should fit tight inside Header A and its corresponding door frame pieces.
8. Drive six additional 3-inch screws through Header B into Header A—drive so that the screw heads are flush with the outside edge.

**Note: Using a Tweaker**

*Some of these wood pieces may be slightly twisted or warped and can be pulled into place with the use of a "tweaker" (my term) which can be built from scrap lumber (pictured below). Place over the lumber and apply pressure in the direction the board needs to be moved to come into alignment and drive the screws into place. The tweaker allows greater leverage to pull a board into alignment.*

9. Move to the footer, drive the four 3-inch screws into the outside board of the door frame—2 into the inside door frame and 2 into the outside door frame.




10. Press the inside door frame boards against the outside door frame boards and drive two additional 3-inch screws through the footer into the inside door frame board and repeat for the second side.

11. On the left or right side, drive eight (in pairs) 3-inch screws from the door frame inside 2×4 into the outside door frame 2×4.

12. Repeat steps 9–11 on the opposite side of the door frame. This will pull together and strengthen the door frame.
13. The door frame is complete. The door frame can be set aside until after the door has been built and skinned.

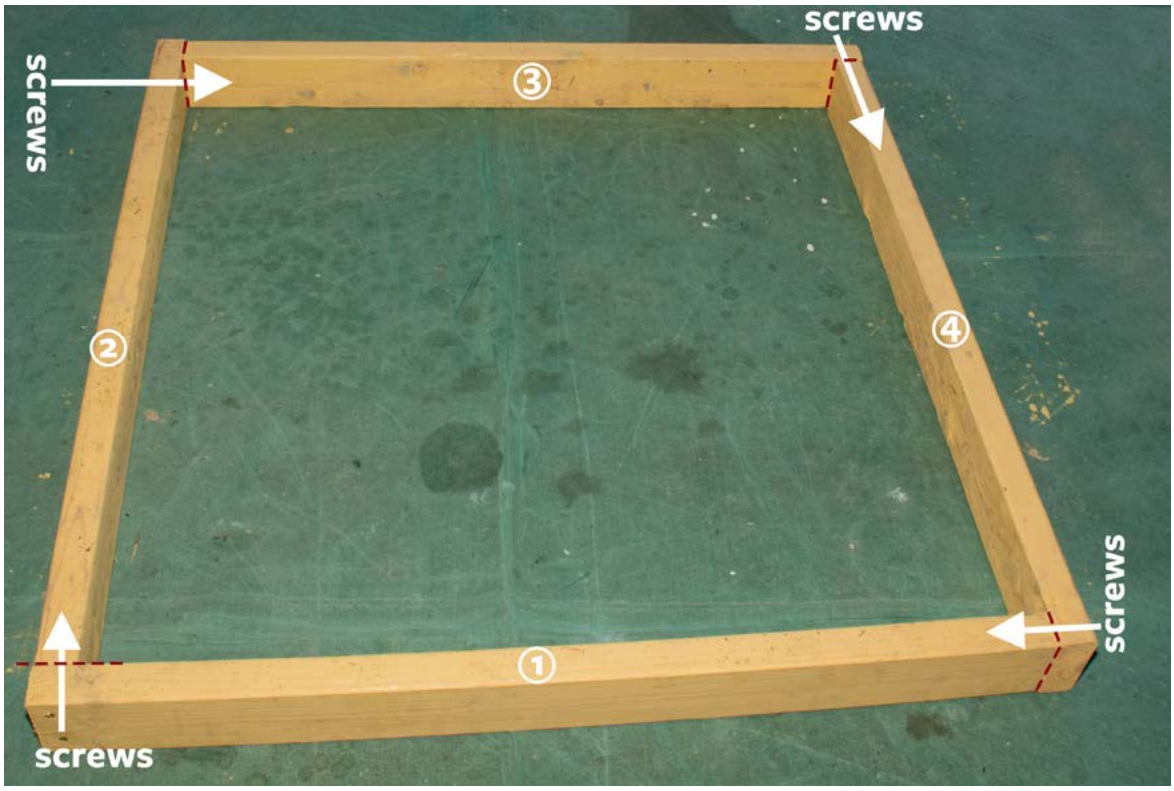
youtu.be/OMpod84ozMI

## DOOR

1. Layout all 8 pieces of cut 2×4 lumber intended for the top and bottom halves of the door (36-3/4-inches long) so that the wider side is in contact with the work surface.
2. Start two 3-inch screws 3/4-inch from one end of each of the 8 boards used in the door.

3. Using four of the 36-3/4-inch boards build a box frame for the upper door section. Mentally label the boards numbers 1 through 4. (Note: This process is the same for the lower door section.)

4. Lay boards 1 and 2 on the work surface narrow side of the 2×4 up, screws out. Place board 1 perpendicularly away from you so that the end with the screws are closest to you. Place board 2 horizontally in front of you at 90 degrees to board 1, so that the screws of board 2 are furthest away from board 1. The wide side of the 2×4 of board 2 should be flush with the end grain of board 1. You are creating a lap joint. Board 1 is overlapping (lap) the end grain of board 2.

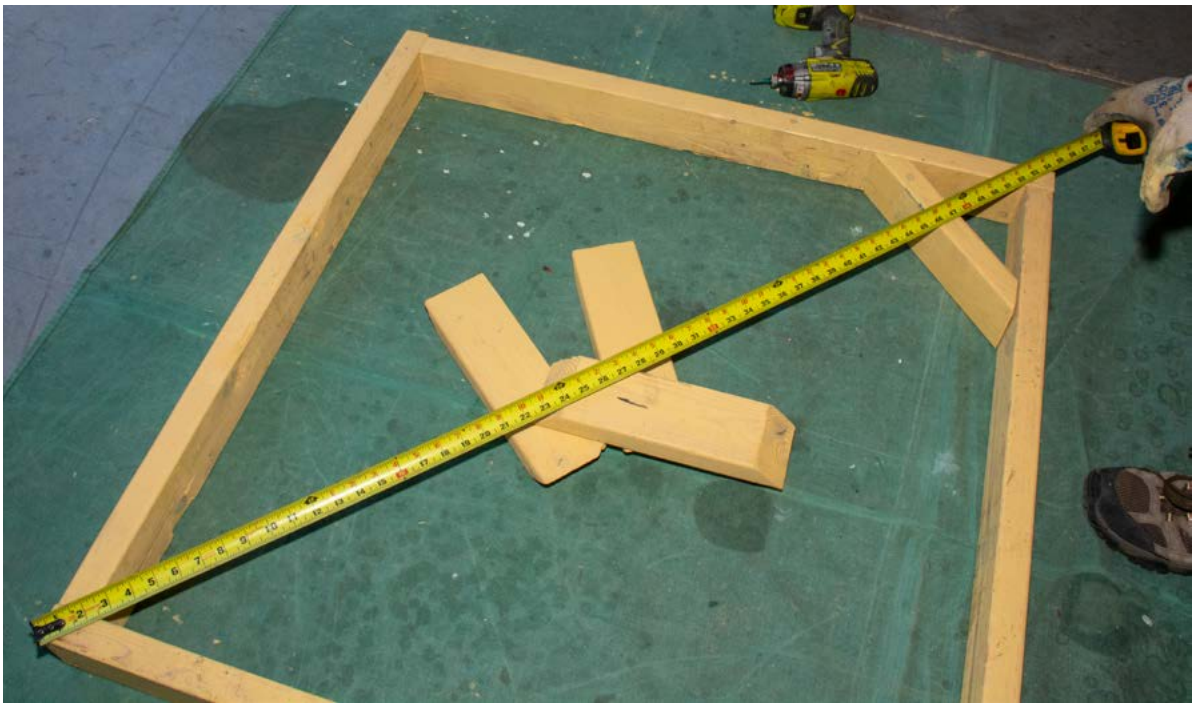



5. Drive the screws through Board 1 into the end grain of board 2.
6. You now have an "L" shape, rotate the "L" 90 degrees so that board 2 is now vertically away from you, place Board 3 flush with Board 2 in the same manner as Board 2 from the previous step. Board 2 should be overlapping the end grain of Board 3. Drive the screws through Board 2 into the end grain of Board 3, you now have a "U" shape.
7. Repeat step with boards 3 and 4, and finally 4 and 1. The box should be complete. Lapping the joints in this manner, while not the traditional method of building a door, assists in keeping the door frame square.
8. Repeat steps 4–7 to build the box frame for the lower half of the door.

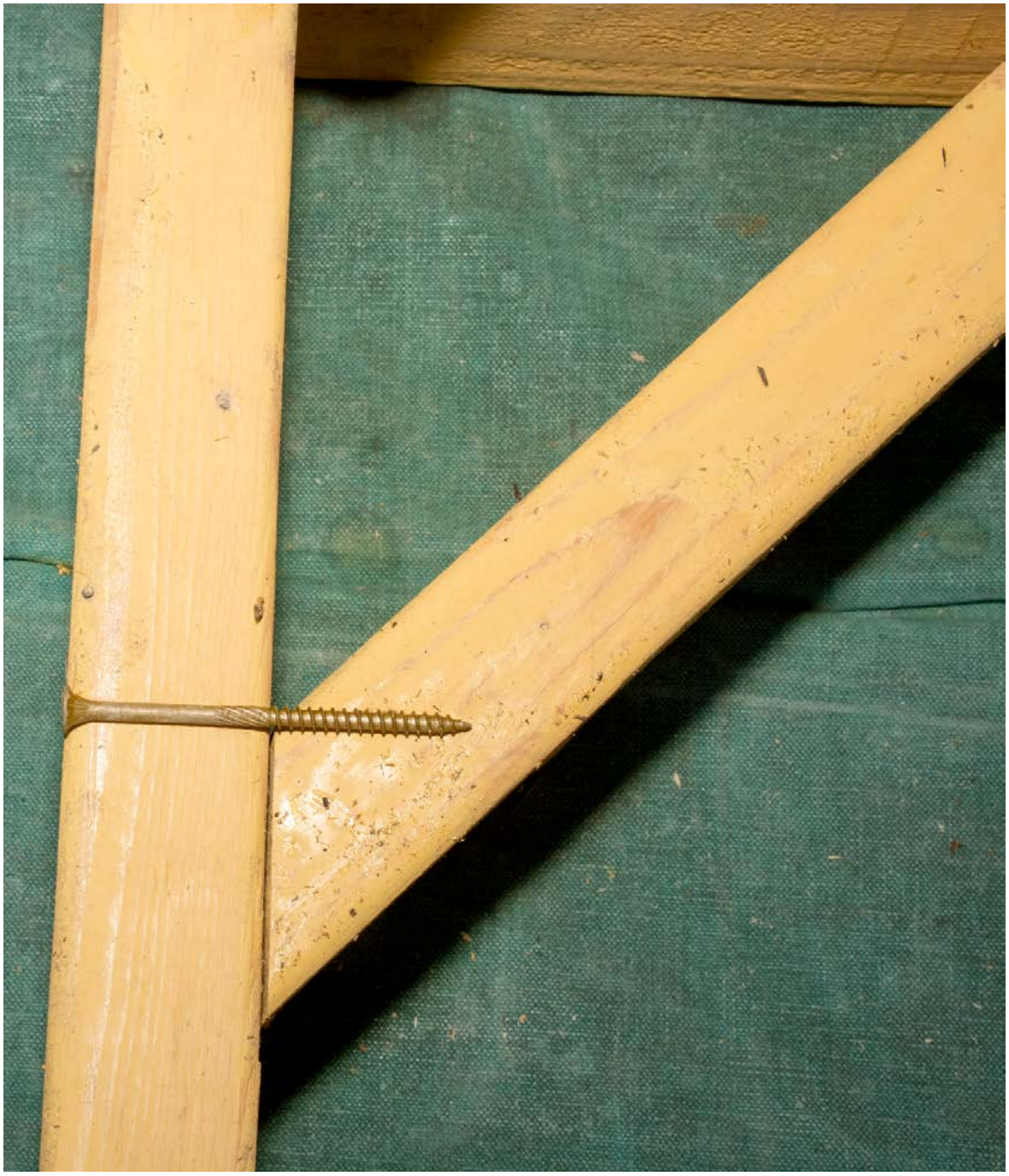
## DOOR BRACES, HINGE, AND LATCH SUPPORTS

In this step you are keeping the door square and prepping for hinge and latch attachment.

1. Looking at the schematic, page 67, cut 8 corner braces from scrap material. To keep measurements consistent for the door, braces are 12 inches long (long edge to long edge).
2. Place scrap 2×4 material onto miter saw, set miter saw left or right of zero to 45 degrees, cut one end from the scrap piece, flip the board toward the saw 180 degrees, slide the board to desired length (12 inches) and make a second cut, repeat for a total of 8 braces.
3. Checking your tolerances—to see if the upper and lower door boxes are square, measure the distances from opposite corners and repeat across the other diagonal. If the measurements are the same (they should be 54 inches) proceed to next step—if not "adjust" by applying pressure to the longest corner and repeat the measurements. Repeat any adjustments until the measurements are equal and meet your tolerances.



4. Install the braces into the door frames as indicated by the schematic, page 67. Drive 3-inch screws from the outside of the door frame and parallel to the door frame directly into the brace where it the widest part of the brace intersects the door frame. This allows for the longest point of contact at the widest intersection of the two pieces of lumber and prevents screw points from coming through the opposite side.



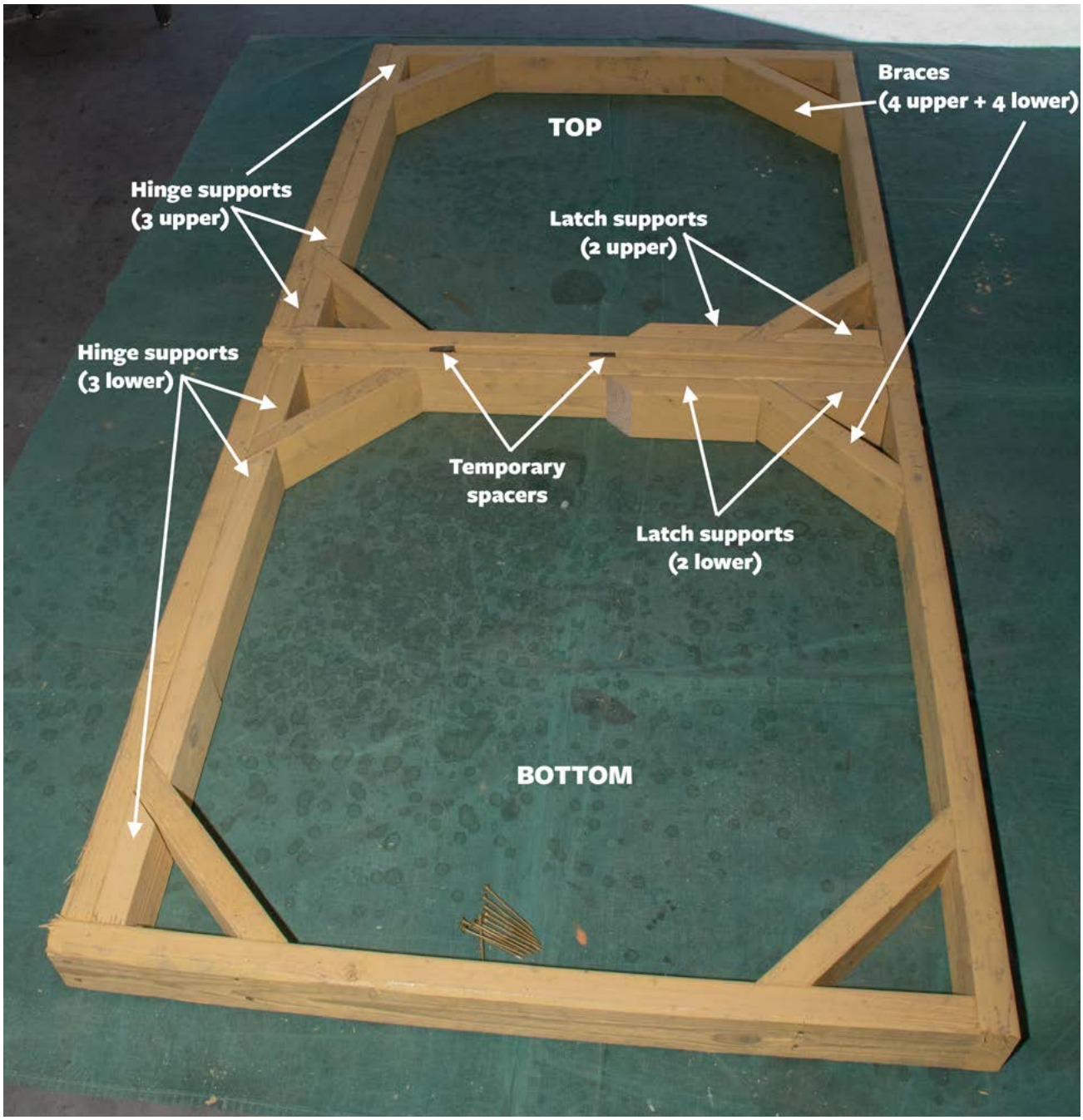
## HINGE SUPPORTS

You are doubling the 2×4s on the side where the hinges will be mounted so that you can use 3-inch screws to attach the hinges.


Determine which side will be the hinge side, measure and cut six individual pieces (they may all be a little different lengths) to fit next to the frame all along the hinge side in both the top and bottom halves of the door. Attach using 3-inch screws. Reference schematic, page 68.

## LATCH SUPPORTS

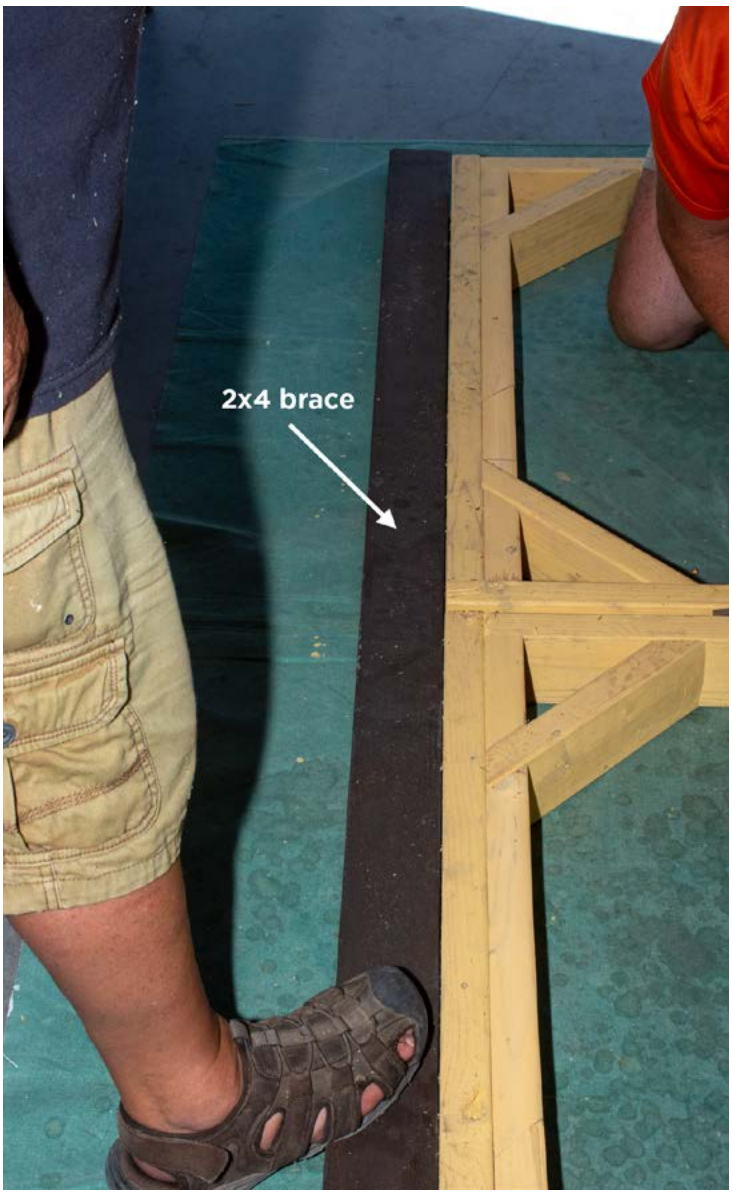
1. Cut the latch support from scrap 2×4. The latch support is a parallelogram. The distance from the point of the brace to the end point of the latch support is 7 inches.
2. Using 3-inch screws attach the latch supports on both the top and bottom half of the doors.
3. Measure, cut to fit, and attach the piece from the door frame to the inside of the brace. This piece is purely cosmetic and is placed in the corner next to the latch support.
4. Repeat steps 1–3 for the second half of the door.




youtu.be/ztOC_G8qj-o

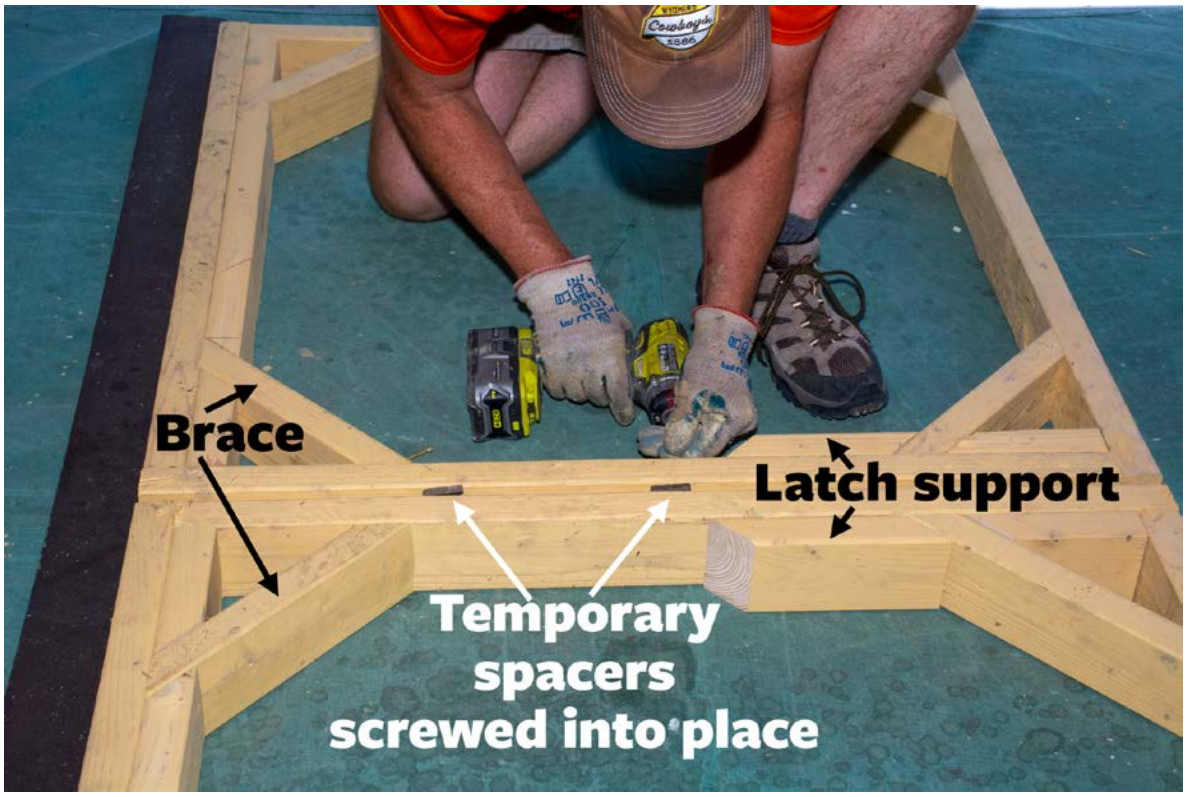
## DOOR PREP FOR SKINNING

1. Lay both frames flat on the working surface, butt together one door half next to the second—push the long side of both door frames up to a straight edge (wall or 2×4, etc.). This will keep the door in align for the next steps.




2. Identify the top and bottom halves of the door (It does not matter which one is the top or bottom, but commit to a top section and a bottom section—for me, when standing and facing the door frame, the section furthest away is generally the top and the section closest is usually the bottom with hinge supports on the left and latch supports on the right).
3. Cut two 3-1/2-inch-long lengths of the 3/8-inch by 1-1/2-inch lath material for use as temporary spacers. Wedge between the two door halves with one on the left side and one on the right side between the door brace and the latch support. These spacers keep the door in position, and remain in place until the door is mounted into the structure).

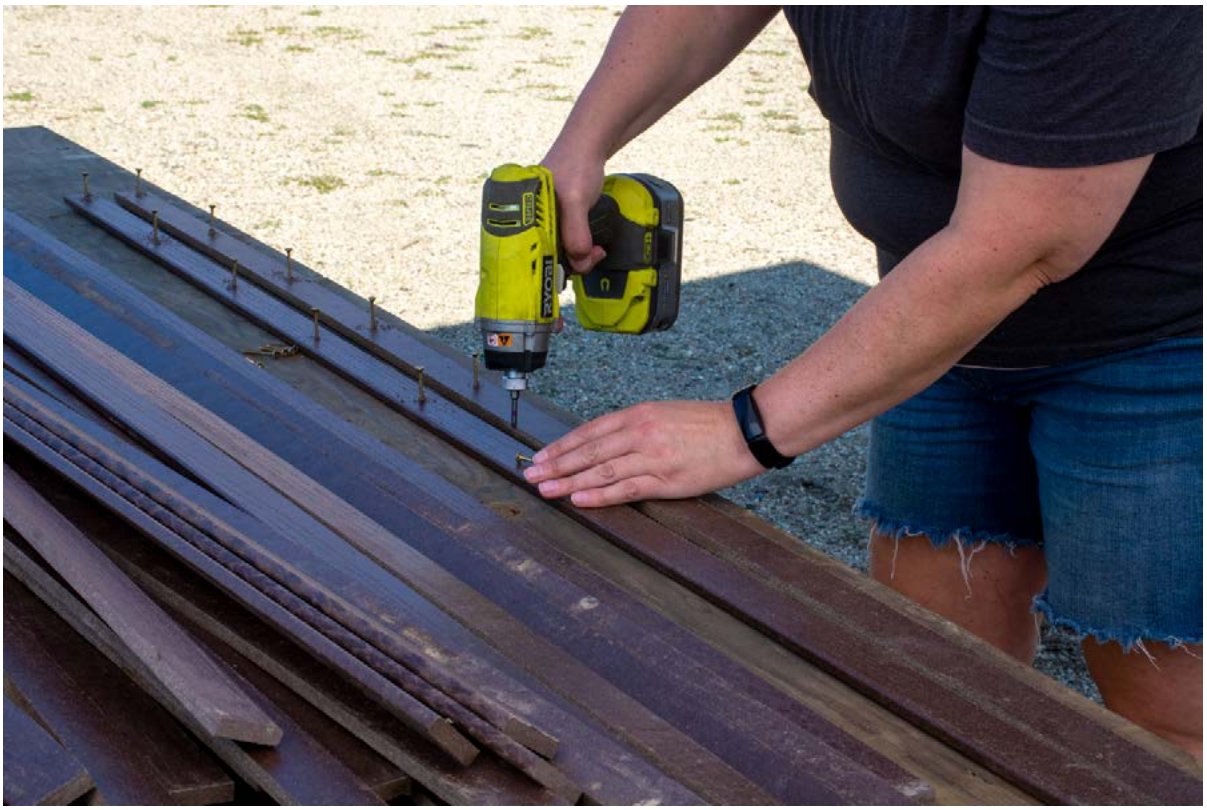
4. Drive a single 3-inch screw through the bottom board of the top door frame, through the lath material and into the top board of the bottom door frame. Through the left and right locations where you placed the lath.



## SKINNING THE DOOR

You may find an assistant useful for the next steps. You will want to pull the skin material as tight as possible while mounting it to the door frame.

1. Locate and unpack the 4-ft × 12-ft piece of poly-skin material—this will be used to cover the door and once the door is skinned and trimmed the left-over piece will provide hail protection for the roof vent.
2. Using the miter saw, cut 3/8-inch × 1-1/2-inch lath strips into eight (8) pieces 36-3/4-inch lengths. These lengths are the same length as the door section and will be installed in a lap fashion just like the door frame pieces. They will hold the door's skin material in place.
3. Using a power driver and a T20 bit, start 1-1/2 screws into the lath, starting about 1-inch from the end and then repeating the screws in the lath every 6 to 8 inches along its length.




4. Repeat starting screws in all 8 pieces of lath. Set the lath with screws to the side within arm's reach of the door frame.

5. Lay the 4-ft × 12-ft piece of polyethylene tarp on the door face (the upside) so that there is excess material overlapping all sides of the door frame. ***Note:*** Make certain you can trim from the excess polyethylene tarp material, either on the door top or bottom, a piece which is at least 4-ft × 4-ft. This scrap piece will be reserved for the top layer of the vent cupola during final construction of the dome.

6. Starting on one corner on either the top or bottom of the door, lay a 3/8-inch × 1-1/2-inch × 36-1/4-inch lath pre-started with screws on top of the polyethylene tarp—and match the lath along the end of the of the door frame. The start end of the lath should be flush with the edge of the door frame.

7. Drive the end screw through the lath, plastic, and into the 2×4 door frame. On the opposite side from the started screw, pull the polyethylene tarp tight away from the screw. To pull the polyethylene tarp tight - pick it up and using your foot, step on it so that it pulls the polyethylene tarp over the edge closest to you and you pull the skin material taught along the door frame surface and hold in place with your foot.


8. Keeping the lath aligned and the skin tight, drive the remaining screws through the lath/plastic/door frame. Continue driving screws sequentially from the start screw along the length of the lath towards opposite end of the lath.

9. Move to the opposite end of the door (opposite from the first piece of lath—if you started at the bottom of the door move to the top and vis versa). Keeping the lath aligned and the skin tight, drive the remaining screws through the lath/plastic/door frame. Continue driving screws sequentially from the start screw along the length of the lath towards opposite end of the lath.

**IMPORTANT**: ***when working on the opposite end from the first piece of attached lath, not only are you pulling the skin away from the first started screw across the door frame, but you are also pulling the plastic away from the first lath strip installed on the opposite end.***

youtu.be/iiMWGbDr7xQ

**Technique suggestion**: To keep the skin free of folds or puckering, we have found that by picking up the end of the plastic, pulling and placing your foot on top of the plastic, then slowly stepping with your foot against the door frame, and allowing your foot to slide down the door frame, all while keeping tension on the plastic. Finally step all the way down so that your foot contacts the floor—you will get a nice tight hold on the plastic while installing the screws. Attach screws where your foot is, then reposition your foot (repeat above) along the length of the plastic until all screws on that end are driven onto place.

10. The lath at the top of the door and the bottom of the door should be installed.
11. Next install the lath along one side (and just for fun say the latch side).

12. Butt a piece of lath to the lath attached at the bottom, place along the side and screw into place—no need to pull excessively here—but if there are wrinkles attempt to pull them from the surface and keep the plastic taught from left to right.
13. Repeat on the upper half, latch side of the door.
14. Now on the hinge side of the door, using the foot technique as described previously. Place the lath on the hinge side and attach to the door frame. Continue so until the lath has been attached on the upper and lower halves of the door.
15. Attach the 2 lath strips to the bottom of the top half and the top of the bottom half (the 2 strips in the center of the door). Be certain the get the lath onto the center of the 2×4s and leave the 3/8-inch gap between them.
16. Trim excess poly-skin to approximately 2 inches from edge of door. **Do not slice poly-skin between top and bottom door sections.**
17. Measure and cut lath strips which will cover the corner braces in the top and bottom halves. Attach with 1-1/2-inch screws.

18. Measure and cut lath strips to cover the latch supports on both top and bottom (including the “cosmetic” pieces).


19. Skinning the door should be complete.

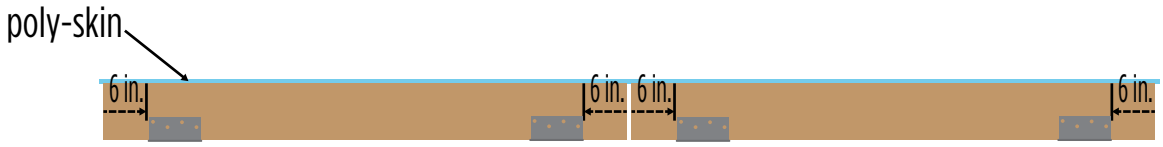
youtu.be/iiMWGbDr7xQ

## DOOR HINGE INSTALLATION

The door is mounted so that the skinned surface you just finished is on the outside of the structure but the door opens toward the inside.

1. Pick up the door hinge side up so that the door is standing vertically and resting on its side latch side/edge down. (See image, step 18, above.)
2. Measure 6 inches from the top of the door along the hinge side towards the bottom of the door and mark with a pencil.

3. Measure 6 inches from the bottom of the top half of the door toward the top of the door and mark with a pencil.
4. Repeat for the bottom half of the door. There should be 4 marks (2 on top section and 2 on the bottom section) on the hinge side of the door 6 inches for each end of the door half.




*For reference start at the top mark on the hinge side at the top of the door.*

5. Orient the hinges so the pin tops are pointed toward the top of the door and lay the hinge, so the beveled screw hole side is facing you and the back side of the hinge is flat against the wood of the hinge side of the door.

6. Align the hinge top edge with the mark at 6 inches.
7. Allow the other half of the hinge to fall over the edge of the door—this helps with proper hinge placement.
8. Carefully center a 3-inch screw in one of the 4 holes of the hinge plate and drive the screw nearly all the way in. Check alignment of the hinge carefully center and drive a second 3-inch screw through hole in the hinge plate into to wood. Repeat for the 2 remaining screw holes.

9. Tighten all screws and keep the hinge aligned.

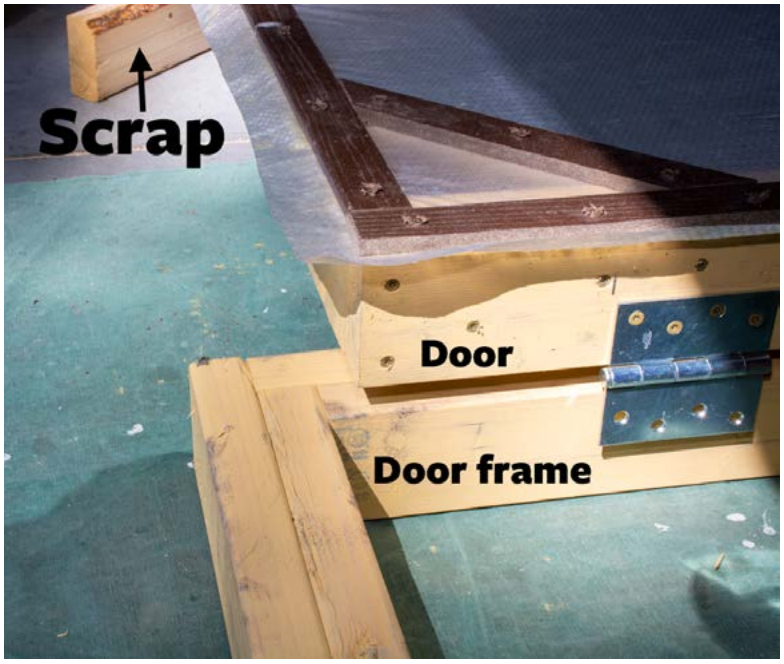
Working towards the bottom of the door the next hinge is placed on the door edge as above and aligned so that the bottom edge of the hinge is in line with the second mark on the lower half of the upper section of the door.

10. Repeat second hinge.
11. Repeat for the lower half of the door (a total of 4 hinges, 2 in either half should be mounted at this point).

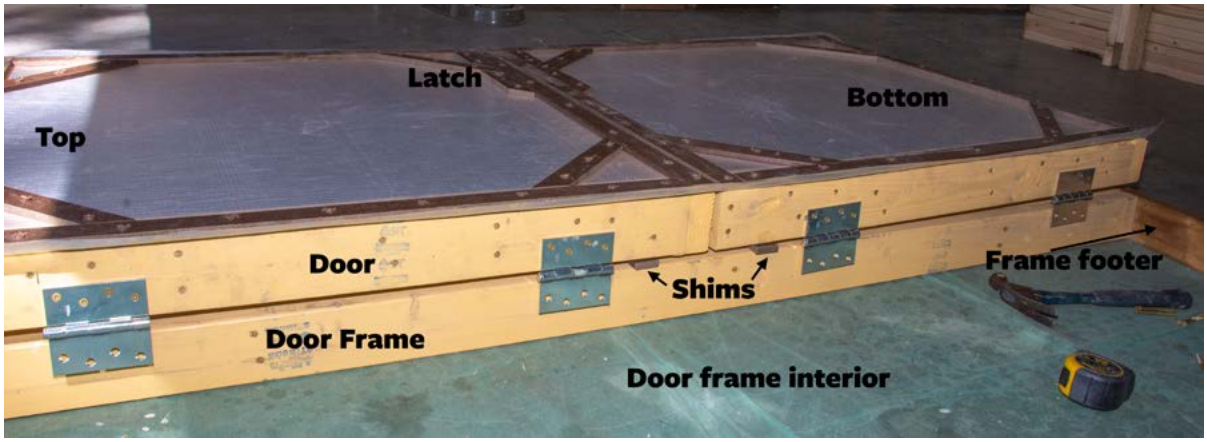
## INSTALLING THE DOOR INTO THE DOOR FRAME

Good spatial relations are required for this portion of the project...the KEY is to remember the door (skin side is the outside) opens inward—to orient yourself for attaching the door to the door frame, imagine that you are inside the structure and the door is open.

1. Lay the **door frame** flat on the working surface.
2. Lay the **door** on the door frame so that the hinges hang into the right side of the door frame. Use 2×4 scrap turned narrow side is up, under the non-hinge side to hold the door at the same elevation as the door frame.




3. You should insert 3/8-inch spacers or shims between the door and door frame. This will keep the hinges from binding when door and door frame are fully screwed together.




4. Center the door in the door frame (top to bottom.) You should have approximately 9/16-inch clearance on both the top and the bottom.

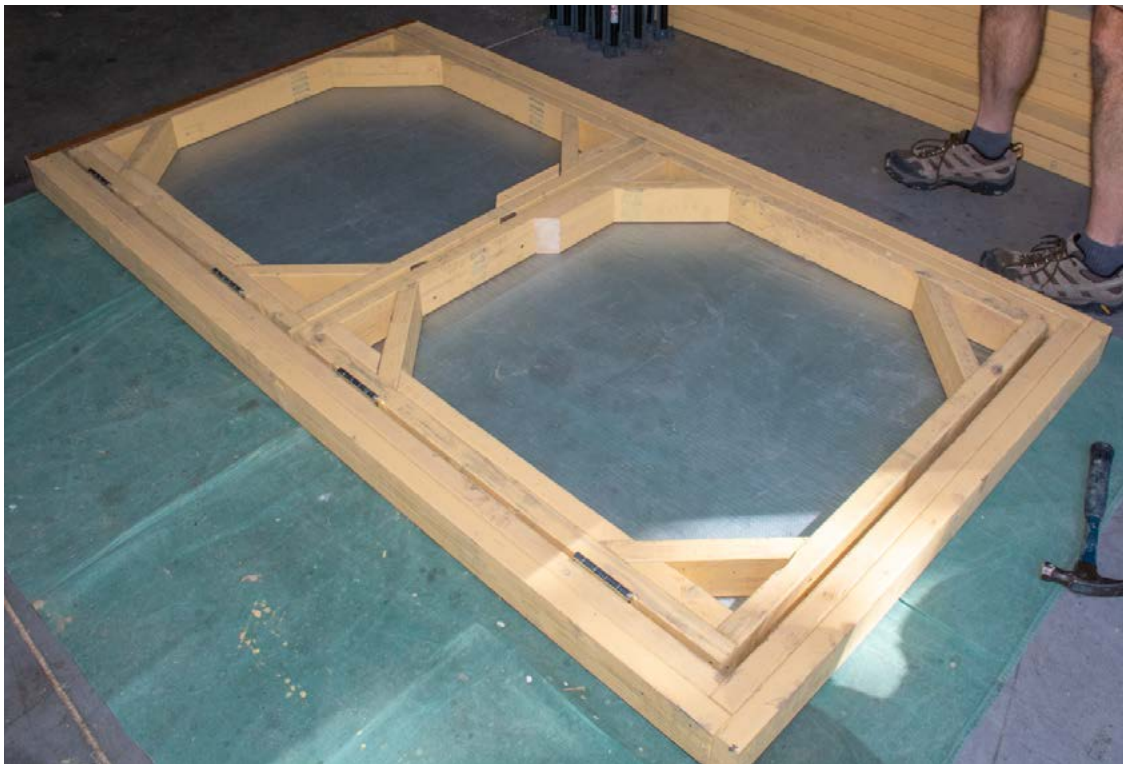
5. Start at the center hinges attach with 3-inch screws.

6. Remove the shims between the door and door frame at the center and move to either the top or bottom hinge and set the spacing at 3/8-inch and attach the corresponding hinge to the door frame using 3-inch screws.

7. Repeat from above at the opposite end.

8. Remove any remaining spacers/shims.

9. Lift the latch side of the door and lower into the door frame to check fit. Door skin should be facing the ground (remember the skin side is the outside and you are still on the inside of the dome).



10. Place 3/8-inch spacers under the door frame on the side opposite the hinges. These spacers get the door frame and the door to the same elevation.

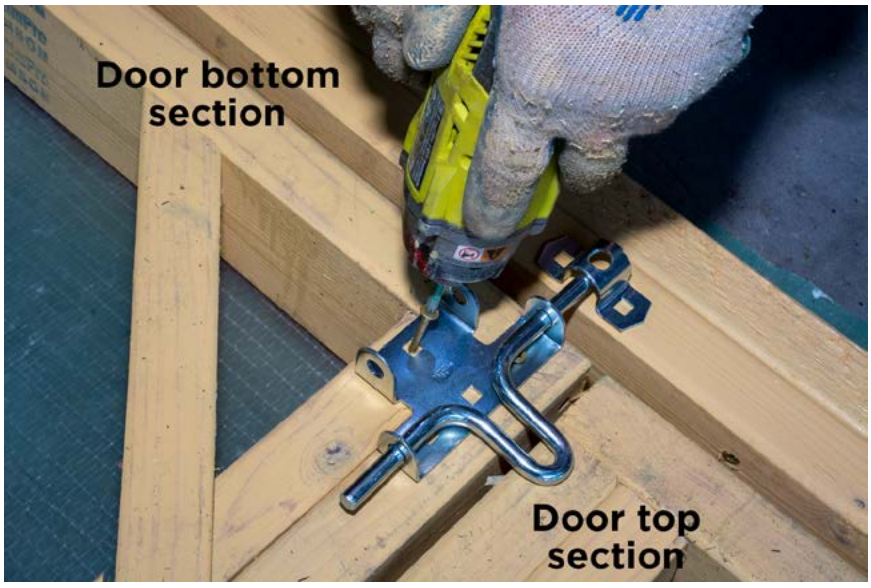
11. Temporarily lock the door to the door frame by using shims/spacers and a 3-inch screw driven from the inside of the door through the spacers into the door frame at the top center, bottom center, and the center of each door (on the non-hinge side). These screws will be removed after the door is installed.

## DOOR HARDWARE INSTALLATION

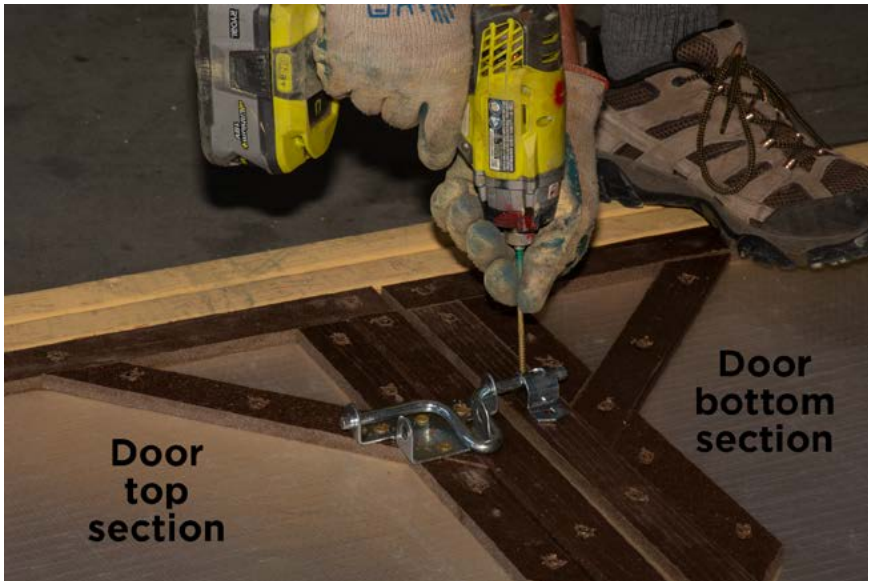
Dutch door latches are installed so that an individual on the inside has the control of the door—the emergency exit is available to anyone inside.

1. Leaving the door as it was above—you are still technically on the inside of the door.
2. Locate the bail type latch and remove from packaging.
3. Place the latch on the latch support the lower half of the Dutch door so that the latch frame is not hanging over the edge of the door. Latch should be oriented so that the bail of the latch will slide toward the door frame.
4. Drive 3-inch screws through the latch frame into the door latch support.

5. Position the latch bail over the door frame and install the loop for the latch. Check that it is centered over the latch lever and drive 3-inch screws through the loop into the door frame.




6. Flip the door/door frame assembly 180 degrees so that you are now technically on the outside of the structure.
7. Place the door/door frame assembly on the wide side of scrap 2×4s to prevent damage to the latch on the underside.
8. The second latch is installed from the latch supports of the top door with 3-inch screws so that the latch mechanism will latch to the lower half of the door.
9. Position the latch bail over the lower door and install the loop for the latch centered over the latch lever and drive 3-inch screws through the loop into the lower door.



## DOOR FRAME ATTACHMENT RAILS

youtu.be/4O0iCbDZ_ZU

What are these you might be asking? These rails are attached to the door frame to allow an attachment point for the door trim when the door is installed into the dome frame.

1. Have the door in the same position as previous step (outside of the door facing up).
2. Locate the three door frame attachment rails: 2 pieces 1-1/2 × 1-3/4 × 81-1/2-inches and 1 piece 1-1/2 × 1-3/4 × 39-1/4-inches.
3. Start 3-inch screws into the 1-1/2-inch-wide side of each of the rails using approximately 12-inch spacing. The ripped side will be attached to the door frame.
4. Lay the 81-1/2-inch rails side rails on the inside 2×4 of the door frame and align with the top of header A and the bottom of the footer.

5. Drive the screws into the door frame.

6. Lay the 39-1/4-inch rail between the two side rails previously attached in step c. and in alignment with Door Header B. Drive the screws into the frame.

7. The door is complete. Set it out of the way.

***Note:*** *The door frame attachment rails can be installed prior to installing the latches. Install the outside latch, then flip the door and install the inside latch. The door frame attachment rails will protect the outside latch from damage while installing the inside latch.*

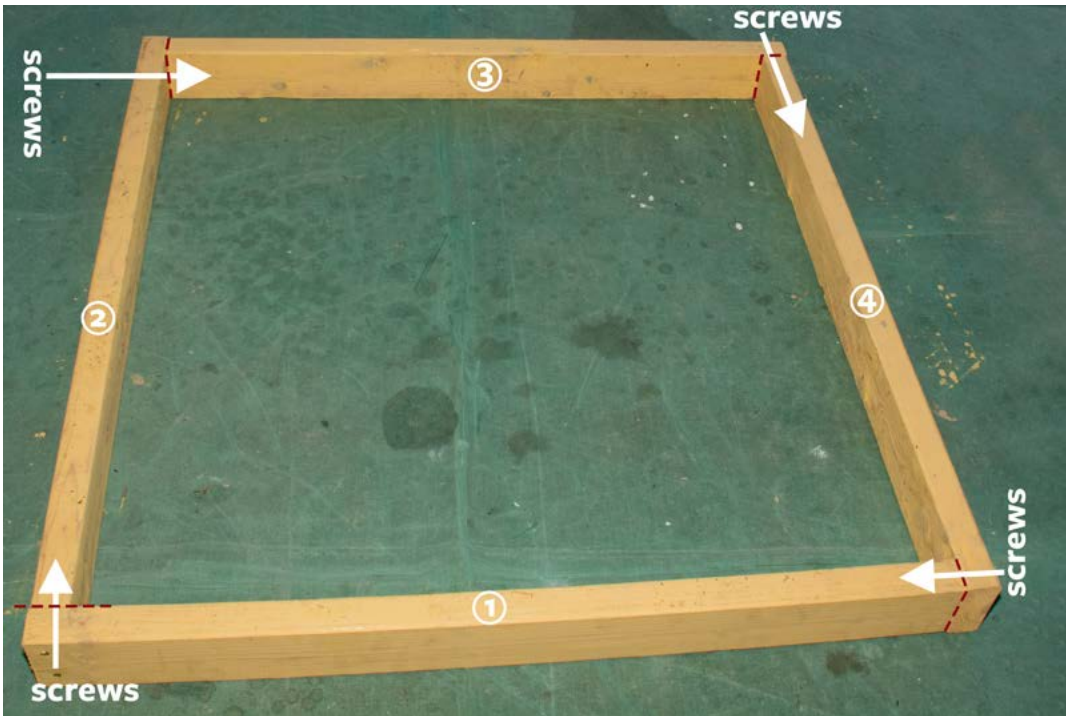
# BUILDING VENT FRAMES

Assembly of the vent frames are exactly like the assembly of the door halves—using lap joints to keep the frame square. A total of 4 vents will be installed.  One in the top tier of the dome and three  in the bottom tier. Each vent frame has two vent frame halves.  The first frame mounts in the skeleton of the dome - this frame is structural and provides a mounting point for the louvered vent.  The second frame is attached to the first frame after the skin has been attached, this further protects the vent fins and provides a point to attach screening.  These vent frames pieces are 31-1/4-inches long and you should have cut 32 of them.

1. Layout all 32 pieces of cut 2×4 lumber intended for the smaller vent frame (31-1/4-inches long) so that the wider side is in contact with the work surface.

2. Start two 3-inch screws 3/4-inch from one end of each of the 32 boards, insert in the same manner as you did with the door upper and lower sections.

3. Using four of the 31-1/4-inch boards build a box frame for the vent. As with the door halves, assign the boards numbers 1 through 4.




4. Choose boards 1 and 2.
5. Lay boards 1 and 2 on the work surface narrow side of the 2×4 up, screws out. Place board 1 vertically away from you so that screws are closest to you. Place board 2 horizontally in front of you at 90 degrees to board 1, so that the screws of board 2 are furthest away from board 1. The wide side of the 2×4 of board 2 should be flush with the end grain of board 1. You are creating a lap joint. Board 1 is **overlapping** (**lap**) the end grain of board 2. Drive the screws through Board 1 into the end grain of board 2.
6. You now have an "L" shape, rotate the "L" 90 degrees so that board 2 is now pointing away from you, place Board 3 flush with Board 2 in the same manner as Board 2 from the previous step. Board 2 should be overlapping the end grain of Board 3. Drive the screws through Board 2 into the end grain of Board 3, you now have a "U" shape.
7. Repeat with boards 3 and 4, and finally 4 and 1. The box should be complete. Lapping the joints in this manner assists in keeping the frame square.

*Use the tweaker if necessary.*

youtu.be/feVRLBcBonc

8. Repeat and build the three additional vent frames of this size.

9. Repeat steps 1–7 and build the larger size (37-1/2-inch) vent frame.

   *You should have nine frames—eight smaller and one larger.*

## CUPOLA ASSEMBLY

The next steps are to pre-build the cupola for the roof vent—this step is strongly recommended if you live in areas where it hails...this structure is used for preventing hail from damaging the roof vent.

1. Locate the eight 16-inch long 2 × 4 vent studs.
2. Select four and start three 3-inch screws, 3/4 inch in from the edge, along the long side (one at either end and one at the middle). Repeat this in all four studs.

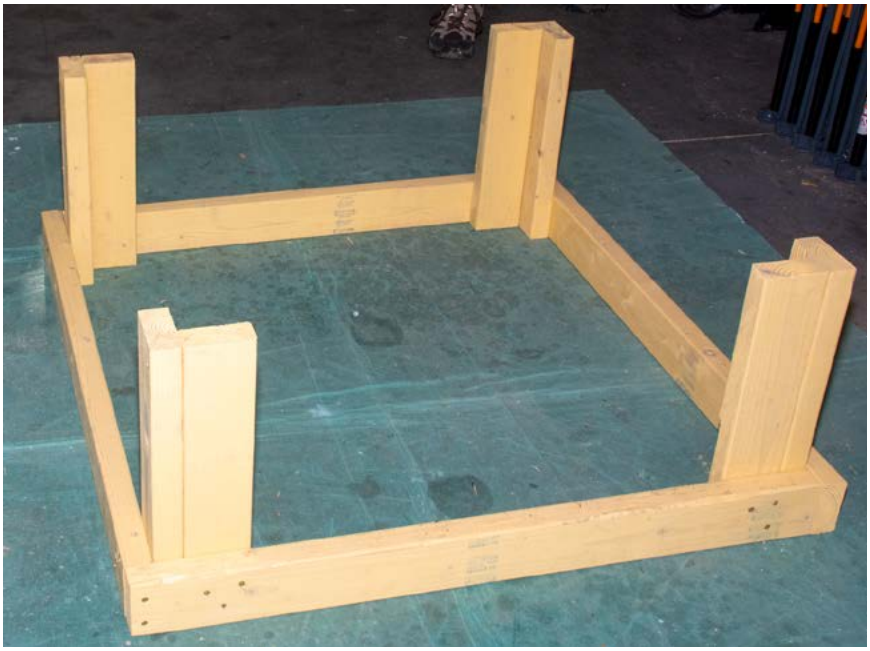
3. Pair a stud with screws with a stud without screws.
4. Set the stud without screws on the working surface wide side down.

5. Set the stud with screws, screw heads facing you so that the narrow side is up, and the two studs form an “L”. Match the cut ends of both pieces of lumber.

6. Drive all three screws into the second stud. Leg 1 is complete.
7. Repeat until you have built **four** “L” shaped legs.
8. Set the large vent frame (from previous section, page 102) on the work surface.
9. Place one “L” shaped leg vertically in each **inside** corner of the large vent.

10. Drive 3-inch screws from the outside of the vent frame into the leg to hold the leg into the corner.

11. Repeat until all four legs are attached to the large vent frame.



12. Flip the large vent frame/leg assembly 180 degrees so it is resting on the legs on the work surface.

13. **Set each leg onto a 3/8-inch spacer.** This will allow the cupola to sit flush on the vent frame during final assembly.
14. Drop the small vent frame into the center of the opening of the legs and allow the small vent to rest on the work surface.

15. Drive 3-inch screws though the vent frame legs (four total, two on either side of the "L") into the small vent frame to hold the corner in place.
16. Repeat for all corners.
17. It is also helpful to start two 5-inch screws into the narrow side of each board of the small vent frame that was attached to the cupola. The screws should be on the inside of the of the cupola (again, helpful during final construction).

***Congratulations! Assembly of the 22-ft geodesic dome "kit" is now complete.***

## HELPFUL NOTE — PREP THE LATH

The bio-composite fence pickets recommended for the lath are about 1/2-inch longer than the length of strut A and can be used as-is. You may need to cut the lath to the correct length for Strut A and Strut B. If your lath is shorter than Strut B you will need to cut 33 pieces of lath to make up the distance to complete skin attachment on the Strut B's (for this project, we will need 33 pieces 8-inches in length).

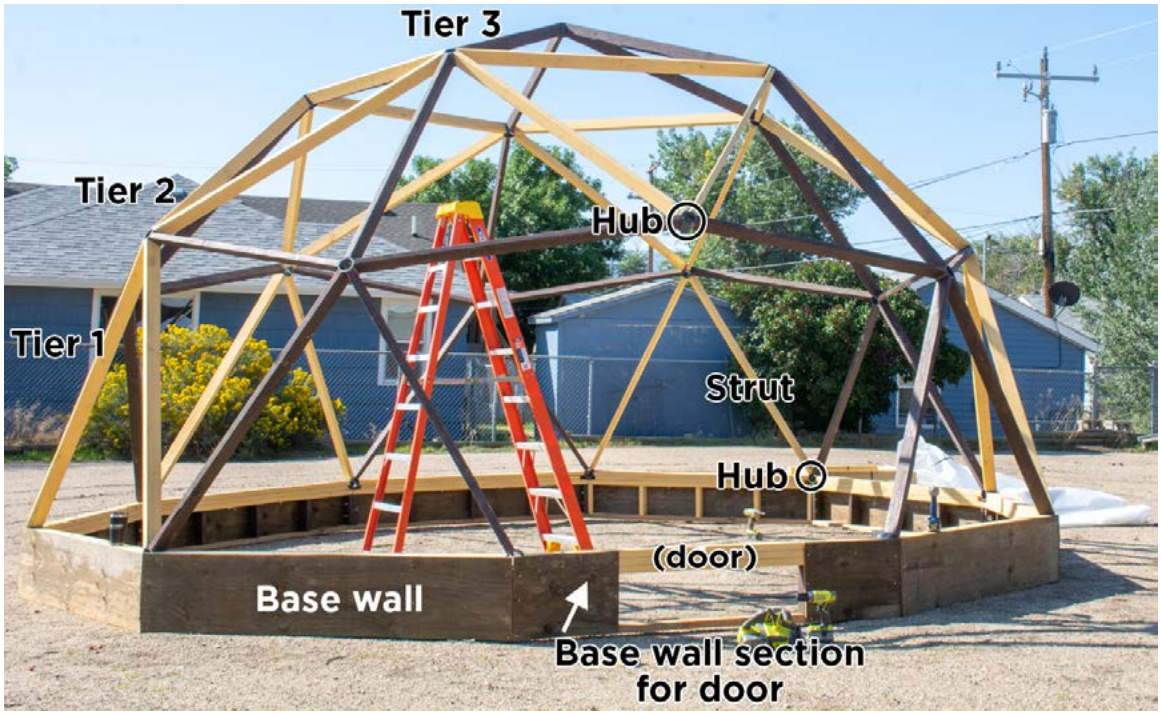
Also, cut lath strips to fit all four sides for two of the small vent frames and one large vent frame.

It is handy to have all lath strips **started** with screws—just as you prepped the lath for the installation on the door. For the long lath pieces start 1-1/2-inch screws, 1 inch from either end. Then, start screws at every 8 inches along the length of the lath—**do this in every piece of lath**. The 8-inch pieces of lath, should have 3 screws—2 are started 1 inch from each end and the third screw is in the middle. The vent frame lengths should also have 3 screws started—2 are started 1 inch from each end and the third screw is in the middle. It is helpful to pre-drill all the holes in the lath using a 1/8th-inch drill bit. The bio-composite material is weird stuff to work with - if you do not pre-drill and start the screws the plastic heats up and fills the screw threads - this hardens the plastic around the screw and stops the screw from being driven through the lath strip. Not something you want to deal with while on top of the dome.

**Do not drive the screws all the way through the lath** (this will prevent snagging the plastic during installation). Pre-driving screws into the lath significantly reduces the amount of time it takes to attach the skin to the structure and will reduce your anxiety about driving the screws through the lath and plastic into the dome frame if you are uncomfortable with heights.

Attaching the skin with prepped lath.

# CHAPTER 5 – DOME FRAME ASSEMBLY




The dome base, frame, door, and vents, can be erected in about four hours. Skinning and finishing takes an additional four to eight hours. A recent dome project (from unloading supplies to finishing the skinning) was completed by two instructors and a half a dozen volunteers in 7.5 hours. The more you build with a consistent crew the faster they go together. Skinning has been completed in as little as 2 hours. A word of caution—humidity/condensation can cause the woven poly cover to be very slick when working on it. This can add a additional level of excitement to the project.

Before you begin—locate the vent openers. Open the package and remove the openers (the black things with a metal rod) and place them into a refrigerator or cooler—do not place them into a freezer. You will not need them until the section on Installing Aluminum Shutters, page 148—but they do need to be cool for correct installation.

## TOOLS

- Drill
- 7/16-inch × 6-inches long drill bit
- Screw gun
- Star T20 or T25 screwdriver bit
- Chop saw
- Circular saw
- Pencil
- Reciprocating saw with wood cutting bit
- 9/16-inch box end or open-end wrenches of your choice—ratcheting type are great. Small 90-degree power ratchet with 9/16-inch socket may work as well.

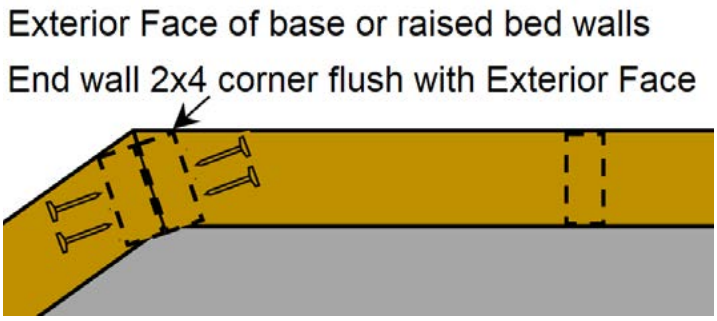
## THE BASE WALL

1. Layout the 10 base wall pieces in a circular pattern on the building site (wall pieces placed vertically so that the pressure-treated 2×4 is on the bottom in contact with the soil, sheeting towards the outside). Remember, the odd looking one is the wall section for the door. Place the door section on the side you wish to have the door facing.

2. Butt the wall ends to each other.

3. Working in a circle attach one base wall section to the next using two 3-inch screws. Sheeting should be flush, top and bottom rails should match and be flush.

youtu.be/aJKZ4kyjHrg

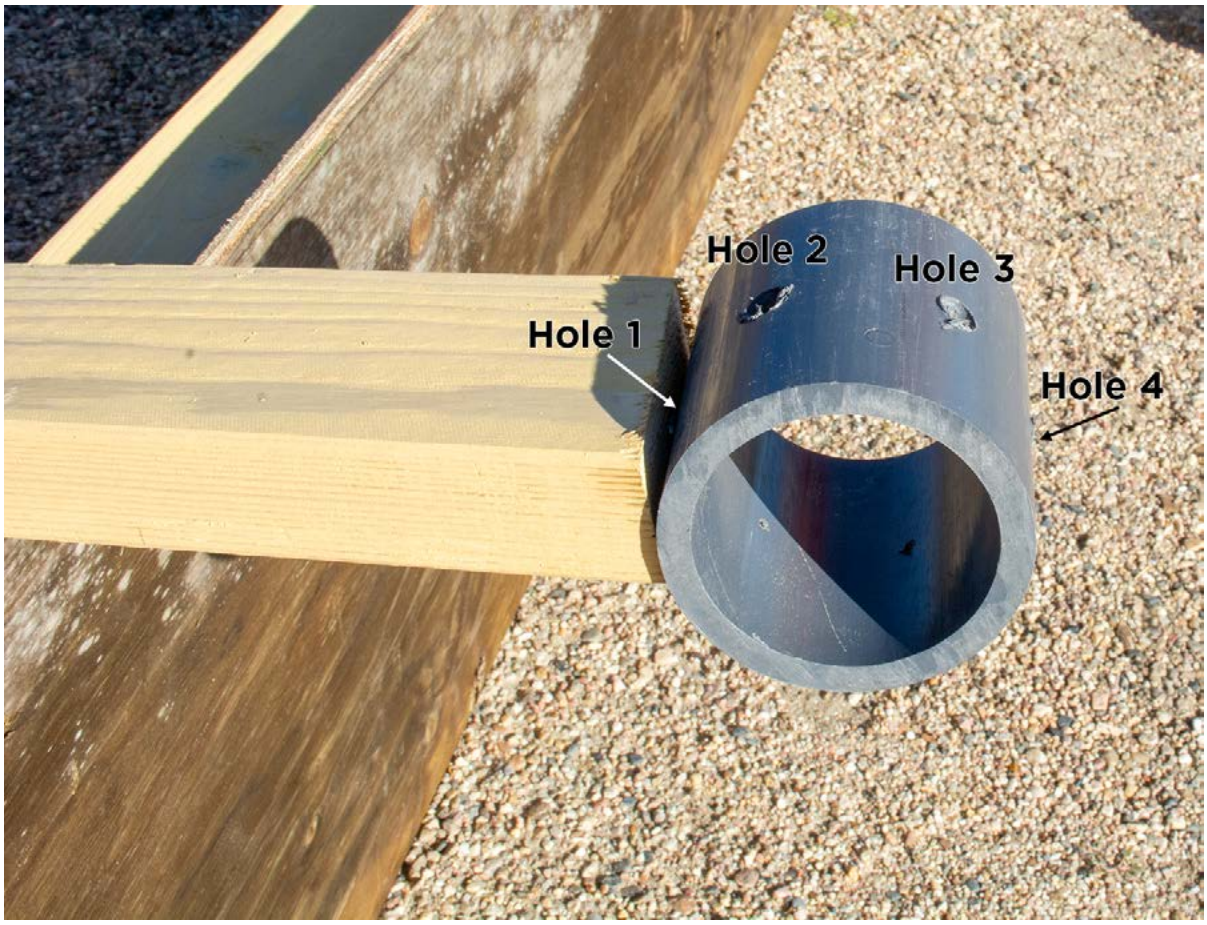



4. Once all 10 sections are attached to each other, using a drill and 7/16-inch bit; Drill two holes through the 2×4s of each end of the wall sections (equidistant from the top rail and the bottom rail) where the sections butt together.

5. Attach the sections permanently using the 4-inch hex head bolts and fender washers. Use washers on both left and right side of each bolt.

# BUILDING THE DOME ON THE BASE – BOTTOM OF TIER 1

1. Lay one long strut (Strut B—the ones with the blue ends) on each of the base wall sections. You will use 10 long struts total.
2. Locate the hubs with 4 holes (there should be 10 of them).
3. Hub hole selection for the next step: Remember the long side of the strut (point to point) is the outside of the structure. Place the long strut (strut B, or blue strut from the schematic) in one hand so that you can easily see/reach the hanger bolt (outside of the long strut is away from you). Hold the hub in your other hand so that one hole is closest to the hanger bolt, there are 2 holes visible on top and the fourth hole is pointing away from the hanger bolt.




4. Slip the hole closest to the hanger bolt on the end of the long strut.

5. Attach the hub to the strut using a 3/8-inch Nylock® nut (no washer). Tighten the nut using the 9/16-inch box end ratchet. Tighten so that the nut is **snug** (**in this instance, snug means for you tighten the nut so that the hub is in full contact with the end of the 2X4 and the hub cannot be twisted around the hanger bolt**) against the inside wall of the hub and that the outside wall of the hub is snug against the cut end of the long strut. **Do not over tighten**—even though the hanger bolt is glued into the 2×4 strut you can pull the hanger bolt from the 2×4 by overtightening the Nylock® nut.

6. Your assembly should consist of hub—long strut—hanger bolt.

7. Repeat steps 8–11 for each of the remaining 9 long struts placed on the walls of the structure.
8. Starting with the first strut/4-hole hub combo (BT1-LS1[9]), lay BT1-LS1 (2×4 wide side down) on top of the spacer 2×4 of the base wall so that hub 10 rests in the open gap between the two wall sections.

9 BT1-LS1 stands for Base Tier 1-Long Strut 1. BT1-LS2 = Base Tier 1-Long Strut2 and so forth around the structure. See diagram page 120 for clarity or even greater confusion.

9. Move to the area of hub 11. From inside the structure hub 11 is to the left of the door opening.
10. Lay the next long strut (BT1-LS2) on top of the next wall section (on top of the spacer 2×4) with hub 12 resting in the open gap of the wall section furthest away from you, and thread the hanger bolt from strut BT1-LS2 into the hole of hub 11 opposite of the hanger bolt/nut of strut BT1-LS1). To check your orientation...two open holes of the hub should face up.
11. Attach strut BT1-LS2 to hub 11 using a 3/8-inch Nylock® nut (no washer) and tighten the nut.

12. Repeat steps until all 10 sections are connected to each other. You should have a complete 10-sided ring consisting of long struts and hubs.
13. **You will notice that the 10 pieces you just assembled do not fit in the ring of the base wall. This likely due to measurement rounding and the level of exactness during the creation of the parts and pieces.**

14. To fix this, use a circular saw and cut 1 1/2 to 2 inches from the center of the long strut that will rest on the **door section** of the base wall. This does nothing to the integrity of the structure as the whole section in the door space is removed later.

15. Move to the wall section panel opposite away from the door.
16. On this panel, fit the long strut and corresponding hubs into the base ring on top of the spacer 2×4.

17. Position the long strut so that it is in full contact with the 2×4 spacer (and the exterior sheeting). The hubs should "float" between the spacers in the gap of the base wall. Attach this long strut to the spacer 2×4 using two 3-inch screws. Drive the screws through the long strut into the spacer 4–6 inches away from the hub on both ends. The center of the hubs should be near the center of the point where the 2 base panels are joined.

18. Moving left **OR** right around the circle towards the door from the long strut in the previous step, align the next long strut on top of the next spacer and attach the long strut to the next spacer using 3-inch screws in the same manner as outlined above. You may need to pull the long strut and hub toward the previously attached long strut to make them fit correctly.

19. Repeat until you reach the hub for the door. Align the long strut in the door frame and attach using two 3-inch screws to the spacer.

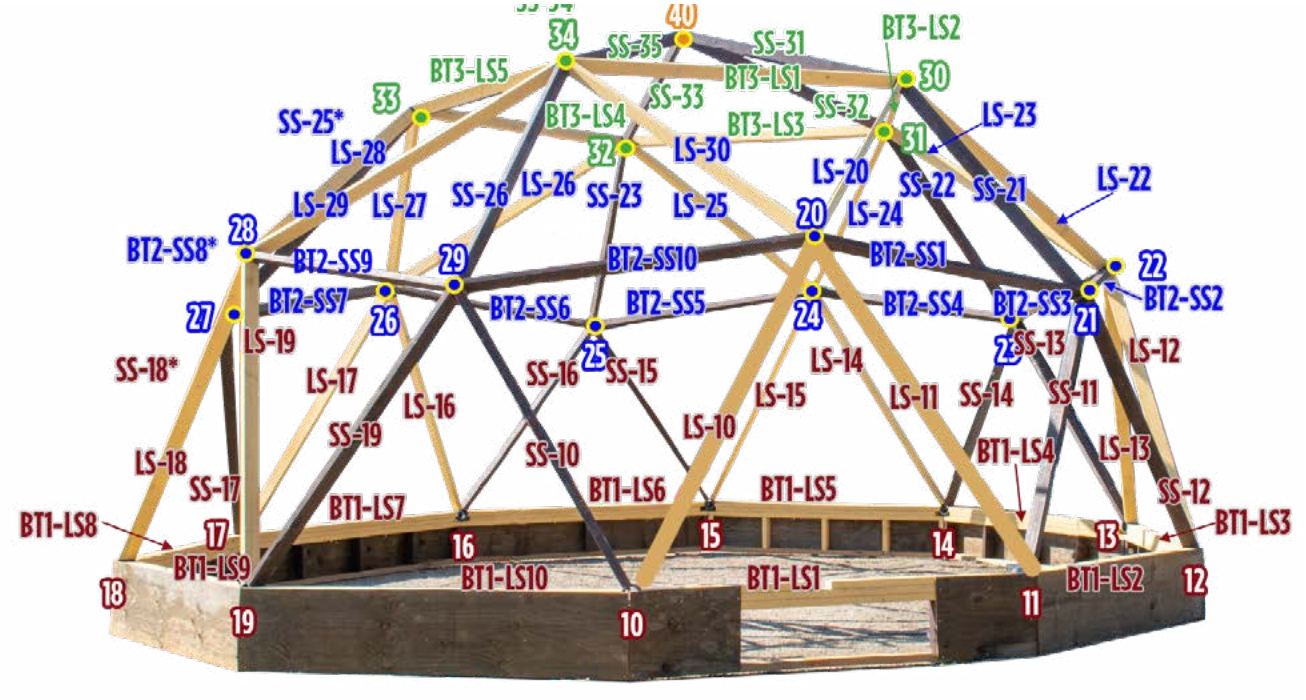

20. Return to the starting point on the opposite side of the structure and repeat on the opposite side of the structure until you have screwed all 10 BT1 long struts to the spacers of the 10 wall sections.

21. Using a drill and 7/16-inch bit; Drill two holes through BT1-LS1, the spacer, and the top rail of the base wall equidistant from the left and right hub (one hole approximately 12 inches in from each hub).

22. Repeat on all nine remaining base wall assemblies.

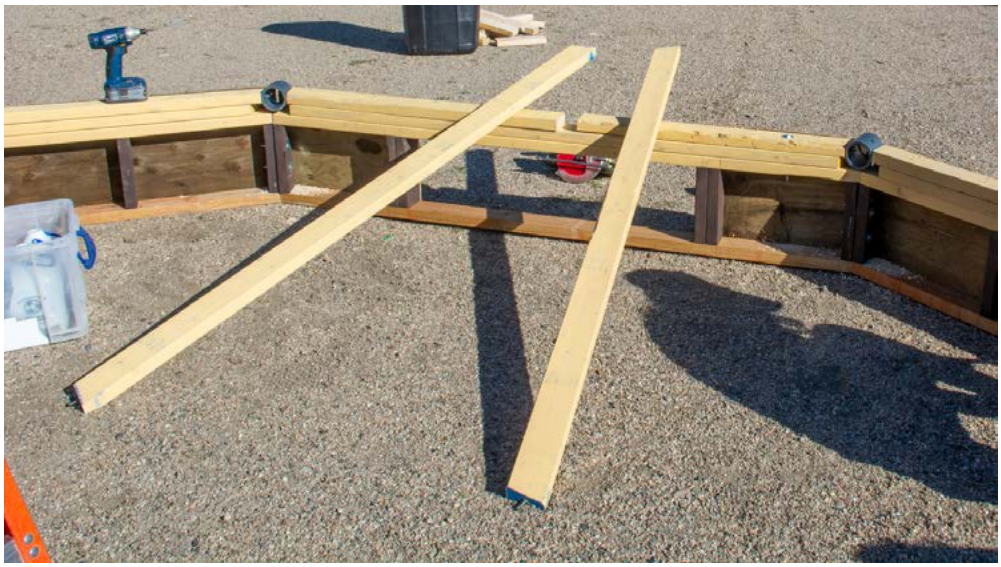
23. Attach the base of the geodesic dome to the wall sections permanently using the 5-inch × 3/8-inch hex head bolts, washers on **both** the bolt head and nut sides, and nuts. Tighten the nuts.

## TIER 1




*Note: Going forward, as you build up, only finger-tighten all Nylock® nuts until final assembly.*

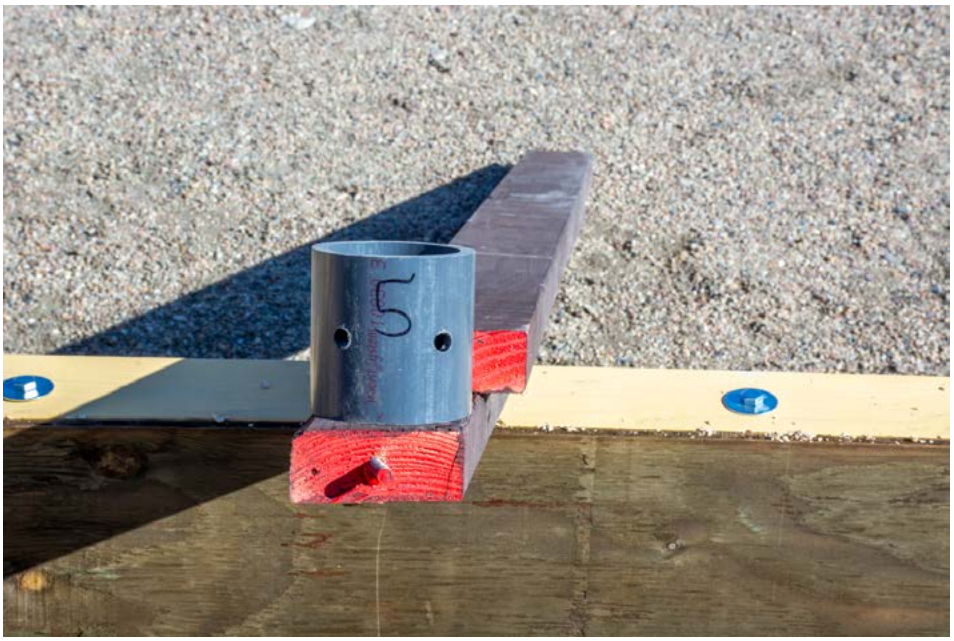
1. Start at the door section and stand inside the structure.
2. Place two long struts (pair) on top of the door wall section so that one end of the struts is resting inside the structure and the other end is pointing out.



3. Repeat step 1 and place 1 pair of long struts on each alternating wall section. There should be 5 pairs of long struts resting on alternate sections of the base wall.

4. Place two short struts (pair) on top of the wall section left or right of the door and lay out the short struts in the same manner as steps 1–2. There should be 5 pairs of short struts resting on their corresponding alternate wall sections.
5. Locate five 6-hole hubs and five 5-hole hubs.
6. Attach one 6-hole hub to one of the long strut pairs using a 3/8-inch Nylock® nut at each of the five wall locations around the structure.

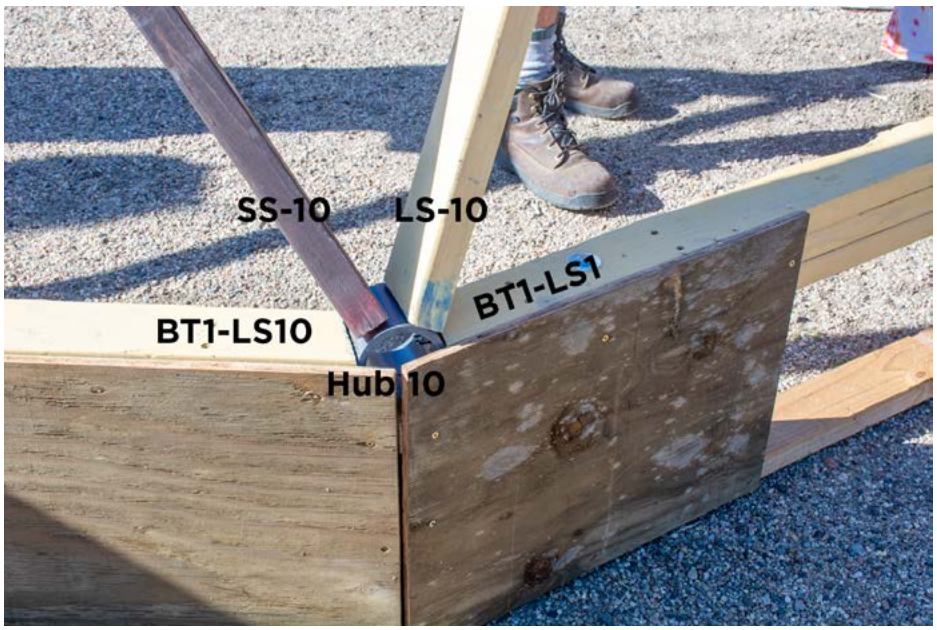
7. Attach one 5-hole hub to one of the short strut pairs using a 3/8-inch Nylock® nut at each of the five wall locations around the structure.



8. Using the numbering system established page 120, pick up the LS-11 which has hub 20 attached and LS-10 so that LS-11/hub 20 pair is in your left hand with hub 20 pointing skyward. Insert the hanger bolt from LS-10 into the hub 20 hole that is adjacent to the hanger bolt of LS-11. Do this by forming a triangle above the base (angles facing in towards center). Attach LS-10 to hub 20 using a 3/8 inch Nylock® nut.


youtu.be/OMpod84ozMI

9. Insert the lower hanger bolt from LS 11 into the open right hole of hub 11 (of the base wall) and insert the lower hanger bolt from long strut 10 into the open left hole of hub 10 (of the base wall) attach struts 11 and 10 to the base hub with 3/8 inch Nylock® nuts. You should have a triangle in place above the door wall section.




youtu.be/OMpod84ozMI

10. Moving to the right or the left of the door section repeat steps 8–9 using two short struts and a 5-hole hub.
11. Continuing in the same direction, the next section would be the same as steps 8–9 using two long struts and a 6-hole hub.

12. Alternate long strut triangle...short strut triangle for this first tier on top of each base section until you get back to the door (looking from the side, the structure should resemble a large crown).

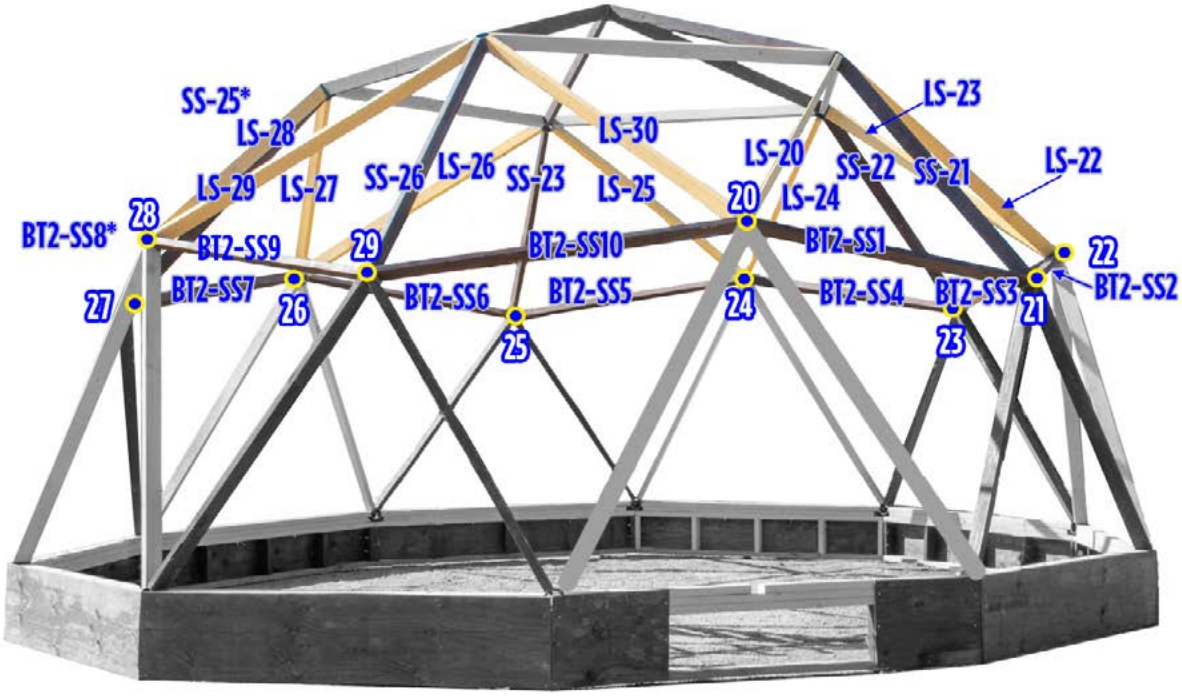
13. To finish Tier 1, connect each top triangle hub point (you are connecting the long strut triangle (blue) to short strut (red) triangle long strut (blue) triangle) using a short strut at each hub connection using 3/8-inch Nylock® nuts.

14. To do this start at the door, place the hanger bolt from a short strut into the next adjacent hole of the hub at the top of the long strut triangle and bridge the gap to the hub of the short strut triangle.

15. Connect the short struts to the hubs using 3/8-inch Nylock® nuts.

*Note: The top of Tier 1, which is the base of Tier 2, is comprised of only short struts. You are connecting hubs 20–29 to complete the top of Tier 1.*

# TIER 2




You will need two ladders going forward so you can support the points as you build the triangles. Think of the top of Tier 1 as the base for Tier 2. There should be five 6-hole hubs and one 5-hole hub remaining.

1. Lay out one short strut on the base where each 5-hole hub is in the top of Tier 1.
2. Lay out two long struts on the base where each 6-hole hub is in the top of Tier 1. These are the struts the comprise Tier 2.

3. At each **short strut** laying on the base, attach a 6-hole hub to one end of the short strut by slipping one of the hub holes over the hanger bolt and secure with a 3/8-inch Nylock® nut. There are 5 hubs (numbered 30–34).

4. While on a ladder, start the Tier 2 triangles on the base of Tier 2 (= top of Tier 1) at a section with a 5-hole hub (only the top hole of the 5-hole hub should be open) by inserting the hanger bolt of the short strut (opposite end of the hanger bolt with the 6-hole hub) into the last hole of the 5-hole hub in Tier 1.

   To clarify ... or confuse ... Start at hub 21 and insert SS-21 (short strut 21) into the remaining hole of hub 21. Hub 30 is pointing toward the sky.

5. While holding the SS-21 (from step 4) in place, insert the hanger bolt from LS-20 into the right adjacent hole of the 6-hole hub (from step 4) *AND* insert the opposite hanger bolt of the long strut into the neighboring 6-hole hub in the base of Tier 2 (= top of Tier 1).

6. Secure all hanger bolts to the hubs with 3/8-inch Nylock® nuts.
7. While at the same location on the ladder, repeat steps 5 and 6 on the right side of the short strut from step 4. Install LS-21 into Hubs 21 and 30. Connect struts to hubs using 3/8-inch Nylock® nuts.


8. Move to the next 5-hole hub of the base of Tier 2 (left or right) and repeat steps 4–7.
9. Once you have and completed two of the peaks of Tier 2, connect the peaks to each other using one long strut and Nylock® nuts.

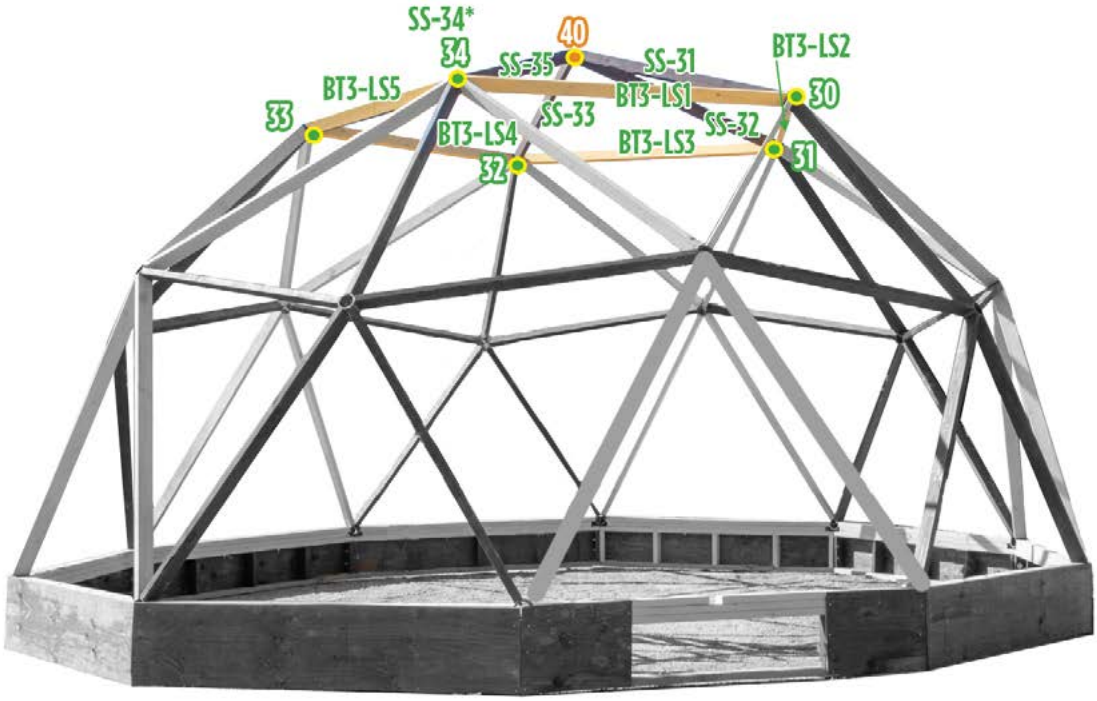

10. Work your way around the structure (left or right) repeating steps 4–7 and 9.

*Note: The top of Tier 2, which is the base of Tier 3, is comprised of long struts. BT3-LS1 = Base Tier 3-Long Strut 1.*

11. Don't wait to connect the peaks of Tier 2 (bottom of Tier 3) as this step stabilizes the structure as you go.

***All the horizontal point connectors around the top circle of Tier 2 are long (blue) struts. Once you get to the last two horizontal long strut connectors you will need to remove the long struts that are above the doorway and use them to complete Tier 2. The door frame will eventually stabilize the points above the door.***

# TIER 3—THE PEAK




1. Select a short (red) strut and connect the last 5-hole hub (Hub 40) to the hanger bolt of either end using a 3/8 Nylock® nut.
2. Slide the hanger bolt from the opposite end you attached the hub to in step 1, into one of the remaining holes of the 6-hole hubs at the bottom of Tier 3. Connect the hubs to the hanger bolt with a 3/8-inch Nylock® nut.

3. Support the SS-31 (short strut 31) and insert SS-35 into the 6-hole hub opposite the hub from step 1 and into the corresponding hole in the 5-hole hub of the peak (Hub 40) and connect both hanger bolts to Hub 40 using 3/8-inch Nylock® nuts.


4. Using the remaining short (red) struts connect one strut from each of the remaining three 6-hole hubs of the top of Tier 2 to the corresponding hole in the peak of the 5-hole hub using 3/8-inch Nylock® nuts.

5. **Once *all* connections have been made, tighten *ALL* the Nylock® nuts "snug" (do not over tighten) starting at the peak hub of the structure and working down to the base.**

# DOME GROUND CONNECTIONS

The structure is held to the ground using 2-ft long sections of 3/8-inch rebar.

1. Using a 7/16-inch drill bit. Drill one hole through the base pressure-treated 2×4 4–6 inches away from the double 2×4 studs where the base sections connect to each other. Drill the hole so that it angles towards the double stud.
2. Repeat step 1 on the opposite side of the double stud in the adjacent base section and again angle the hole so that when the rebar is driven through the hole the two pieces scissor across one another in the soil.
3. Using a mallet, drive one piece of 3/8-inch rebar into each of these holes. Drive the rebar deep enough so that no rebar is above the base plate of the wall.

4. Repeat steps 1–3 at each wall section connection. There should be 20 sticks of rebar holding the structure to the ground.

# MOUNTING THE DOOR AND DOOR FRAME TO THE DOOR BASE WALL SECTION AND THE DOME.

When the door is mounted on the inside of the structure and opens inward, the doorways are easier to trim, finish, look cleaner, and are less affected by the wind (this was a trial and error finding with much discussion, head scratching and maybe a little bit of cussing before we settled on this technique).

1. Move to the door base wall section of the geodesic dome. The door section must be prepared to receive the door. The long strut, spacer, and top rail 2×4s of the door base section must be removed to allow access to the door (do not remove the pressure-treated footer of the base wall section).
2. Lay the "T"-edge of a speed square horizontally on the long strut 2×4 of the door section so that the strait edge rests next to the edge of the stud on the inside of the door frame (the speed square should be resting on the long strut, point down on the inside of the structure).
3. Using a pencil, draw a vertical line so that you are extending the line of the 2×4 stud up through and to the top side of the long strut.
4. Move the speed square to the top of the long strut and continue the line across the face of the long strut toward the wall sheeting.

5. Repeat steps 2–4 on the opposite side of the door frame.

6. Using a reciprocating saw, and the lines drawn from steps 2 and 3, cut through the long strut, spacer, and top rail of the wall section so that the saw blade remains parallel to the inside the door frame surface of the 2×4 stud.

7. Repeat step 5 on the opposite side. Save the lumber. **Note:** *Do not cut through and remove the pressure-treated base rail.*
8. Using a tape measure and the speed square measure 1-1/2-inches from the inside of the door frame ***toward*** the door section hub. Lay the speed square on the surface of the long strut and mark this distance using a pencil (the line should be parallel to the cut you just completed.

9. Using a circular saw or a reciprocating saw cut on the line and ONLY remove this additional 1-1/2-inch section from the long strut. ***Do NOT remove this amount from the spacer 2×4 or the top rail of the base wall.***

10. Slide the door and frame inside the dome. Stand vertically and face the door so the skin side is facing the outside of the structure.

11. **Line the door up with the door base wall section and slide it so that the header or vertical door frame 2×4s *contacts* the short struts at the top of Tier 1.**

12. If your tolerances can't handle the door being slightly off center, center the door in-line with the 6-hole hub at the top of the door wall section (this might really drive you crazy—you may have to let it go and go to your happy place and trust me when I say it will be okay).
13. Using a level, adjust and set the door so that it is plumb left to right and front to back.

    **Note:** *The substrate surface on several dome projects has not been level, to correct for something like this match the left and right angle of the door with the angle of the door wall section (approximately). The door is still mounted plumb front to back.*

14. Using the 2×4 scrap from step 6 above, start two 3-inch screws into the wide face of each of the 2×4s about 1-1/2-inches from the edge.


15. (***Omit Steps 15 - 20 if adding interior raised beds.***)When you are satisfied with the placement/plumb of the door/door frame, place one of the 2×4 scraps on the outside of the double stud in the space on the inside of the door wall section so that the narrow side of the 2×4 is touching the bottom side of the top rail of the wall section. Drive in one screw. The length of the scrap 2×4 should be in line with the outside 2×4 of the door frame.

16. Level the scrap 2×4 and drive a screw through the 2×4 into the door frame.

17. Drive the second screw at the double stud of the door section and a second screw through the 2×4 into the door frame.
18. Repeat steps 14–17 on the opposite side of the door.
19. Repeat steps 14–16 on both sides of the door using additional scrap lumber so that the narrow side of the 2×4 is in contact with the top of the pressure-treated footer of the door wall section.
20. Use a reciprocating saw to cut off the “tails” of the 2×4s that are hanging beyond the door frame into on the inside of the door frame. Save the scrap for additional bracing mentioned below.

21. At this point the top of the door frame should be in contact with the dome and four 2×4 pieces holding the door/door frame to the base wall section.


22. As part of the geodesic dome kit and described in the cut sheet, there are two Strut A's without hanger bolts—find them, see page 30. They may need to be cut (if they do, that is a 16 degree angle), however, the geometry is such that these struts will fit perfectly between the top of the wall spacer 2×4, vertically to the bottom side of the short strut which makes the top of Tier 1). These will frame out the space for the door on the exterior of the dome.
23. Position the strut so that it sits in the 1-1/2-inch space cut from the long strut and on top of the spacer 2×4 of the base wall door opening. The point of the short strut should be flush with the outside edge of the spacer 2×4. The top beveled cut should be positioned on the underside of either BT2-SS1 or BT2-SS10 (top of Tier 1) so that it is in-line with the inside 2×4 of the door frame.

24. Drive two 3-inch screws through the wide side of the door frame strut into the end grain of the long strut on the door base wall.


25. Drive two 3-inch screws through the top of the short strut BT2-SS1 or BT2-SS10 (the top of Tier 1) into the end grain of the door frame (short) strut.


26. At the point where the door/door frame intersects the dome frame, drive two 5-inch screws through the outside dome strut (BT2-SS1) into the door/door frame to secure the door at the top.

27. Repeat steps 22–26 for the opposite side of the door opening.

    *Continue framing the "walkway" to the door (walkway—the space between the outside edge of the base wall to the outside face of the door).*

28. As high as you can on the vertical door frame (short) strut, attach a 2×4 scrap that overlaps the door frame strut on the outside face from the outside of the dome edge to the inside of the door frame attachment rails using 3-inch screws.

    **Note:** *Instead of exact measurement and correct angle I will use a scrap 2×4 piece that is longer than needed, attach it to the door frame attachment rail first, then attach it to the vertical strut of the door frame and cut off extra (on the outside of the structure) with a reciprocating saw to match edges and correct angle.*

29. Repeat step 28 on the other side of the door.

30. Repeat step 28 about halfway down the vertical door frame strut (on both sides).

31. At this point you should have four to five 2×4 braces on both sides of the walkway frame to hold the door frame in place.

When the dome base wall height is greater than 16 inches, it has been found that inserting a door header between the short, angled studs of the door frame walkway allows easier and cleaner attachment of the polyskin around the door. If there is a gap between the door header and the walkway header use a piece of PTP cut to fit in this space.

# PLYWOOD SHEETING THE DOOR WALKWAY

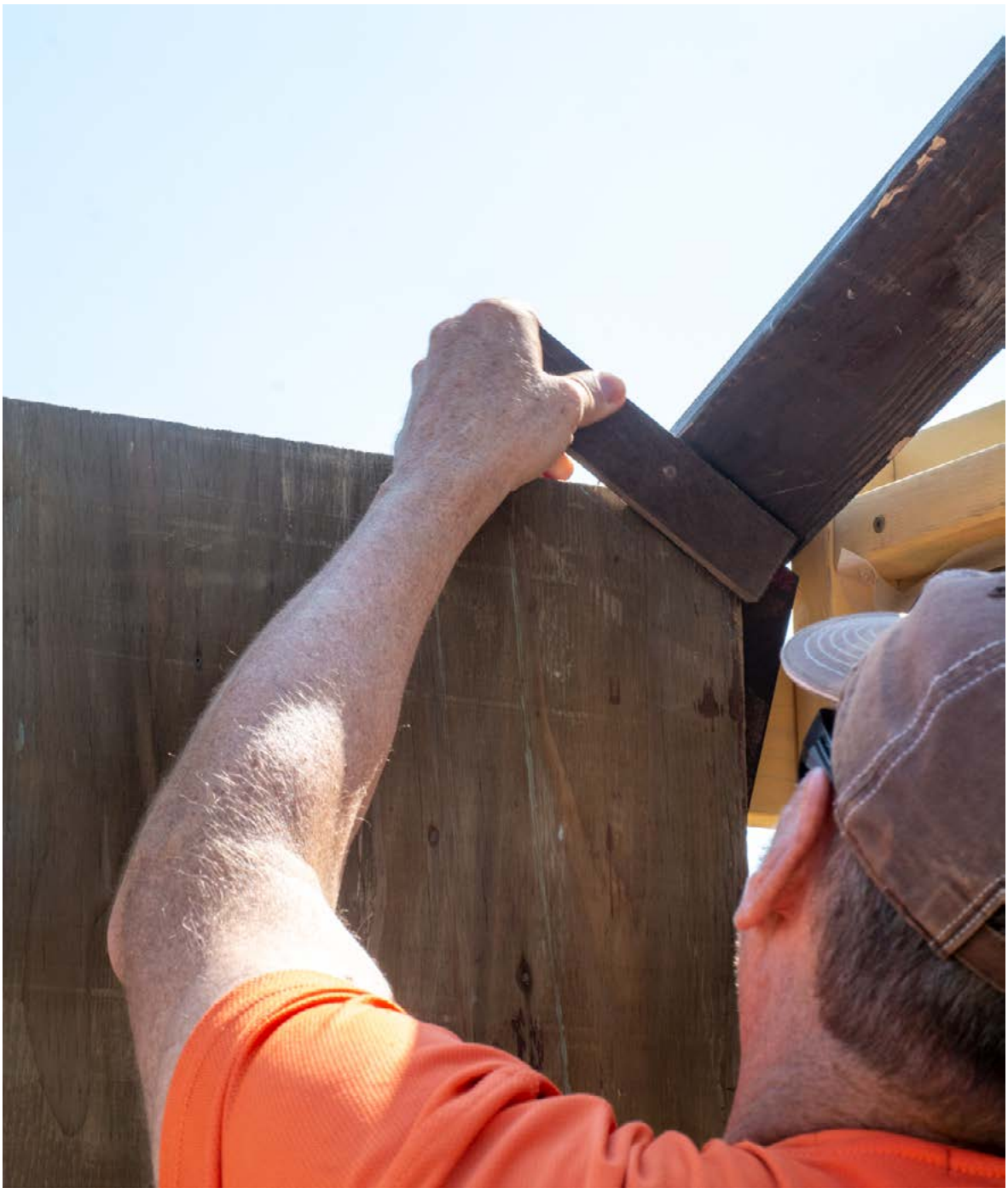
1. Prior to sheeting the walkway, remove all the 3-inch screws and lath holding the door to the door frame and between the two sections of Dutch doors. Then carefully cut the skin material between the Dutch door so that it operates correctly. Push the door in, then close the door (and latch the doors) so that all the extra skin material is pushed inside the gap between the door and the door frame. If you do not do this and attach the sheeting with the skin under the sheeting, you will need to cut the door free to open it.

2. At the base of the door (the door should be latched shut) on the skin side, measure the horizontal distance from the outside face of the door frame to the outside face of the base wall (this distance should be 24 inches or less).
3. Measure the vertical distance from the base of the door to the peak point where the vertical short strut of the door frame intersects with the underside of the short strut that is the top of Tier 1.
4. Cut and fit the piece of sheeting (4-ft × 8-ft sheeting with the kit) to fit the width and height dimensions of the walkway.

5. Set the piece of sheeting in the walkway space so that the long edge is parallel to the door. The panel should be longer than will fit in the space.

Steps 6 and 7 can be omitted if you attached a header to the door frame as described on page 142.

6. While holding the panel in place (parallel to the door) hold a piece of lath 1-1/2-inches wide parallel with the inside angle of the bottom side of the short strut of Tier 1.



7. Using a pencil, transfer this angle to the sheeting and cut and remove this material from the sheeting.
8. Also cut a 1-1/2-inch × 3-1/2-inch piece from the bottom edge of the sheeting to accommodate the pressure-treated footer of the base wall section.

9. Slide the siding into place, so that the inside edge is next to the door. Hold the sheeting firmly against the vertical short strut of the door frame and using a pencil, transfer a line that matches the angle of the short strut to the panel.

10. Cut the excess material from the panel.

11. Slide the panel back into position and attach to the vertical strut, the base wall studs, and the door frame attachment rails using 1-1/2-inch screws.

12. Repeat on the other side of the walk space.
13. Your sheeting should be flush from the door to the outside edge of the wall.

## DOOR TRIM

youtu.be/bLvLnVRNJSI

1. From the cut sheet find the 78-inch × 1-3/4-inch × 1-1/2-inch door jamb.
2. With the door latched closed, lay the door jamb parallel to the door and on the outside side so that the 1 3/4 inch face is in contact with the door and the 1 1/2 inch face is in contact with the sheeting.
3. Drive five 3-inch screws through the door jamb, the sheeting and into the door frame attachment rails. The screws should be equidistant along the length of the door jamb.

## INSTALLING ALUMINUM SHUTTERS

**Tools:**

- Drill
- Driver
- Correct star bits
- Reciprocating saw
- 1/8-inch drill bit
- 1-1/2-inch, 3-inch, and 5-inch screws
- Nimble fingers
- Needle nose vice grips
- Refrigerator or cooler

1. Locate the aluminum shutter, louver opener box and the pre-built wooden frame from the dome kit.
2. Lay the pre-built 2×4 frame on a flat surface and lay the aluminum vent onto the 2×4 frame so that the louvers open into the frame.

3. Align the outside edges of the vent frame with the outside edges of the 2×4 vent frame and drill three 1/8-inch holes along each of the 4 sides (12 holes total).
4. Mount the aluminum vent to the 2×4 vent frame using 1-1/2-inch screws and driving the screws through the drilled holes into the 2×4 frame.

5. Repeat steps 1–5 and mount the second vent to the second, third, and fourth vent frame (*not* the small frame of the cupola).

*Be certain the shutters will open fully without obstruction from the frame. Read instructions for attaching the louver opener mechanism and attach the opener to the vent frame (do not insert the expanding opener yet—do this after skinning).*

6. Position the vent/wooden frame onto the long base strut in the center of the triangle opposite of the door. These vents will fit inside the triangle space created by at least short struts—they will not fit inside any of the long strut triangles without additional support.
7. Attach the vent/frame combination to the **base wall** using three 3-inch screws—the screws should be placed as close as possible toward the louvers, as there will be a 16 degree gap on the exterior face between the long strut of the base and the vent frame.
8. Move the upper corners of the vent frame so they are in contact with the short struts of the triangle in which the vent/frame is installed.
9. Turn the struts so that the wide side is in full contact with the corners of the vent frame.
10. Drive two 5-inch screws through the flat side of the strut, into the corner of the vent frame.
11. Repeat step 9 on the opposite side of the vent frame.
12. Cut an 8-ft 2×4 into two 4-ft sections.
13. Lay one of these sections across the top of the vent frame so that the tails extend beyond the short struts.

14. Attach this 2×4 to the struts using two 3-inch screws on both sides.
15. Drive three 3-inch screws through this top brace 2×4, the aluminum vent frame, and the 2×4 vent frame.
16. Using a reciprocating saw, cut the tails off the horizontal 2×4 at the top of the frame to match the angle of the struts.

17. Repeat steps 6 - 16 for vents 2 and 3. These two vents can be placed around the bottom in any of the short strut triangles. They are generally placed in the short triangles on either side of the door. Using a ladder, mount the fourth vent frame in one of the triangles in the top of Tier 3. **Note:** *My preference for the roof vent to be attached to Tier 3 in the triangle directly above the door purely for aesthetic reasons.*

18. To attach the roof vent to a triangle in Tier 3 repeat steps 6–15.

# CHAPTER 6 – BUILDING INSIDE RAISED BEDS

Any time after the door is installed and firmly attached to the dome frame you can begin on the interior raised beds. Refer to the cut sheet Table 5 (page 15) for information concerning the interior raised beds parts and pieces. Hopefully you have cut all pieces for the raised beds. If not, do so now. As previously stated, the walls for the raised beds are built like the dome base wall, however they do not have a spacer 2x4 on the top rail.

There are three distinct wall sections for the inside raised beds:

1. The seven (7) individual **"principle wall sections"** using pattern and the diagram on page 154 (again stud height will be different if using RVT that is not 20 inches wide).

2. The two (2) **"short wall"** connecters on both sides of the door from the inside dome base wall to the inside of the door frame. No measurements are listed in the cut sheet as the top and bottom rails are cut to fit. These sections also serve as structural anchor points from the interior raised beds to the door frame and the outside dome base wall.

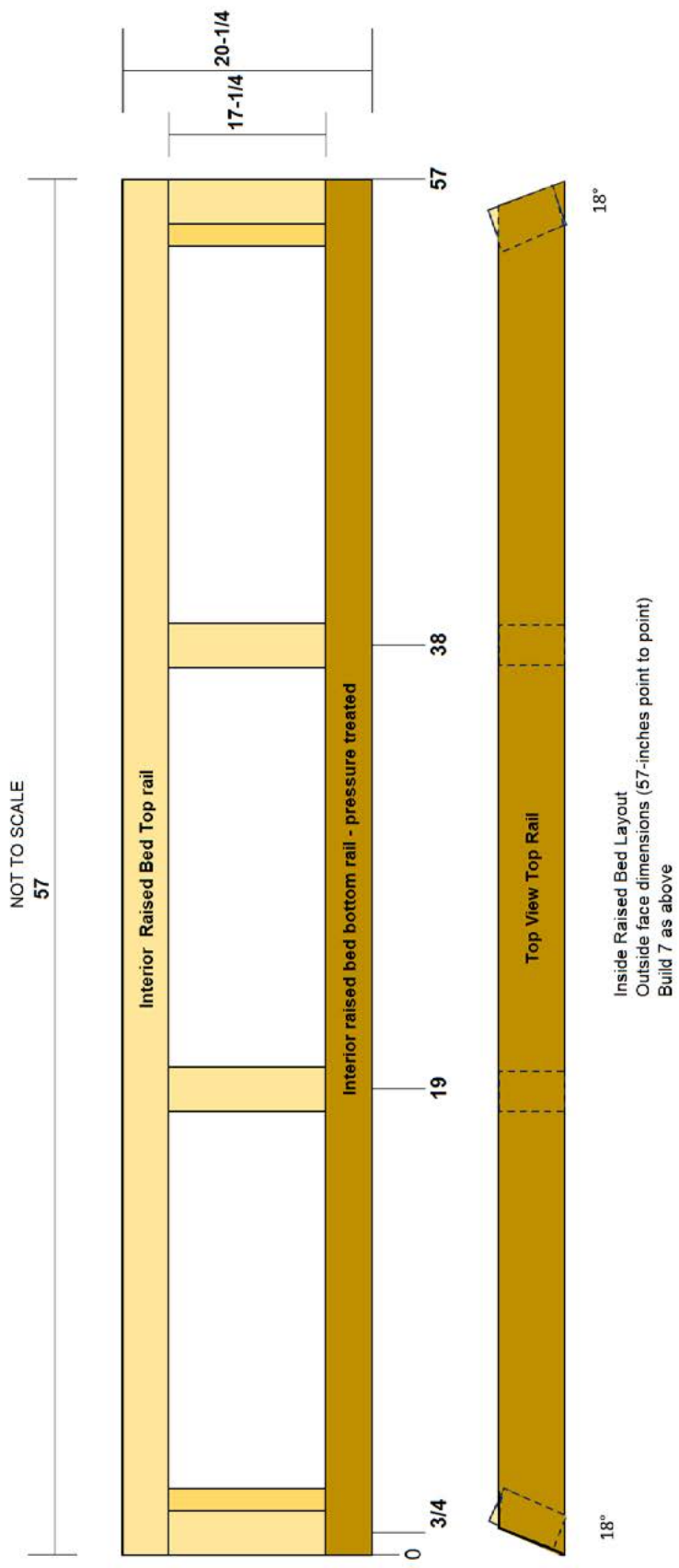
3. The two (2) final **"long wall sections"** of the interior raised beds connect the door and the principle wall sections on both sides of the door. No measurements are listed as the top and bottom rails are cut to fit.

## BUILDING THE PRINCIPLE WALL SECTIONS FOR THE INTERIOR RAISED BEDS.

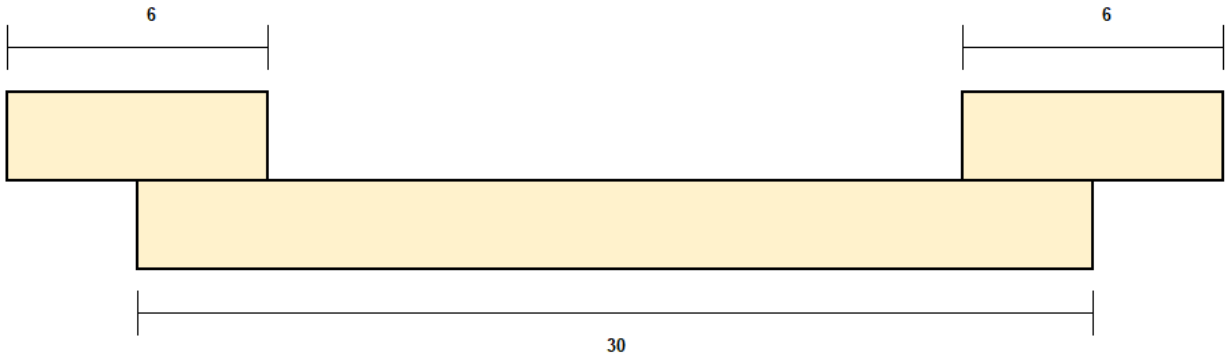
1. Using a similar assembly technique to dome base wall construction, assemble the seven principle wall sections and move them to the inside of the dome.

2. Be sure to make the end studs flush with the end cuts (18 degrees), when you do the inside corner of the stud should be flush with the front face of the 2x4 top and bottom rails. See following image on page 154 labeled "Top View Top rail."

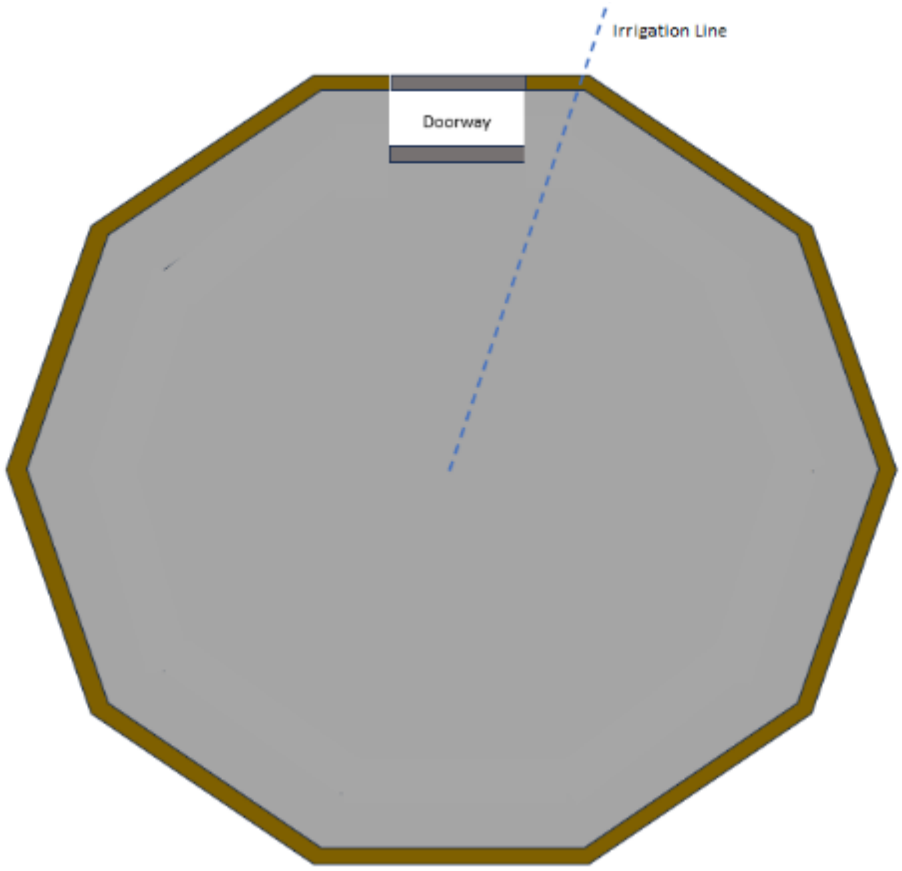
3.


20-1/4
17-1/4
NOT TO SCALE
57
Interior Raised Bed Top rail
Interior raised bed bottom rail - pressure treated
57
38
19
3/4
0
18°
18°
Top View Top Rail
Inside Raised Bed Layout
Outside face dimensions (57-inches point to point)
Build 7 as above

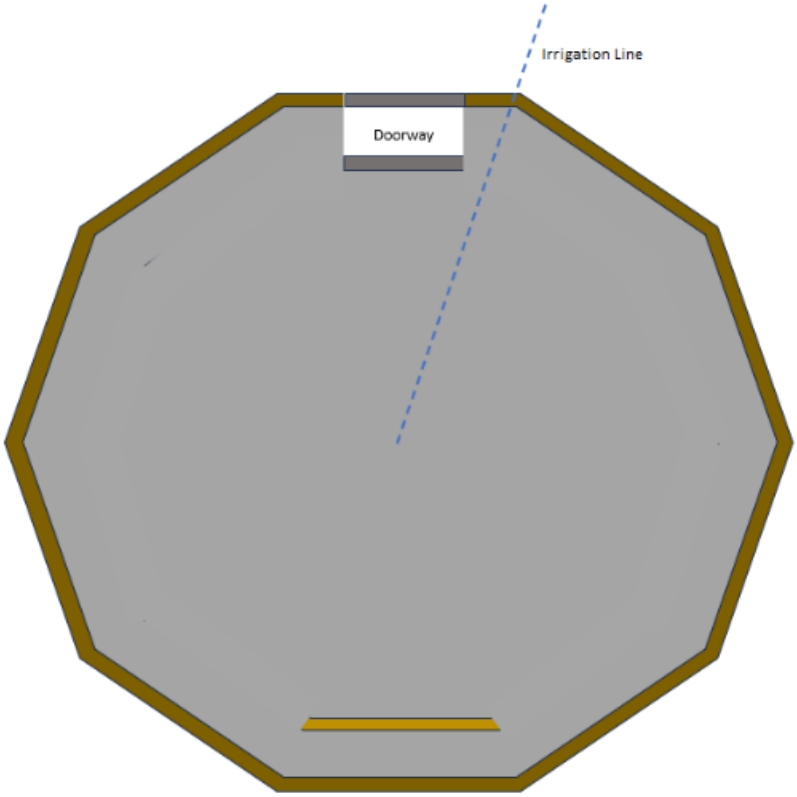
These 7 sections are intended to be 30-inches from the base wall. To keep these sections 30-inches from the base wall, build six "wall jacks" from scrap 2x4s as below. Attach the 6-inch pieces to the 30-inch "jack" using 3-inch screws. These jacks are just temporary and will be removed once the beds are in place.




At this point when looking top down onto your structure this is what the footprint should resemble.

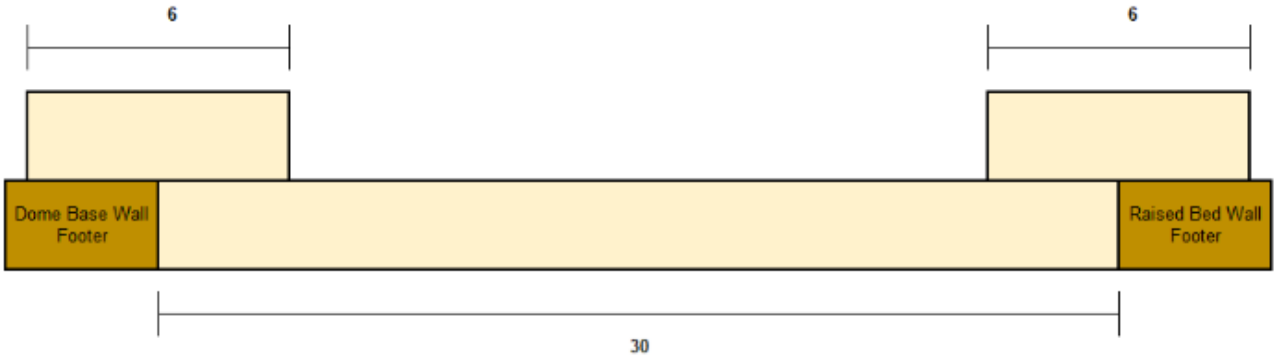


1. Place the first piece of principle interior raised bed wall on the ground opposite the door.



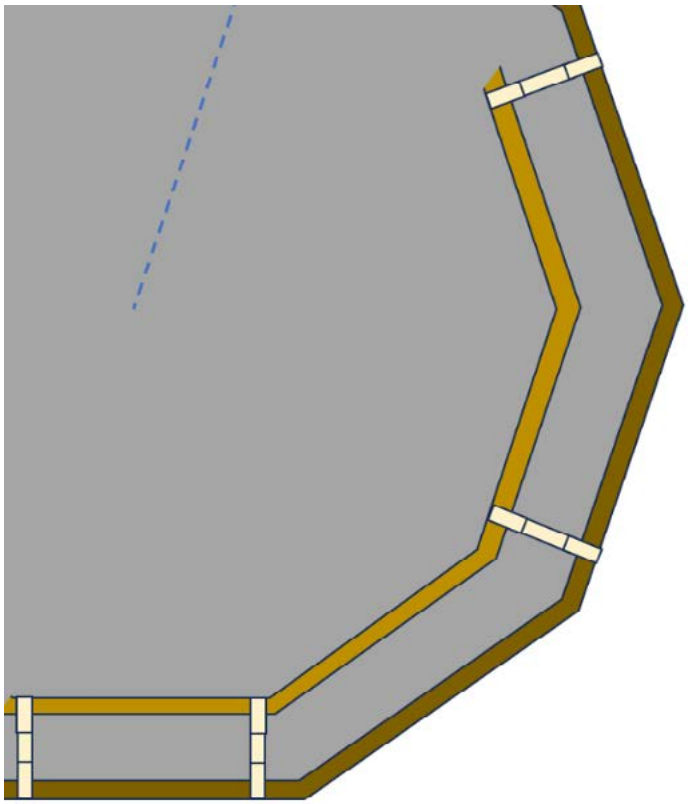

youtu.be/7LDDsM0ieiY

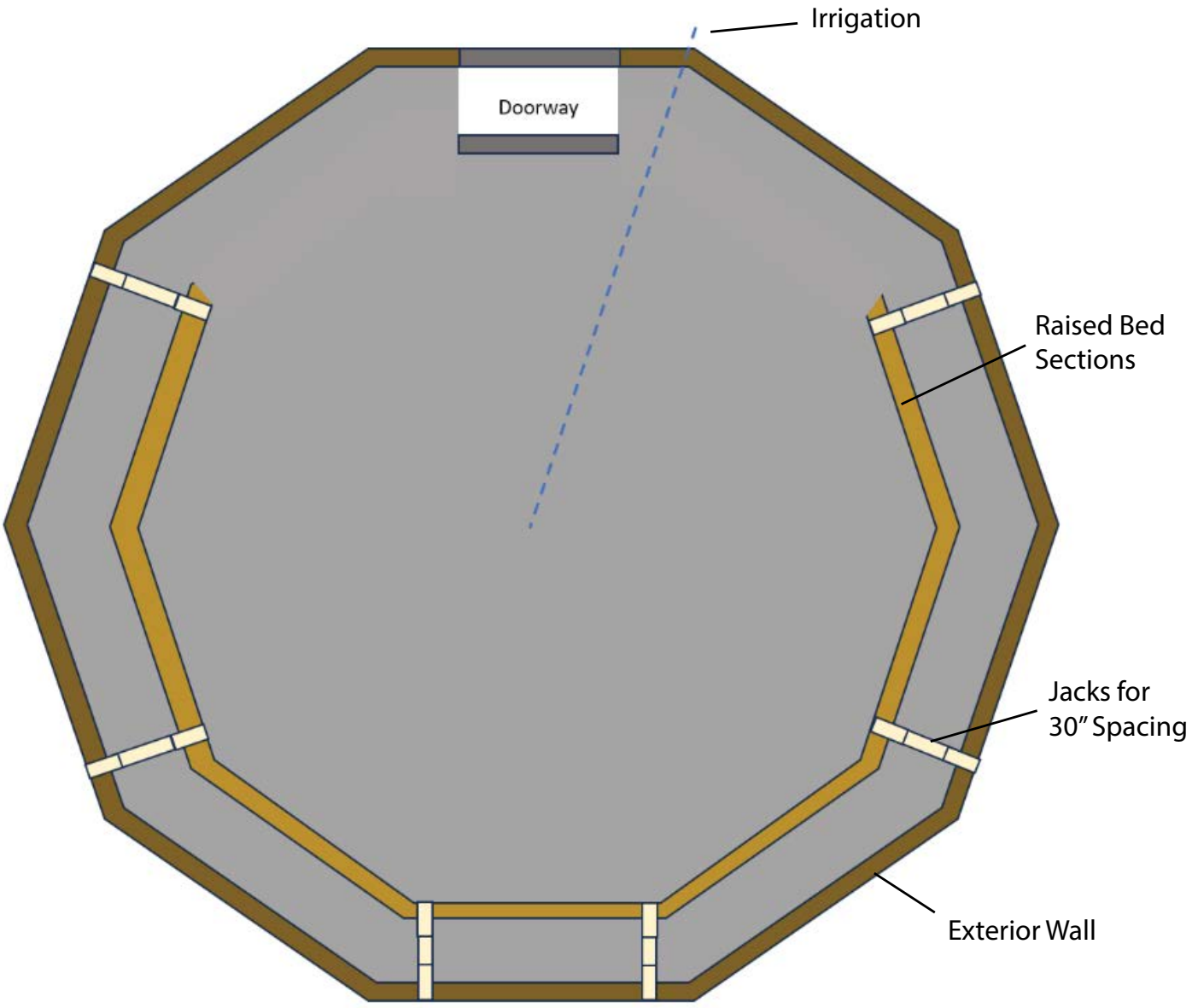
2. The figure on page 157 shows jack placement between the raised bed sections and dome wall footers.




3. Make certain the jack is perpendicular to the raised bed wall section.
4. Attach the jack to the first piece of the principle raised bed wall near the outside stud by driving 3-inch screws through the six-inch piece of wood into the principle raised bed wall footer.
5. Attach the second jack to the opposite end of the principle raised bed wall footer using 3-inch screws.
6. Align the interior raised bed wall section to be in the center of the dome base wall.

7. Attach both jacks to the footer of the dome wall opposite the door. [Figure to right, **Note:** Can you see the irrigation system over the top of the jacks? DO NOT install the irrigation system until after you have lined the raised beds with RVT – you will be much happier].
8. Working left or right from this first interior raised bed wall section. Attach a second raised bed wall section to the first using eight 3-inch screws (two near the top and two near the bottom of both sides of the stud).
9. Repeat for the third wall section.
10. Install a 3rd jack on the third section of the primary interior raised bed footer and the base wall footer in the location represented in the image below.
11. Attach the 4th primary interior raised bed wall to the third raised bed section
12. Install a 4th jack on the fourth section of base wall and interior bed wall.
13. Repeat steps 8-12 on the opposite side of the dome. Installing the remaining interior raised bed sections and the 5th and 6th jacks.

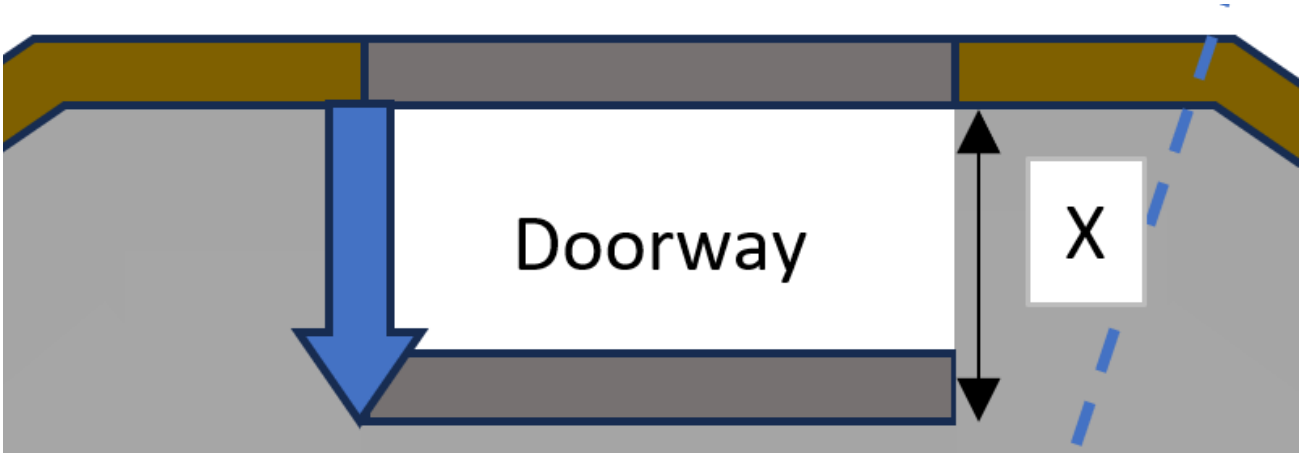



Irrigation
Doorway
Raised Bed Sections
Jacks for 30" Spacing
Exterior Wall

# BUILDING FRAMES ATTACHING THE DOME BASE WALL TO THE INTERIOR RAISED BEDS.

Measure this distance (blue arrow on the left and black arrows on the right in figure below) be sure to check both sides of the doorway, unless you are an absolute perfectionist, they will be different.

**It will be easiest to make all these parts out of pressure treated 2x4s as you will be dealing with the left and right handedness of the sides.**

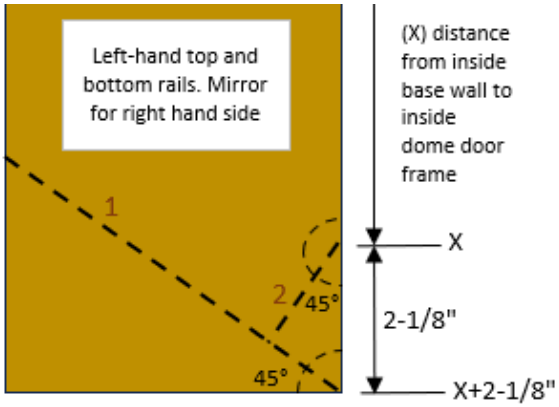



For demonstration purposes, the length of both sides is designated as (X). This is the distance measured from the inside of the base wall to the inside the dome edge of the door frame.

For the top and bottom rails of the raised bed sections we are building, add 2-1/8-inches to this measurement (X+2-1/8-inches). The reason for adding these 2-1/8-inches will become clearer (maybe) as we complete this section.

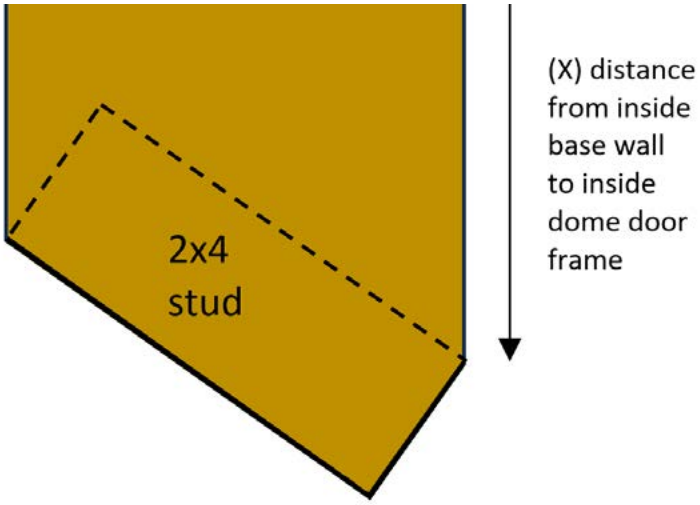
## To prepare the top and bottom rails.

1. Cut one end of a pressure treated 2x4 to 0-degrees.
2. Measure the distance from the inside base wall to the inside doorway frame (X).
3. From the 90-degree cut board end, measure and mark your 2x4 at (X) and (X+2-1/8 inches).
4. At the (X+2-1/8-inches) mark, cut the pressure treated 2x4 at 45 degrees. This first cut corresponds to number 1 in the figure to the right.
5. On your chop/miter saw, roll the board 180 degrees and cut the board at 45-degrees at length = (X). This second cut corresponds with number 2 in the figure below.
6. Duplicate steps 1-5 for the left side bottom rail.
7. Duplicate steps 1-5 for the right side top and bottom rails.



## Assemble the short, interior raised bed wall sections

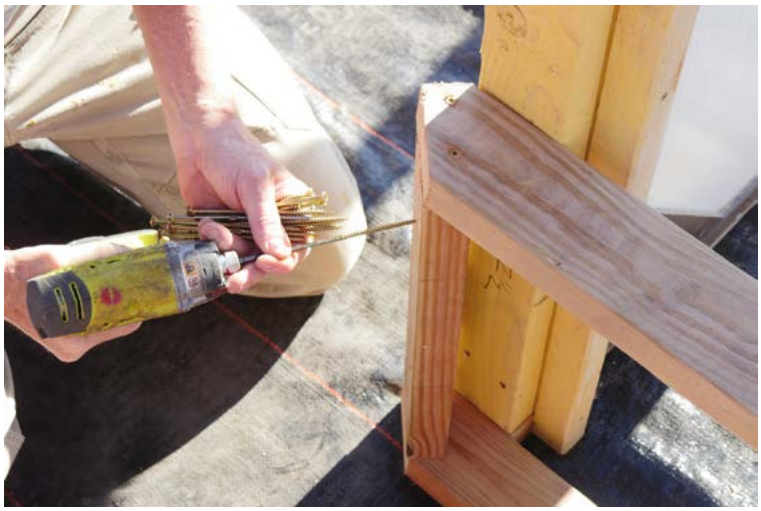
These short, interior raised bed wall sections are built just like all the base wall and other raised bed sections; however, they consist of top and bottom rails and only two studs.  Make a box.




1. Align the first 2x4 stud perpendicular to the 0-degree end and attach with 3-inch screws.
2. For the 45-degree cut end, align the 2x4 stud so that a narrow face is flush with cut number 2 from step 5 above and the long face is flush with cut number 1and attach with 3-inch screws. Figure to the right.
3. Repeat attachment of these two studs to the second rail.
4. Repeat steps 1-4 for the opposite side of the door.  Remember the second side is a mirror of the first side, so the top and bottom rails are rolled 180-degrees.
5. Also NOTE: IF the (X) measurements are different for the left and right sides, it would be best to completely build one side then the other as to not to mix the pieces.

## Install the short, interior raised bed wall section (left or right side).

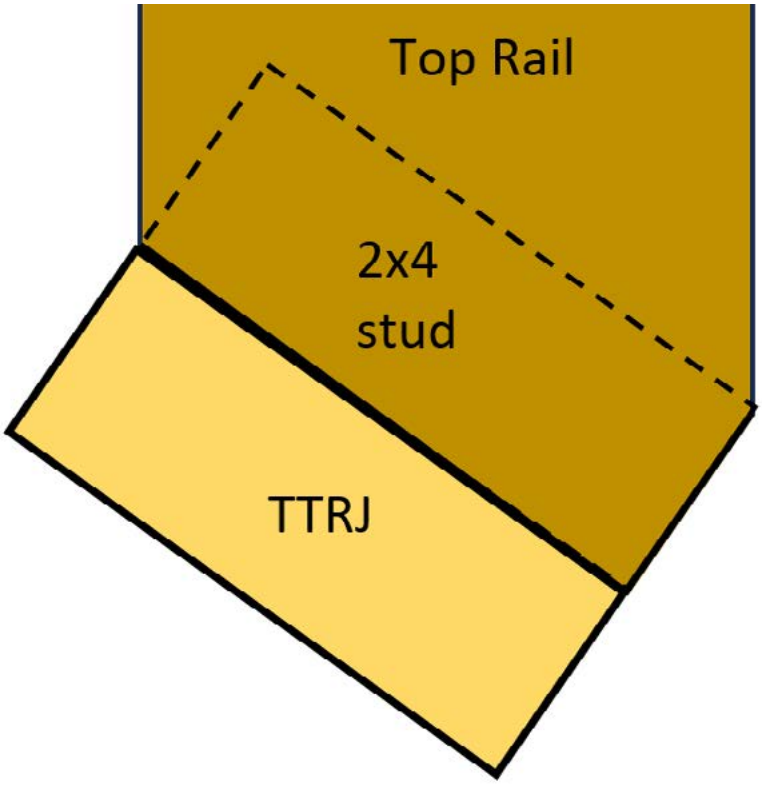
1. Start two 3-inch screws on the interior face (a pair about 3 inches from the underside of the top rail) in the stud attached to the 0-degree end of the top rail.
2. Fit the section between the base wall and the interior dome edge of the door frame.
3. Using a level, plumb the wall section vertically.  The 0-degree side should be parallel to the base wall door frame studs but not overlapping them.
4. The top rail of the short wall section should be level with the top of the Tier 1 triangle board (strut B) attached to the base wall.
5. Once level and plumb drive the two started screws into the base wall.
6. Attach the 2x4 stud of the short, interior raised bed wall section (the one aligned with the 45-degree face of the top and bottom rail) to the door frame using three 5-inch screws (low middle and high)



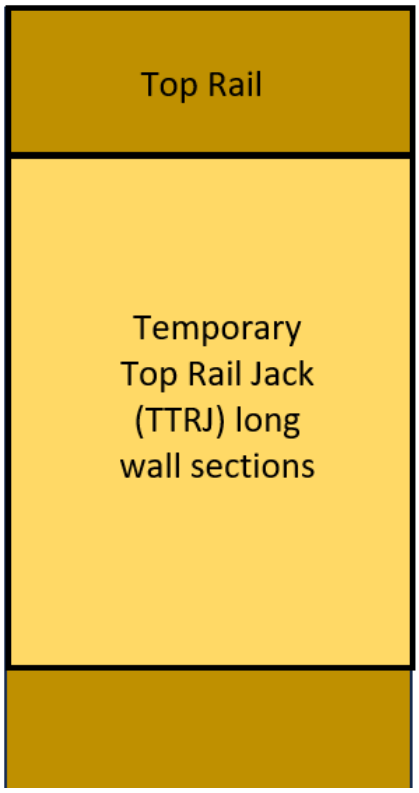
## BUILDING THE "LONG WALL SECTIONS" FOR THE INTERIOR RAISED BEDS

The last to sections of raised beds complete the framework for the interior raised beds by connecting the short sections at the doorway and the seven primary raised bed wall sections. Attach a scrap piece of 2X4 to the exterior face of the short wall stud using 3-inch screws. This is just temporary and will be removed prior to installing the long wall section.

This will serve as a resting spot to measure the top rail of the long wall section.

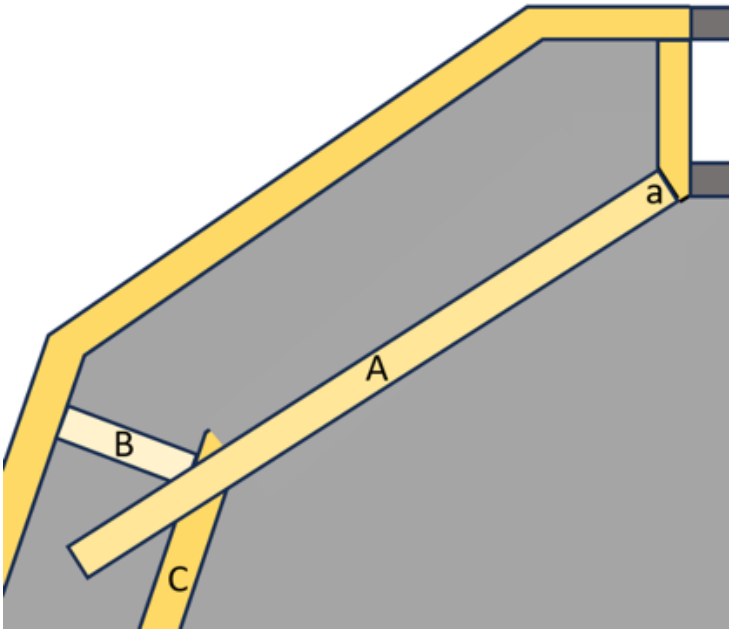



TOP VIEW

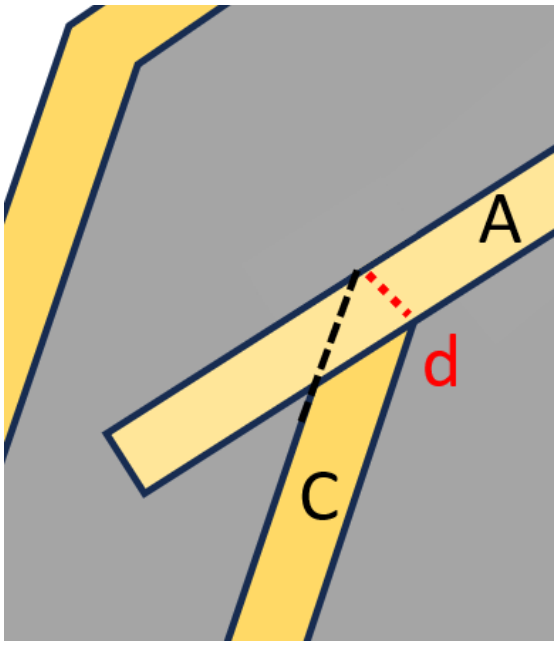



END VIEW

## Prepping the long wall sections



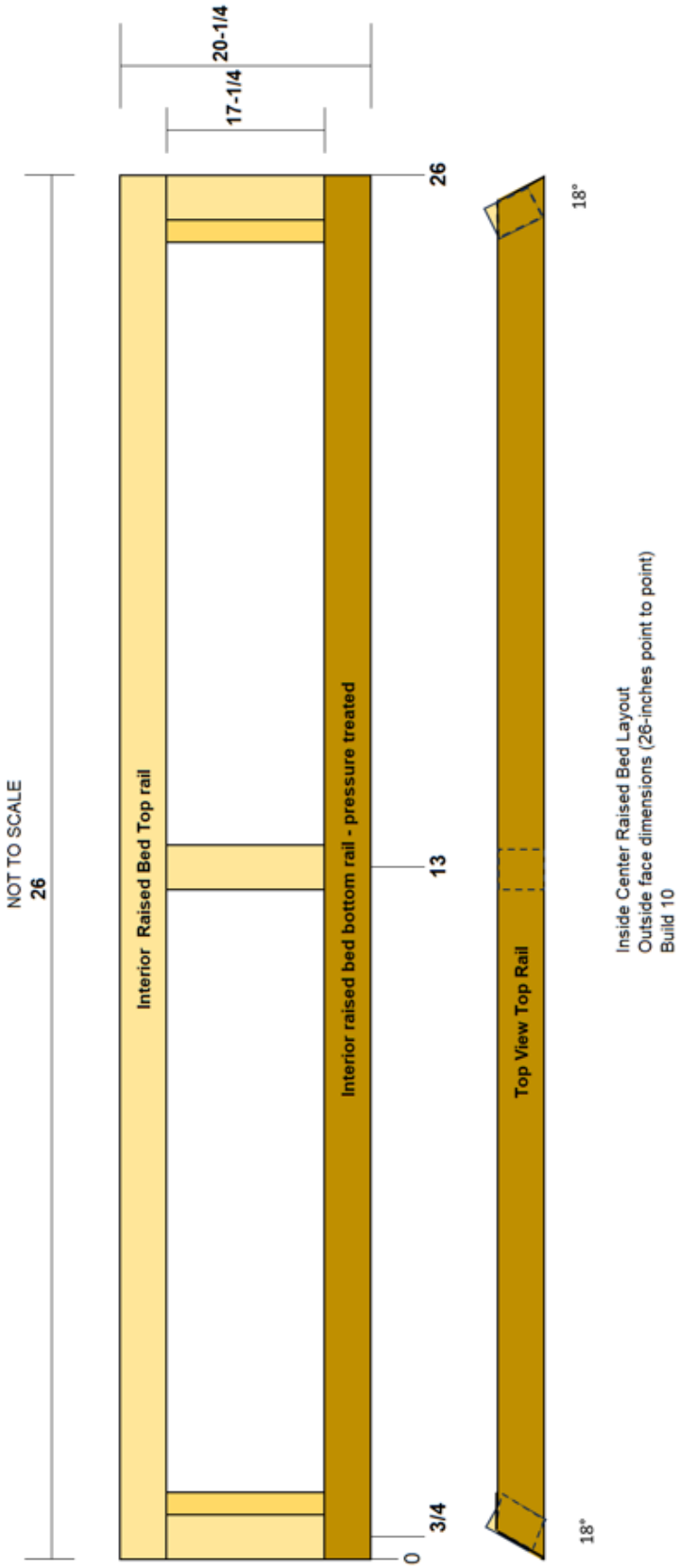

1. To create the left side top rail, trim end (a) of a full length 2x4 (A) and make certain it is cut at 0-degrees.
2. Set 2x4 (A) so that end (a) is resting on top of the TTRJ and butted against the top rail of the short, interior raised bed wall section.
3. Temporarily attach point (a) to the TTRJ with 3-inch screws.
4. Rest the opposite end of 2x4 (A) on the top rail of the interior raised bed section (C).
5. Remove jack (B)
6. Adjust and align interior raised bed section (C) under 2x4 (A) so that the end edge sides of (C) are flush with the edges of 2X4 (A).
7. Using a pencil, scribe the underneath FACE of the intersection of section (C) onto 2x4 (A). Red line (d) image right.
8. Remove the screws at point (a).
9. Remove the screws holding the TTRJ and discard the scrap of wood.
10. Return the board (A) back to the chop/miter saw, adjust the angle to match the line scribed onto the face and cut board (A). (this will be an angel cut between 10 and 20 degrees)
11. Use the top rail (A) as a template and cut a pressure treated 2x4 to the same dimensions (this will be the bottom rail).
12. Repeat steps 1-11 to prepare the top and base rails for the wall section on the side right of the door. Left and right sides will be different measurements.




## Adding studs to the wall sections

1. The long wall section will have 5 studs.
2. Build the long wall sections just like all other base and raised bed wall sections by placing the studs and driving 3-inch screws through the top and bottom rails into the studs.
3. Lay the top rail and bottom rail next to each other, narrow side up, orient so the 90-degree ends match and the point of the cut end is up.
4. Measure the length. Divide by 2 (this is center).
5. Then measure the distance between the end and the center and divide the distance by two to find the location of the remaining two studs.

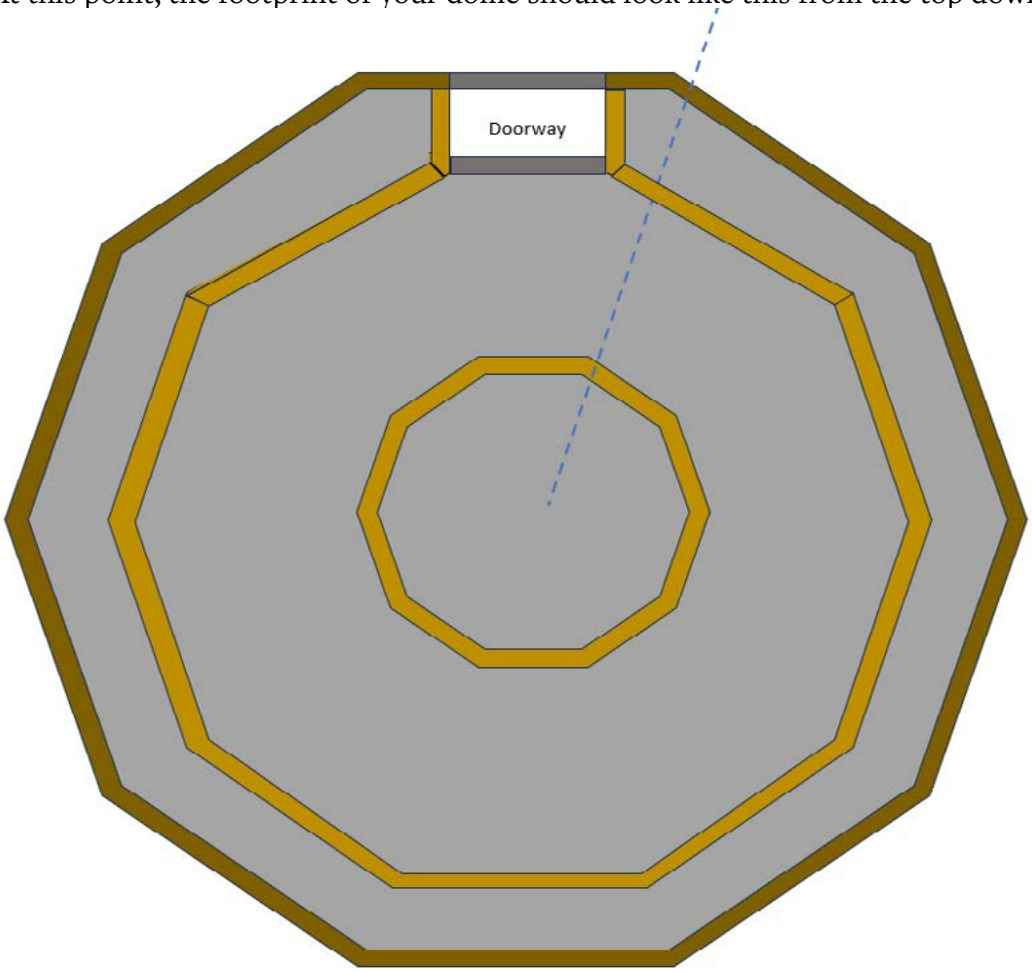
6. Repeat steps 1-4 for the second side.
7. Place the long wall sections between the principle wall sections and the short wall sections.
8. Secure the long wall section using 3-inch screws to the short wall and the principle raise bed wall sections.
9. Drive 2 screws through the studs near the top and 2 near the bottom from both directions on all connecting wall sections.
10. Remove all jacks from the interior raised bed.


20-1/4
17-1/4
NOT TO SCALE
26
Interior Raised Bed Top rail
Interior raised bed bottom rail - pressure treated
26
13
3/4
0
Top View Top Rail
18°
18°
Inside Center Raised Bed Layout
Outside face dimensions (26-inches point to point)
Build 10

## Building the center raised bed

1. Refer to the cut sheet.
2. You should have all the parts and pieces for the remaining center raised bed wall sections. If not cut them now.
3. Build 10 wall sections for the center raised beds using the layout diagram on page 164.
4. Arrange the 10 wall sections in the interior of the dome.
5. Choose one wall section and attach it to the next wall section using eight 3-inch screws (two near the top and two near the bottom, both sides of the studs).
6. Continue around the circle and attach one section to the next until you complete the "circle" of the interior raised bed.
7. Position the raised bed near the center of the dome encircling the center riser of the irrigation system.

At this point, the footprint of your dome should look like this from the top down.



# CHAPTER 7 – LINING BASE WALL AND INTERIOR RAISED BEDS

Roof Valley Tin (RVT) has been found to be the most economical, durable, and easiest to use material for lining raised beds. It can also be difficult to handle and will "gut you like a fish" or so the saying goes, so caution must be used when handling this product. I've cut my hands, arms, my students, my boot leather and a shoestring just by resting it on my feet. It will bite you without warning. It does not need to be the material you use. See notes below on "taming" this stuff.

## RECOMMENDED TOOLS

- Leather or Palm/finger Coated Gloves (preferred, better grip)
- Straight edge
- Marker
- Tape Measure
- A means to cut lath strips to length (Razor Knife, Reciprocating Saw, etc.,)
- Tin Snips or one of these things (image right) (a Metal Cutter Attachment) that can cut tin by attaching to an impact driver or drill. This is recommended over tin snips – works well, post learning curve (I'm still learning).
- Rubber mallet
- Impact driver

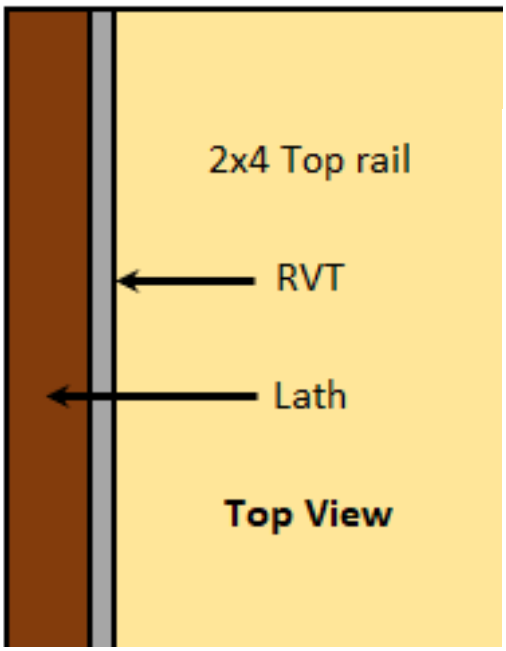
## TAMING RVT

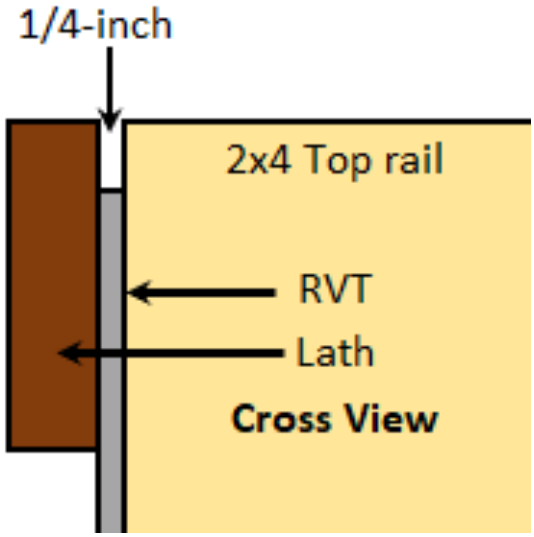
youtu.be/JtPoGrMaYNY

To prevent some of the possible detrimental health effects of RVT, a vertical dispensing reel was built out of scrap 2x4s, an eye bolt, and some bits of scrap RVT. This reel is used to prevent direct contact with the RVT when running it off the spool. The reel also eliminates unwanted "kinks and bends" in the RVT. The RVT sits on the reel and can be "dispensed" as needed without constant handling of the RVT.

The RVT is "loaded" onto the reel. The entire reel spins on the eye bolt at the top. Be sure to manage the end of the reel when cutting the strap holding the reel together.

Attachment of the RVT is by driving 1.5-inch screws through the RVT into the top rail of the wall/ raised bed frame. The goal is to sandwich the RVT between the biocomposite lath and the top edge of the bed top rail to prevent the RVT from cutting people who will be using the beds. (top view of RVT sandwich (image below left)). The dome wall height and the raised bed wall height should be at least ¼-inch taller than the RVT is wide – this allows for some "play" when attaching RVT to the top rails. The extra height will provide a space to set the RVT below the top surface of the top rail. The lath can then be attached with 1.5-inch screws to the narrow face of the top rail (cross view, right).




## ATTACHING THE RVT

It really does not matter where you begin, but at this stage you will be covering the 1) exterior dome base wall; 2) the internal dome base wall; 3) the inside of the interior raised bed; 4) and the interior of the center raised bed. More RVT will be installed to the exterior raised beds after skinning the dome. The longest manageable rolls of RVT are 50-feet and the dome base perimeter length is about 80 feet (I rounded up) – this means that you will be splicing (overlapping) rolls of RVT around both the inside and the outside.

### Exterior dome base wall

1. Set the RVT near you and pull the tail of the roll to the door side edge of the second door section stud. Translation: The RVT should be completely overlapping the stud second from the doorway.
2. Hold the RVT about ¼-inch below the top rail (The top rail of the base wall is the top of strut "B" of the first dome triangle).
3. Drive one 1.5-inch screw through the RVT into the top rail of the base wall.
4. Pull the RVT tight at the top away from the first screw. Keep your alignment of the RVT at ¼-inch from the top and drive a second 1.5 screw near the hub of the base wall.
5. Pull the RVT around to the second section of base wall (pulling so that the RVT is tight) and maintain the ¼-inch elevation of the RVT.
6. Drive a screw through the RVT into the top rail on the other side of the hub.
7. Drive a screw through the RVT into the base rail at the door starting point.
8. As you move around the sides, pull the RVT tight and place screws about every 2-ft along the top and bottom rails to hold the RVT in place.

*Technique tip: I'm right handed, so I hold the screw onto the driver bit with my left hand, find the location where I am going to drive the screw and tap/hit the back of the driver with my right hand so that the screw pierces the tin. Then drive the screw though the RVT into the 2x4.*

## What happens at the hubs?

The RVT is pulled across the open-ended face of the hub. Align the lath so that it comes to a point at the center of the hub. Drive 1.5-inch screws through the lath and RVT into the top rail. You will need to cut lath strips for all wall sections to make up the difference and have them meet in the middle of the hub. Doing this will prevent the RVT from rubbing or cutting holes in the polyethylene skin.

Since the bottom of the RVT will be under the soil and you have attached it using screws to the base rail, there is no need to use lath to hold it in place anywhere except the top rail.

## Lapping seams of two rolls of RVT

The tail of the RVT will likely not end on a stud of the wall. When starting the new roll, slip the tail of the new roll under tail of the previous roll so that it overlaps a stud and that you cannot see the seam from the outside wall. Attach the RVT as described above.

## Ending the RVT

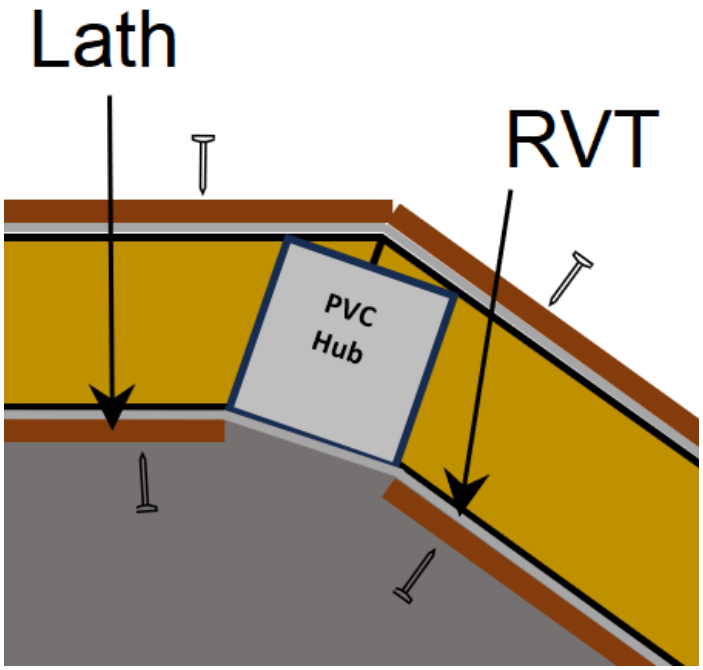
It is highly likely the RVT roll end will not match up with the end of the raised bed. You will need to mark the end and cut the roll from the portion used in the raised bed.

## Attaching RVT to the interior raised bed and center bed

The technique is the same as described above. Begin with the partial piece remaining on the reel, square the end and bend a 1.5-inches wide strip the full width of the RVT to 90-degrees. This will allow you to start in one of the 90-degree corners at the door. Beginning either direction is up to you.

Pull the RVT tight into the corner. Begin attaching the RVT, adding the lath and move along in this manner until you arrive back at the starting point. Cut the RVT so that it fits in the 90-degree corner you started with.

What's happening at the inside hub corners with the lath? Since there is nothing to attach the lath to on the inside corner, measure and cut the lath to end just before the hub. See image right.



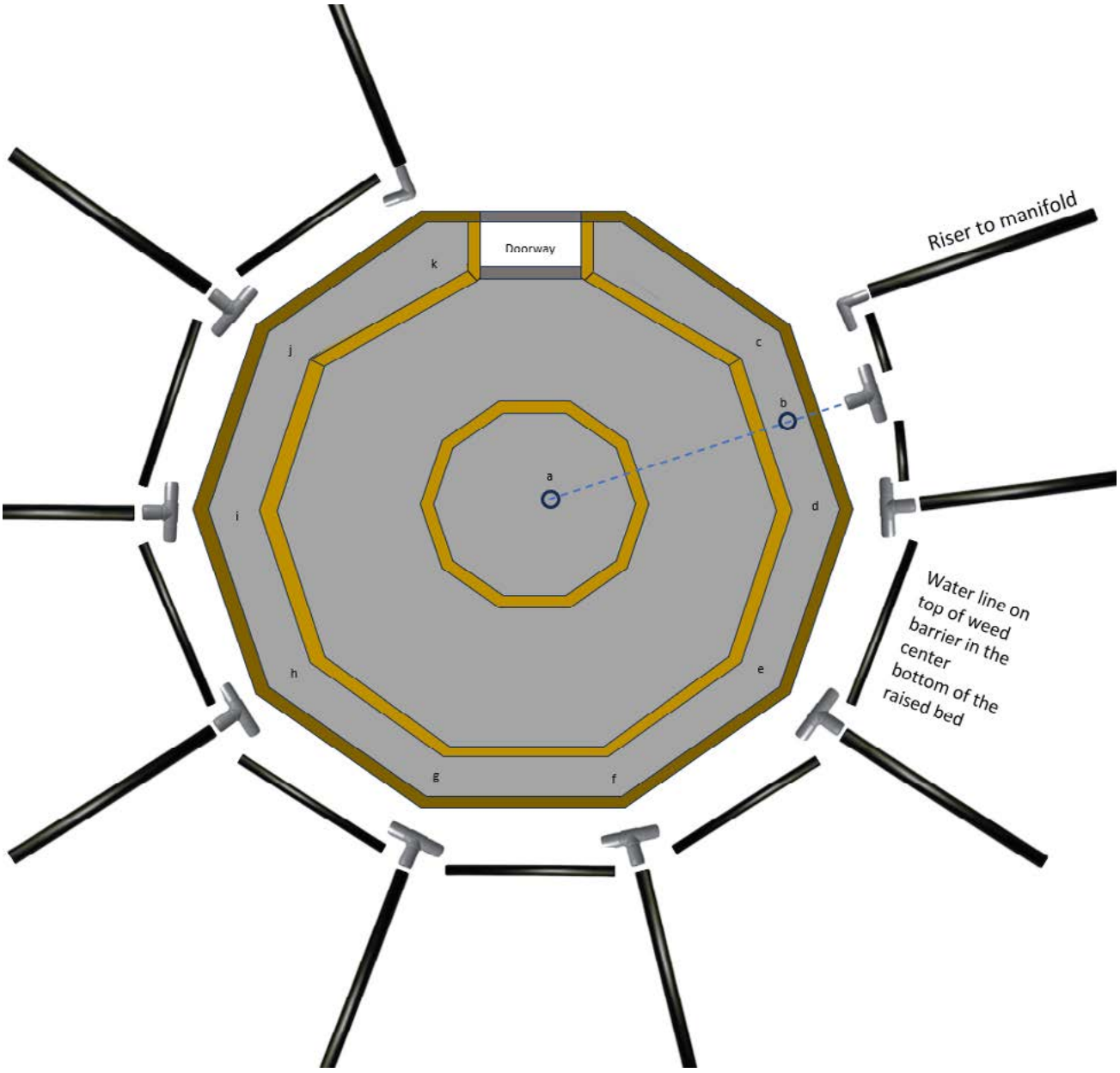
## ADDING RVT TO THE CENTER BED

The process is the same on the center bed for adding RVT. Start at one of the studs and work your way around the inside space as you did in the inside bed.  Drive 1.5-inch screws through the RVT about every 2-ft around the inside perimeter of the top and bottom rails, cut lath to fit the inside length of the top rail and attach the lath to the top rail with 1.5-inch screws.  The image below shows the center bed with lath on the bottom, this is not necessary and if you only purchased 42 fence pickets you will not have enough material to finish the outside raised beds.

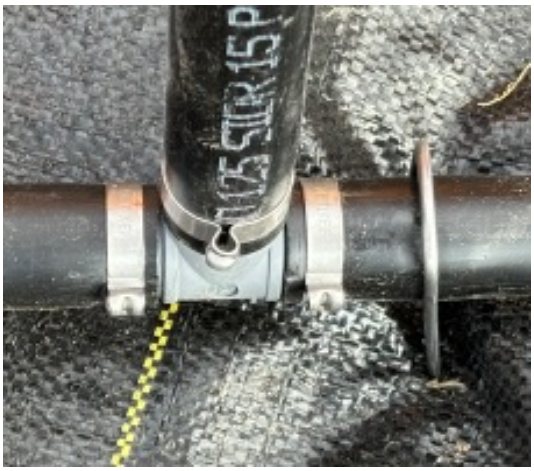
# CHAPTER 8 – INTERIOR RAISED BED IRRIGATION

Ignore the center bed for now – irrigation will be completed once the bed has been filled with soil.

Determine the interior raised bed irrigation starting point by locating the riser (b) from the underground line in this bed. Your starting point may be different, and you may need to adjust the configuration. However, if the starting point (b) falls in the center of one of the raised beds your configuration of the irrigation system will resemble this layout.



1. Layout enough ¾-inch black poly pipe in the bottom of the interior raised bed to make a run between raised bed riser points c-g.
2. Layout all the Tees, 90s, clamps in the location where they will be placed.
3. Cut the black poly pipe (with pipe cutting tool or razor knife) that is resting in the bottom of the raised bed at riser points c-g.
4. Place clamps over the black poly sections and press, push, or tap with a mallet all Tees and 90's into place.
5. Complete the irrigation assembly by tightening the clamps.




6. Tape the riser openings, to prevent soil from getting into the system.

7. Your dome should now resemble the image found on page 173.

At this point the dome frame has been assembled and includes the door, all vents, all internal raised beds. The raised beds have been lined with RVT, and the rudimentary irrigation system is in place.

## ADDING SOIL TO THE RAISED BEDS

Why fill the beds now? It is better to fill the beds now than after the poly skin cover has been added to the dome as it can get very hot inside and make this activity very uncomfortable.

How you do this is entirely up to you. We have found that if you set the center bed up on edge inside the dome you can move soil around using wheelbarrows to the interior beds without much difficulty. You can also add soil to the beds from the outside. Once the internal raised beds are filled, position the center bed and fill it with soil. Keep the riser in position near one of the edges, so that the manifold can be attached.

When adding soil, be certain to hold the vertical risers of the irrigation system in the center of the raised beds and at the beginning of each of the individual beds. Doing so will keep everything aligned for the final addition of the manifolds.

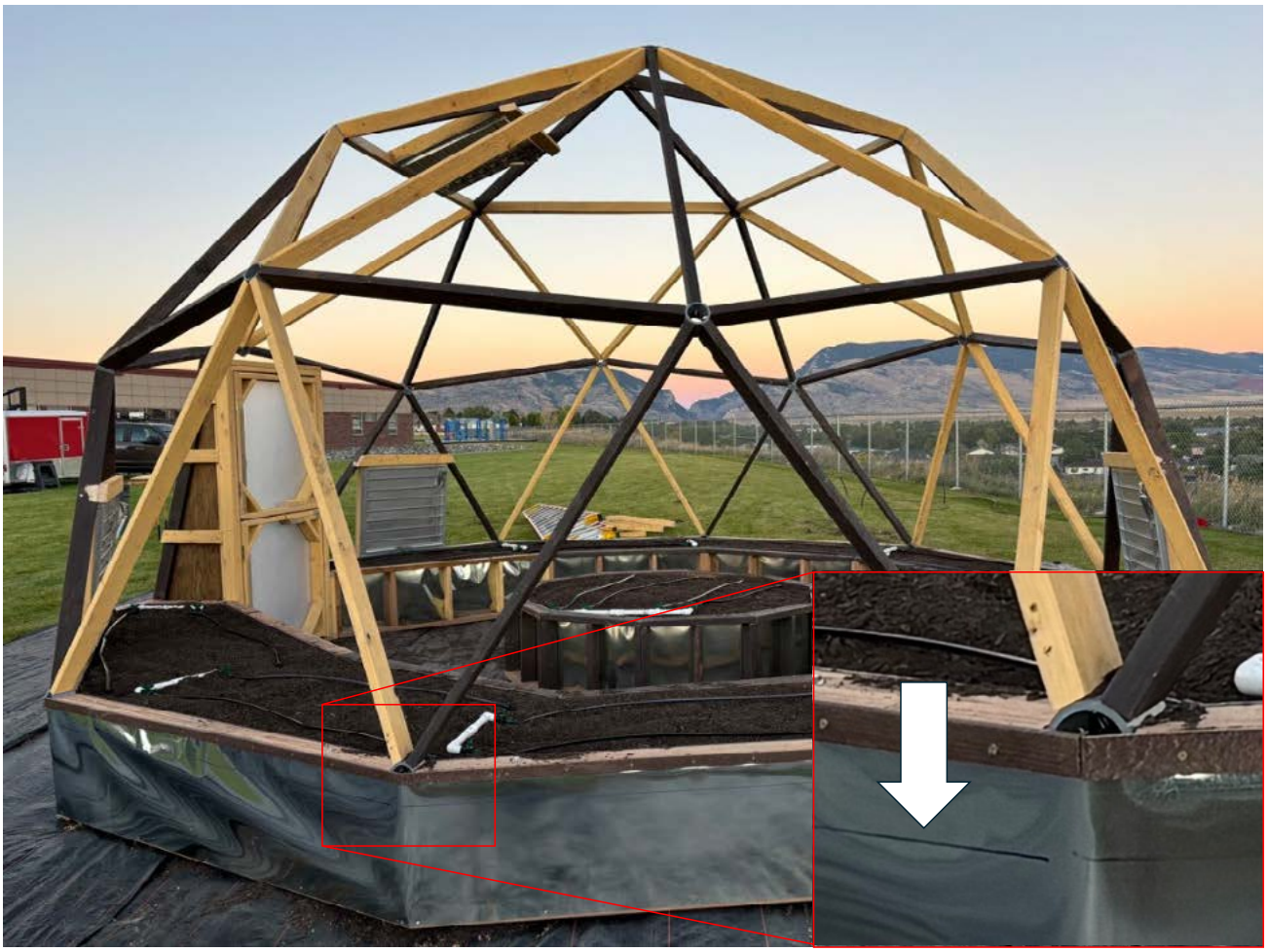
If you can use your local soil that is always best but if you need to purchase soil, be prepared. The approximate number of cubic yards needed can be found in the table on page 26.

## ADD IRRIGATION MANIFOLDS TO THE CENTER AND INTERIOR RAISED BEDS.

1. Place the 4-valve manifold in the center bed and nine of the 2-valve manifolds at the risers of the interior raised beds.
2. Remove the tape from the risers and trim/cut the risers at the raised soil surface.
3. Slip a clamp onto each poly riser pipe.
4. For each of the manifolds, insert the ¾-inch Barb Polypropylene x ¾-inch Male Pipe Thread Adapter Fitting into the riser and tighten the clamp.
5. Cut two drip tape pieces the length of each interior raised beds and install onto the valves of the manifolds and tighten.
6. Install a drip tape line plug into the end of the drip tape, twist to tighten in place.

All interior beds at this point should have been fitted with manifolds and drip tape.

One final task prior to skinning the dome is to use a marker and draw a line around the entire perimeter on the exterior RVT 4-1/2-inches from the top of the dome base wall top rail. A speed square is useful for this task. See inset on image to the right. This line will be a guide as the lowest possible position for attaching the final lath strip holding the poly skin in place.



# CHAPTER 9 – SKINNING THE GEODESIC DOME

## TOOLS

- Chop saw
- Drill
- 1/8-inch drill bit
- Screw gun
- Correct size star bit
- Tape measure
- Pencil
- DeWalt DWHT80276 Carbon Fiber Composite Stapler
- 3/8-inch staples
- Ladders
- Retractable razor
- Required – at least three assistants who are good at holding your ladder and handing you things.

## SKILLS

- Declared the winner of a recent game of Twister®
- No fear of heights
- Ability to walk/balance on the edge of a 2×4

**The goal of skinning the project is to complete the attachment of the skin using the lath strips while keeping the plastic taut in all directions. Focus on one strut and one triangle at a time. The process gets more complex the closer you get to the base.**

## PREPARATION

1. Locate the woven poly cover you ordered for the project.
2. Untie, unfold, and layout the plastic sheet skin material. This skin must go on in one piece. **Cutting and covering individual triangles will not adequately cover a hub style dome.**
3. Locate the bio-composite lath material in the kit. There should be at least 70 pieces 1-1/2-inch × 68-inches.
4. Since the short struts are 68-1/2-inches and the long struts are 78-inches, you will need to cut 3 laths into eight 8-inch long pieces. These pieces will be attached to the long struts so that the entire length of the long struts is covered with lath.
5. Pre-drill all lath pieces using a 1/8 inch drill bit along the length on the flat side at 8-inch intervals (see lath attachment on door as guide). The drill bit that is included in the louver opener is a 1/8 inch drill bit and can be used for this purpose.

6. **Start** 1-1/2-inch screws into each hole drilled into the lath (deep enough to grab but not through the other side), yes, all pieces. Starting the screws reduces the opportunity for slipping off the screw with the screw gun and piercing the polyethylene tarp while playing Twister® on the top of the dome.

# SKINNING TIER 3

**Note:** *Before skinning, check to make certain all screws are removed from the door/door frame and that the door opens freely. Then close and latch the door shut.*

**Tools**

- Screw gun with T20 star bit
- Construction stapler with 3/8-inch T50 staples
- 10-ft aluminum extension ladder (extensions separated)
- Retractable construction razer or pair of scissors
- At least 3 additional people

1. Pull the sheet up and over the dome. Three people minimum are needed, two on the leading corners and one on a 10-ft ladder inside the structure. As the two people outside pull the skin up and over the dome, the person inside is keeping the plastic moving by lifting the leading edge over any catch points (i.e., hubs and strut edges).

2. Center the sheet on the dome. There may be some colored guidelines incorporated into the plastic to assist you.

**Note:** *Make certain that the skin overlaps the top rail of the base wall all the way around the structure.*

3. Set your extension ladder so that the side rails rests on the top of Tier 1. Have someone hold your ladder and the skin material on the structure and climb to the peak hub of the dome. Do not allow the ladder to drag across the dome/skin/strut. This will wrinkle the skin and potentially cause tears or wear points in the plastic cover.

4. Ask for someone on the ground to hand you a pre-drilled lath.
5. Position the polyethylene tarp on one of the five struts so that there are no wrinkles and working from the center hub down, attach the skin to the structure by driving the pre-drilled screws through the lath, the skin, and the narrow edge of the 2×4 strut.

6. After attaching a couple of the first screws have someone on the ground, pull the plastic toward them. Keep the plastic taught and drive the remaining screws.

7. Repeat step 5 for three more of the top struts. Have the people on the ground pull the polyethylene tarp so that it is taught and lays flat against each of the short struts as you attach the individual lath pieces.

8. You will see that the polyethylene tarp will begin to bunch at the 5th short strut of the peak. Work with the ground crew to pull the plastic left or right to get the skin material flat (in one direction) on the final strut.

youtu.be/xczLergtosg

9. Using the stapler, staple the plastic to the strut along the full length of the strut. Staples should be on the edge of the strut that is closest to the direction of pull.

youtu.be/xczLergtosg

10. Once stapled, pull the plastic in the opposite direction creating a fold over the strut and staple the flap of the plastic to the strut.

11. Attach the stapled flap of plastic to the last short strut using the pre-drilled lath.

youtu.be/xczLergtosg

12. Using the retractable razor or scissors, trim the flap of plastic from the peak to about 6 inches from the lower hub connected the strut you just attached the lath. Use the lath as a guide to prevent cutting the skin that is intended to cover the panel of the triangle. Let the cut piece of flap hang for now.

13. Attach lath strips to the five short struts that are the bottoms of the five triangles of the peak tier (Tier 3 = top of Tier 2).

*At this point you should attach and finish the cupola (unless you want to climb back to the top later).*

## CUPOLA ATTACHMENT AND FINISH

You will need the cupola frame (it is helpful to start eight 5-inch screws (2 per 2×4) in the narrow side of small frame of the cupola), four lath strips that have been cut to fit the smaller 2×4 frame and four lath strips cut to fit the larger 2×4 frame. Lath should be pre-drilled and 1-1/2-inch screws started. You will also need a 32-inch × 32-inch piece of window screen and a 48-inch × 48-inch piece of polyethylene tarp material (there should have been extra polyethylene tarp when you skinned the door).

1. Have someone from the ground crew—pass you the cupola (try NOT to rest or drag the cupola on the structure as it may puncture the polyethylene tarp.
2. Position the small 2×4 frame of the cupola down so that it aligns with the vent frame.
3. Drive eight 5-inch screws (2 per 2×4) through the narrow side of the lower cupola frame through the polyethylene tarp and into the 2×4 frame of the vent.
4. Using the retractable razor—cut the plastic cover **inside** the vent frame in an "X" (corner to corner).

5. Pull the polyethylene tarp flaps up through the inside cupola frame opening and wrap around the bottom 2×4 frame of the cupola.
6. Staple the plastic flaps to the top narrow side of the small 2×4 frame of the cupola.

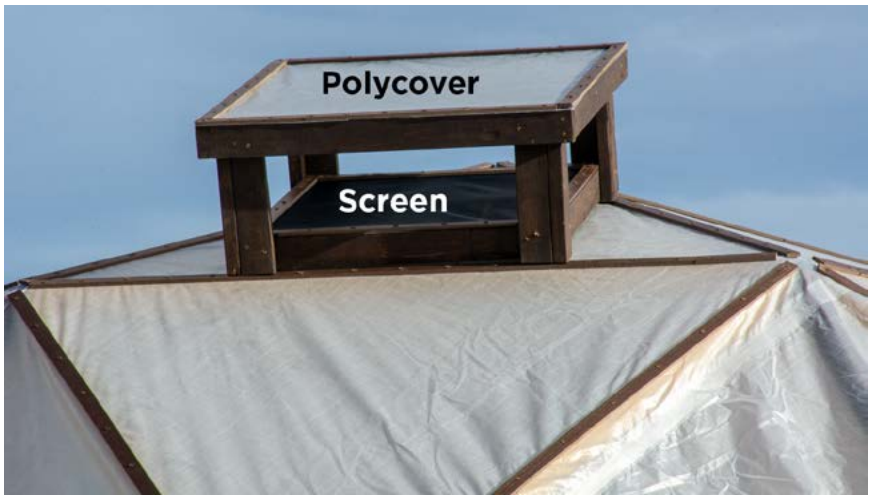

7. Staple the window screen to the top narrow side of the small 2×4 frame of the cupola. Work your way around the frame and pull the screen tight as you staple.
8. Using the lath strips cut to fit the small 2×4 frame, drive the screws through the lath, window screen, skin material into the 2×4 frame.

9. Using the retractable knife trim any excess skin material and screen from the frame of the cupola.


10. Center and staple the piece of skin material reserved from skinning the door to the top narrow side of the large 2×4 frame of the cupola. Work your way around the frame and pull the skin tight as you staple.

11. Using the lath strips, cut to fit the large 2×4 frame, drive the screws through the lath, the skin material and into the 2×4 frame.

12. Using the retractable knife, trim any skin material from the frame of the cupola.




## SKINNING TIER 2

You will notice areas around the dome where the plastic lays (relatively) smoothly on the surface and other areas where the skin begins to bunch. You will need to fold and staple the excess so that the skin lays flat on Tier 2—**this works out best if you can plan to keep the folds on each of the 5 short struts of Tier 2.**

It will be easier to keep the skin tight if you move your body into the triangle adjacent to the triangle you are attaching lath—use the people on the ground to hold the plastic and move/pull it so that it lays flat and tight against the frame (and keep you from falling through the polycover).

1. Select a triangle of Tier 2 where the skin is laying smoothly — usually this will be along two long struts. Continue pulling the skin taught and attaching lath to the struts down the structure, proceed to the top of Tier 1 (= bottom of Tier 2) in a manner like skin attachment at the peak.
2. Use the appropriately sized lath for the size of strut—use the 8-inch pieces of lath to complete the skin attachment on the long struts. Work from the top down.
3. Complete all the triangles where the skin lays flat first—this means you are to skip sections where the plastic starts to bunch at the short struts.
4. In the areas where the skin bunches at the short struts, proceed as you did on the fifth strut of the peak.
5. Pull excess plastic one direction, staple to the strut, pull plastic the opposite direction and staple overlapping plastic to the strut, drive screws through the lath, skin and into the strut over the top of the folded plastic.

6. Trim the fold flap to about 6 inches from the hub at the top of Tier 1 (bottom of Tier 2).

youtu.be/voQodqKWvhk

7. Work your way around the structure and complete attachment to Tier 2.
8. One of the folds in Tier 2 will be a continuation of the fold from strut 5 of Tier 3.
9. Fold and staple then fold back the flap in the same direction as you did in Tier 3.
10. Leave some of the flap while cutting so it can be tucked and anchored under the lath at the top of Tier 1 (bottom of Tier 2).

11. All folded plastic will be removed once you get to the attachment of the triangles in Tier 1.

## SKINNING TIER 1

1. As in Tier 2, there will be areas around the dome where the plastic lays (relatively) smoothly on the surface and other areas where the skin collects in large bunches. These bunches are continuations of the folds created in Tier 2.
2. Select a triangle of Tier 1 where the skin is laying smoothly. Continue pulling the skin taught and attaching lath to the struts down the structure (complete the easy parts first, those that lay naturally and can be attached without stapling).

   *In the areas where the skin bunches on Tier 1, proceed as you did on the fifth strut of the peak and these similar areas of Tier 2. Pull, one way and staple. However, because there is so much plastic at this point, the flap is not folded back onto itself but cut the length of the strut and pulled into place, then stapled, then attached with lath.*

3. Pull excess plastic one direction, staple the plastic along the entire length of the strut.

4. In the triangle where the skin is loose and you are attempting to remove the fold: Use a construction (razor) knife or sharp pair of scissors cut the plastic about 4 inches from the point of the base hub* to a point that is about 6 inches from the peak hub of the triangle in Tier 1 (if you work the plastic back and forth you can see how far away from the peak hub you should cut the skin). You must leave enough space from the peak hub so that the skin can be lapped over the strut without leaving a hole in the plastic at or near the hub. This cut is approximately 1-inch from and parallel to the vertical strut in Tier 1 and on the loose side of the strut in the area where you are removing the excess skin. **NOTE: to completely free this piece of plastic you may need to cut all the way through to the bottom edge of the plastic sheet.*

5. Pull the skin plastic "flap" the toward the strut which you previously stapled the skin to, lay flat, pull taught and staple the overlapping plastic to the strut.

youtu.be/j6BSQbu9XzM

6. Attach the lath over the top of the overlapped plastic.

7. Repeat steps 1–6 until you have completed skin attachment to Tier 1.

## SKINNING – DOOR WALKWAY FRAME

1. Pull the skin tight in the door walkway frame.
2. Attach lath to the left and right vertical door walkway frames. You will need to measure and cut the lath to fit in this space.
3. Cut skin plastic in the door walkway frame using razor knife or scissors from the base of the doorway to the top of the doorway (the connection point of the frame and the bottom of the strut at the top of Tier 1). Or cut to the bottom of the door header if a header was installed.

4. Do not cut the polyethylene tarp left and right of the vertical frame pieces.

5. Staple a piece of polyethylene tarp material into both upper corners of the doorway. This piece of scrap cover needs to be large enough to reach about inches from the corner both down and into the header area. It also needs to be wide enough to be attached to the door header and struts BT2 SS10 and BT2 SS1 in the top of the door frame.

   If no header installed. Staple a scrap piece of polyethylene tarp material into both upper corners of the doorway. This piece of scrap cover needs to be large enough to reach about 8-inches from the corner both down and into the door frame header area. It also needs to be wide enough to be attached to the door header and struts BT2 SS10 and BT2 SS1 in the top of the door frame.

   All of step 5 can be ignored if a header was installed in the door way between struts BT2 SS10 and BT2 SS1.

6. Pull and wrap the plastic cut from the vertical supports of the door frame up and under the hub/header and attach to the top of the door frame and walkway top using lath cut to size (scraps from trimmed ends).

7. Trim excess polyskin material and discard.


8. Trim excess polyskin material from the base of the structure and discard.

## COMPLETING THE LOWER VENT FRAMES

You will need the last 2×4 vent frame (it is helpful to start eight 5-inch screws (2 per 2×4) in the narrow side of small frame), four lath strips that have been cut to fit the 2×4 frame Lath should be pre-drilled and 1-1/2-inch screws started. You will also need a 32-inch × 32-inch piece of window screen.

1. Position the small 2×4 frame so that it aligns with the vent frame.
2. Drive eight 5-inch screws (2 per 2×4) through the narrow side of the frame through the polyethylene tarp and into the 2×4 frame of the vent.
3. Using the retractable razor—cut the plastic inside the vent frame in an "X" (corner to corner).
4. Pull the polyethylene tarp flaps up through the inside of the frame opening and wrap around the 2×4 frame.
5. Staple the plastic flaps to the top narrow side of the small 2×4 frame.
6. Staple the window screen to the top narrow side of the small 2×4 frame. Work your way around the frame and pull the screen tight as you staple.
7. Using the lath strips cut to fit the small 2×4 frame, drive the screws through the lath, window screen, skin material into the 2×4 frame.
8. Using the retractable knife trim any excess skin material and screen from the frame.
9. Install automatic vent openers (the black piston previously placed into the refrigerator) according to the manufacturer's instructions.

youtu.be/ESOlAuRMmFI

# CHAPTER 10 – COMPLETING EXTERIOR RAISED BEDS.

By this point you should be a pro at building walls for the raised beds. But there can be some tricky bits based on left and right handedness around the door. As with the dome wall pieces it is best to cut the longest pieces first and then use smaller pieces of lumber for the smaller sections of the wall. Therefore, cut all the parts and pieces starting with the longest first.

**The exterior bed walls consist of the follow sections**

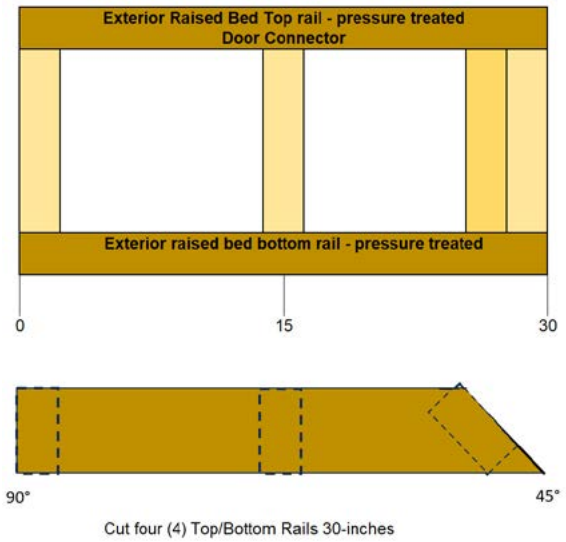
1. There are **nine exterior raised bed wall sections**. These sections are 105-inches wide; they should be assembled from one section that is 21-inches and one section that is 84-inches in length. Again, it is recommended that the 21-inch-wide and 84-inch sections be built using pressure treated top and bottom rails to eliminate the left and right handedness.
2. There are two exterior raised bed wall sections that are considered **the tenth wall**. This is the wall section at the door.
3. The **exterior raised bed door connectors** on both sides of the door, complete the circuit between the exterior dome wall and the tenth wall.

This next section seems out of order, however once everything is cut it works out best to assemble these pieces and attach to the dome completing the exterior raised beds in this order.

## ASSEMBLING THE EXTERIOR DOME WALL TO EXTERIOR RAISED BED DOOR CONNECTORS.

1. Cut the four pieces for the top and bottom rails from pressure treated 2x4s at 30-inches. These four pieces have one 90-degree end and the other end is cut at a 45-degrees.
2. Assemble both wall sections by attaching the studs in the patten below driving two 3-inch screws through both the top and bottom rails into the studs.
3. As with all wall/raised bed assembly. Align the front face (outward facing) of the studs are flush with the outside face of the wall section.

There will probably be some overhang by the 2X4 studs on the back side when aligning the studs on the non-90 degree ends. This is preferred and acceptable. Making these out of pressure treated will eliminate the left and right handedness.

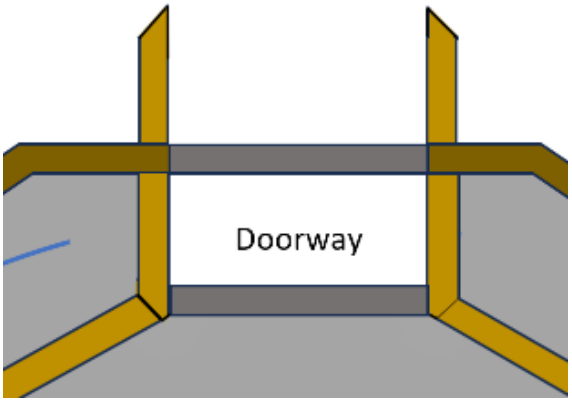


Cut four (4) Top/Bottom Rails 30-inches

These 90-degree side of these exterior raised bed sections can be butted to the studs on the dome base wall door opening and attached using four 3-inch screws. Placement is adjacent to the side of the pressure treated plywood sheeting of the door and level with the top rail of the dome base wall.

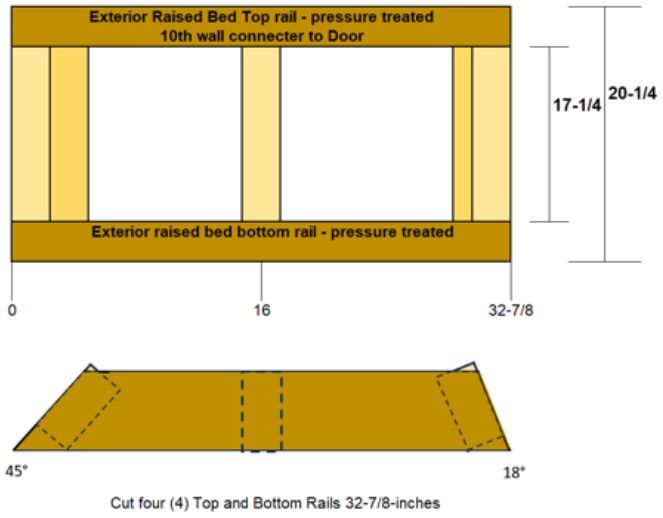
Drive two screws near the top and bottom of the stud and into the double stud of the door base wall section.

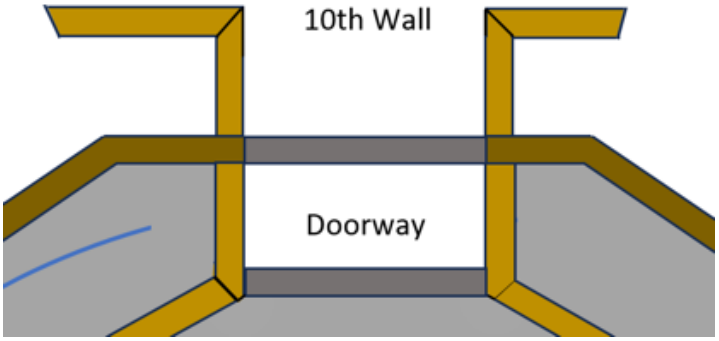
If you attached the skin to the dome correctly, you may need to remove the lath strip holding the RVT and the skin to the door wall section and trim it to allow for the width of the 2x4 of the raised bed door connector.




## THE TENTH WALL

1. Cut the four pieces for the top and bottom rails from pressure treated 2x4s at 32-7/8-inches. These four pieces have one 18-degree end and the other end is cut at a 45-degrees.
2. Assemble both wall sections by attaching the studs in the patten below driving two 3-inch screws through both the top and bottom rails into the studs.
3. As with all wall/raised bed assembly. Align the front face (outward facing) of the studs are flush with the outside face of the wall section.
4. Attach the 10th wall sections by matching the 45-degree angles, align the top rails and the studs and attach the 10th wall to the door connectors using eight 3-inch screws (two each top and bottom and on both sides of the studs.
5. See image to the right for layout.

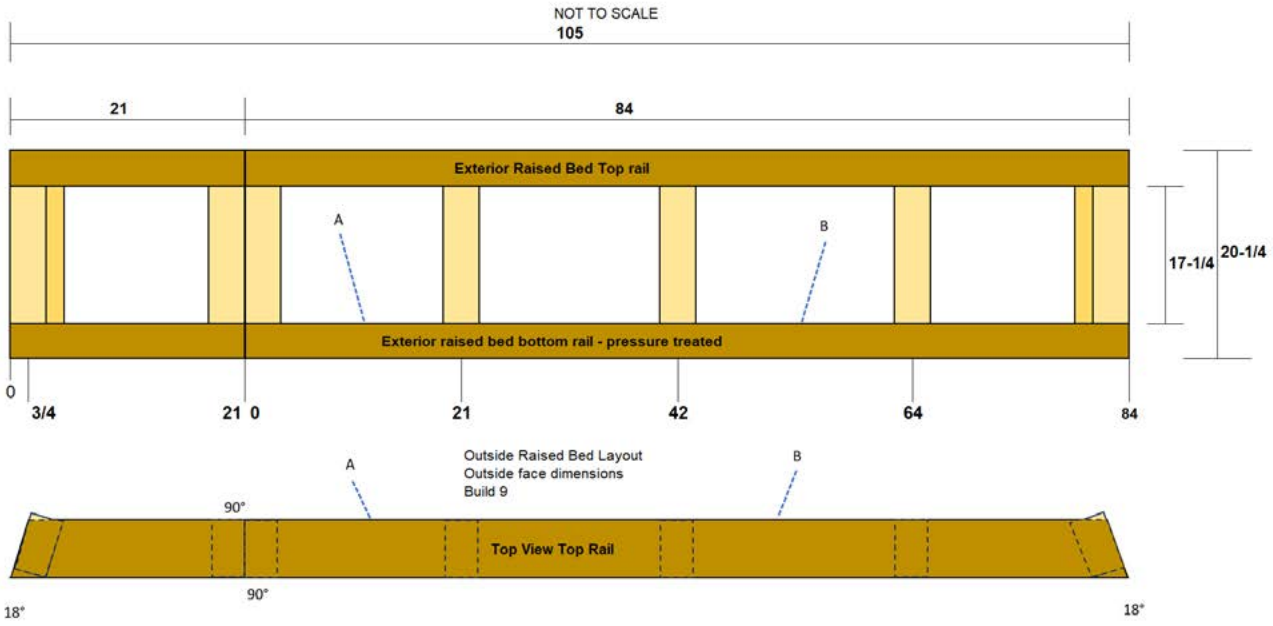


# THE NINE-EXTERIOR RAISED BED WALL SECTIONS

There are nine exterior raised beds wall sections that are all the same. Refer to the cut sheet and cut all the parts and pieces for this section. Assemble as previously described and set around the base of the dome.

One final bit of prep for the exterior raised beds. Drill two 7/16-inch holes (A &B) through the base rail at an angle (for you to determine) and slightly angled into the interior of the base wall. It is possible that the soil in the exterior raised beds may bow out the walls, these holes will be used to drive 3/8-inch rebar into the soil to prevent the wall from bowing out.



# PROCEDURES FOR ASSEMBLING THE EXTERIOR RAISED BED.

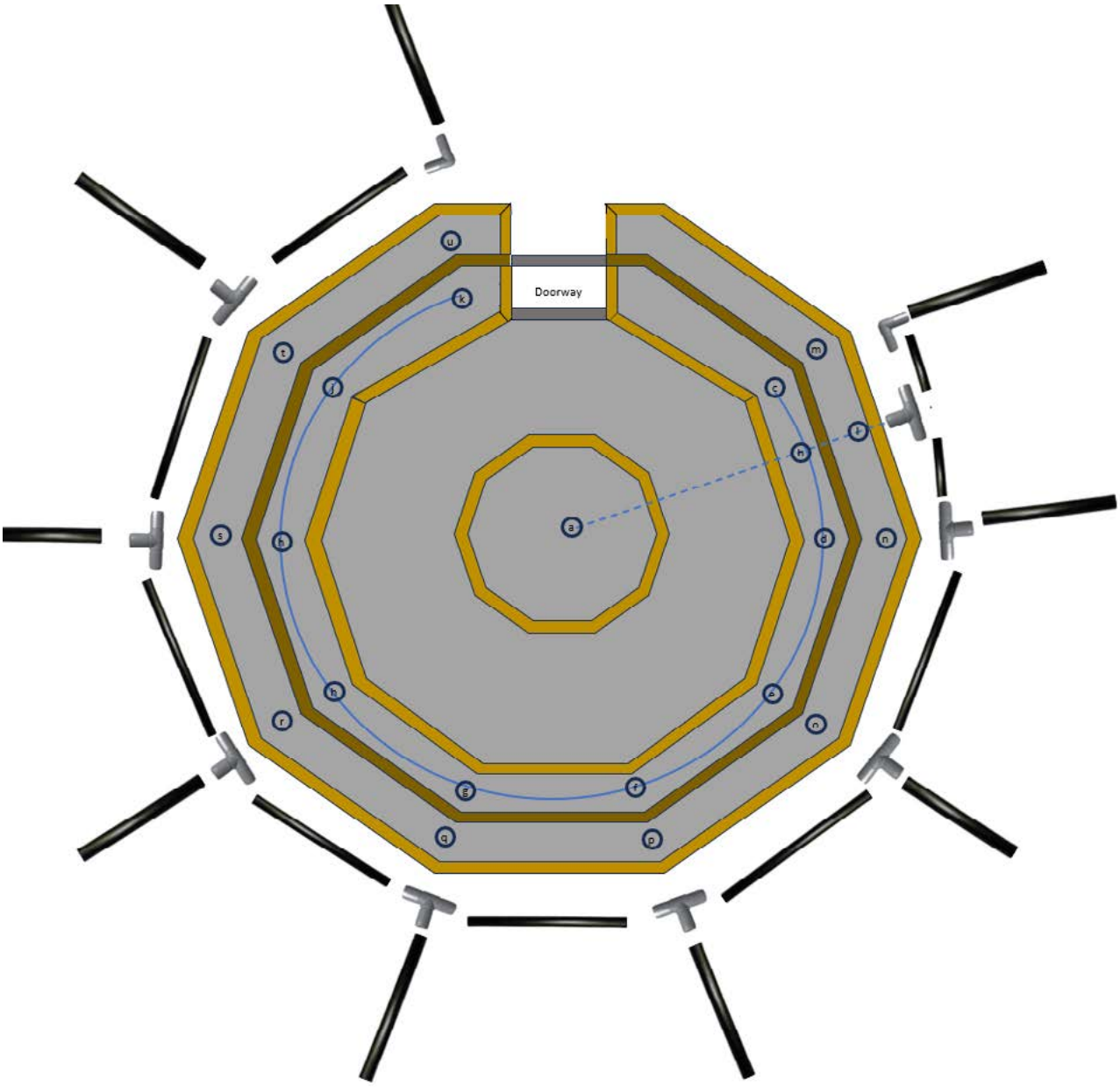
1. Connect the door wall sections to the left and right side of the door of the dome base by driving four 3-inch screws through the stud into the dome base door frame 2x4s. Two screws at the at the top and two screws near the bottom of the stud.
2. Align the 10th wall sections so that the 45-degree angles match and that the top rails of the door sections are flush
3. Connect the left and right hand 10th wall sections to the respective left and right hand door connectors from step 1. Attach by driving 3-inch screws through both sides of the stud on the 45-degree angle.
4. Work your way around the structure, adding sections of the exterior wall to the next until you complete the raised bed. Do not use the raised bed jacks to determine the raised bed width as you did on the inside. It is best to just eyeball the placement evenly around the perimeter.
5. Drive 18, 2-ft sections of 3/8-inch rebar through the holes previously drilled in the base rail of the exterior bed wall into the soil to hold the exterior wall in place..

## EXTERIOR RAISED BED RVT

Line the inside of the exterior raised bed wall with RVT in the same manner as lining the interior raised beds (see previous section).

## EXTERIOR RAISED BED IRRIGATION

The process for completing the exterior raised bed irrigation system is exactly like the interior raised bed configuration (see previous section). Same parts and pieces, slightly different location. The end configuration of risers and parts and pieces will resemble this:



Once the pipe ends have been taped. Fill the Exterior raised beds with soil.

After filling with soil, push the manifold barb into the riser and tighten the clamps, then  attach the drip tape to the manifolds as described in previous sections.

# CHAPTER 11 – FINISHING THE IRRIGATION WATER SOURCE CONNECTION

Go to the trench outside the raised bed, locate the end of the black poly pipe (if you are like me, you have tripped over or fallen into this hole many times over the course of the project). Finalize the irrigation system by adding a timer and a drain valve.


1. Cut the end of the black poly pipe at the outside edge of the exterior raised bed wall.
2. Insert a clamp over the end of the pipe and insert a ¾ barbed Tee.
3. Cut a section of pipe long enough to reach the top rail and the Tee you just installed. Place this over the Tee and clamp (this riser is the inlet for the water system).
4. Locate the ¾-inch X ¾-inch threaded valve.
5. Thread the ¾-inch polypropylene male pipe thread adapter X ¾-inch barb Insert into one end of the valve and tighten.
6. Cut an 8-inch section of black poly pipe and slip onto the barbed end of the barbed end of the adapter from step 5, place a clamp on this connection and tighten the clamp.
7. Place a clamp on this 8-inch section of poly pipe.
8. Insert the open end of the 8-inch section of black poly pipe over the Tee and tighten the clamp.
9. Place an irrigation box over this valve for protection and a reminder where it is located.

This valve is used to drain the entire watering system at the end of the season.

# IRRIGATION SYSTEM AUTOMATION

Depending on your water source, utilizing a controller for your irrigation system can be a great time saver and production management tool.

1. Locate the ¾-inch Female Hose Thread X ¾-inch Female Pipe Thread Adapter.
2. Place a clamp over the riser.
3. Wrap the thread of a ¾-inch Male Pipe Thread Adapter Fitting X ¾-inch Barb Insert Polypropylene with Teflon pipe tape.
4. Thread the pipe fitting end onto the male threads of the ¾-inch Female Hose Thread X ¾-inch Female Pipe Thread Adapter (usually the Hex head end).
5. Insert the barb end into the poly pipe riser and tighten the clamp.
6. Attach your timer to the hose end and program.
7. Attach your water source, turn on water and test the system.

# SOME FINAL COMMENTS


It has been suggested to incorporate your water source into the dome by installing a frost-free hydrant in the inside raised beds. A frost-free hydrant inside the structure adds convenience to your watering schedule and allows you to use a hand wand to supplement your watering (to help germinate certain seeds) and is great for extending your opportunity to water.

This image does not show it, but if you attach a "Y" fitting on the hydrant prior to the timer, you will have free access to water for a hand wand.

**Be warned:** The risk in placing the hydrant inside the dome. If you ever need to replace the hydrant that is inside a raised bed inside the dome, you will be cussing me. Personally, the convenience of having water available is worth the risk.

I hope you enjoyed this project. Please contact me if you have any questions.

**Now grow!**

# APPENDIX A: DOME COVERS

| Source | Item/ Description | Website | Notes |
|---|---|---|---|
| Dripworks | Dome cover — 12mil greenhouse material clear | https://www.dripworks.com/ | Does not show in their e-catalog. You must call them or see page 40 of their print catalog. Will cut to size. |
| A.M. Leonard | Dome cover — Palring | https://www.amleo.com/Search.aspx?ss=palring | Will NOT cut to size |
| J-M Industries | Dome cover — Sollux | https://www.jm-ind.com/products/custom-fabrication/solarig/ | $100 minimum order. Will cut to size if ordered through the regional sales rep Brad Uthe. |

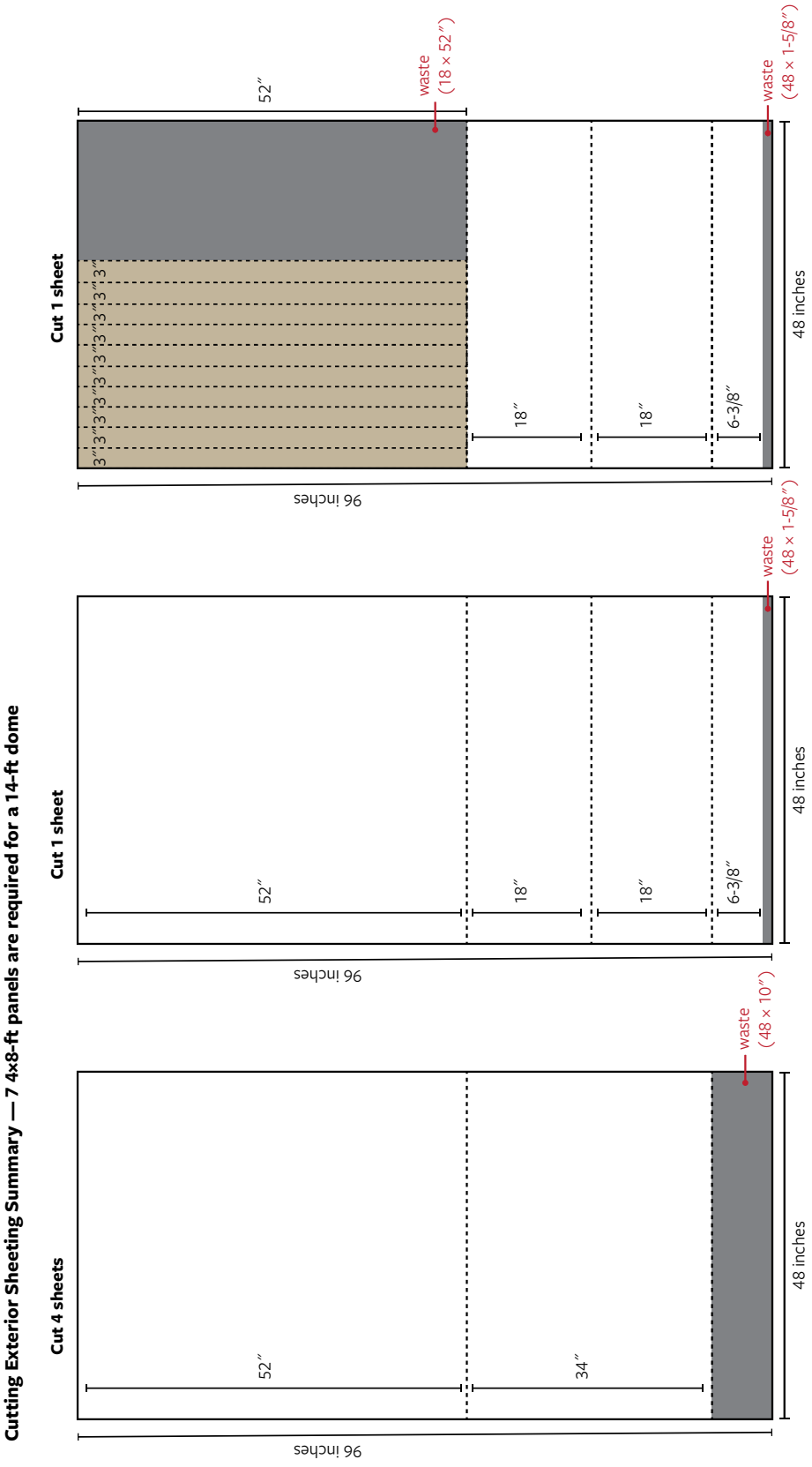
# APPENDIX B: 14-FT DOME SPECIFICATIONS

## CUT LIST

| Items that must be cut prior to assembly | Length (inches) | Count | Material Details | Cut Angle (degrees) |
|---|---|---|---|---|
| **Hubs** | | | | |
| Hubs | 3-1/2 | 26* | 3″ Sch80 water pipe<br>*Drill 10 with 4 holes<br>*Drill 10 with 6 holes<br>*Drill 6 with 5 holes | 0 |
| **Struts** | | | | |
| Strut A | 42-1/2 | 32 | Doug fir | 16 |
| Strut B | 48-1/2 | 33 | Doug fir | 18 |
| **Base Wall Parts** | | | | |
| Base bottom rail | 52 | 10 | Pressure treated | 18 |
| Base top rail | 52 | 10 | Doug fir | 18 |
| ″Spacer″ - attached to base top rail - allows space for hub to fit | 46-1/2 | 10 | Doug fir | 18 |
| Base vertical supports (″studs″) | 42 | 42 | Waste doug fir or treated | 0 |
| Side panel (exterior cover sheet)** | 52 | 6 | 52″ × 48″ panel | 0 |
| Side panel (exterior cover sheet)** | 34 | 4 | 34″ × 48″ panel | 0 |
| Side panel (exterior cover sheet)** | 18 | 4 | 18″ × 48″ panel | 0 |
| Side panel door panel** | 18-3/4 | 2 | 18-3/4″ × 48 panel | 0 |
| Base lath for skin attachment** | 52 | 10 | 52″ × 3″ strip (from one exterior cover panel above) | 0 |
| **Lath** | | | | |
| Lath for Strut A | 42-1/2 | 32 | 3/8″ × 1.5″ Biocomposite lath | 0 |
| Lath for Strut B | 48-1/2 | 23 | 3/8″ × 1.5″ Biocomposite lath | 0 |
| **Door Parts** (list continues on following page) | | | | |
| Door header A | 45-1/4 | 1 | Doug fir | 0 |
| Door header B | 42-1/4 | 1 | Doug fir | 0 |
| Footer | 45-1/4 | 1 | Pressure treated | 0 |
| Inside door frame | 78 | 2 | Doug fir | 0 |
| Outside door frame | 79-1/2 | 2 | Doug fir | 0 |
| Vertical door supports top section | 29-1/16 | 2 | Doug fir | 0 |
| Vertical door supports bottom section | 44-7/16 | 2 | Doug fir | 0 |
| Horizontal door supports | 36-3/4 | 4 | Doug fir | 0 |
| Door brace | CTF | 8 | Doug fir CTF = Cut to fit | 45 |

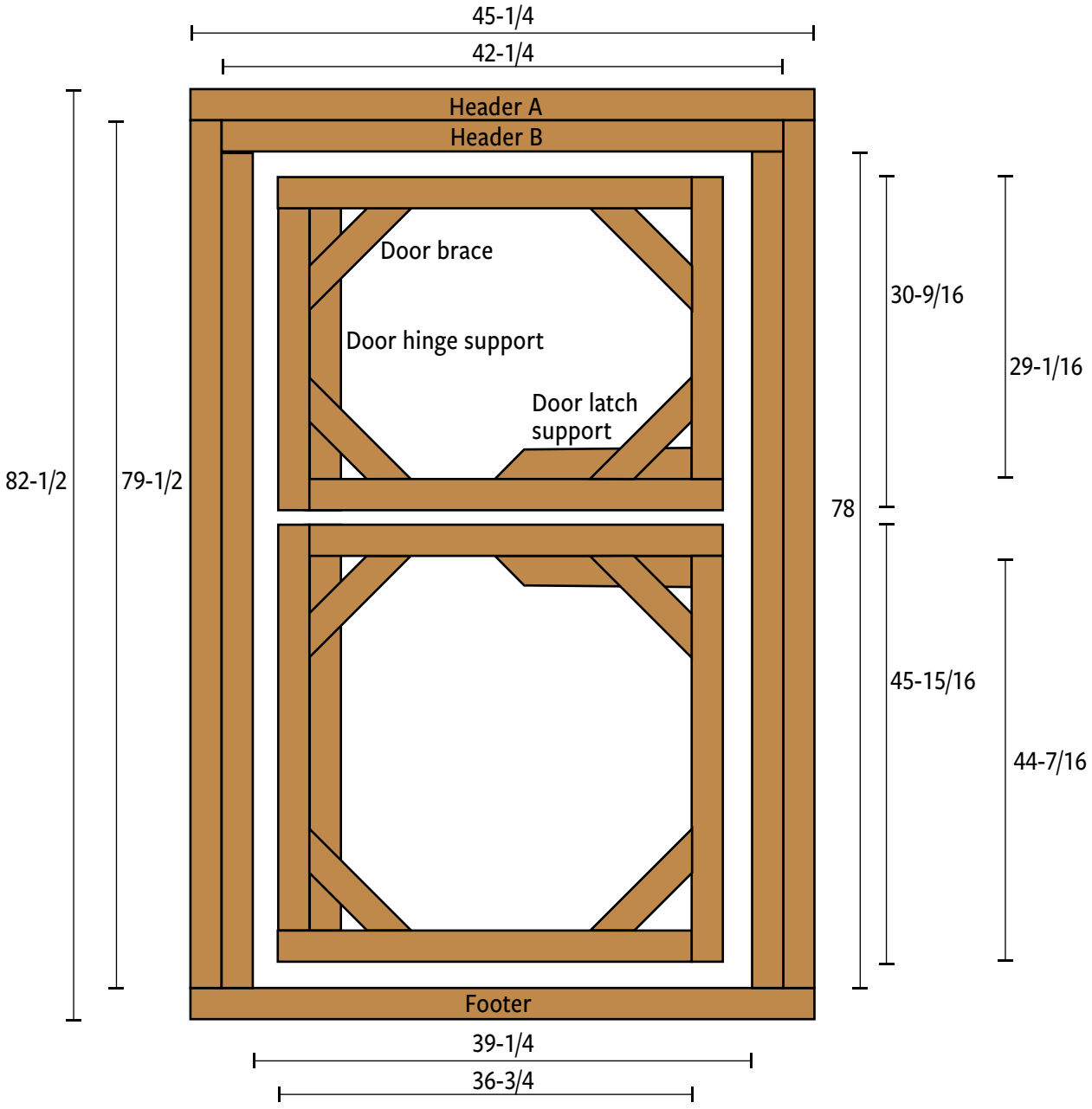
| Items that must be cut prior to assembly | Length (inches) | Count | Material Details | Cut Angle (degrees) |
|---|---|---|---|---|
| **Door Parts** (list continues from previous page) | | | | |
| Door hinge & latch supports | CTF | 6 | Doug fir CTF = Cut to fit | 0-45 |
| Door frame attachment rails | 82-1/2 | 2 | 1-1/2 × 1-3/4 (ripped 2×4) | 0 |
| Door frame attachment rail | 39-1/4 | 1 | 1-1/2 × 1-3/4 (ripped 2×4) | 0 |
| Door jamb | 78 | 1 | 1-1/2 1-3/4 (ripped 2×4) | 0 |
| **Vent Parts** | | | | |
| Vent frame | 19-5/16 | 16 | Doug fir | 0 |
| Outside vent frame | 25-9/16 | 4 | Doug fir | 0 |
| Vent studs | 16 | 8 | Doug Fir | 0 |
| ** Seven (7)- 4-ft × 8-ft panels are required for a 14 ft dome. See cutting instructions page 213. | | | | |

# EXTERIOR SHEETING CUT SCHEMATIC




**Cutting Exterior Sheeting Summary — 7 4x8-ft panels are required for a 14-ft dome**

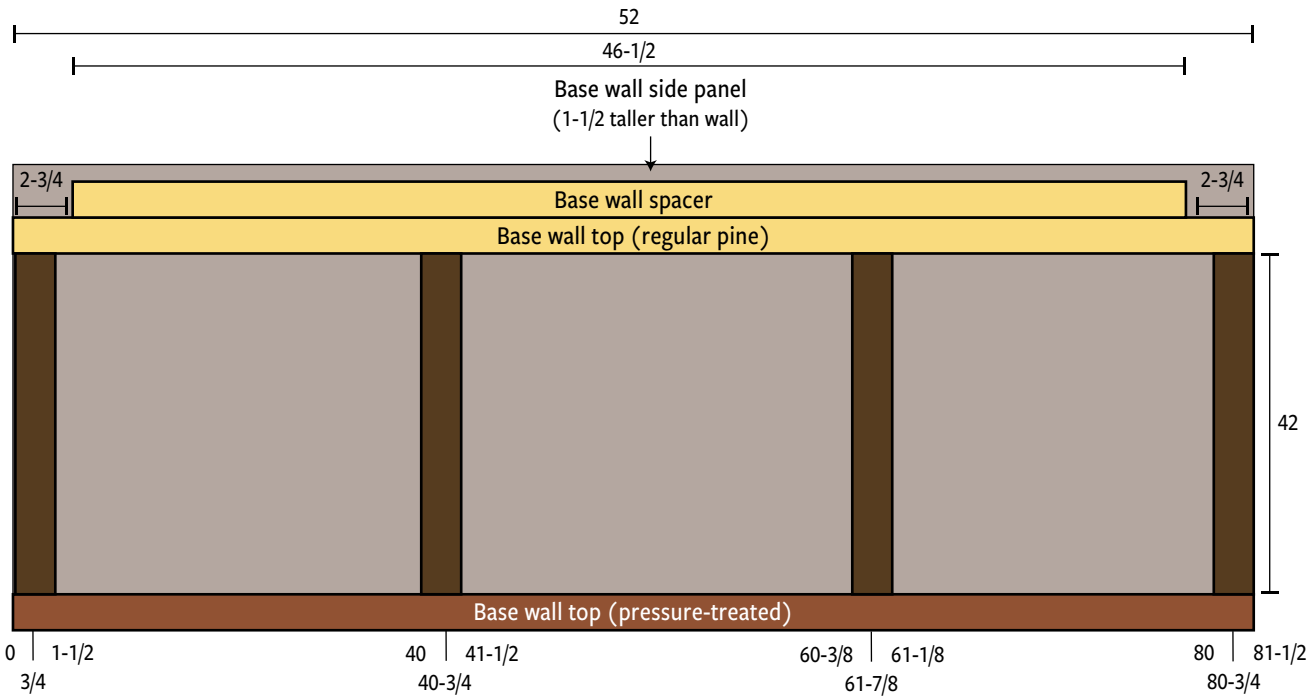
# DOOR SCHEMATIC



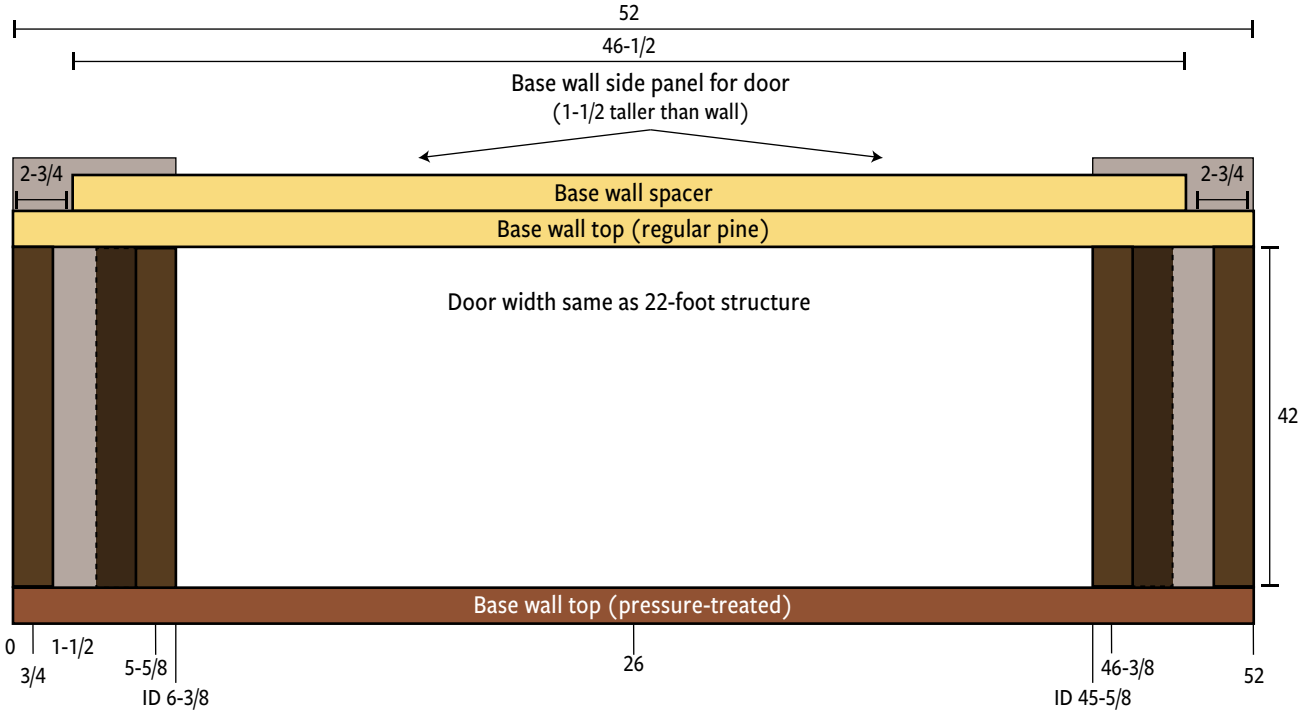

See cut sheet page 14 for length and piece count. Note: Diagram not to scale.

# BASE WALL SCHEMATIC

## Base Walls (build 9)




## Base Wall for Door (build 1)




Note: Not to scale.

# APPENDIX C: LEGAL STUFF

## DOME DATA SPEC SHEET FOR MUNICIPALITIES ADDRESSING WIND AND SNOW LOAD.

Information supplied by:
CTL|Thompson, Inc.
400 North Link Lane
Fort Collins, CO 80524
Office: 970-206-9455
Direct: 970-416-6221
Mobile: 970-691-1874

Visit this link for the Complete engineering package for wind and snow load of these structures.

https://www.wyoextension.org/agpubs/pubs/B-1387Engineering.pdf


B-1387: A User's Guide to Building a Complete 22-ft. Diameter 2v Geodesic Dome: A Construction Manual for Anyone

August 2025