

Wood Mold for Concrete BioSand Filters

a how-to guide for construction



ohorizons 

Written & Illustrated by Aaron T. Howard
Edited by Stephanie Doud & Natalie Relich

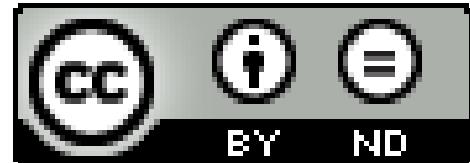
This manual is current as of October 17, 2016. Please check our website regularly for updated versions of the manual and appendix.

The OHorizons Foundation (d/b/a OHorizons) and each of its directors, officers, employees, contractors, and agents disclaim liability for any claims or demands of any nature which may arise from the use of the information in this Construction Manual.

This document is licensed under the **Creative Commons Attribution- No Derivatives 4.0 International License**. A copy of the license can be found at:

<http://creativecommons.org/licenses/by-nd/4.0/>

This license allows you to:



Share: copy and redistribute the material in any medium or format for any purpose.

Under the following conditions:

Attribution: You must give credit to OHorizons as the original source of the document. When crediting, please include our website www.ohorizons.org

No-Derivatives: If you edit, transform, or build upon the material in this document, you may not distribute it. This is to ensure preservation of the proper measurements and dimensions of the Wood Mold. If the dimensions of the Mold are altered, this will change the dimensions and geometry of the filter and its effectiveness may be impacted.

OHorizons may contact you from time to time to gather feedback on its materials and how they are being used.

You must follow proper safety guidelines and procedures at all times when constructing the Wood Mold. Basic safety procedures and guidelines are outlined in this manual and the accompanying appendix, but you should always consult the operations and maintenance guide for the specific device you are using. You assume the risk of any injury or harm arising out of the use of the information in this Construction Manual.



**For questions, please visit our website www.ohorizons.org
or email us at info@ohorizons.org**

Cutting and Constructing the OHorizons Wood Mold

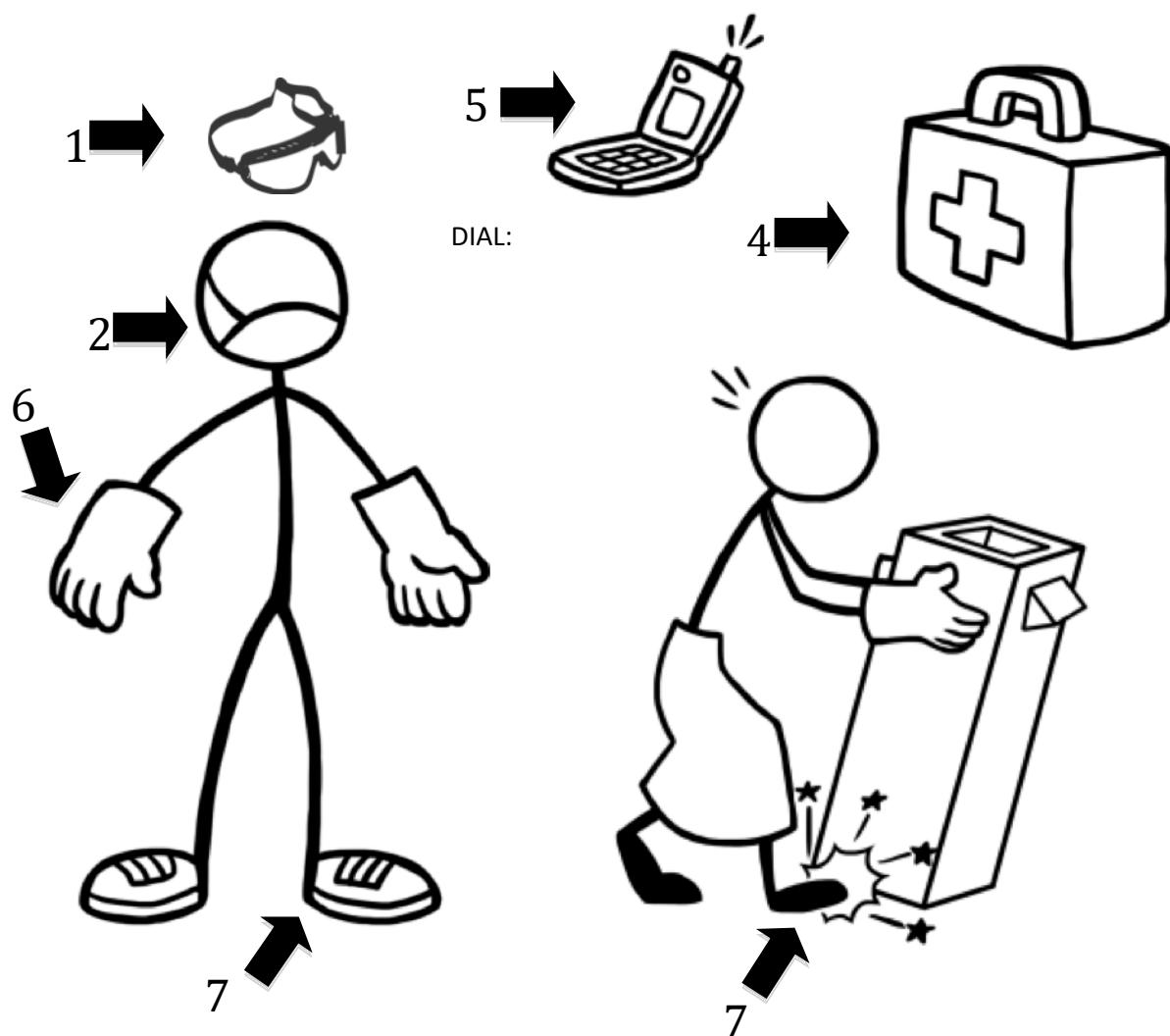
Table of Contents

<u>BEFORE YOU START</u>	II
SAFETY FIRST!	II
WORKING WITH CEMENT	III
TOOLS FOR CONSTRUCTION:	IV
MATERIALS FOR ONE WOOD MOLD:	VI
READING THE MANUAL:	VII
MEASUREMENT CONVERSIONS:	VIII
WOOD MOLD BIOSAND FILTER DESIGN SPECIFICATIONS:	IX
USING A CIRCULAR SAW:	X
 CREATING THE WOOD MOLD	 11
SECTION I: CUTTING THE PLYWOOD	11
SECTION II: CUTTING THE SUPPORT MATERIAL (SM)	28
SECTION III: SUPPORT CONSTRUCTION (CN)	28
SECTION IV: NOSE CONSTRUCTION (NC)	35
SECTION V: INNER CORE CONSTRUCTION (IC)	40
SECTION VI: BASE CONSTRUCTION (BC)	44
SECTION VII: DAGGER BOARD CONSTRUCTION (DC)	47
SECTION VIII: INNER CORE LID CONSTRUCTION (LC)	48
SECTION IX: HARDWARE INSTALLATION (HI)	51
SECTION X: CARE & MAINTENANCE (CM)	56
SECTION XI: COMPLETE BUILD (CB)	56
 MAKING CONCRETE (MC)	 61
FILLING THE MOLD (FM)	62
DE-MOLDING (DM)	63
AFTER CARE (AC)	69
INSTALLING A FILTER (IF)	70

Before You Start

Safety First!

1. Keep safety glasses on, especially while using the saw and dry cement.
2. Use masks when dealing with the dry cement and saw dust.
3. No loose clothing (e.g. scarves, draw strings).
4. Everyone should know where the First Aid Kit is located.
5. Everyone knows what number to call in case of emergency.
6. Use gloves when handling concrete and/or cement.
7. Everyone should wear closed toe shoes (tennis shoes or boots, not sandals).



Working with Cement

Cement can hurt you if it comes into contact with your skin, eyes, or if you inhale it (breathe it in). Cement usually contains a metal called hexavalent chromium. This metal causes allergic dermatitis or inflammation of the skin.

When you empty a bag of cement, the dust can irritate your skin. The dust reacts with body sweat or damp clothing to form a solution that can burn you. Cement dust can also get in your eyes, causing redness, burns, or blindness. Inhaling cement dust irritates your nose and throat. It can also cause choking and difficulty breathing. Cement is also hazardous when it is wet – in mortar or concrete. If it gets inside your boots or gloves, or soaks through your clothes, it can cause burns and skin ulcers. The burns caused by cement may be slow and you may not feel anything for several hours. That is why it is important to wash cement off your skin right away.

What to wear:

- Eye protection for mixing, pouring, and doing other work with dry cement
- A face mask to prevent inhaling cement dust
- Gloves
- Long sleeves and full-length pants (pull your sleeves over your gloves)
- Tuck pants into boots when working with wet mortar or concrete

What to do:

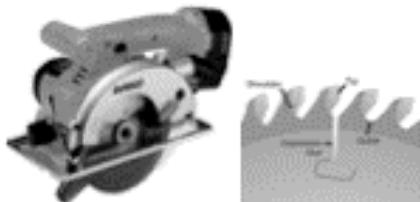
- Work upwind from cement dust.
- Remove rings and watches because cement dust can collect underneath them and burn your skin.
- Remove any clothing contaminated by cement.
- **If your skin comes into contact with cement, wash with cold running water as soon as possible.** Flush out any open sores or cuts. Get medical attention if your skin still feels like it is burning.
- After working with cement, always wash your hands before eating, smoking, or using the toilet.
- **If your eyes are exposed to cement, rinse with cold clean water for at least 15 minutes.** Get medical attention if necessary.

Tools for Construction:



Drill

Battery Powered or Corded
Used for assembling the Wood Mold



Circular Saw

Battery Powered or Corded
With a blade meant for cutting wood (Shown above)
Used for cutting plywood to create mold



**1 Drill bit $\frac{1}{2}$ inch
and
6 Pilot Drill Bits**

Large Drill bit for creating holes in the mold for outlet tube
Pilot Drill Bit: smallest drill bit available, used guide screws



Driver Bit

Used with the drill to insert screws into mold



Metric Tape Measure

Used to measure and mark plywood for cutting and assembling the Wood Mold



**Markers
and/or
Pencils**

Used to measure and mark plywood for cutting and assembling



Straight Edge

Minimum 3ft or 1 meter in length



**2 Sawhorses
or a Table**

Used as a cutting surface and to support the plywood



Speed Square

Used to make quick straight measurements



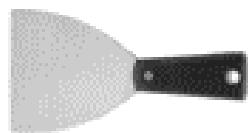
**OPTIONAL:
Table Saw**

Used in replacement of a circular saw



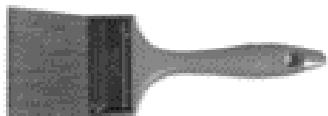
Tarps

Used to cover the filter after it is poured



Putty Knife

Used to clean the Wood Mold by scrapping off concrete remnants



Brush

Used to apply oil to the Wood Mold



**2 Pliers
and/or
Wrenches**

Used to loosen and tighten the nuts and bolts



Small Container

Used to hold oil



2 Shovels

Used to mix concrete



Container with 1 liter mark

Used to measure sand, gravel, and cement



Trowel

Used to smooth concrete and fill the molds



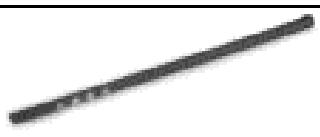
Rubber Mallet

Used to vibrate the Wood Mold



Large Container

Used to transport materials



Rebar

Used to tamp the concrete filled mold

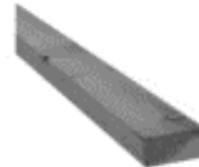


Level

Used to ensure the filter is level

**Scrap Lumber**

Approximately 1 foot or 1/3 meter long
Used to make disassembly easier

**2x4 Lumber**

Approximately 8 feet long
Used with rope as a lever to remove the dagger board from mold

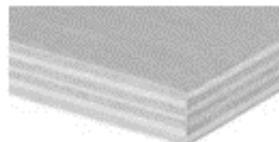
**Rope**

Used with a 2x4 to remove dagger board from mold

**Claw Hammer**

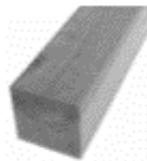
Used to remove the lid of the center core from the hardened filter

Materials for One Wood Mold:



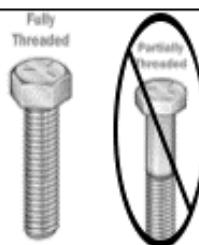
Plywood
4ft x 8ft
3/4 in thick

Both sides should be smooth to the touch

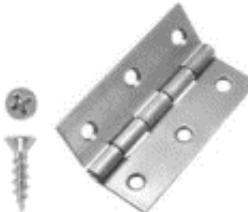


Lumber
1½ x 1½ inch
8- 46cm long
4- 40cm long
4- 35cm long

Used as support material for the Wood Mold



16 Bolts with Hexagon Heads and Fully Threaded
Thickness: between 1/8 in and 1/4 in
5-7in long



12 Hinges with Screws
Approximately 2 ½ inch long

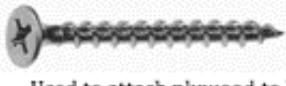
Used in the center core to facilitate removal

**17 Nuts**

Each nut should be matched with a bolt and tested before purchase

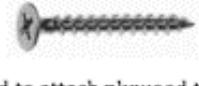


17 Washers
Each washer should be matched with a bolt and tested before purchase



75 Screws
4cm length

Used to attach plywood to lumber



60 Screws
3 cm length

Used to attach plywood to plywood

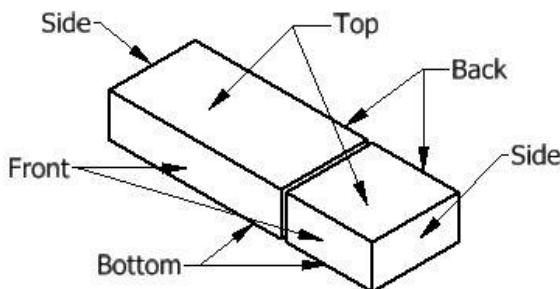


1 Carriage Bolt
4-5in long

Used with a nut in the lid to facilitate removal

Reading the Manual:

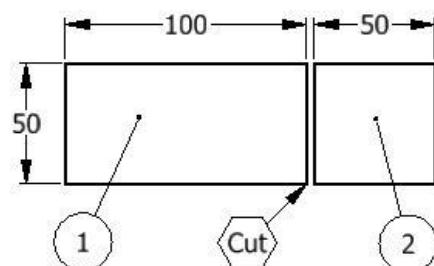
3D View of Parts



The Part shown is labeled with views. A view is set by the orientation of the Part and not by the viewer. The part will only be labeled with a view if it is necessary to the step.

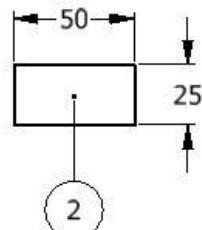
The Top is considered to be the face that will be in contact with the concrete. The top is decided by the quality of the outer layer of the plywood laminate.

Top View of Parts



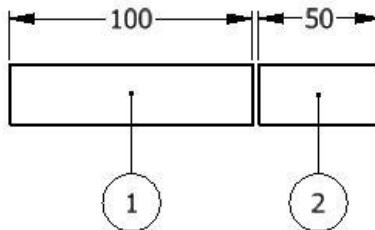
Balloons are used throughout the text to label the part names.

Side View of Parts



Hexagon shaped balloons are used to label the cut location.

Front View of Parts



Unless specifically noted, given dimensions are in centimeters.

Step Number	Instruction	Measurement	Direction	Notes
1	Cut between 1a and 1b.	64.5	←	Set aside 1b. Part 1a= M*

Asterisk (*): signals the Part is not yet completed. More cuts are needed before Part completion.

Measurement Direction: The arrow shows which side to measure from. For example, an arrow (←) start measuring from the right edge pulling the tape from right-to-left. Ideally, this will be the straightest edge on the piece.

Set aside: This Part will be cut again later.

Parts labeled with “SC” are scrap components. Much of the scrap cut is re-used to make the Wood Mold, so do not discard.

All measurements, unless otherwise noted, are in centimeters (cm).



This symbol denotes a very important step or complex step, such as an angled cut. It is used to remind you to carefully read the instructions for that step.

Measurement Conversions:

Use these conversions as a guide, if necessary, when cutting and constructing the Wood Mold as well as installing a filter.

Length or Distance	Volume	Area
1 foot = 0.30 meters	1 gallon = 3.78 liters	$1 \text{ m}^2 = 10.76 \text{ ft}^2$
1 meter = 3.28 feet	1 liter = 0.26 gallons	$1 \text{ ft}^2 = 0.09 \text{ m}^2$
1 inch = 25.4 mm	1 liter = 33.8 fluid oz (US)	
1 inch = 2.54 cm	400 mL = 13.5 fluid oz (US)	
1 cm = 0.39 inches	1 liter = 1000 milliliters	
1 mm = 0.1 cm	1 liter = 0.9 quarts (dry)	
1 cm = 10 mm		

Flow Rate

0.4 L/min (liters per minute) = 400 mL/min (milliliters per minute)

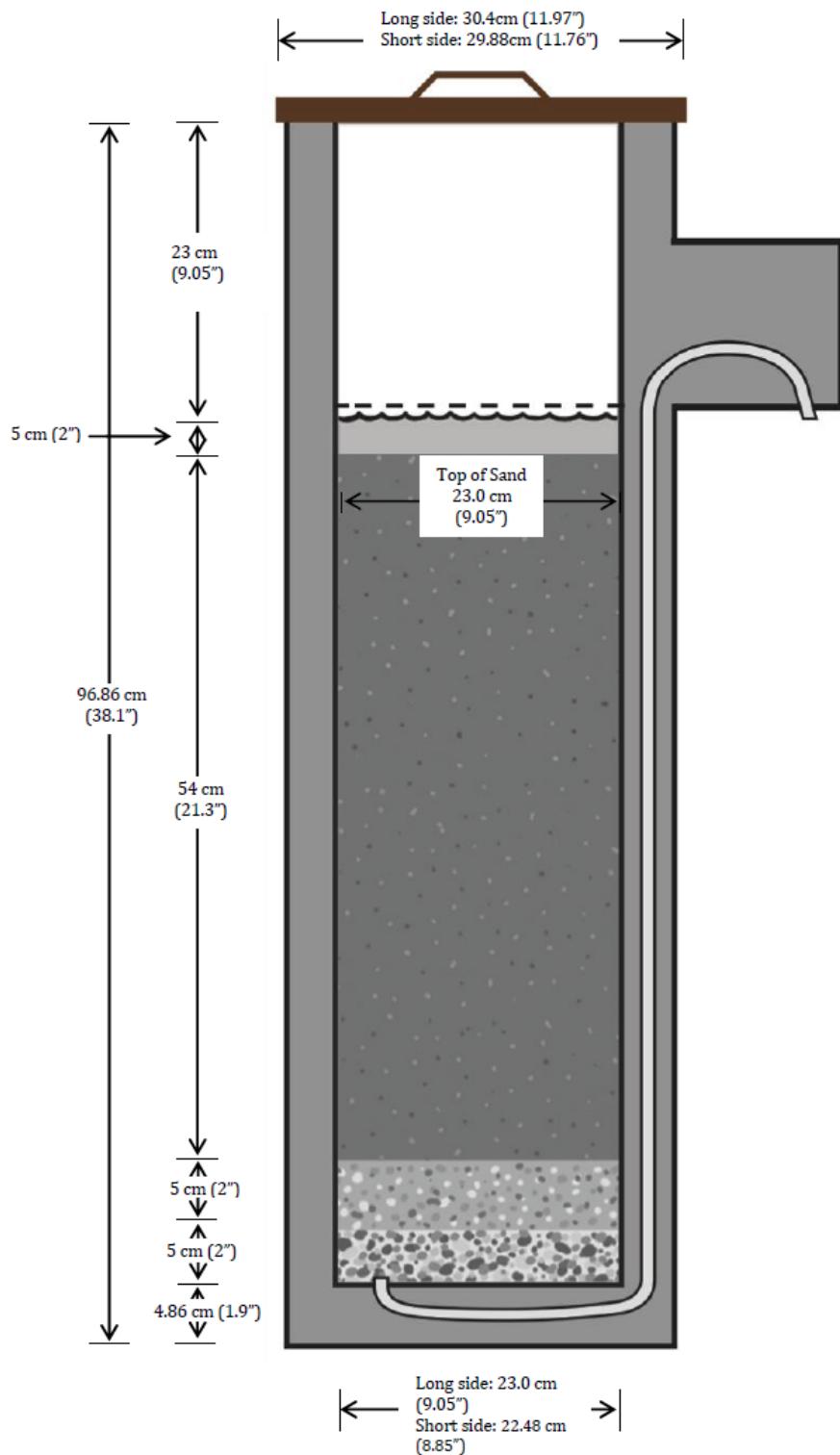
0.4 L/min is the same as getting 1 liter of water in 2 ½ minutes (2 minutes and 30 seconds)

0.4 L/min is the same as 13.5 US-ounces per minute

1 liter in 2 minutes 30 seconds is the same as 33.8 US-ounces in 2 minutes 30 seconds

Wood Mold BioSand Filter Design Specifications:

Please use the diagram below as a guide for the dimensions of your BioSand Filter made from the Wood Mold. Each Wood Mold may vary slightly due to differences in craftsmanship. A difference of 1-2 millimeters is okay, but filters that have very different specifications than those shown in the diagram below may not be as effective in removing pathogens. To guarantee filter effectiveness, make sure to construct your Wood Mold to the specifications outlined in this manual. **NOTE:** these specifications are different than those for a BSF made from a steel mold. **Your BSF will be rectangular NOT square.**



Design Specifications

Filter loading rate = 337 liters/hour/m²

Flow rate = 0.34 liters/minute

Reservoir volume = 11 liters*

Sand pore volume = 11 liters

Standing water depth = 5 cm

***Users should only pour 11 liters of water into the filter at a time.**

This is known as a batch. For maximum effectiveness there should be a pause period of several hours between batches. We recommend 4 batches per day for optimum filter performance.

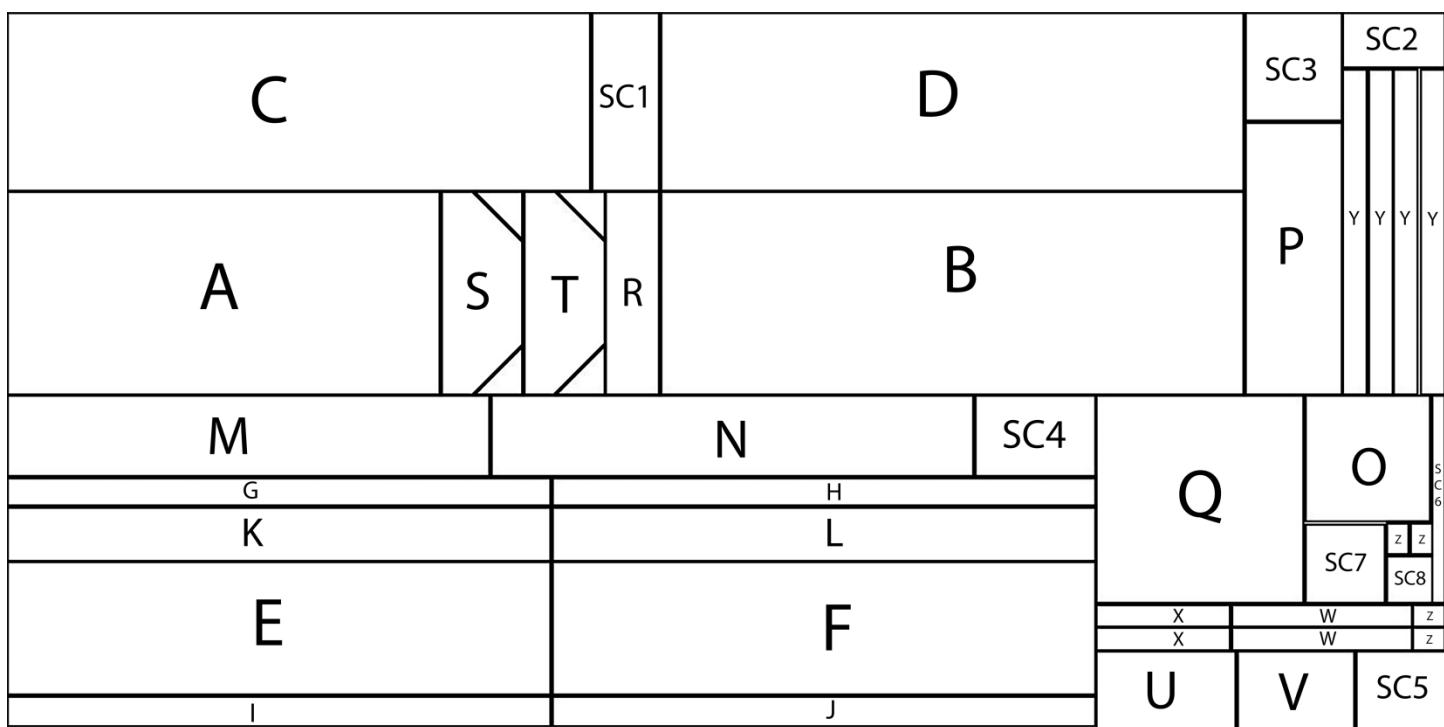
Using a Circular Saw:

- Never reach across the path of the blade.
- Never start the saw with the blade touching the wood.
 - The blade should be less than one centimeter away from the wood before turning on the saw.
- Always have a partner around in case of emergency.
- Always wear safety glasses while cutting with a saw.
- Only hold the saw on the yellow handholds. DO NOT touch the silver platform while using the saw.
- The saw should only be running while near the wood. DO NOT turn around or wave the saw while it is on. As soon as you have finished your cut, allow the saw blade to stop before moving the saw.
- Always use the silver platform/guide to keep your cuts level and straight.
- Look down at the saw from the top, not the side while cutting. Looking from the side will cause you to veer off the cut line or angle your blade. Looking from the top will keep you balanced and allow you to use the guides on the platform.
- Kickback: when the saw unexpectedly tries to move backward while running because something has stopped the blade from turning.
 - Everyone near the saw needs to be aware of this possibility and maintain the hands/arms etc. out of the way of a potential kickback.
 - It is the saw user's responsibility to try to control the kickback by stopping the movement and immediately releasing the 'on' trigger.
 - Kickback is usually very mild and can usually be pushed through.
 - Kickback is EASY to prevent, if the saw is used correctly.
- If the blade is getting stuck or you are experiencing kickback:
 - You have run out of battery.
 - The piece you are cutting off is unsupported and pinching the blade.
 - You have changed the angle at which the blade is cutting and caused the blade to pinch.
- Don't try to cut through metal. Check your piece of wood for nails or screws before cutting. Metal will ruin the blade.

Creating the Wood Mold

SECTION I: Cutting the Plywood

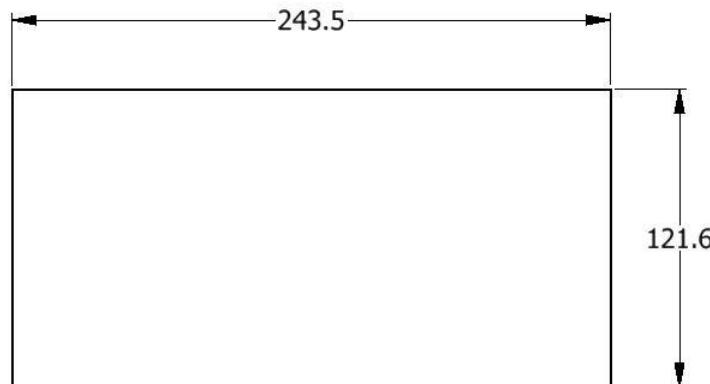
WOOD CUT CHART:



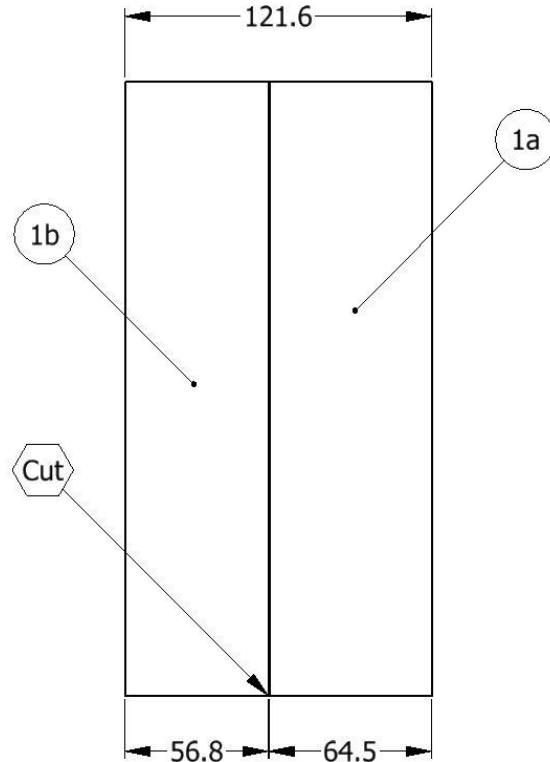
HELPFUL TIPS BEFORE BEGINNING:

- ALL MEASUREMENTS, UNLESS OTHERWISE NOTED, ARE IN CENTIMETERS (CM).
- MEASURE TWICE, CUT ONCE.
- LABEL THE CUT WITH ITS LETTER ONCE IT IS CUT (e.g. Part P or "P").
- DON'T THROW AWAY ANYTHING UNTIL YOU HAVE COMPLETED CONSTRUCTION.
- BE FAMILIAR WITH THE TOOLS AND SAFETY EQUIPMENT USED IN THIS MANUAL.
- THOROUGHLY REVIEW THE INSTRUCTION BEFORE MAKING CHANGES.

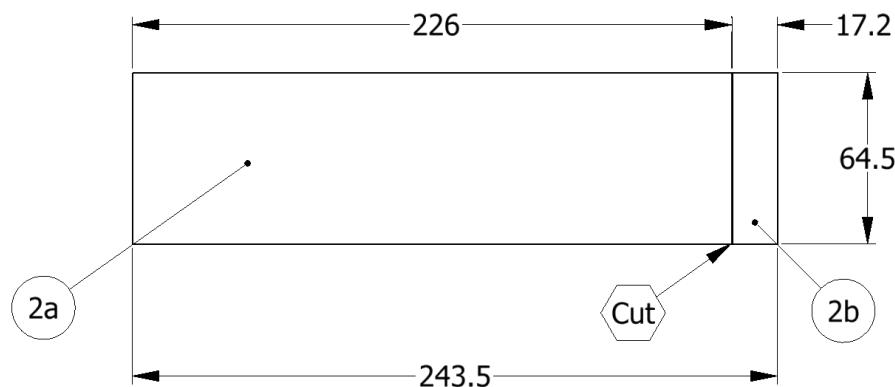
0	Gather and Support Plywood.	243.5cm X 121.6cm X 1.84cm	
---	-----------------------------	----------------------------	--



1	Cut between 1a and 1b.	64.5		Set aside 1b
---	------------------------	------	--	--------------



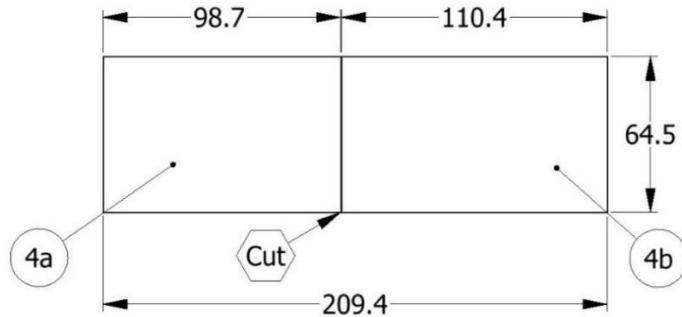
2	Continue with 1a. Cut between 2a and 2b.	17.2		Set aside 2b
---	--	------	--	--------------



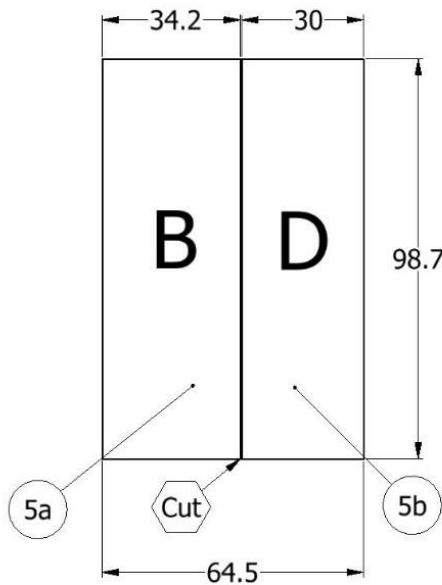
3	Continue with 2a. Cut between 3a and 3b.	16.3		Set aside 3b.
---	--	------	--	---------------



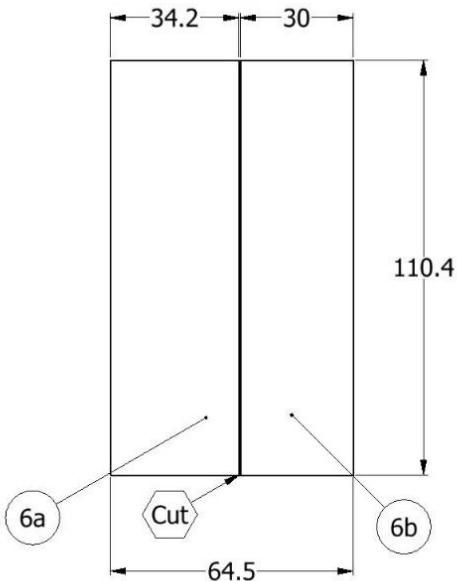
4	Continue with 3a. Cut between 4a and 4b.	→	98.7	Set aside 4b
---	--	---	------	--------------



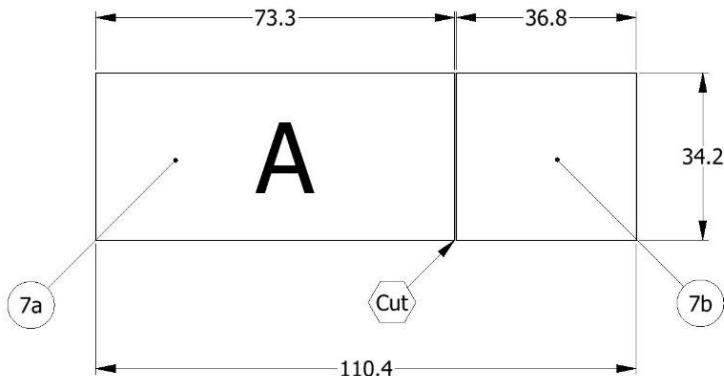
5	Continue with 4a. Cut between 5a and 5b	←	30	Cut 5a = Part B & Cut 5b = Part D
---	---	---	----	-----------------------------------



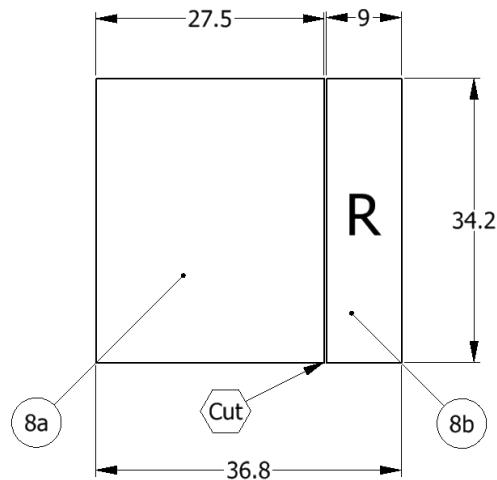
6	Begin with (already cut) 4b. Cut between 6a and 6b.	30	←	Set aside 6b.
---	---	----	---	---------------



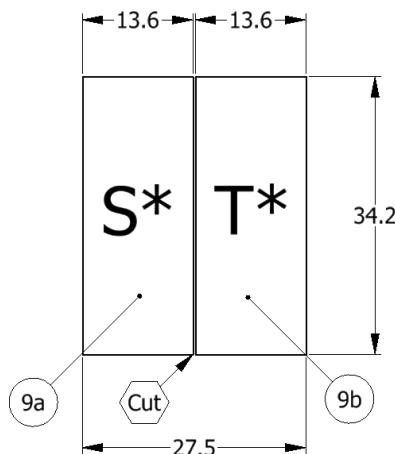
7	Continue with 6a. Cut between 7a and 7b.	73.3	→	Cut 7a = Part A
----------	--	-------------	---	-----------------



8	Continue with 7b. Cut between 8a and 8b.	9	←	Cut 8b = Part R
----------	--	----------	---	-----------------

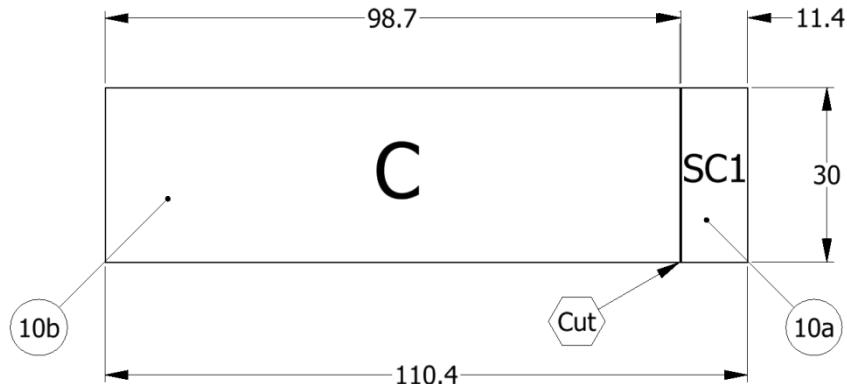


9	Continue with 8a. Cut between 9a and 9b.	13.6	→	Cut 9a = Part S * & Cut 9b = Part T *
----------	--	-------------	---	---------------------------------------

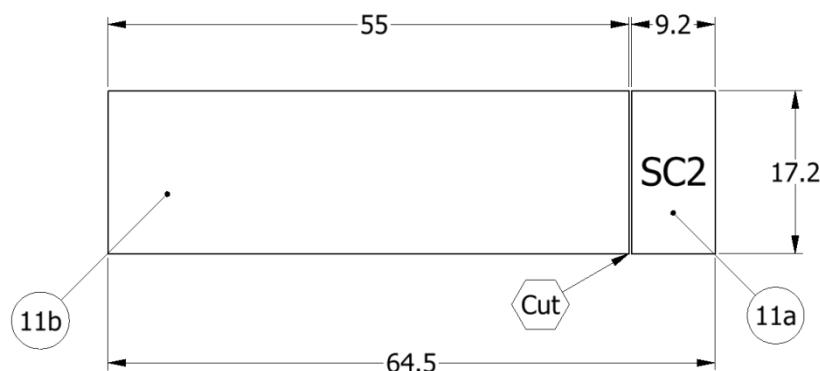


NOTE: ENSURE THE
BOARDS ARE EQUAL

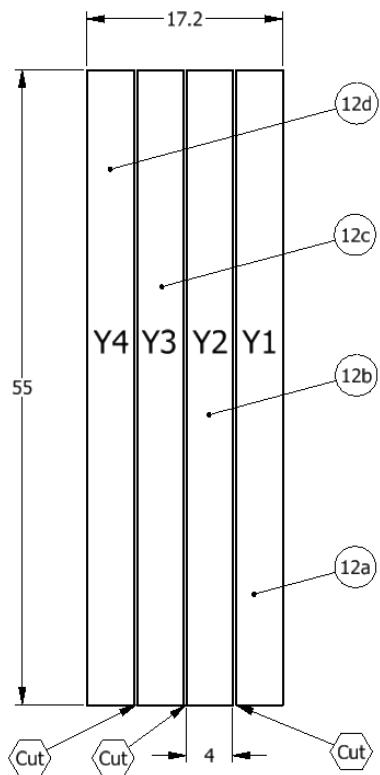
10 Begin with (already cut) 6b. Cut between 10a and 10b. 98.7 → Cut 10a = Part SC1 & Cut 10b = Part C



11 Begin with (already cut) 2b. Cut between 11a and 11b. 55 → Cut 11a = Part SC2

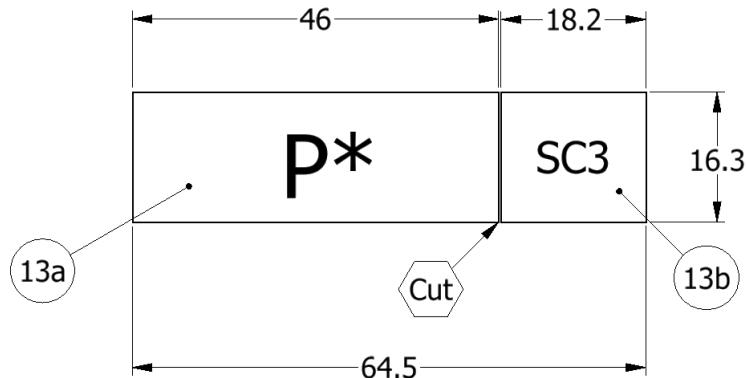


12 Continue with 11b. Cut each Y Part from 11b as shown. 4 ← Cut 12a=Y1, 12b=Y2, 12c=Y3, 12d=Y4

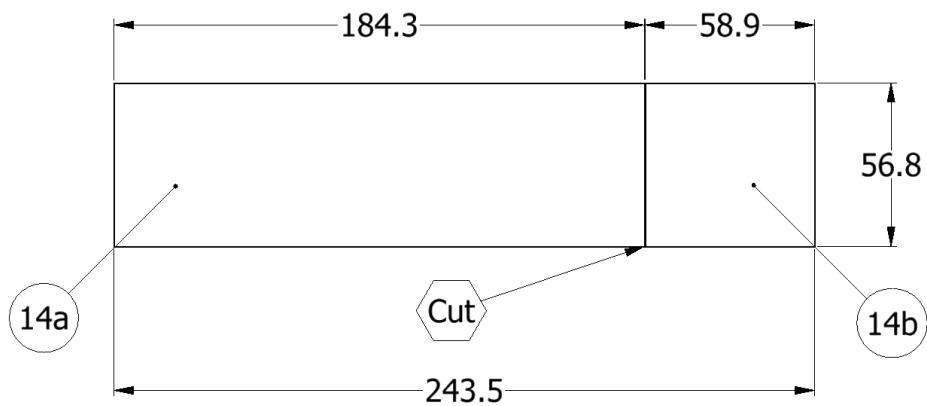


NOTE: ENSURE THE
BOARDS ARE EQUAL

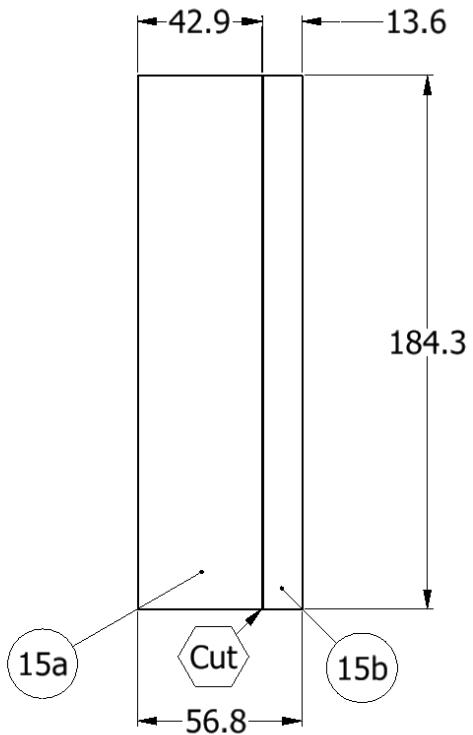
13 | Begin with (already cut) 3b. Cut between 13a and 13b. 46 → Cut 13a = Part P* & Cut 13b = Part SC3



14 | Begin with (already cut) 1b. Cut between 14a and 14b. 58.9 ← Set aside 14b



15 | Continue with 14a. Cut between 15a and 15b. 42.9 → Set aside 15b



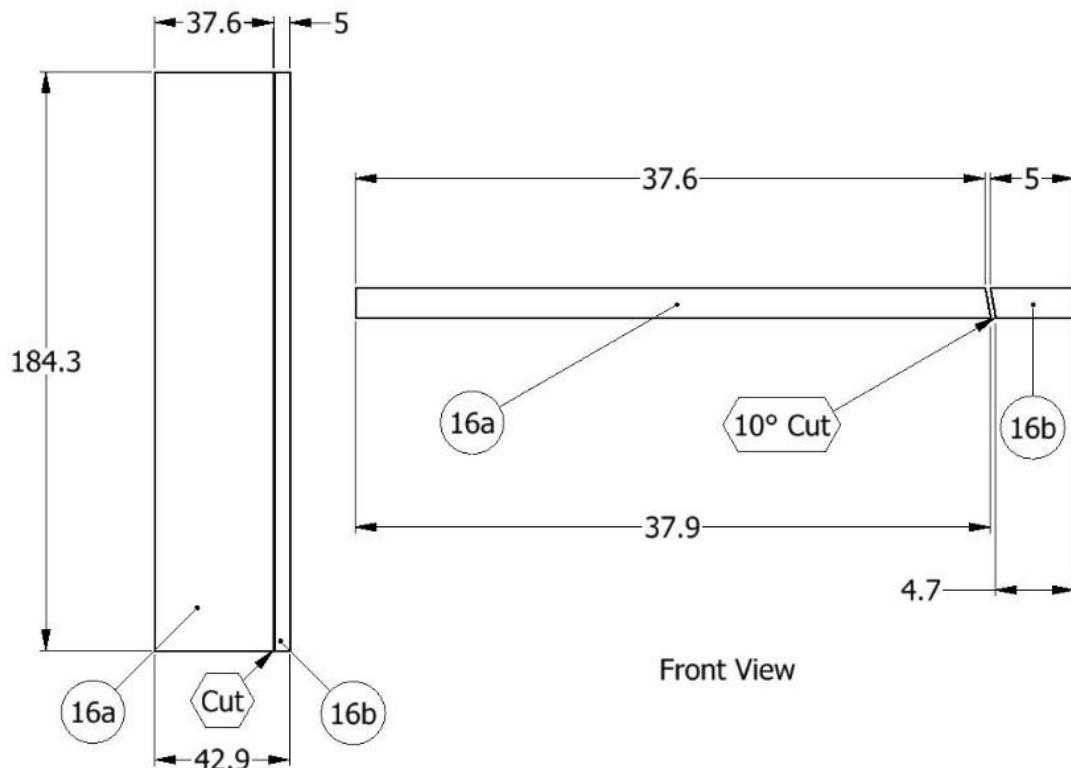
16

Continue with 15a. Cut between 16a and 16b.
THIS IS A 10° ANGLED CUT. SEE INSET FOR A DETAILED VIEW.

5



Set aside 16b*



Front View

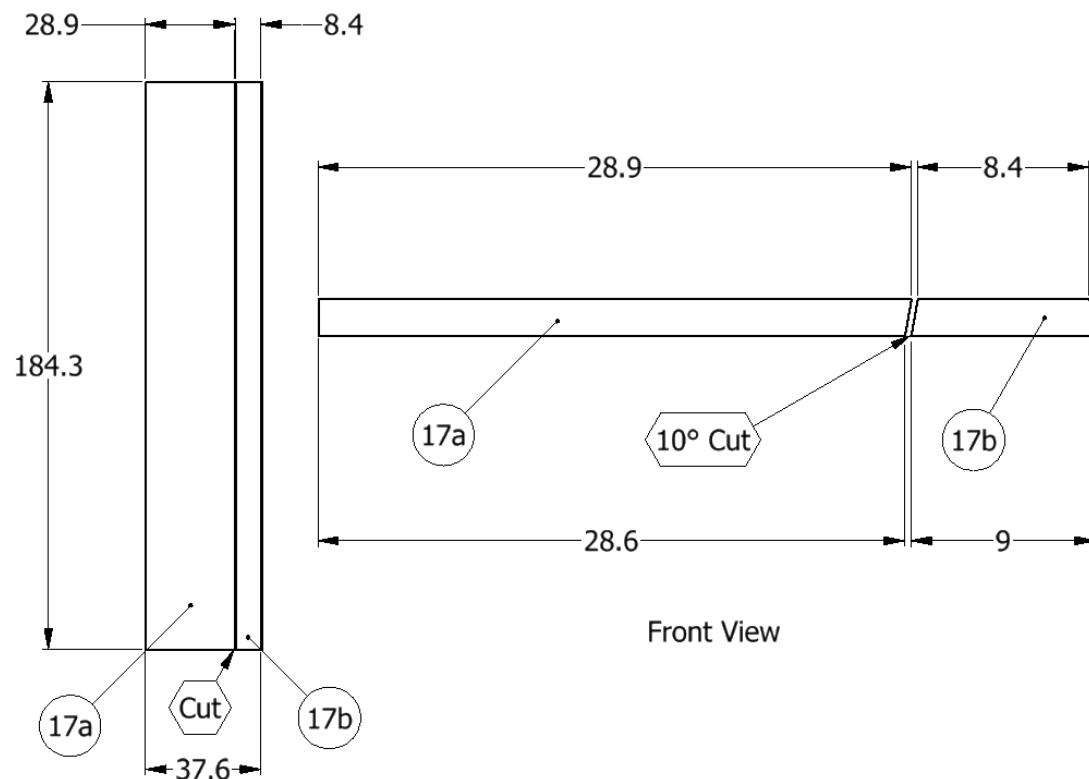
17

Continue with 16a. Cut between 17a and 17b.
THIS IS A 10° ANGLED CUT. SEE INSET FOR A DETAILED VIEW.

8.4



Set aside 17b*



Front View

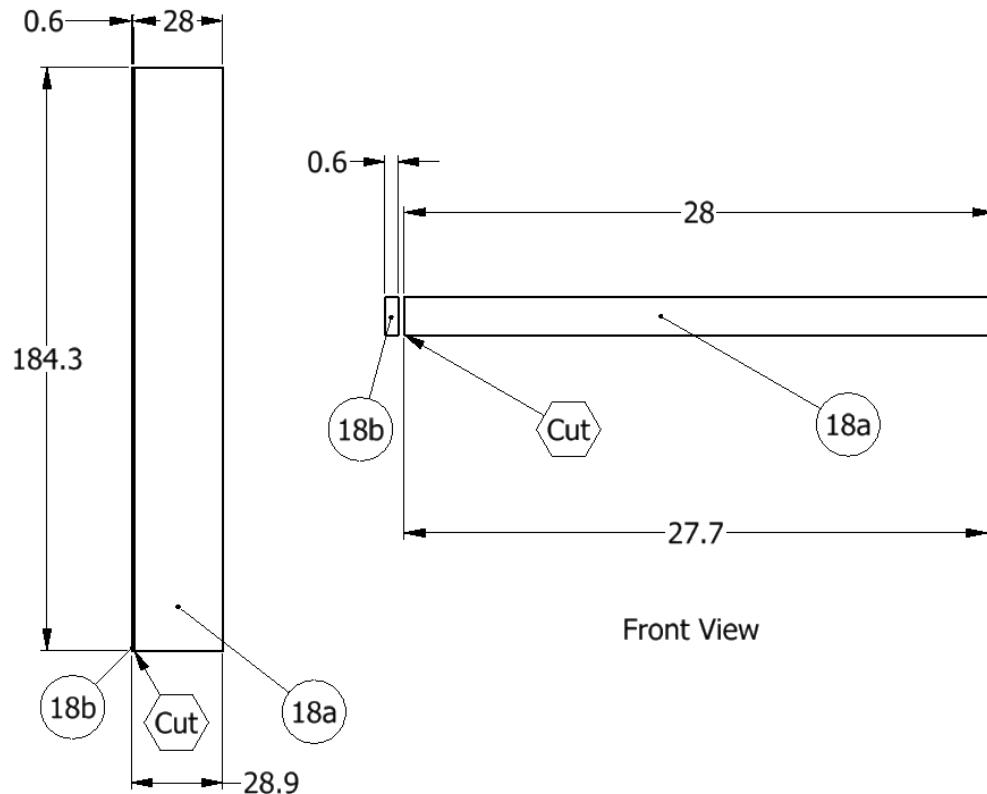
18

Continue with 17a. Cut between 18a and 18b.

28



Cut 18b = Garbage



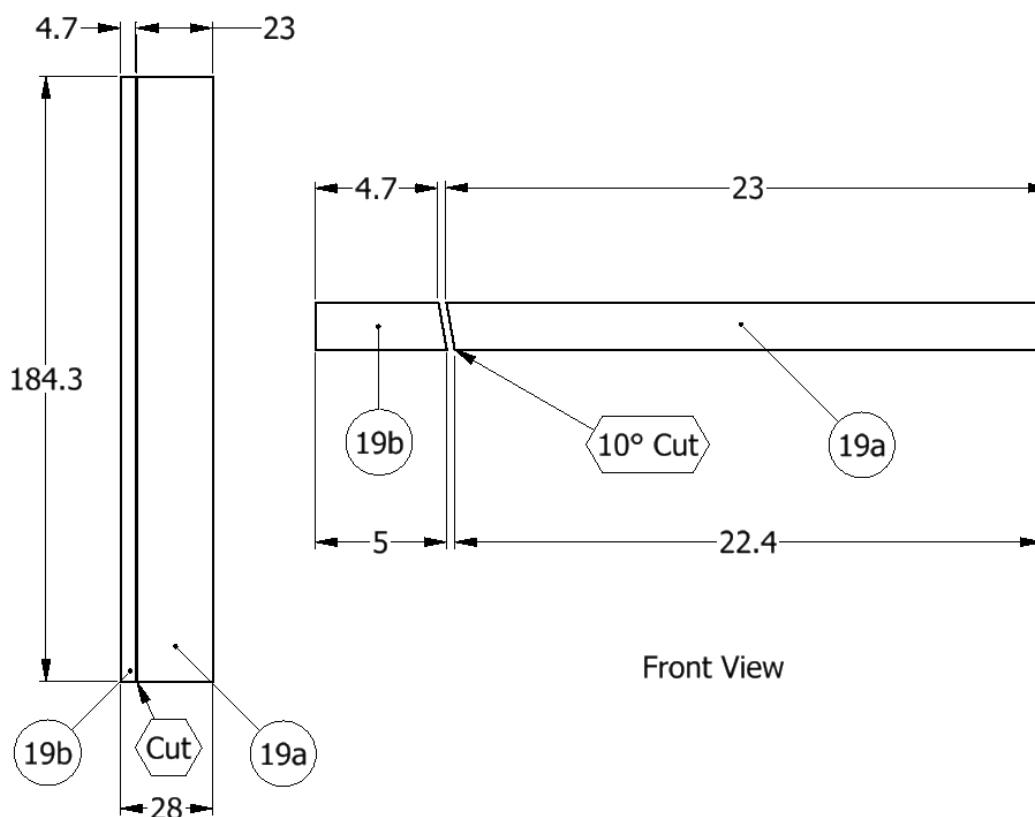
19

Continue with 18a. Cut between 19a and 19b.
THIS IS A 10° ANGLED CUT. SEE INSET FOR A DETAILED VIEW.

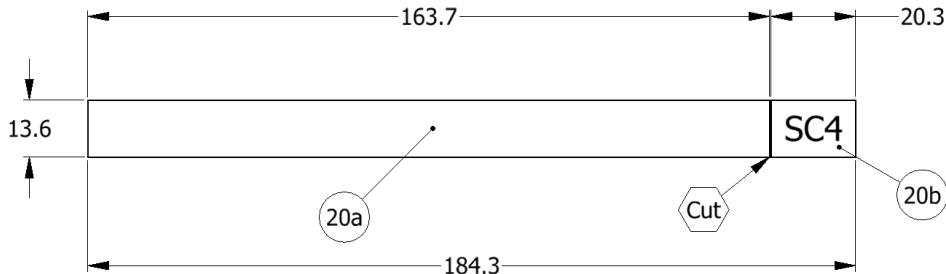
4.7



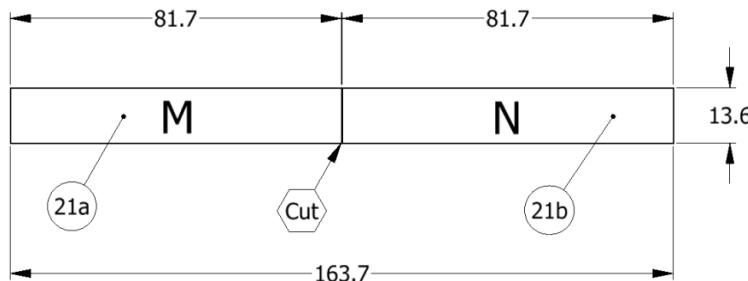
Set aside Cut 19a* & Cut 19b*



20 Begin with (already cut) 15b. Cut between 20a and 20b. 163.7 → Cut 20b = Part SC4

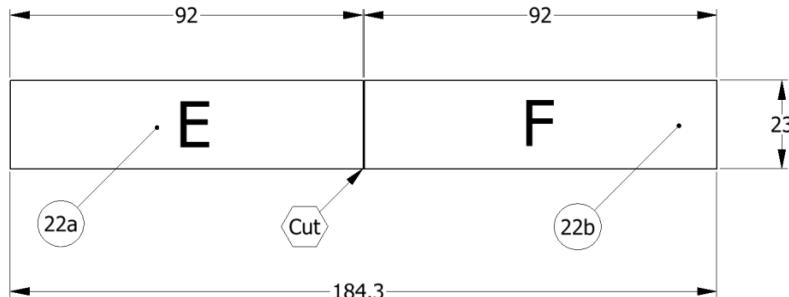


21 Continue with 20a. Cut between 21a and 21b. 81.7 ← Cut 21a = Part M & Cut 21b = Part N



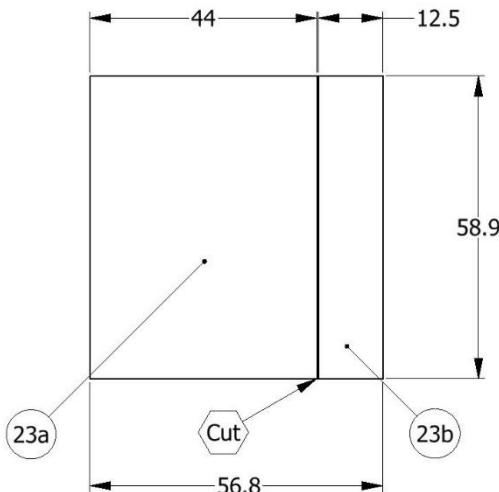
NOTE: ENSURE THE BOARDS ARE EQUAL

22 Begin with (already cut) 19a. Cut between 22a and 22b. 92 ← Cut 22a = Part E & Cut 22b = Part F



NOTE: ENSURE THE BOARDS ARE EQUAL

23 Begin with (already cut) 14b. Cut between 23a and 23b. 44 → Set aside 23a



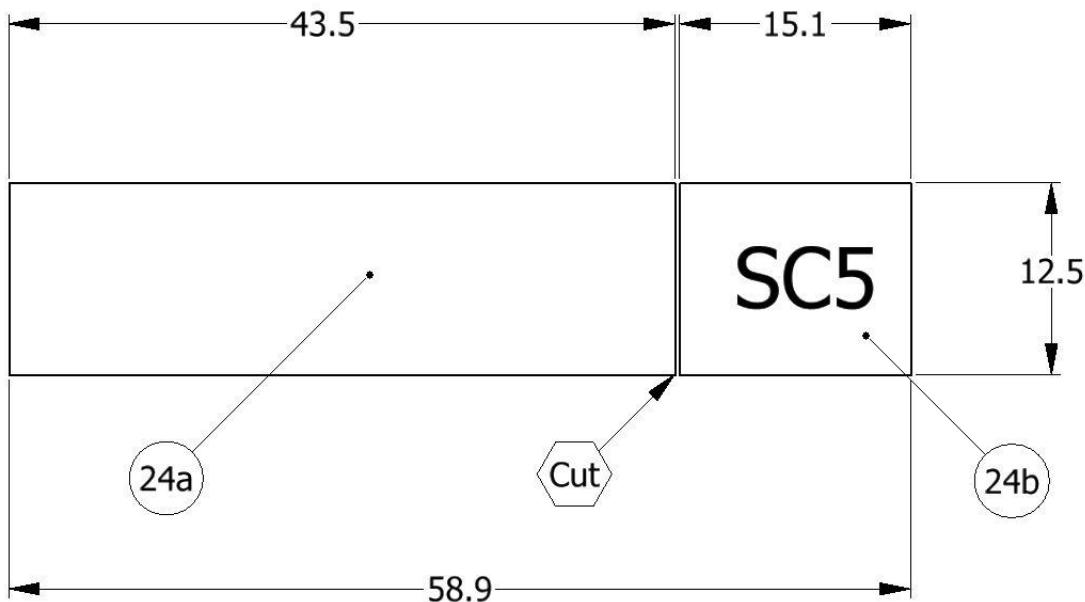
24

Continue with 23b. Cut between 24a and 24b.

43.5



Cut 24b = SC5



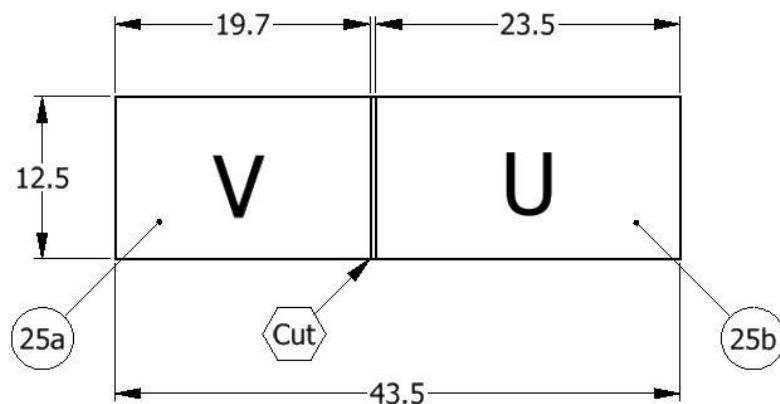
25

Continue with 24a. Cut between 25a and 25b.
THIS IS A 45° ANGLED CUT. SEE INSET FOR A DETAILED VIEW.

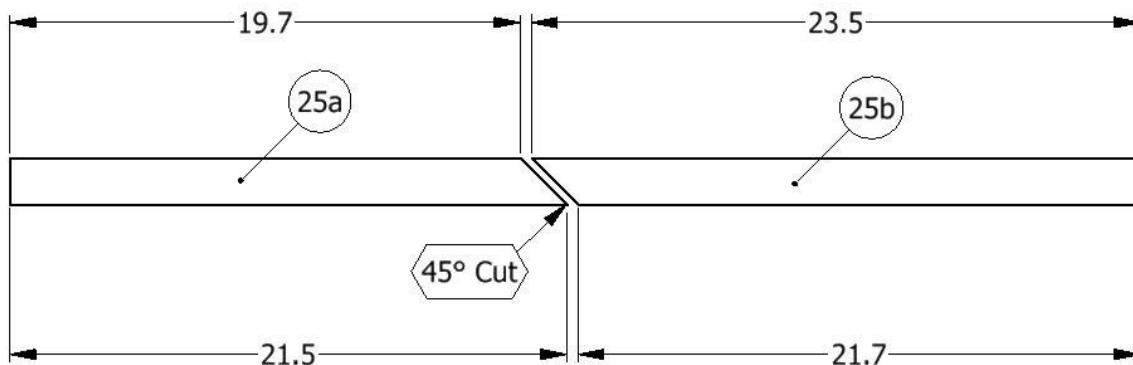
19.7



Cut 25a = Part V
Cut 25b = Part U

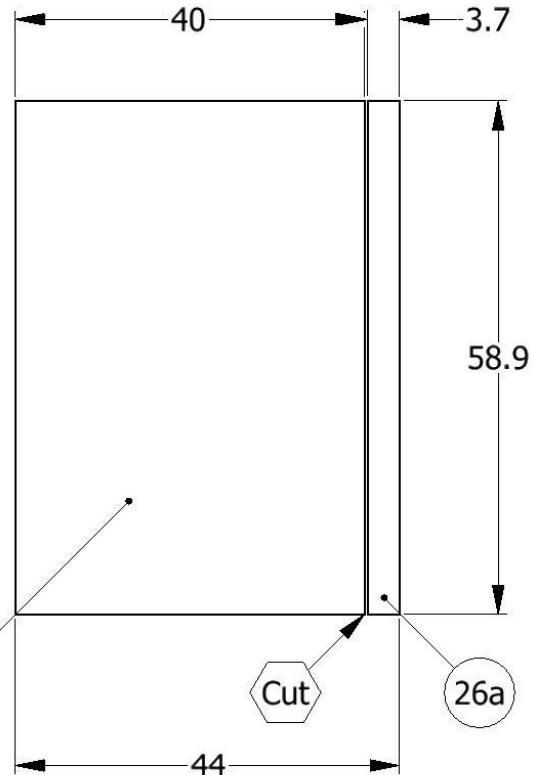


Top View

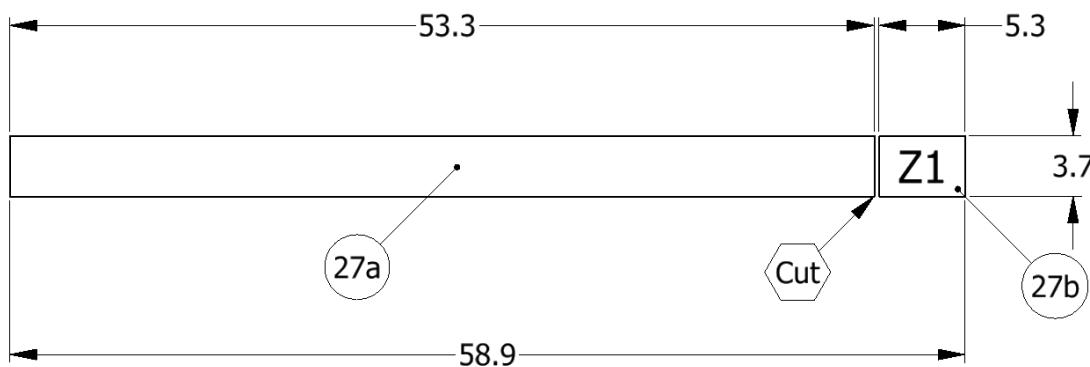


Side View

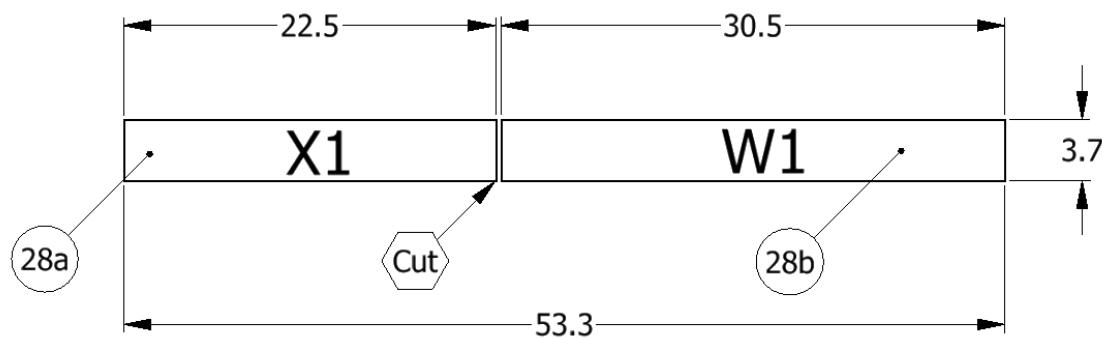
26	Begin with (already cut) 23a. Cut between 26a and 26b.	40	→	Set aside 26b
-----------	--	----	---	---------------



27	Continue with 26a. Cut between 27a and 27b.	53.3	→	Cut 27b = Part Z1
-----------	---	------	---	-------------------



28	Continue with 27a. Cut between 28a and 28b.	22.5	→	Cut 28a = Part X1 & Cut 28b = Part W1
-----------	---	------	---	---------------------------------------



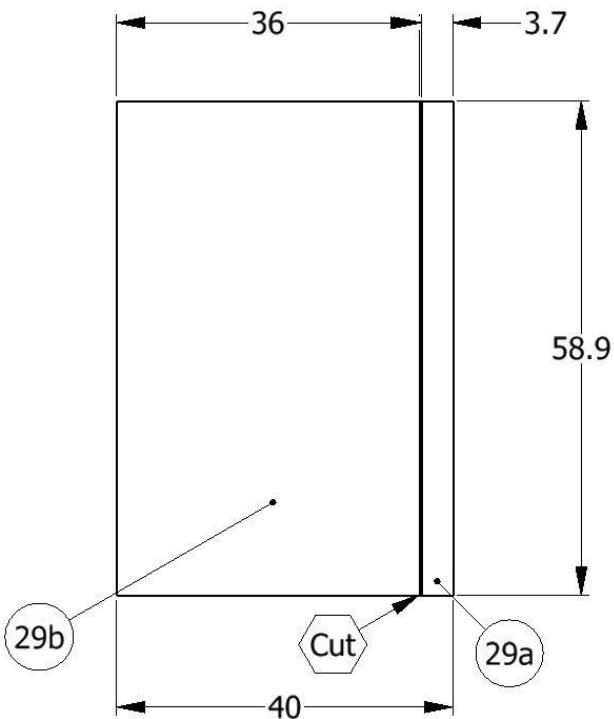
29

Continue with 26b. Cut between 29a and 29b.

36



Set aside 29b



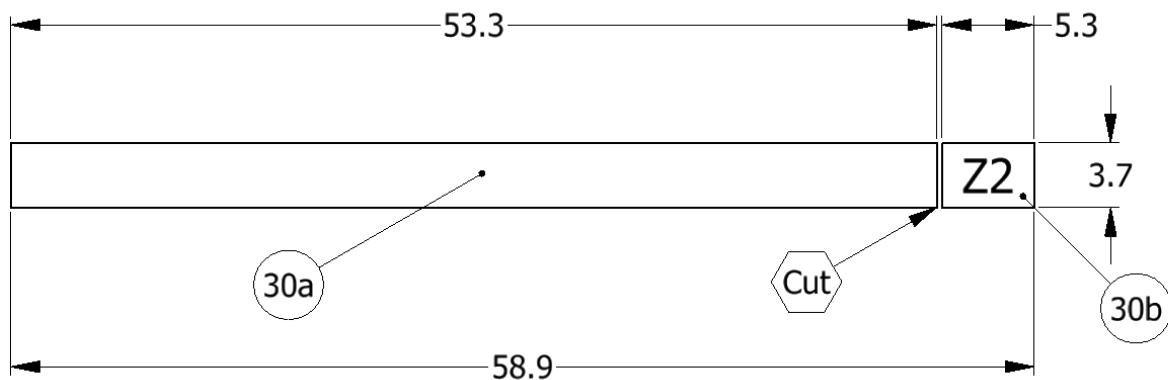
30

Continue with 29a. Cut between 30a and 30b.

53.3



Cut 30b = Part Z2



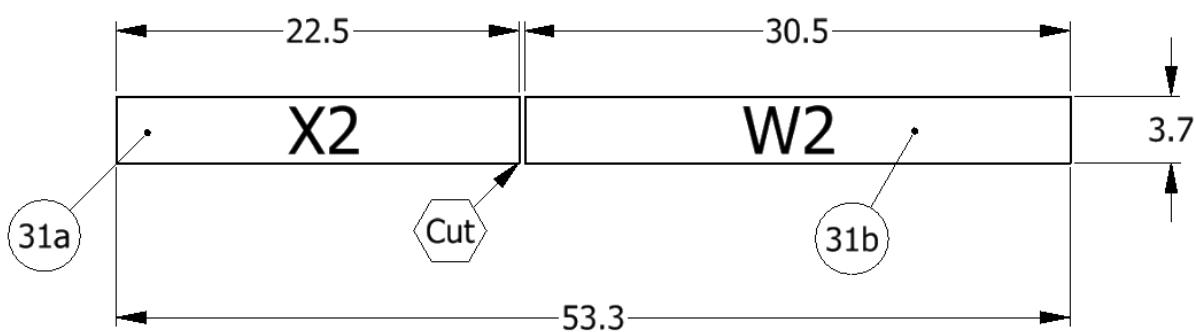
31

Continue with 30a. Cut between 31a and 31b.

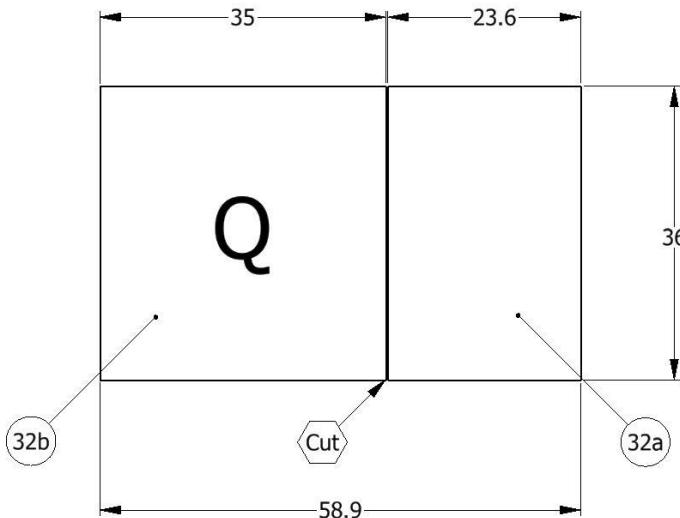
22.5



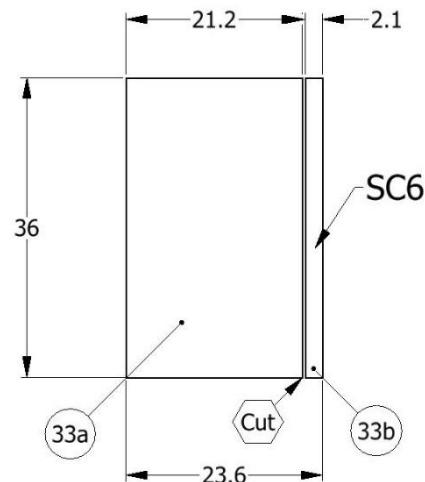
Cut 31a = Part X2 & Cut 31b = Part W2



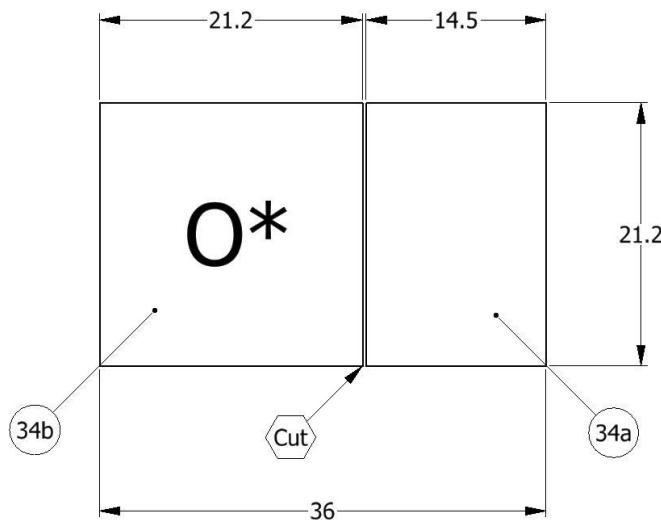
32	Begin with (already cut) 29b. Cut between 32a and 32b.	35	→	Cut 32b = Part Q
----	--	----	---	------------------



33	Continue with 32a. Cut between 33a and 33b.	21.2	→	Cut 33b = Part SC6
----	---	------	---	--------------------



34	Continue with 33a. Cut between 34a and 34b.	21.2	→	Cut 34b = Part O*
----	---	------	---	-------------------



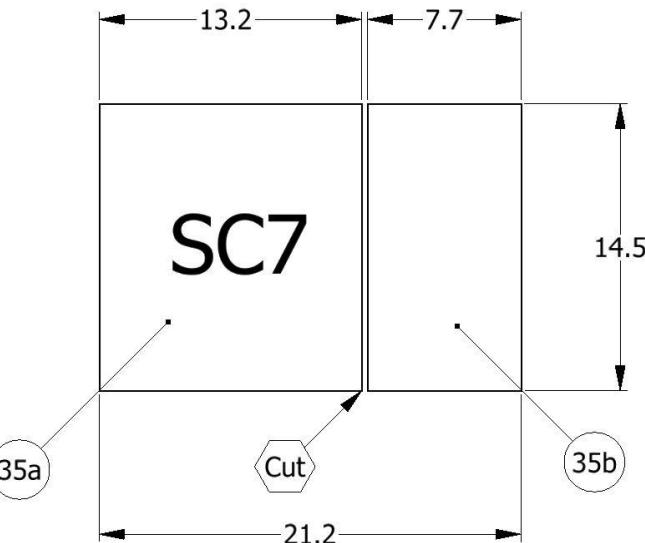
35

Continue with 34a. Cut between 35a and 35b.

7.7



Cut 35a = Part SC7



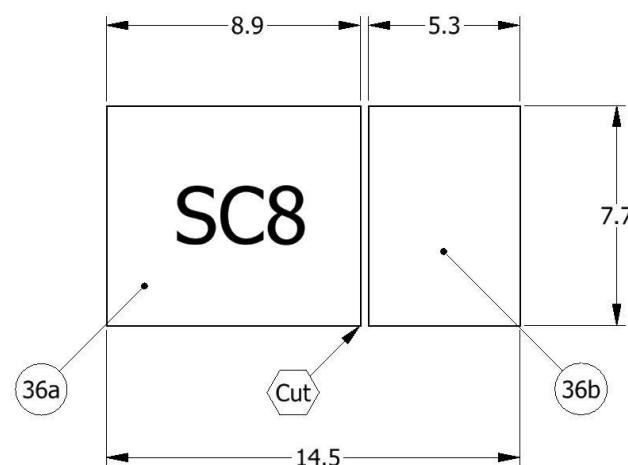
36

Continue with 35b. Cut between 36a and 36b.

5.3



Cut 36a = Part SC8



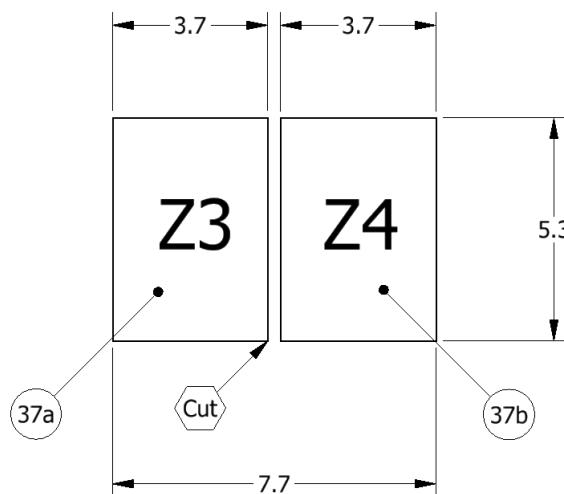
37

Continue with 36b. Cut between 37a and 37b.

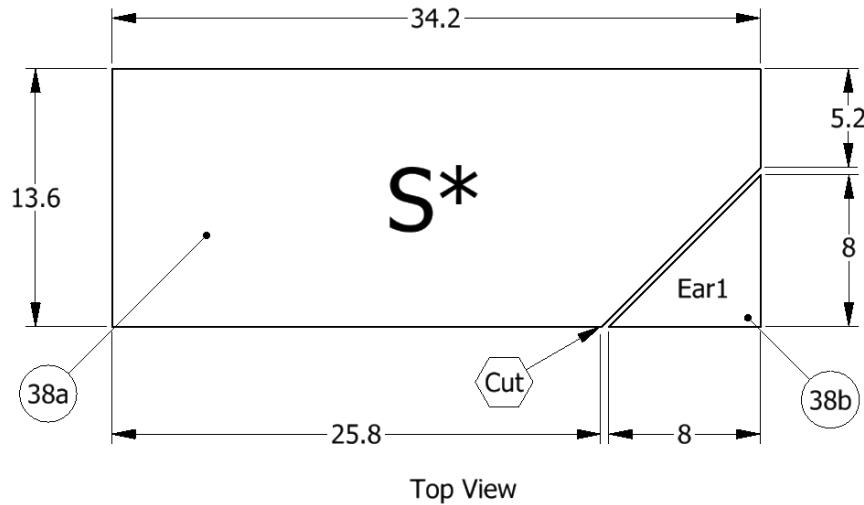
3.7



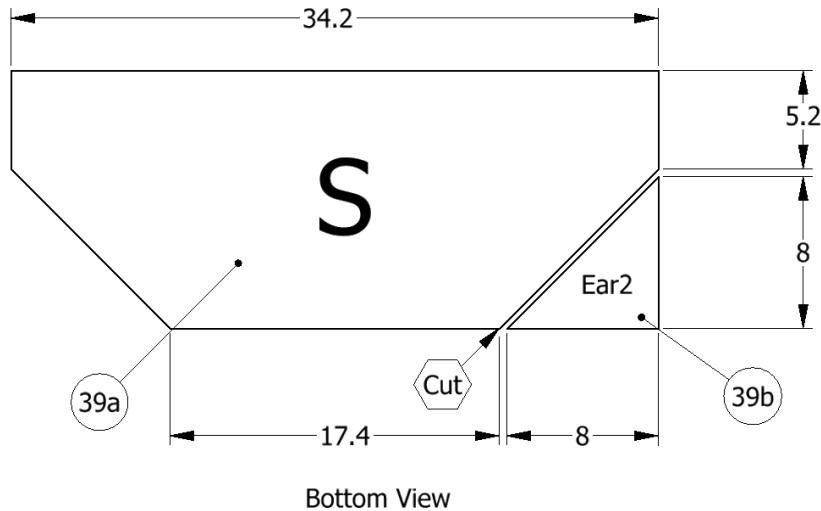
Cut 37a = Part Z3 & Cut 37b = Part Z4



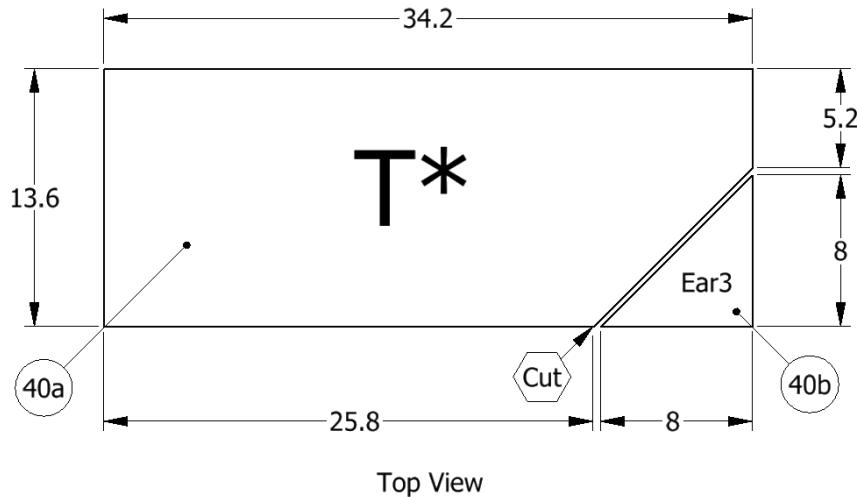
38 Begin with Part S*. Cut between 38a and 38b. 8, 5.2 ←, ↓ Cut 38a = Part S* & Cut 38b = Ear1



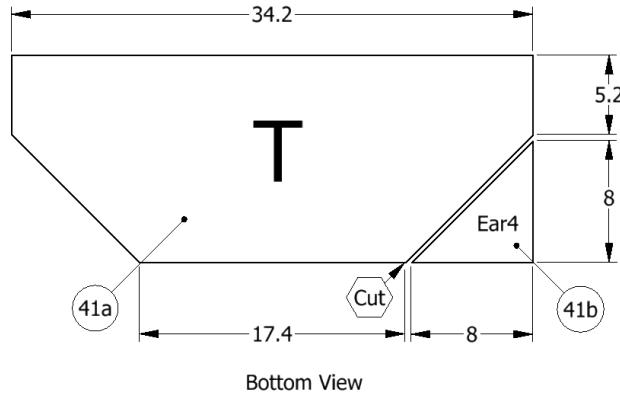
39 Continue with Part S*. Cut between 39a and 39b. 8, 5.2 ←, ↓ Cut 39a = Part S & Cut 39b = Ear2



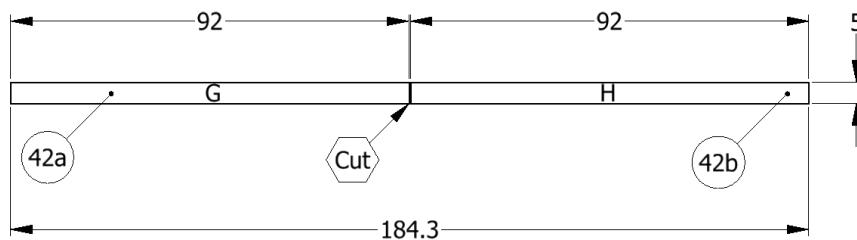
40 Begin with Part T*. Cut between 40a and 40b. 8, 5.2 ←, ↓ Cut 40a = Part T* & Cut 40b = Ear3



41 | Continue with Part T*. Cut between 41a and 41b. 8, 5.2 ← Cut 41a = Part T & Cut 41b = Ear 4

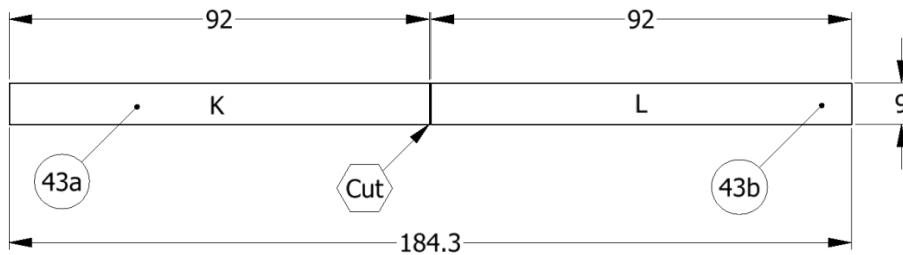


42 | Begin with (already cut) 16b. Cut between 42a and 42b. 92 → Cut 42a = Part G & Cut 42b = Part H



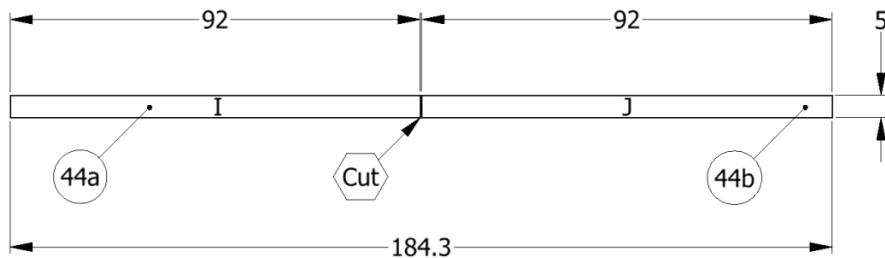
NOTE: ENSURE THE
BOARDS ARE EQUAL

43 | Begin with (already cut) 17b. Cut between 43a and 43b. 92 → Cut 43a = Part K & Cut 43b = Part L



NOTE: ENSURE THE
BOARDS ARE EQUAL

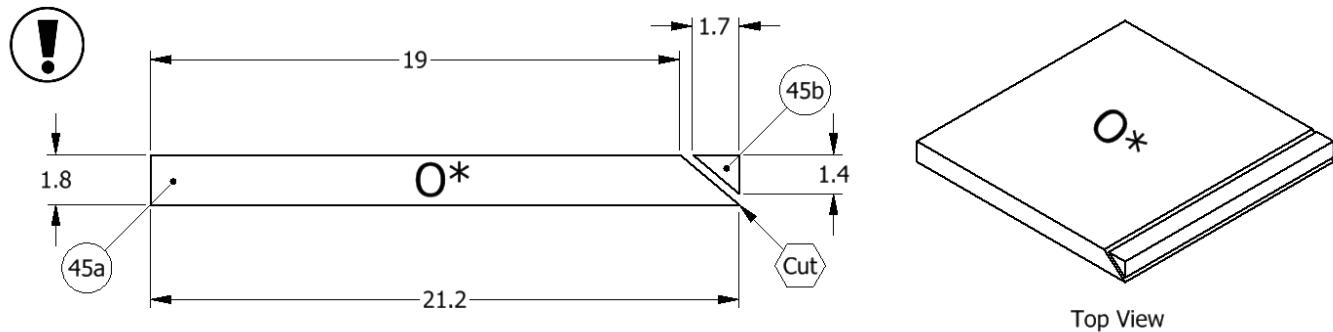
44 | Begin with (already cut) 19b. Cut between 44a and 44b. 92 → Cut 44a = Part I & Cut 44b = Part J



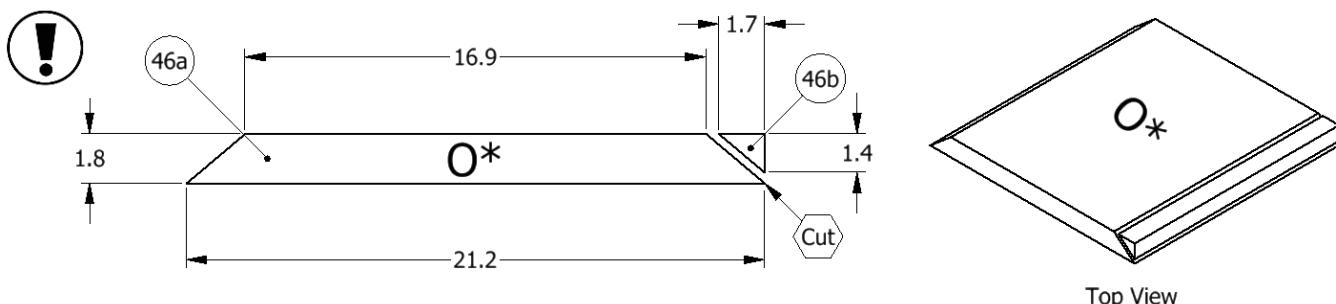
NOTE: ENSURE THE
BOARDS ARE EQUAL

NOTE: PARTS G, H, I, J, K & L SHOULD ALL BE 92 cm IN LENGTH!

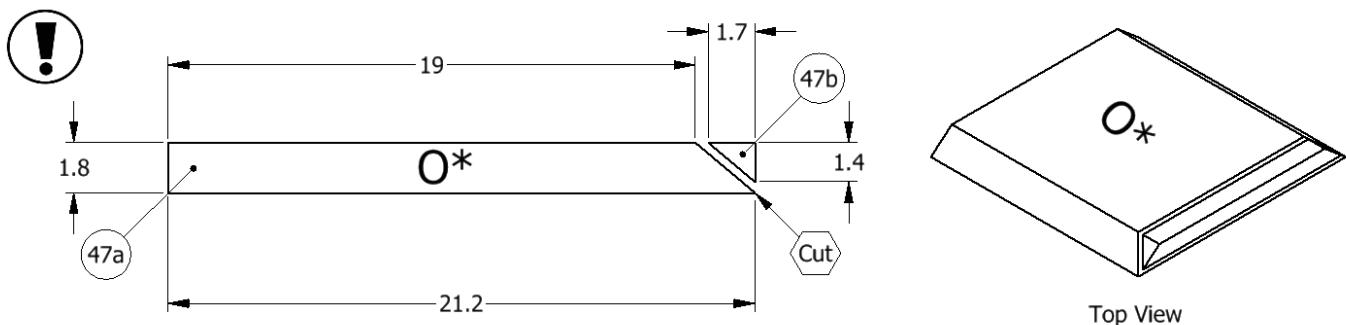
45	Begin with (already cut) O*. Cut between 45a and 45b. THIS IS A 40° ANGLED CUT. SEE INSET FOR A DETAILED VIEW.	19	→	Cut 45a = Part O* Cut 45b = Garbage
----	--	----	---	--



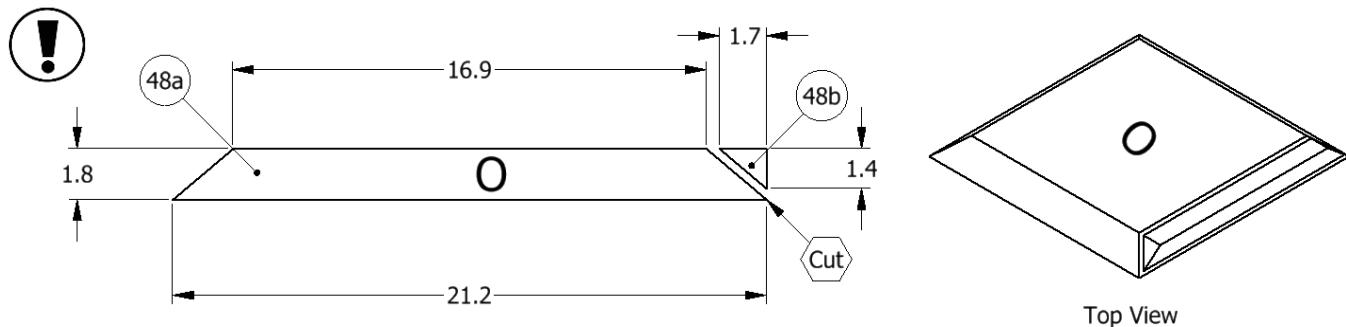
46	Continue with Part O*. Cut between 46a and 46b. THIS IS A 40° ANGLED CUT. SEE INSET FOR A DETAILED VIEW.	16.9	→	Cut 46a = Part O* Cut 46b = Garbage
----	--	------	---	--



47	Continue with Part O*. Cut between 47a and 47b. THIS IS A 40° ANGLED CUT. SEE INSET FOR A DETAILED VIEW.	19	→	Cut 47a = Part O* Cut 47b = Garbage
----	--	----	---	--



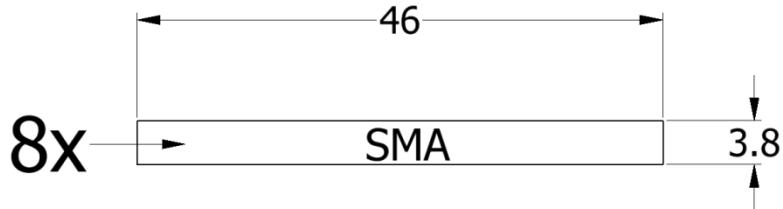
48	Continue with Part O*. Cut between 48a and 48b. THIS IS A 40° ANGLED CUT. SEE INSET FOR A DETAILED VIEW.	16.9	→	Cut 48a = Part O Cut 48b = Garbage
----	--	------	---	---------------------------------------



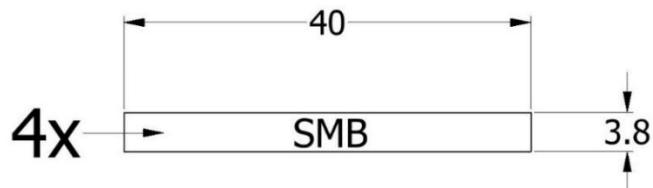
NOTE: THIS COMPLETES THE PRIMARY CUTS.

SECTION II: Cutting the Support Material (SM)

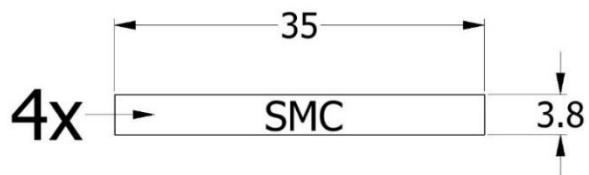
(8) Support Material A or SMA: 3.8 x 3.8 x 46



(4) Support Material B or SMB: 3.8 x 3.8 x 40



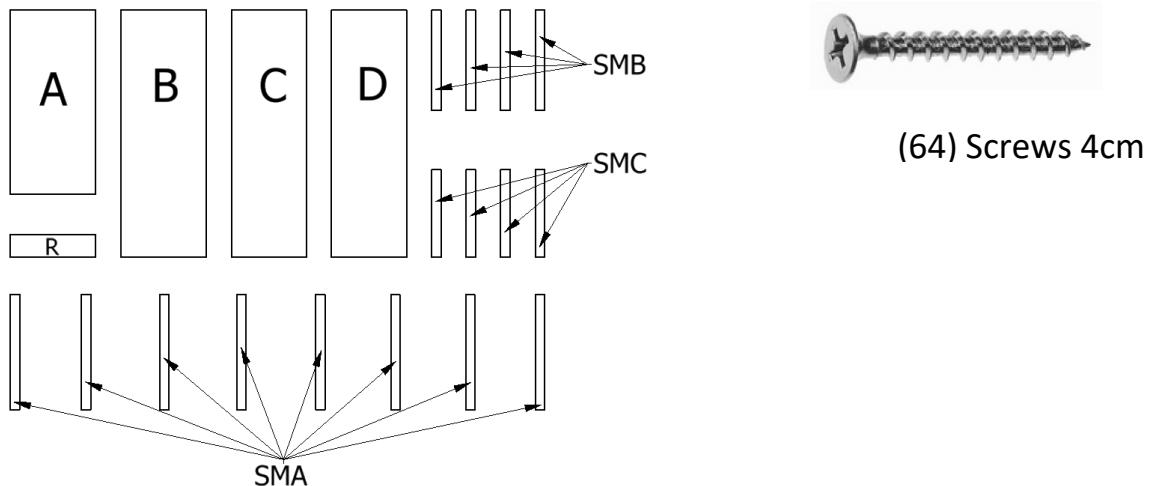
(4) Support Material C or SMC: 3.8 x 3.8 x 35



NOTE: THIS COMPLETES THE SUPPORT CUT SECTION.

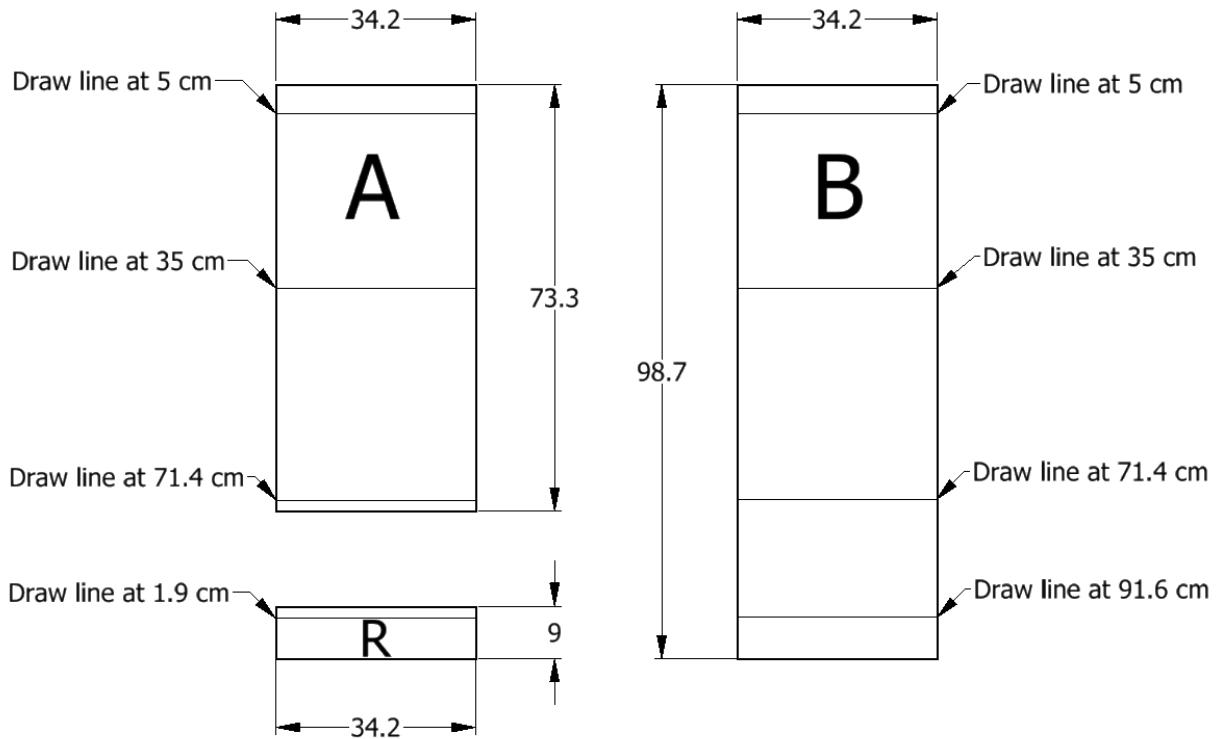
SECTION III: Support Construction (CN)

CN0	Gather the materials shown.	A, R, B, C, D, SMA, SMB, SMC, (64) 4 cm screws
-----	-----------------------------	--

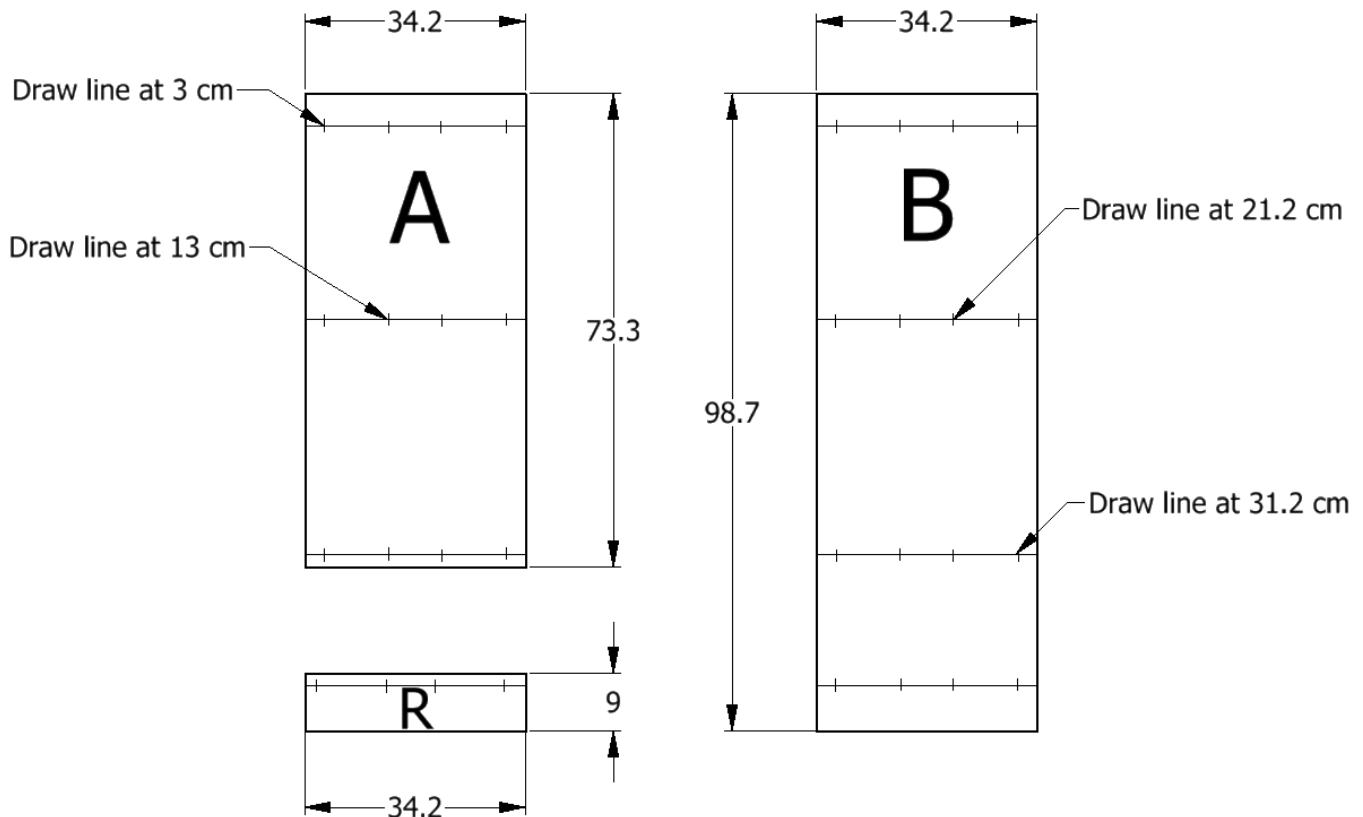


(64) Screws 4cm

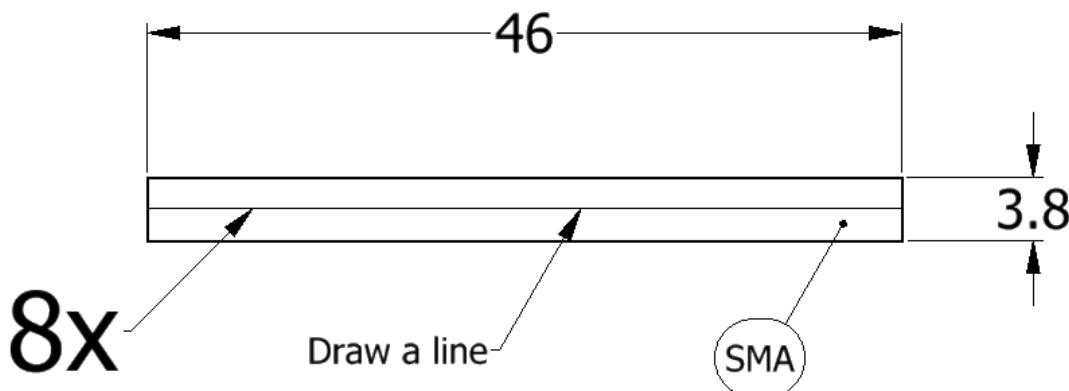
CN1	Begin with Part A, Part B & Part R. Place FACE DOWN. Draw the following lines with a pencil.	1.9, 5, 35, 71.4, 91.6	↓	Part A, Part B, Part R
-----	---	---------------------------	---	---------------------------



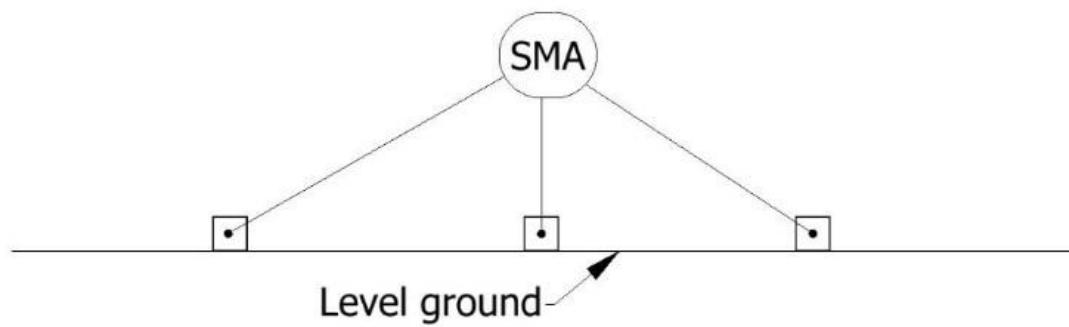
CN2	Continue with Part A, Part B & Part R. Draw the following crossing lines with a pencil. Repeat for each line and Part.	3, 13, 21.2, 31.2	→	Part A, Part B, Part R
-----	---	----------------------	---	---------------------------



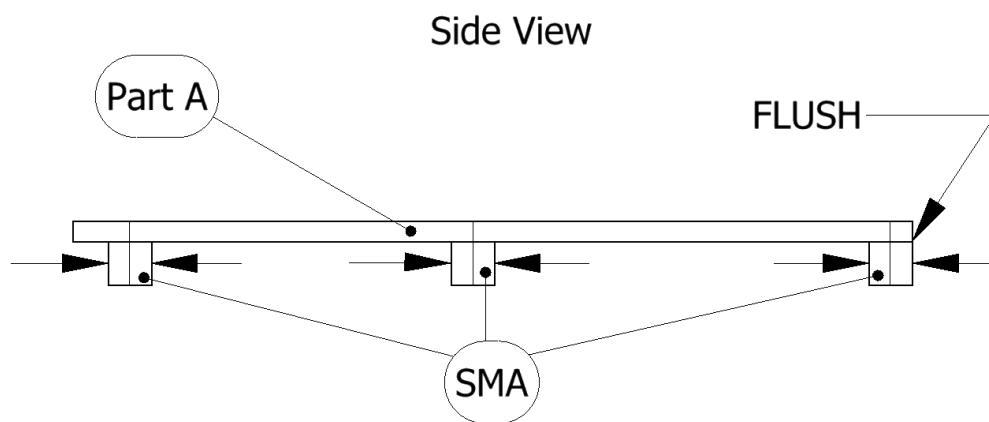
CN3	Gather the (8) Support Material A (SMA) pieces. Draw the following line with a pencil, carrying onto sides.	Centerline 1.9	→	SMA
-----	--	-------------------	---	-----



CN4	Lay three (3) SMA pieces on a level surface.			SMA
-----	--	--	--	-----

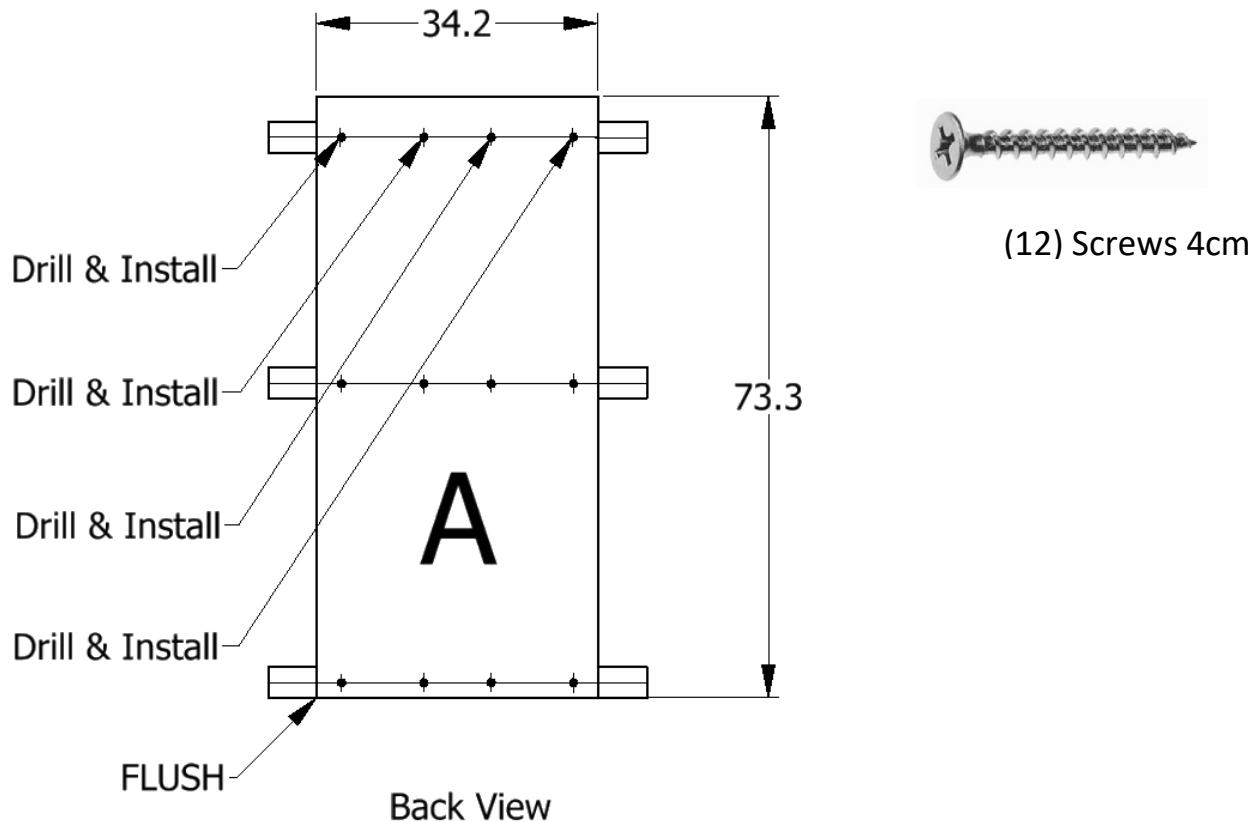


CN5	Place Part A on top of the SMA boards FACE DOWN, then align marks.			Part A, SMA
-----	--	--	--	-------------

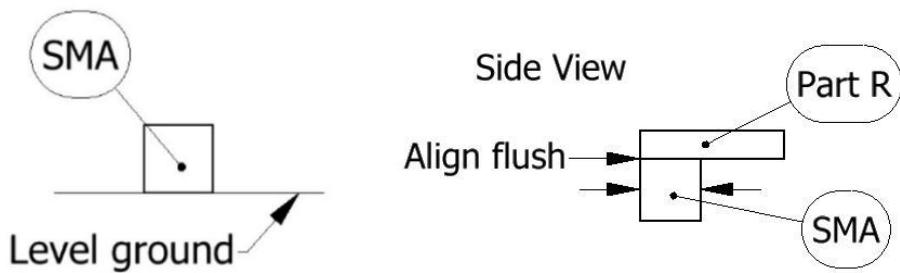


Move supports until marks line up.

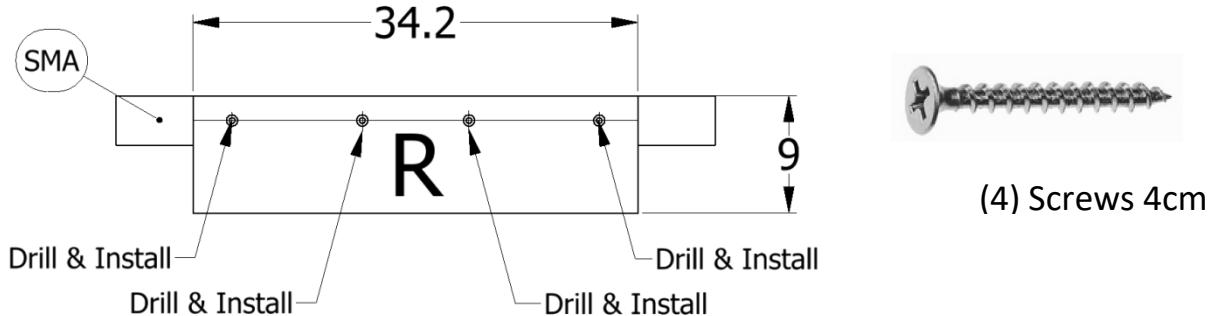
CN6	Drill pilot holes on top of marks (crossed lines). Repeat for each row. Then install (12) 4 cm screws.	3, 13, 21.2, 31.2	→	Part A, SMA, 12 Screws
-----	---	-------------------	---	---------------------------



CN7	Lay one (1) SMA piece on a level surface. Then, place Part R on top of the SMA board FACE DOWN, then align flush.	SMA, Part R
-----	---	-------------



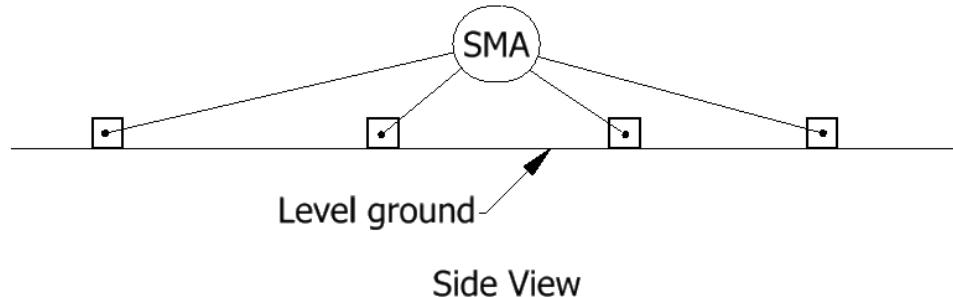
CN8	Drill pilot holes on top of marks (crossed lines). Then install (4) 4 cm screws.	3, 13, 21.2, 31.2	→	Part R, SMA, 4 Screws
-----	---	-------------------	---	--------------------------



CN9

Lay four (4) SMA pieces on a level surface.

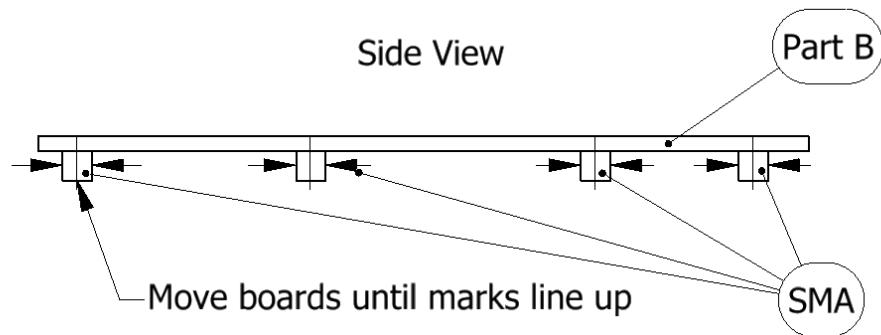
SMA



CN10

Place Part B on top of the SMA boards FACE DOWN, then align marks.

Part B, SMA

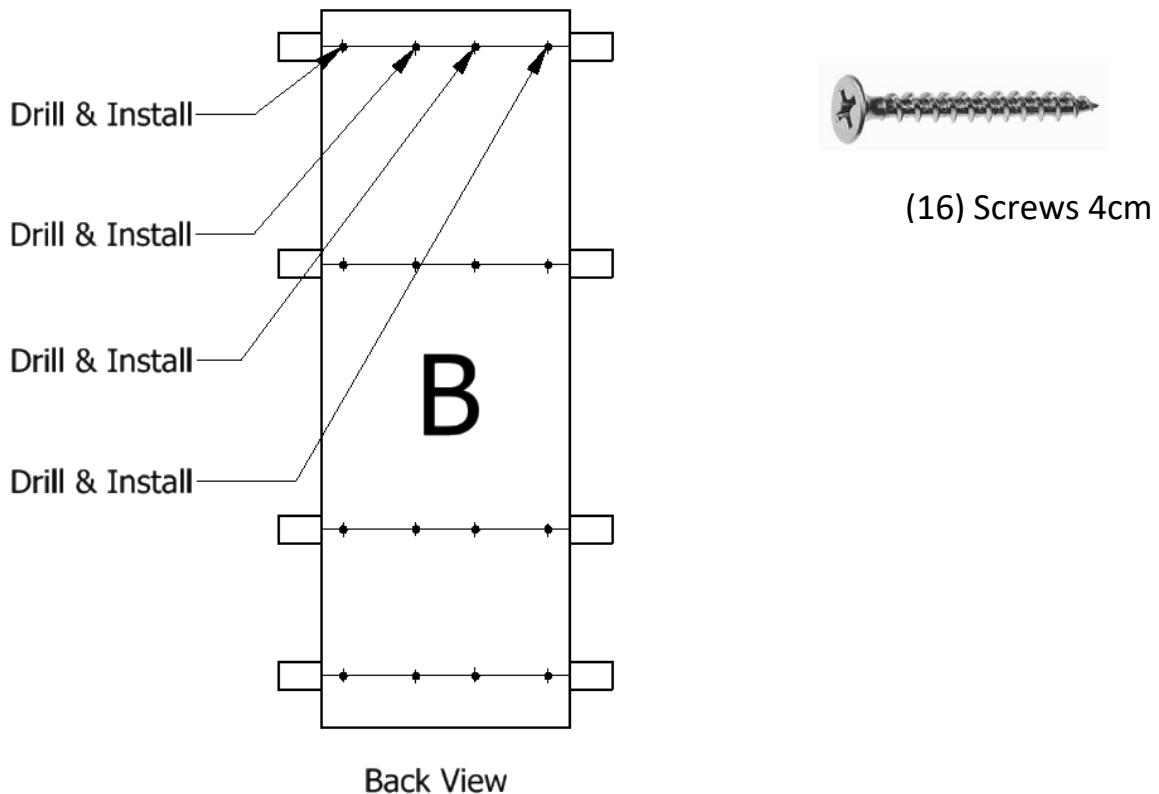


CN11

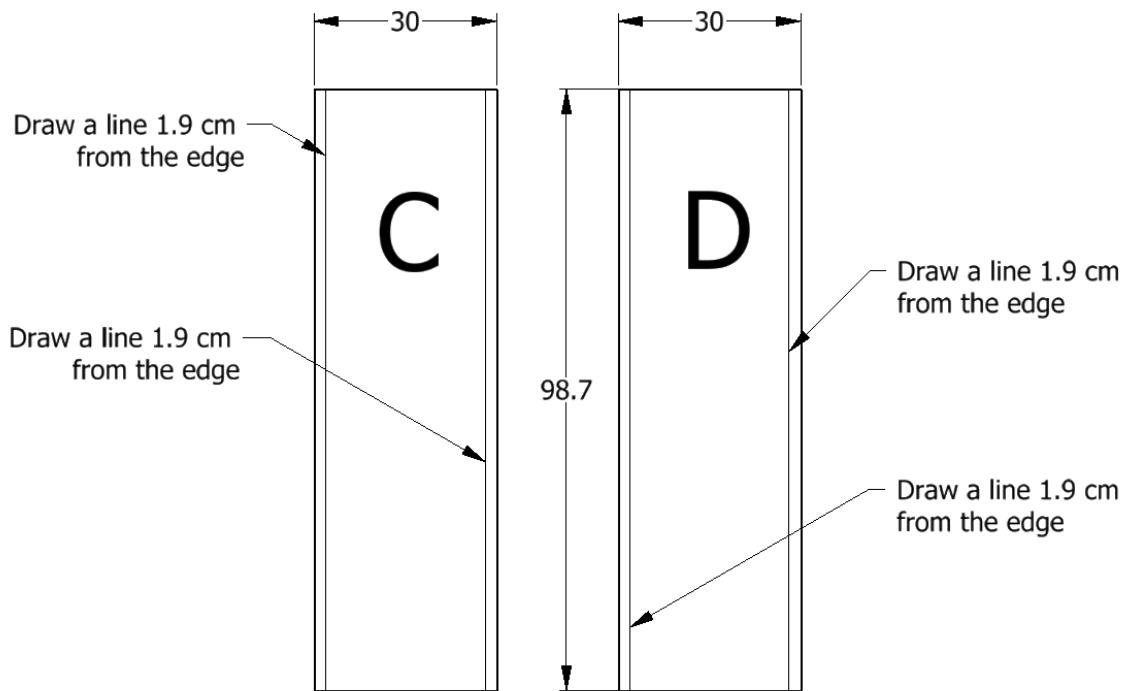
Drill pilot holes on top of marks (crossed lines).

Repeat for each row. Then install (16) 4cm screws.

3, 13, 21.2, 31.2

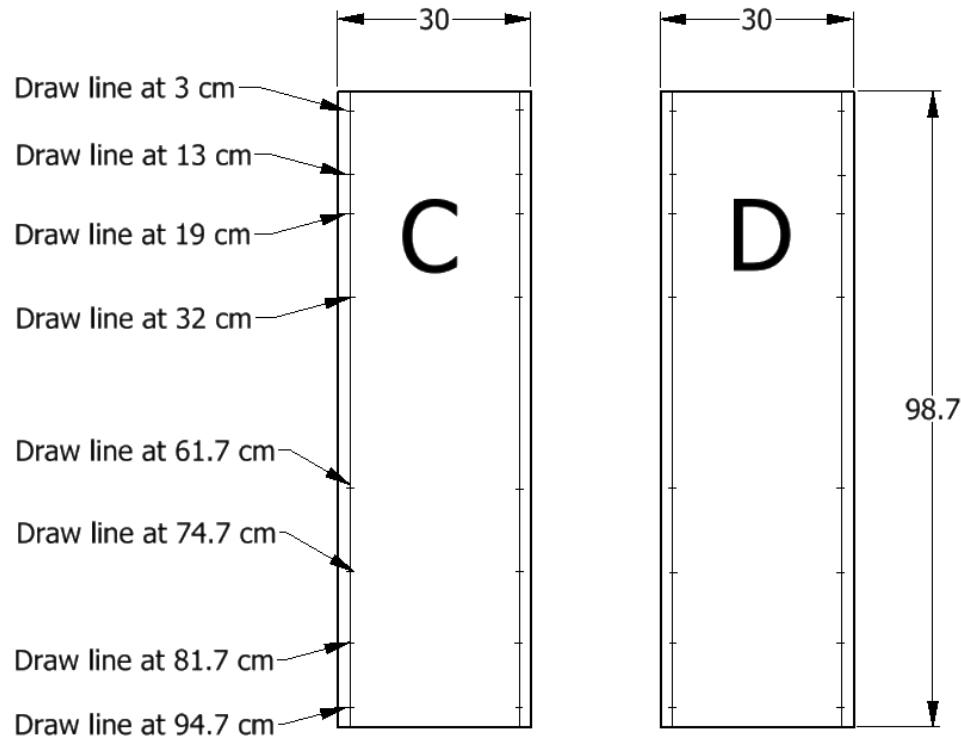
Part B, SMA,
16 Screws

CN12	Begin with Part C & Part D. Place FACE DOWN. Draw the following lines with a pencil.	1.9	← & →	Part C Part D
------	---	-----	-------	------------------



Back View

CN13	Continue with Part C & Part D. Draw the following crossing lines with a pencil. Repeat on other side. Repeat lines on Part D.	3, 13, 19, 32, 61.7, 74.7, 81.7, 94.7	↓	Part C Part D
------	--	--	---	------------------

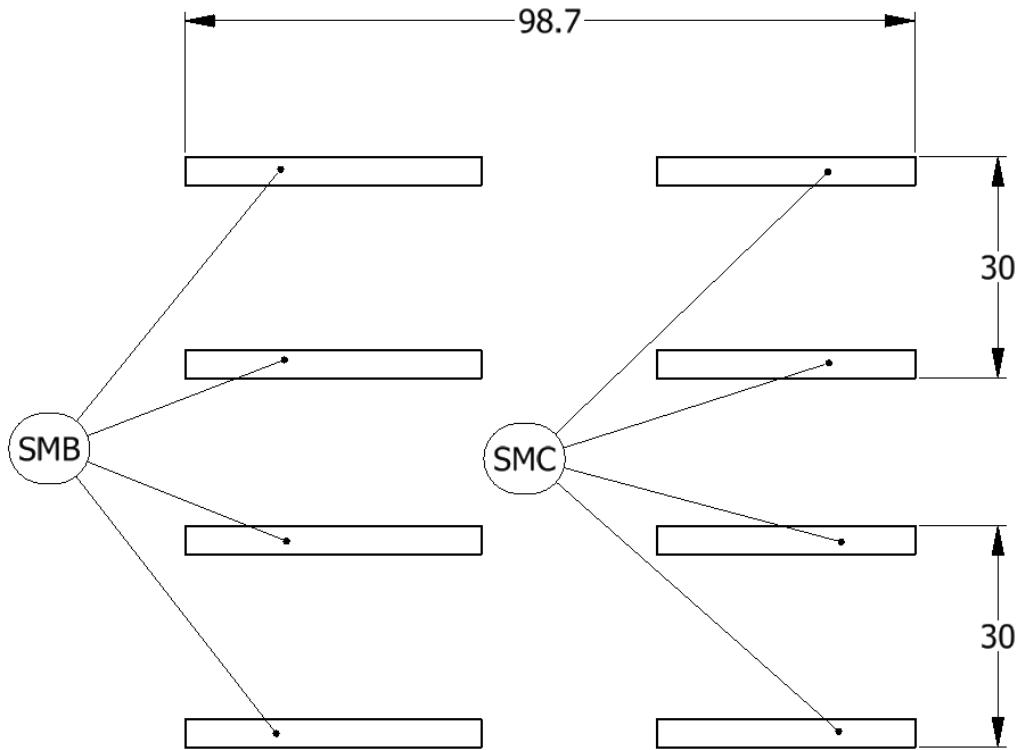


Back View

CN14

Lay four (4) SMB pieces and four (4) SMC pieces on a level surface.

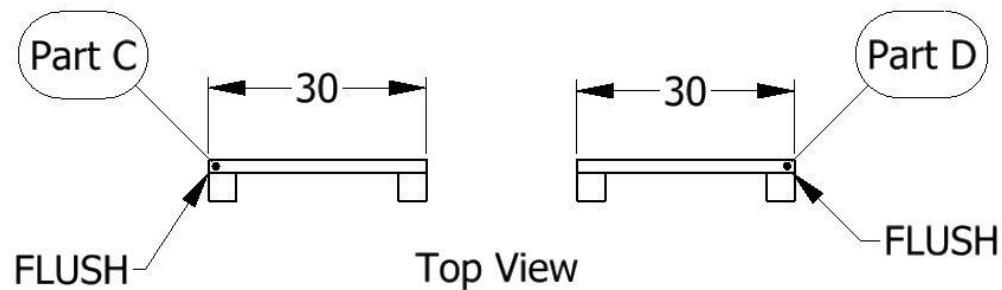
SMB, SMC



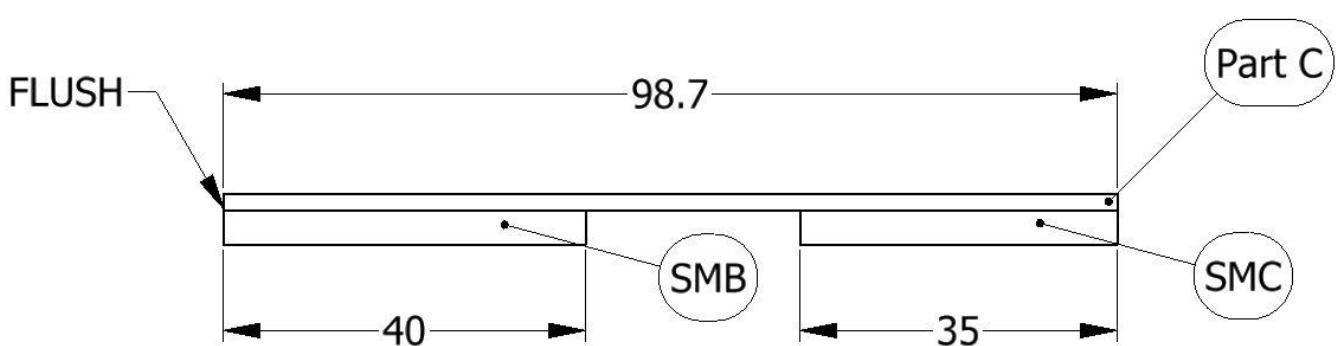
Top View

CN15

Place Part C on top of the SMB and SMC pieces FACE DOWN, then align them flush to the outer edges of the board (as shown). Repeat this action for Part D.

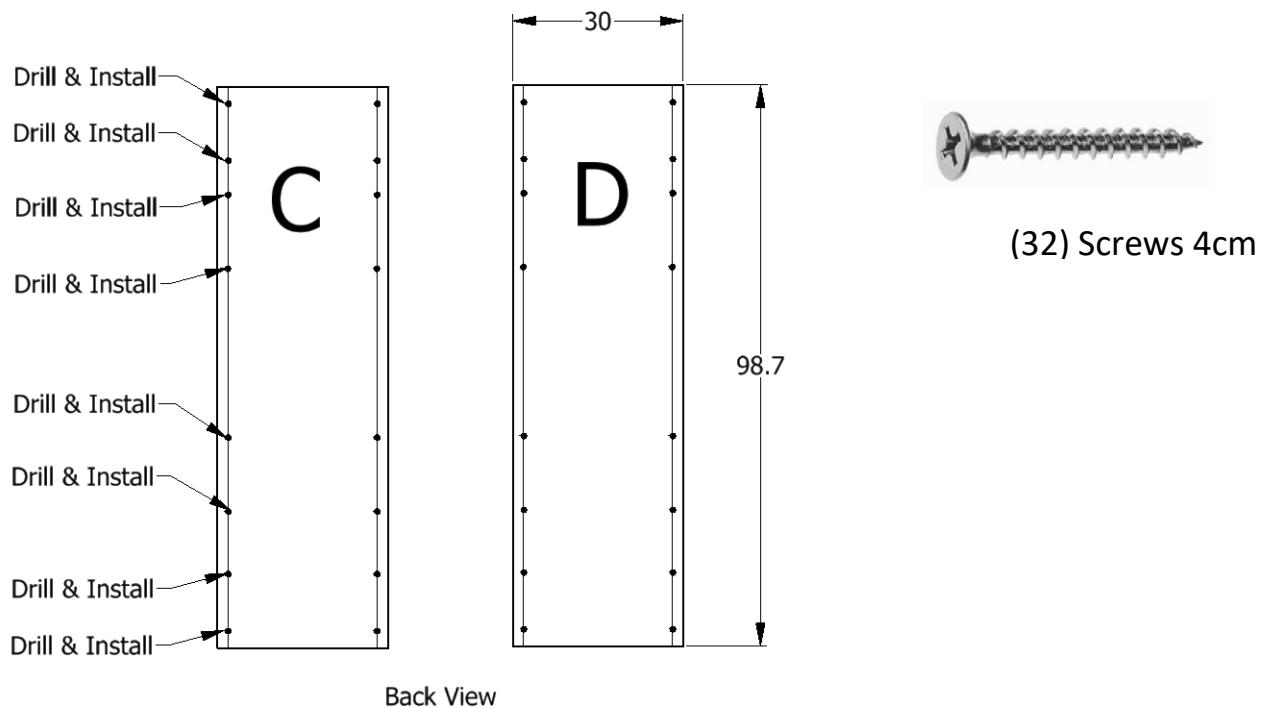
Part C, Part D,
SMB, SMC

Top View



Side View (Right)

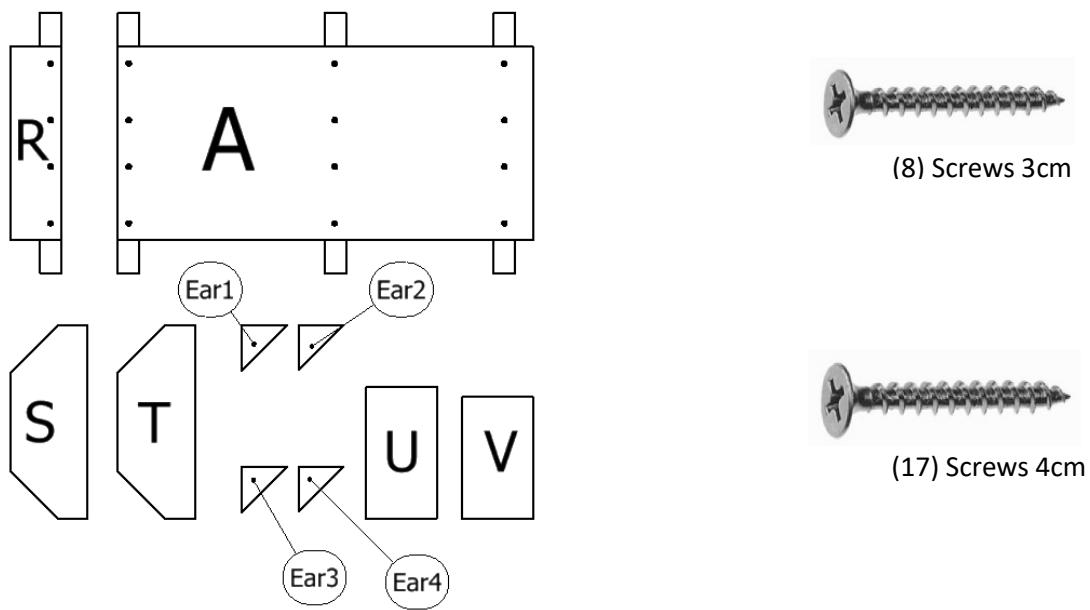
CN16	Continue with Part C & Part D. Drill pilot holes on top of marks. Then install (32) 4cm screws.	3, 13, 19, 32, 61.7, 74.7, 81.7, 94.7	↓	Part C, Part D, SMB, SMC, 32 Screws
------	---	--	---	--



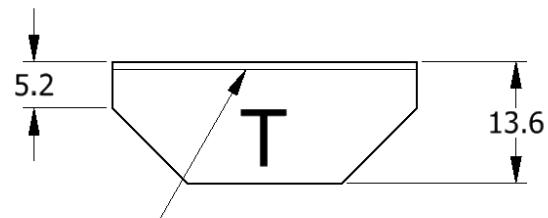
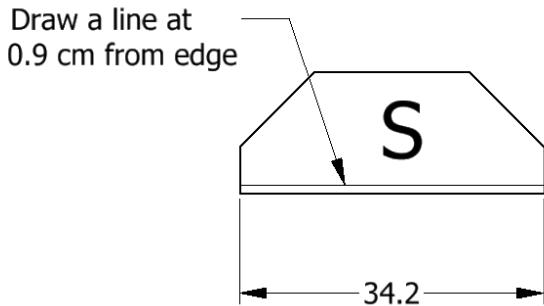
NOTE: THIS COMPLETES THE SUPPORT CONSTRUCTION SECTION.

SECTION IV: Nose Construction (NC)

NC0	Gather the materials listed.	A, R, S, T, U, V, Ear 1, Ear 2, Ear 3, Ear 4, (17) 4 cm screws, (8) 3 cm screws
-----	------------------------------	--

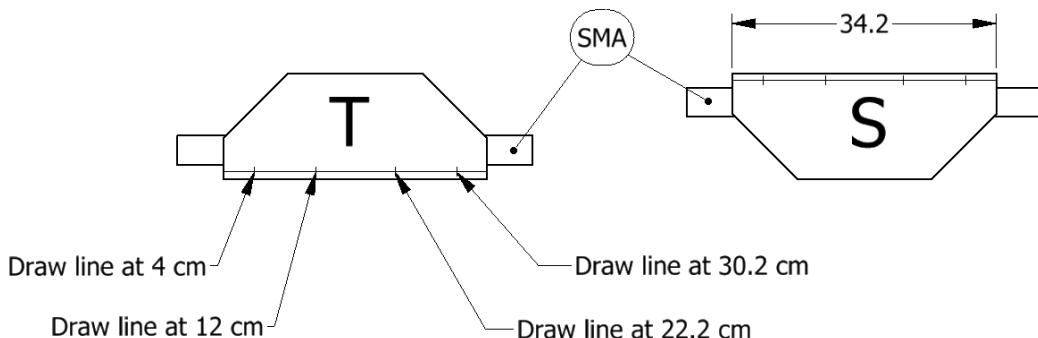


NC1	Begin with Part S & Part T. Place FACE DOWN. Draw the following lines.	0.9	↑	Part S, Part T
------------	---	------------	----------	-----------------------

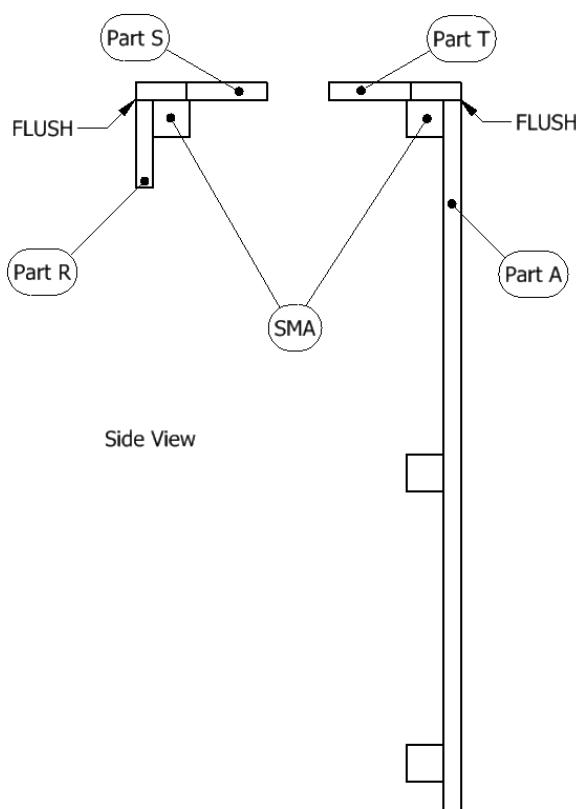


Draw a line at 0.9 cm from edge

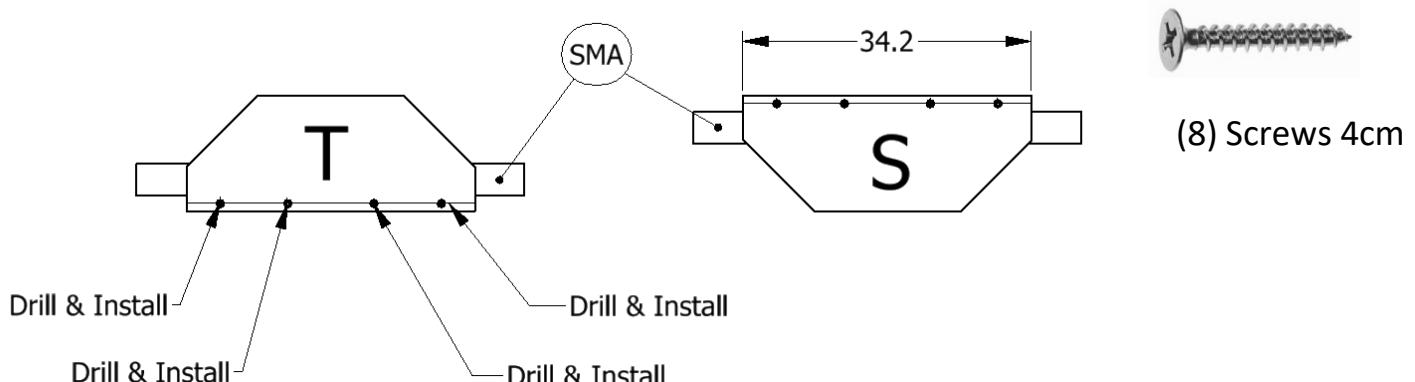
NC2	Continue with Part S & Part T. Draw the following crossing lines. Repeat for each Part.	4, 12, 22.2, 30.2	→	Part S, Part R, SMA Part T, Part A, SMA
------------	--	------------------------------	----------	--



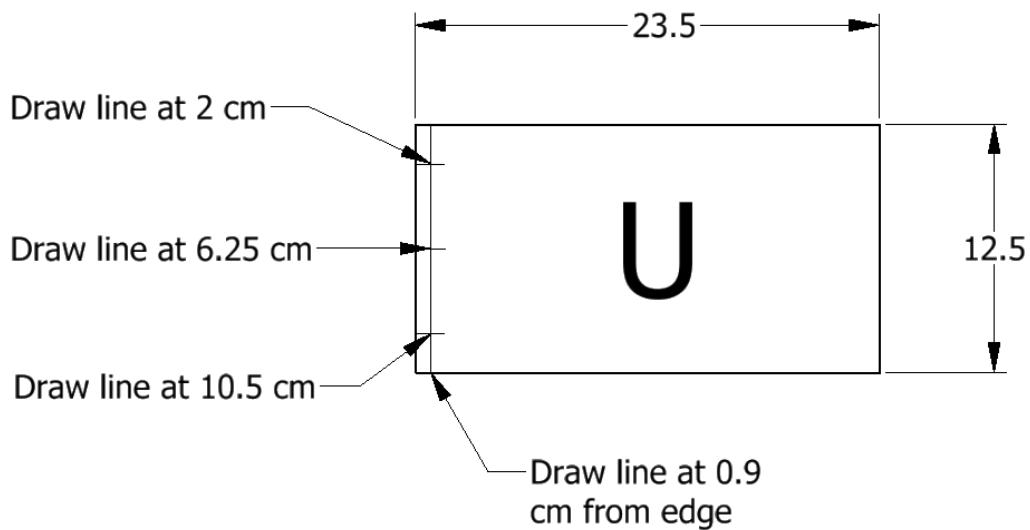
NC3	Continue with Part S & Part T. Place Part S on top of Part R/SMA. Place Part T on top of Part A/SMA. Align the edges flush as shown.	→	Part S, Part R, SMA Part T, Part A, SMA
------------	---	----------	--



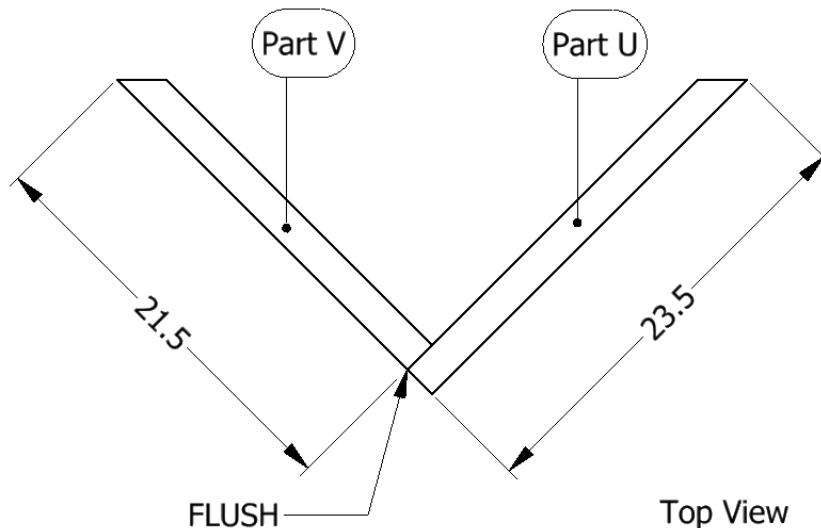
NC4	Continue with Part S & Part T. Drill pilot holes on top of the lines. Then install (8) 4 cm screws.	4, 12, 22.2, 30.2	→	Part S, Part R, SMA, Part T, Part A, SMA, 8 Screws
-----	---	----------------------	---	---



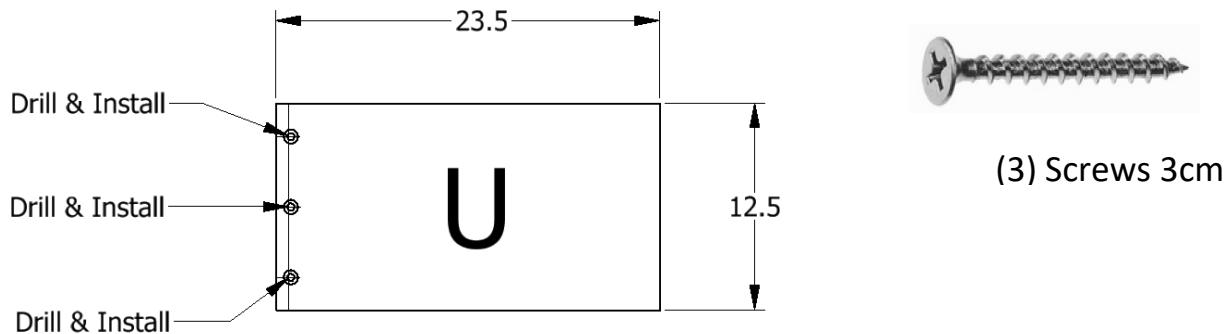
NC5	Begin with Part U. Place FACE UP. Draw the following lines.	0.9 & 2, 6.25, 10.5	↓, →	Part U
-----	---	---------------------	------	--------



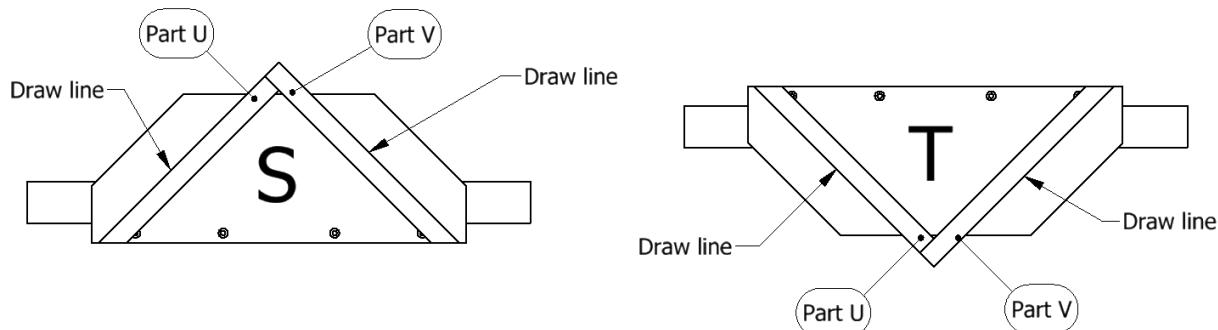
NC6	Continue with Part U and gather Part V. Align flush as shown.			Part U, Part V
-----	---	--	--	----------------



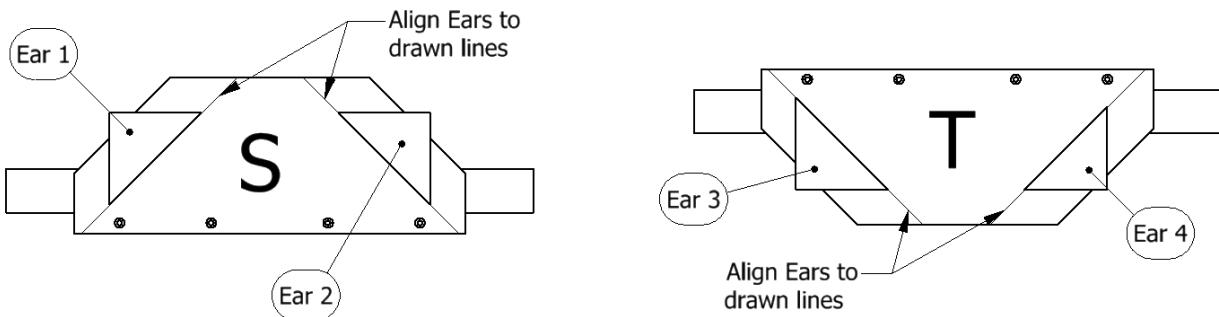
NC7	Continue with Part U and Part V as aligned components. Drill pilot holes. Then install (3) 3 cm screws.	2, 6.25, 10.5	↓	Part U, Part V, 3 Screws
------------	--	------------------	---	-----------------------------



NC8	Place Part U/Part V against Part S. Then draw the following lines along the Part U and Part V faces onto Part S. Repeat for Part T. Make sure there is no gap between the point of Part U/V and the edge of Part S or Part T. See Appendix for more information.	Part U/Part V, Part S/Part R/SMA, Part T/Part A/SMA
------------	--	---

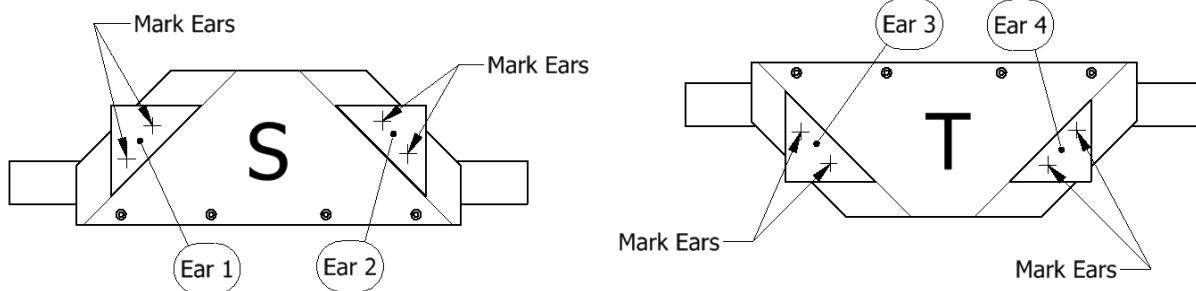


NC9	Align the Ears to the drawn lines as shown.	Part S/Part R/SMA, & Part T/Part A/SMA, Ears 1-4
------------	---	--



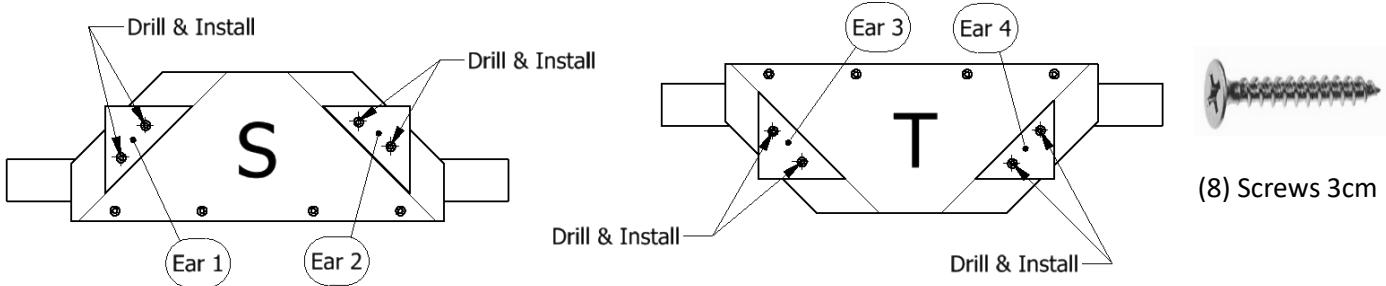
NOTE: The Ears may be adjusted as needed.

NC10	Make the following marks on Ears 1 - 4.	Part S/Part R/SMA, & Part T/Part A/SMA, Ears 1-4
-------------	---	--

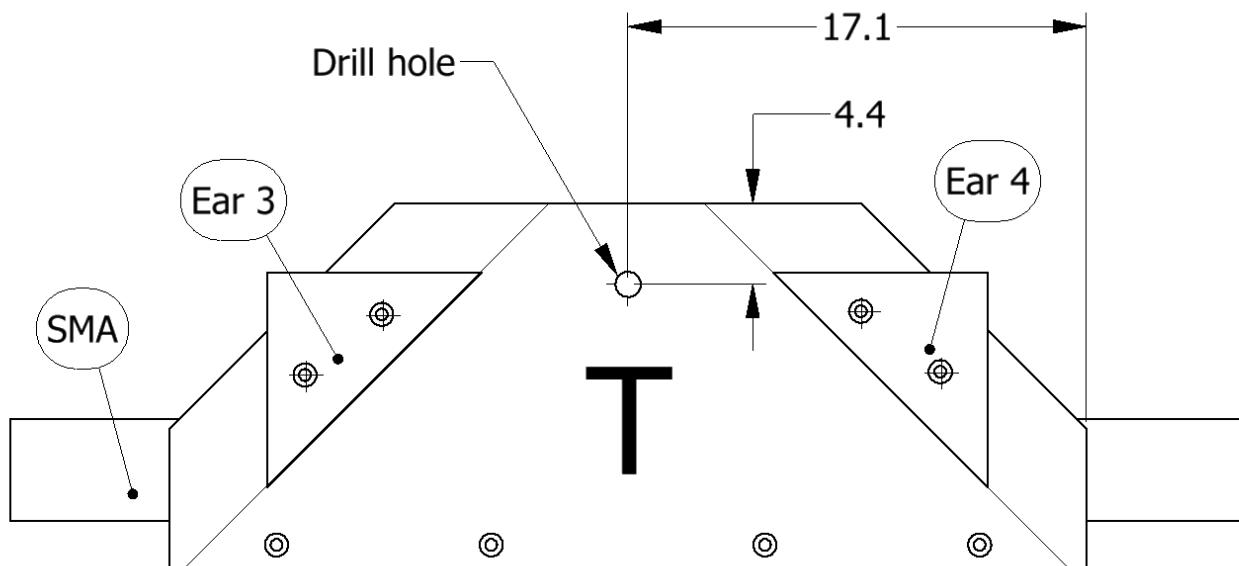


NOTE: The Ears may be adjusted as needed.

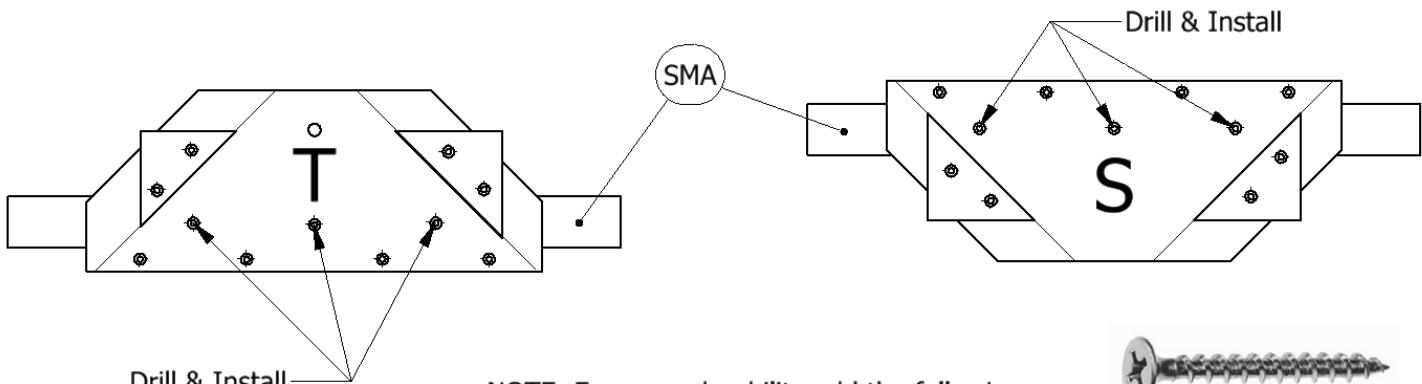
NC11	Drill pilot holes on top of the eight marks as shown. Then install (8) 3 cm screws.			Part S/Part R/SMA, & Part T/Part A/SMA, Ears 1-4, 8 Screws
------	--	--	--	--



NC12	Continue with Part T and attached components. Drill the hole for the tube hole as shown.	17.1, 4.4	↖, ↓	Part T/Part A/SMA/Ear 3/Ear 4
------	---	-----------	------	-------------------------------



NC13	Drill and install (3) 4 cm screws each into Part S & Part T, centered on SMA, between the existing screws, as shown.			Part S/Part R/SMA, & Part T/Part A/SMA, Ears 1-4, 6 screws
------	--	--	--	--



NOTE: For more durability add the following three (3) screws (each) to Part S and Part T.

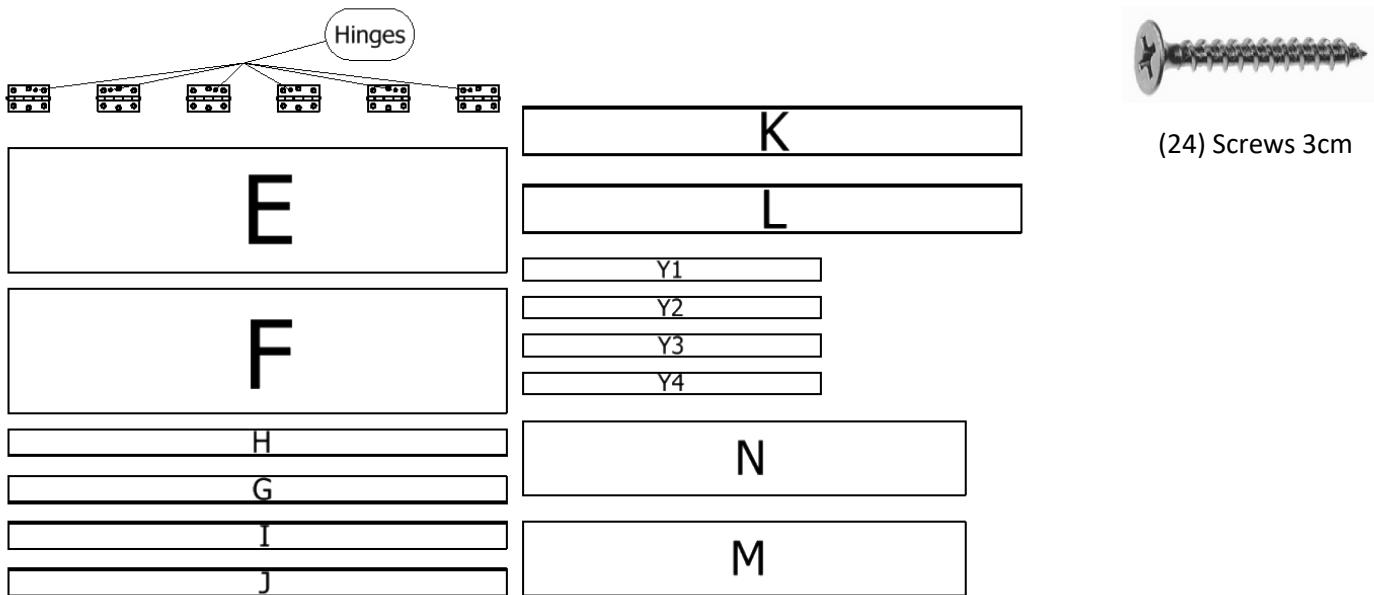
(6) Screws 4cm

NOTE: THIS COMPLETES THE NOSE CONSTRUCTION SECTION.

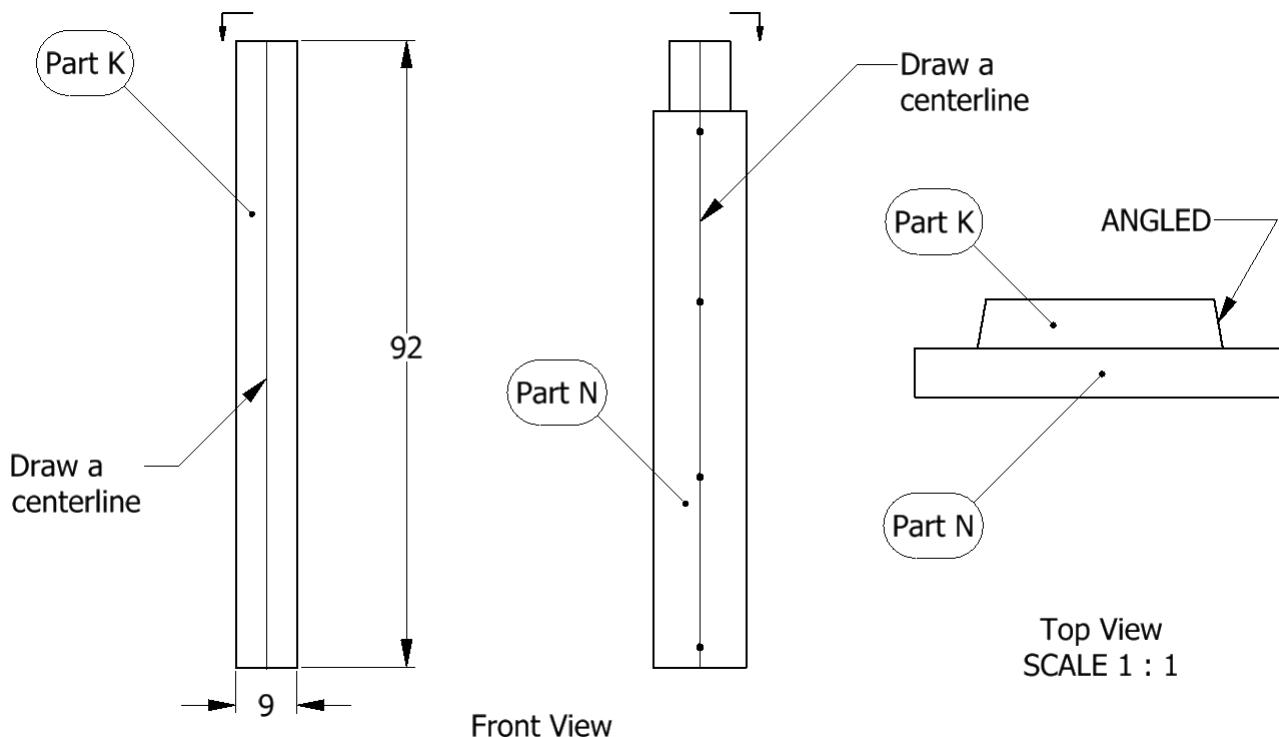
SECTION V: Inner Core Construction (IC)

Some of the illustrations in this section show TWO VIEWS of the Mold in each step. The views are marked and may differ. This is only for clarity of instruction, not for building two Wood Molds.

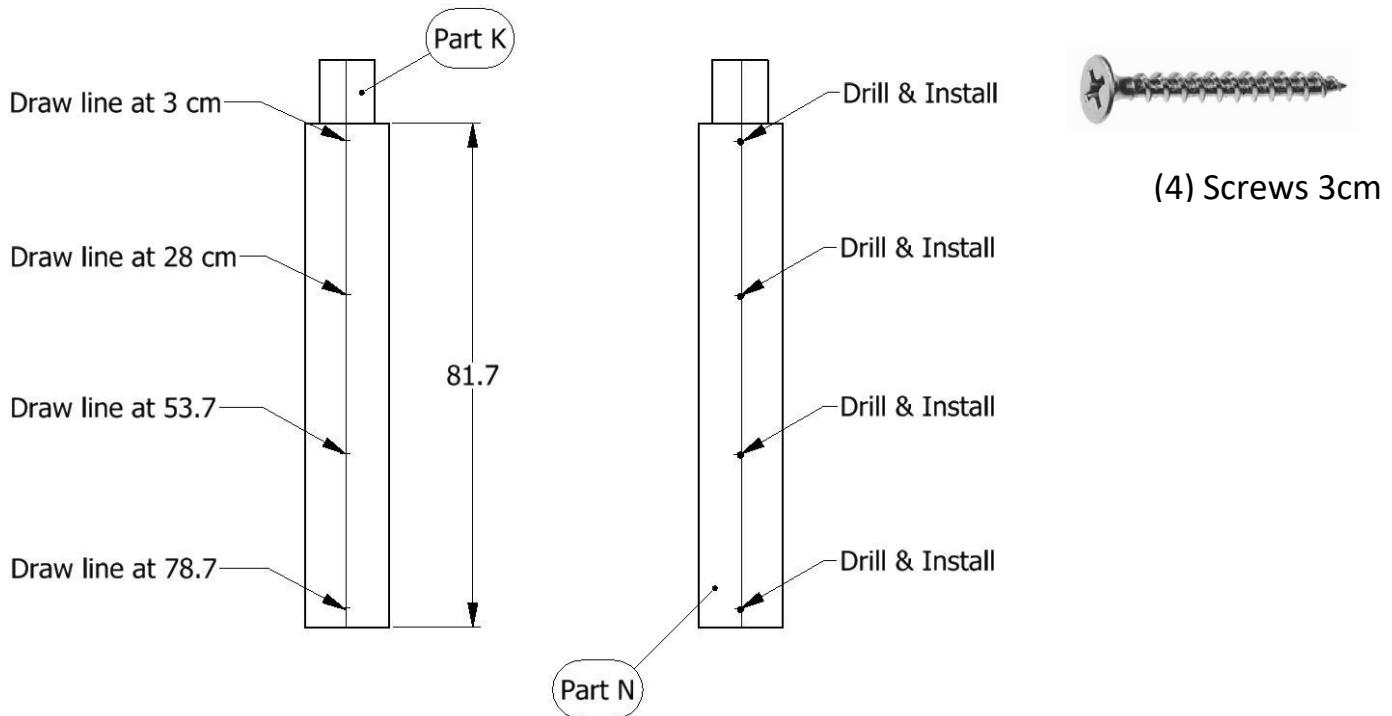
IC0	Gather the materials listed and shown. Hinge sets shown will vary by the choice of hardware.	E, F, G, H, I, J, K, L, M, N, Y1, Y2, Y3, Y4, Hinges, (24) 3 cm screws
-----	---	---



IC1	Begin with Part K. Place FACE DOWN and draw a centerline as shown. Place Part N on top of Part K as shown. Then draw a centerline.	4.5 & 6.8	←	Part K, Part N
-----	---	----------------------	----------	---------------------------

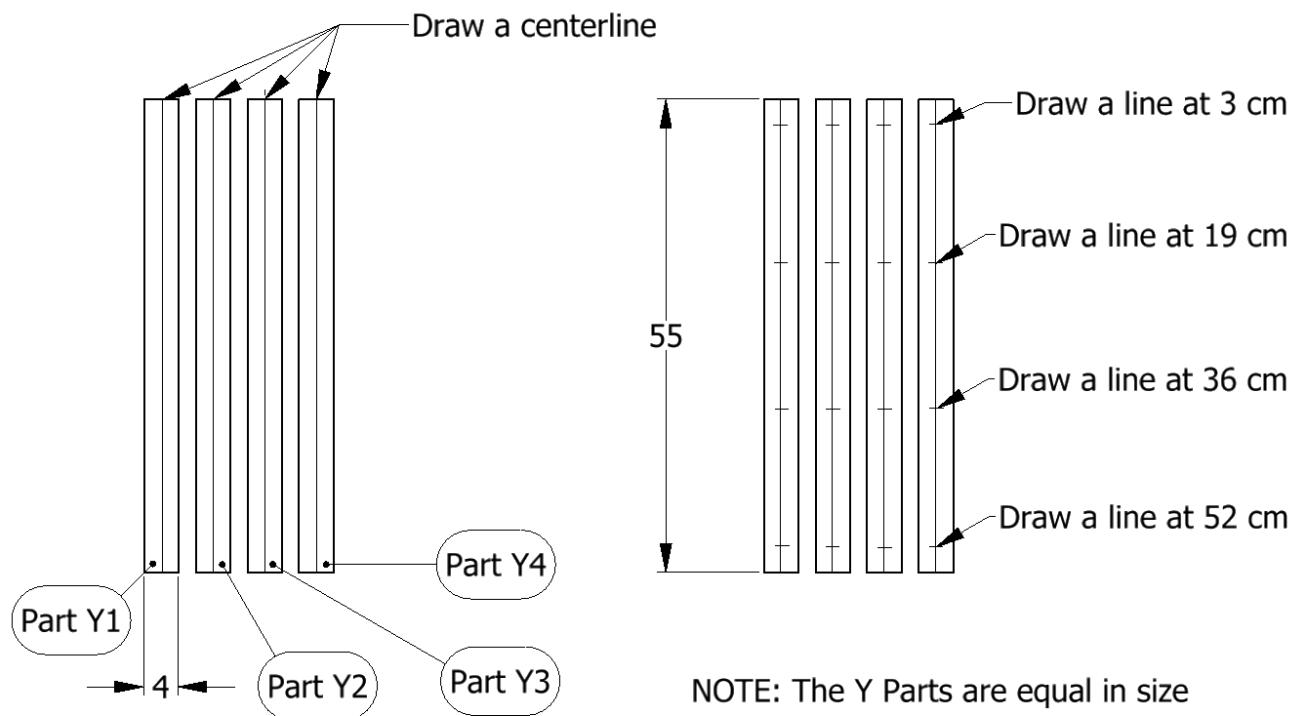


IC2	Continue with Part K/Part N. Draw crossing lines as shown. Then, drill pilot holes and install (4) 3 cm screws into Part N.	3, 28, 53.7, 78.7	↓	Part K, Part N, 4 screws
-----	---	----------------------	---	-----------------------------

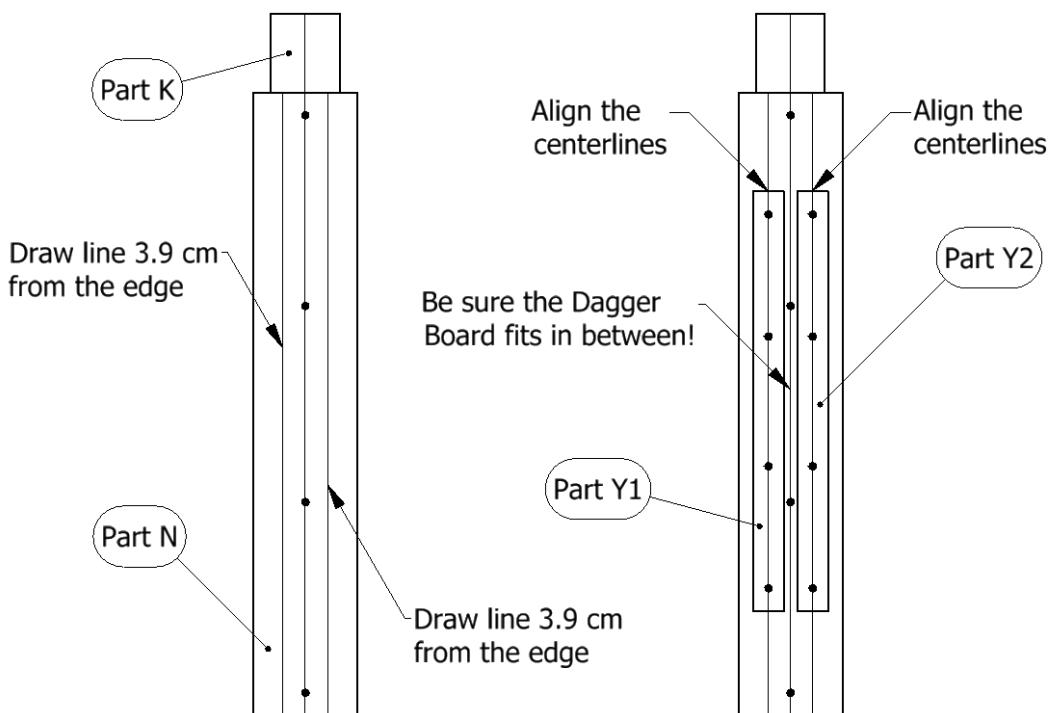


IC3	Gather Part L and Part M. Repeat Steps IC1 & IC2 for Parts L & M, they are identical to Part K and Part N. NOTE: If the screws aren't flush the Dagger Board (Part P) may stick!			Part L, Part M, 4 screws
-----	--	--	--	--------------------------

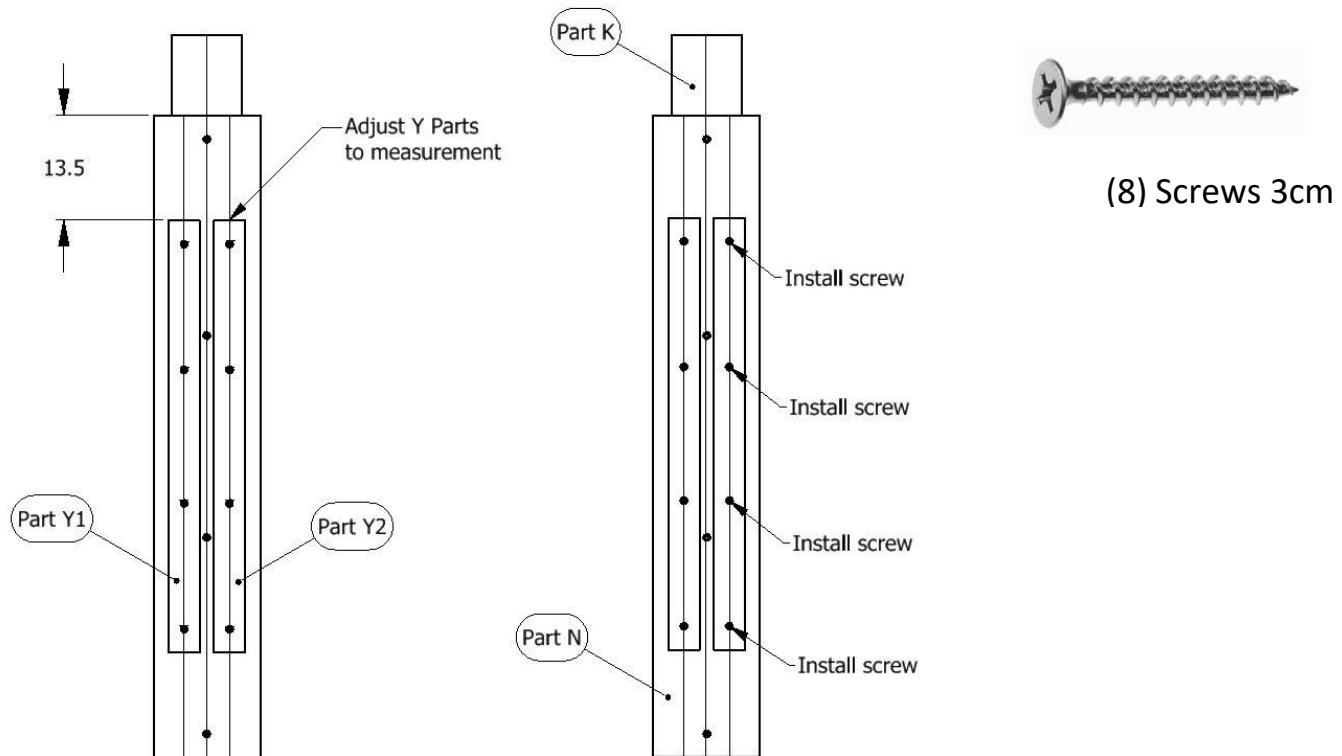
IC4	Gather the four (4) Y Parts. Draw centerlines and crossing lines. Repeat for each Y Part.	2 & 3, 19, 36, 52	→ & ↓	Parts Y1, Y2, Y3, Y4
-----	---	-------------------	-------	----------------------



IC5	Continue with Part K/Part N. Draw two lines as shown. Place Part Y1 and Part Y2, then align the centerlines. Be sure to check the Dagger Board fit!	3.9	→, ←	Part K, Part N, Part Y1 & 2
-----	--	-----	---------	--------------------------------

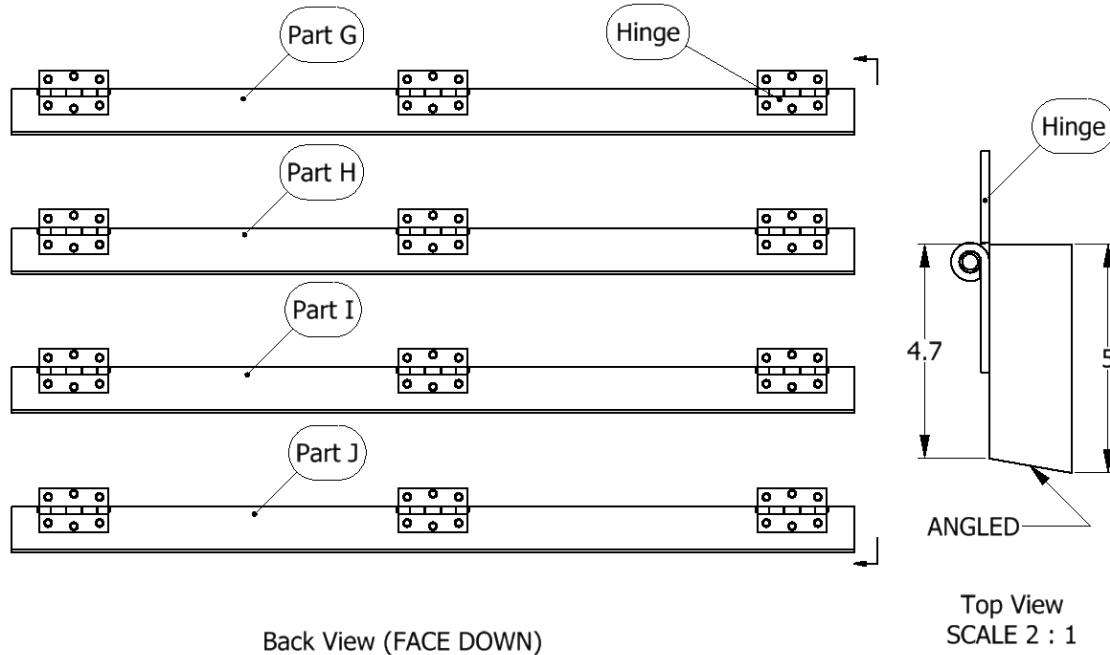


IC6	Continue with Part K/Part N/Part Y1/Part Y2. Adjust Part Y1 and Part Y2. Drill pilot holes on top of the crossed lines. Then install (8) 3 cm screws.	13	↓	Part K, Part N, Part Y1, Part Y2
-----	--	----	---	-------------------------------------

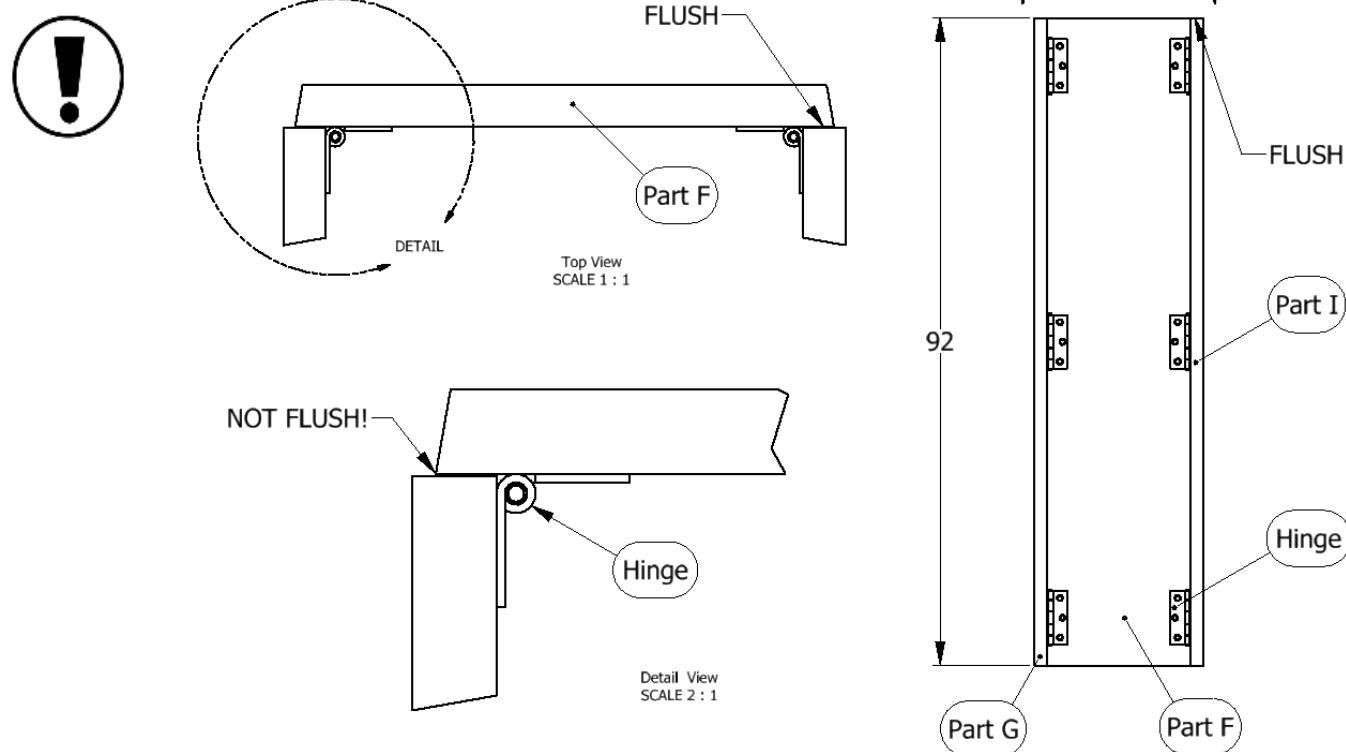


IC7	Gather Part L/Part M/Part Y3/Part Y4. Repeat Steps IC5 & IC6.			Part L, Part M, Part Y3, Part Y4
-----	--	--	--	----------------------------------

IC8	Begin with Part G, Part H, Part I & Part J. Attach hinges as shown, flush to the straight edge.	3 cm from ends, 42.2 cm	→	Part G, Part H, Part I, Part J, & Hinge sets
------------	--	------------------------------------	----------	---



IC9	Place and install Part G & Part I onto Part F as shown. Parts G & I should be offset on Part F approximately 1mm as shown.			Part F, Part G, Part I, Hinges
------------	---	--	--	---------------------------------------

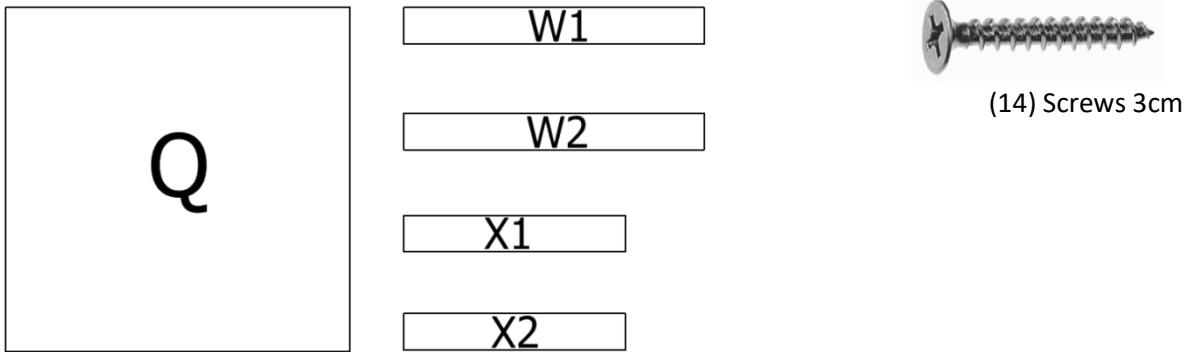


IC10	Repeat IC9 for Part H & Part J onto Part E.	4.6	←	Part F, Part H, Hinges
-------------	--	------------	----------	-------------------------------

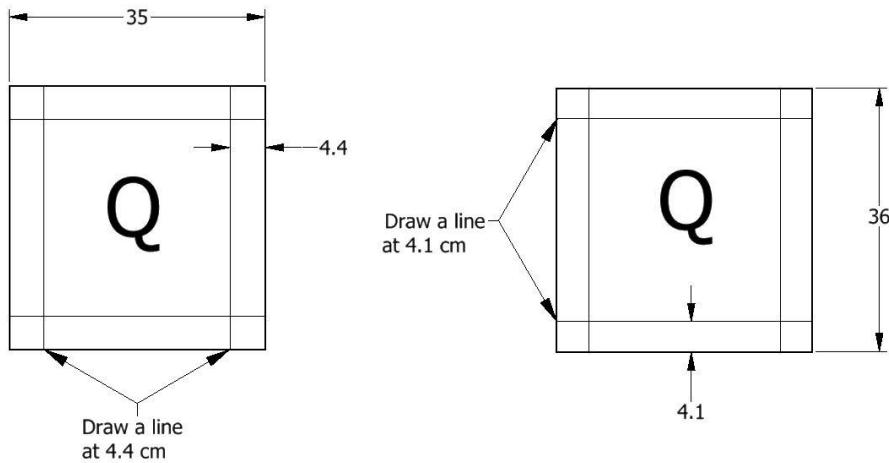
NOTE: THIS COMPLETES THE INNER CORE CONSTRUCTION SECTION.

SECTION VI: Base Construction (BC)

BC0	Gather the materials listed.	Q, W1, W2, X1, X2, (14) 3 cm screws
------------	------------------------------	--

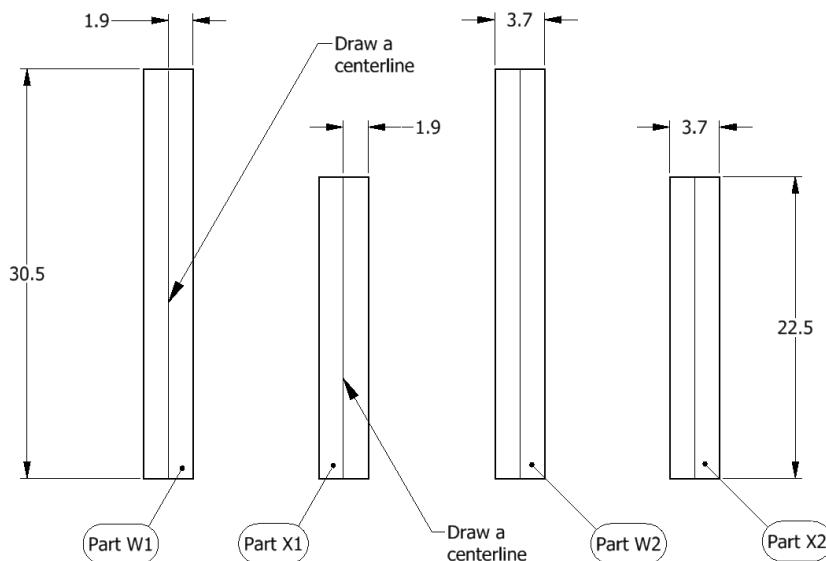


BC1	Begin with Part Q (Cut 34b) FACE UP, then draw lines as shown.	4.4, 4.1	→, ← & ↓, ↑	Part Q
------------	--	----------	-------------	--------

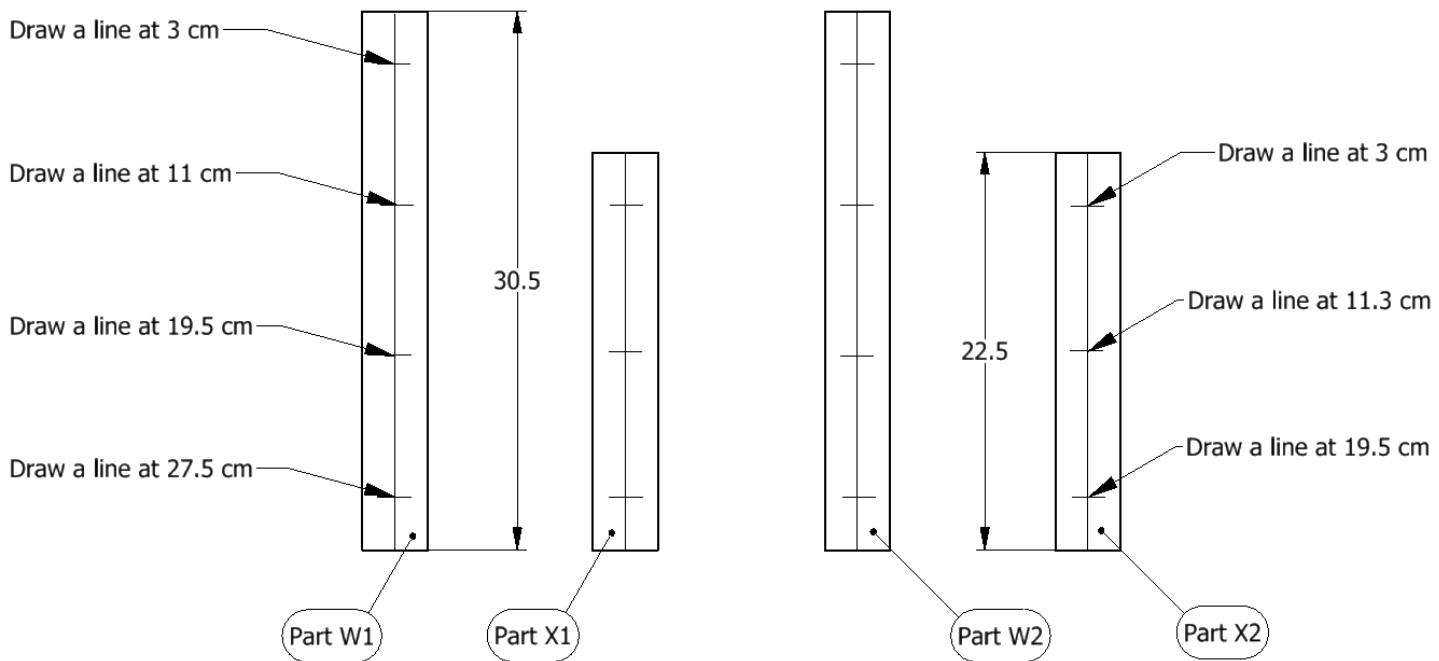


Top View (FACE UP)

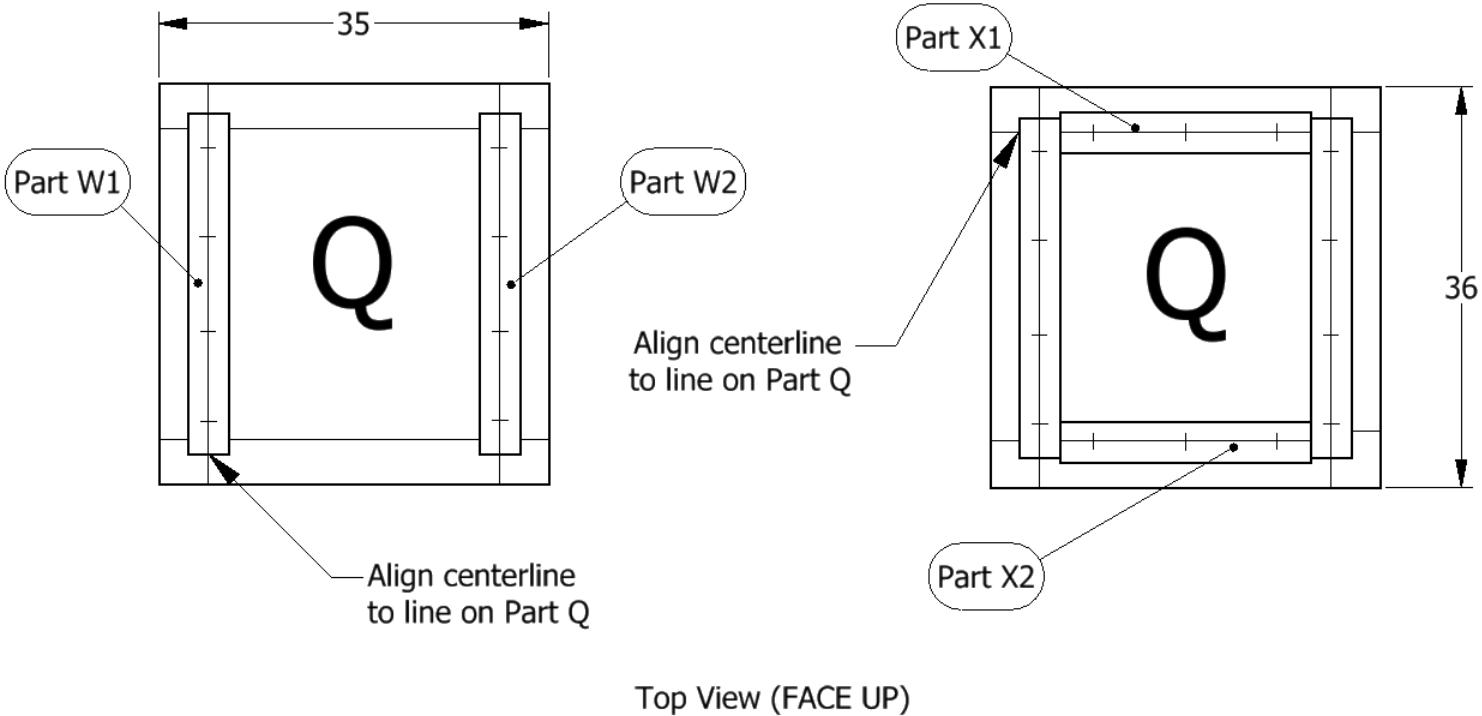
BC2	Gather Part W1 & W2 and Part X1 & X2, then draw the following centerlines as shown.	1.9	→, ←	Part W1, Part W2, Part X1, Part X2
------------	---	-----	------	------------------------------------



BC3	Continue with the W & X Parts. Draw crossing lines as shown.	3,11, 19.5, 27.5 & 3, 11.3, 19.5	↓	Part W1, Part W2, Part X1, Part X2
------------	---	---	----------	---



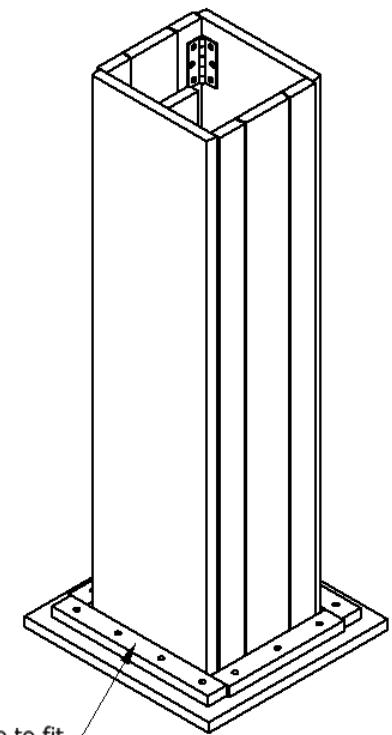
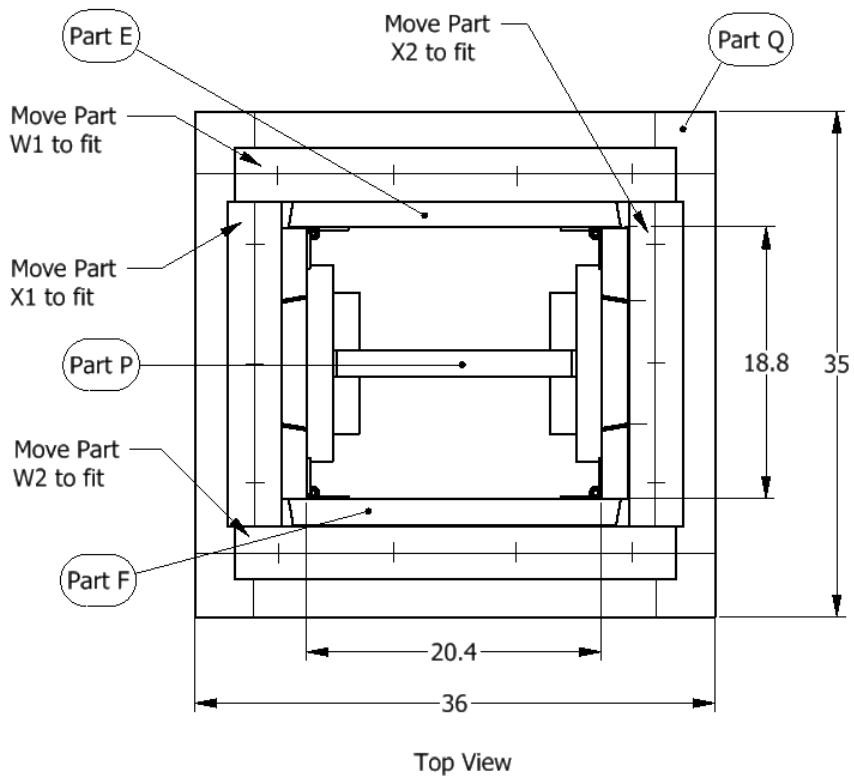
BC4	Place the W Parts & X Parts on top of Part Q and align as shown.	Part Q, Part W1, Part W2
------------	---	---------------------------------



BC5

Place the assembled inner core onto Part Q. This is to ensure that the fit is correct. Move the X & W Parts, as needed, to fit the inner core pieces.

Part Q, X & W Parts,
Inner Core Assembly

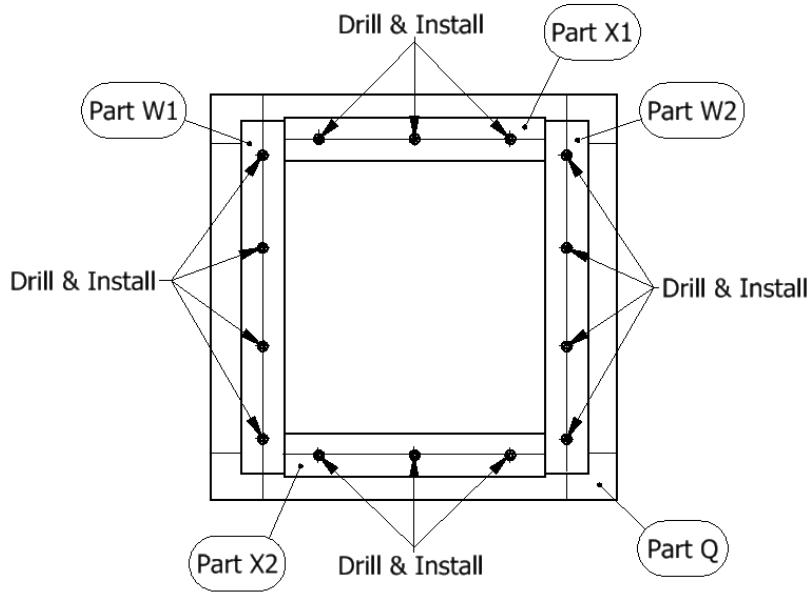


TROUBLE ASSEMBLING THE INNER-CORE? PLEASE SEE THE "Complete Build (CB)" SECTION OF THE MANUAL FOR HELP.

BC6

Drill pilot holes on top of crossed lines as shown, then install (14) 3 cm screws.

Part Q, Parts W1, Part W2, Part X1,
Part X2, (14) 3 cm screws



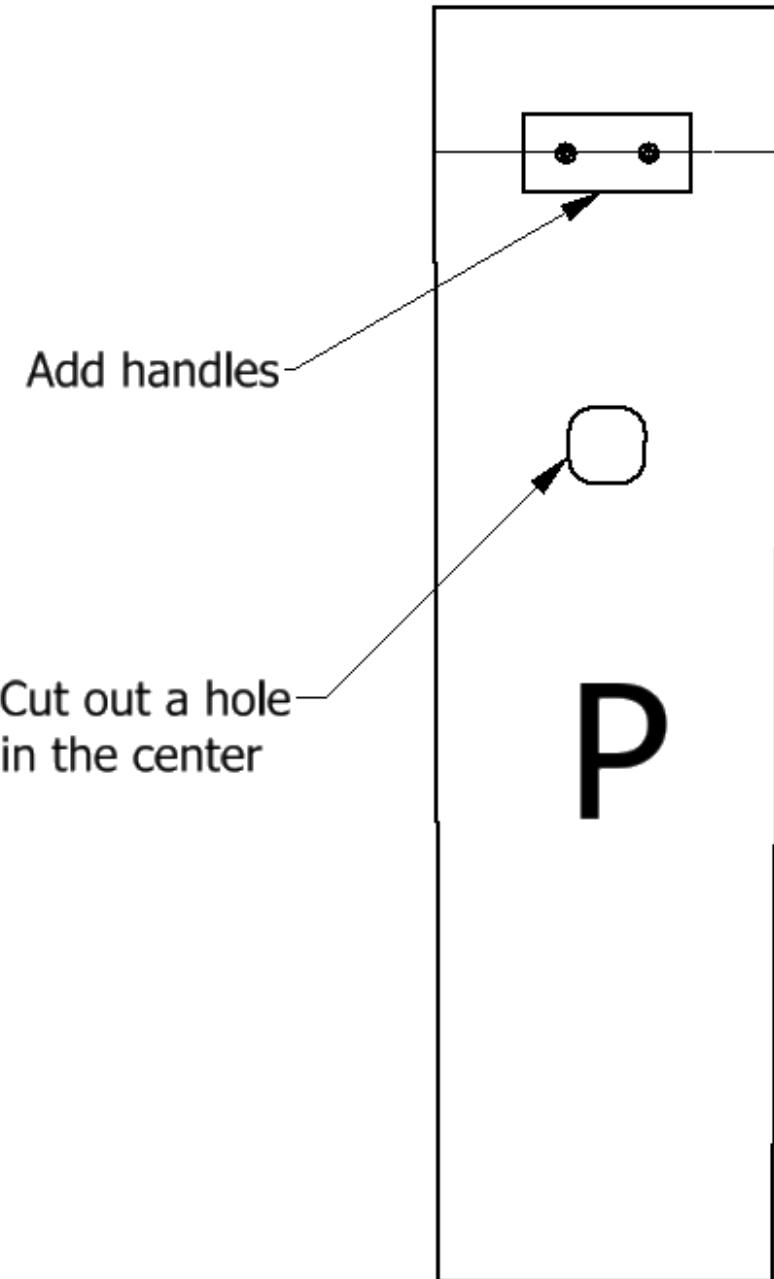
(14) Screws 3cm

NOTE: THIS COMPLETES THE BASE CONSTRUCTION SECTION.

SECTION VII: Dagger Board Construction (DC)

The Dagger Board (Part P) can be modified to ease removal. Options:

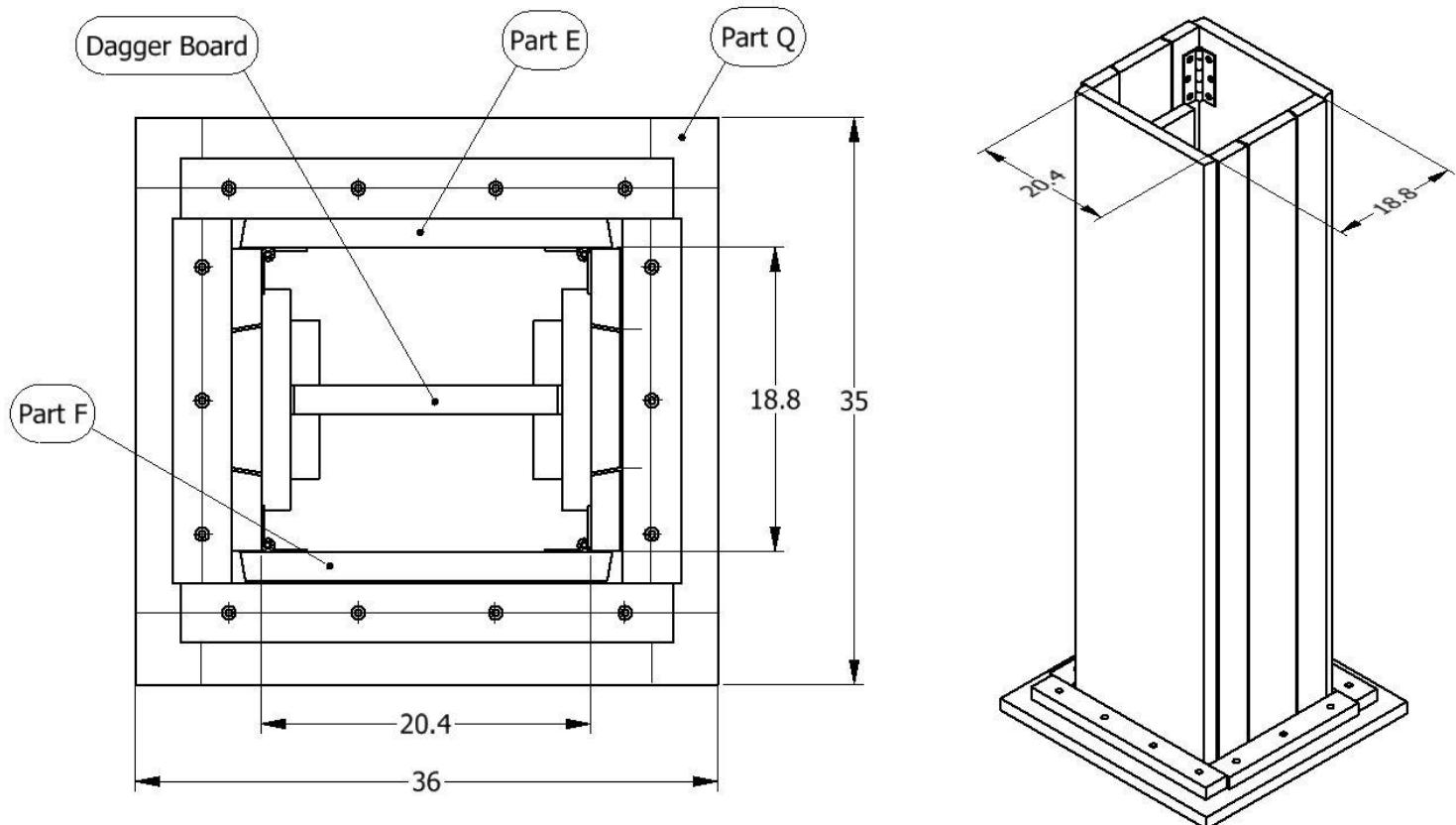
- 1.) Cut a hole in the center, large enough to run a rope through.
- 2.) Add handles utilizing the scrap wood from the initial cuts.
- 3.) Add draft – the board will be slightly tapered downward.



NOTE: THIS COMPLETES THE DAGGER BOARD CONSTRUCTION SECTION.

SECTION VIII: Inner Core Lid Construction (LC)

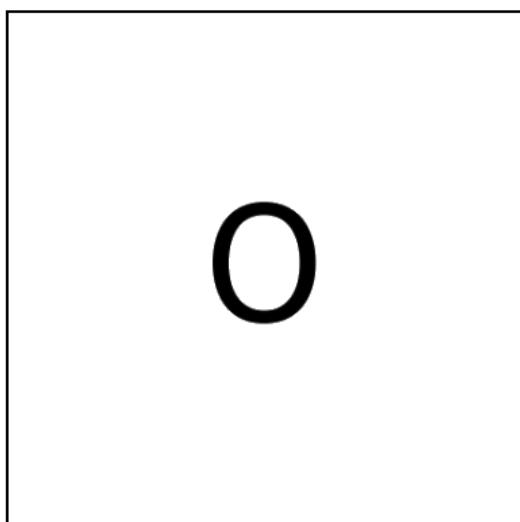
LC0	Record the inner-core measurements:	Between E&F: _____ cm	Between K&L: _____ cm
-----	-------------------------------------	-----------------------	-----------------------



Measure the inside of the Inner Core

TROUBLE ASSEMBLING THE INNER-CORE? PLEASE SEE THE "Complete Build (CB)" SECTION OF THE MANUAL FOR HELP.

LC1	Gather the materials listed.	Part O	Part Z1, Z2, Z3, Z4, (8) 3 cm screws
-----	------------------------------	--------	--------------------------------------



Z1

Z2

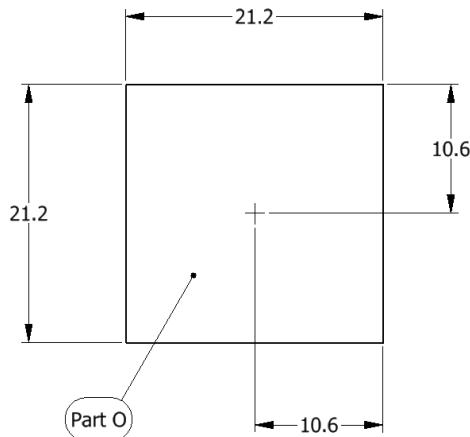
Z3

Z4

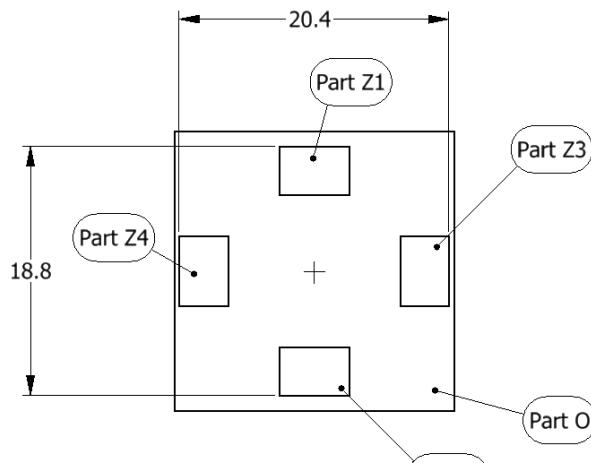


(8) Screws 3cm

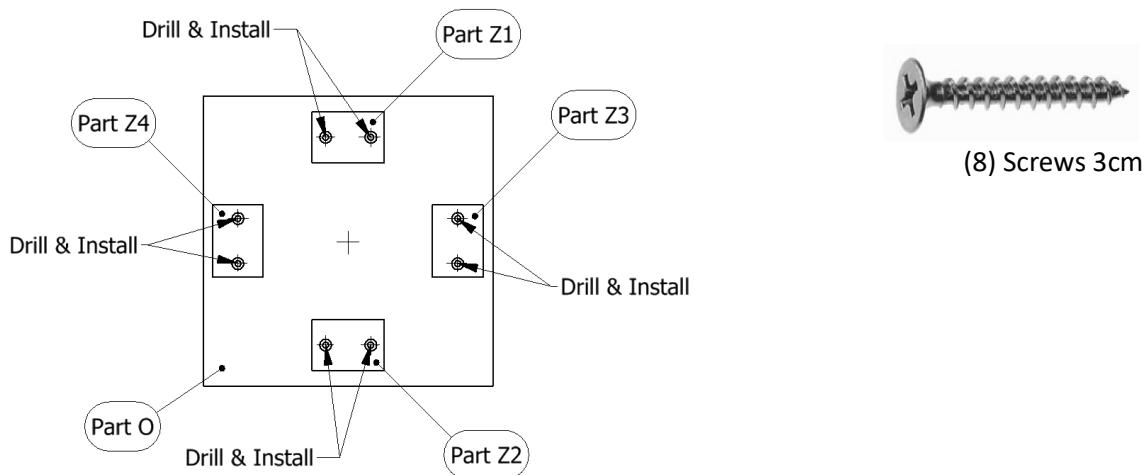
LC2	Place Part O and make the following center mark.	↓, →	10.6, 10.6	Part O
-----	--	------	------------	--------



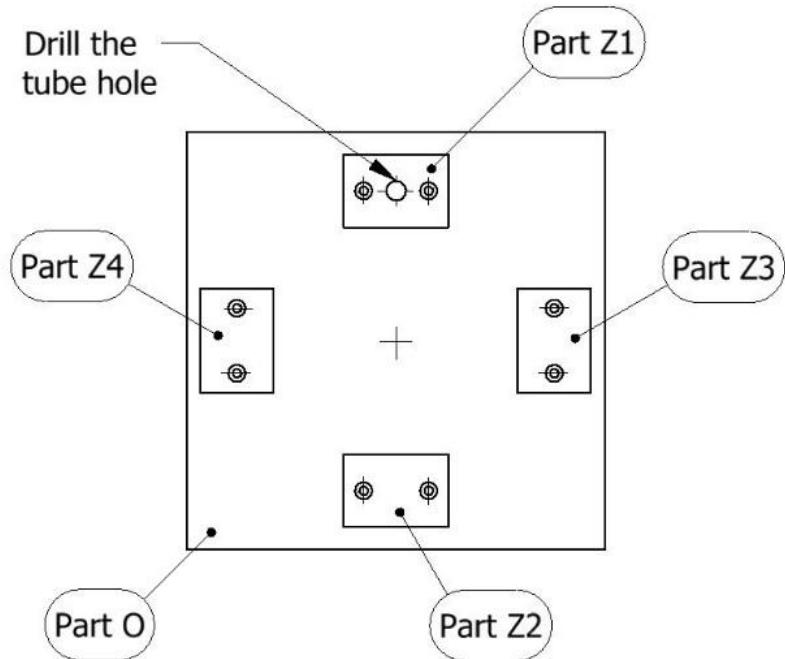
LC3	Arrange Z Parts on Part O, using the measurements from LC0. The measurements are from outer edge to outer edge. Center the Z Parts.	Part O, Parts Z1,2,3,4
-----	---	---------------------------



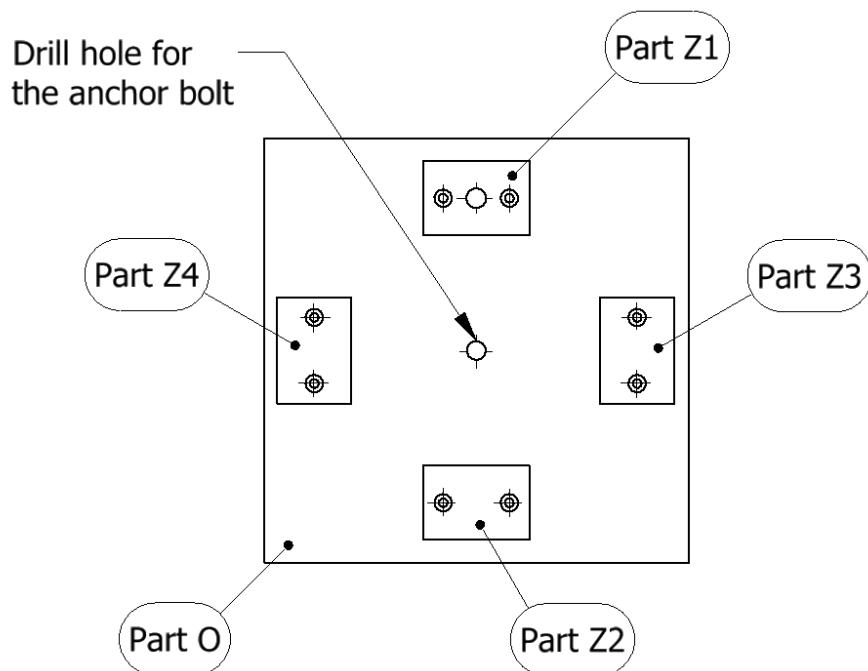
LC4	Drill pilot holes and install (8) 3 cm screws.	Part O, Parts Z1,2,3,4, 8 screws
-----	--	----------------------------------



LC5	Drill a hole for the tube. It should be the same size as the OUTSIDE DIAMETER of the tubing selected for use. Check the tube fit before moving forward.			Part O, Parts Z1,2,3,4, tube
-----	---	--	--	------------------------------



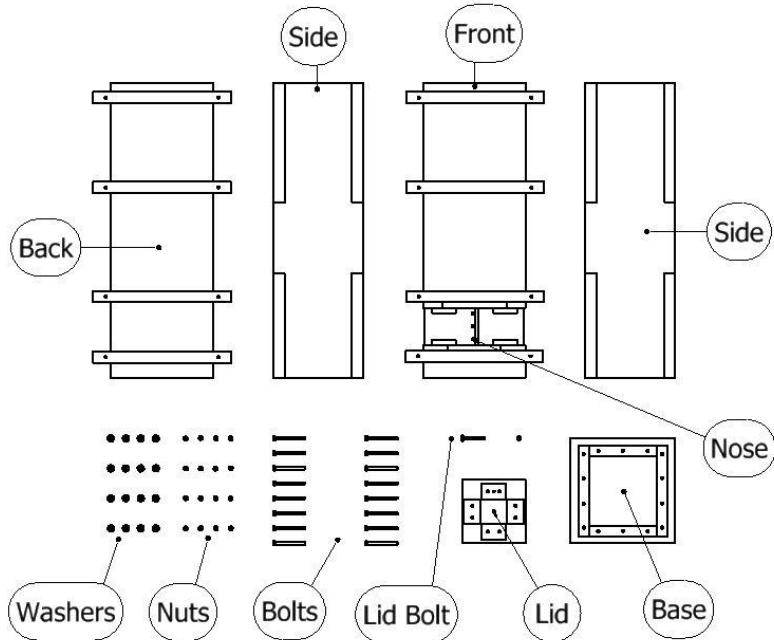
LC6	Drill a hole for the anchor bolt. It should be the same size as the OUTSIDE DIAMETER of the bolt selected for use.			Part O, Parts Z1,2,3,4
-----	--	--	--	------------------------



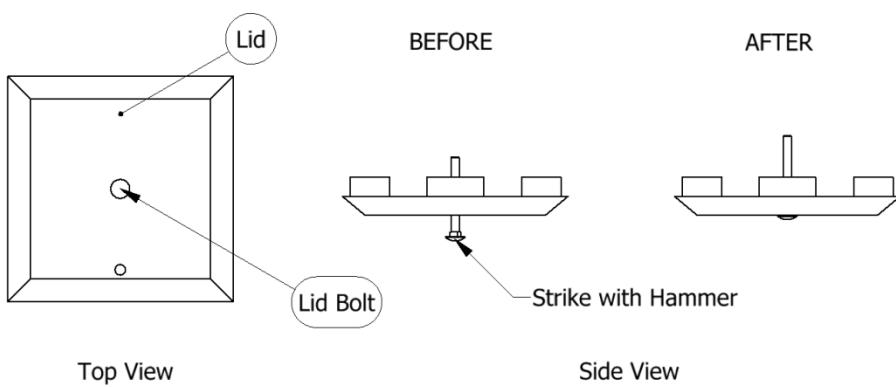
NOTE: THIS COMPLETES THE LID CONSTRUCTION SECTION

SECTION IX: Hardware Installation (HI)

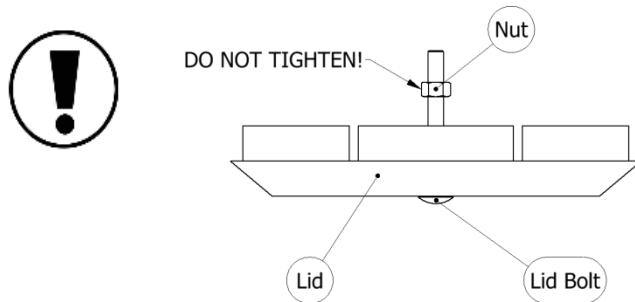
HI0	Gather the materials listed.													



HI1	Put the Lid Bolt in the hole. Strike the bolt on the head until it is flush to the Lid.													
-----	---	--	--	--	--	--	--	--	--	--	--	--	--	--



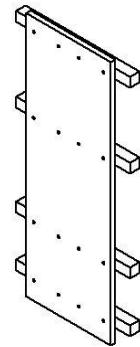
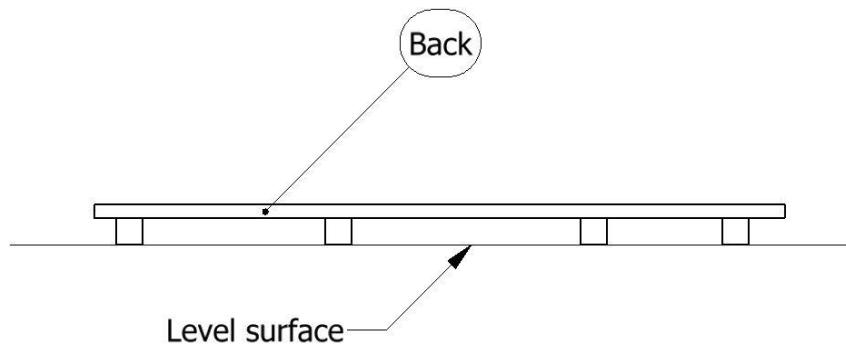
HI2	Continue with the Lid. Add a nut to the Lid Bolt as shown. DO NOT FULLY TIGHTEN! NOTE: The Lid Bolt is the Carriage Bolt.													
-----	---	--	--	--	--	--	--	--	--	--	--	--	--	--



HI3

Begin by placing the Back (Part B) FACE DOWN as shown.

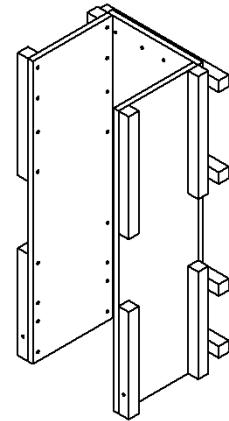
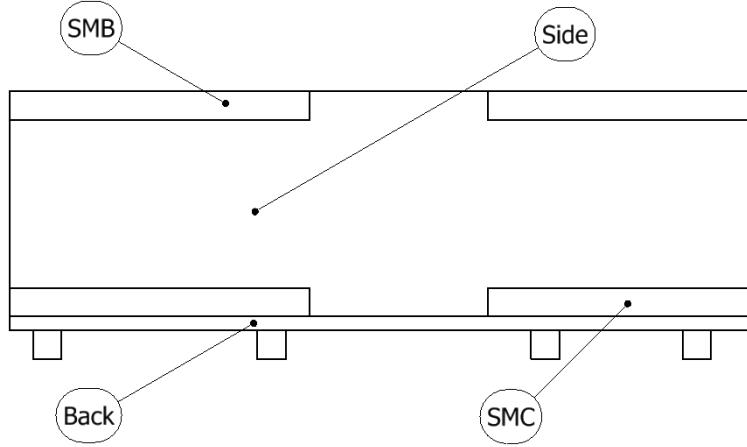
Back



HI4

Place Sides (Part C & Part D) on top of the Back as shown.

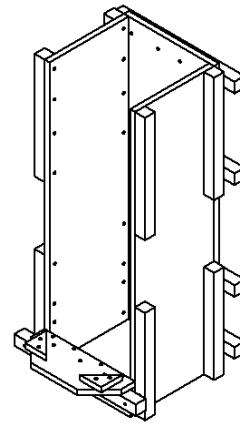
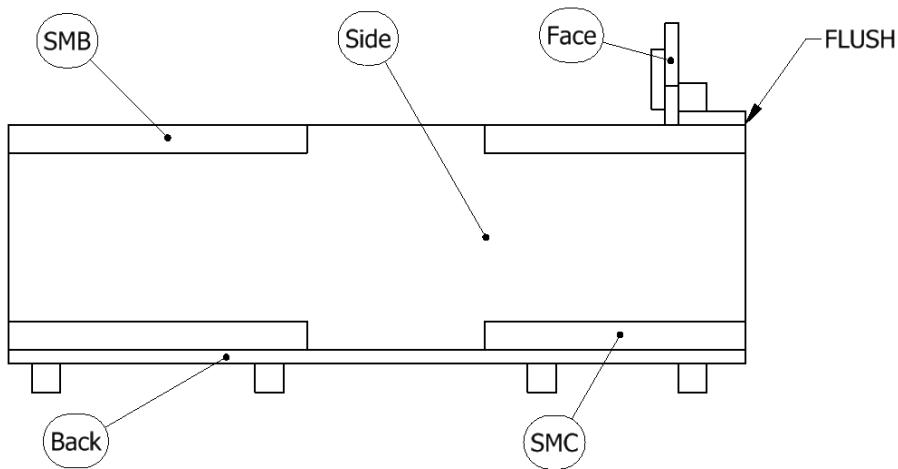
Back, Sides



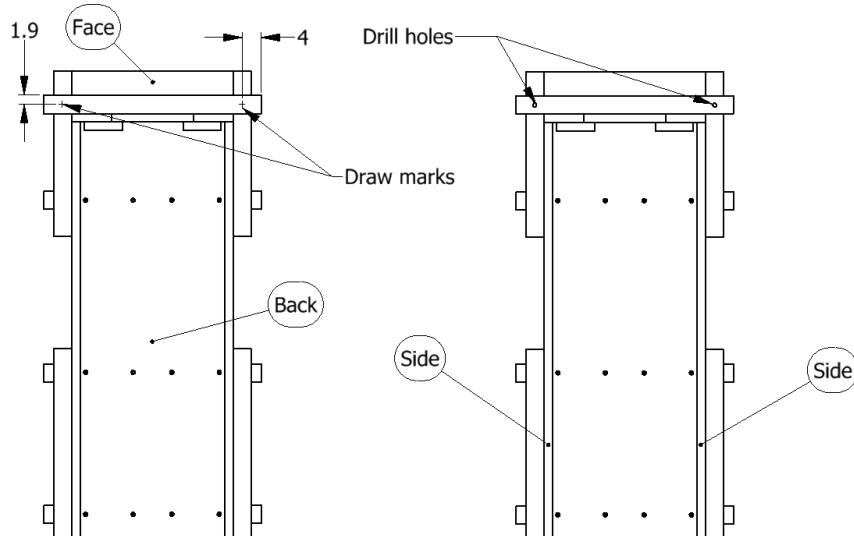
HI5

Place the first Face piece (Part R) on top of the Sides as shown.
Then, align the Face flush to the Sides as shown.

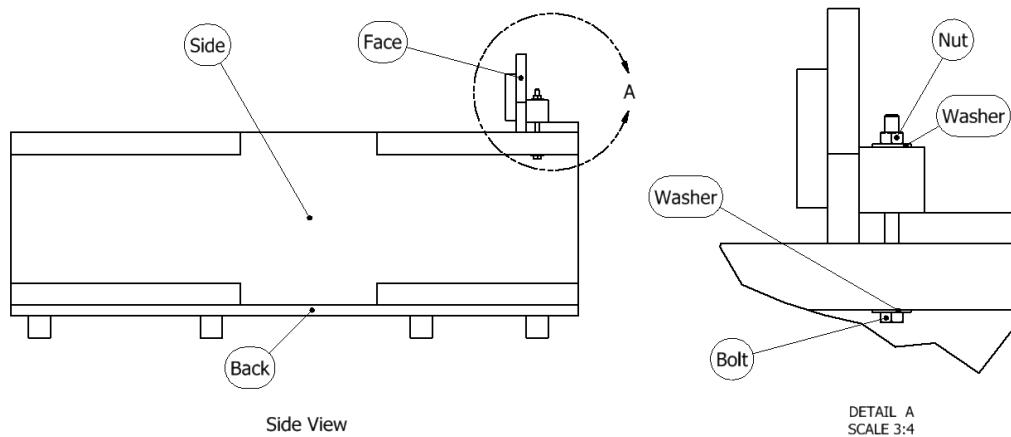
Back, Sides, Face



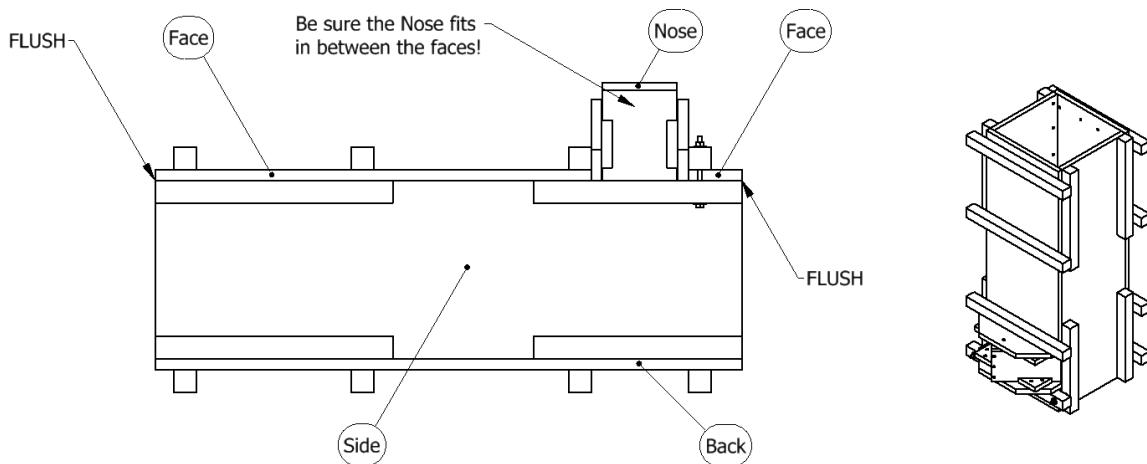
HI6	Once aligned, make the following two marks. Then drill holes on top of the marks as shown. Be sure that the hole goes through both supports!	1.9 , 4	↓, → & ↓, ←	Back, Sides, Face
-----	--	------------	-------------	-------------------



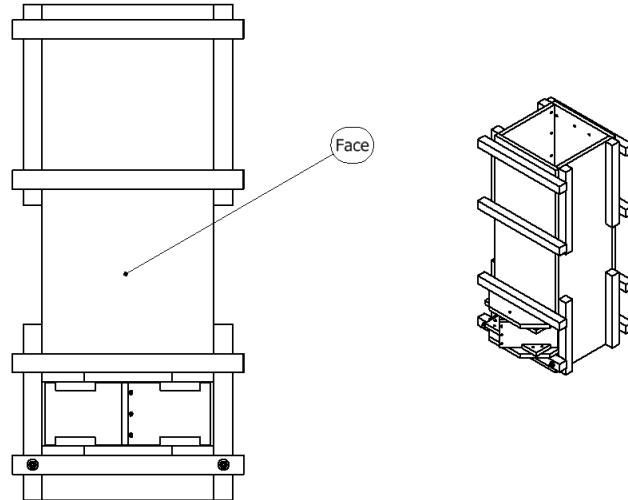
HI7	Loosely install a bolt, two (2) washers, and a nut as shown. Then, repeat the bolt installation for the other side.			Back, Sides, Face
-----	---	--	--	-------------------



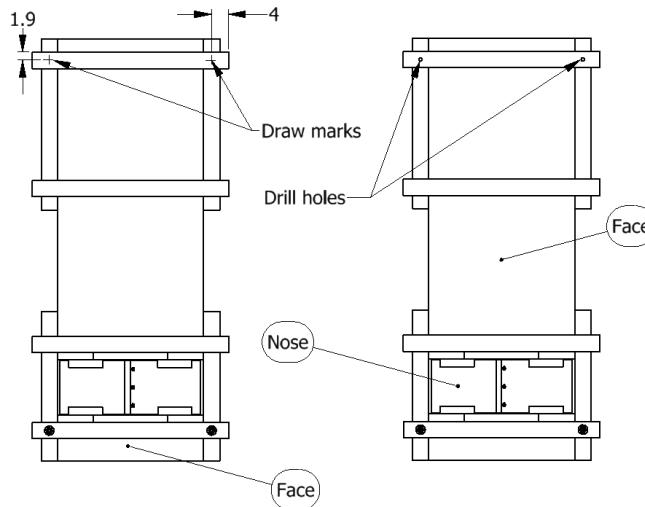
HI8	Place the Face piece (Part A) on top of the Sides as shown. Add the Nose in order to align the face pieces. Then, adjust the Face flush to the Sides as shown.			Back, Sides, Faces, Nose
-----	--	--	--	--------------------------



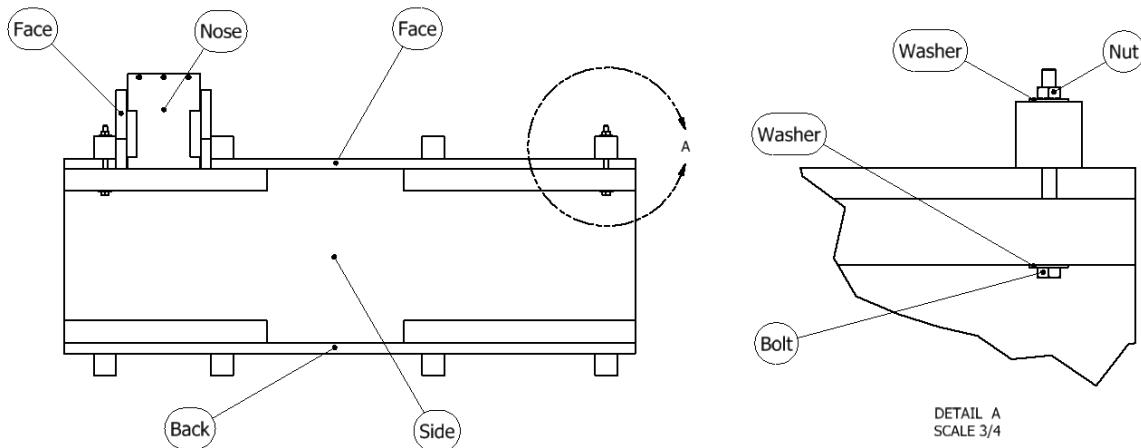
HI9	Orient the Shell as shown and stand above it looking down.			Back, Sides, Faces, Nose
-----	--	--	--	--------------------------



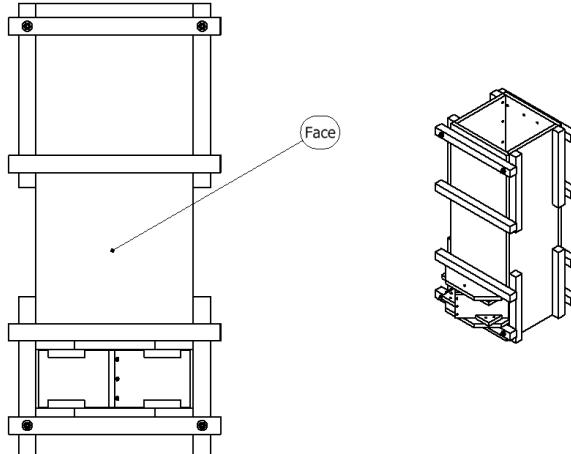
HI10	Once aligned, make the following two marks. Then drill holes on top of the marks as shown. Be sure that the hole goes through both supports.	1.9 , 4	↓, → & ↓, ←	Back, Sides, Faces, Nose
------	--	------------	----------------	-----------------------------



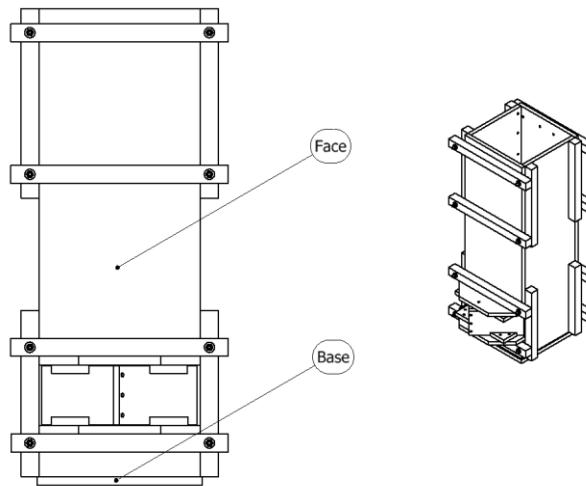
HI11	Loosely install a bolt, two (2) washers, and a nut as shown. Then, repeat the bolt installation for the other side.			Back, Sides, Faces, Nose
------	--	--	--	-----------------------------



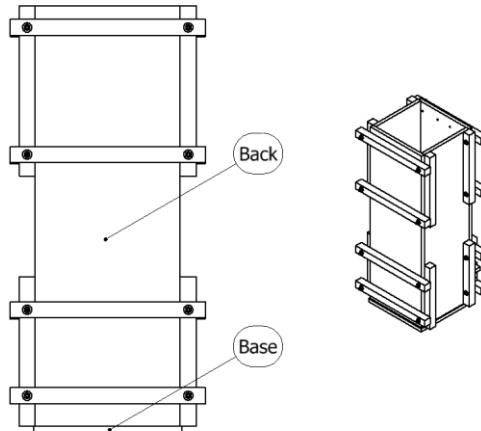
HI12	Orient the Shell as shown and stand above it looking downward.			Back, Sides, Faces, Nose
------	--	--	--	--------------------------



HI13	Repeat HI Steps 9 – 11 for the remaining two bolts. Once completed, place the Base onto the ground and place the Outer-Shell on top.			Base, Faces, Sides, Back, Nose
------	--	--	--	--------------------------------



HI14	Once components are aligned, begin repeating the HI steps to install the bolts into the Back. Install bolts as shown. Start at the bottom first. Then the top, doing the middle two last.			Base, Faces, Sides, Back, Nose
------	---	--	--	--------------------------------



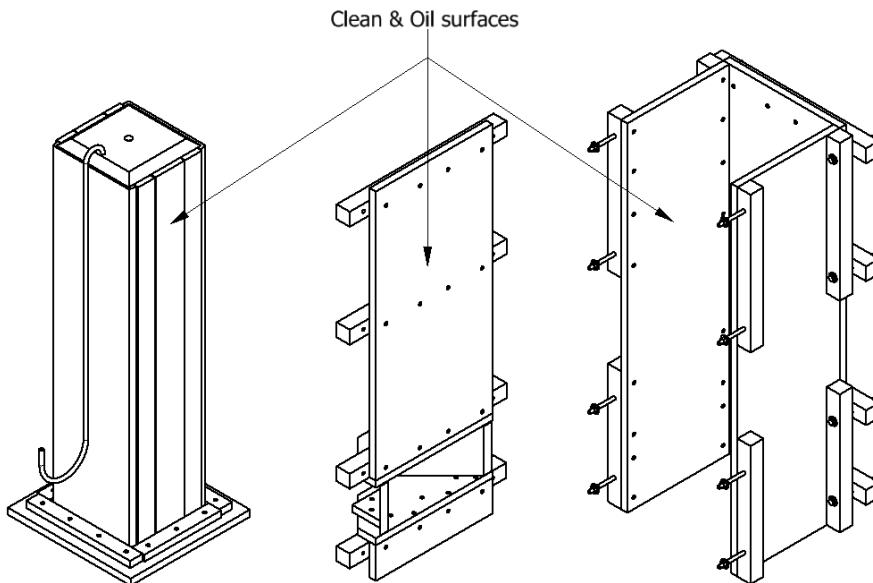
NOTE: THIS COMPLETES THE HARDWARE INSTALLATION SECTION.

SECTION X: Care & Maintenance (CM)

This section contains information for the care and maintenance of the Wood Mold. It is important that this section is reviewed before beginning to assemble the Mold for first use. The Wood Mold must be properly maintained to ensure the best results. Failing to care for the Mold properly may result in damage to the Mold and/or unsuccessful forms.

The Wood Mold does not have to be completely disassembled for cleaning. The back three faces (Shell Parts B, C, & D) may stay together and be cleaned as one piece. When a significant amount of concrete builds up between the edges and back face, the pieces may be separated and cleaned. This may occur approximately every three to five castings.

CM0	If this is the first time using the Wood Mold, skip to Step CM2. Once the Mold is constructed, review all steps in this section.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	All components
CM1	Clean and remove dried concrete from the surfaces that come into contact with wet concrete between EVERY USE.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	All components
CM2	Using an edible oil (corn, vegetable, etc.) coat the surfaces that come into contact with wet concrete between EVERY USE.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	All components



SECTION XI: Complete Build (CB)

The “Outer Shell” is a name for all the parts that make up the outside of the Mold: **A** (with **T** attached), **B**, **C**, **D**, & **R** (with **S** attached) with the attached support material and hardware.

The “Inner Core” is a name for all the pieces that create the inside of the Mold: **E**, **F**, **G**, **H**, **I**, **J**, **K**, **L**, **M**, **N**, **Y1**, **Y2**, **Y3** & **Y4**.

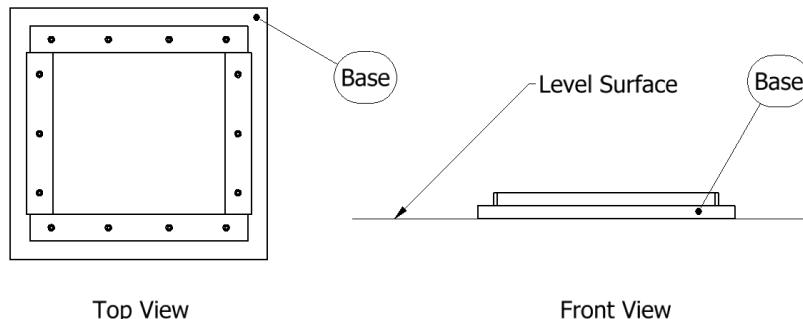
The “Nose” is Parts: **U** & **V**. The “Base” is Parts: **Q**, **W1**, **W2**, **X1** & **X2**.

The “Lid” is comprised of Part **O**, and the Tabs **Z1**, **Z2**, **Z3**, & **Z4**.

CB0	Gather all Wood Mold components for assembly. It is helpful if you have 2-3 people when assembling the inner core, particularly when placing the Dagger Board.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	All components
------------	--	--------------------------	--------------------------	--------------------------	----------------

CB1 Place the base down onto a level surface.

Base

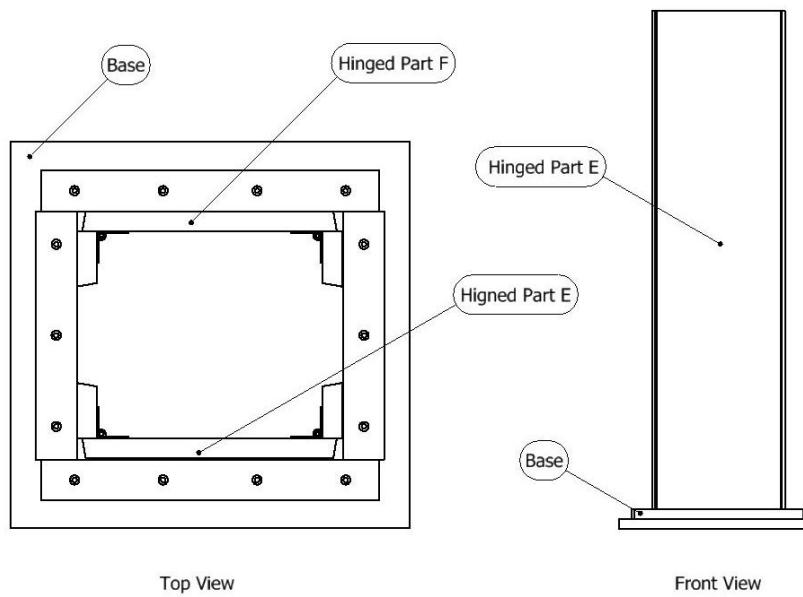


Top View

Front View

CB2 Place the hinged Parts E & F onto the Base as shown.

Base, Parts E & F

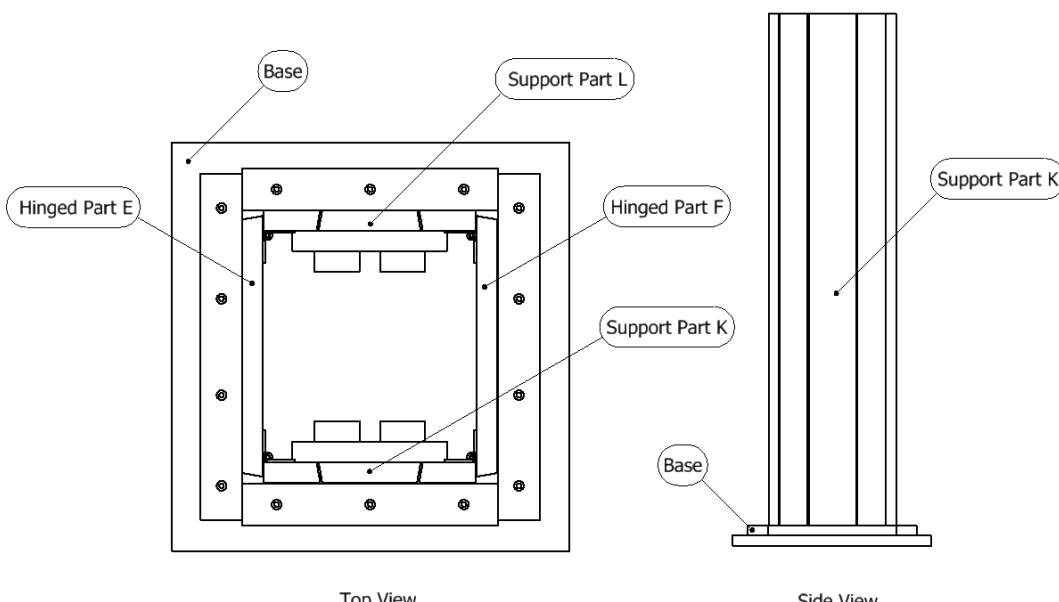


Top View

Front View

CB3 Place the support Parts K & L onto the Base as shown.

Base, Parts E & F, Parts K & L

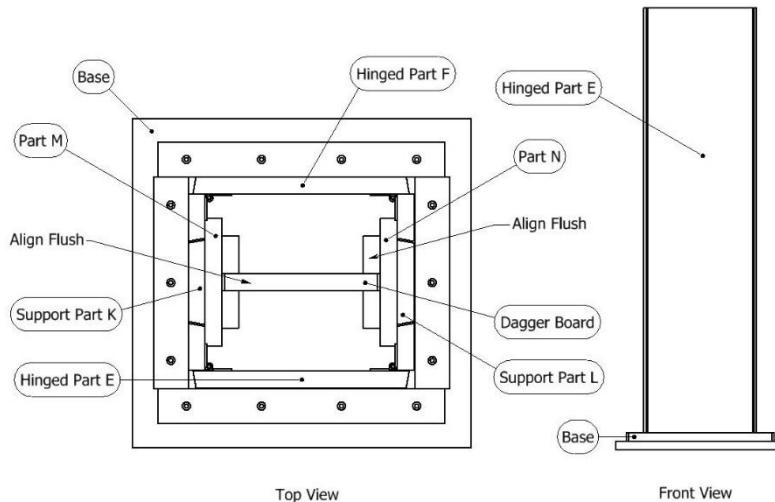


Top View

Side View

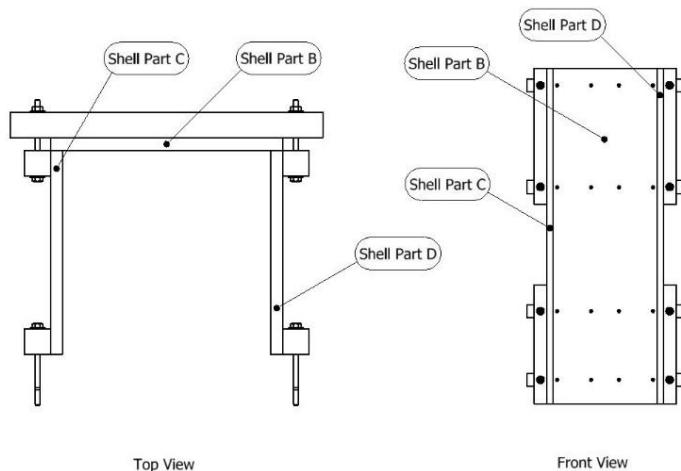
CB4 Insert the Dagger Board flush to Parts M & N.

Base, Parts E & F, Parts K & L, Dagger Board



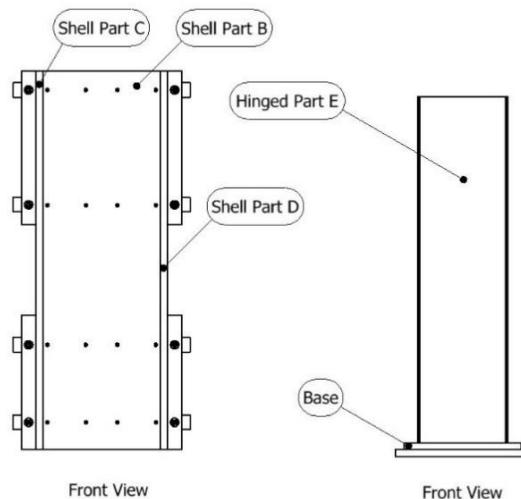
CB5 If not already assembled, create the Outer Shell as shown.
Leave the Nuts slightly loose, it will make assembly easier.

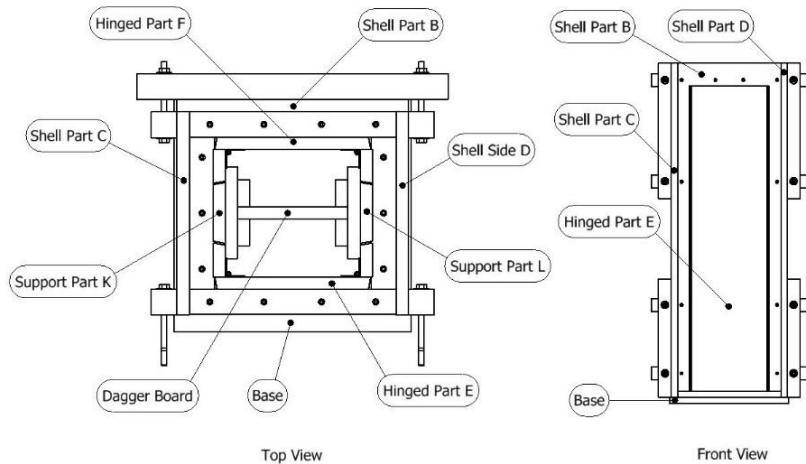
Shell Parts B, C, & D



CB6 If not already oiled, prepare these components with oil.

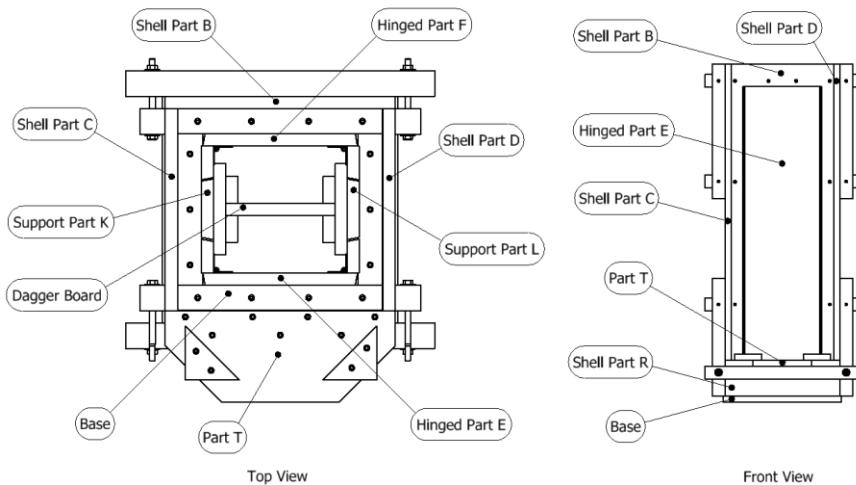
Base, Outer Shell, Inner Core



CB7**Place the Outer Shell on top of the Base as shown.****Base, Outer Shell, Inner Core**

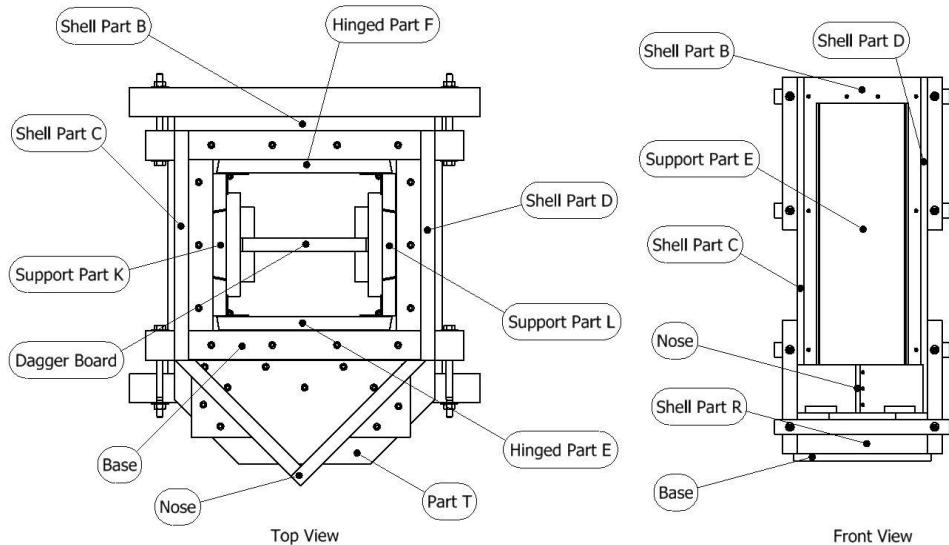
Top View

Front View

CB8**Place Shell Part R and loosely install the hardware.****Base, Outer Shell, Inner Core**

Top View

Front View

CB9**Place Nose Parts U & V on top of Part T.****Base, Outer Shell, Inner Core, Nose**

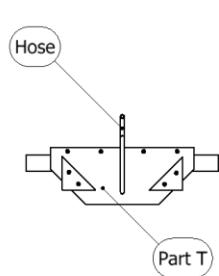
Top View

Front View

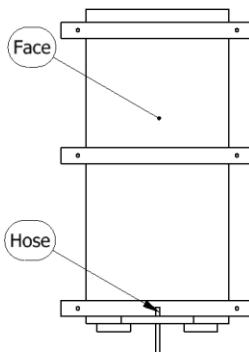
CB10

Prepare Part T (attached to Shell Part A) with the Hose.

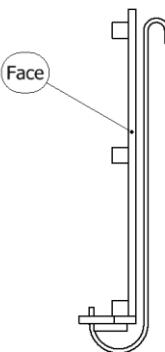
Shell Part A/T, Hose



Bottom View



Front View

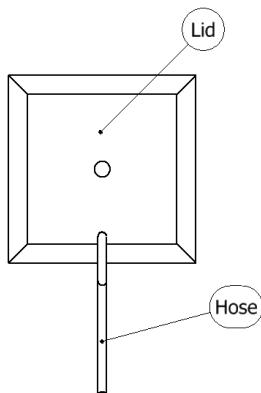


Side View

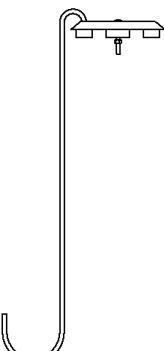
CB11

Prepare the Lid (with attached Tabs) with the Hose.

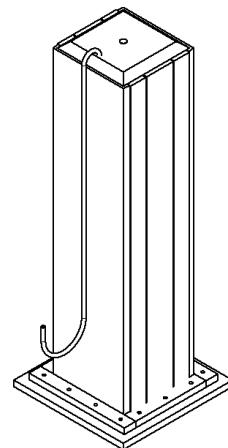
Lid, Hose



Top View



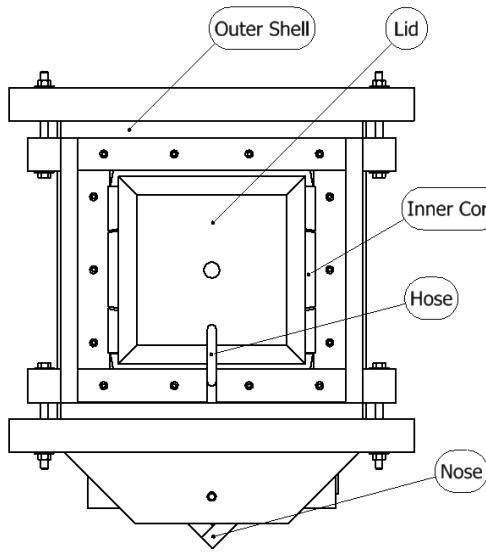
Side View



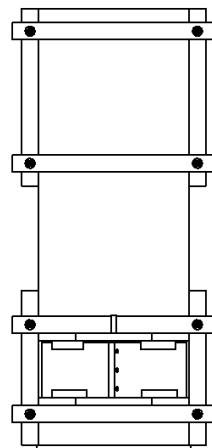
CB12

Place the Face onto the rest of the Shell. Place the Lid on top of the Inner Core. Center the Hose between the walls. Tighten Nuts until no light shows.

Base, Outer Shell, Inner Core



Top View

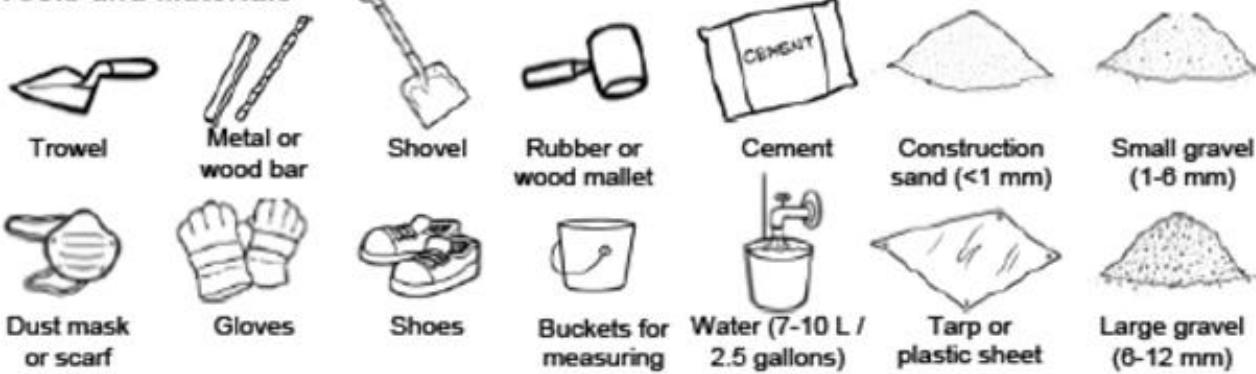


Front View

THIS COMPLETES THE ASSEMBLY OF THE WOOD MOLD. THE MOLD IS NOW READY TO MAKE A FILTER.

Making Concrete (MC)

Tools and Materials



1. Measure the cement, sand and gravel into a pile using a bucket. You need to know how much each bucket holds. Do not use a shovel to measure, because you do not know how much each shovel-full holds.



For 1 filter, you will need:

15 L of Cement
30 L of Sand
15 L of 1-6mm Gravel
15 L of 6-12mm Gravel

- Use equal amounts of cement, small gravel and large gravel
- Use twice as much sand
- 12 L is about equal to 11 dry quarts

2. Mix the dry materials very well.



3. Add the 7-10L of water slowly while mixing. Mix it well.



The concrete should look quite dry.

4. Test the concrete: Stick a shovel into the pile several times to make ridges.



- If the ridges are easy to see, it is good to use.
- If there are no ridges and the concrete just crumbles, it is too dry. Add more water.
- If the ridges disappear, it is too wet. Add more cement, sand, small gravel, and large gravel. Remember to add twice as much sand as gravel.

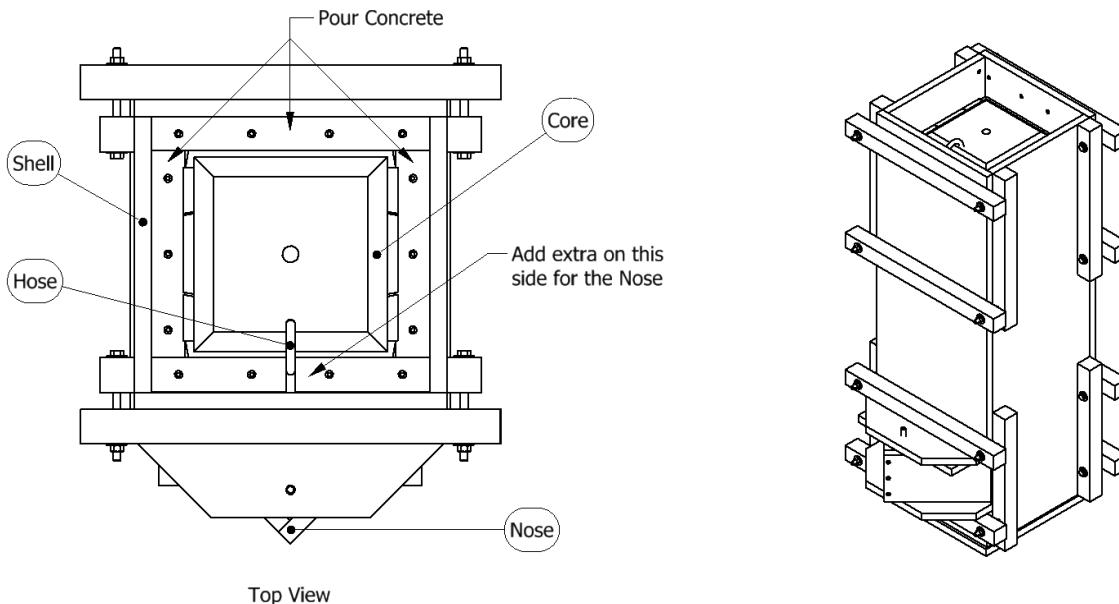
(This image has been adapted from the original, which can be found at www.cawst.org)

Filling the Mold (FM)

Once the concrete has been prepared, fill the Wood Mold with the mixture. Be sure the Mold is clean and oiled! Please also see the “How to Fill the Wood Mold” section in the Appendix for more information.

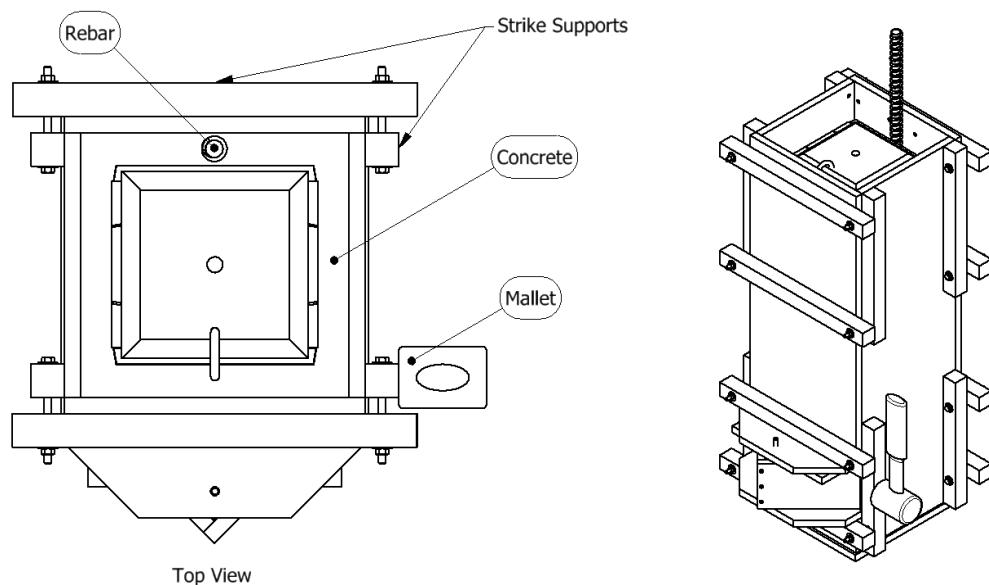
FM0	Gather the Wood Mold, concrete mixture and the tools listed in the “Making Concrete (MC)” section.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	All components
------------	--	--------------------------	--------------------------	--------------------------	----------------

FM1	With a grain scoop or trowel, pour concrete into the Wood Mold, evenly distributing the mixture down each of the sides. Be sure to add extra in the front for the Nose.
------------	---



Top View

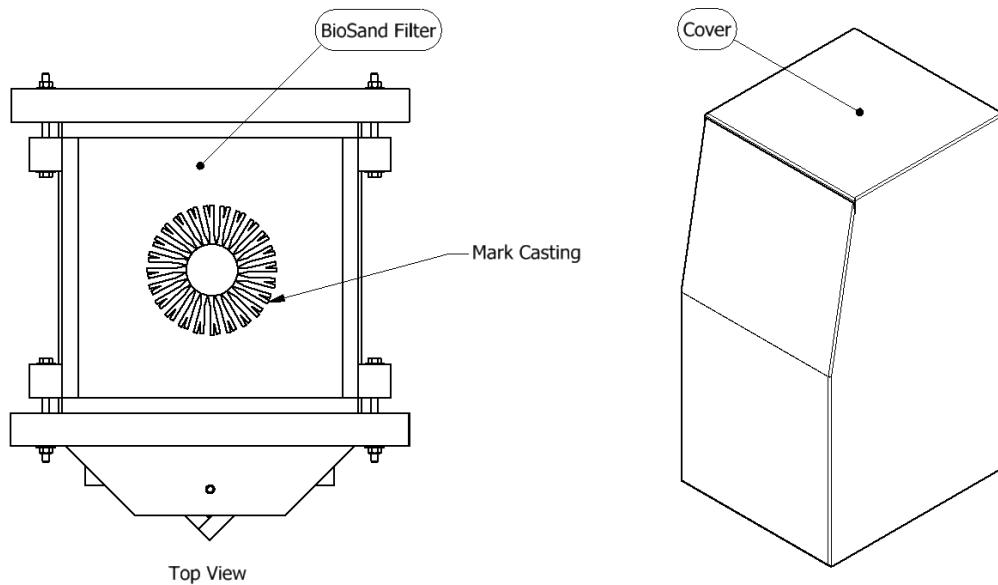
FM2	Once the mixture has reached the top of the Nose, tamp the Mold using a mallet and rod the mixture to relieve air pockets. It is better to strike the Support Material rather than the Wood Mold Faces.
------------	---



Top View

FM3	Repeat Step FM2 two to three times more while filling up the Wood Mold. Some concrete and/or water will leak from around the Nose during filling and tamping, this is normal.
------------	---

FM4	Once the Mold is full, (if desired) mark the casting. Then, cover the casting for several hours. Cure time will vary depending on environmental factors. Usually, letting it sit overnight is sufficient before de-molding.
-----	---

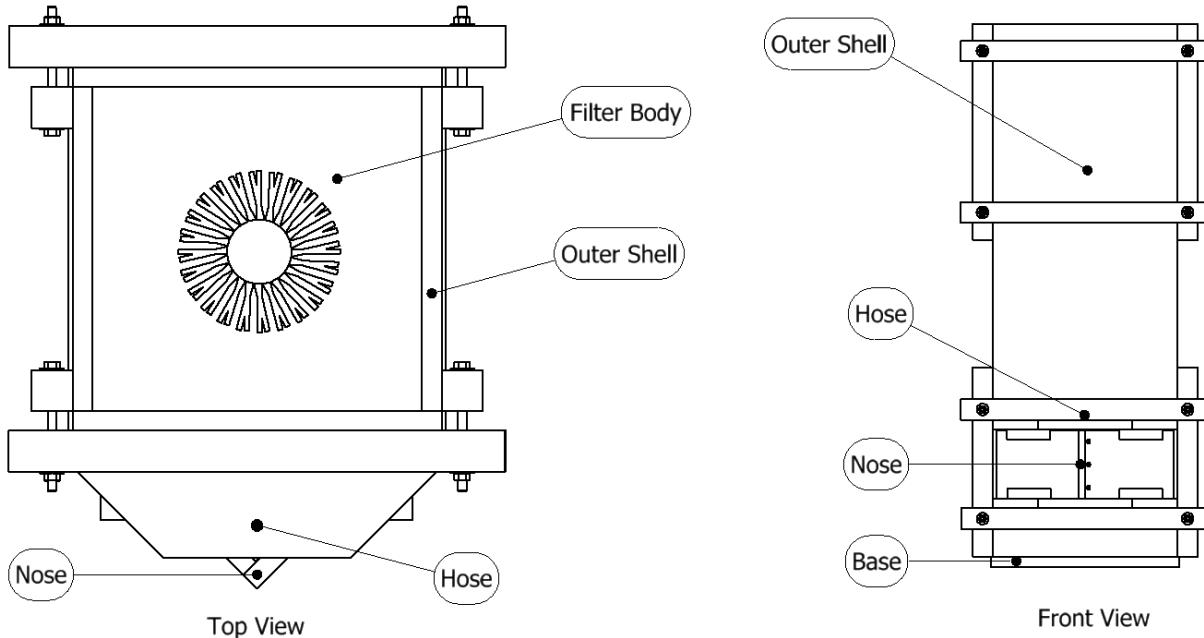


THIS COMPLETES THE FILLING OF THE WOOD MOLD. THE CONTAINER IS NOW READY FOR CURING.

De-molding (DM)

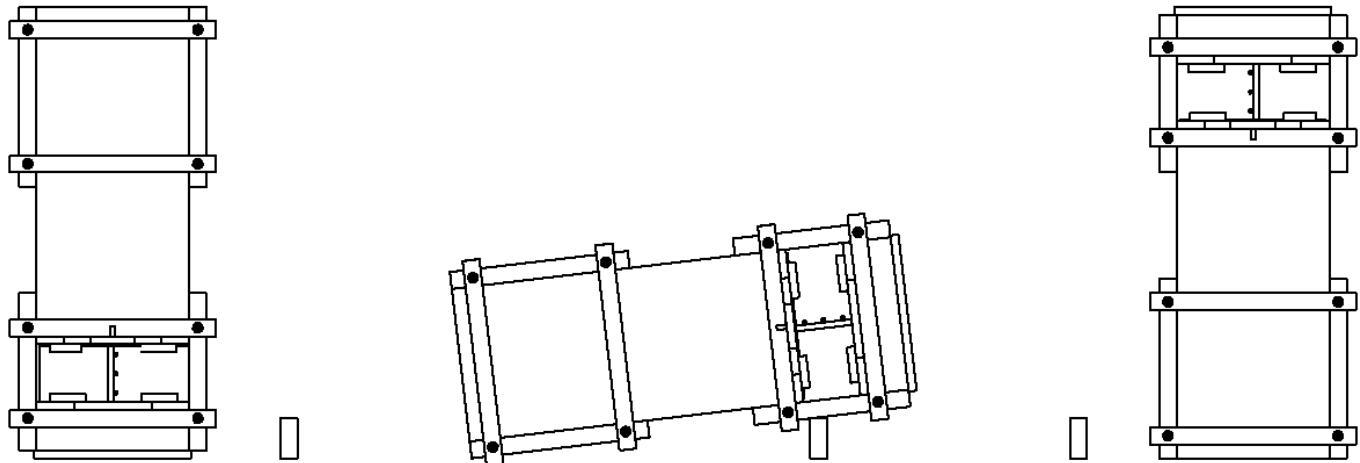
The Filter will continue to strengthen for about a week. During removal the Filter will be at its weakest and can still be damaged easily. USE CAUTION WHEN REMOVING THE WOOD MOLD!

DM0	Remove any covering from the Mold and clear a space to de-mold.	Covering(s)
-----	---	-------------



DM1

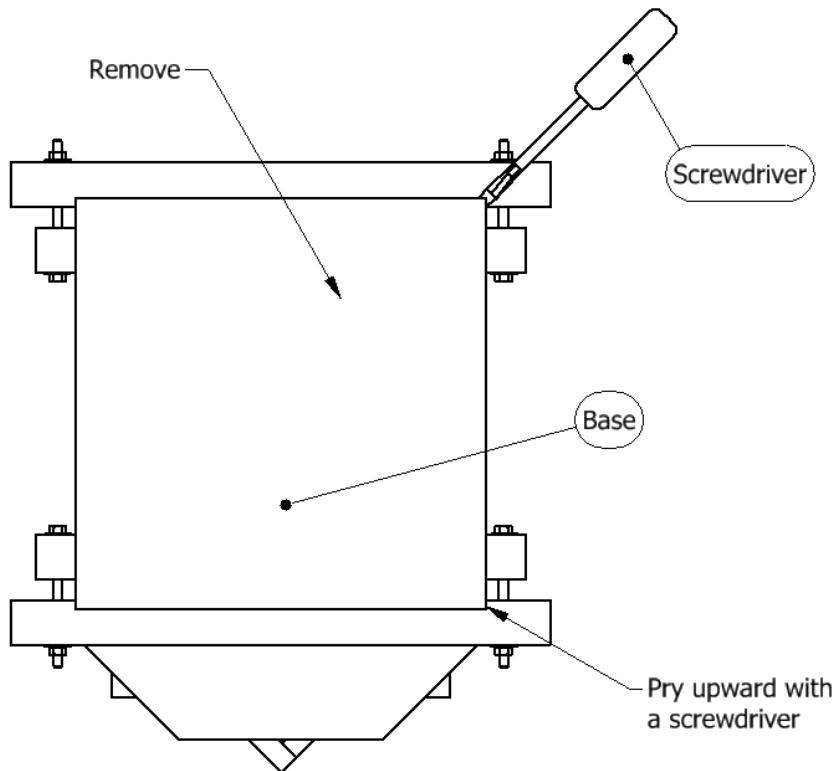
Flip the Mold so that the Nose is closest to the top. Use a piece of scrap wood, or suitable items such as bricks, as a support while turning the Wood Mold over.



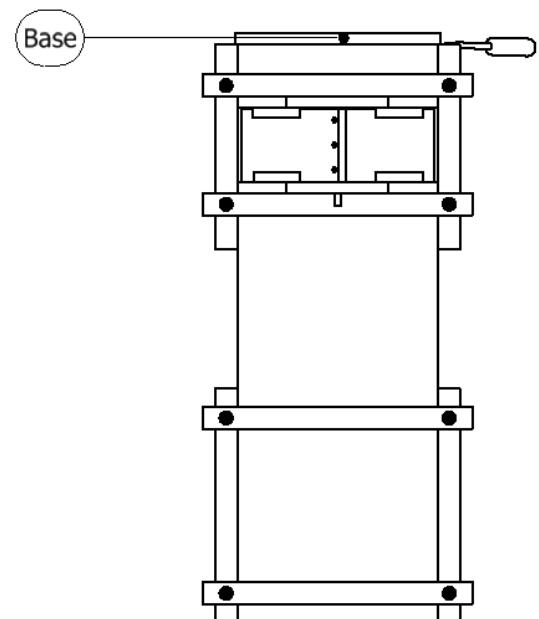
Front View

DM2

Remove the Base. Using a screwdriver to pry the Base upward helps.



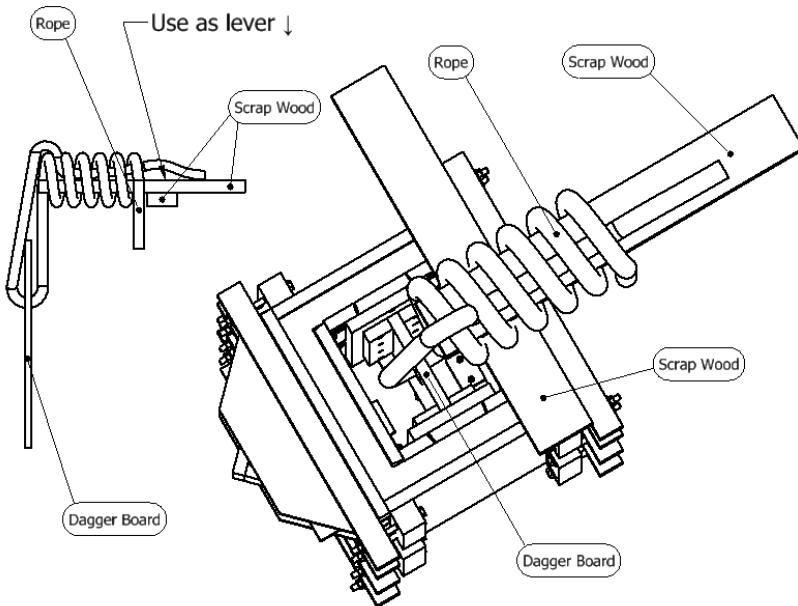
Top View



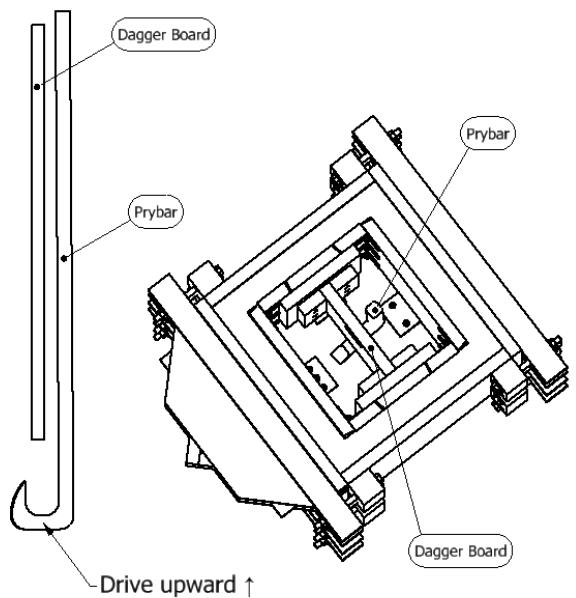
Front View

DM3	Use a piece of lumber and a rope to create a lever to remove the Dagger Board. Alternatively, use a crowbar to strike the bottom of the Dagger Board upward.	Dagger Board
-----	---	--------------

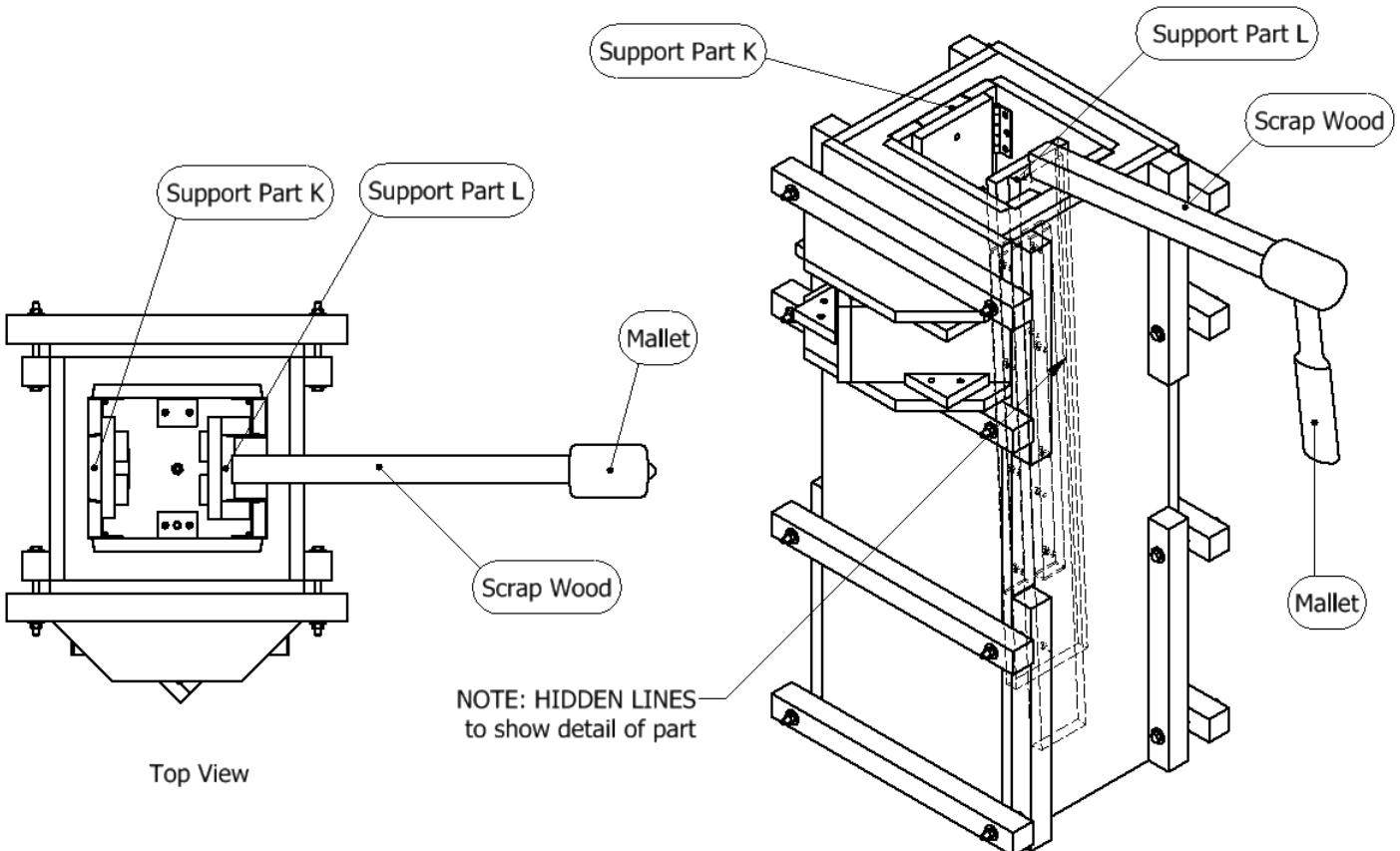
Rope Method



Prybar Method



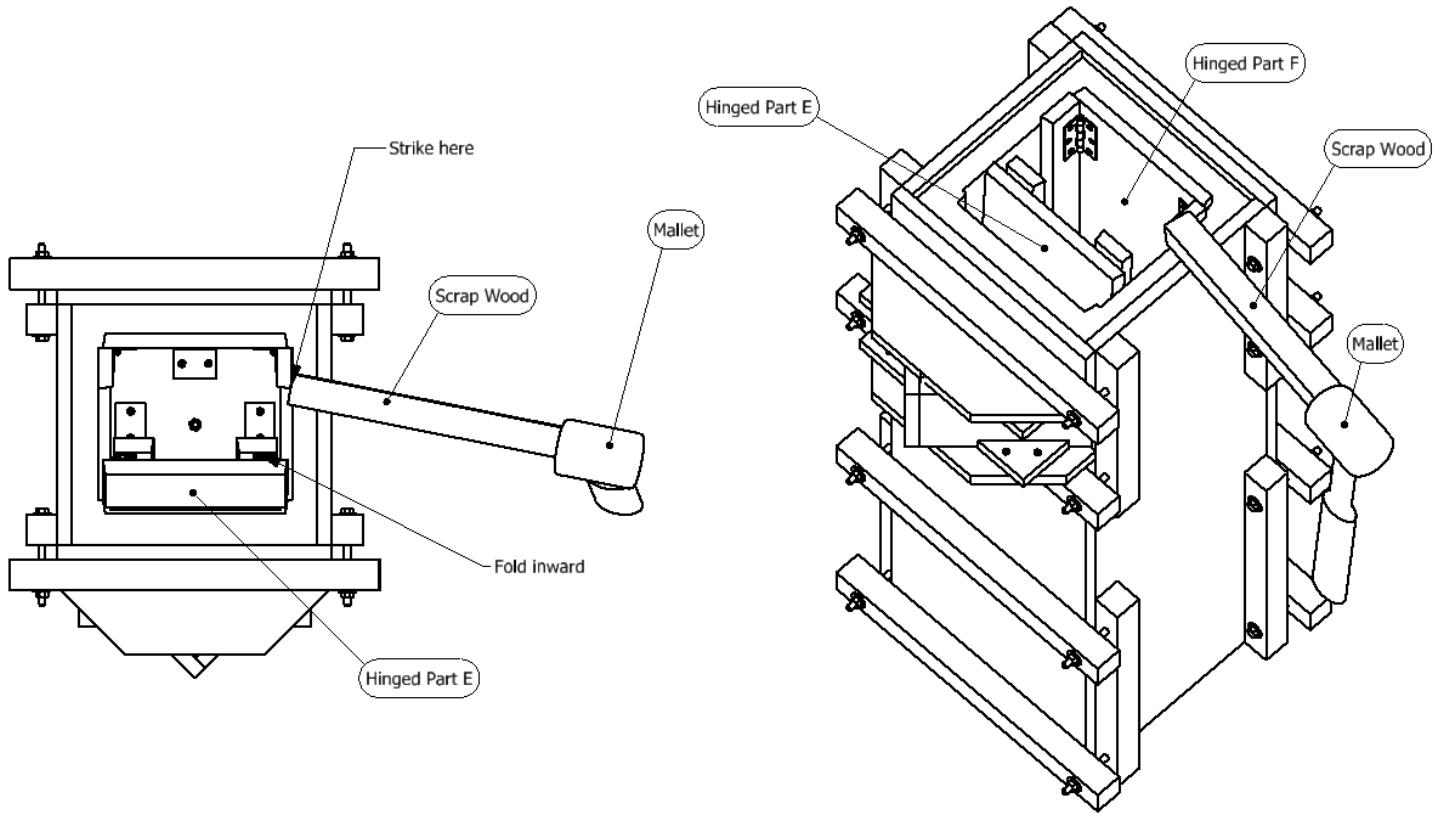
DM4	Remove Support Parts K and L by collapsing the Parts toward each other. A hammer and piece of wood may be used to strike the Supports.	Support Parts K & L
-----	---	---------------------



DM5

Remove Hinged Parts E and F by collapsing the Hinged Supports inward.
A hammer and piece of wood may be used to strike the Hinged Supports.

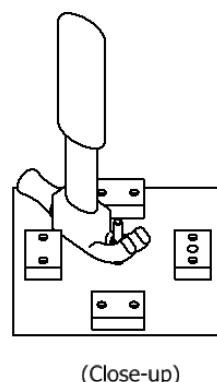
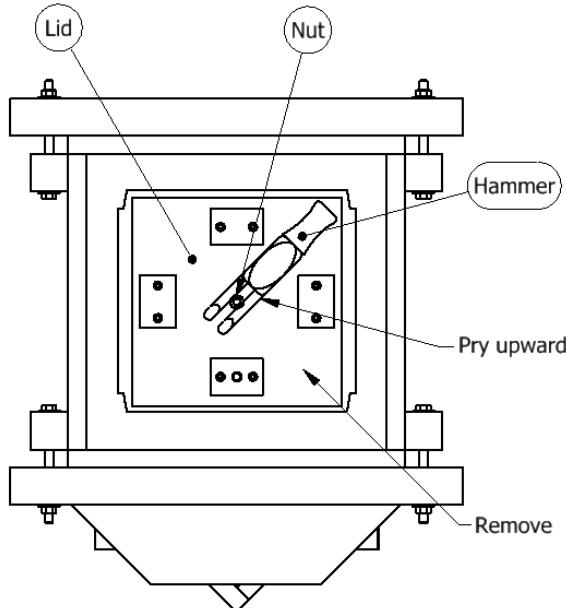
**Hinged
Parts E & F**



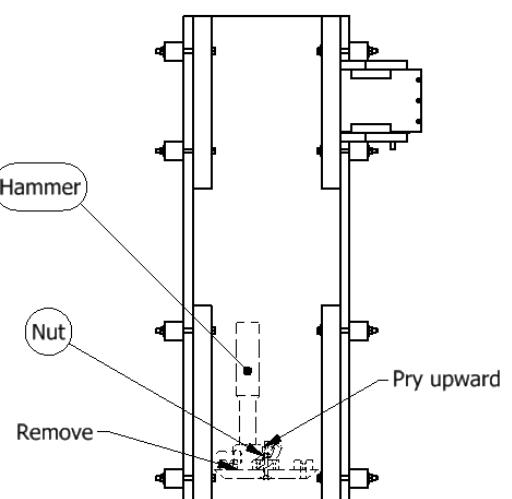
DM6

Remove the Lid from the bottom of the core. The claw part of a hammer will work as a pry against the Nut to lift the Lid upward and out of the core.

Lid



NOTE: In this view the Lid is shown using Hidden Lines (---). This shows where to pry against with the hammer for Lid removal.



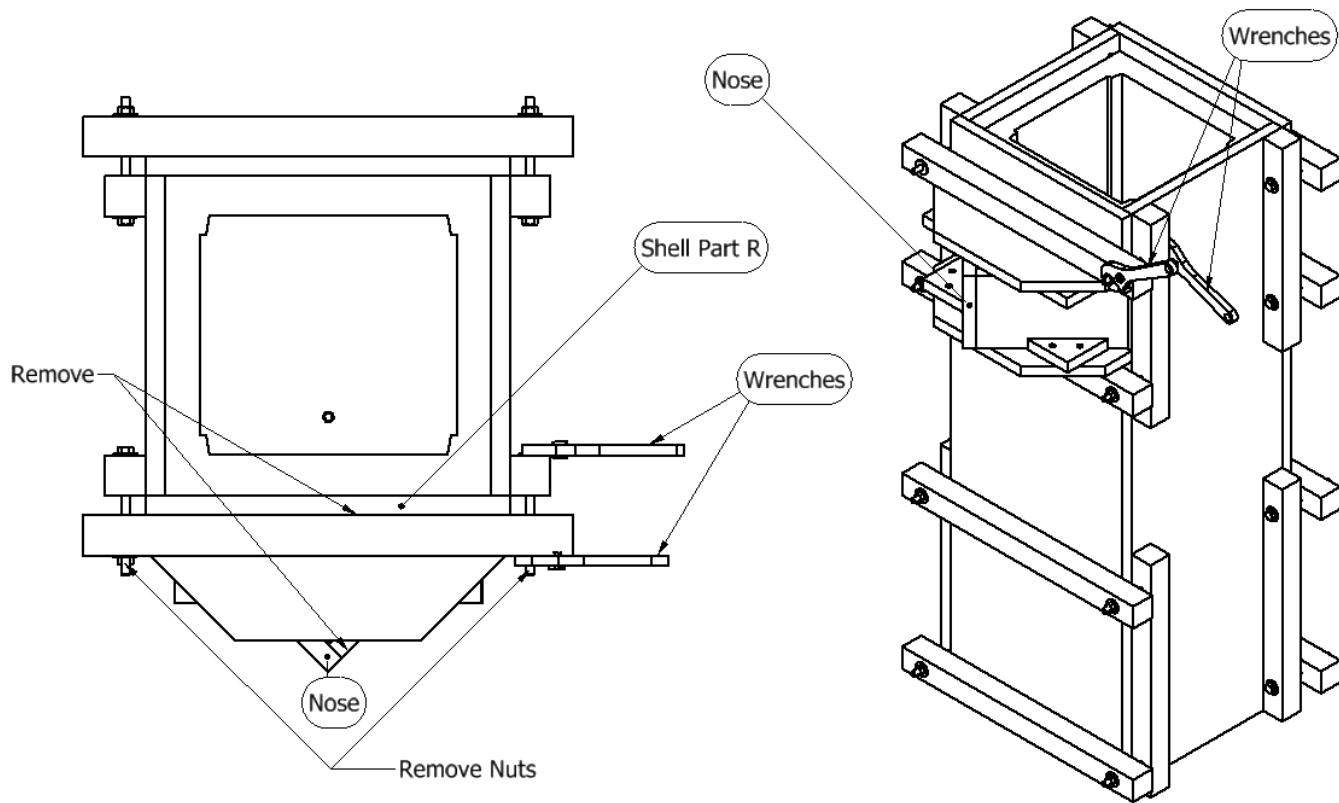
Top View

Side View

DM7

Remove the Outer Shell Part R and the Nose Parts. If the Nose sticks, gently pry it off by hand. DO NOT USE A TOOL TO PRY THE NOSE OFF!

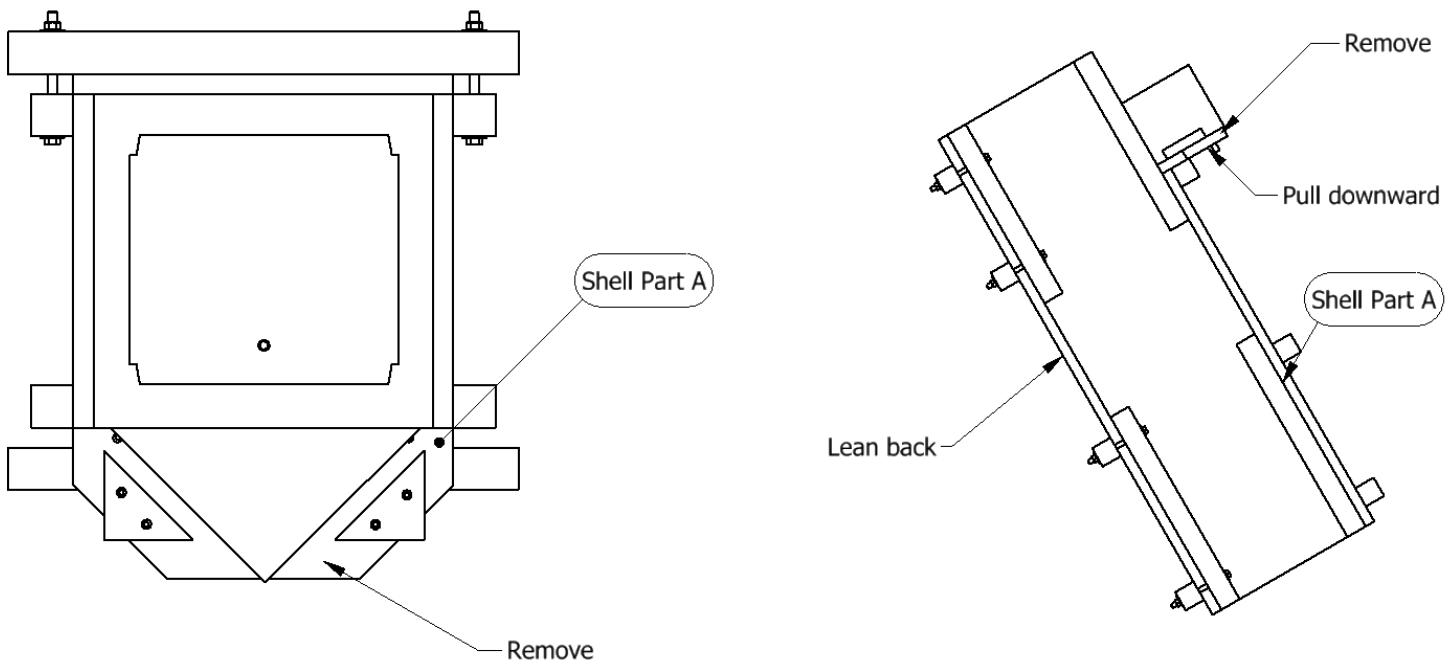
Outer Shell R, Nose



DM8

Remove the Outer Shell Part A by removing the hardware and then gently leaning the Casting/Wood Mold backward as shown, while pulling downward on the Shell Part A.

Outer Shell A

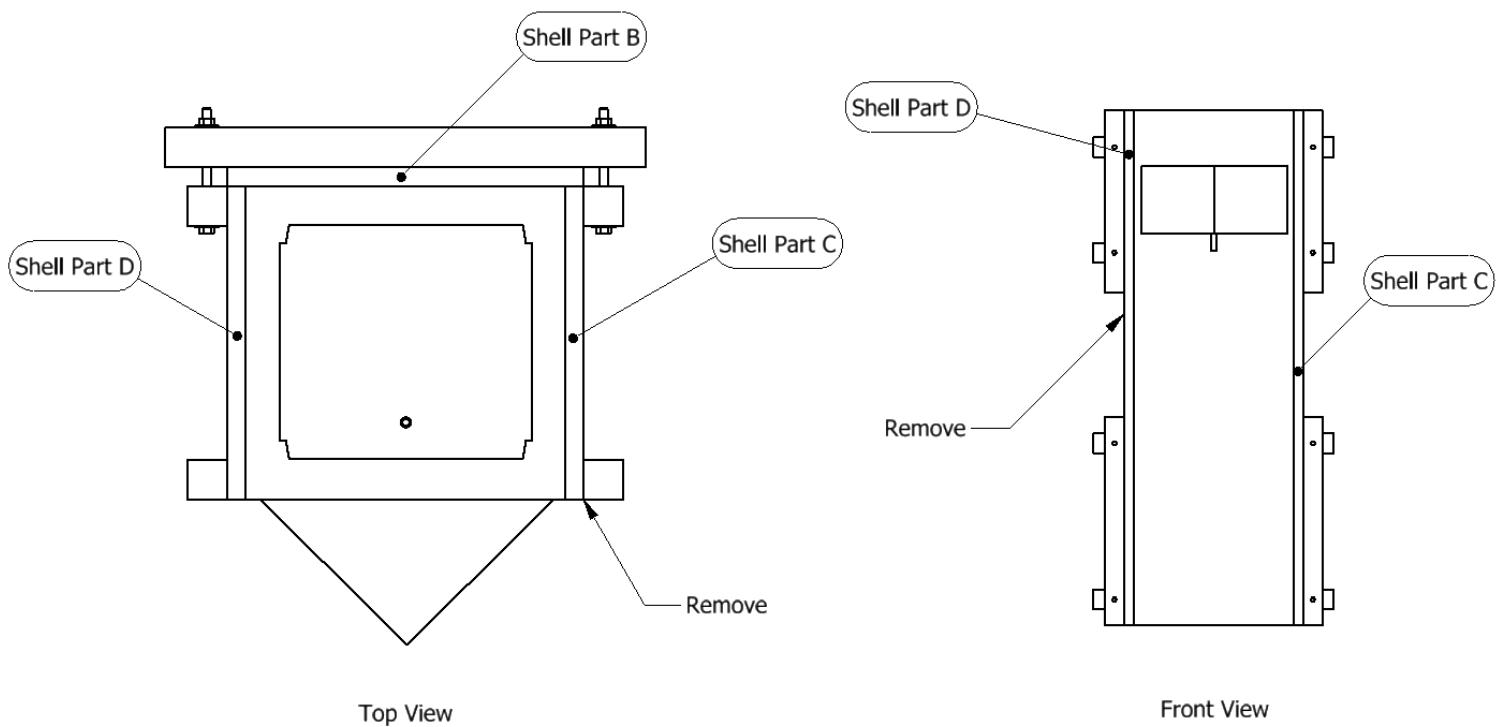


Top View

Side View

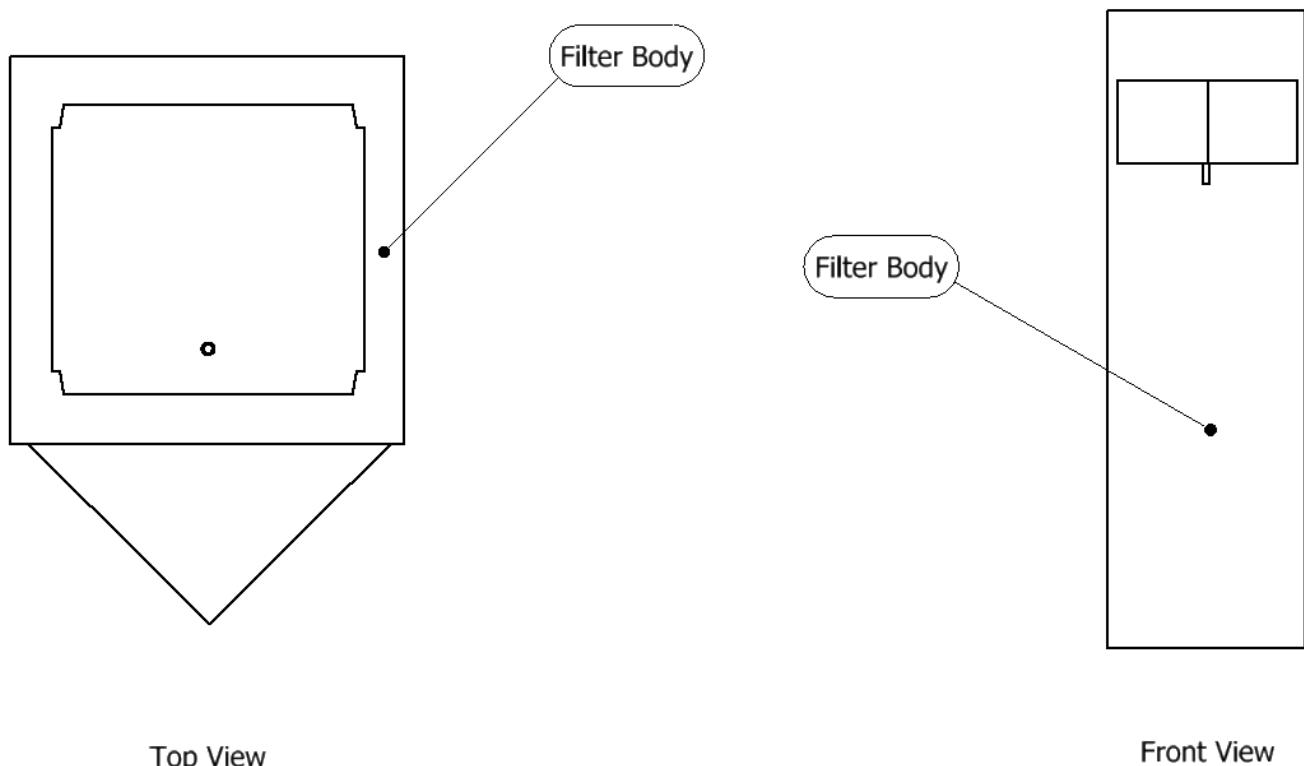
DM9

Remove the Outer Shell Parts BCD by gently pulling outward on the sides of the Wood Mold from the concrete Filter Body. Loosen the Nuts if sticking occurs.

Outer Shell
Parts BCD

DM10

CONGRATULATIONS! The Filter Body used to create a BioSand Filter (BSF) is now complete. Proceed to the After Care section before filling the Filter Body.



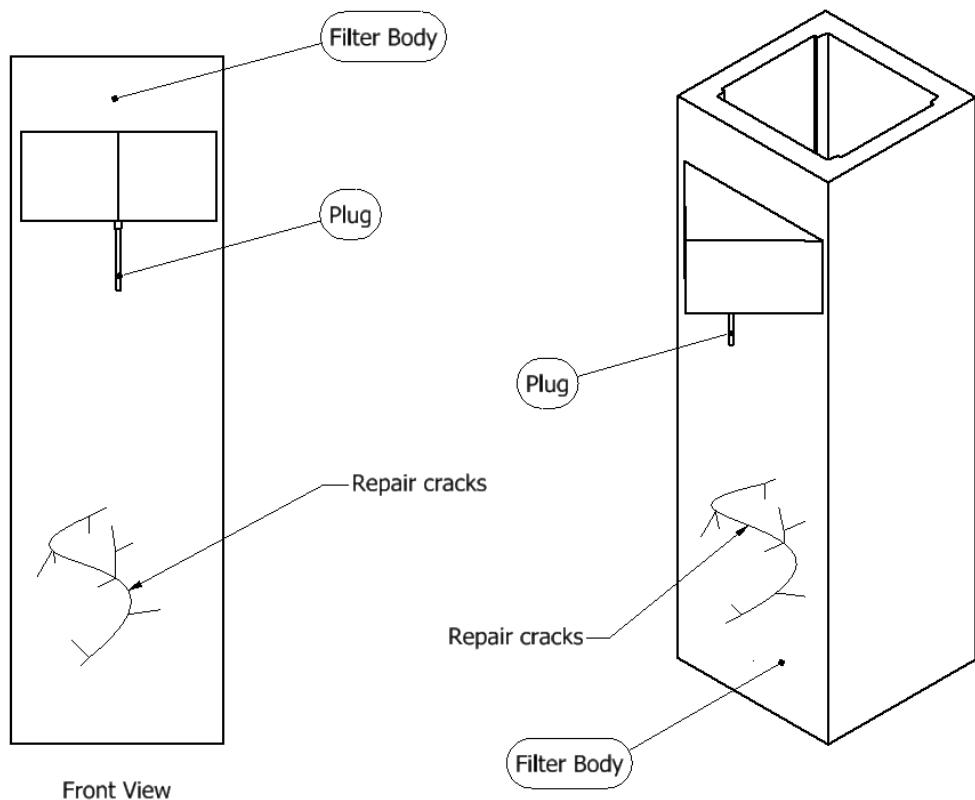
After Care (AC)



If you are not familiar with making a BioSand Filter, installing a filter, checking the flow rate, etc, please see the Appendix for more detailed information on these topics. In the Appendix, pages 33-52 detail how to finish the filter body, find sand and gravel, sieve the sand and gravel, and wash the filter media.

AC0 Before the concrete Filter Body can be filled with sand/gravel for use as a BioSand Filter, it must first be cured. This process will strengthen the concrete. The Filter Body should be covered during the cure. Please see the Appendix for more detailed information on finishing the Filter Body (pg 33).

AC1 After de-molding, fill the Filter Body to the top with water. Check the flow rate of the Tube. It should be 1 Liter per minute (33.8 US fluid ounces per minute). Refill any lost water. Inspect the Filter Body for cracks, chips, or leaking. The outlet tube should not be more than 1cm long. If it is too long, cut it shorter.



AC2 Plug the outlet tube with tape, cloth, or a stick. Fill the filter to the top with water and cover with a tarp, cloth, or plastic sheet. Allow the filter to cure for at least 7 days. Do not move the filter during this time. The concrete will become stronger the longer it cures. For more information on this process, please see the Appendix (pg 33).

Installing a Filter (IF)

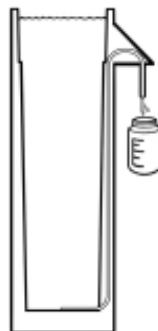
This section contains information modified from the CAWST BioSand Filter Construction Manual. The full CAWST Manual can be found at www.cawst.org. Please read this section carefully even if you are familiar with how to properly install a BioSand Filter. There are some differences (flow rate, volume of sand, etc) between a filter made from a Wood Mold and a filter made from a steel mold. If you are not familiar with the processes for finding, sieving, and washing sand and gravel, please see the Appendix.

These are the steps to install a filter:

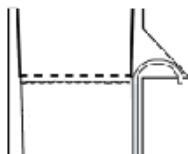
1. Put the filter in a good location.
2. Put in the drainage gravel, separation gravel and sand.
3. Check the flow rate.
4. Flush the filter.

TIP: Try to install a few filters nearby each other on the same day. While you are waiting for the water to run through one filter, you can start installing the next filter.

Before you install the filter, make sure the outlet tube is not blocked. When you fill the empty filter to the top with water, the flow rate should be about **1 liter per minute**. When it stops flowing, the top of the water should be just below the diffuser.



! This should have been checked when the container was made. But it is good to check it again now - before you fill the filter with gravel and sand!



Also make sure the inside of the filter is clean. Check that the filter is level.

The next page has a list of things you need to take with you when you go to install filters.

Materials to take with you for a filter installation:

You will need to take all of these materials with you when you go to install a filter.

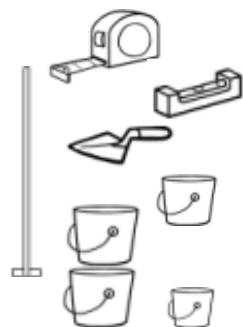


Putting in the sand and gravel

- Filter
- Safe storage container (if provided with the filter)
- Sand (27.4 L or 29 quarts)
- Separation gravel (2.5 L or 2.6 quarts)
- Drainage gravel (2.5 L or 2.6 quarts)
- Diffuser
- Lid

- Extra sand and gravel
- Extra diffuser in case one gets broken or does not fit
- Extra lid in case one gets broken or does not fit

- Measuring tape or ruler
- Level to check if the filter is level and flat
- Wooden bar for measuring how deep the gravel is during installation
- Shovel or trowel for putting sand and gravel in the filter
- Small buckets for measuring sand and gravel if they are not in the correct size bags already
- Buckets for pouring and catching water
- Small bucket or cup for removing dirty water from the top of the filter (Swirl and Dump)



Checking the flow rate

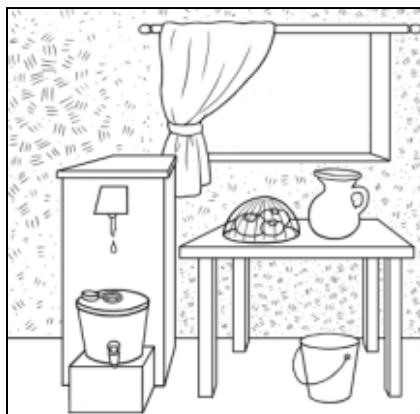


Educating the users and filling out monitoring form



- Pen or pencil
- Monitoring forms (please ask OHorizons for our baseline survey and other monitoring forms if necessary)
- Education materials and your organization's contact details to leave with the family

Position



The filter should be in a safe place. It should also be easy for the family to use.

The filter should be:

- Away from sunlight, rain, animals and children
 - On flat, level ground or floor
 - In or near the kitchen, where it will be easy to use and clean
 - Where there is room to lift buckets and pour them into the filter
-
- If users are short, it is difficult to pour a bucket of water into the filter. They can use a step in front of the filter to make it easier.
 - It is best to put filters inside the house. They can also be put under a roof on the side of the house.
 - Filters full of sand and gravel should never be moved. They are too heavy, and moving the filter may cause it to stop working.



Once the filter is filled with sand and gravel, it cannot be moved!

If the user wants the filter moved later, a technician needs to come and take out all the sand and gravel. Then they can move the filter. Then the technician must reinstall the filter with sand and gravel as if it was a new filter.

If the filter is moved without first taking out the sand and gravel, it may not work as well after it is moved. Sand or gravel may block the outlet tube and/or the biolayer could be disturbed.

Put in the sand and gravel



See Appendix for information on how to wash and sieve the sand and gravel!

Tools and Materials



Tape measure or ruler



Level



Wood bar or leveling stick



About 2.5 liters of washed separation gravel



About 2.5 liters of washed drainage gravel



About 27.4 liters of washed filtration sand



Water



Bucket



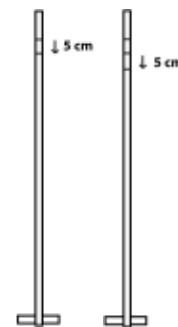
Shoes

Put in the sand and gravel –Continued



1. Put a stick into the filter and touch the bottom of the filter. Draw a line on the stick even with the top of the filter.

Put a bucket under the filter outlet to catch any water that flows out during the installation.



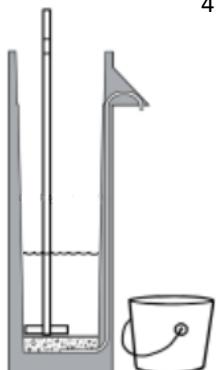
2. Draw another line on the stick 5 cm (2") down from the first line.

Draw a third line 5 cm (2") down from the second line.



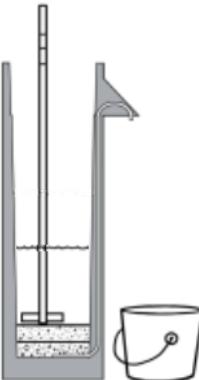
3. Draw a line on the inside of the filter, about 28 cm down from the top. This is about where the sand should come to.

Put about 10 liters of water in the filter. Having water in the filter when you put in the gravel and sand will prevent air pockets and dry spots in the sand.



4. Put drainage gravel into the filter until it is 5 cm (2") deep. This should be about 2.5 liters of gravel. Make the top of the gravel flat and level using the stick.

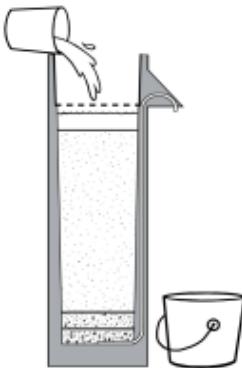
Put the stick on top of the gravel. If the second line on the stick is level with the top of the filter, you have added enough gravel (5 cm).



6. Put separation gravel into the filter until it is 5 cm (2") deep. This should be about 2.5 liters of gravel. Make the top of the gravel flat and level using the stick. Put the stick on top of the gravel. If the third (bottom) line on the stick is level with the top of the filter, you have added enough gravel (5 cm).

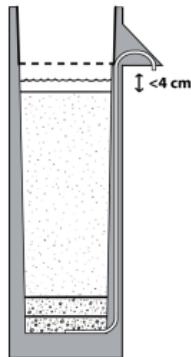


7. Quickly add about 27.4 L of filtration sand, until the sand comes up to the line you drew on the inside of the filter. As you add the sand, the water level in the filter should always be higher than the sand. You may have a little dry sand at the very top – this is ok. See the note on the following page.



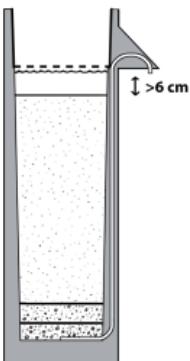
8. Put in the diffuser. Pour a bucket of water into the top of the filter. Let the filter run until the water stops flowing. This could take an hour or more. Use this time to educate the user, or install another filter in a nearby location.

10. When the water stops flowing, check the depth of the water above the sand. The water should be between 4 and 6 cm deep.



If the standing water level is less than 4 cm deep, check the outlet tube. If it is longer than 1 cm, cut it shorter. Fill the filter with water again and measure the standing water level again.

If the water is still less than 4 cm deep, there is too much sand. Take some sand out. Make the top of the sand smooth and flat. Put the diffuser in. Pour a bucket of water into the top of the filter and let it run until the water stops flowing. Measure the standing water level again.



If the standing water level is more than 6 cm deep, there is not enough sand. Add some more sand. Make the top of the sand smooth and flat. Put the diffuser in. Pour a bucket of water into the top of the filter and let it run until the water stops flowing. This could take an hour or more. After the water stops flowing, measure the standing water level again.



11. When the water above the sand is between 4 and 6 cm deep, you have added enough sand. Now you need to clean the top of the sand so the filter does not clog.

Put your hand flat on the top of the sand, and swirl it around the surface of the sand. The water above the sand will become very dirty.



12. Remove the dirty water using a cup or small bucket. Throw this water away - dump it down a drain or into the bushes.

Repeat the Swirl and Dump in steps 11 and 12 until the water in the top of the filter stays clear. If you remove all the water, put the diffuser back in before pouring more water into the top of the filter. Then you can repeat the Swirl and Dump.

Check the Flow Rate

Tools and Materials



Water
(11 liters or
3 gallons)



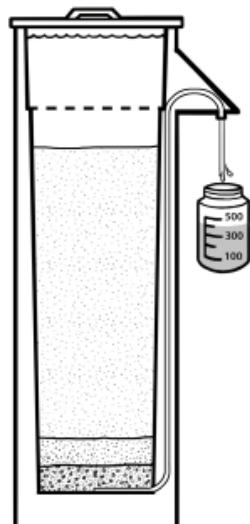
Bucket to collect
filtered water



Measuring container or old bottle
to measure collected water



Stopwatch or
timer

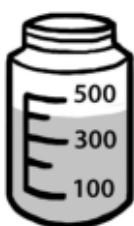


1. Pour 11 liters of water into the filter. Instruct users that they should not add more than 11 liters of water to the filter at a time (i.e each batch of water should not exceed 11 liters). This will maximize the filter's effectiveness at removing pathogens.
2. Start the timer. Hold the measuring cup or bottle under the outlet to collect the water. Measure the flow rate.



Measure the flow rate when the filter is full.
The flow rate will get slower as it empties.

Using a measuring container



If you are using a
measuring container,
collect water for exactly 1
minute. Then look to see
how much water you
collected.

You should get 340 mL or less in 1 minute.

If you get less than 250 mL in 1 minute, the sand was not washed enough.

If you get more than 400 mL per minute, the sand was washed too much. You need to reinstall the filter with different sand.

Using a 1 L bottle



If you are using a 1L bottle, time how long it takes to fill the bottle.

It should take 2 minutes and 54 seconds or longer to fill a 1 L bottle.

If it takes more than 3 minutes and 45 seconds to fill the bottle, the sand was not washed enough.

If it takes less than 2 minutes and 35 seconds, the sand was washed too much. You need to reinstall the filter with different sand.

Using a 500 mL bottle



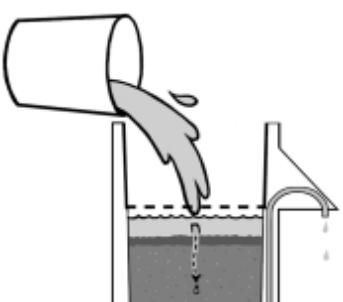
If you are using a 500 mL bottle, time how long it takes to fill the bottle.

It should take 1 minute 27 seconds or longer to fill a 500 mL bottle.

If it takes more than 1 minute and 52 seconds to fill the bottle, the sand was not washed enough.

If it takes less than 1 minute and 17 seconds, the sand was washed too much. You need to reinstall the filter with different sand.

WHAT IF THE FLOW RATE IS TOO SLOW?



If the flow rate is less than 340 mL/minute, the filter will still work effectively.

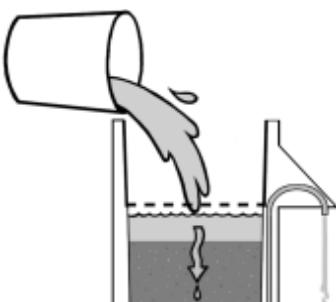
But, users may not like a slow flow rate. The flow rate will get even slower as they use the filter because the top of the sand clogs with dirt. If the flow rate gets too slow, they may stop using the filter.

If the flow rate is too slow after you install the filter, you can try to make it faster by cleaning the top of the sand. Do a Swirl and Dump. Swirl the top of the sand with your hand. Then use a cup to dump out the dirty water in the top of the filter.

If the flow rate is not faster after doing 4 “Swirl and Dumps”, you must wash all the sand more. Take all the sand out of the filter. Take the sand back to be washed again. Do another jar test. Install 1 filter and test the flow rate. Tell the people who wash the sand that it has not been washed enough, so they can adjust their washing method.

Reinstall the filter in the home with new gravel and sand that has been washed more. Check the flow rate again.

WHAT IF THE FLOW RATE IS TOO FAST?



If the flow rate is more than 340 mL/minute, the filter might not work as well. It might not remove as many pathogens from the water.

If the flow rate is higher than 400 mL/minute, you should replace the sand. Take all the sand out of the filter. Start with new sand and wash it less. Do a jar test. Install 1 filter and test the flow rate. Tell the people who wash the sand, so they know they are washing it too much.

Reinstall the filter with the new sand and gravel. Check the flow rate again.

Flush the Filter

Tools and Materials

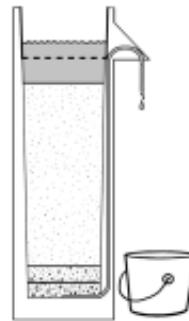
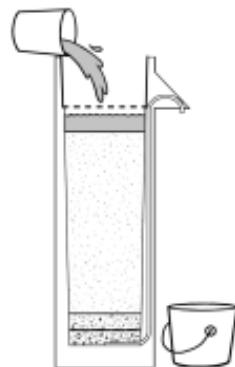
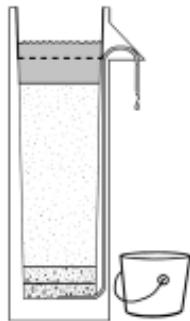
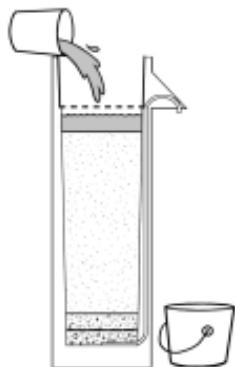


Water
(40 to 80 liters or
10 to 20 gallons)



Bucket to collect
water from outlet

Flushing the filter will remove any dirt and fine sediment that may still be in the sand and gravel. Sometimes there is fine sediment that comes out the outlet tube as a result of the installation procedure. If these fine particles are not flushed out of the filter now, the user may see them in the water when they start pouring water through the filter, and they may stop using the filter.



1. Make sure the diffuser is in the filter. Put a bucket under the outlet to catch water.

Pour a bucket of clear water into the top of the filter. Use the clearest water possible.

2. Look at the water coming out of the outlet tube. It may be dirty at first. It will get clearer as more water flows through the filter.

Using the updated installation procedure above will reduce the amount of flushing needed.

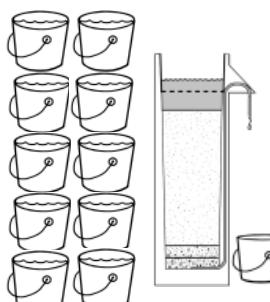
3. When the filter stops flowing, throw the dirty water in the collection bucket away—pour it down a drain or into the bushes.

Pour another bucket of water into the top of the filter.

4. Continue pouring water into the filter until the water coming out of the spout is clear.

In some cases, it may take up to 40 to 80 liters (10 to 20 gallons) before the filtered water is clear.

5. Check the standing water level. The water above the sand should be 4 to 6 cm (1.5" to 2.5") deep. The surface of the water should be below the diffuser, not touching it.



WHAT IF THE WATER NEVER GETS CLEAR?

If you have put more than 10 buckets of water (124 liters or 30 gallons) into the top of the filter and the water coming out of the spout still is not clear, the gravel was not washed enough. You must take the sand and gravel out of the filter. Wash the gravel more, until it is completely clean and there is no dirt in the water in the wash bucket. Then reinstall the filter, using the clean gravel.

THIS COMPLETES THE WOOD MOLD CONSTRUCTION MANUAL.

Where can I find additional Information?

The OHorizons Wood Mold Construction Manual contains technical information on creating the Wood Mold, using the Wood Mold, and proper filter installation. For additional assistance on problem solving with the Wood Mold, creating diffusers, sourcing sand and gravel, and more please see the OHorizons Appendix, which can also be found on our website.

For more information on educating the user, follow-up procedures, and more please contact OHorizons. We have many additional materials that may be helpful in planning and implementing your project. If we don't have the specific resource you need, we can help you locate additional resources elsewhere.

You can always contact OHorizons via the Contact form on our website (www.ohorizons.org) or you can email us directly at info@ohorizons.org.

