

Sundial Cupola Assembly Instructions

by John L. Carmichael



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Sundial Sculptures: www.sundialsculptures.com

This is the Assembly Instructions for the **Free Sundial Cupola Plans** in the **Sundial Cupolas and Towers** website at : http://www.advanceassociates.com/Sundials/Stained_Glass/CupolaSundial/index.html.

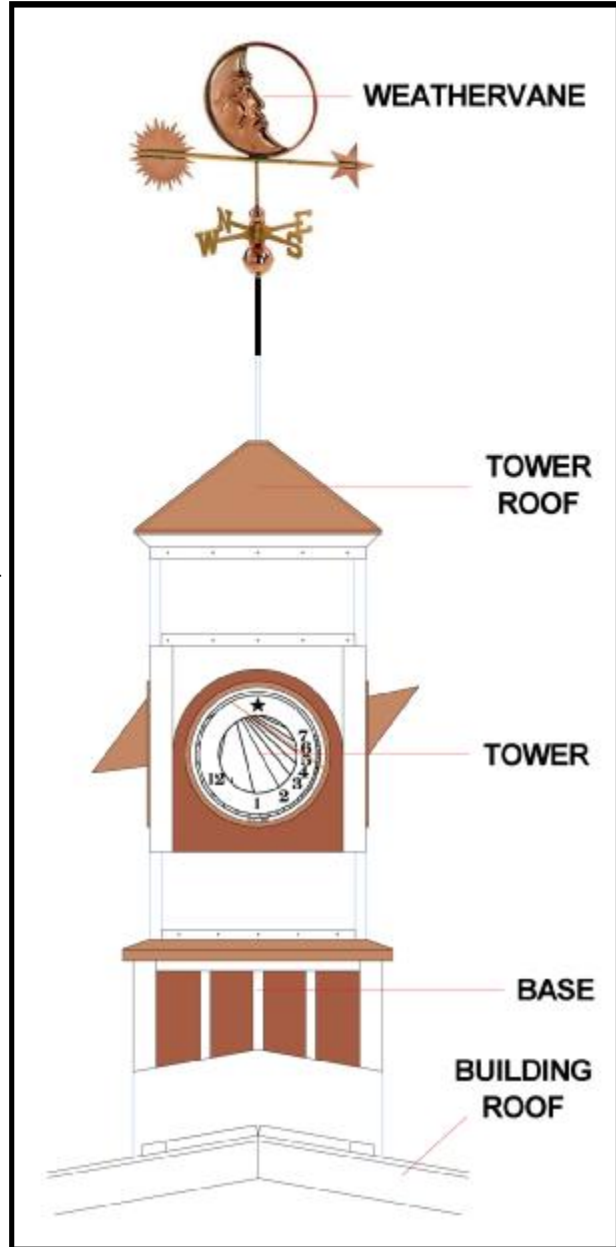
I am a professional sundial designer and maker, but I'm not a professional architect nor a carpenter, so you may find a few errors in the design plans. Feel free to modify the plans and these assembly instructions as needed. My cupola was installed on Oct 9, 2005 with one sundial. The other three will be added soon.

The cupola has three main parts that you should assemble individually: the **Base**, the **Tower**, and the **Tower Roof**. When finished, move these three parts separately to the roof to be joined together. Use high quality hardwood such as cedar or redwood and good exterior grade plywood. And use countersunk stainless steel exterior wood screws (I like the bugle head type) and ridged exterior finishing nails. Glue all wood together with carpenters glue before screwing and nailing. After gluing and screwing, seal all wood corners and gaps with paintable silicone caulk. Let dry at least one week before painting and copper cladding. Paint all assembled parts inside and out with two coats primer and three coats of good exterior paint before applying the copper cladding and before roof installation. (I used oil based white satin enamel). I purchased all the wood materials except copper at my local hardware stores. The copper cladding came from MSC Industrial supply Co. Phototech made the stainless steel, porcelain covered sundial faces using my custom sundial designs.

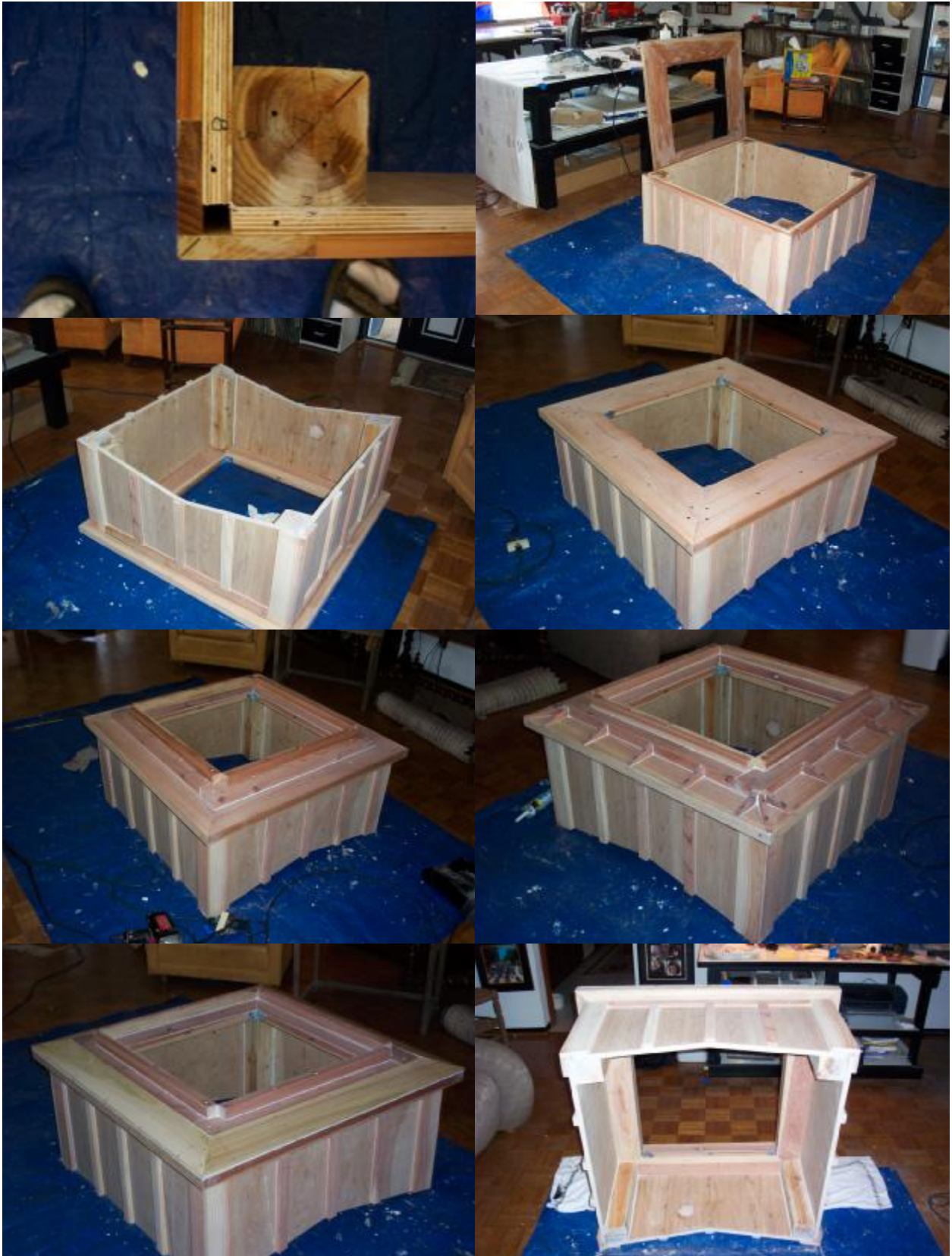
Tools Needed: cut-off saw with mitering capacity, a table saw, a jigsaw, a hand drill, palm sander, wood plane, screwdrivers, hammer, Dremel Moto tool with cutoff wheel, paintbrushes. (I let the hardware store cut the big plywood sheets for me).

STEP 1: BASE ASSEMBLY

1. Glue and screw plywood siding (D & E) to the four corner posts (A) with 3" screws. You must modify piece D to match the slope of your building's roof.
2. Glue and nail corner trim (F & G) with finishing nails or screws.
3. Glue and nail decorative batten (H, I, J, K) with finishing nails or screws.
4. Glue and screw Base Sill Eave (L) to top of Base with 3" screws.
5. Glue and screw Base Sill Roof (M) to Base Sill Eave (L).
6. Glue and screw Base Sill/Tower Couple (N) to Base Sill Roof with 2 1/2" screws
7. Glue and nail Rafters (O & P) with finishing nails
8. Glue and nail Base Sill Roof Cover (Q) with 1" finishing nails
9. Caulk all corners and holes then let dry at least one week before painting (see Step 4)



Base Assembly Photographs



STEP 2: TOWER ASSEMBLY

1. Glue and screw plywood Tower Siding (R) to Corner Posts (S) with 2 1/2" screws.
2. Glue and nail Semicircle Trim (Wa and Wb) to siding with finishing nails.
3. Nail Tower Trim (T & U) with finishing nails.
4. Glue and screw Tower/Tower Roof Couple (V) to the top of tower with 2 1/2" screws.
5. Caulk corners and holes and let dry at least one week before painting.

Note: Do not attach the sundials until after the cupola has been completely assembled on the building.

Tower Assembly Photographs



Tower temporarily fitted to base

STEP 3: TOWER ROOF ASSEMBLY

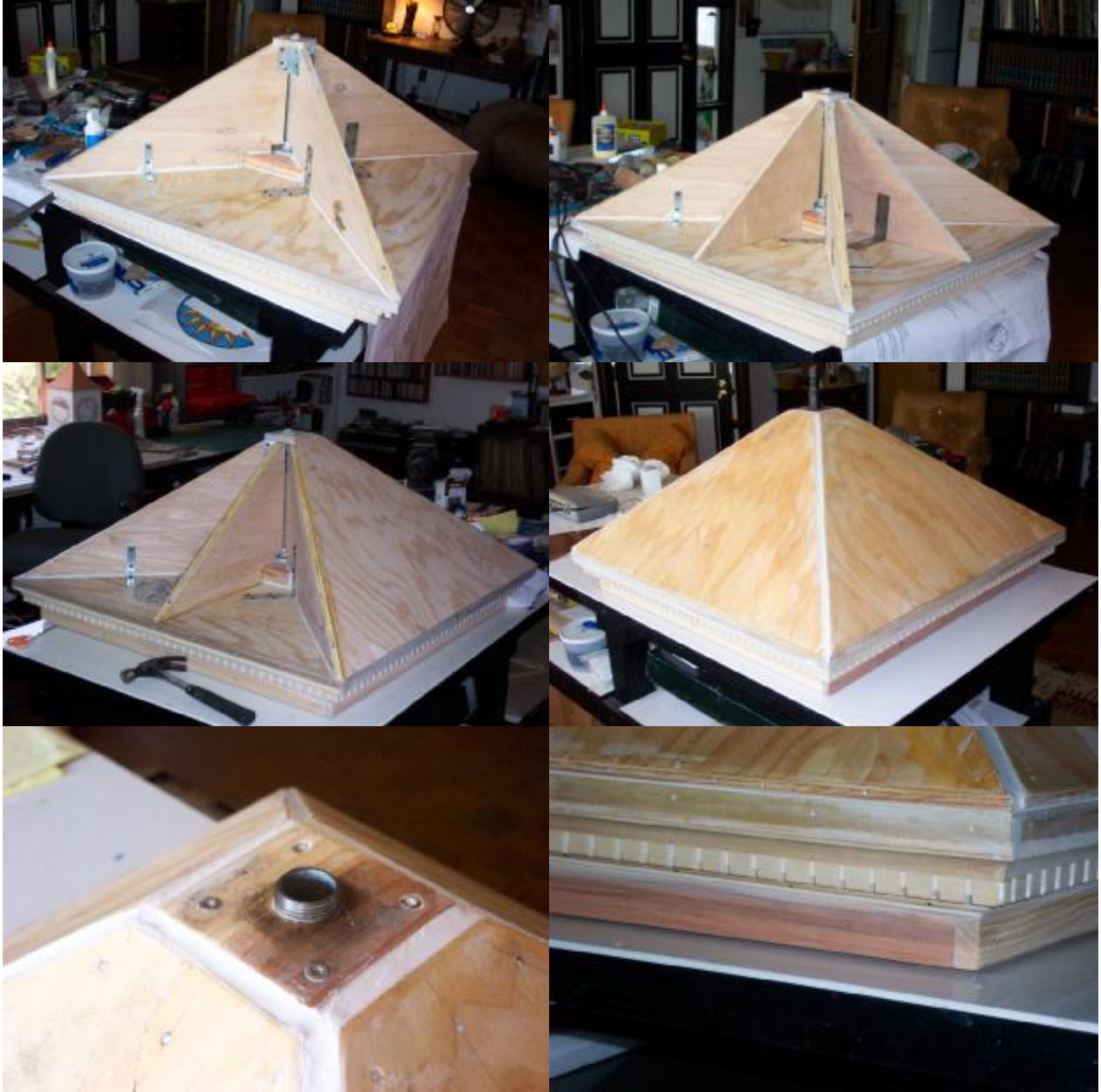
1. Glue and screw Tower Roof Eave (X) to the bottom of the Plywood Roof Base (Z).
2. Glue and nail Crown Molding (Y) to the bottom of the Tower Roof Eave (x) and the Plywood Roof Base (Z).
3. Glue and Screw wood Floor Flange Base (Z') to the top of Plywood Roof Base (Z).
4. Screw 3/4" zinc-plated steel pipe (for the weathervane rod) into the steel floor flange, then screw this assembly on top of the wood Floor Flange Base (Z'). Waterproof the bottom of the pipe with caulk so that rainwater does not leak from the bottom of the pipe.
5. Glue and screw the four Corner Roof Rafters (Z'') to the top of the Plywood Roof Base (Z). Screw metal 90 degree angle straps between the base and the rafters and between the rafters.
6. Glue and screw the four Side Roof Rafters (Z''') to the Plywood Roof Base (Z).
7. Glue and screw the four Roof Panels (Z'''' to the eight Roof Rafters (Z'' and Z''').
8. Slide the Roof Cap down over the steel 3/4" pipe and glue and screw it to the rafters at the top.
9. Caulk and seal Roof Panels.
10. Plane bottom edge of Roof Panels where they touch the Plywood Roof Base so that the edge is straight up and down. (This will allow the copper cladding to bend neatly around the edge.)
11. Caulk all corners and holes and let dry for at least one week before painting.

Tower Roof Assembly Photographs



More Tower Roof photos on next page

Tower Roof Assembly Photographs (cont.)



STEP 4: PAINTING

I think it's best to paint all three parts (Base, Tower and Tower Roof) at the same time. It's easier and will assure that each of the parts is painted in the same way. After letting all three unpainted parts dry and cure for two weeks, I painted them with two coats of primer then three coats of a good exterior oil-based gloss enamel. (I used Ace brand "Rust Stop" for both the white trim ("Ultra White Tint Base") and the brick colored accent color (color matched to the brick of the house). Let each coat of enamel dry for at least 24 hours between coats. Lightly sand between coats. Since this cupola has two colors, I painted the white light color first, then I taped and painted the darker accent color.

Painting Photographs



Painting Photographs (cont.)

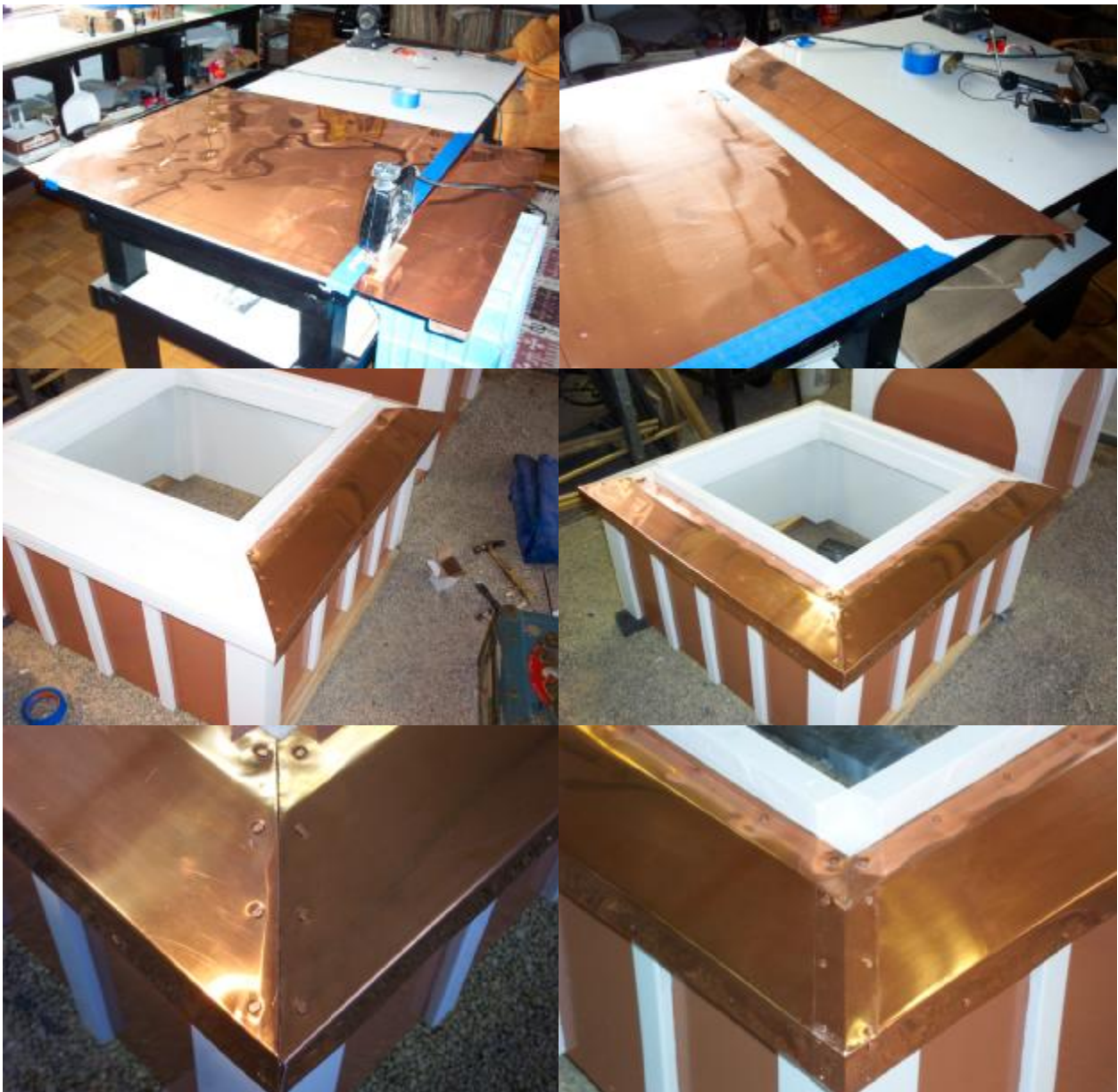


STEP 5: COPPER CLADDING

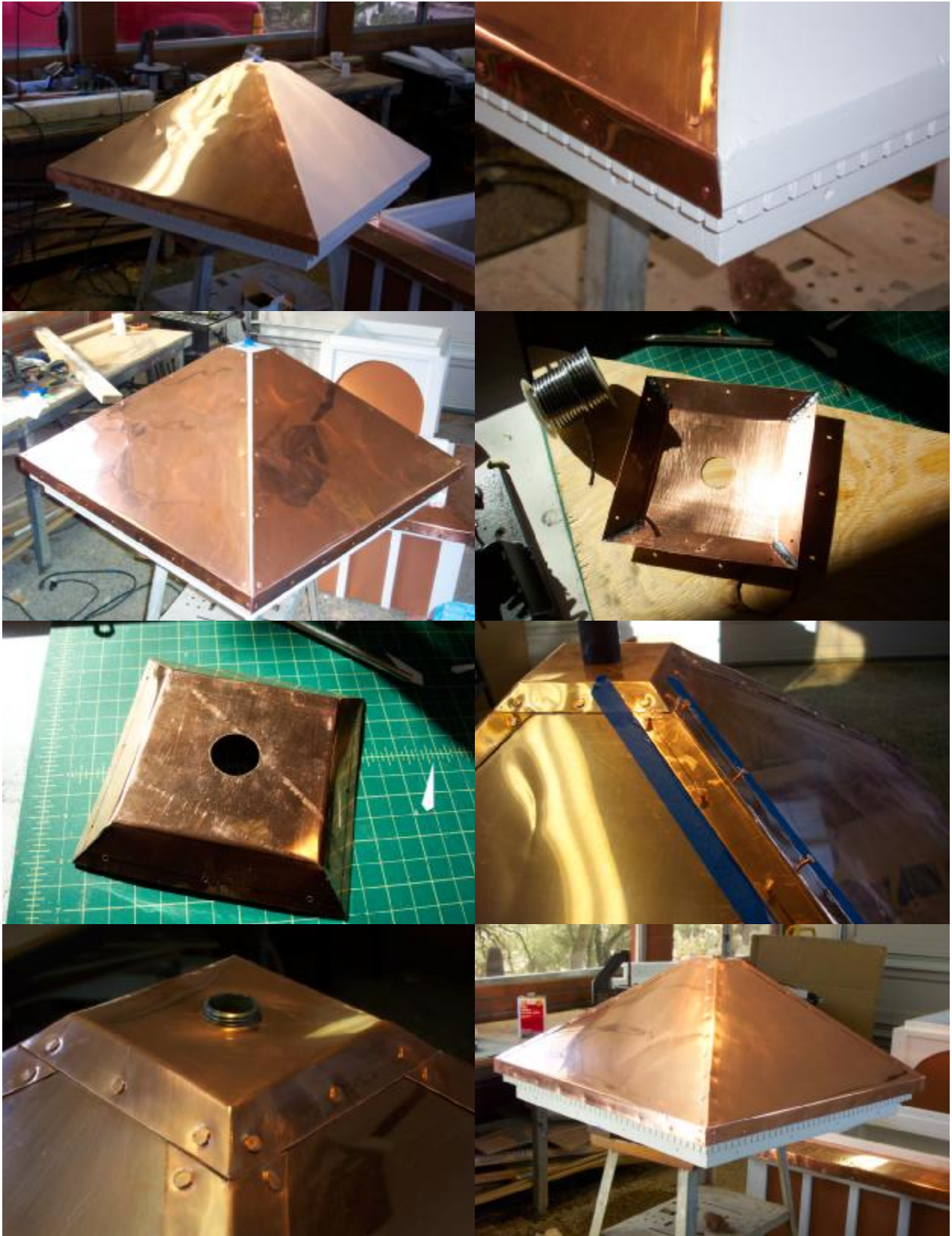
1. Let the paint enamel dry at least one week, then you can cut out, drill, bend and the copper cladding to the Base Sill and Tower Roofs. Use a jigsaw with a metal blade for long cuts and use metal shears for trimming.
2. Use painter's tape to keep silicone off of places where it's not wanted. Use 5/8" flat head copper tacks in predrilled holes with clear silicone underneath all edges.
3. Cover seams and corners with 2" wide bent copper strips.
4. Thoroughly clean off all excess silicone with paint thinner before it dries!

NOTE: Go to the **Sundial Cupolas and Towers** website and download the drawings of the **Copper Cladding Templates**: http://www.advanceassociates.com/Sundials/Stained_Glass/CupolaSundial/SUNDIAL_CUPOLA_COPPER_CLADDING_TEMPLATES.pdf

Copper Cladding Photographs



Copper Cladding Photographs (cont.)



STEP 6: CUPOLA INSTALLATION ON BUILDING

1. Carefully lift the Cupola Base to the top of the roof of the building and sit it on the ridge of the roof in the location you want. Double check to make sure it faces in the correct direction and shim it if necessary to make sure it is vertical.
2. Screw the House/Base couples (C and D) to the roof inside of the Cupola Base. Apply silicone caulk to the holes and bottom of the pieces before screwing them in with 4" long 1/4" stainless steel lag bolts.
3. Screw the Cupola Base to the House/Base couples (C and D). Do not glue if you want the cupola to be removable. Seal union with silicone caulk.
4. Lift the Cupola Tower up and screw it to the Cupola Base. Do not glue if you want the cupola to be removable. Seal union with silicone caulk.
5. Lift the Tower Roof up and screw it to the Cupola Tower. Do not glue if you want the cupola to be removable. Seal union with silicone caulk.
6. Insert the Weathervane Rod into the Tower Roof's metal pipe and tighten the set screws on the pipe to prevent the rod from spinning around in the wind.
7. Finally, caulk all around the Cupola Base where it touches the building's roof. Also caulk the connections between the Base and the Tower and the Tower and the Roof. And Caulk over and paint visible screws.
8. Install the sundials.
9. Touch up paint job if needed, polish all the copper, and let patina develop naturally over time.

Cupola Installation on Building Photographs



Pieces ready for installation



Cupola Installation on Building Photographs (cont.)



Cupola Installation on Building Photographs (cont.)



STEP 7: SUNDIAL ASSEMBLY & INSTALLATION

1. Employ the services of a professional sundial designer or a surveyor to measure the declination (orientation) of the building's roof, then employ a professional sundial designer to design the sundials. (If you contact me (John Carmichael) by email at jlccarmichael@comcast.net I can arrange to have the sundial faces designed and/or made for you. This includes the frames. But I will not make your cupola since I'm not really a professional carpenter.)
2. Employ a professional metal worker to cut the stainless steel plate for the sundial faces. Don't forget to cut the two slits in the face plate for the gnomon attachment flaps. If your sundials have a perpendicular post gnomon instead of a triangular sheet gnomon, then the steel plates will just have one round hole for the gnomon post.
3. Add the sundial face design to the steel plate. If the face is coated with porcelain, employ a professional porcelain painter.
4. Using J&B Weld epoxy, glue four metal gnomon attachment brackets to the bottom of the steel plate. The holes in these brackets will be used to bolt the gnomon flaps to the steel plate.
5. Make the copper frame for the sundial face using heavy gage copper. You can cut both the frame face and the gnomon from a single sheet of 24"x24" copper. Make the frame edge from a 6ft. Long, 1" wide copper strip that's been bent into a circular shape. I bent mine by wrapping it around a round plastic bucket. Cut the edge to the size of the frame top circumference and hold in place on workbench with horseshoe nails. With J&B Weld epoxy attach frame edge. Let dry, then drill four holes in the edge for the cupola attachment brackets.
6. Make 4 cupola attachment brackets for the frame with 1" wide by 1.75" long brass or copper strips bent in half at a 90 degree angle with two holes for screw and bolt. Use J&B Weld to glue nuts to the bolt holes. Attach the four brackets to the frame then a paper template showing the location of the bracket holes.
7. Using Silicone caulk, glue the steel sundial face plate into the back of the copper frame.
8. Insert the gnomon flaps into the slits in the steel plate and bolt them to the angled brackets on the bottom.
9. After the Base, the Tower, the Tower Roof, and the Weathervane have been installed on the roof of the building, attach the four frame attachment brackets to the cupola with wood screws using the paper template as a guide for drilling the holes in the tower. Place the sundial frame over the cupola attachment brackets and bolt the sundial frame to them.

Sundial Assembly Photographs



Sundial Assembly Photographs (cont.)



Sundial Assembly Photographs (cont.)



Sundial Installation Photographs



Safety Tips

Roof Strength: You should consult a person familiar with building construction if there is any doubt that your roof is not strong enough to support the cupola. I'm guessing that this cupola weighs about 300 lbs. The building under my cupola is a typical truss and rafter residential structure with 2x8 trusses and rafters spaced at 24". I have been told by a structural engineer that the building's roof is strong enough as is without any additional reinforcement needed in the attic. I've also been told that air conditioners weigh more than my cupola and are routinely placed on similar roofs without reinforcements.



Lightning: When I asked one of the companies that manufactures cupolas if I needed to attach a ground wire to the weathervane for lightning protection, they told me that in eleven years of business that they had never heard of a cupola being struck by lightning. So I'm going to risk it, and not install one. (I hope these aren't my famous last words!) And I'll just keep my fingers crossed that we don't get struck. But if you are in doubt, have a professional electrician install the appropriate ground wire and/or lightning rods.