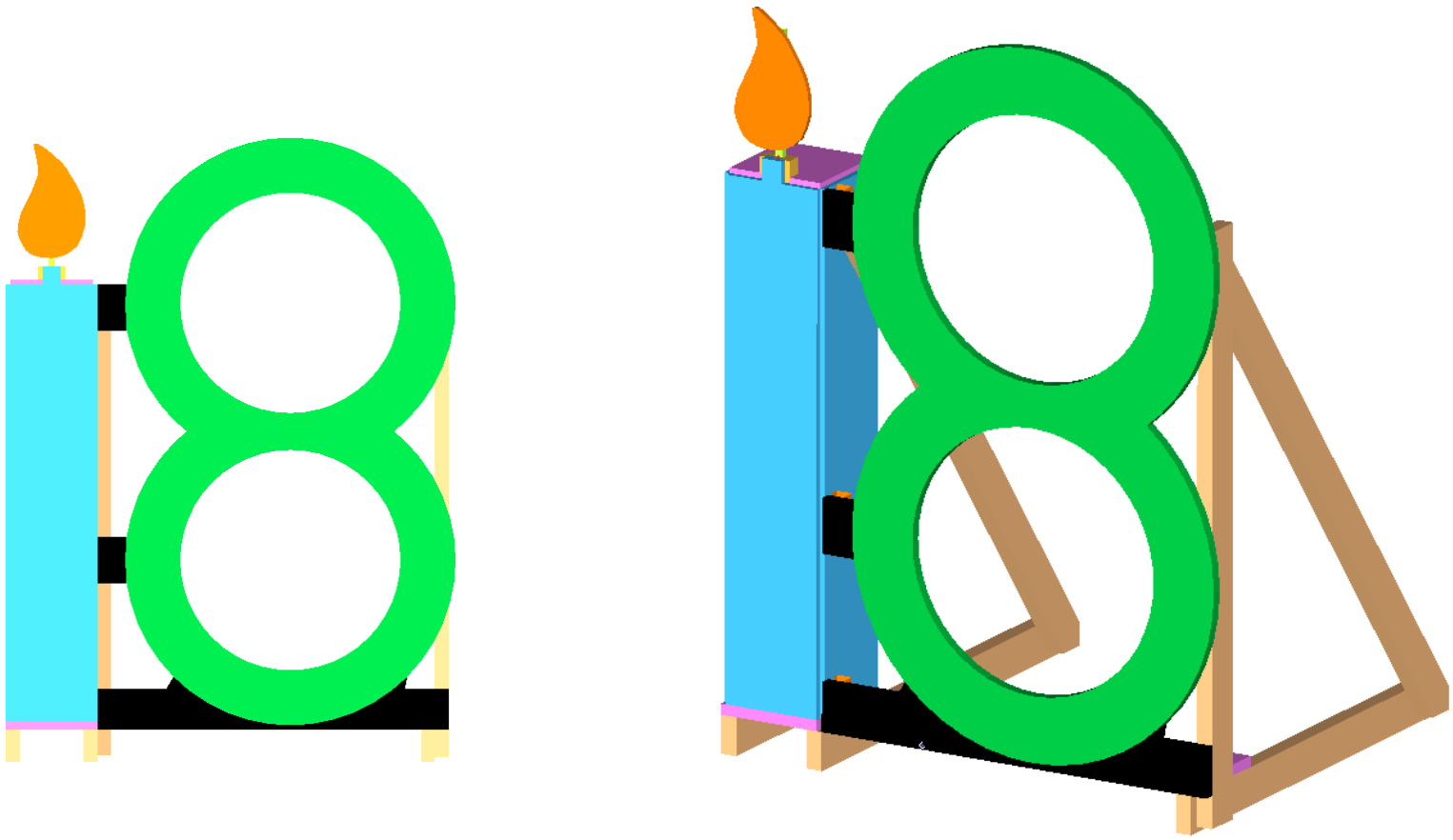
Plans for the 2015 Invention Challenge Target

Paul MacNeal

August 9, 2015



Target

Target Parts List

Component	Material	Overall Dimensions	Quantity	Detail on Page
Long Base Joist	2 x 4 Douglas Fir (DF) Stud	40.9” long	2	8
Short Base Joist	2 x 4 DF Stud	10” long	1	8
Base Plate	1” plywood	46.75” x 10”	1	9
Base Sills	2 x 2 DF Stud	35”; 7”; 7”; 5”; 5” long	5	10
Candle Column Panels	¾” plywood	46.75” x 10”	2	11
Candle Column Panels	¾” plywood	46.75” x 8.5”	2	11
Candle Column corner posts	2 x 2 DF Stud	45” long	4	11
Top of Column plate	¾” Plywood	10” x 10”	1	12
Candlewick Supports	1 x 3 Pine board	2.5” long	2	12
Candle Column Connection Studs	2 x 2 DF Stud	2”; 5”; 5” long	3	11
Candlewick	1 x 3 Pine board	2” x 13.3”	1	13
Flame Plate	¾” Plywood	8” x 13”	1	13
Vertical Support	2 x 4 DF Stud	53.5”	1	14
Column and Right Diagonal	2 x 4 DF Stud	Approx. 64” with angled cuts	2	14
Number 18 Plate	1” Plywood	36” x 54”	1	15
T-nut	¼”-20 T-nut		1	11
Screws	#8 deck screws	2.0” long, 2.5” long, 3.5” long	142; 30; 5	various
¼”-20 machine bolts with washers and nuts	¼”-20 bolt	2” long (1); 4” long (5)	6 sets	various

Bill of Materials

Item	Size	Quantity	Notes
2 x 4 Douglas Fir (DF) Stud	8 feet long	4	Straight and free of large knots
2 x 2 DF Stud	8 feet long	3	Straight and free of large knots
¾” Plywood (AC Grade)	4’ x 4’	1	Half of a full sheet
1” Plywood (AC Grade)	4’ x 8’	1	
1” x 3” Pine board	2’ long	1	Larger width works as well
#8 Deck Screws	2” long	142+	Cheaper by the box
#8 Deck Screws	2.5” long	30+	Maybe cheaper by the box
#9 Deck Screws	3.5” long	3	By some extras
¼” hex bolt	2” long	1	
¼” hex bolt	4.0” long	4	
¼” washers		17	8 used for centering the flame on the pivot bolt
¼” hex nut		5	
¼” T-Nut		1	
Latch set (male and female)	Small	1	Manufacturer is Richelieu Item number BP 6032G found at OSH .
#6 machine screw and nut	1.5” long	2 bolts and 2 nuts	To attach female latch to support
Paint		As needed if desired	
Heavy weights	50 pounds each	3	To secure to ground

Assembly Instructions

A. Cut all pieces per each detailed sheet (all dimensions are in inches)

B. Attach 2 x 2 studs on top of base plate
   1. Carefully mark where each sill should go (refer to Slide 16).
   2. Install 2.5” long deck screws from below up into the 2 x 2 studs.

C. Attach lower beams to base plate with screws every 6 inches
   1. Line up base plate assembly to the three base joists (refer to Slide 17).
   2. Install 2.5” long deck screws from above down into the 2 x 4 joists.

D. Assemble candle column together using four plates and 2 x 2 studs in the four corners using multiple screws.
   1. Install ¼” T-nut by drilling hole per manufacturer’s instructions in the Right Panel where shown (refer to Slide 11) and hammering the T-nut in from the far side (inside).
   2. Attach corner posts to Front Panel and Back Panel using 2.0” deck screws as shown in Slide 18.
   3. Attach three short 2 x 2 connection posts to the right panel using 2.0” deck screws as shown on Slide 18.
   4. Attach left panel to front and back panels using 2.0” deck screws with approximately the same spacing as done before when attaching the corner posts. Make sure the tops of the panels are co-aligned.
   5. Attach the right panel to the front and back panels using 2.0” deck screws. Make sure the connection posts are in the correct location. Make sure the tops of the panels are co-aligned.

E. Assemble top of column and candlewick supports
   1. Attach candlewick supports to top plate from the underneath using 2.0” deck screws approximately where shown in Slide 19.
   2. Drill the ¼” hole through both supports where shown in Slide 19.

Assembly Instructions

F. Attach top plate to column
   1. Attach top plate to column using 2.0” deck screws in the four corners as shown in Slide 20.
   2. Attach front panel to candlewick supports using two 2.0” deck screws.
   3. Line drill the ¼” hole for the candlewick through the candlewick supports per Slide 20.

G. Assemble the flame assembly
   1. Attach the male latch piece to the candlewick using manufacturer’s screws where shown on Slide 21.
   2. Align the flame and attach to the candlewick with four screws as shown.
   3. Putty over the screw heads (if desired)

H. Attach latch (female piece) to candlewick support
   1. Use multiple ¼” washers to make sure the candlewick is centered between the candlewick supports when mounted on the ¼” bolt.
   2. Create a spacer with two holes to achieve good alignment between the female latch piece with the male latch piece (refer to Slide 22).
   3. Attach the female latch piece to the candlewick supports using #6 machine screws and nuts. It is best to mark the holes using the actual latch with the male and female parts together and the candle in the upright position.
   4. Make sure the flame assembly falls down with a light “hit” on the flame, but not too light. Adjust latches if needed.

I. Attach candle column to base plate using the 2.0” deck screws going into the 2 x 2 sills (refer to Slide 23).

Assembly Instructions

J. Attach upright support on right side of base opposite from the candle column
   1. Align the front face of the bottom of the upright support with the base sill (refer to Slide 24).
   2. Line drill a ¼” hole through both 2 x 4 studs.
   3. Attach the boards using a 4.0" long ¼” bolt, washers, and nut.

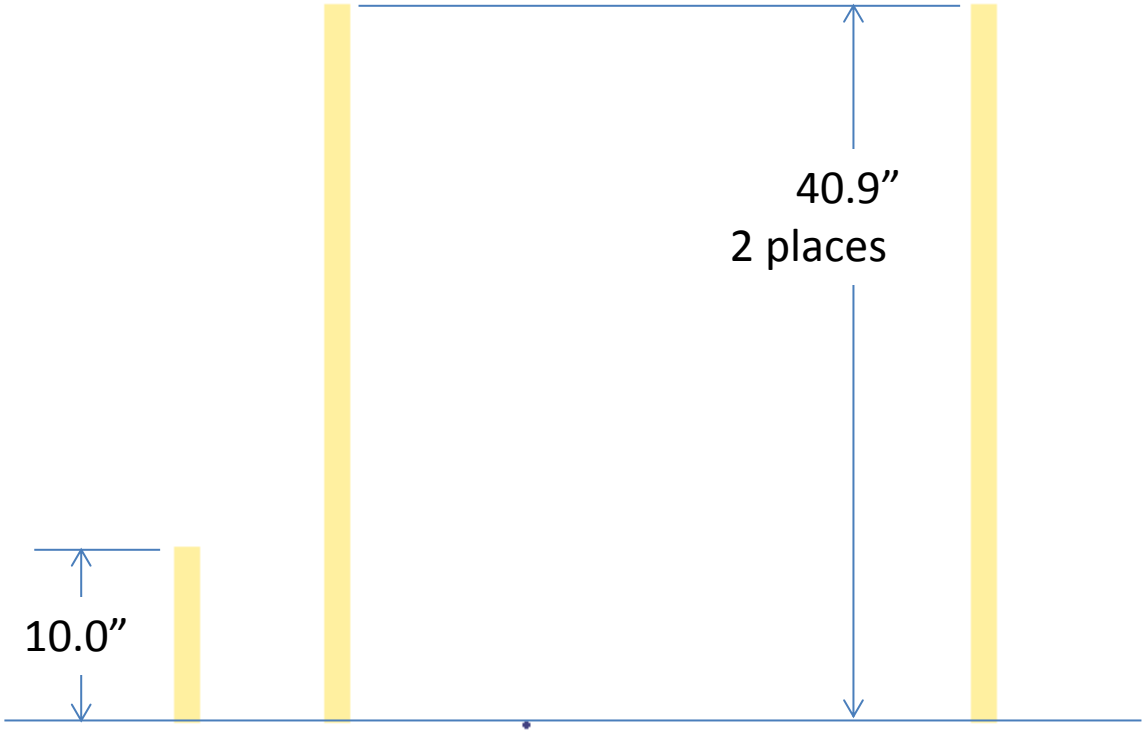
K. Attach right diagonal to the upright support
   1. Ensure upright support is vertical using a level or other device.
   2. Using two people, hold the right side diagonal in position to verify that the surfaces of the upright support and the diagonal are flush at the top and that there is room at the base to attach to the diagonal to the base joist (refer to Slide 25).
   3. If alignment looks good, clamp the bottom of the diagonal to the base joist.
   4. Drive 2 or 3 3.5” long deck screws through the diagonal into the upright support.
   5. Line drill a ¼” hole through both the right diagonal and the base joist.
   6. Attach the boards using a 4.0" long ¼” bolt, washers, and nut.

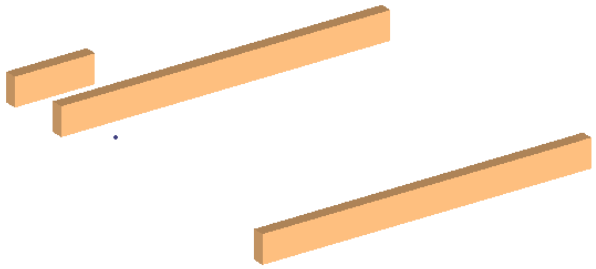
L. Attach diagonal to the candle column
   1. Locate the diagonal and find the proper location for the hole to match to the existing T-nut (refer to Slide 26).
   2. Drill the ¼” hole into the column diagonal.
   3. Attach the column diagonal to the column using a 2” long ¼” bolt and washer.
   4. Ensure that the column is vertical.
   5. When the column is vertical, line drill a ¼” hole through both the column diagonal and the base joist.
   6. Attach the boards using a 4.0" long ¼” bolt, washers, and nut.

M. Attach Number “18” plate to the remainder of the target using approximately 22 2.0” deck screws (refer to Slide 27)

Call Paul MacNeal at (626)788-7433 if there are any questions or concerns.

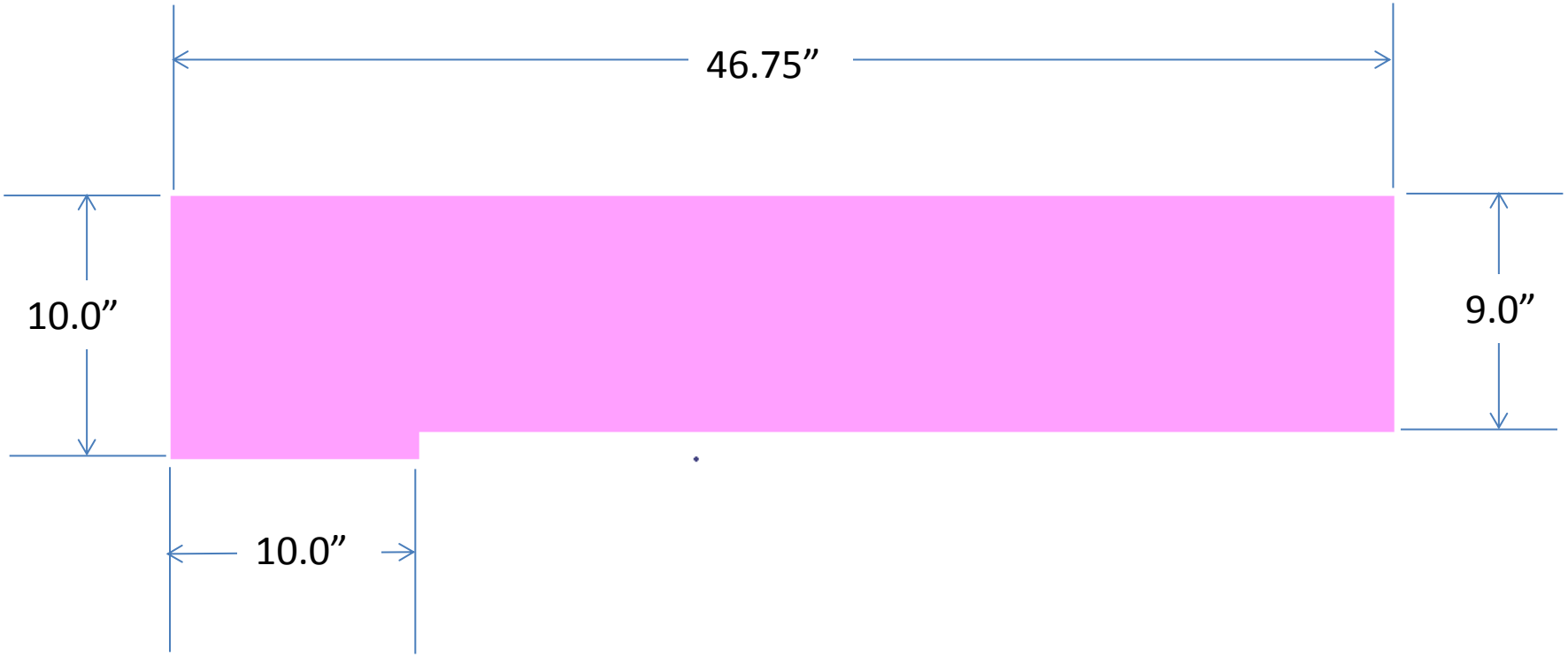
Make from 2 x 4 Stud





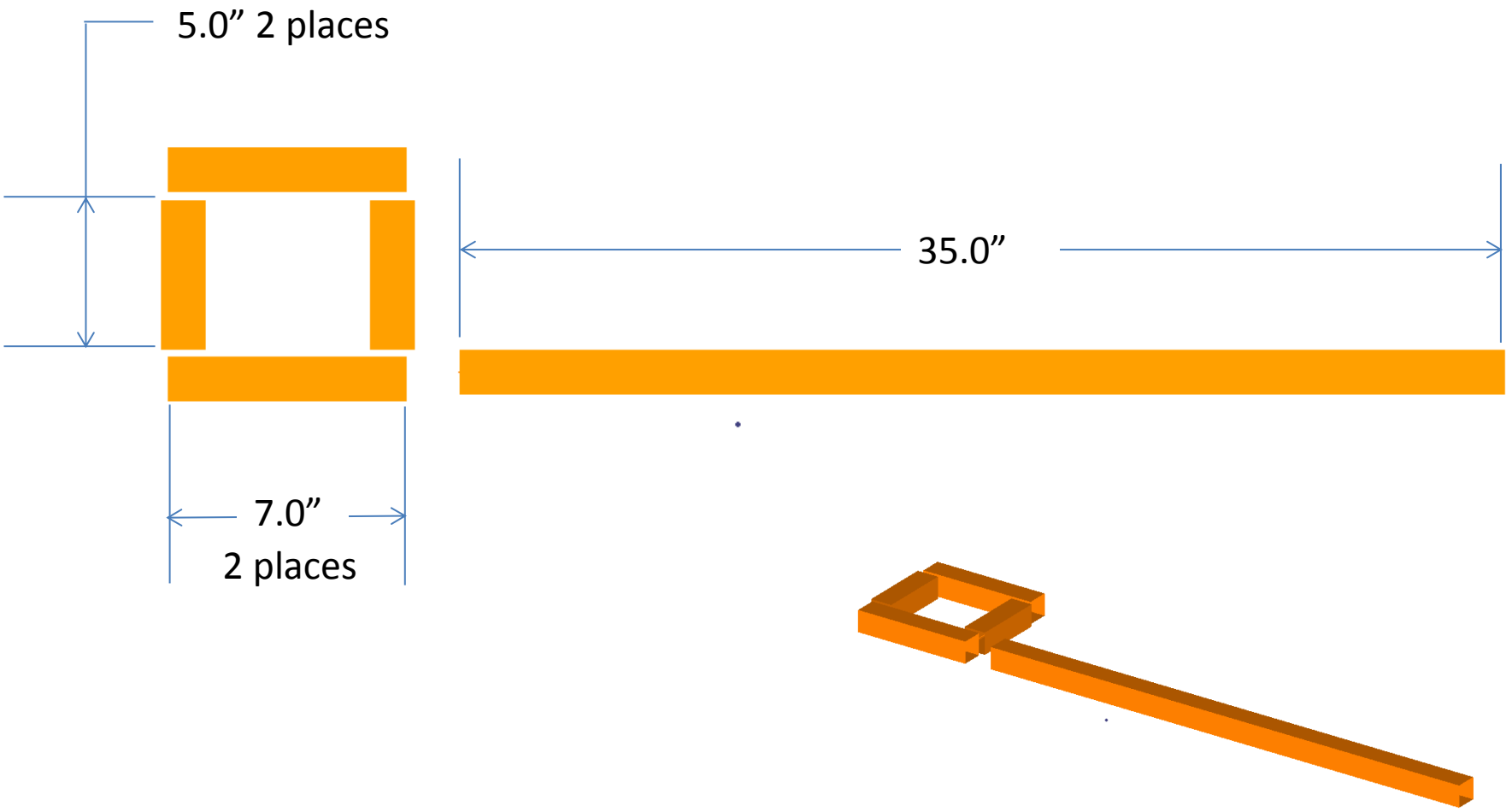
Long and Short Base Joists

Make from 1” Plywood



Base Plate

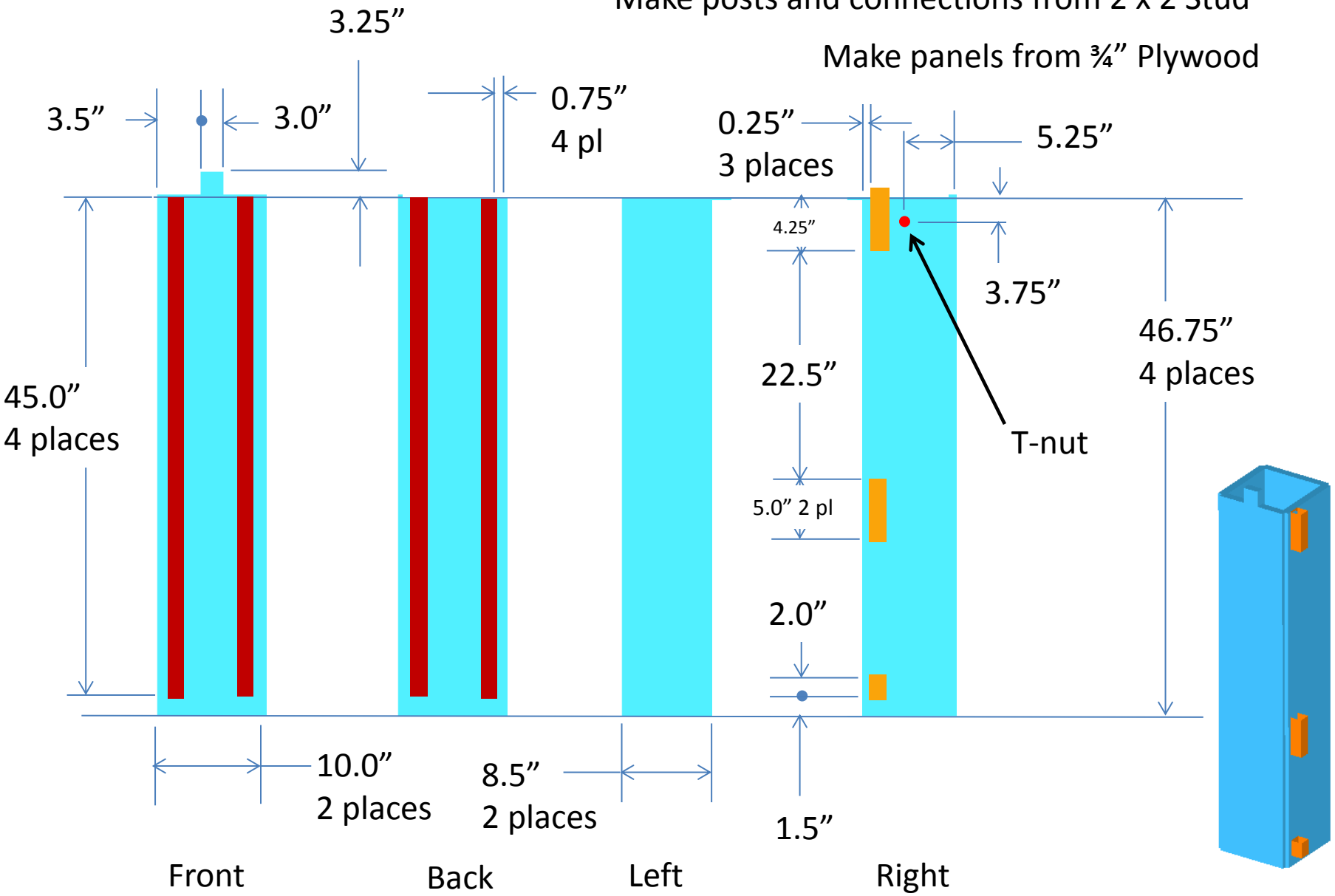
Make from 2 x 2 Stud



Base Sills

Make posts and connections from 2 x 2 Stud

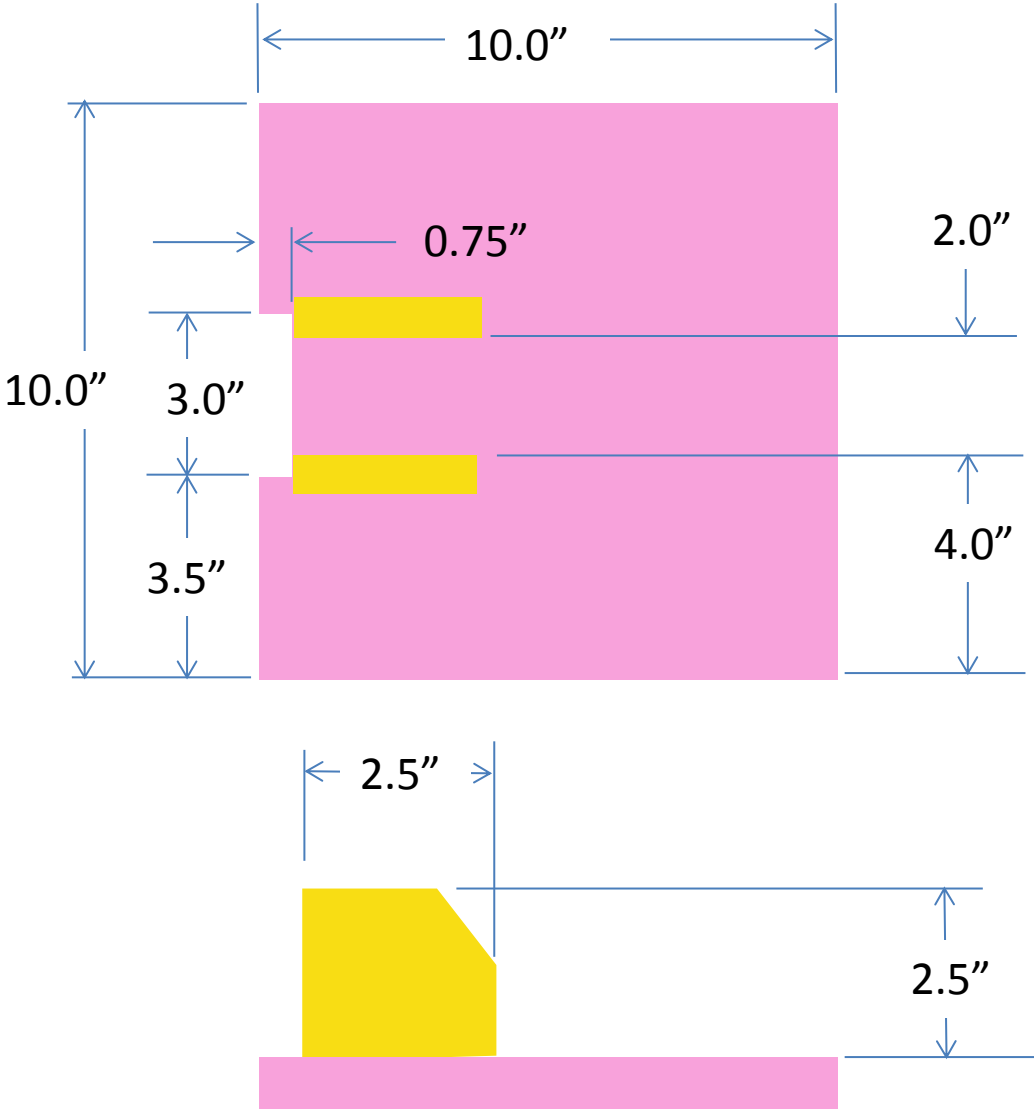
Make panels from ¾” Plywood

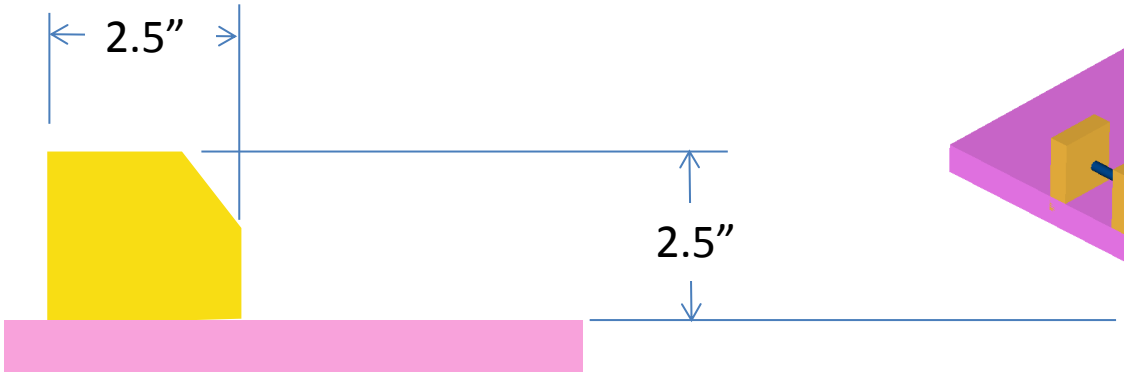


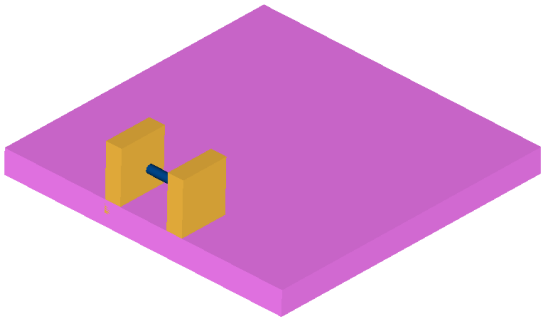
Candle Column Panels, Corner Posts, and Connection Studs

Make candlewick supports from 1 x 3 Board

Make top from ¾” Plywood





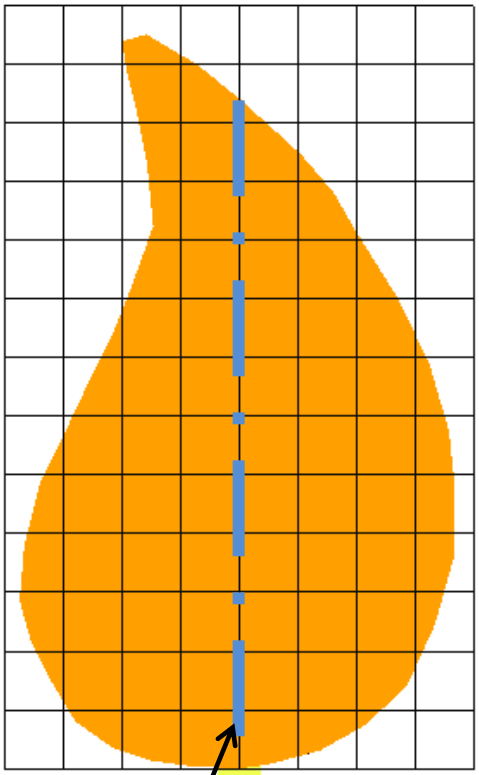


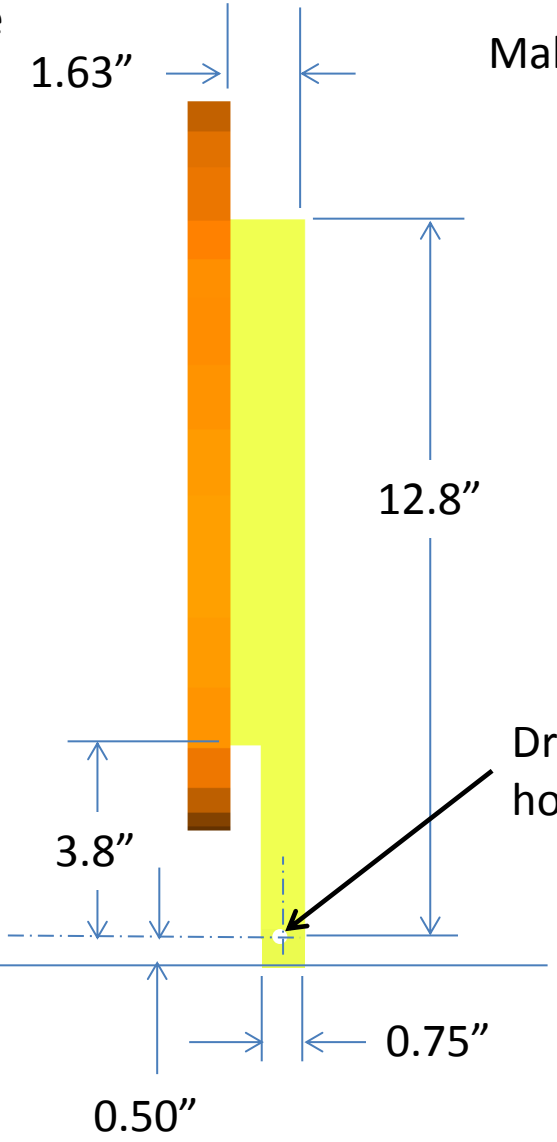
Top Plate and Candlewick Supports

Make flame support from 1 x 3 board

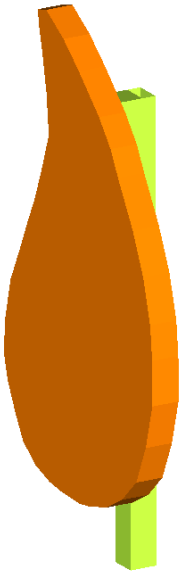
Make flame from ¾” plywood

1” grid to create outline of flame



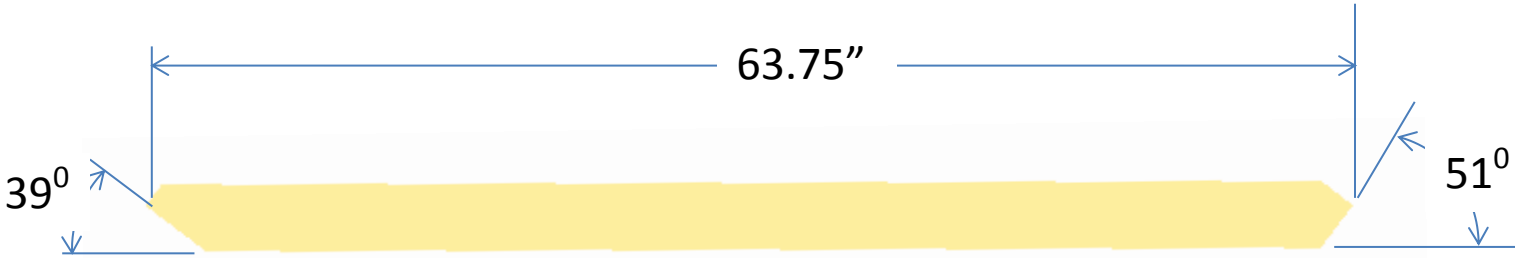


Mark centerline on flame

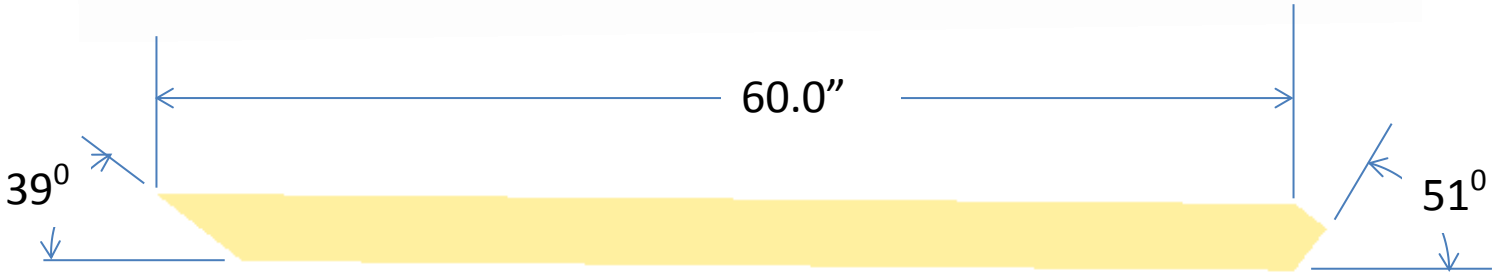


Flame Plate and Candlewick

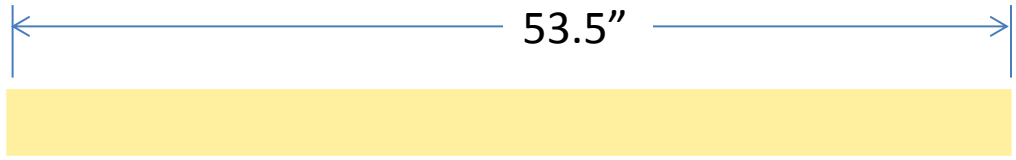
Make from 2 x 4 Stud



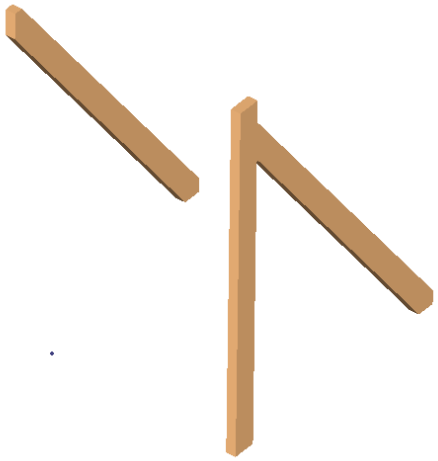
Column Diagonal



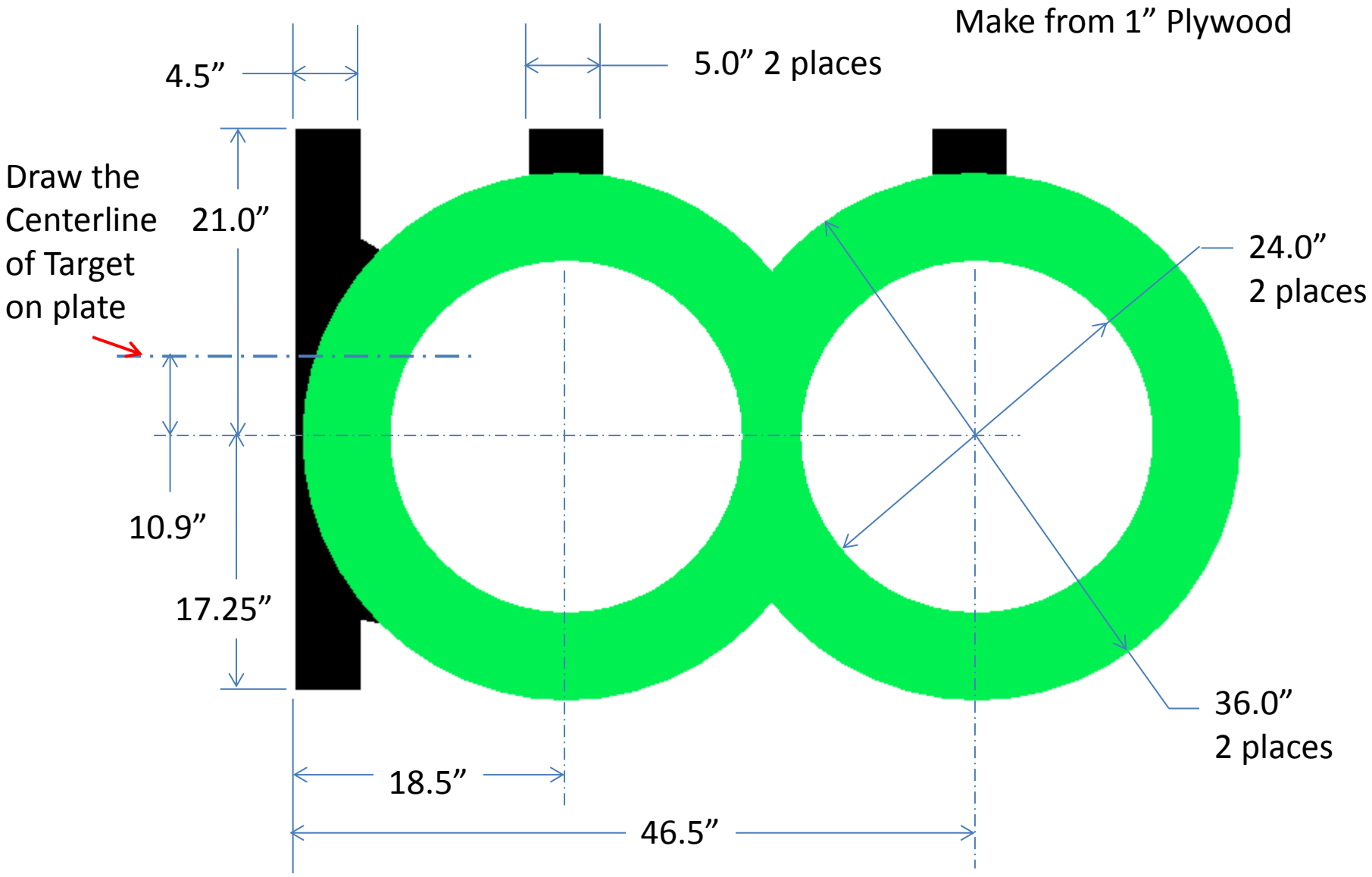
Right Diagonal



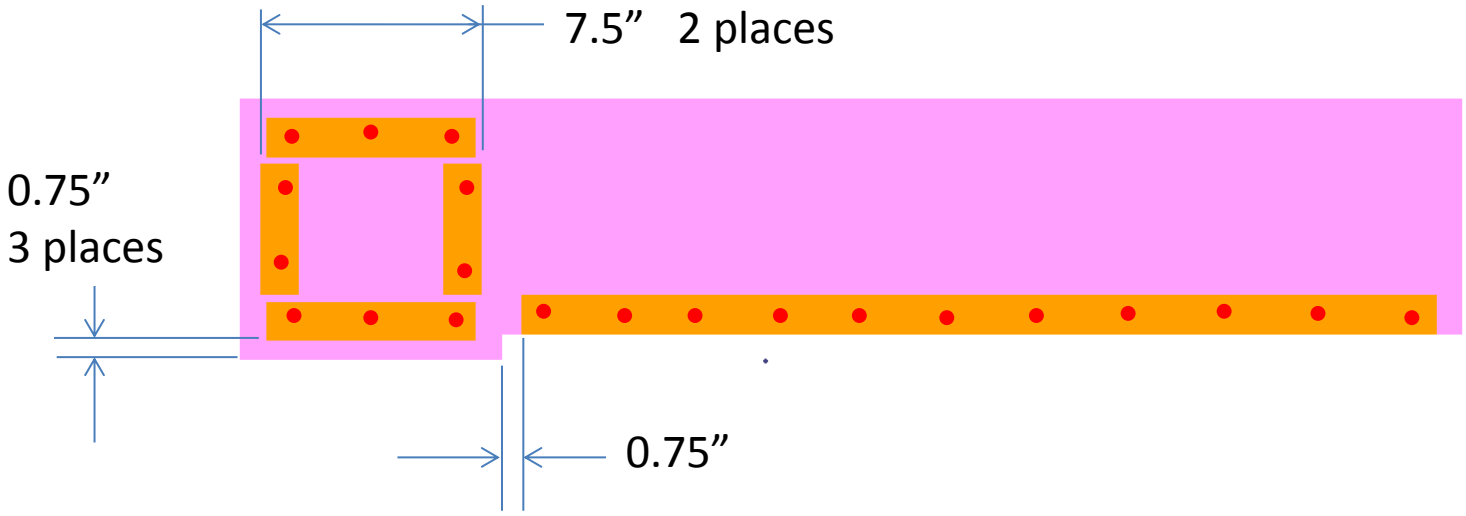
Upright Support



Upright Support and Diagonals

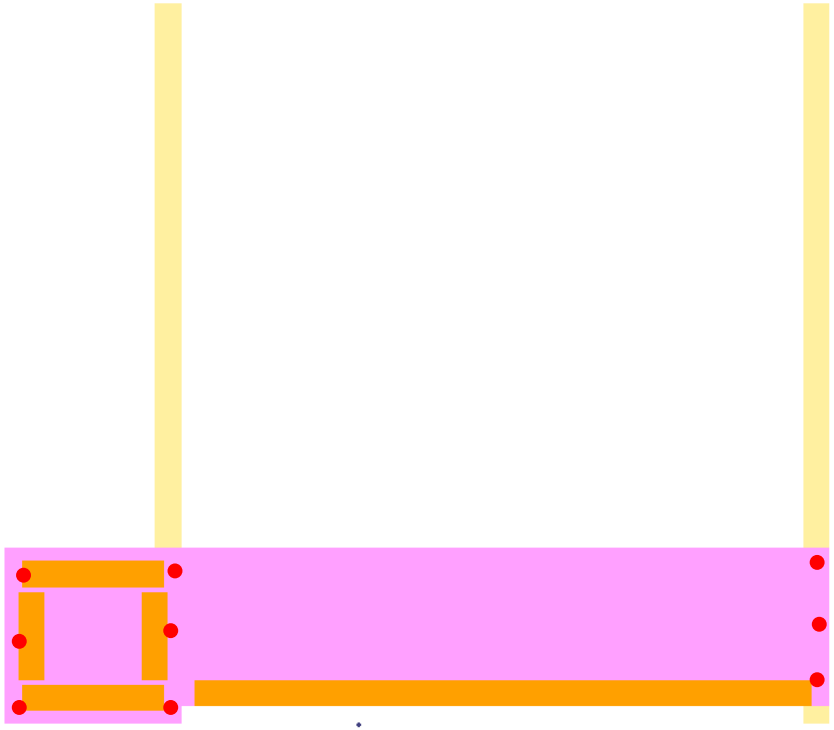


Number “18” Plate

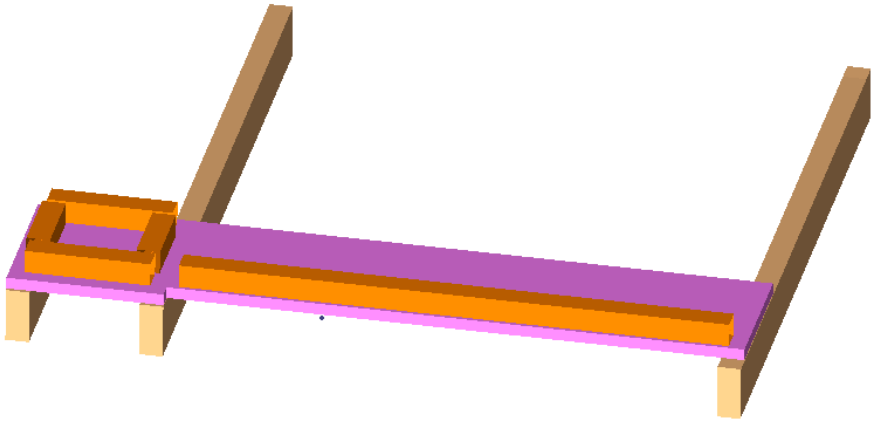


Install 2.5” long deck screws from below approximately where shown •

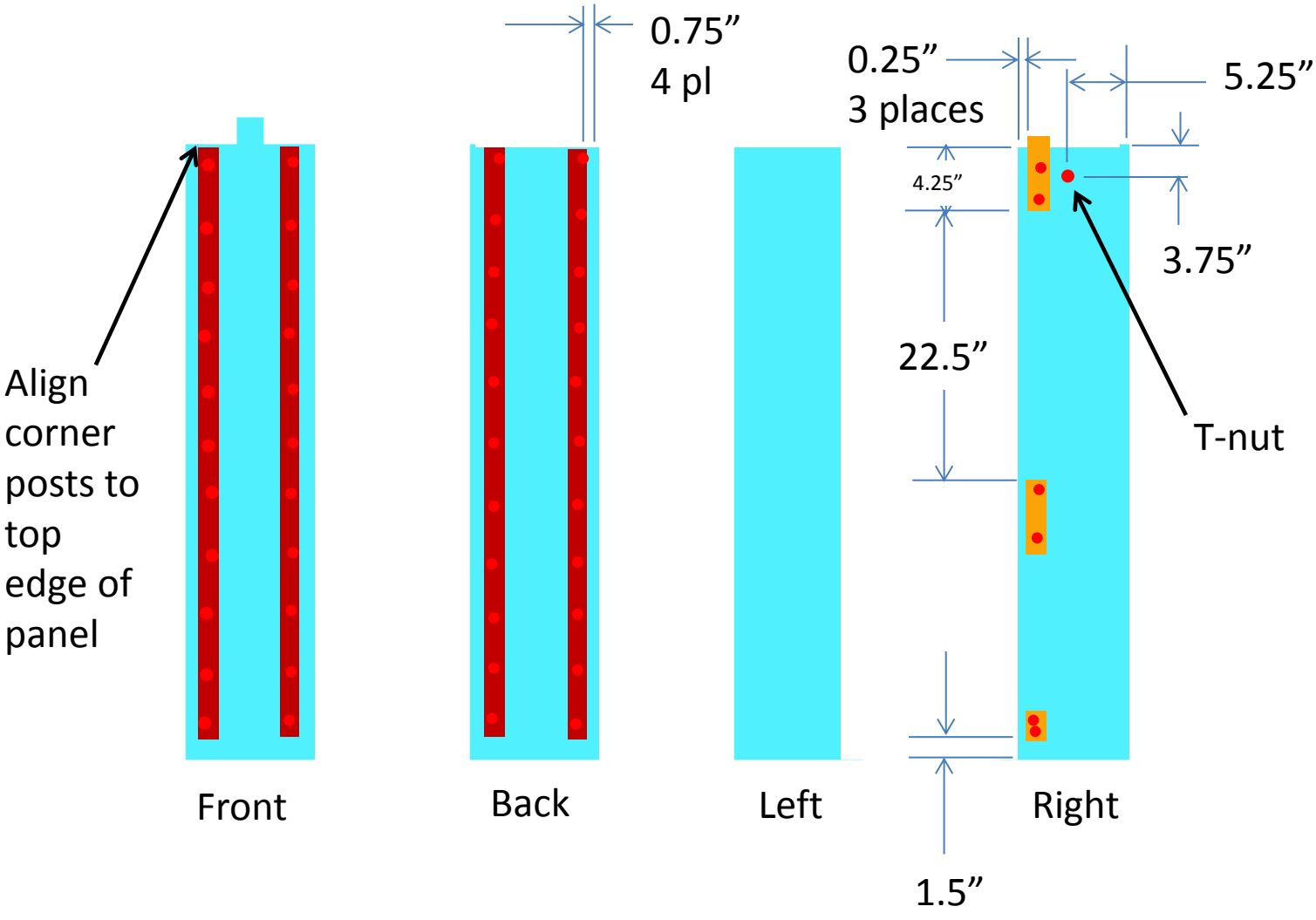
Assembly Step B

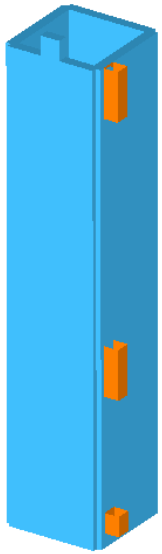


Install 2.5” long deck screws from above down into 2 x 4 base joists approximately where shown •

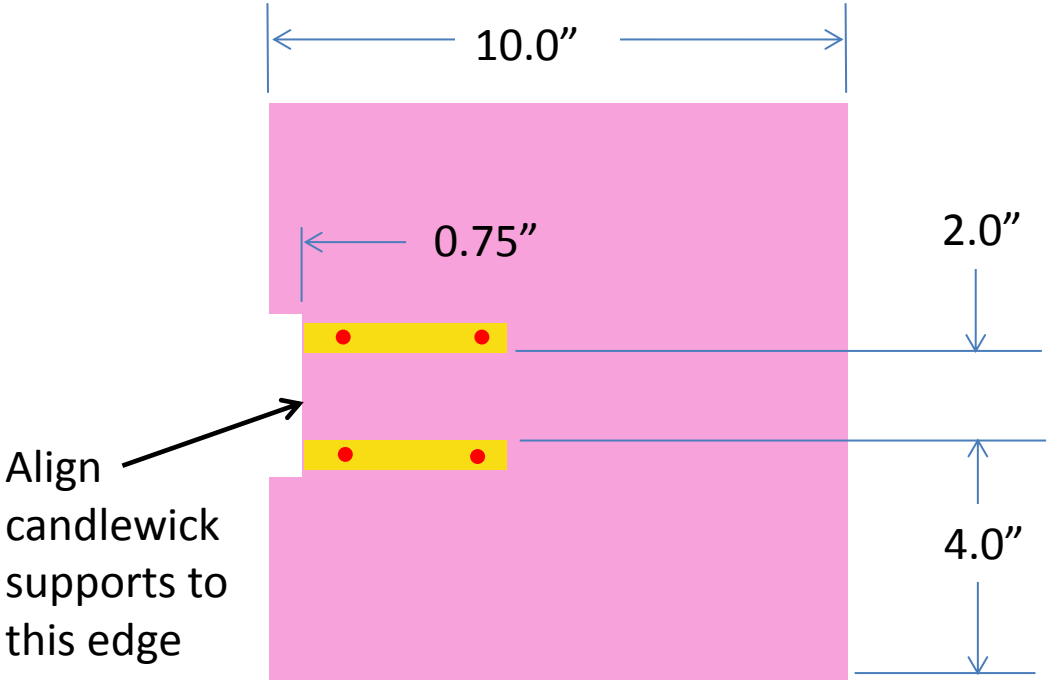


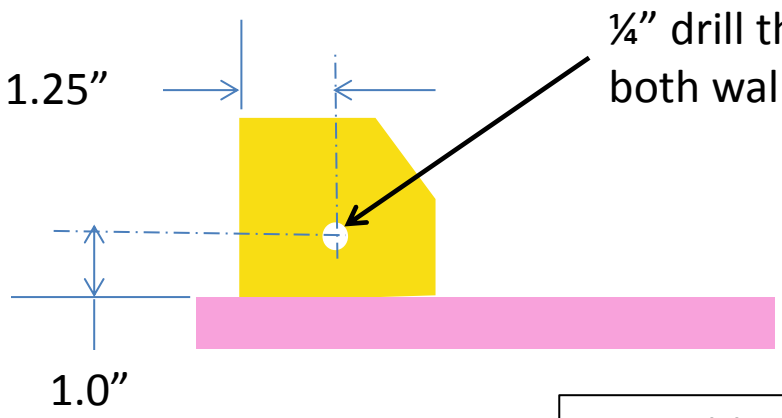
Assembly Step C

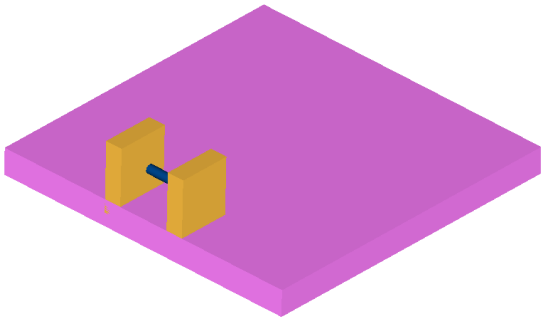




Assembly Step D

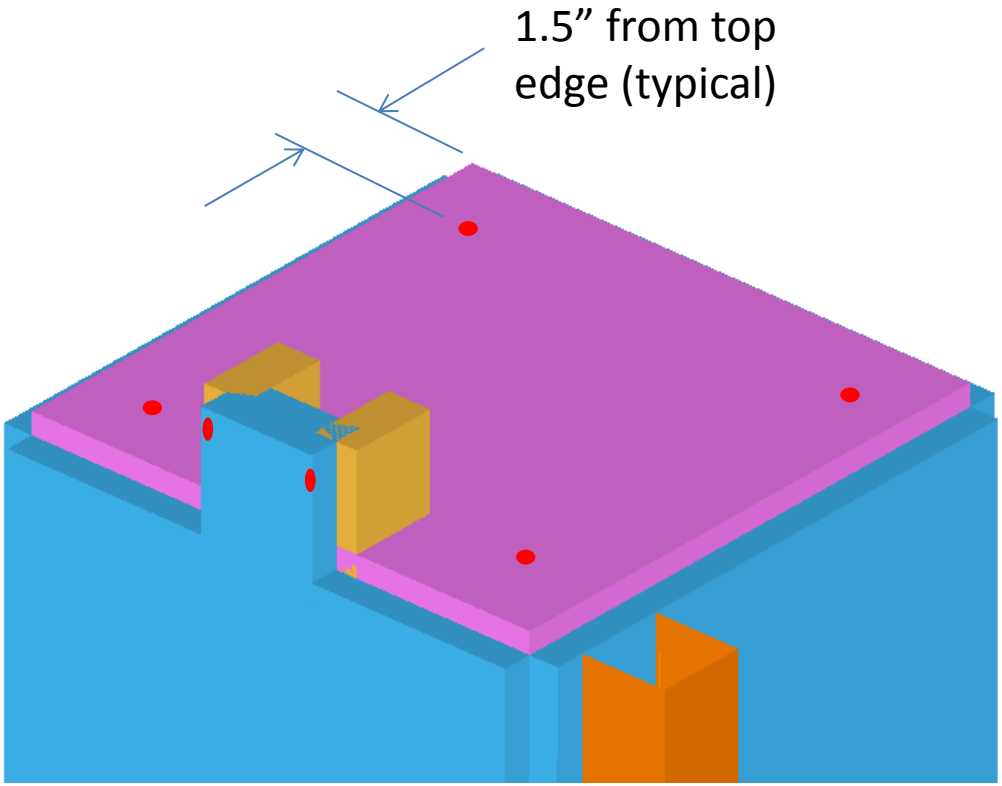


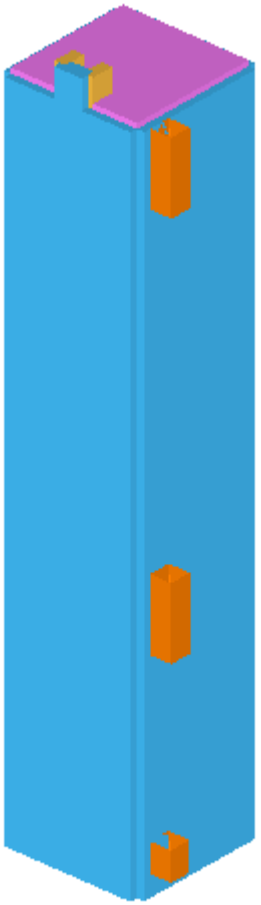




Assembly Step E

Install 2.0” long deck screws approximately where shown

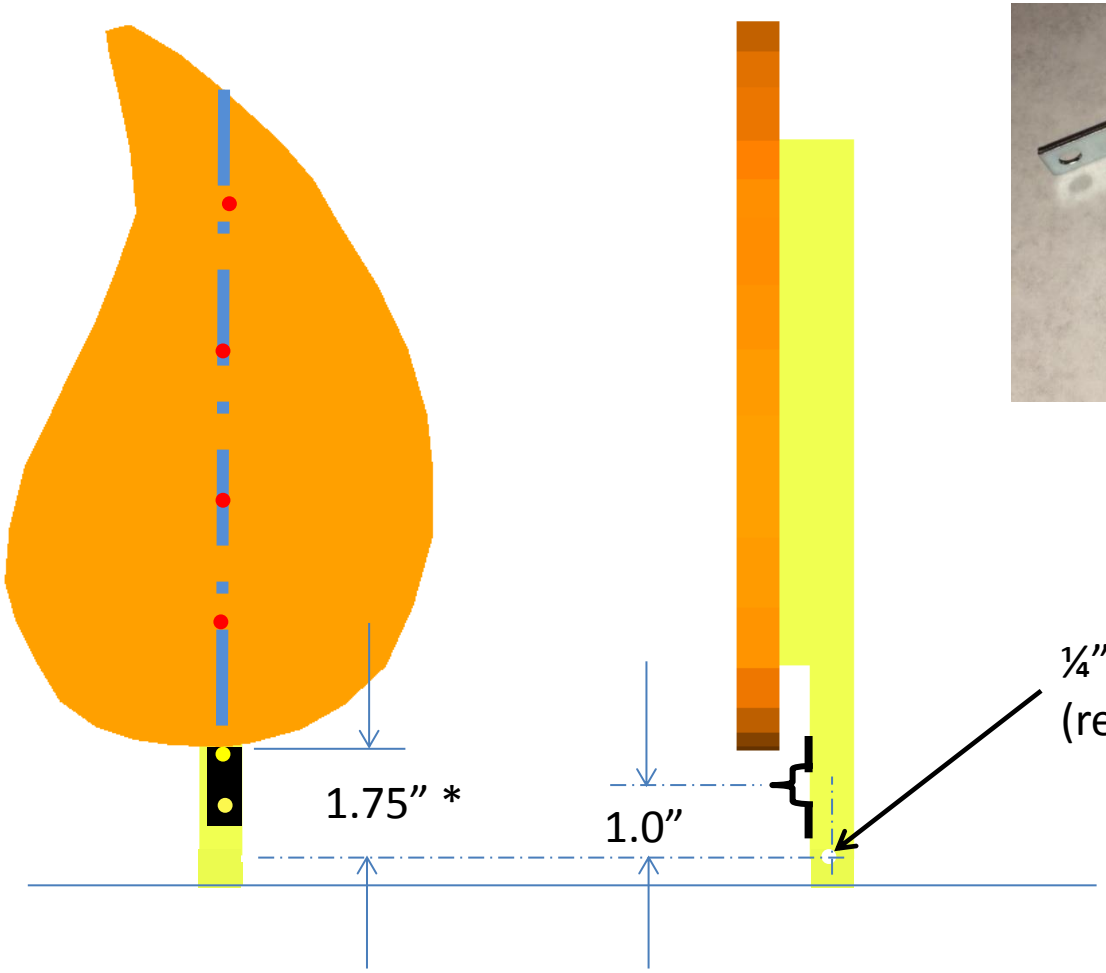




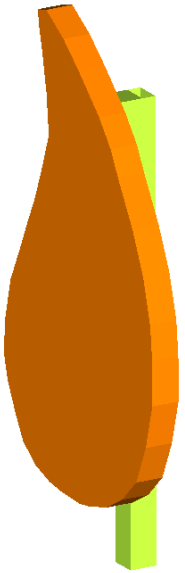
Note: CAD model does not show the correct detail for this assembly step, but the screw locations are nearly correct

Assembly Step F

Install 2.0” long deck screws approximately where shown •

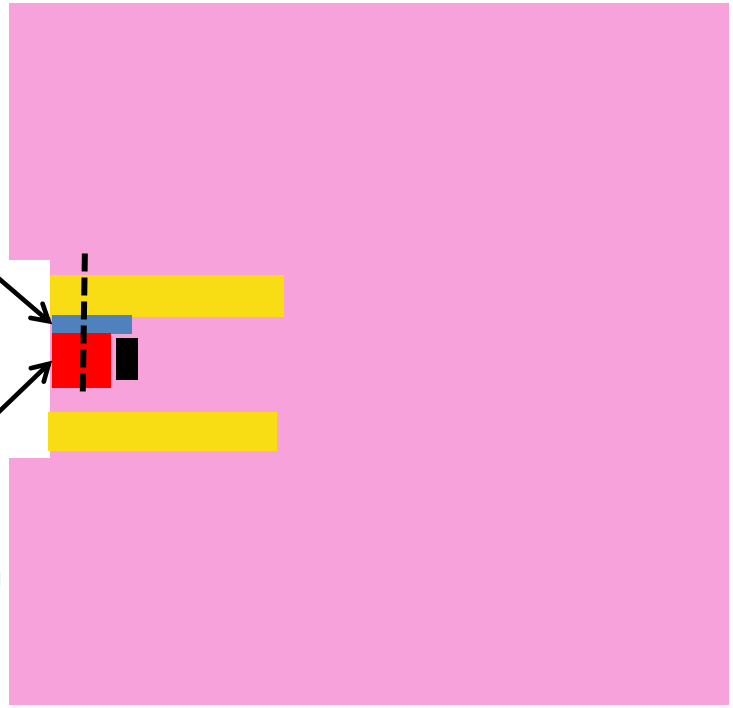


Latch apart



* Not shown to scale

Assembly Step G



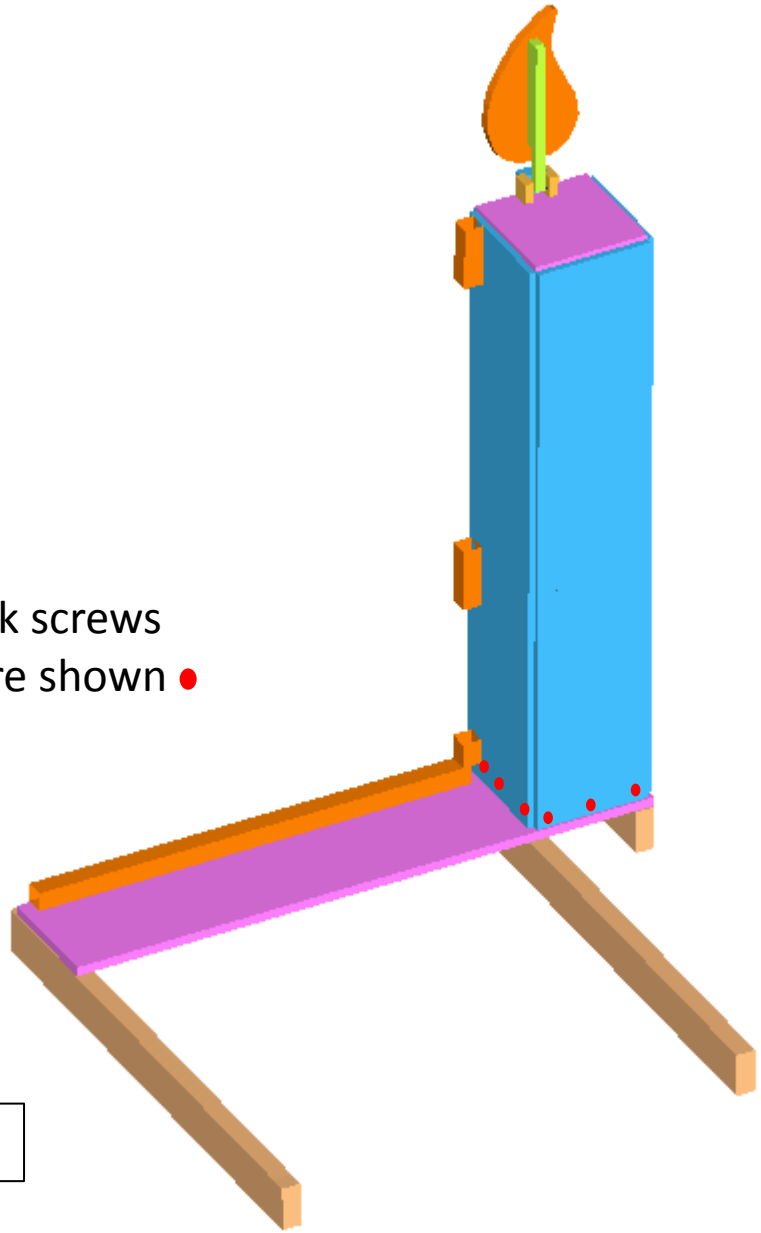
Latch apart

Latch together

The details of this installation may require modifications or special techniques. If you have issues contact Paul MacNeal.

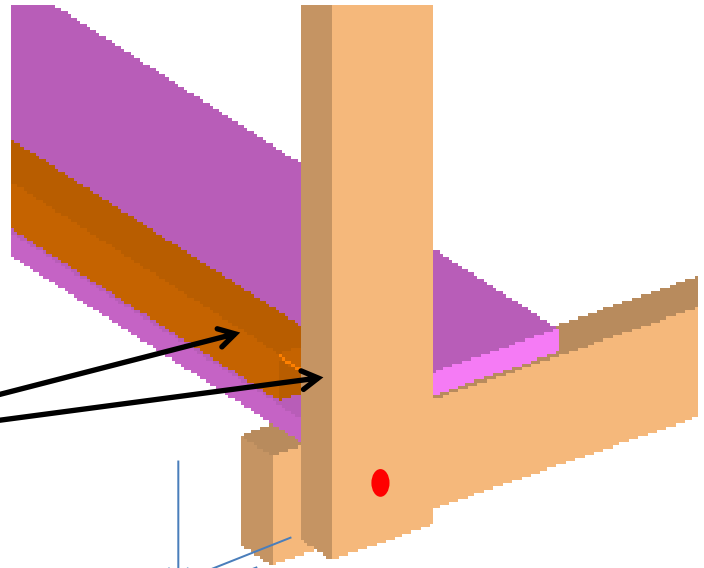
Assembly Step H

Install 2.0” long deck screws approximately where shown •

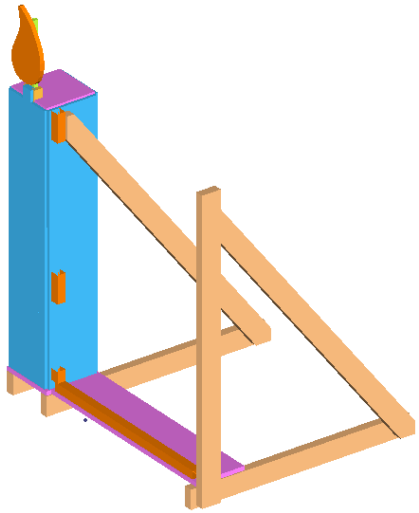


Assembly Step I

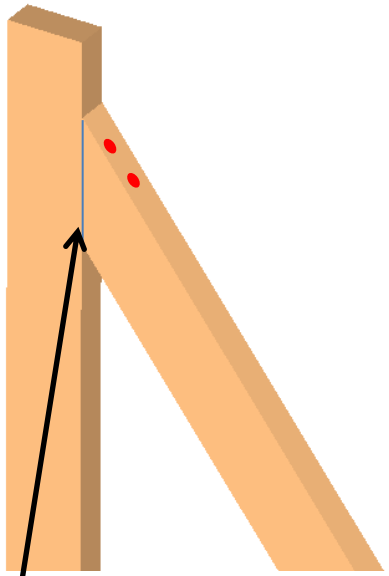
Ensure front of 2 x 4 upright is flush with the base plate sill



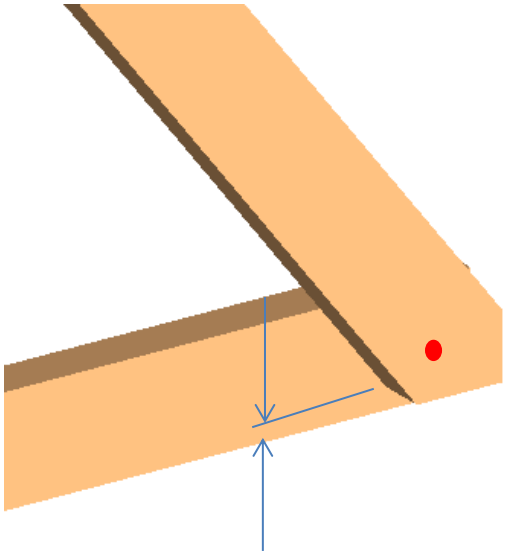
0.5”

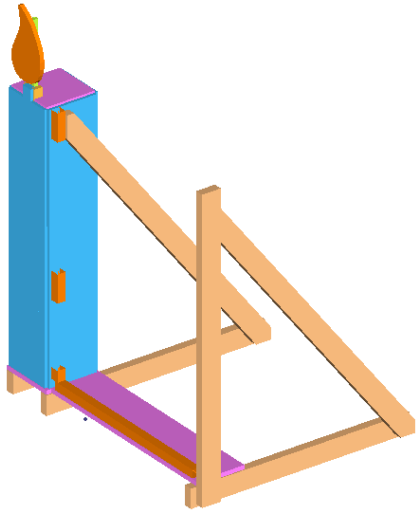


Assembly Step J

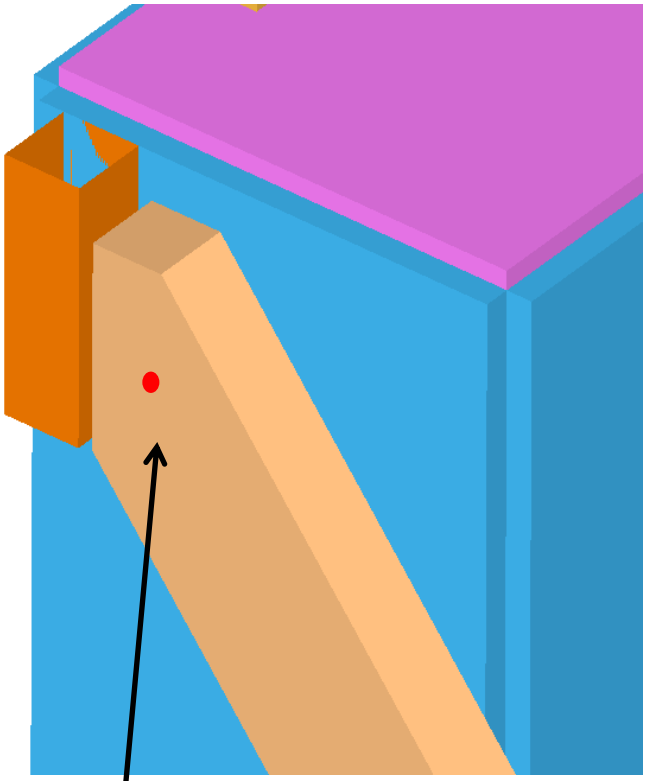


Ensure these surfaces are flush to each other

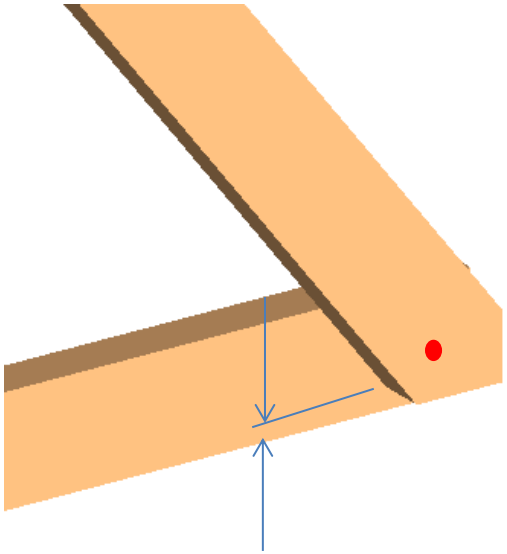


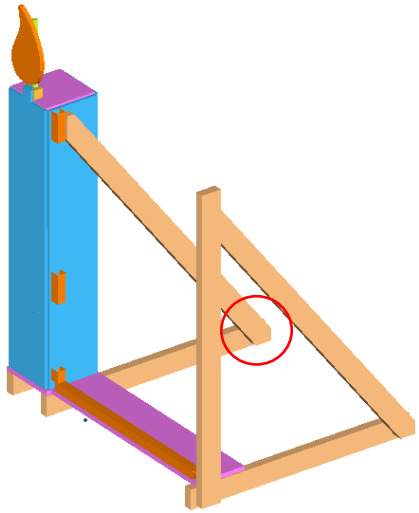


Assembly Step K

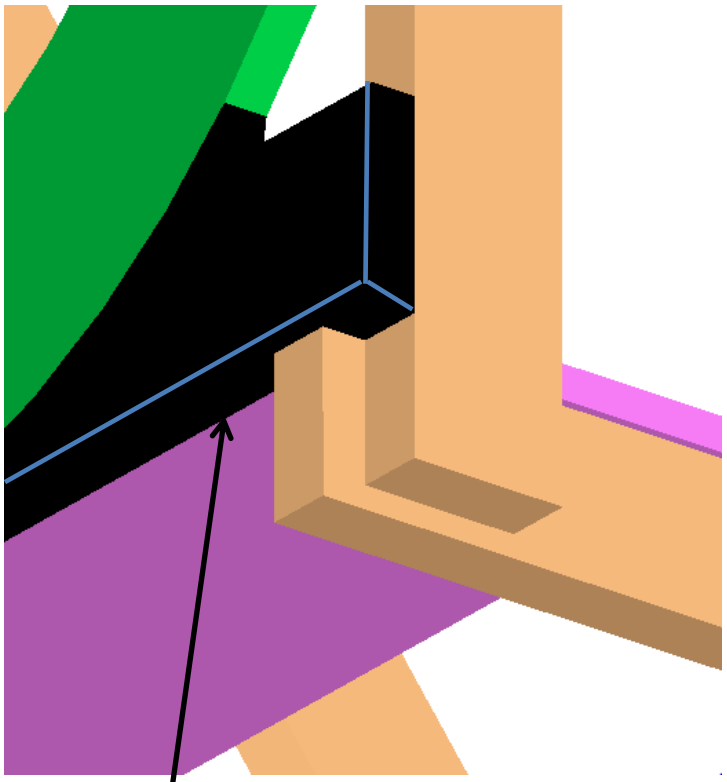


Find the proper location for the diagonal. Locate the hole for the T-Nut. Drill the ¼” hole into the column diagonal

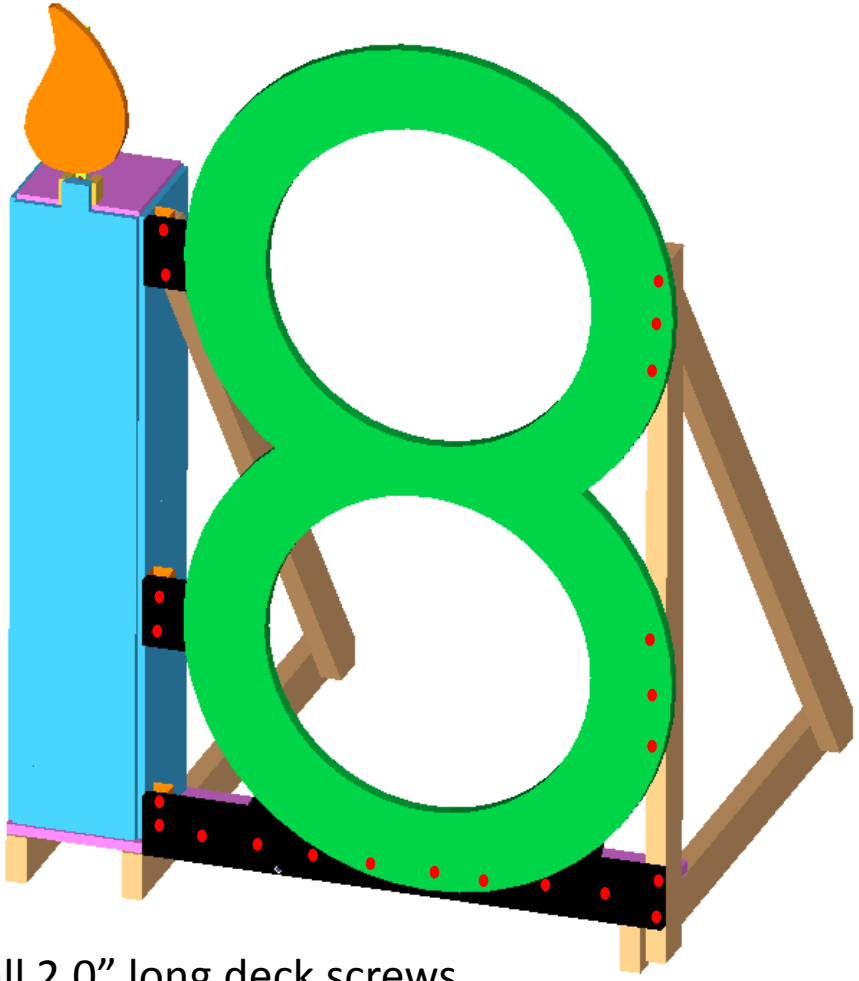




Assembly Step L



Ensure these surfaces are flush to each other



Install 2.0” long deck screws approximately where shown •

Assembly Step M