

# CLAMSHELL BOX CONSTRUCTION

Update of Manual Guide 6A

Rev 4/05

The type of box described below completely encloses the protected item, and is recommended for the protection of: fragile items to be preserved in original condition, important bindings, certain loose materials, or bindings with clasps or nails. The box consists of three basic parts: lower tray, upper tray, and outer case.

## Materials:

- Barrier board (20 pt)
- Binder's board (0.074 in.)
- Buckram
- PVA (adhesive)
- Lightweight Folder Stock (10 pt.) (Lightweight bristol board)
- Heavyweight Folder stock (20 pt.) (Map folder stock)

## Hand Tools:

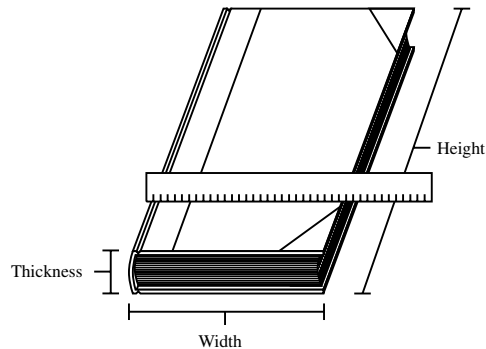
- Bone folder
- Scissors
- Glue Brush
- Ruler with cm units
- T-square and knife or mat cutter, or board shear

## MEASUREMENT of the Trays

### 1) Determine Object Dimensions

- a) Measure and record the object's Height, Width, and Thickness.

FIGURE 1-1



### 2) Determine Tray Dimensions

#### LOWER TRAY

- a) To the height of the object, add **2x its Thickness, plus 0.4cm.**
- b) To the width of the object, add **1x its Thickness plus 0.2cm.**

Object Height	
	+
Object Thickness x2	
	+
	0.4
Lower Tray Height	

Object Width	
	+
Object Thickness	
	+
	0.2
Lower Tray Width	

#### UPPER TRAY

- c) To the height of the Lower Tray, add **1.2cm.**
- d) To the width of the Lower Tray, add **0.6cm.**

	+
	1.2
Upper Tray Height	

	+
	0.6
Upper Tray Width	

# CONSTRUCTION of Trays

## 3) Cut Tray Boards

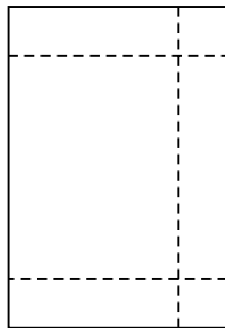
- Cut one board for each tray from 60 pt. barrier board (grain should run parallel to height of object) according to the dimensions determined above.
- After cutting, mark each board as Upper and Lower accordingly. Note: always mark the blue side. If making multiple boxes, label each board according to the object it is being designed for.

## 4) Mark and Score Tray Boards (always on the blue surface)

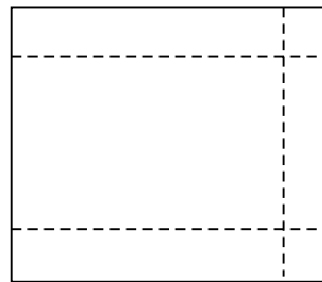
- Mark the object's Thickness measurement along 3 sides of the Lower Tray board.
- Mark the object's Thickness measurement **plus 0.3cm** along 3 sides of the Upper Tray board.

**FIGURE 4-1**

Orientation of score lines  
for a vertical book

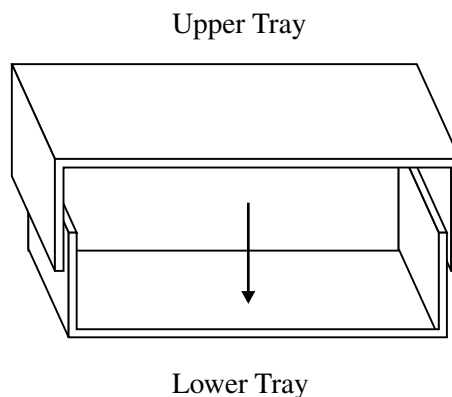


Orientation of score lines  
for a horizontal book



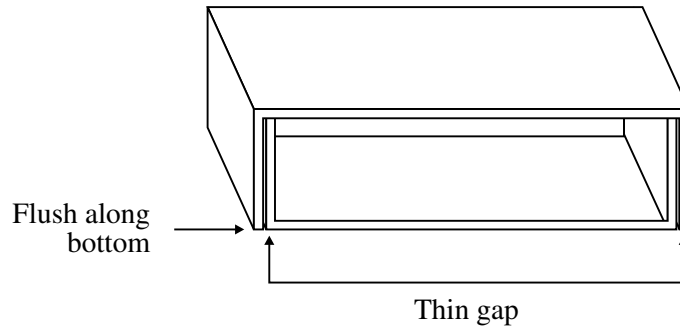
- Using a mat cutter, or a straight-edge and sharp knife, score the boards along the marked lines
  - Score halfway through the blue layer until the white is just visible
- Cut off and discard the 2 square corners of each board.
- Fold up the sides of each board and nest them together as shown.

**FIGURE 4-2**



- f) The bottom of the Lower Tray should be flush with the lower edges of the Upper Tray.

**FIGURE 4-3**



**TEST FIT!** - If the object does not fit at this point, repeat previous steps. Confirm measurements, and double-check accuracy of marks and scoring.

### 5) Reinforce Upper Tray

The width of the reinforcement strip = the thickness of the Upper Tray x the perimeter of the Upper Tray.

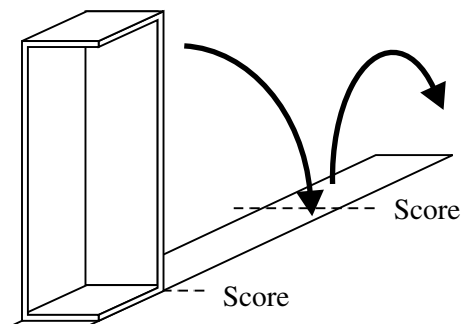
- a) Determine the perimeter (sum of all three sides) of the Upper Tray. (A cloth tape measure works well.)  
NOTE: If no cloth tape measure is available, calculate it as shown.

**FIGURE 5-1**

$$\begin{array}{r}
 \text{Tray Width} \\
 \times 2 \\
 \hline
 \text{Tray Height} \\
 + \\
 \hline
 \text{Strip Length}
 \end{array}$$

- b) Determine the outside thickness of the Upper Tray (any side folded up).  
c) Cut the Reinforcement Strip from a sheet of map folder stock (grain should run parallel to the perimeter of the tray).  
d) Glue out the strip and lay the Upper tray on it.  
e) Roll the tray so the strip wraps around the walls (score corners, and keep flush with edges).  
f) Rub well with a bone folder.

**FIGURE 5-2**

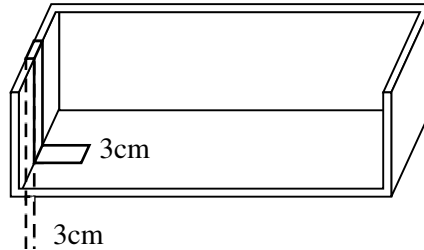


## 6) Measure and Cut Tray Cloth

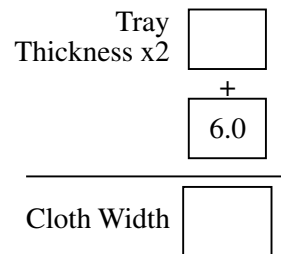
Determine length and width of cloth for covering the trays.

- To determine the length, add 5.0cm to the length of the tray's perimeter.
- To determine the width, double the thickness of the tray and add 6.0 cm. (Wrap a cloth tape measure around a side as shown or use a strip of paper.

**FIGURE 6-1**



**FIGURE 6-2**

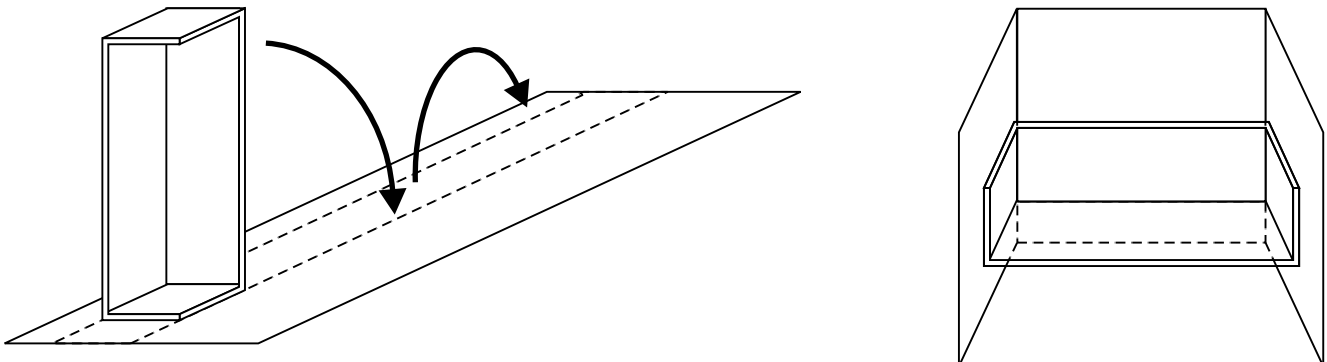


- Cut two pieces of buckram according to these dimensions. Grain direction should run parallel to the perimeter.

## 7) Cover the Trays

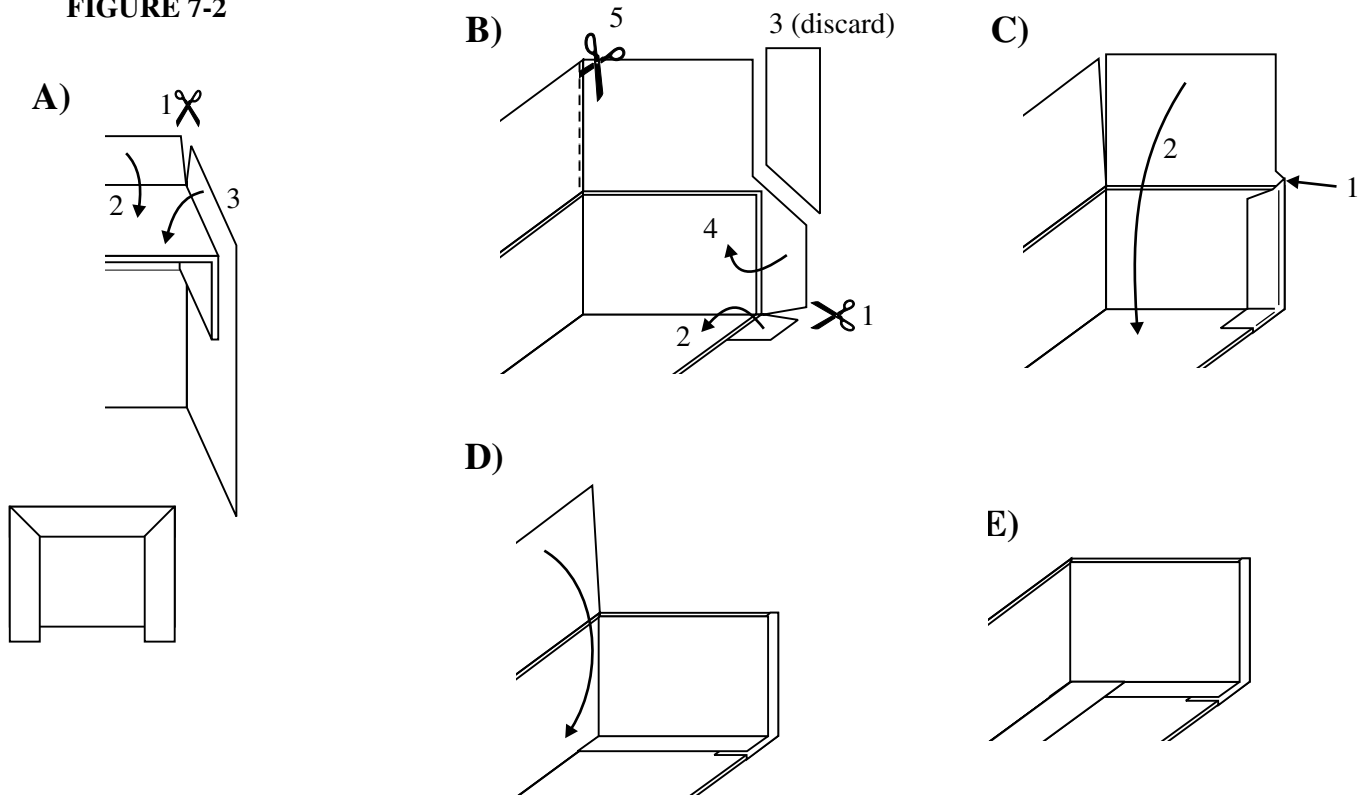
- Glue out one buckram strip.
- Lay a tray onto the strip according to Figure 7-1.
- Roll the tray so that the strip wraps around the walls.

**FIGURE 7-1**



d) Make cuts and turn cloth in.

**FIGURE 7-2**



e) Be sure that corners and angles are fitted snugly.

f) Place bricks against inner and outer walls to hold shape while drying.

g) Repeat for next tray.

**Test Fit!** When dry - if the object does not fit at this point, repeat previous steps. Place Upper Tray over Lower Tray (as in Figure 4-2) and check fit. Trays should not fit together too tightly .

## CONSTRUCTION of the Outer Case

*Note that if the box will require velcro tabs to keep it closed tightly, refer to the Appendix for the remainder of box construction*

The outer case is cut from 0.074 in. binder's board, and consists of a front board, a back board, and a spine piece.

### 8) Measurement of Outer Case

a) The height is the same for all three pieces.

Height of Case = (Height of Upper Tray plus 0.5 cm)  
 Width of each Board = Width of Upper Tray plus 0.3 cm.  
 Width of Spine = Thickness (outer depth) of Upper Tray

## 9) Cut Case Boards

- Cut the Front, Back, and Spine boards from 0.074 in. binder's board
- Be sure that grain direction runs head to tail or parallel to the height.

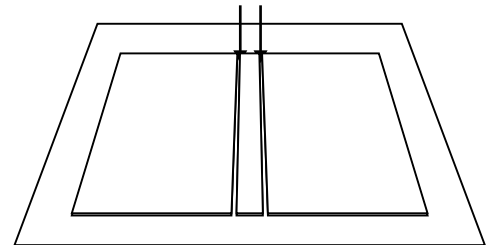
**Test Fit!** - Make sure:

- All three pieces are the same height
- Case boards are wider and taller than upper tray
- The width of the spine equals the thickness of the upper tray

## 10) Cut Case Cloth

- Cut a piece of buckram to the size of all three pieces of the Outer Case laid out plus 3.0cm added to Height and Width. Note: a space equal to 2x the board thickness must be left between each board.

**FIGURE 11-1**

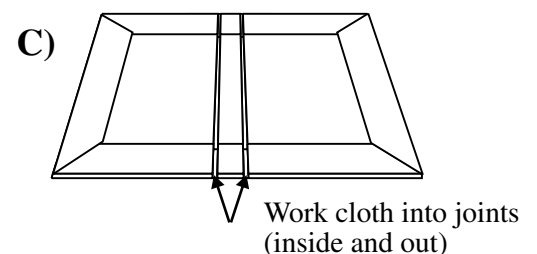
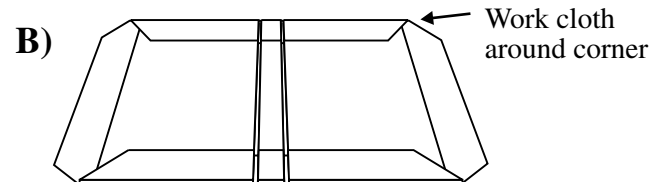
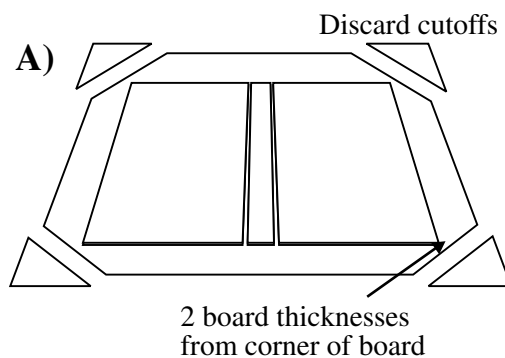


- Be sure that grain direction runs parallel to the height of the cloth/boards.

## 11) Cover the Case Boards

- Glue out buckram.
- Place the three Outer Case boards on the glued cloth with a roughly even margin of buckram overlap around, making sure the top and bottom edges of the boards are even.
- Make corner cuts and turn cloth in head and tail first, then pinch corners and turn in foreedges.

**FIGURE 11-2**

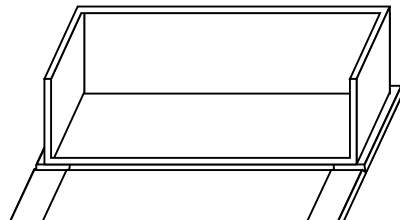


- Place under board and blotter to dry.

## 12) Final Assembly

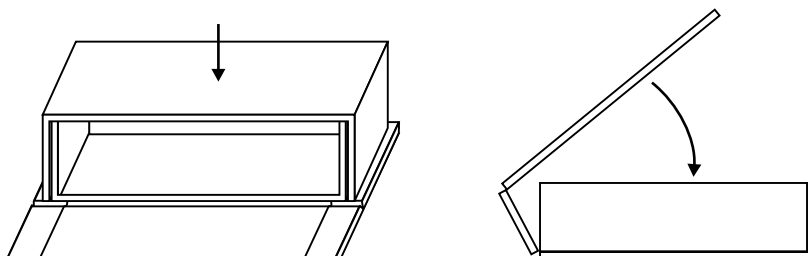
- a) Apply a light, but thorough layer of glue to the underside of the Lower Tray.
- b) Lay Lower Tray on the inside of the Outer Case board to your right
- c) Open edge of Tray should be flush with the inner edge (spine side) of the Outer Case board.

**FIGURE 12-1**



- d) Place assembly in a press with pressing boards filling the Tray. (If a press is not available, a heavy weight will work.)
- e) Apply pressure slowly to ensure that the Tray does not shift position.
- f) Leave under pressure for approximately 15 seconds, and remove, repositioning boards if necessary for coverage.
- g) Repeat for the Upper Tray, using the Lower Tray as a positioning guide

**FIGURE 12-2**



## 13) Cut Linings

- a) Cut a strip of buckram to cover the inside of the Spine board, making sure the grain runs parallel to the height of the Spine. The buckram should fit just inside the Lower Tray, and should be approximately 4cm wider than the Spine board.
- b) Make sure that grain runs along the height of the Spine strip.
- c) Cut two same-sized pieces of Lightweight Bristol board to cover the insides of the Trays
- D) They should be sized to loosely fit the inside of the Lower Tray. It will be slightly smaller for the Upper Tray, but is OK.

## 14) Line Trays

- a) Glue the buckram strip, then place and smooth over inside Spine and open edges of both Trays.
- b) Be sure to work cloth into the gap between boards.
- c) Glue one piece of Bristol board and center in place. Rub down with a bone folder.
- d) Repeat for second Tray and piece of Bristol.
- e) Set completed box aside while open and allow to dry for half an hour. Do not close box until glue has set..

## APPENDIX

### CONSTRUCTION of the Outer Case With Velcro Tabs

If making a box with velcro enclosures, refer to these steps in place of the original instructions.

The outer case is cut from 0.074 in. binder's board, and consists of a front board, a back board, and a spine piece.

#### A1) Measurement of Outer Case

- a) The height is the same for all three pieces.

Height of Case = (Height of Upper Tray plus 0.5 cm)

Width of each Board = Width of Upper Tray plus 0.4 cm (to allow for both foredge square and velcro tabs).

Width of Spine = Thickness (outer depth) of Upper Tray

#### A2) Cut Case Boards

- a) Cut the Front, Back, and Spine boards from 0.074 in binder's board
- b) Be sure that grain direction runs head to tail (parallel to the height).

**Test Fit!** - Make sure:

- a) All three pieces are the same height
- b) Case boards are wider and taller than upper tray
- c) The width of the spine equals the thickness of the upper tray

#### A3) Mark Velcro Placement

- a) Line up Case boards and nested Trays (leave spine board aside).
- b) With a pencil, trace foredge of Trays against inside of Outer Case Boards.
- c) Set Trays aside and place both boards pencil-side up.
- d) Place sample velcro in 2 balanced positions (roughly 1/3rds) on one pencil mark.
- e) Mark the same locations on the opposite board.  
- Note that one Case Board will be the Back - this needs extra space to allow for lip of upper tray.

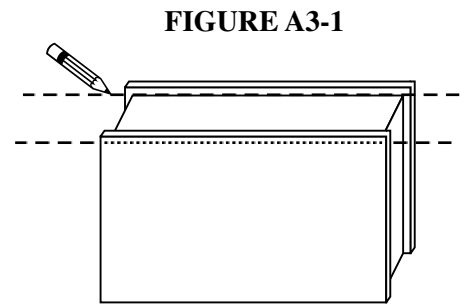
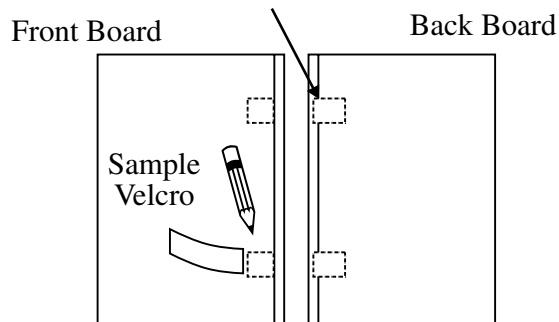


FIGURE A3-1

FIGURE A3-2





#### A4) Cut Out Velcro Recesses

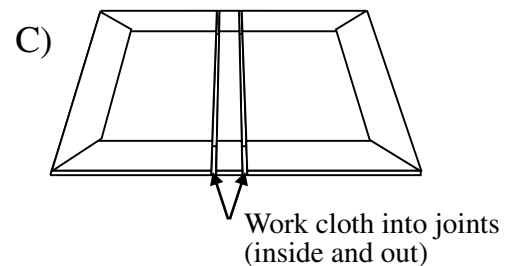
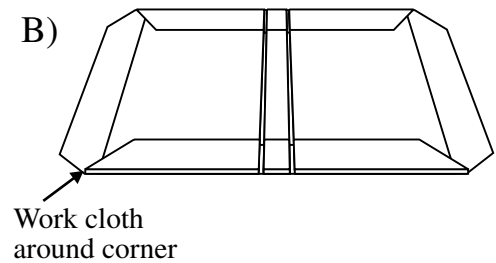
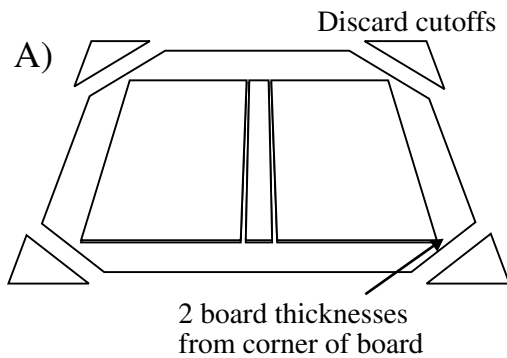
- a) With a sharp knife, score through several layers of the board along the pencil lines.
- b) Pry out the material until it is uniform and the velcro sits fairly flush with the surface of the board.

#### A5) Cut Case Cloth

- a) Cut a piece of buckram to the size of all three pieces of the Outer Case laid out plus 3.0cm added to Height and Width. Note: a space equal to 2x the board thickness must be left between each board.

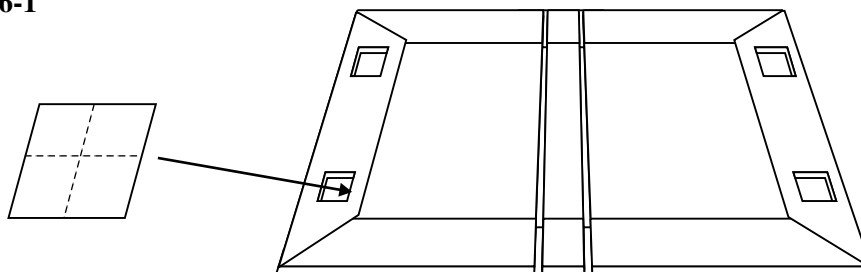
#### A6) Cover the Case Boards - As normal, except for adjustments needed for velcro attachment

- a) Glue out buckram.
- b) Place the three Outer Case boards on the glued cloth with a roughly even margin of buckram overlap around, making sure the top and bottom edges of the boards are even.
- c) Make corner cuts and turn cloth in head and tail first, then pinch corners and turn in foreedges.



- b) When the Case Board is freshly covered, make small cuts where the velcro recesses are overlapped.
- c) Work the cloth into the recesses.

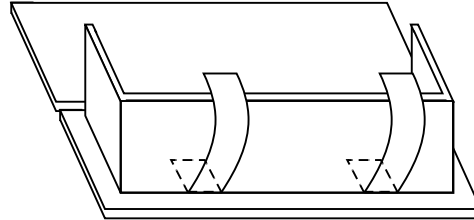
**FIGURE A6-1**



## A7) Measure and Cut Velcro Tabs

- a) Place one end of velcro in a recess.
- b) Place tray on board
- c) Cut velcro to length longer than edge of tray.

**FIGURE A7-1**



## A8) Attach Velcro Tabs

- a) Dab a small amount of glue into each recess.

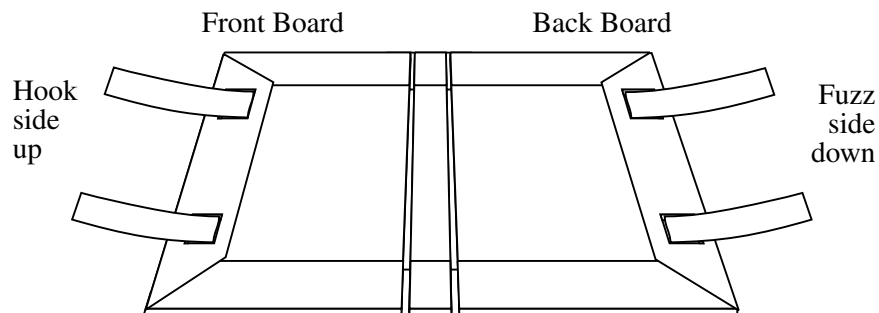
### *Front Case Board*

- b) Place hook-side velcro into recesses, texture side up cover with wax paper and weights.

### *Back Case Board*

- c) Place fuzzy-side velcro into recesses, texture side down cover with wax paper and weights.
- d) Let sit until glue has set.

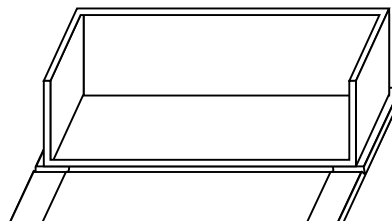
**FIGURE A8-1**



## A9) Final Assembly

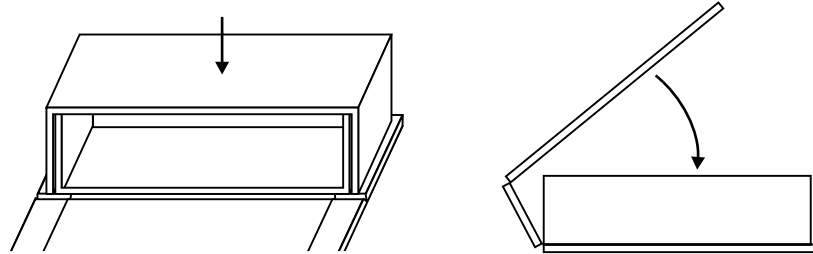
- a) Apply a light, but thorough layer of glue to the underside of the Lower Tray.
- b) Lay Lower Tray on the inside of the Outer Case board to your right
- c) Open edge of Tray should be flush with the inner edge (spine side) of the Outer Case board.

**FIGURE A9-1**



- d) Place assembly in a press with pressing boards filling the Tray.(If a press is not available, a heavy weight will work.)
- e) Apply pressure slowly to ensure that the Tray does not shift position.
- f) Leave under pressure for approximately 15 seconds, and remove, repositioning boards if necessary for coverage.
- g) Repeat for the Upper Tray, using the Lower Tray as a positioning guide

**FIGURE A9-2**



### **A10) Cut Linings**

- a) Cut a strip of buckram to cover the inside of the Spine board, making sure grain runs parallel to height of the Spine. The buckram should fit just inside the Lower Tray, and should be approximately 4cm wider than the Spine board.
- b) Make sure that grain runs along the height of the Spine strip.
- c) Cut two same-sized pieces of Lightweight Bristol board to cover the insides of the Trays
- d) Should be sized to loosely fit the inside of the Lower Tray (will be slightly smaller for the Upper Tray, but is OK).

### **A11) Line Trays**

- a) Glue the buckram strip, then place and smooth over inside Spine and open edges of both Trays.
- b) Be sure to work cloth into the gap between boards.
- c) Glue one piece of Bristol board and center in place. Rub down with a bone folder.
- d) Repeat for second Tray and piece of Bristol.
- e) Set completed box aside while open and allow to dry for half an hour. Do not close box until glue has set..

### **A12) Finish Velcro Tabs**

- a) Trim velcro to slightly less than the thickness of the tray
- b) Trim hook velcro into pointed shape

**FIGURE A12-1**

