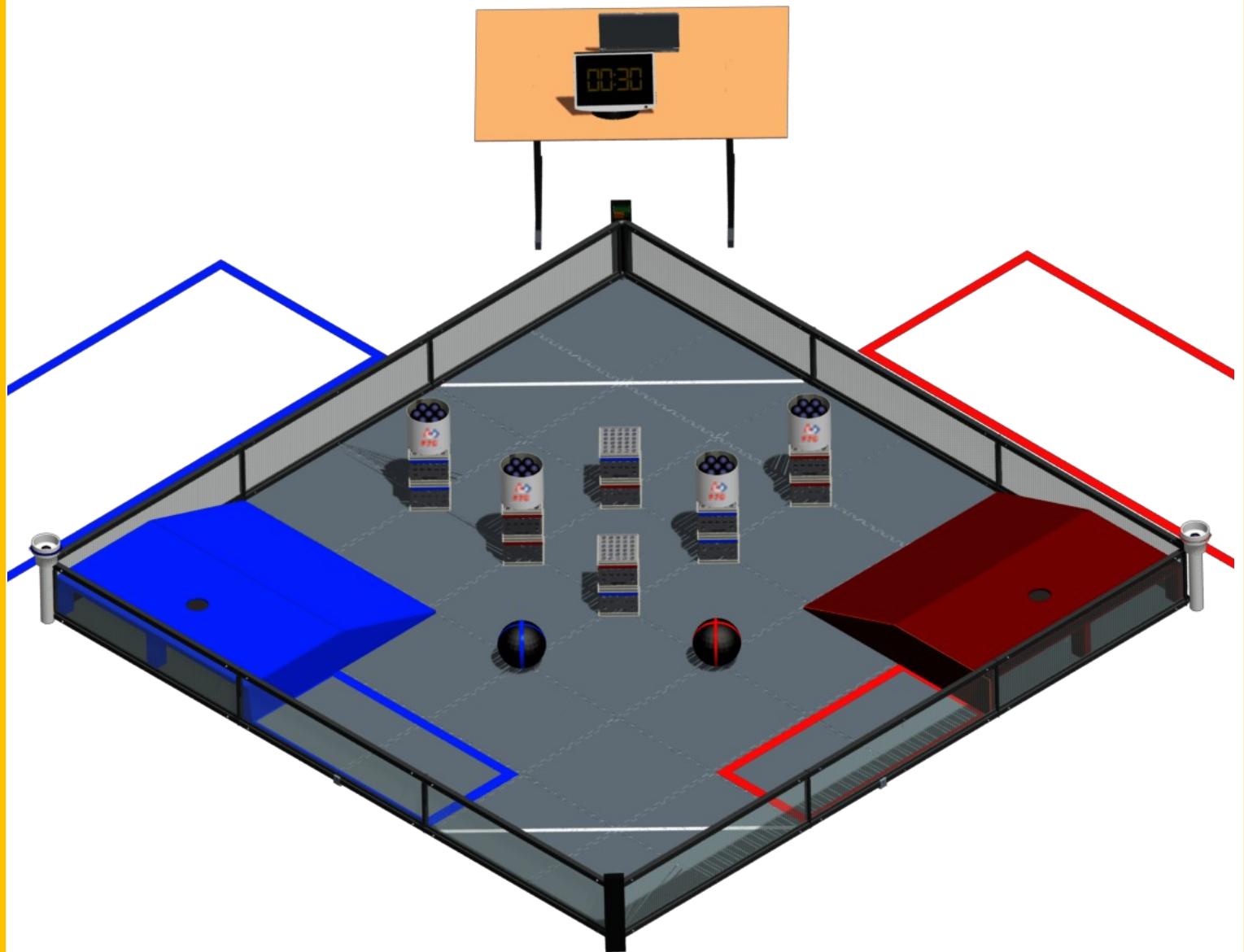




## Field Setup



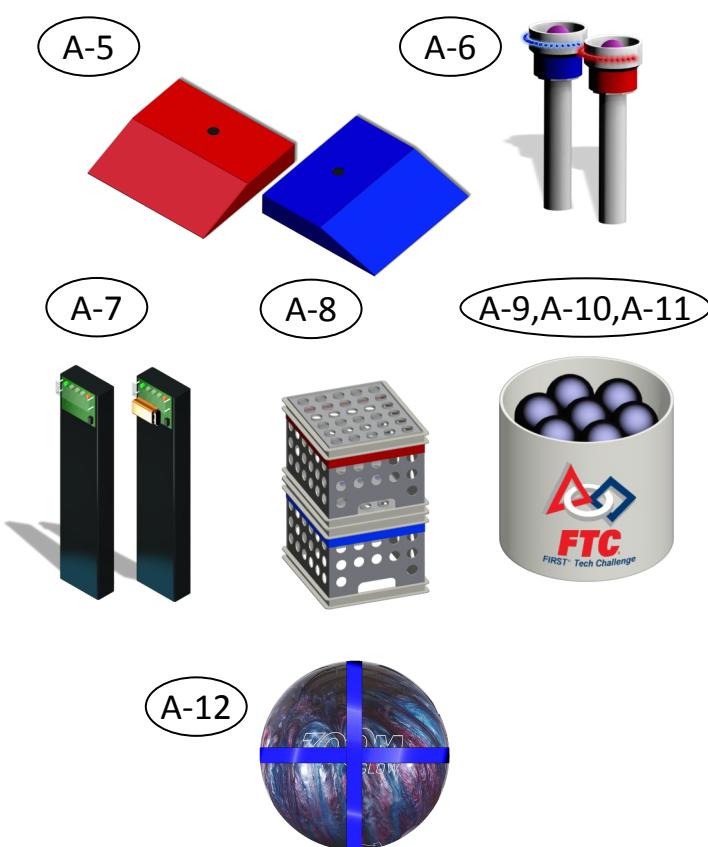
## Basic Field Requirements

Item	Description	QTY	Notes / Suggested Source
A-1	Soft Tiles	36	2' x 2' x 5/8" Gray <a href="http://www.softtiles.com">www.softtiles.com</a>
A-2	FTC Field Perimeter *	1	<a href="http://www.andymark.com">www.andymark.com</a>
A-3	Gaffers Tape	As Needed	<a href="http://Www.findtape.com">Www.findtape.com (~ \$18.00 / roll)</a> 2" Pro-Gaff Gaffers Tape - Electric Blue 2" Pro-Gaff Gaffers Tape - Red 1" Pro-Gaff Gaffers Tape - White
A-4	18" Zip Ties	As Needed	Used to secure the Off-Field Goal, and the IR Beacon Supports to the field perimeter.

\* **A note about the FTC Field Perimeter.** This guide uses the newest field available from AndyMark for illustrative purposes. It may be visually different from the field you may be using. This will not effect game set-up in any way. Notations will be made where necessary to account for perimeter differences.

## Bowled Over! Game Elements

Element	Official Name	Qty / Field
A-5	Home Zone Platform / Ramp	2
A-6	Off-Field Goal	2
A-7	IR Beacon	2
A-8	Crates	12
A-9	Ball Tubes	4
A-10	Regular Racquet Balls	88
A-11	Magnet Racquet Balls	12
A-12	Bowling Balls	2



## Necessary Game Field Electronic Components

Component	Description	Qty / Field
A-13	FCS Operator Table	1
A-14	FCS Laptop Computer**	1
A-15	FCS Timer Display Monitor**	1
A-16	WiFi Router**	1
A-17	Powered USB Hubs	2
A-18	Logitech Game Controllers	8
A-19	Power Strips	As needed
A-20	15' USB Cables	2
A-21	Ethernet Cable	1

\*\* An additional laptop, display and router will be required for the Scoring system. Instructions for setting up the Scoring system are not included in this guide. All electronics listed here are for placement reference only. Please see the Field Electronic setup guide for detailed instructions for configuration and operation of the FCS and Scoring systems.



This document is meant to be used as a guide to setting up the game field for competition. It is assumed that the elements have already been built to the specifications given in the detailed drawings, and the Field Element Construction Guides. You should also have a printed copy of the Scoring System Users Guide and the Field Electronics Setup Guide handy to refer to during field setup.

***Read through all the instructions before you begin to build***

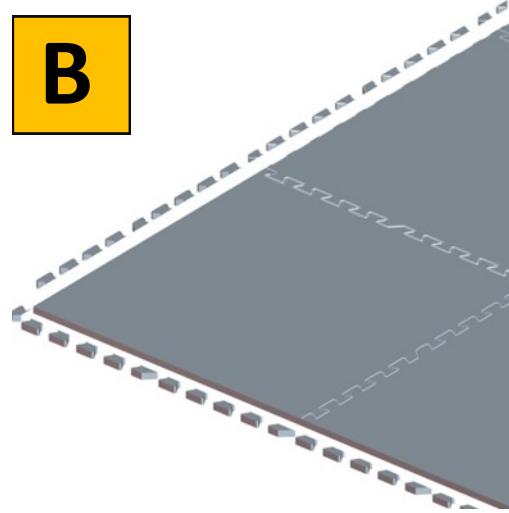
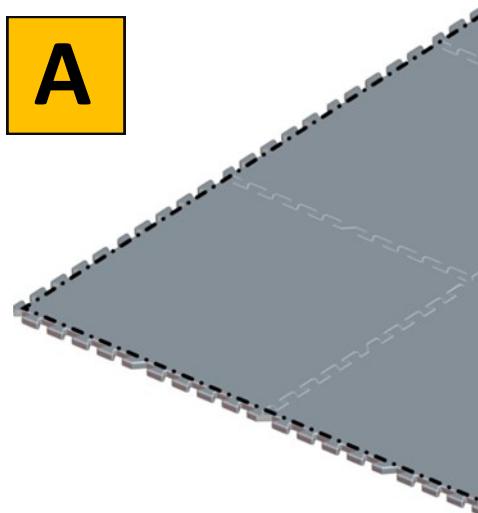
**Revision History**

<b>Revision</b>	<b>Date</b>	<b>Description</b>
1	9/1/2011	Initial Official Release

# Setting up the Floor and Field Perimeter

**1**

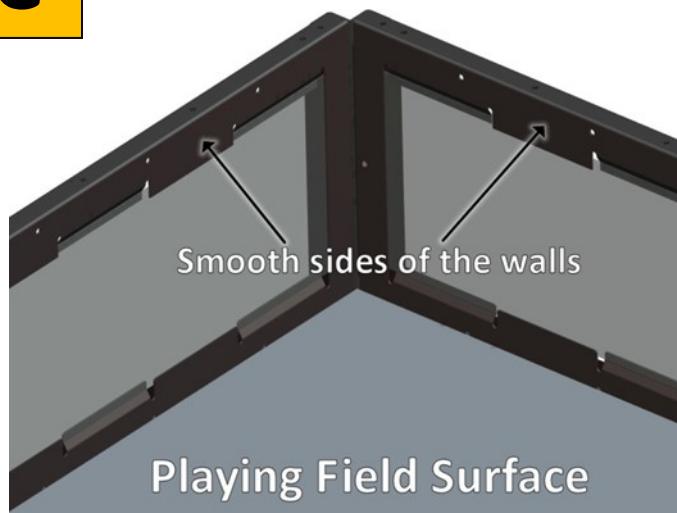
- A. Lay the tiles with the smooth surface facing up.
- B. **Critical Mandatory Step:** Trim all outer tabs from the Soft Tiles.
- C. For older style field perimeters: Set up the perimeter walls with the 'smooth' side toward the inside of the playing field as illustrated. **Note:** The new style Andy Mark field perimeters are the same on both inside and outside surfaces. Follow the setup instructions supplied with your field for details.



**TIP**

Lay the tiles out and mark the outer edge to be cut. Use a sharp box cutter and a straight-edge, or if available, a band saw to get a smooth, clean edge.

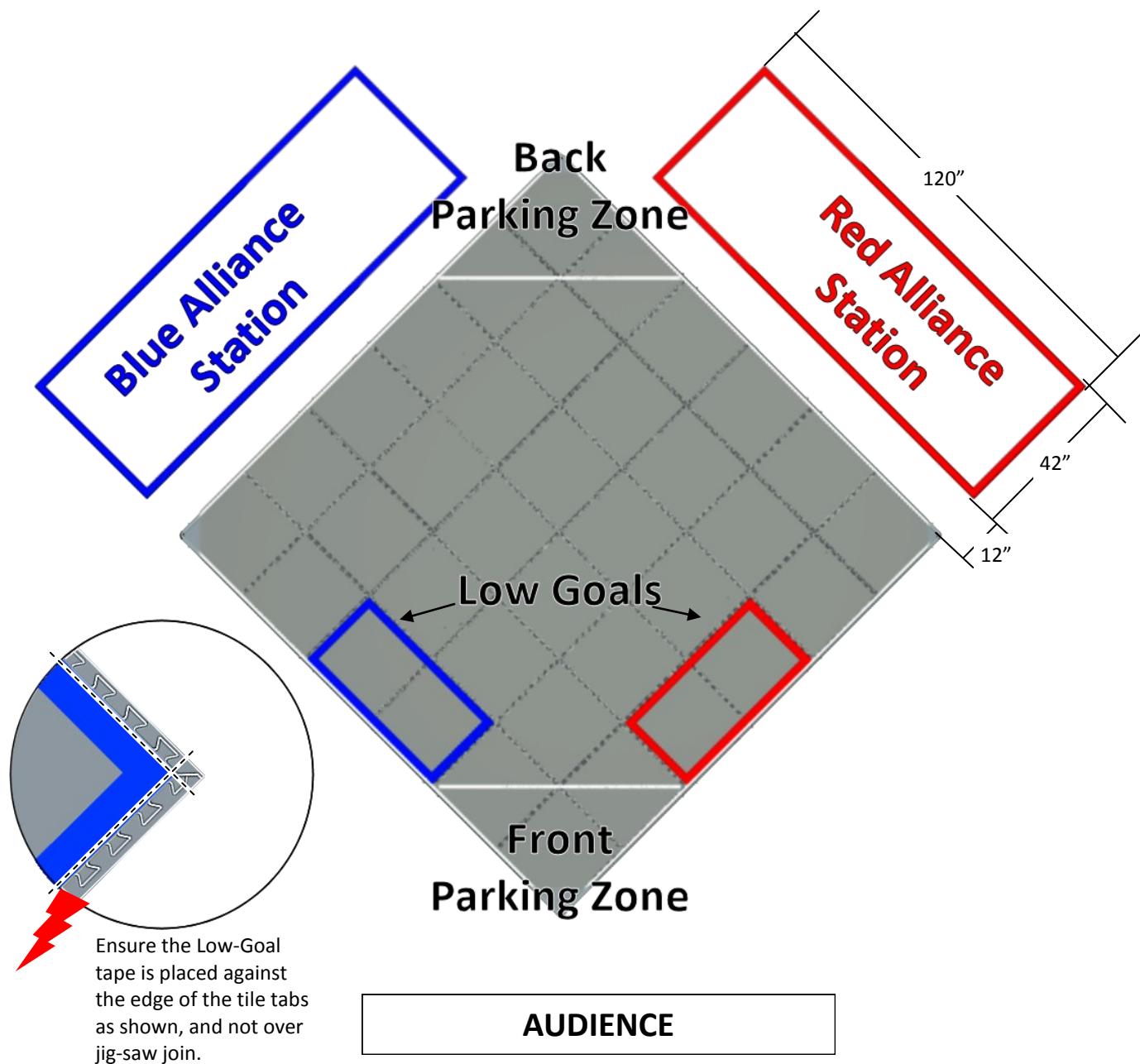
**C**



## Tape Placement

2

- A. Tape the Low Goal using 2" red and blue gaffers tape as shown. **Note: The red alliance boxes shall always be placed on the right as viewed by the audience.**
- B. Use 2" red and blue gaffers tape to mark the Alliance stations on the floor outside the playing field. **Note: The Alliance stations are shorter than the perimeter to allow for space for the FCS Station.**
- C. Use 1" white gaffers tape to mark the back and front parking zones in the positions shown.



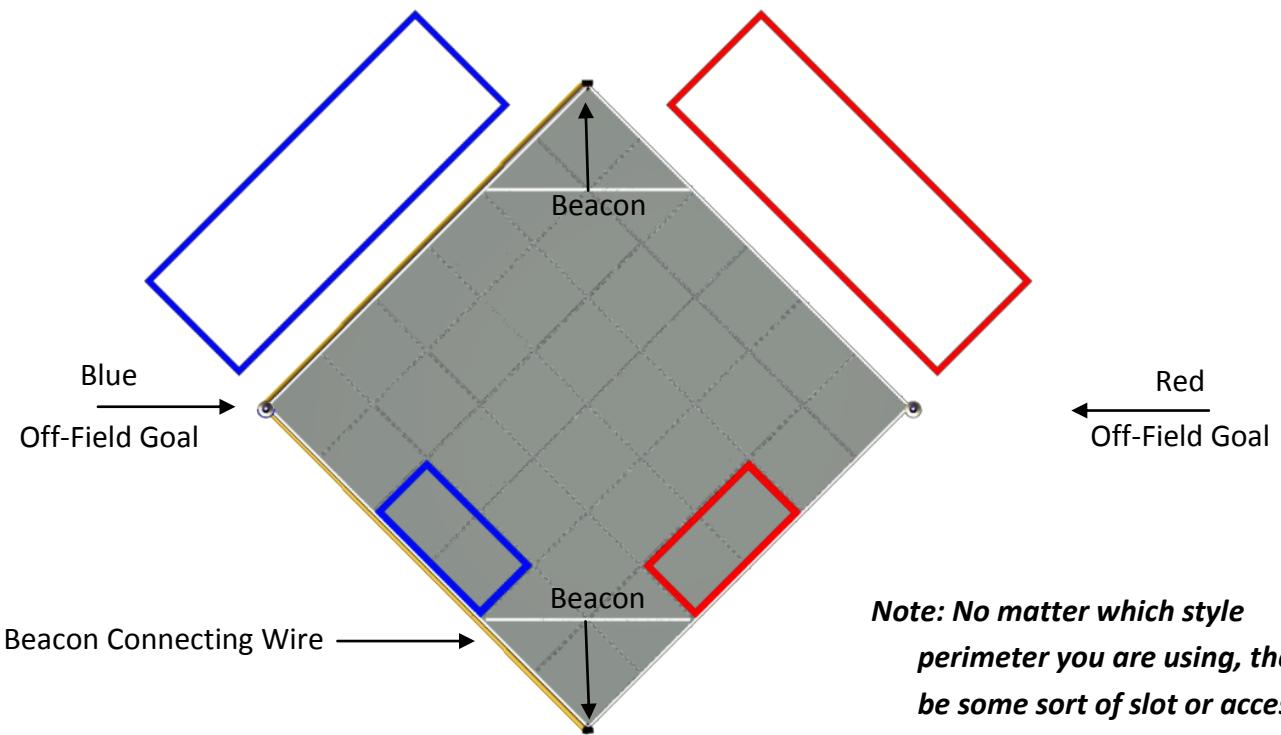
## REMINDER

The BOWLED OVER! playing field is set up diagonally to the audience, rather than square.

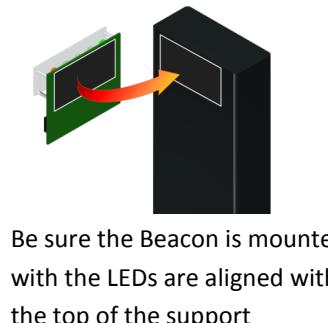
## Beacon and Off-Field Goal Placement

3

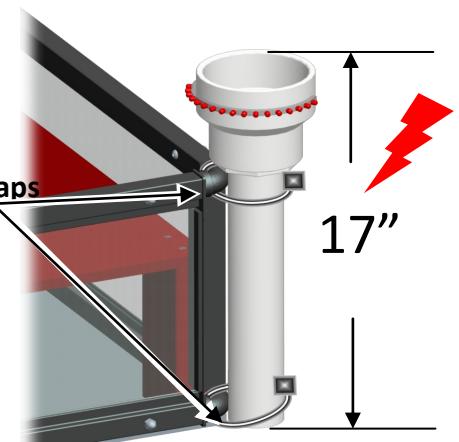
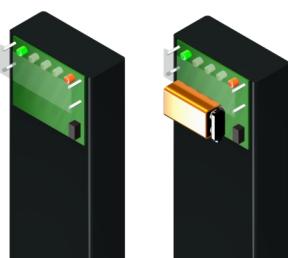
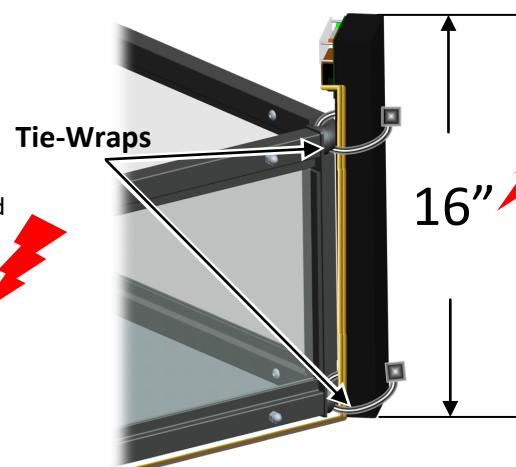
- A. Place the Beacon Posts at the corners of the Front and Back Parking Zones. Use tie-wraps to secure posts to the perimeter. Check the proper position of the Beacon to be sure the LEDs (under the Lexan) are positioned at the top of the post (See illustration.) Catch the connection wire in the tie-wraps. Run the wire along the perimeter floor as illustrated. Secure with gaffers tape for safety. **Critical Dimension: Ensure the beacon support post is 16" and the beacon is aligned with the top edge of the post.**
- B. Secure the red and blue Off-Field Goals at the corners of the appropriate alliance Home Zone. Use tie-wraps to secure the goal to the perimeter frame. Ensure the LED lights are turned to face the audience. **Critical Dimension: Ensure the Off-Field Goal stands 17" off the floor.**



**Note: No matter which style perimeter you are using, there will be some sort of slot or access hole available to secure the tie-wraps.**



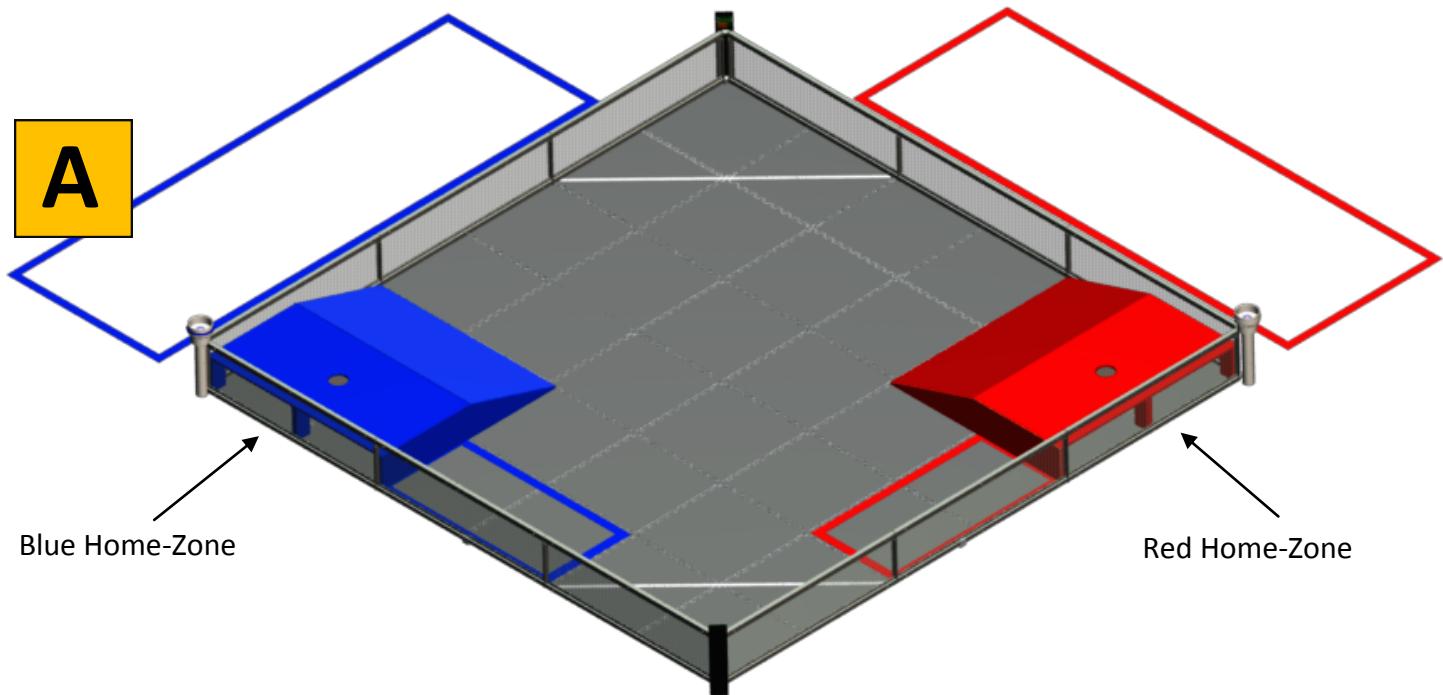
Be sure the Beacon is mounted with the LEDs are aligned with the top of the support



## Home-Zone Placement

4

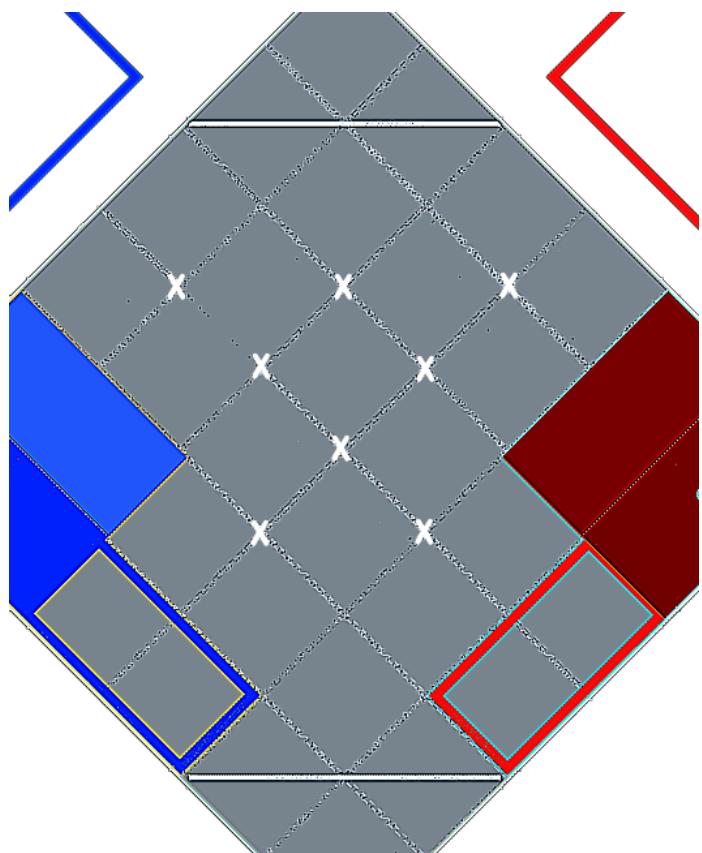
- A. Place each Home-Zone in the appropriate corners of the field as illustrated.



## Mark the Field for Crate and Bowling Ball Placement (Optional)

**TIP**

To aid in a quick field reset, it is helpful to mark the field with a small piece of gaffers tape or a sharpie pen to show the appropriate placement of the field elements. Note that each placement is where four tiles meet. The mark you make should be small and unobtrusive to game play.



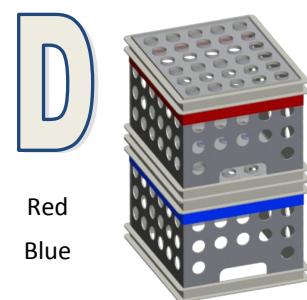
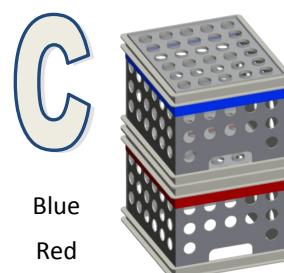
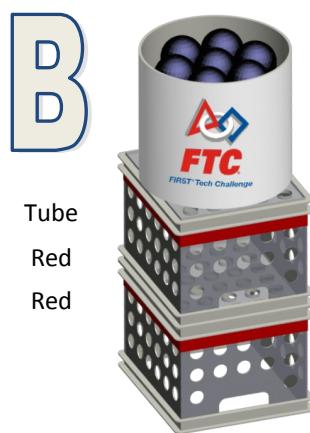
## Element Placement

5

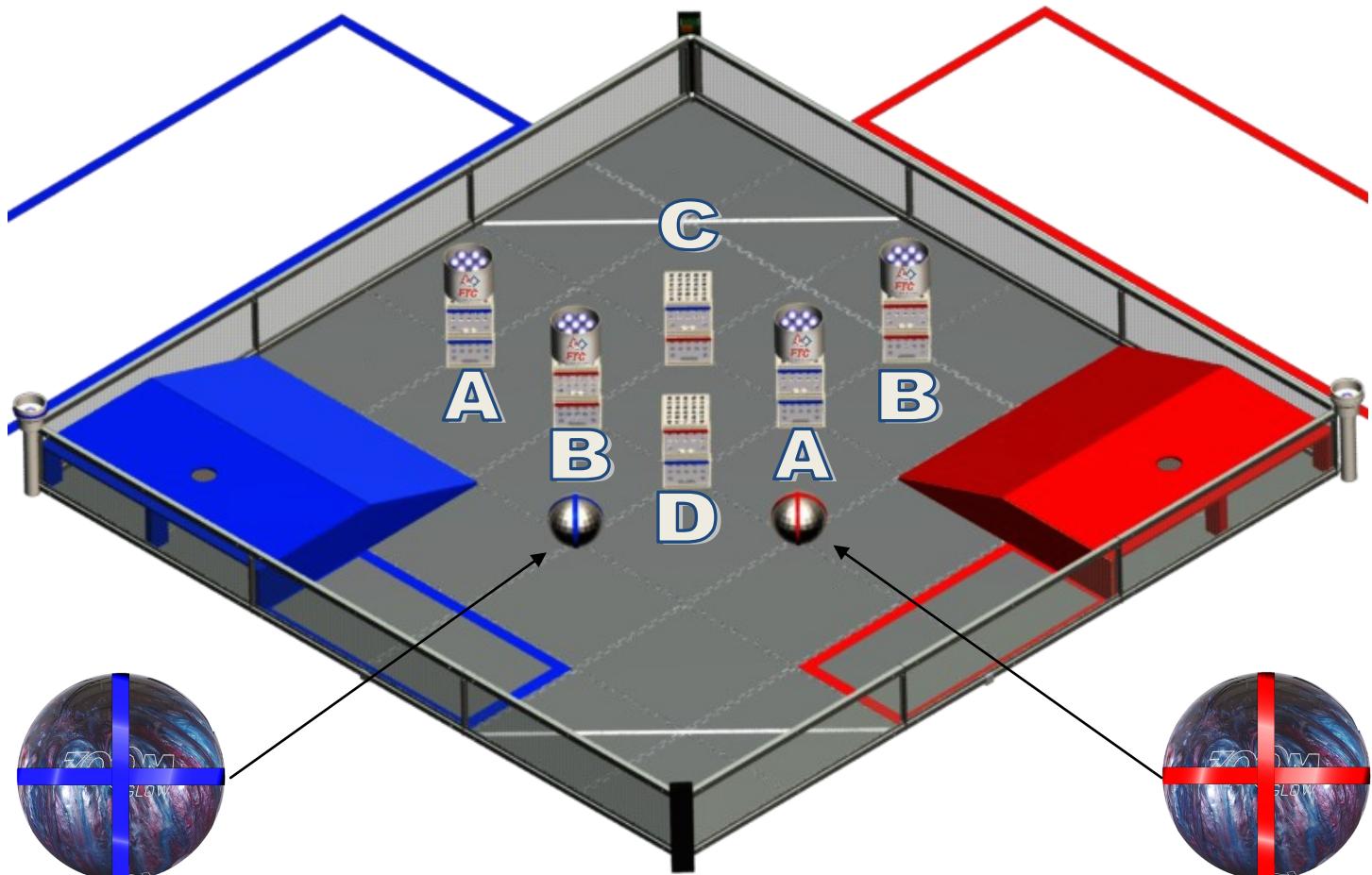
- A. Set up the Crates, Ball Tubes and Bowling Balls in the positions shown. There are 100 racquet balls distributed within the ball tubes.

**TIP**

To save field reset time, it is not necessary to count out exactly 25 balls for each tube. Just fill them up so they're all approximately the same (some may have 26, some may have 24. Just get close). The magnet balls are placed **randomly** in the mix. It is quite possible (though unlikely) that all 12 magnet balls will be in the same tube. ***This is part of the game - you never know where they'll end up.***



**NOTE:** Be sure to position the ball tubes with the FTC logo facing the audience.



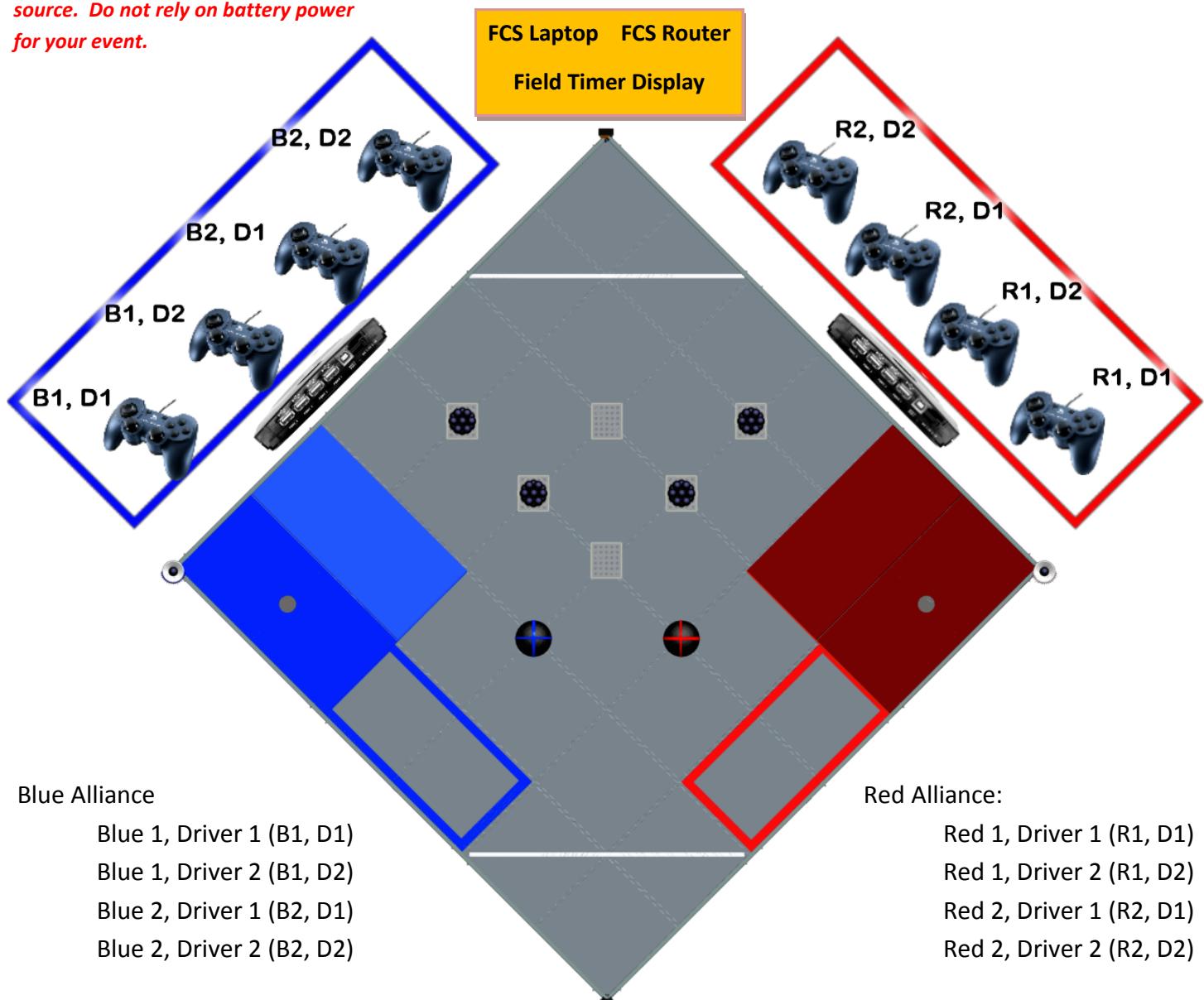
# Game Controller Placement

6

- A. Label the game controllers and mark the floor or the field wall with controller placement as shown below. **Important: Teams must be made aware that they must use the proper controllers. For example: If they are Red Team 2, they must use the controllers labeled for the Red Alliance, R2, D1 and R2, D2.**
- B. Place the table for the FCS Station laptop computer close to the back corner of the field. The Field Timer Display should be facing the Audience.

**Critical: The FCS computer and the USB**

**Hubs must be plugged into a power source. Do not rely on battery power for your event.**



## Electronic Connections

7

- A. Please refer to the Field Electronic Guide and the FCS Operators manual for detailed software configuration and FCS operator instruction.

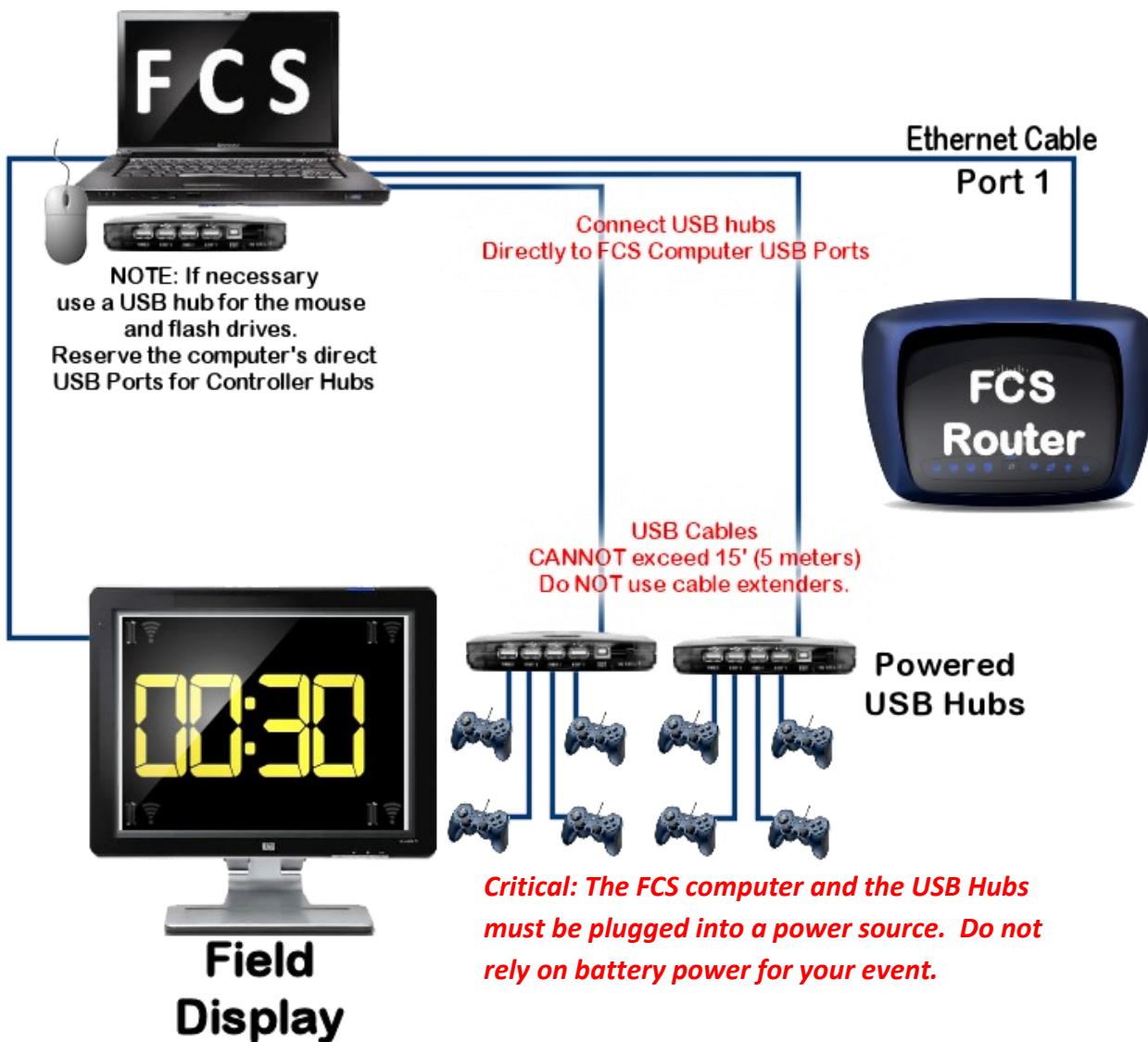
**Use ONE long USB Cable to connect the controller hubs to the FCS computer.**

USB 2.0 requires cable lengths no longer than 5 meters (15 feet). Place the FCS table close enough to the field to accommodate 15' USB cable.

**DO NOT USE MULTIPLE SHORT CABLES OR EXTENDERS ON THE USB CABLES!**

**IMPORTANT:** Reserve the computer's direct USB Ports for the Game Controller hubs.

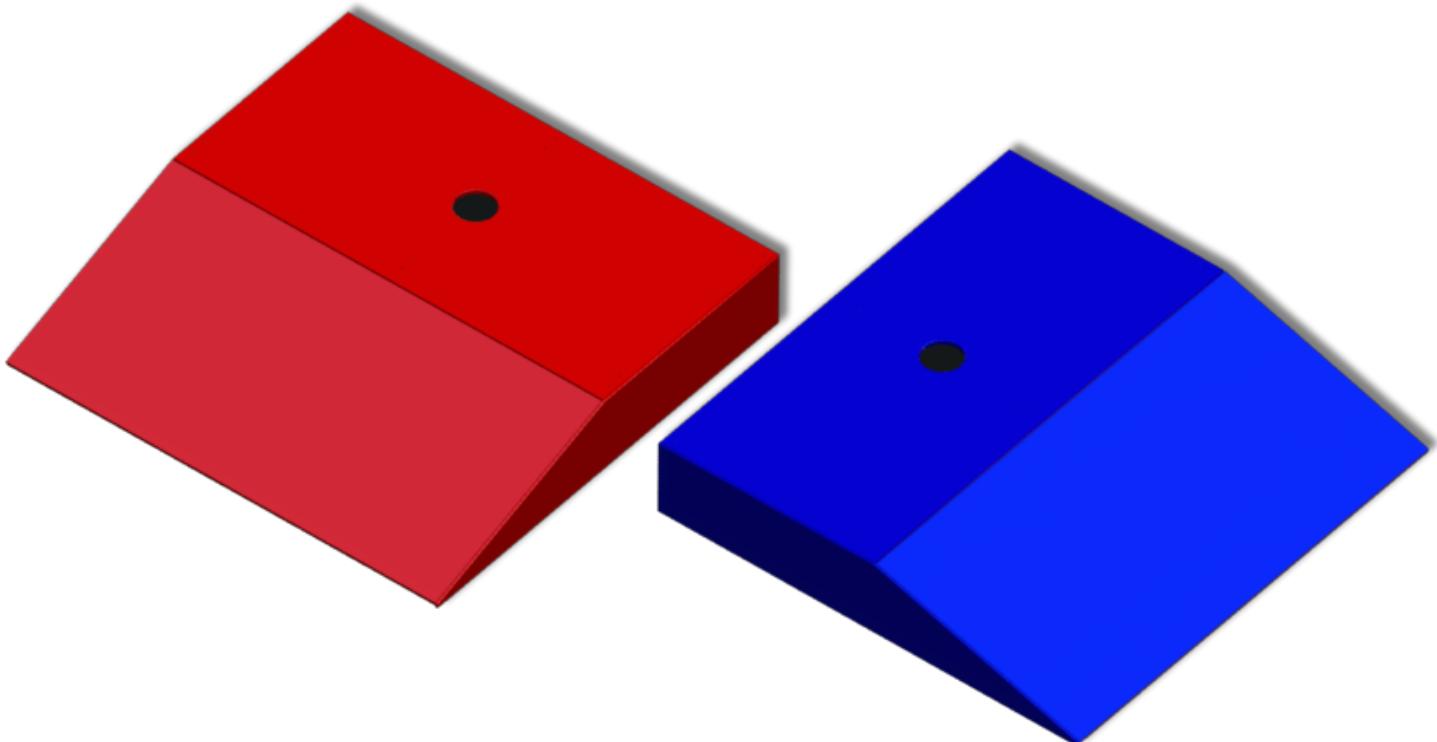
**NOTE:** It is recommended that the FCS operator use a mouse with the system. If there are not enough USB ports available for the mouse and the flash drive and game controller hubs, then use a hub for mouse and flash drive. Connect the game controller hubs directly to the computer.





## Field Element Construction Guide

### B: Home Zone Assembly



## Materials Needed for the Home-Zone Assembly:

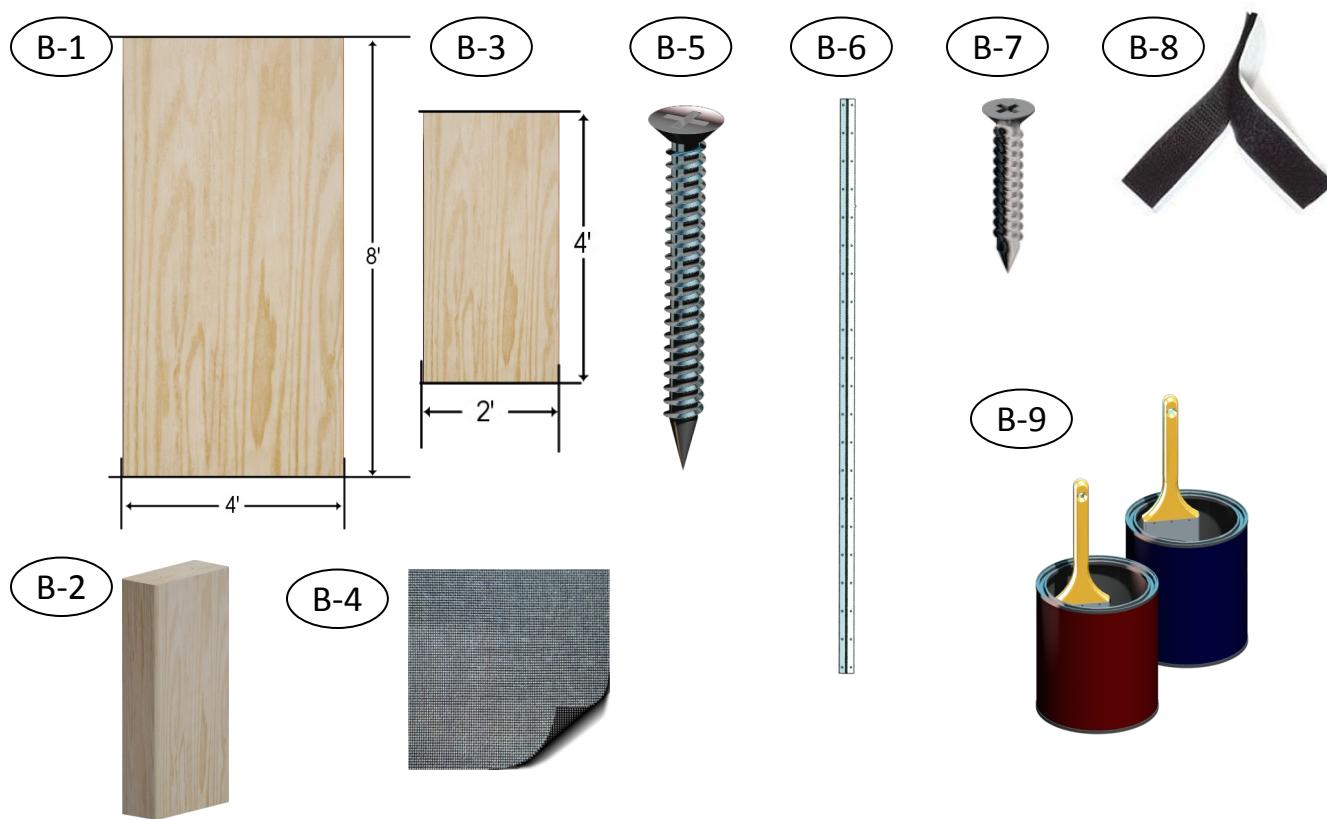
**Note: Quantities given are for ONE goal assembly. You will need to build TWO assemblies per game field.**

**Read through all the instructions before you begin to build**

Item	Description	QTY	Note / Suggested Source
B-1	4' x 8' x 1/2" Plywood	1 sheet	1 sheet of 4' x 8' will make 2 Home-Zone assemblies. Note: You may purchase pre-cut "Handy Panels" If they are available in your area. (See safety note below).
B-2	2" x 4" x ~7.5" Wood	6	(US 2x4 is actually 1.5 x 3.5. Widths may vary but the 7.5" length is critical)
B-3	2'x4' x 1/4" Lauan sheet	1 sheet	One sheet cut for both ramps
B-4	6" x 6" Screen	1	For under the hole
B-5	#8 2.5" Wood Screws	12	For legs
B-6	1-1/2" x 48" Piano Hinge	1	The Home Depot SKU 594641
B-7	#6 - 0.375 (3/8) Wood screws for Hinge	As needed	If the screws that are supplied with the piano hinge are too short, or too small, use the screws in Item 7 as an alternative choice.
B-8	3/4" Sticky Back VELCRO	As needed	Super stick, self adhesive strips
B-9	BEHR Premium Plus Semi-Gloss Paint	As needed	Mickey's Pants (Red) and Midnight Blue (Blue)

## SAFETY NOTE

When using Handy Panels, it is possible that the width is slightly less than 48" wide. This may cause the piano hinge to stick out past the edge of the wood, causing a hazard. **Measure the panel in the store before you purchase your piano hinge.** Purchase a shorter length hinge if necessary.

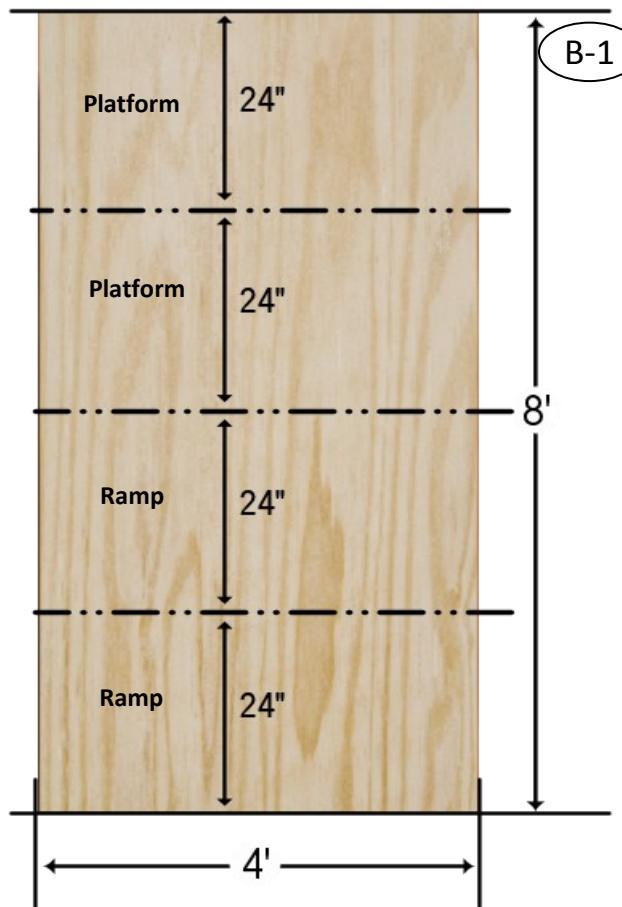


***Read through all the instructions before you begin to build***

#### **Revision History**

<b>Revision</b>	<b>Date</b>	<b>Description</b>
1	9/1/2011	Initial official release

## Platform / Ramp



1

Cut 8' x 4' sheet of 1/2" thick plywood (B-1) to the dimensions shown, to be used for the platform and ramp sections of the Home-Zone assembly.

### TIP

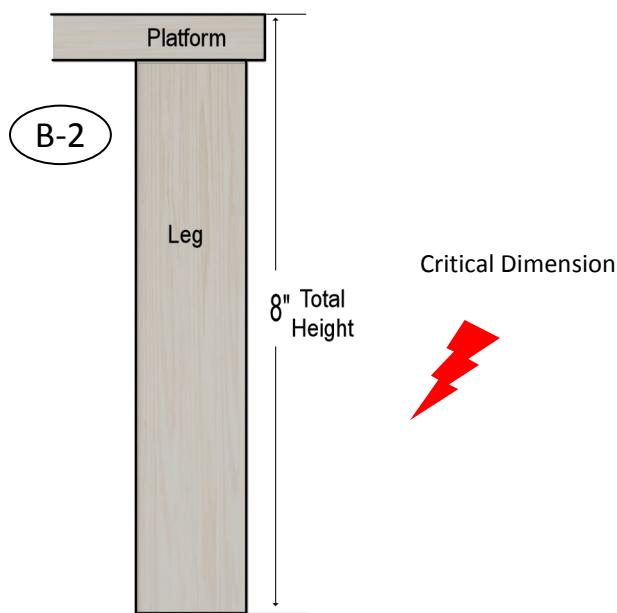
You may purchase four pre-cut 2' x 4' "Handy Panels to use instead of the full sheet.

### NOTE

Due to the thickness of the saw blade, your cut panels may be slightly less than 24" after cutting . This is perfectly acceptable.

2

Place the 2x4 (B-2) against the platform as illustrated and measure the piece so that the total measurement of the leg and the platform is **exactly 8"**. Use this piece as your guide, to cut the remaining 5 legs for the assembly.



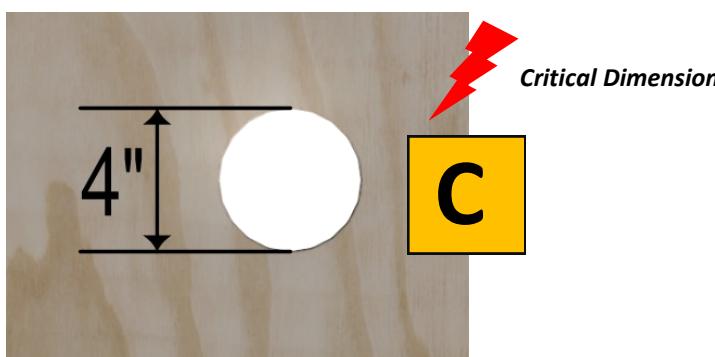
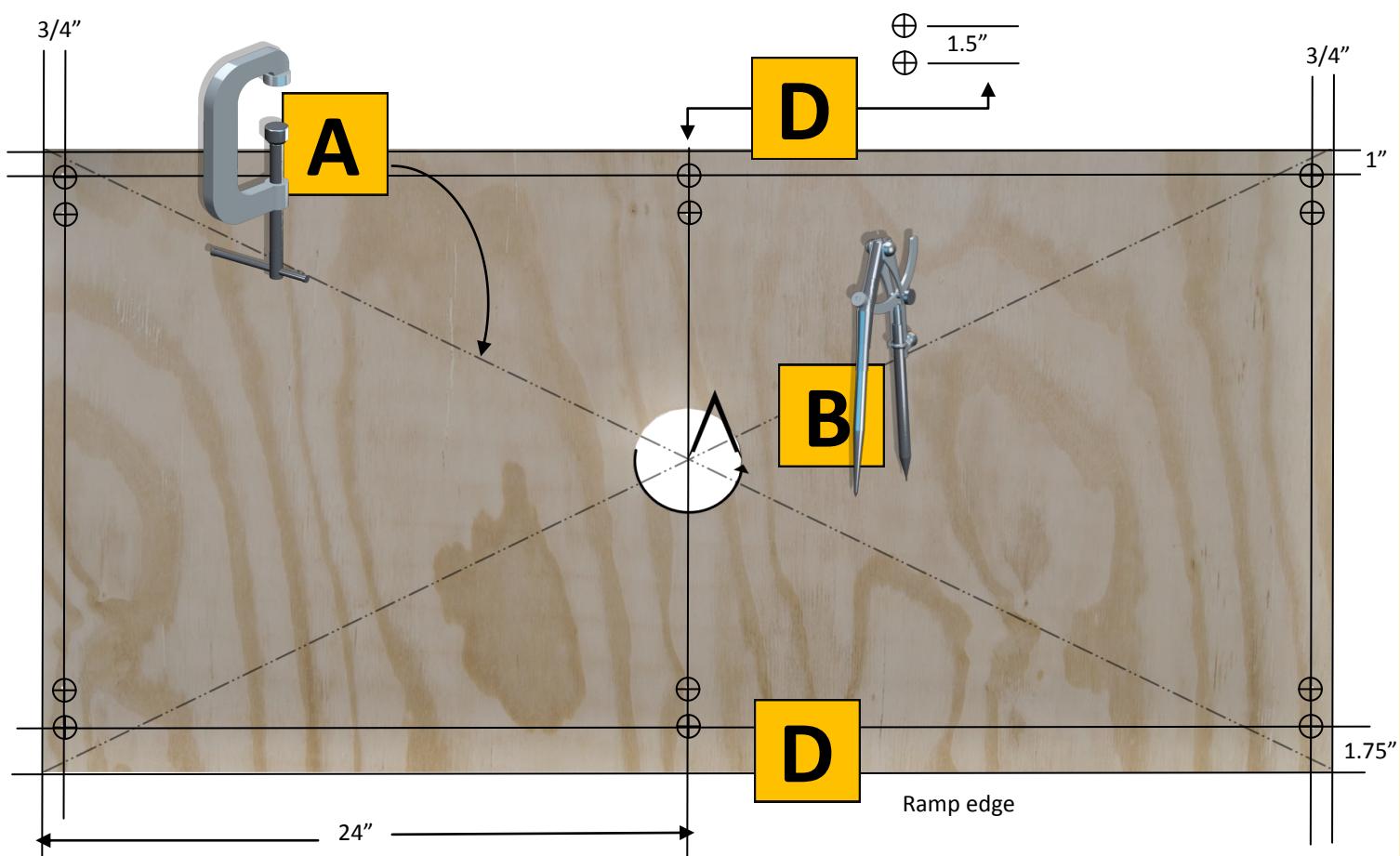
### IMPORTANT

*Thicknesses of plywood or handy panels may be more or less than 1/2" Cut the length of the leg accordingly so the top of the platform, when assembled, is exactly 8".*

# Platform

3

- A. Clamp the platform to your work bench. *Suggestion: Use a chalk line to mark the center of the platform.*
- B. Use a compass set to a 2" radius to make the 4" diameter hole for the Home Zone Goal.
- C. Cut out the Home Zone Goal. Suggestion: *Use a 4" diameter hole saw if available to cut the hole.*
- D. Pre-drill through holes for the Leg screws using a **5/32" drill bit**. Holes should be 1.5" apart and placed .75" away from outer edges, 1" from the upper edge, and 1.75" from the lower (ramp) edge (to allow room for the piano hinge).



## NOTE

Hole placement dimensions are not critical, and may be adjusted as necessary.

## Prepare Legs

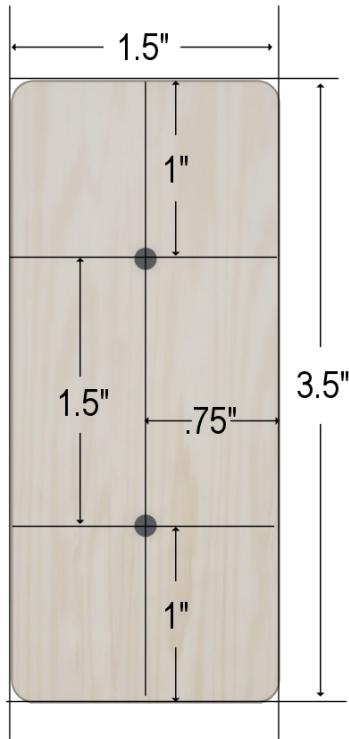
4

- A. Pre-drill pilot holes in the tops of the Legs so that they will align easily with the holes you have pre-drilled in the platform.

**TIP**

Use a drill bit for the pilot holes that is smaller than screw to ensure there is sufficient wood for the screw threads to bite into. (5/32" should do).

### Leg, Top View



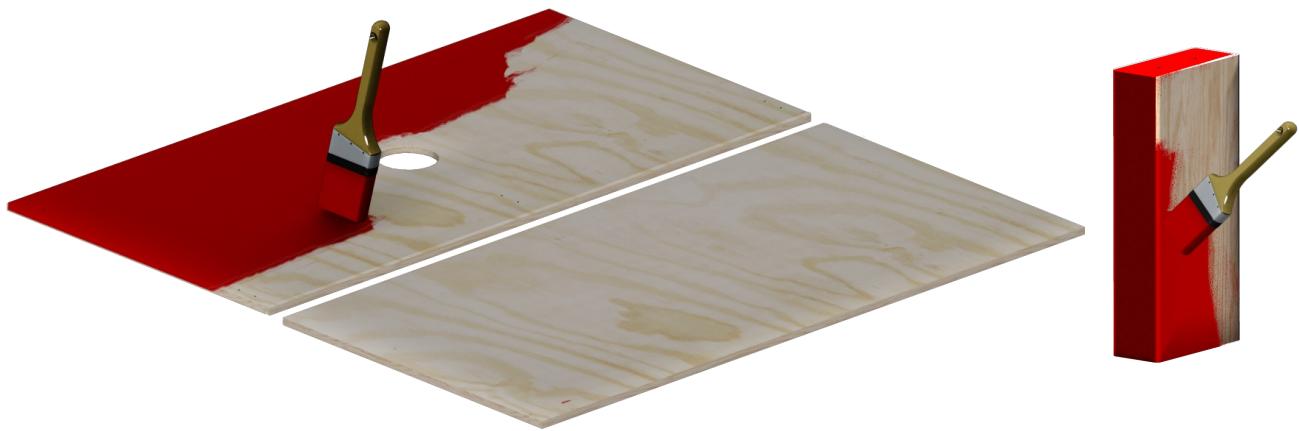
## Paint

5

**TIP**

Paint all the wood before assembly. Use a primer if desired. Apply at least two coats.

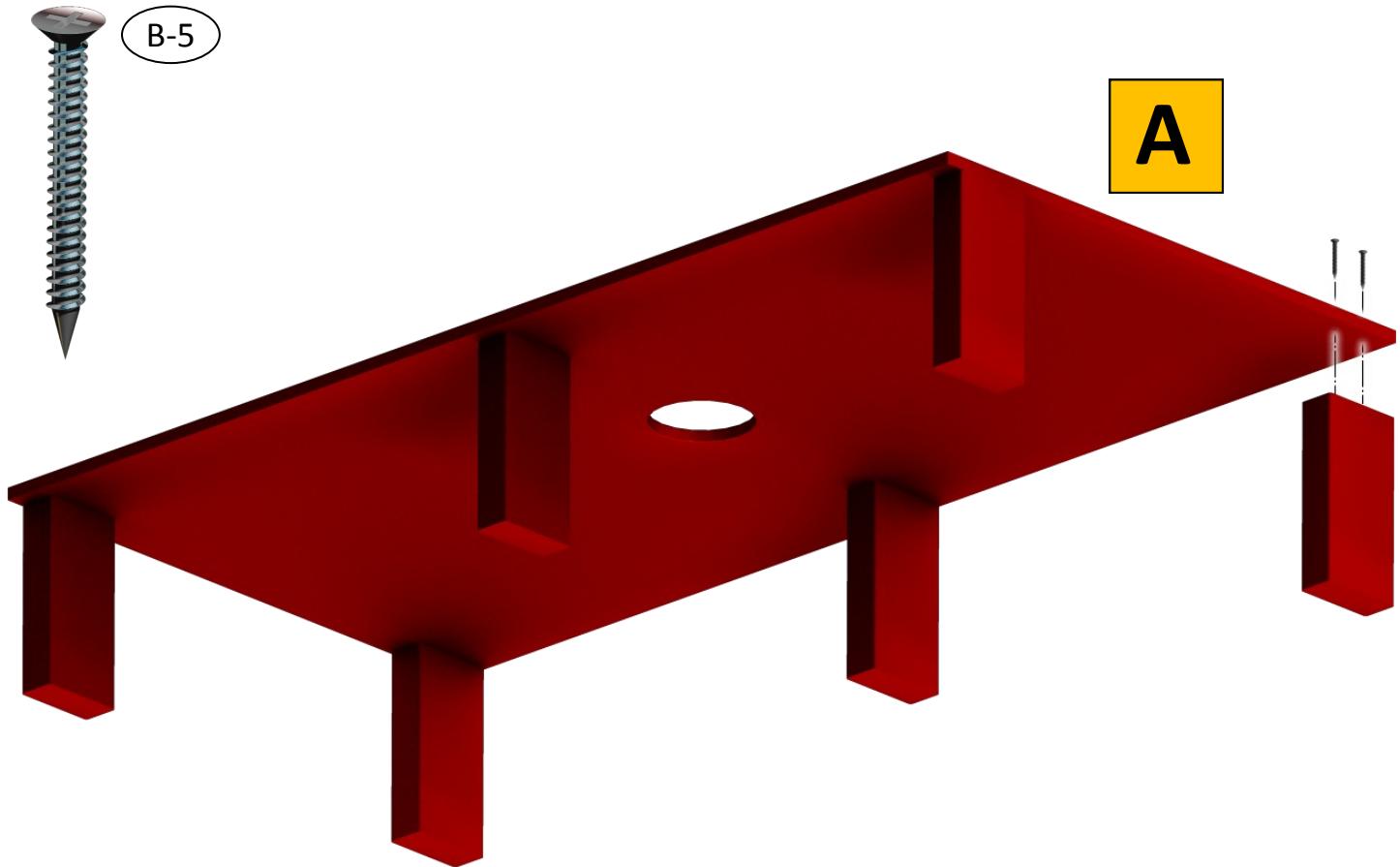
**CRITICAL:** Paint all surfaces of the ramp, platform and side piece to prevent warping.



## Assemble Legs to Platform

6

- A. Using #8 2.5" wood screws, (B-5) attach the legs to the underside of the platform.
- B. Check level and height! **Platform MUST be level and stand exactly 8"**



## NOTE

Platforms may or may not be exactly level. Teams should be made aware to be ready for this circumstance.



B



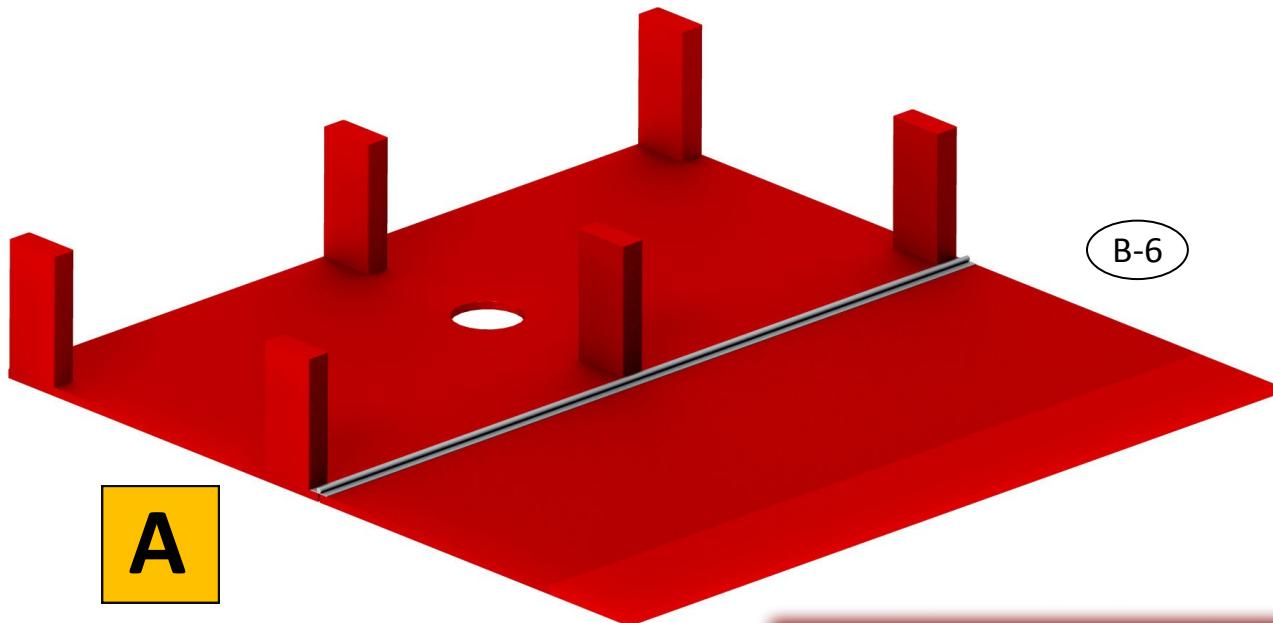
## Attach Ramp

7

- A. Place the assembly bottom-up on a level work surface.
- B. Using the #8 .025 wood screws, (B-7) install the piano hinge (B-6) to the underside of the assembly.

### SAFETY NOTE

When using Handy Panels, it is possible that the width is slightly less than 48" wide. This may cause the piano hinge to stick out past the edge of the wood, causing a hazard. Trim the hinge so that it is completely under the ramp or purchase a shorter length if necessary.



### TIP

Try a #6 wood screw for the hinge so the screw head does not interfere with the closing of the hinge.

B-7

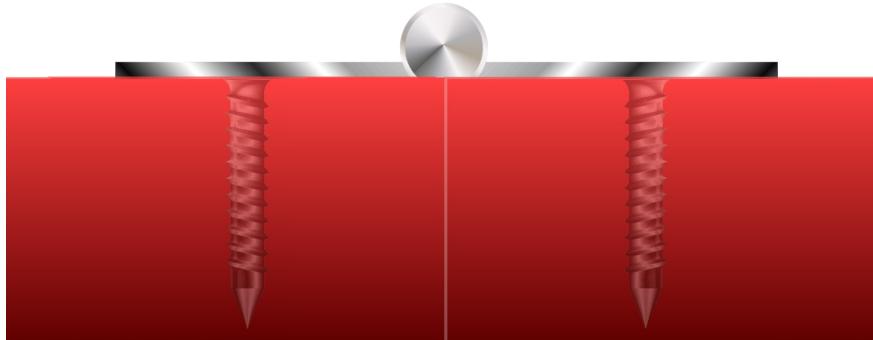


### TIP



**Critical: Ensure the piano hinge is installed straight.**

**Be sure the screws are long enough to secure the hinge, but not long enough to poke through the plywood.**



### TIP

When installing the hinge, do not tighten the screws completely on the first pass. Place them, then open and close the ramp checking for gaps or warps. Tighten the screws once you've ensured the ramp folds smoothly without gaps or warps.

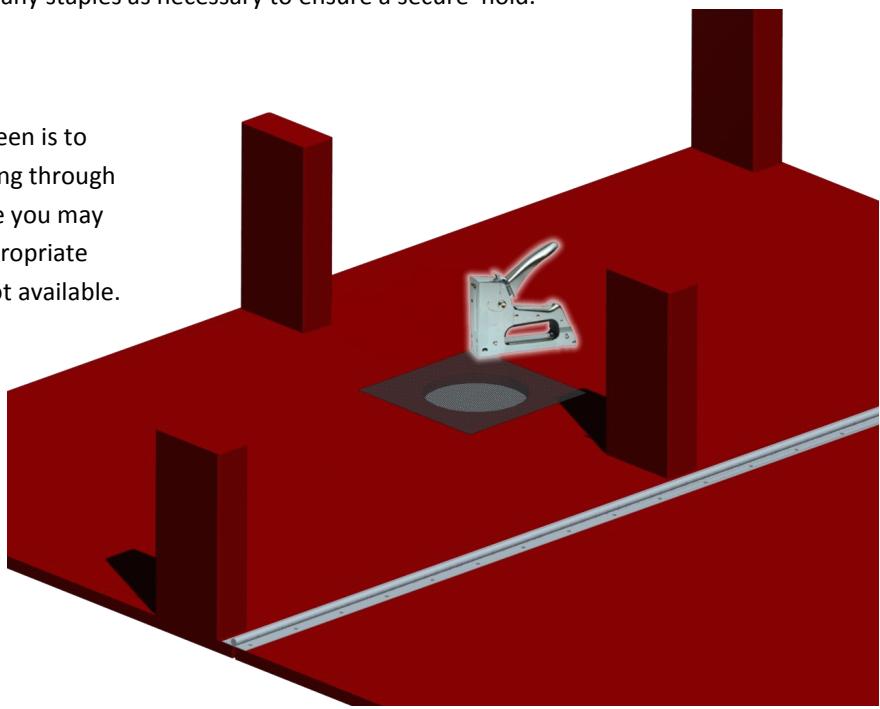
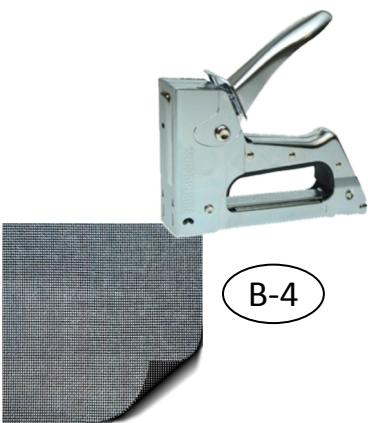
## Screen

8

Affix the 6" x 6" piece of screen (B-4) to the underside of the platform using a standard heavy-duty staple gun. Use as many staples as necessary to ensure a secure hold.

## TIP

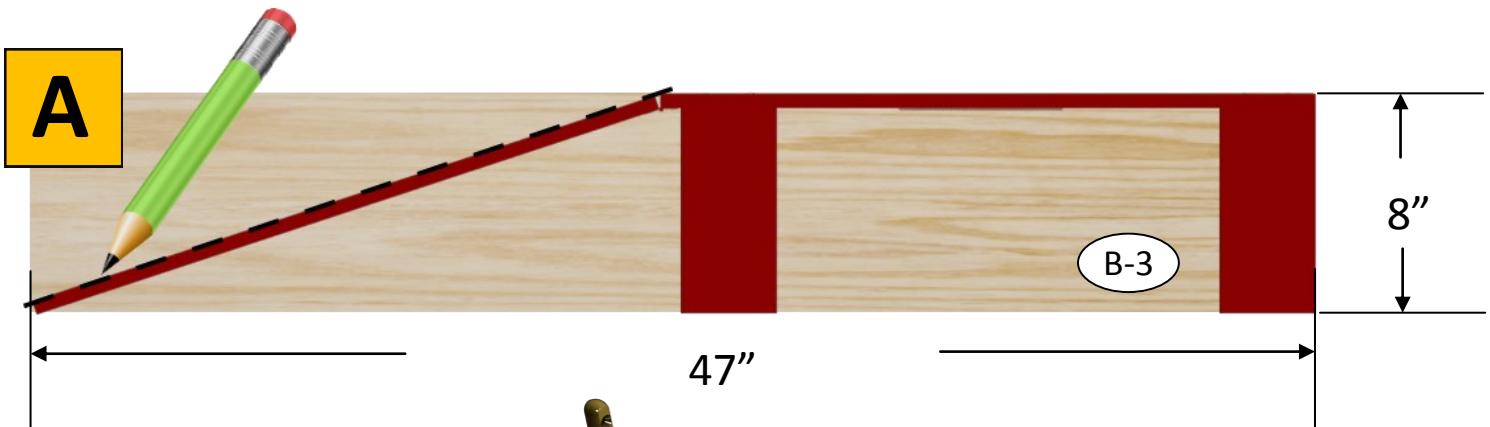
The purpose of the screen is to prevent balls from falling through the platform, therefore you may substitute another appropriate material if screen is not available.



## Side Panel

9

- To get the best fit for the side panel, cut a piece of Lauan (B-3) to 8"x 48". Turn the assembly right side up, then hold the Lauan flush to one side. Use a pencil to mark the exact angle. Cut the wood along the marked line.
- Paint both sides of the side panel.



# Platform

10

Affix Velcro to the inner surface of the side panels, and the outer edges of the ramp/platform assembly.

**IMPORTANT:** Be sure to affix the **RED** side panel to the **RIGHT** side of the **Red Home Zone Assembly**, and the **BLUE** side panel to the **LEFT** side of the **BLUE Home Zone Assembly**.



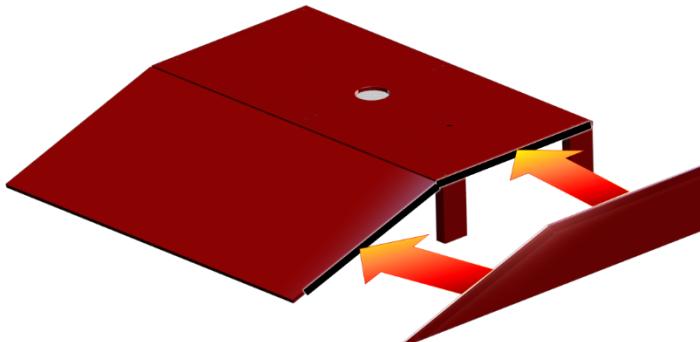
Velcro affixed to the inside of **RED** Side Panel

**TIP**

Add a few heavy duty staples to the self-adhesive Velcro to make it more secure.



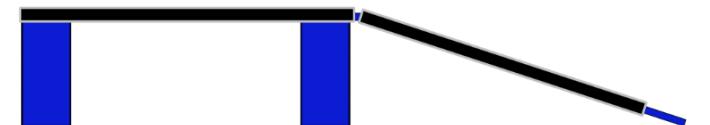
Velcro affixed to the **RIGHT** side of the **RED** Home Zone Assembly



Velcro affixed to the **RIGHT** side of the **RED** Home Zone Assembly



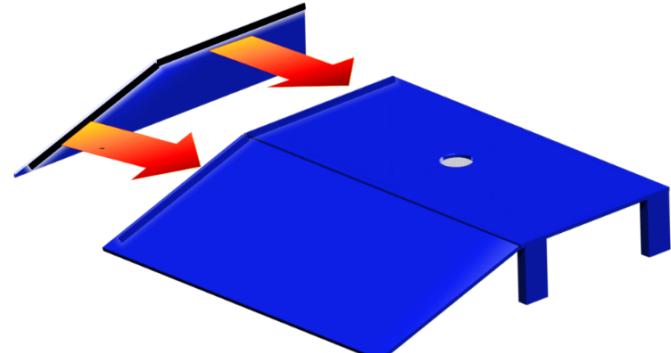
Velcro affixed to the inside of **BLUE** Side Panel



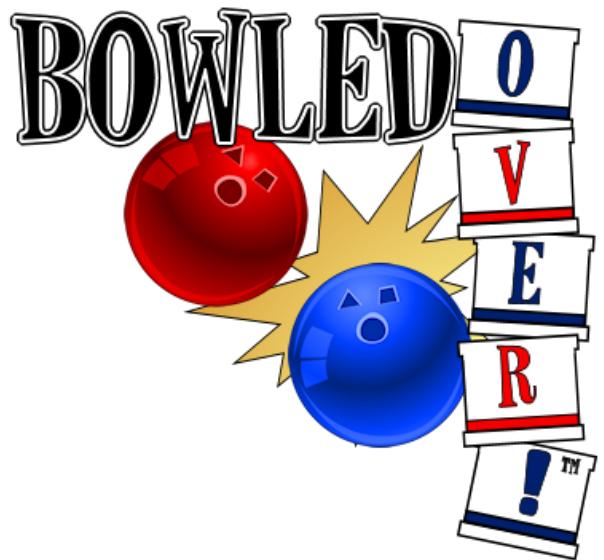
Velcro affixed to the **LEFT** side of the **BLUE** Home Zone Assembly

**TIP**

You may choose to add a small wood screw or two to secure the panel to the platform edge.

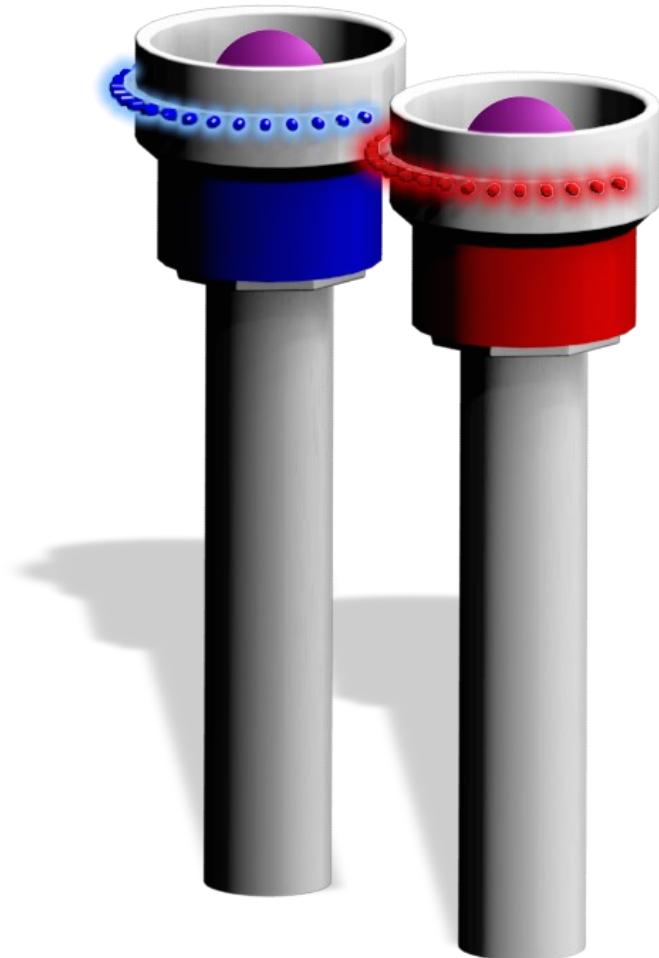


Velcro affixed to the **LEFT** side of the **BLUE** Home Zone Assembly



## Field Element Construction Guide

### C: Off-Field Goal Assembly



## Materials Needed for the Off-Field Goal Assembly:

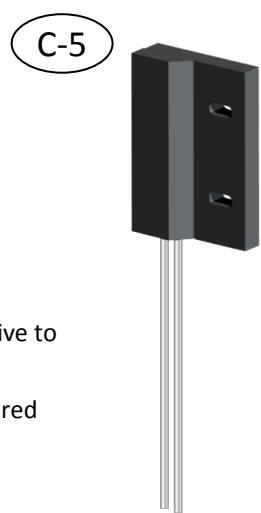
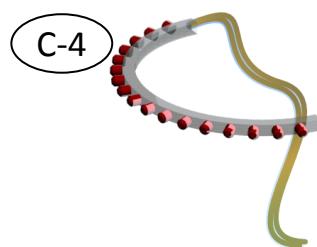
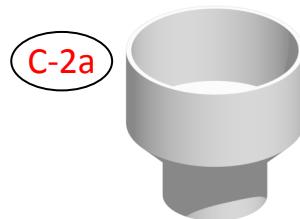
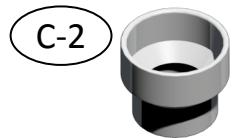
**Note: Quantities given are for ONE Off-Field Goal assembly. You will need to build TWO assemblies per**

Item	Description	QTY per Assembly	Note / Suggested Source
C-1	2" x 13.5" PVC Pipe	1	Comes in 10' length, must be cut to size The Home Depot SKU 193852 (\$6.45 each) Lowes: Item
C-2	3 X 2 PVC Flush Bushing	1	The Home Depot SKU 189073 (\$2.70 each) <a href="#">Lowes: Item 23311</a>
C-2a	2" x 4 " Adapter Coupling	1	Alternative to using C-2 & C-3: Use this single piece. See alternative instructions. <a href="#">Lowes: Item 23321 (\$5.33)</a>
C-3	4" x 3" PVC Reducing coupler	1	The Home Depot SKU 472506 (\$6.52 each) <a href="#">Lowes: Item 23320</a>
C-4	9.5" String LED Light	1	<a href="#">Use one string of red and one string of blue as appropriate</a> <a href="http://www.oznium.com/led-flex-strips">http://www.oznium.com/led-flex-strips</a> (\$11.49 each)
C-5	Magnetic Reed Switches	2	Hamlin 59135-020 (\$6.44 each) <a href="http://search.digikey.com/scripts/DkSearch/dksus.dll?lang=en&amp;site=US&amp;KeyWords=59135-020-ND&amp;x=22&amp;y=27">http://search.digikey.com/scripts/DkSearch/dksus.dll?lang=en&amp;site=US&amp;KeyWords=59135-020-ND&amp;x=22&amp;y=27</a>
C-6	3/8" wood screws	4	Used to secure Magnetic Reed Switch to the wooden support.
C-7	9V Battery Cap	1	<a href="#">Battery Cap</a>
C-8	9V Battery	1	
C-9	1" x .5" x 13 5/8" Wood Strip	1	Use a strip of 1/2" plywood
C-10	PVC Cleaner	As needed	The Home Depot <a href="#">SKU 187194</a>
C-11	PVC Cement	As needed	The Home Depot <a href="#">SKU 212369</a>
C-12	2" Gaffers Tape	As needed	<a href="http://www.findtape.com">Www.findtape.com</a> Pro-Gaff Gaffers Tape - Electric Blue Pro-Gaff Gaffers Tape - Red
C-13	Electrical tape	As needed	
C-14	Wire nuts	3	<a href="http://search.digikey.com/scripts/DkSearch/dksus.dll?DetailName=WM2963-ND">http://search.digikey.com/scripts/DkSearch/dksus.dll?DetailName=WM2963-ND</a> (\$.15)
C-15	3/4" Sticky Back VELCRO	As needed	
C-16	2" PVC Drain	1	Lowes Model # 435613 (Item #: 253249) The Home Depot SKU 728174

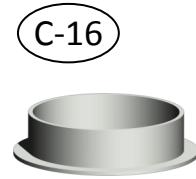
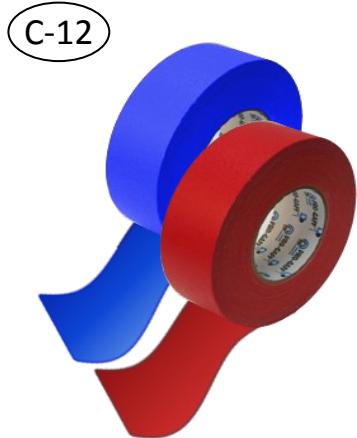
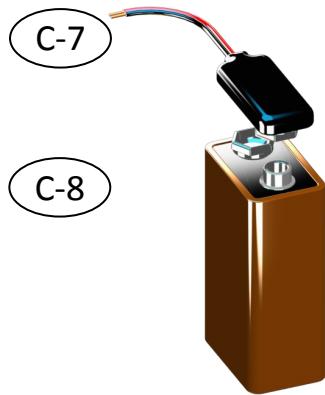
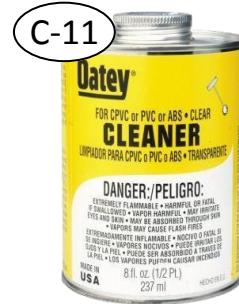
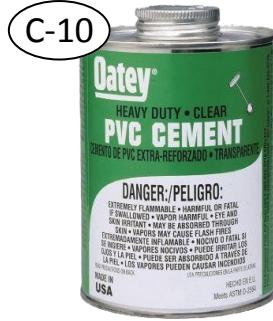
**Read through all the instructions before you begin to build**

### Revision History

Revision	Date	Description
1	9/1/2011	Initial Official Release



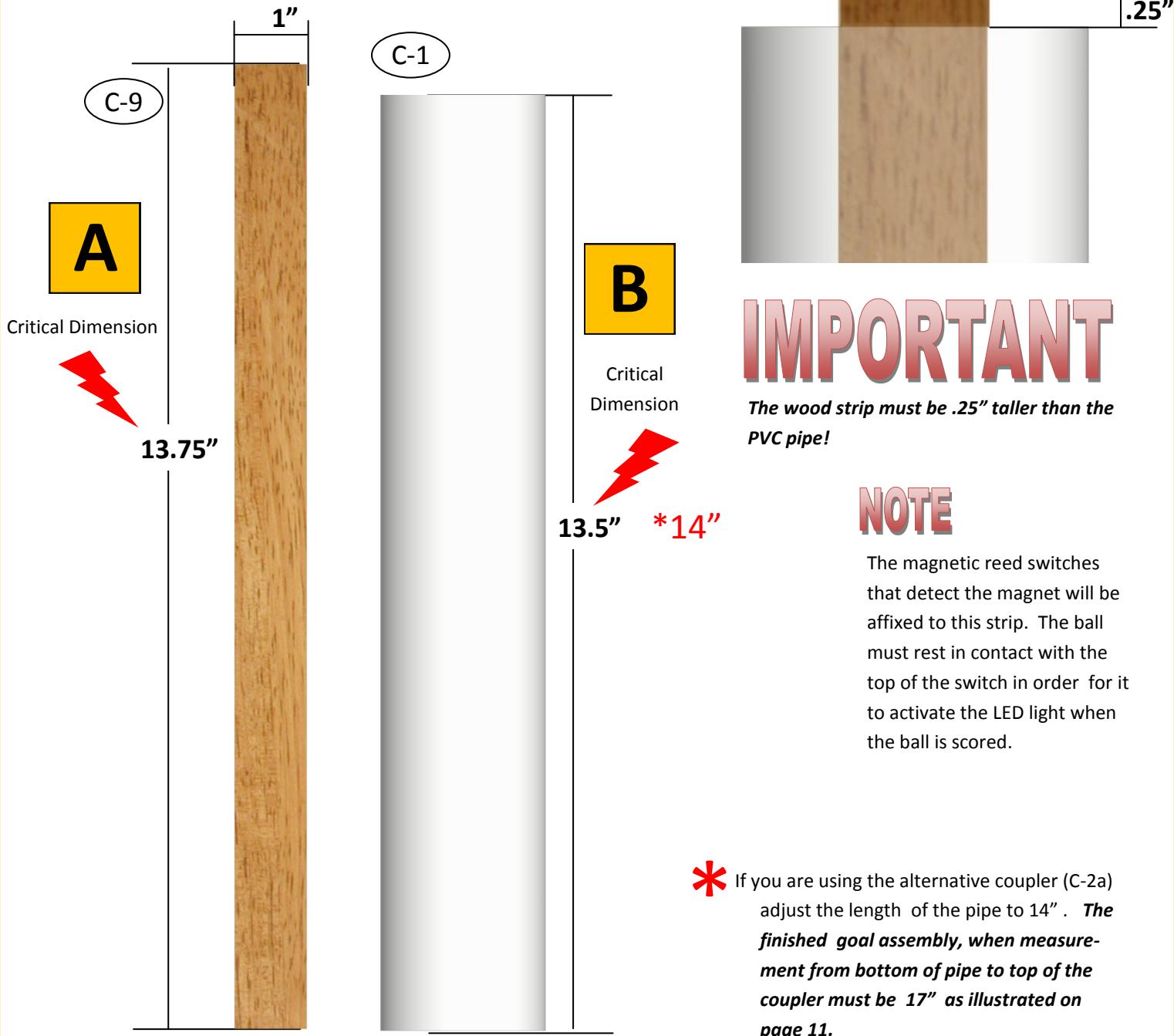
You may use C-2a as an alternative to using C-2 and C-3. Alternative instructions will be marked by a red asterisks (\*)



## Prepare the Center Wood Strip and PVC Pipe

**1**

- A. Trim a strip of 1/2" plywood (C-9) to 13.75" long x 1" wide:
- B. Cut the 2" PVC pipe (C-1) to 13.5" \* 14" If you are using the alternative coupler (C-2a)
- C. Stand the pipe on a flat surface and insert the strip into it as shown, to ensure the strip extends out of the top.

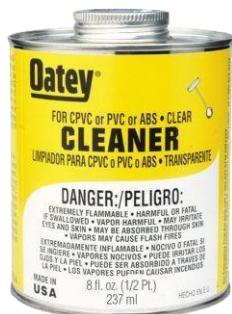


## Clean all PVC

2

- A. Ensure all the PVC components are clean using PVC cleaner (C-10).

A



C-10

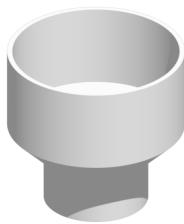
C-1



C-2



C-2a



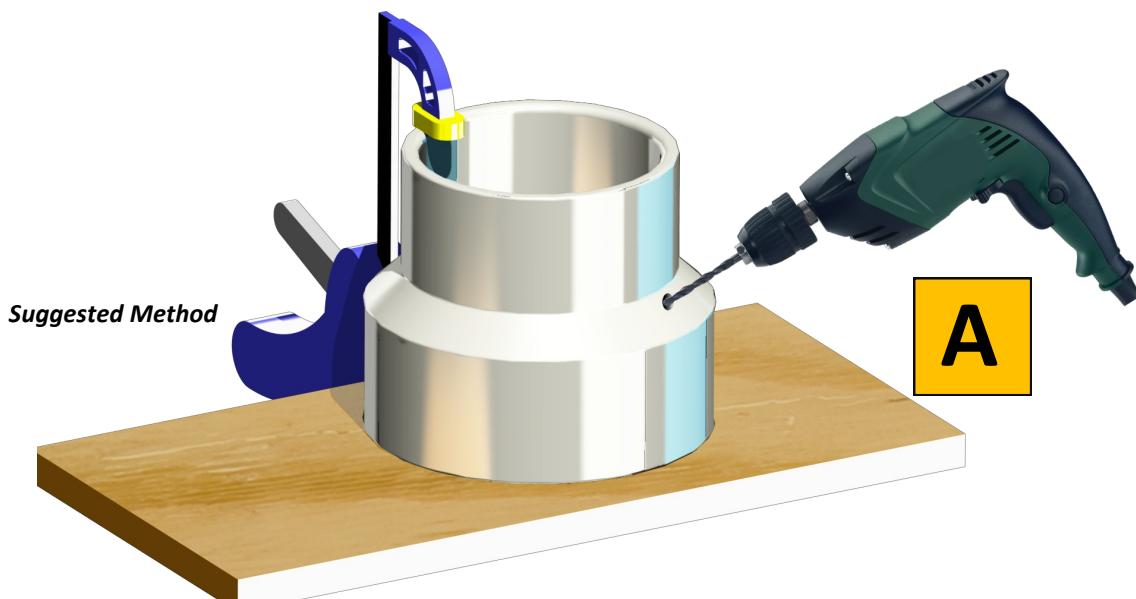
C-3



## Prepare Goal for LED Wires

3

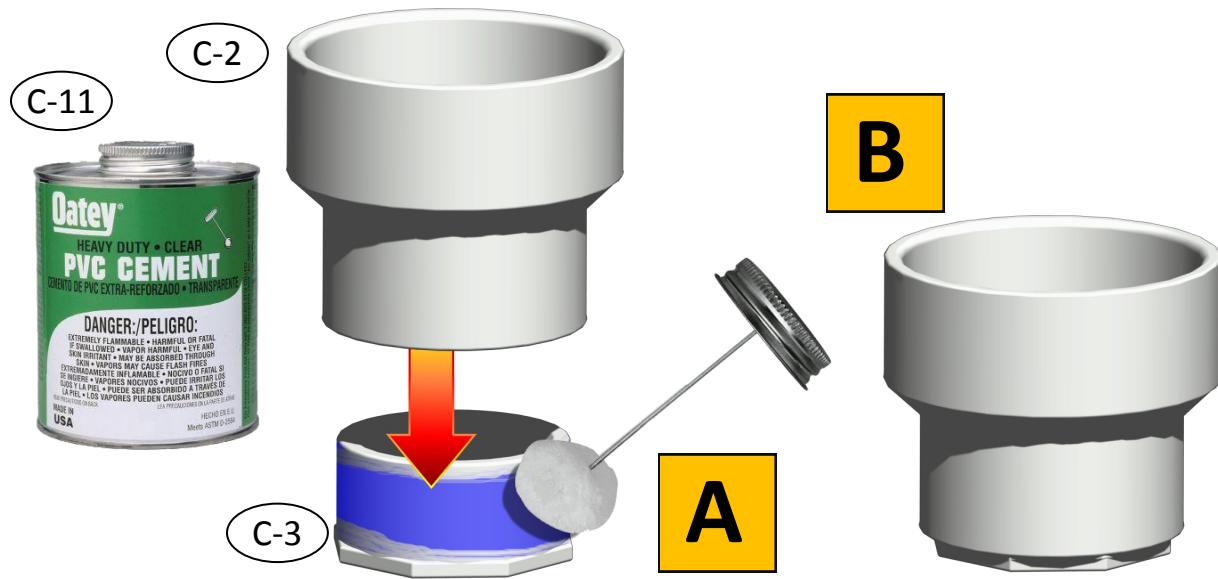
- A. Place the 3x4 PVC coupler (C-2) large end down on a stable surface. *Suggestion: Use a large bench clamp to hold it in place.* Drill an access hole into the 3X4 coupler at the slanted section using a drill about 1/8" to 3/16". The hole should be large enough to pass the LED Strip wires through easily, yet snug. Use a larger drill if necessary. \* **(Use the same method for the alternative coupler (C-2a))**



## Join the Couplers

4

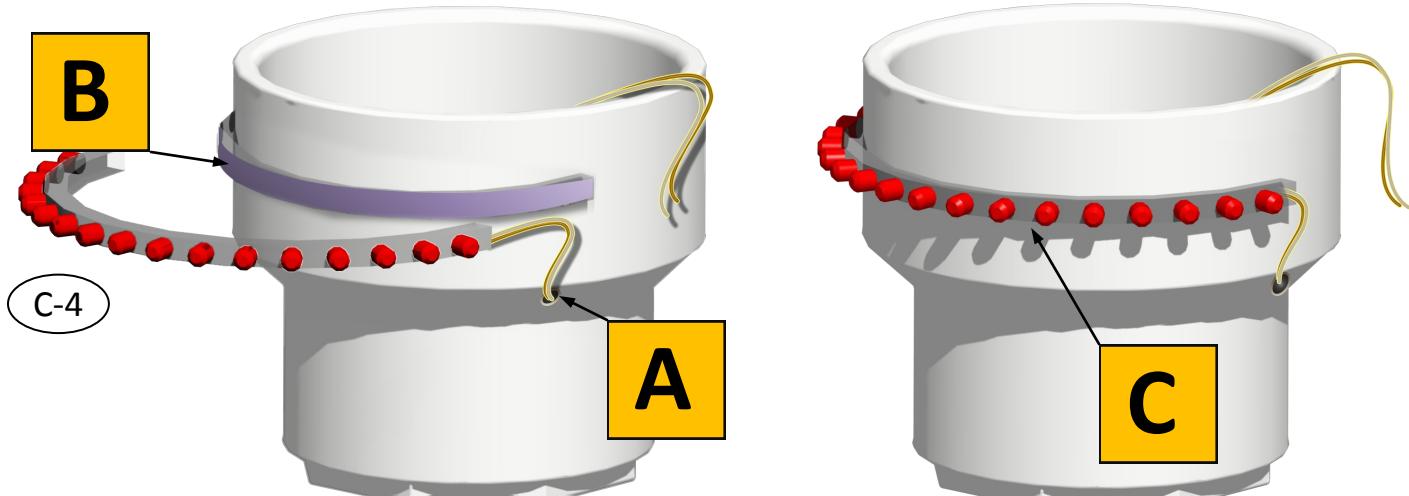
- Carefully apply PVC cement to the outer diameter of the 3"x4" coupler (C-3). Follow safety recommendations on the product for handling.
- Join the (C-2 & C-3) couplers as illustrated. Be sure C-2 is all the way to the flanged edge of C-3 as shown.



## Attach LED String Light

5

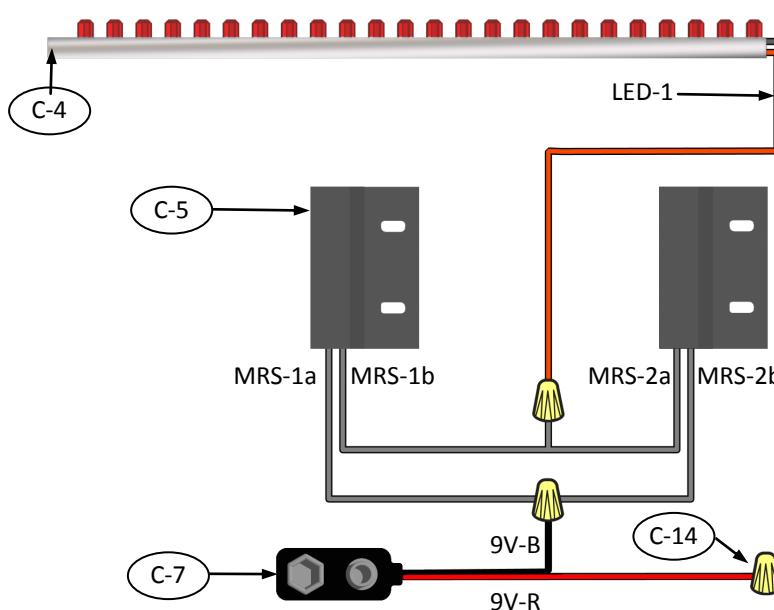
- Pass the LED String Light (C-4) wires through the hole drilled in Step 2. Allow the ends to drape out of the top of the coupler.
- Affix the double sided adhesive that was supplied with the LED lights to the outside of the coupler. Position the adhesive at the approximate center of the wide section of the coupler with the end aligned with the drilled hole as shown.
- Affix the LED String Light to the adhesive. Pull the wire through as much as possible. **Note: you may mount the lights so the lights point up or stick out as shown.**



# Wiring Diagram

**6**

The LED String, Magnetic Reed Switches and 9v Battery Cap all come pre-wired. Connections can be made by twisting the stripped ends of the wires together, and securing them with wire nuts. Refer to the diagram for proper connections. **Note: Do not attempt to connect the LED String before completing Step 5.**



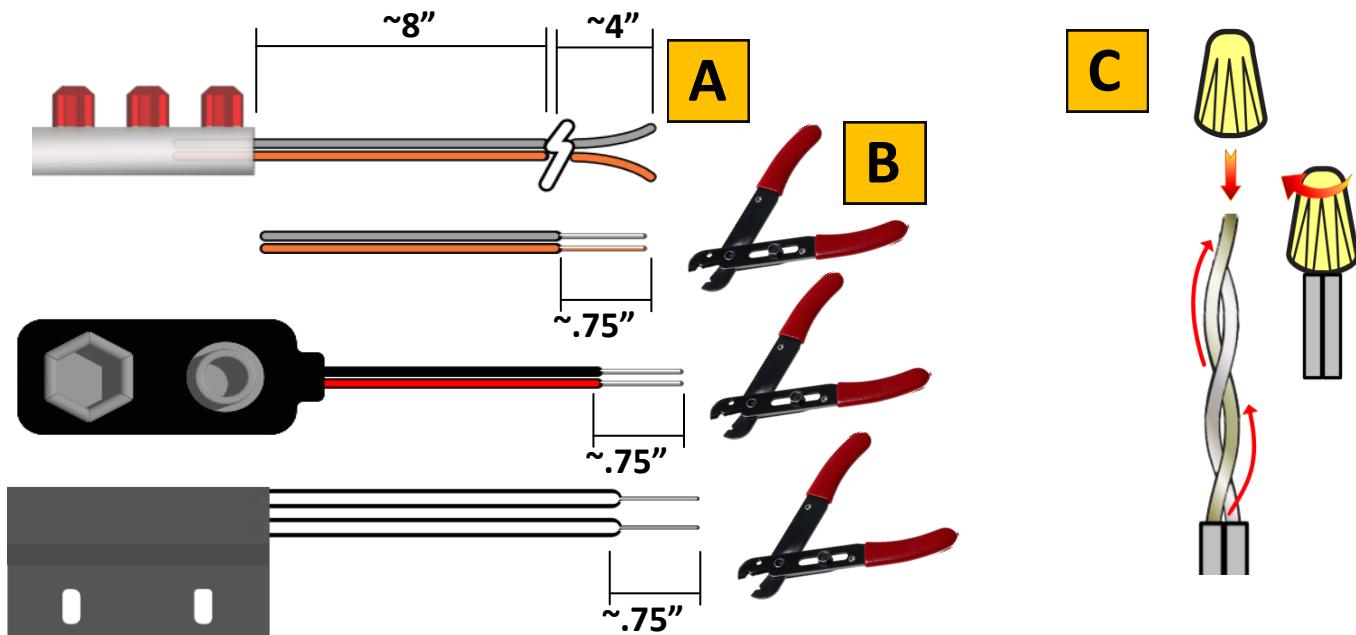
LED-1	LED String (Copper) * (see note)
LED-2	LED String (Silver) * (See note)
MRS-1a	Magnetic Reed Switch (White)
MRS-1b	Magnetic Reed Switch (White)
MRS-2a	Magnetic Reed Switch (White)
MRS-2b	Magnetic Reed Switch (White)
9V-B	Battery Cap Wire (Black)
9v-R	Battery Cap Wire (Red)

\* Note: Know issue with the LED Strings: Some LED Strings may be wired 'backwards'. In this case it is necessary to reverse the connect: Connect LED-1 to 9V-R, and LED-2 to the Reed Switches. **Be sure to perform the test in step 7.**

A. Split the LED String wires about 4" from the end.

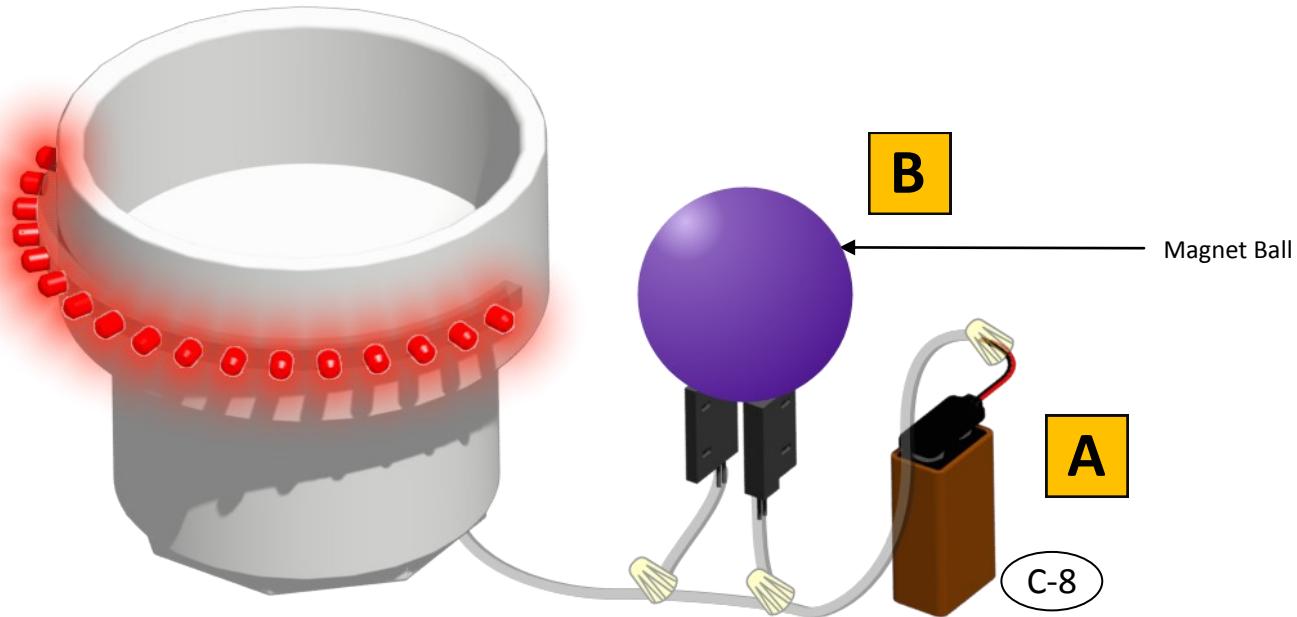
B. Strip off wire covering to expose the raw wires using wire stripper. Strip about 3/4" off each. **Note: Some wires may come pre-stripped.**

C: To make the connections, twist together the stripped ends of wires referring to the diagram above. Secure the connections by twisting wire nuts onto the joined wires.



# TEST YOUR WIRING BEFORE YOU CONTINUE!

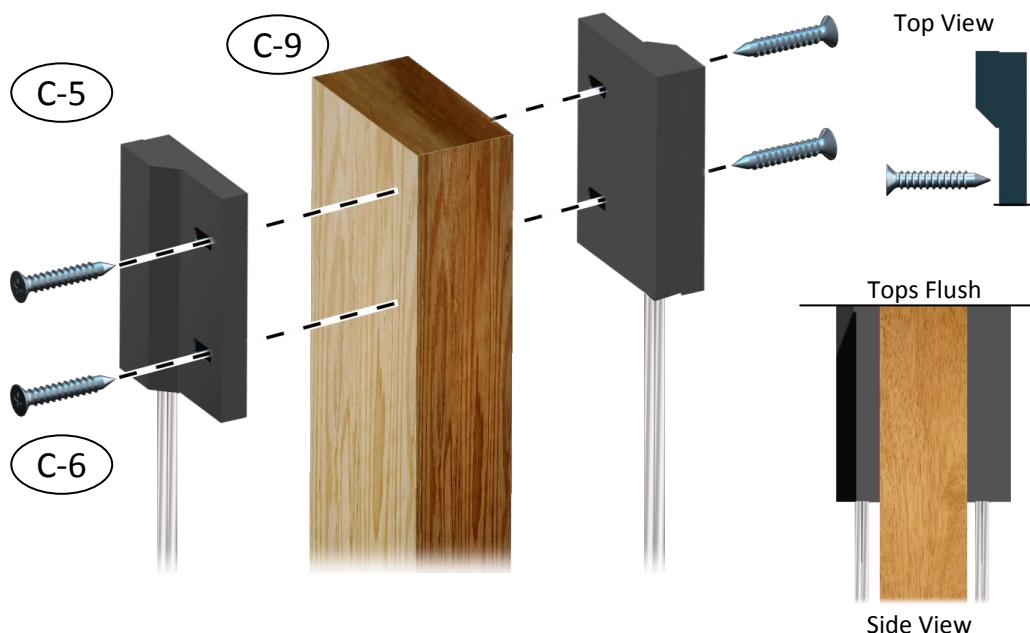
- A. Connect the 9V battery to the battery cap.
- B. Use a prepared Magnet Racquet Ball (See instruction sheet H) to test the light, by placing it on top of the two magnetic reed switches as illustrated. The LED String should illuminate when the ball makes contact with the switches. If the light does not come on, recheck all connections.



## Attach the Magnetic Reed Switches

7

- A. Using the 3/8" wood screws (C-6) attach the magnetic reed switches to the top of the wood strip (C-9) in the orientation illustrated. The top of the switches should align flush with the top of the wood strip and the screwed edges should be flush with the sides.



## NOTE

\* Note: Know issue with the LED Strings: Some LED Strings may be wired 'backwards'. If your light does not come on, try reversing the connections: Connect LED-1 (Copper) to 9V-R, and LED-2 (Silver) to the Reed Switches.

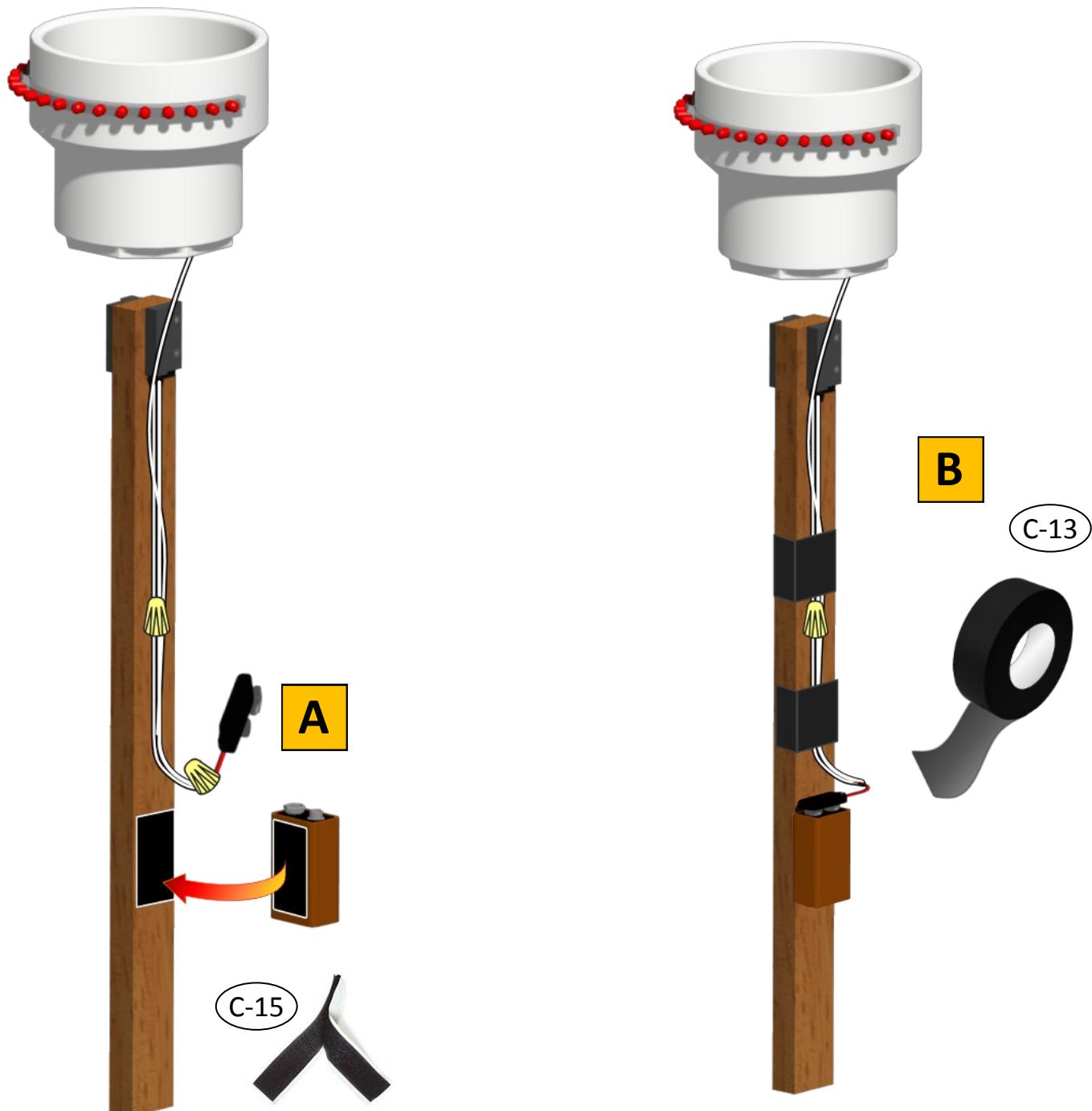
## NOTE

This orientation prevents the screws from colliding, while putting the magnetic portions of the switches as close as possible to each other to ensure the magnet inside the racquet ball will activate the LED String.

## Attach the Battery and Dress Wires

8

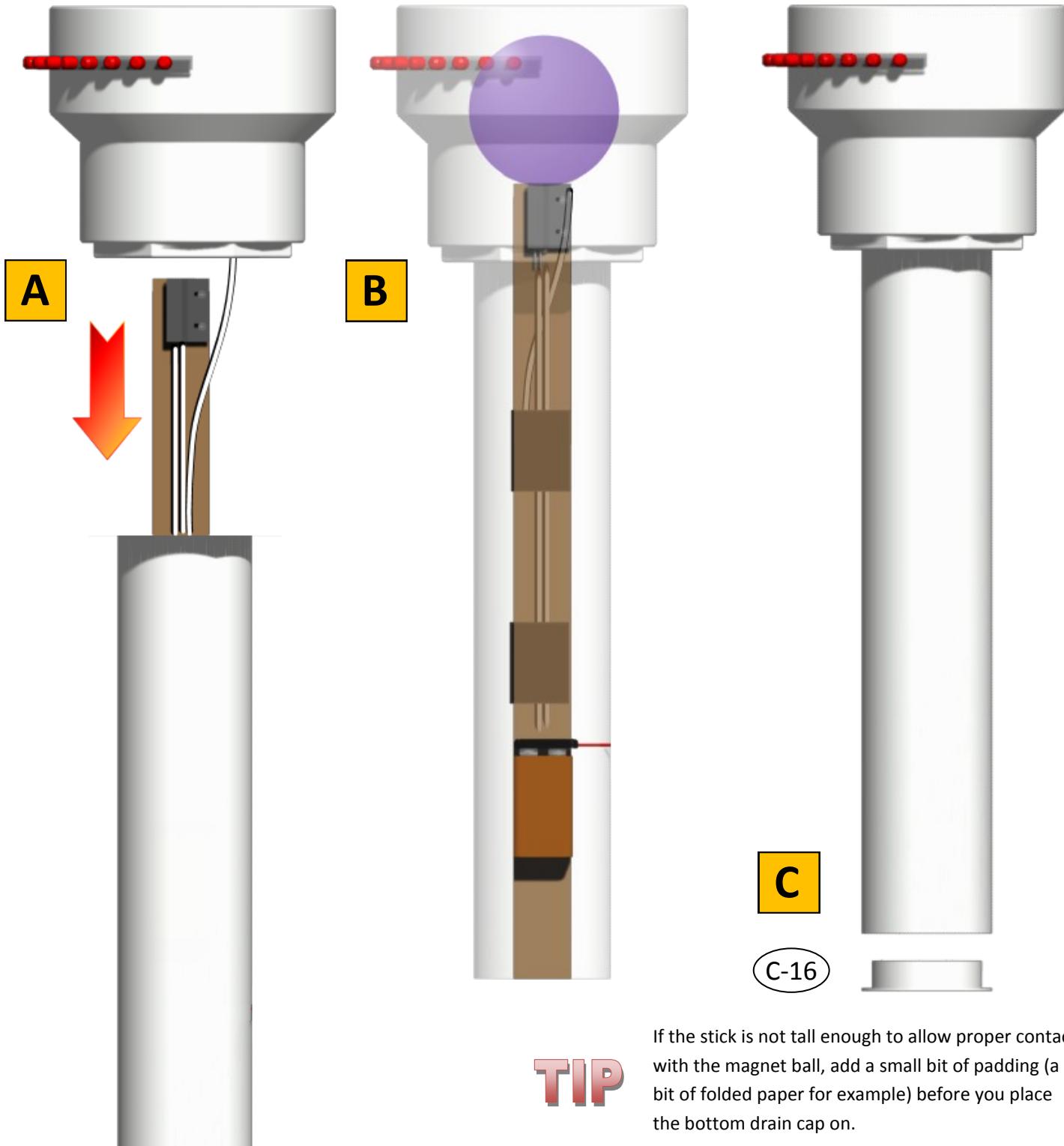
- A. Attach a piece of 3/4" sticky back VELCRO© to the stick, and the matching piece to a 9V Battery. Attach battery and attach the battery clip.
- B. Dress the wires with electrical tape.



## Assemble Goal

9

- A. Carefully place the stick into the center of the PVC Pipe, and push the coupler.
- B. Place a magnet ball into the assembled goal to test the lights.
- C. Insert the PVC Drain Cap (C-16) into the bottom of the assembly. This will keep the center stick assembly from dropping through. **NOTE: Do NOT glue the cap on.** You will need access to the battery.



**TIP**

If the stick is not tall enough to allow proper contact with the magnet ball, add a small bit of padding (a bit of folded paper for example) before you place the bottom drain cap on.

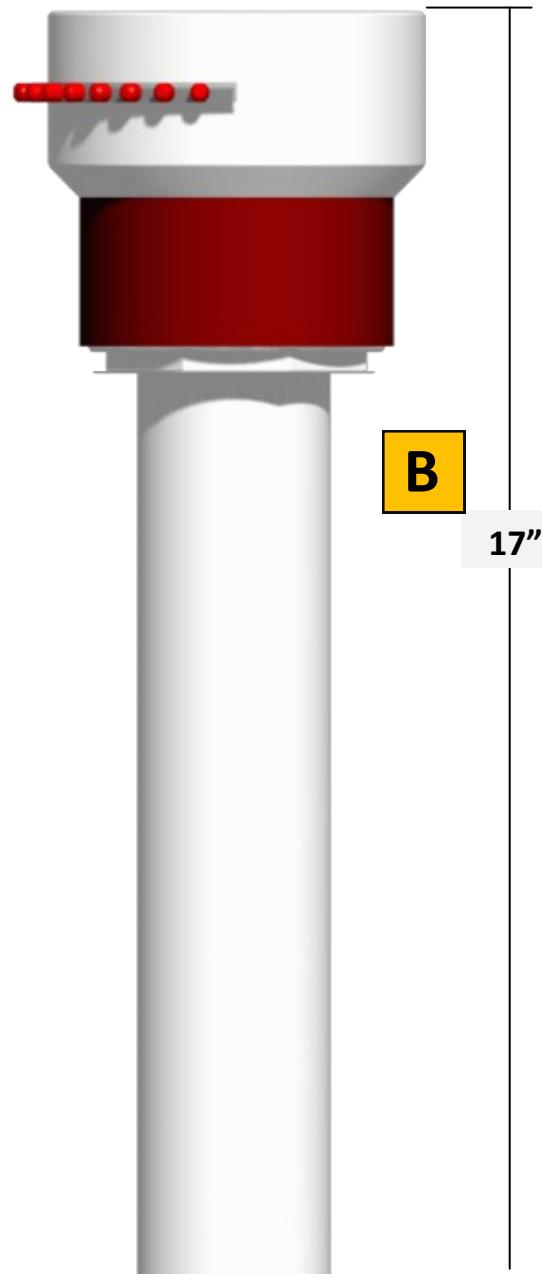
## Assemble Goal

10

- Affix the appropriately colored gaffers tape around the base of the coupler as shown.
- Measure the height of the assembly to be certain it is 17" tall.



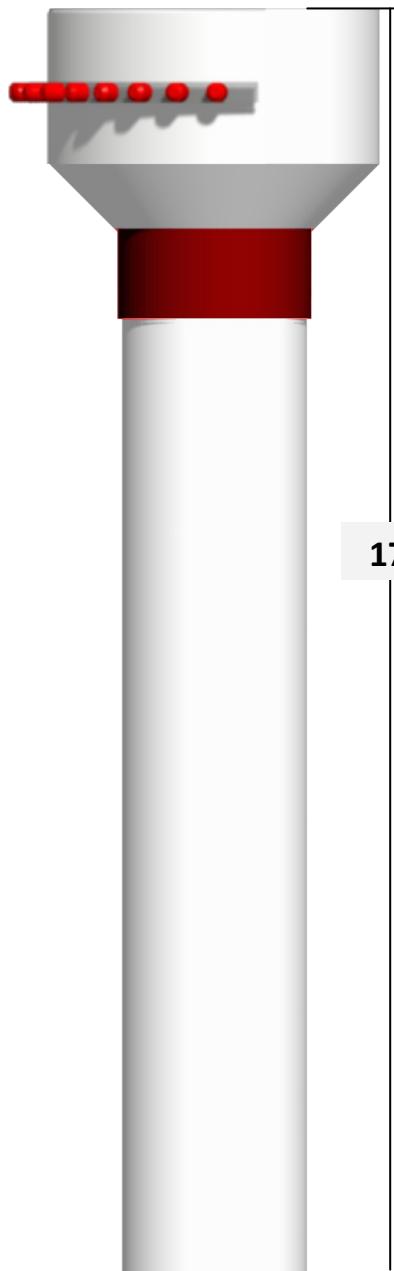
A



B

17"

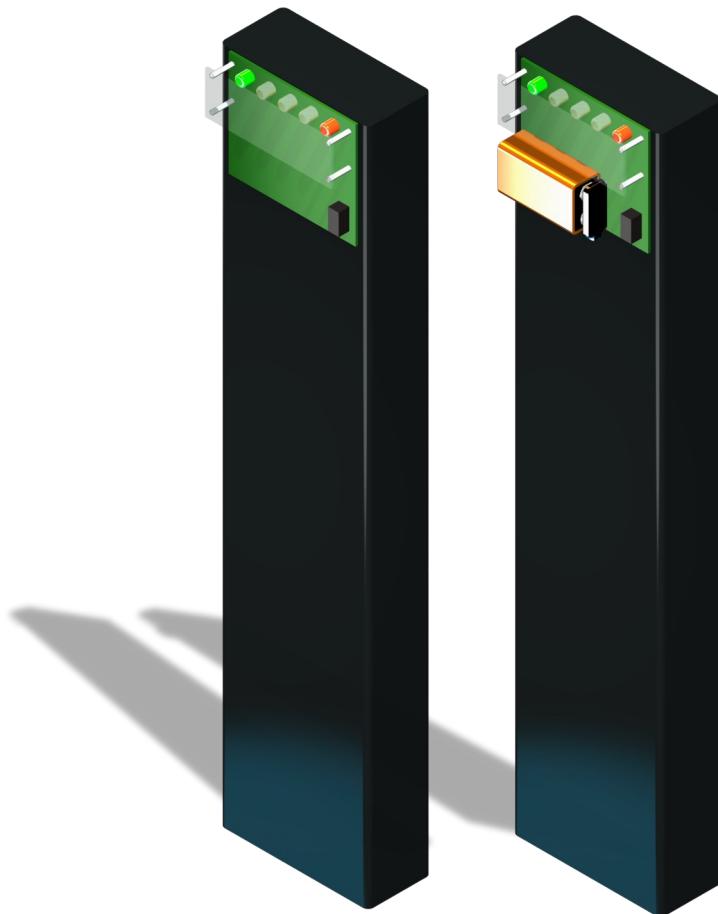
\* Alternative (C-2a) coupler view





## Field Element Construction Guide

### D: IR Beacon Support Assembly (with wire harness instructions)



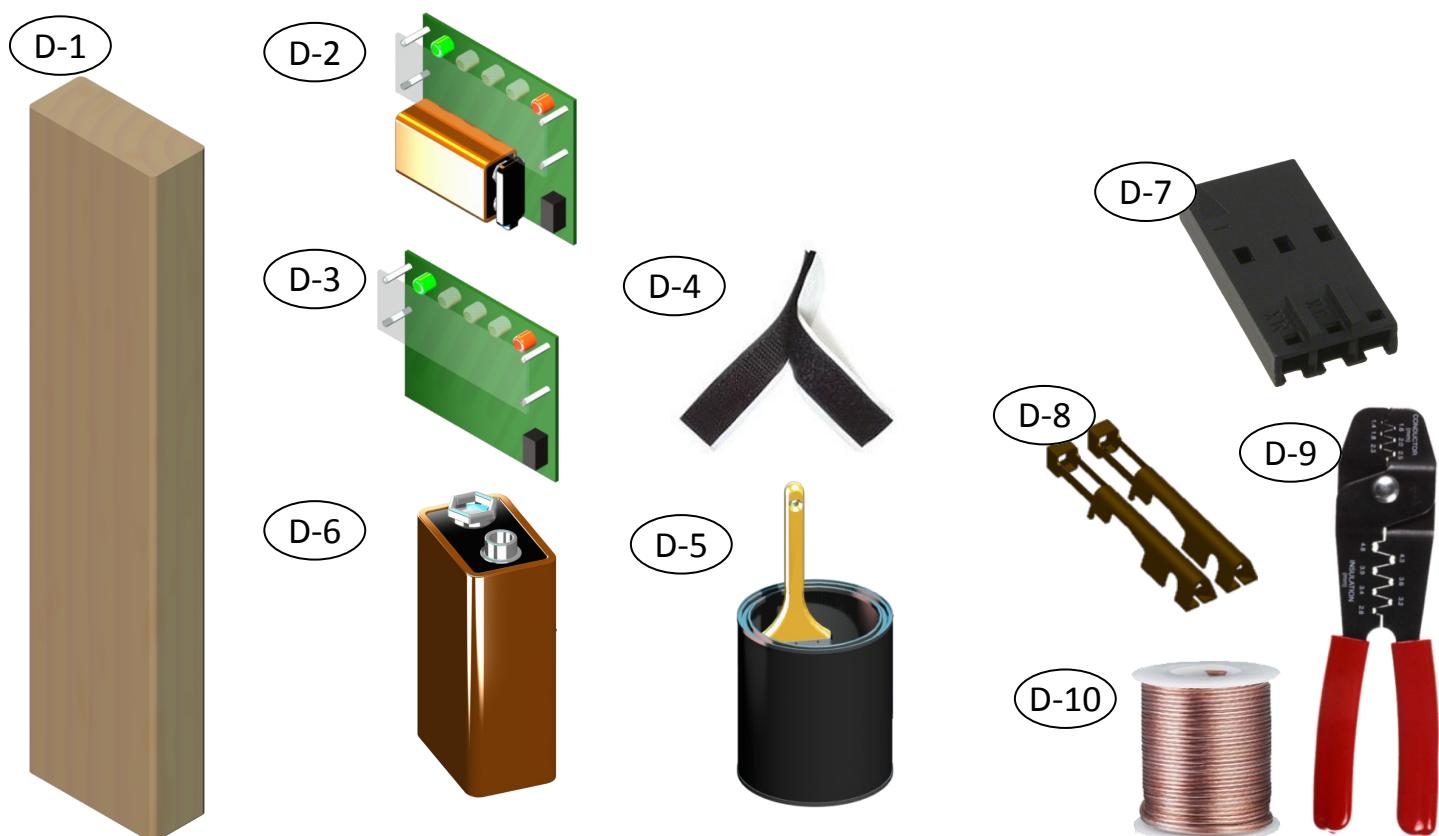
## Materials Needed for the IR Beacon Support and Wire Assembly:

***Read through all the instructions before you begin to build***

Item	Description	QTY	Notes / Suggested Source
D-1	2"x 4" x 16" Lumber	1	
D-2	Master Beacon	1	<a href="http://www.HiTechnic.Com">www.HiTechnic.Com</a>
D-3	Slave Beacon	1	<a href="http://www.HiTechnic.Com">www.HiTechnic.Com</a>
D-4	3/4" Sticky Back VELCRO	As Needed	
D-5	Black Paint	As Needed	BEHR Premium Plus Semi-Gloss Paint, Mouse Ears (Black)
D-6	9V Battery	1	
D-7	Connector Housing - Male .100 3 POS	2	<a href="http://www.digikey.com">www.digikey.com</a> Part Number: WM2872-ND
D-8	Crimps	4	<a href="http://www.digikey.com">www.digikey.com</a> Part Number: WM2555
D-9	Crimp Tool	1	<a href="http://www.digikey.com">www.digikey.com</a> Part Number: WM9999
D-10	24 Gauge Stranded Speaker Wire	As Needed	You need at least 28 feet per field. Speaker wire is readily available at any electronics store (Radio Shack) in spools.

### Revision History

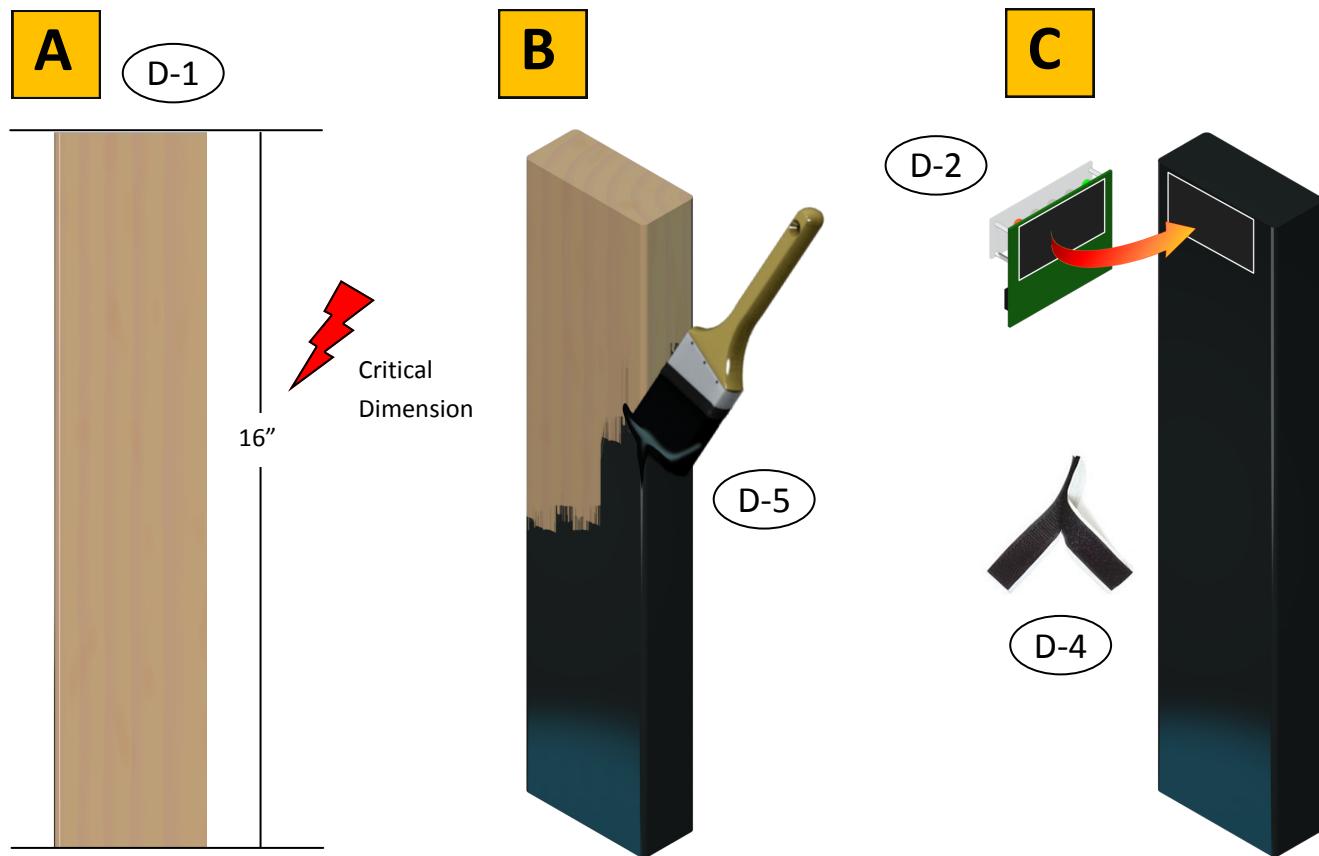
Revision	Date	Description
1	9/1/2011	Initial Official Release



## Beacon & Support

**1**

- A. Cut two 2" x 4" wood supports (D-1) to exactly 16"
- B. Paint each support with black paint. Allow the paint to dry before proceeding to the next step.
- C. Cut a piece of sticky back VELCRO to fit, and affix it to the top of each support, and the matching piece to the backs of both the Master and Slave IR Beacons.
- D. Attach the beacon to the support. Ensure the top of the beacon aligns with the top of the wood.



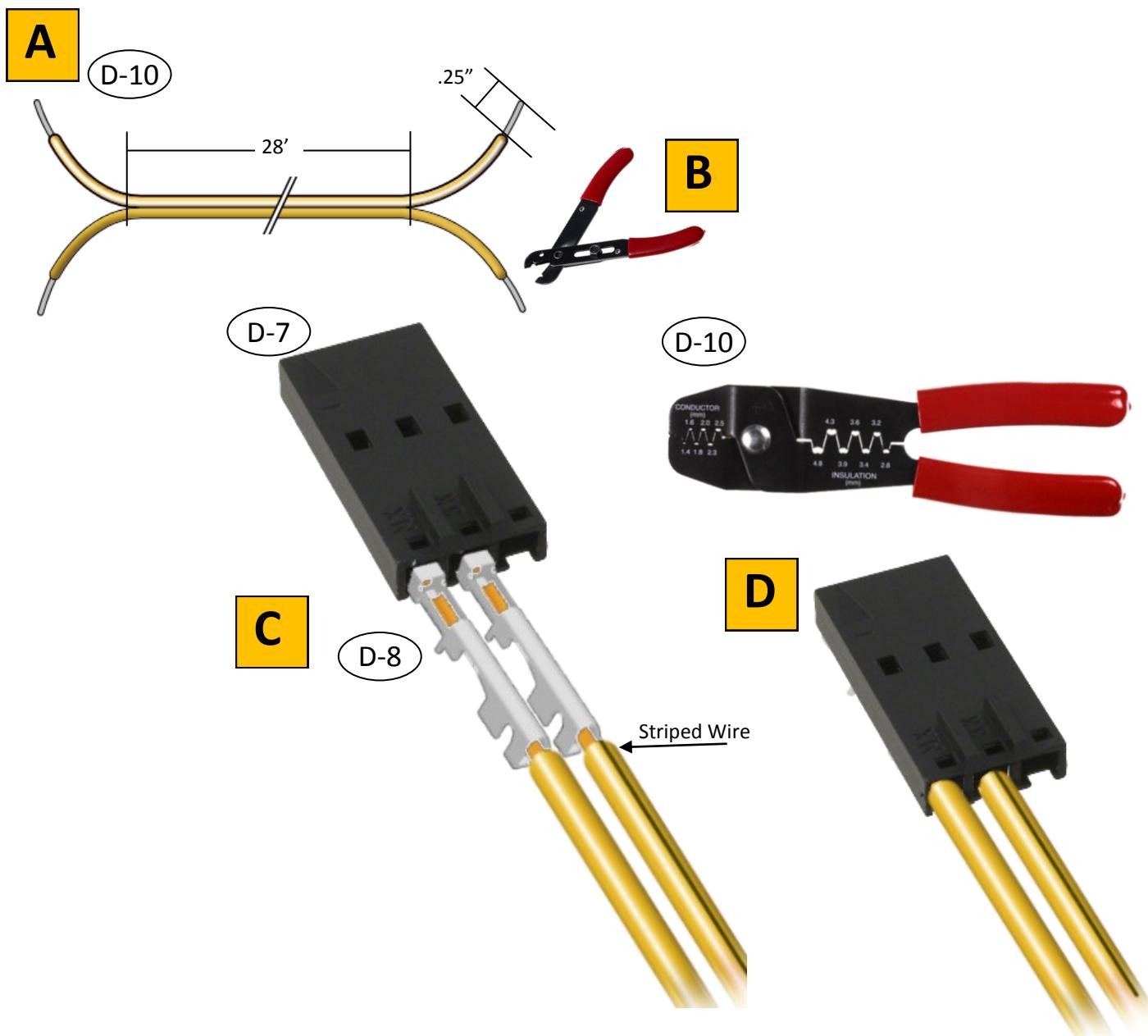
## Beacon Wire Harness

2

**The IR Beacons will be located at opposing corners on the competition field. The wires must reach from beacon to beacon, then around two sides of the perimeter. Make the harness at least 28' long to accommodate the length of each wall, and the height of each support.**

- A. Cut a 28' length of speaker wire (D-10), and split the ends about 3".
- B. Strip the outer casing of each wire, exposing at least .25" of the inner wires. **Look carefully, and keep note of which wire has a striped edge.**
- C. Apply a crimp (D-6) to each stripped end, and close with the crimp tool ensuring a secure hold.
- D. Insert the crimped wires into the connector housing (D-7). They should click securely into place.

**NOTE** Be sure the striped wire is always in the center position. The un-striped wire can go into either of the outer slots on the connector.





FIRST® Tech Challenge



## Field Element Construction Guide

### E: Ball Tube



## Materials Needed for the Ball Tube:

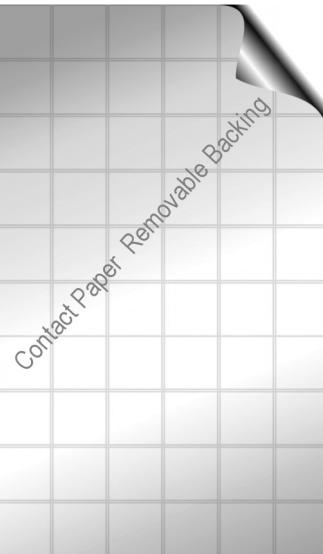
**Note: Quantities given are for ONE Ball Tube. You will need to prepare FOUR Ball Tubes per game field.**

Item	Description	QTY	Notes / Suggested Source
E-1	8"Diameter x 6" Length Sonotube	1	Available in 48" lengths. The Home Depot SKU # 285266 (\$5.73)
E-2	Duck 10'Lx 12"W White Adhesive Shelf Liner	2	Lowes Item # 223760
E-3	Avery Shipping Label 5126	As Needed	Avery Label 5126

E-1



E-2



E-3



***Read through all the instructions before you begin to build***

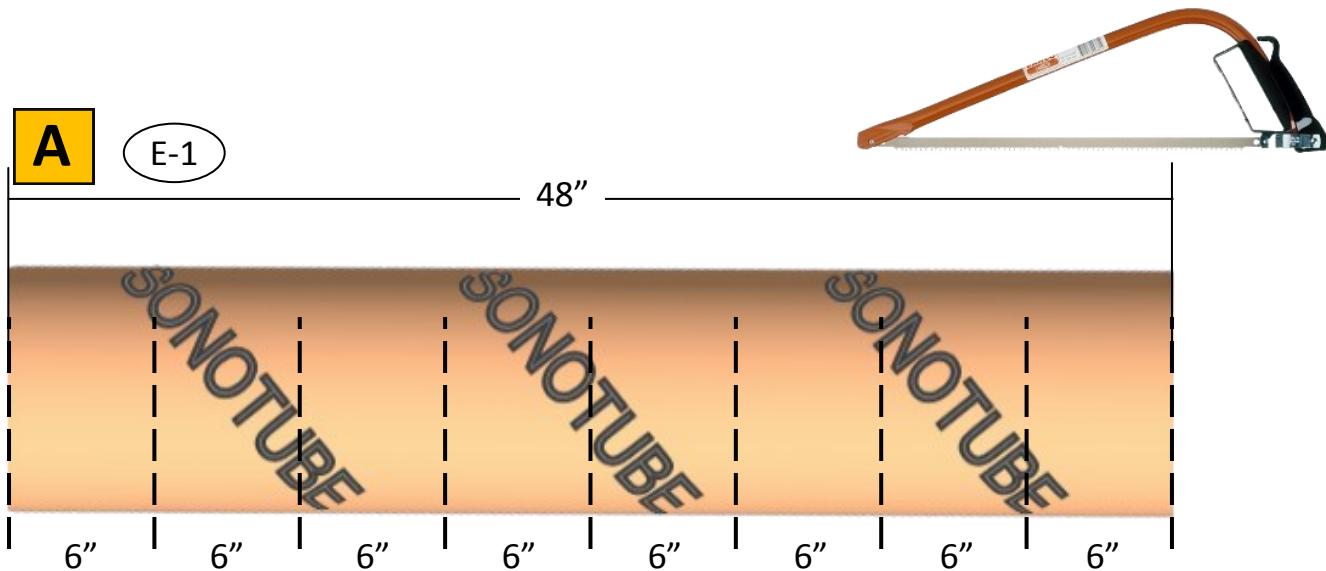
#### **Revision History**

<b>Revision</b>	<b>Date</b>	<b>Description</b>
1	9/1/2011	Initial Official Release

# Prepare Sonotube

**1**

- A. Measure and mark 6" segments on the 48" Sonotube (E-1).
- B. Wipe off any dust, and debris left from the cutting. The tubes must be as clean as possible for the Duck Peel & Stick contact paper to adhere smoothly and securely. Tip: A small amount of Purell Hand Sanitizer Gel works well, and dries quickly.



**Note:** This will give you enough for 2 fields worth of tubes, OR if you are only building 1 field, you have spares.



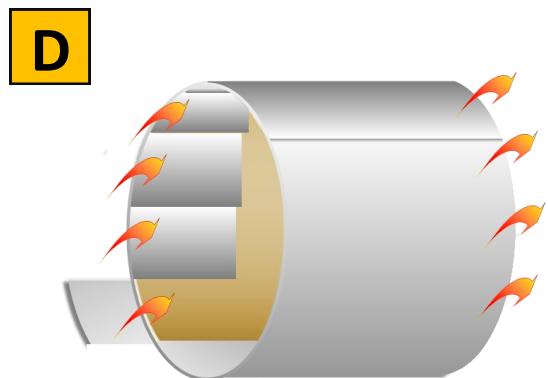
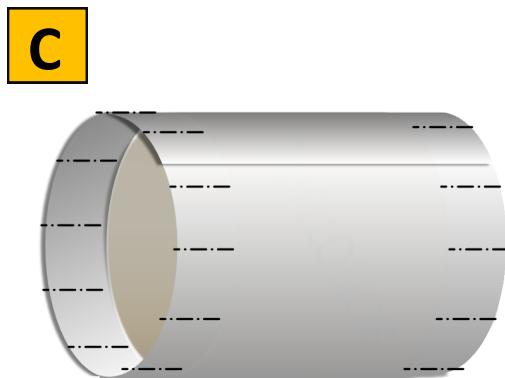
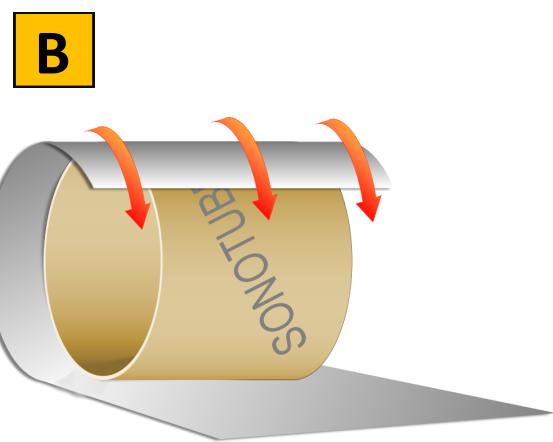
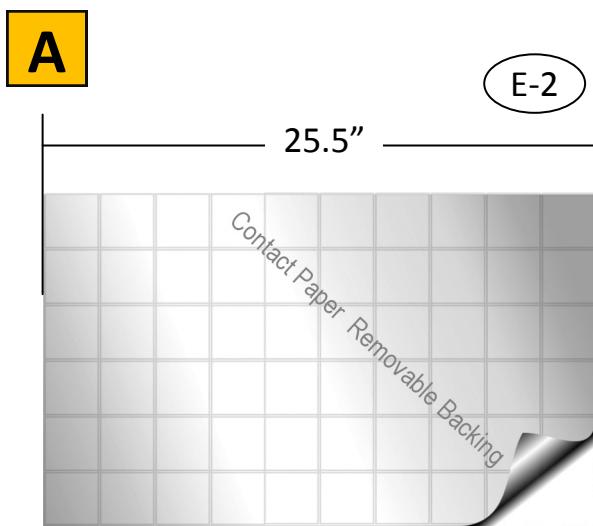
## TIP

Robots and bowling balls will be crashing into the tubes during game play. It is a good idea to prepare all 8 cut segments. (1 whole Sonotube per field). This will give you spares in the event tubes become crushed or otherwise damaged during a tournament.

## Wrap Tube

2

- A. Unroll a length of Duck Peel & Stick contact paper (E-2) to about 25.5" long. Carefully remove the adhesive backing. Lay the contact paper, sticky side up on a flat surface. (Duck contact paper will lay flat after the backing is removed).
- B. Place the tube on its side in the approximate middle of the contact paper. Carefully roll the tube, pressing the contact paper too it. **Go slow! Keep the contact paper as smooth and bubble free as possible.**
- C. Cut slits along the extra edge of contact paper.
- D. Fold the slit edges into the center of the tube, creating a neat top edge.
- E. Print the last page of this document onto Avery half-sheet shipping labels (E-3). Carefully apply the label to the front of the tube.



**TIP**

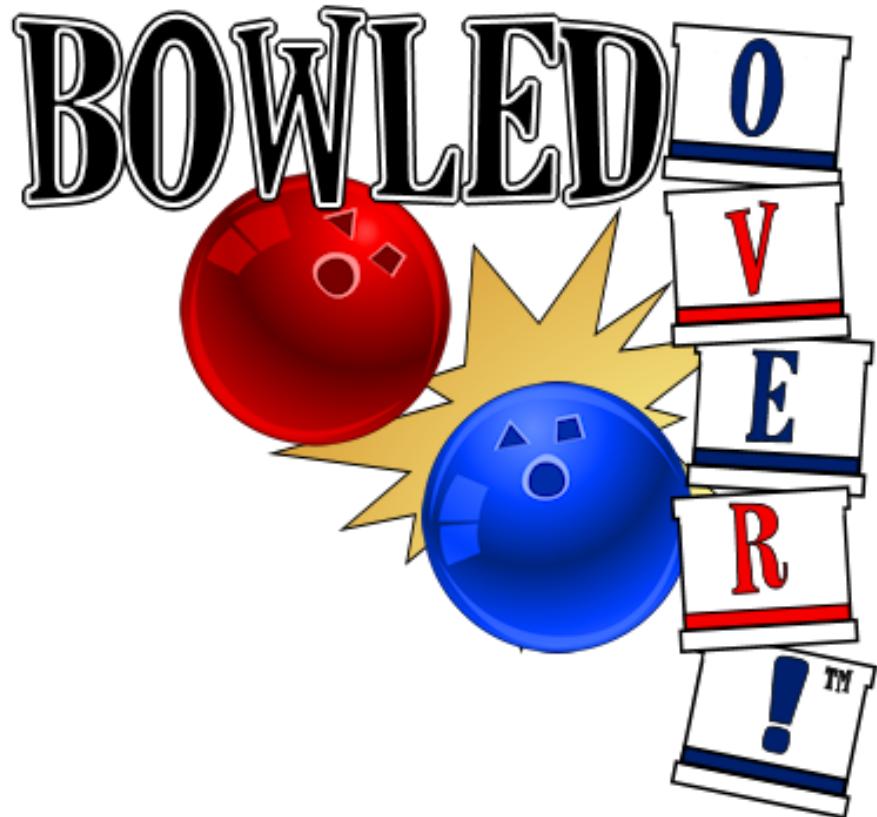
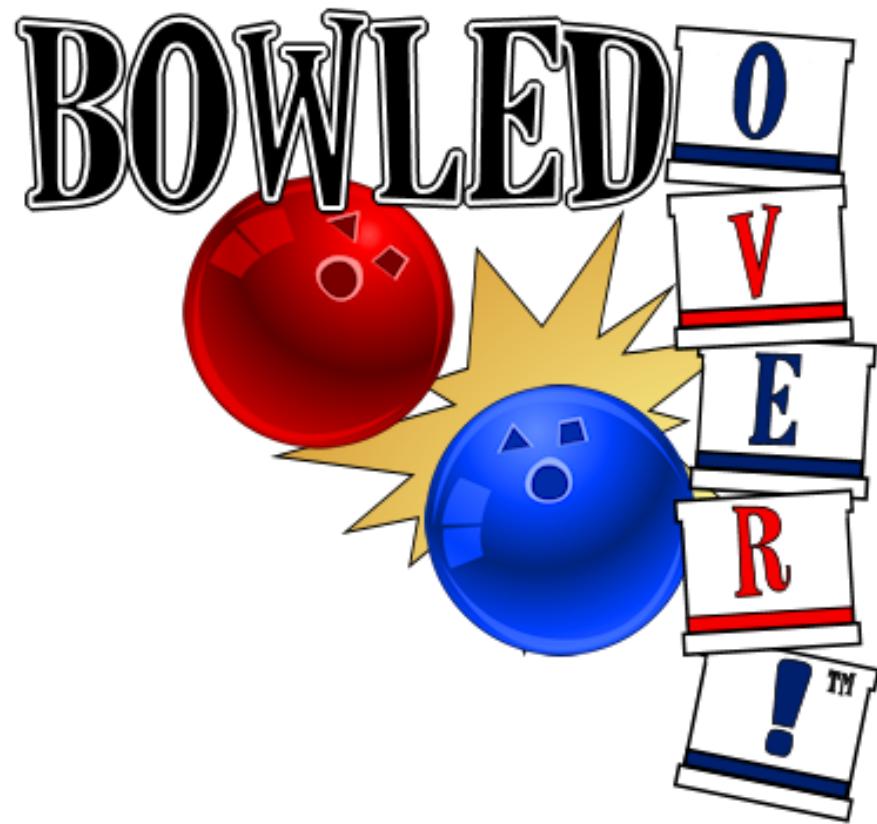
To make the inner tube look neat, use a couple of extra blank shipping labels on the inside of the tube to cover the folded edges.



## Optional

You may print labels with the game logo to place on the opposite side of the tube. Use the logo pages at the end of the document for printing.

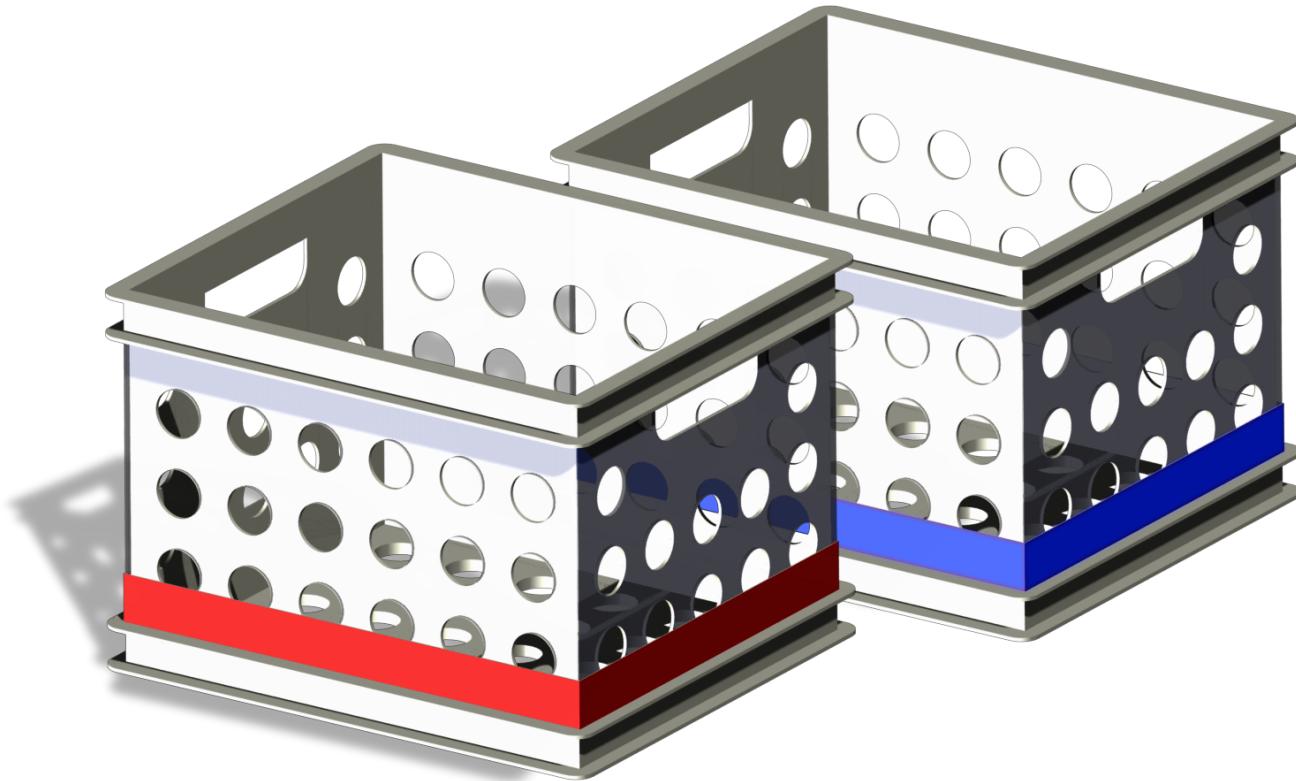






## Field Element Construction Guide

### F: Crates



**Note: You will need to prepare 12 Mini Crates per Field. 6 Red, 6 Blue.**

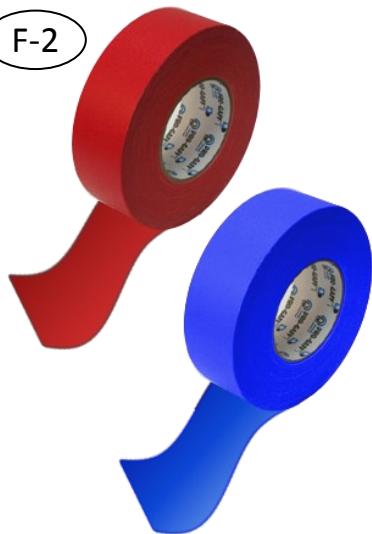
Item	Description	QTY	Notes / Suggested Source
F-1	Serilite® Mini Crate (Translucent) 9" x 7-7/8" x 6-1/8"	12	<a href="http://www.quickaidpharmacy.com/stplmicr16.html">http://www.quickaidpharmacy.com/stplmicr16.html</a> <a href="http://www.usphome.com/catalog/item.aspx?itemid=74450&amp;catid=962">http://www.usphome.com/catalog/item.aspx?itemid=74450&amp;catid=962</a>
F-2	1" Gaffers Tape	As needed	<a href="http://Www.findtape.com">Www.findtape.com (~\$18.00 / roll)</a> Pro-Gaff Gaffers Tape - Electric Blue Pro-Gaff Gaffers Tape - Red

F-1



**NOTE**

F-2



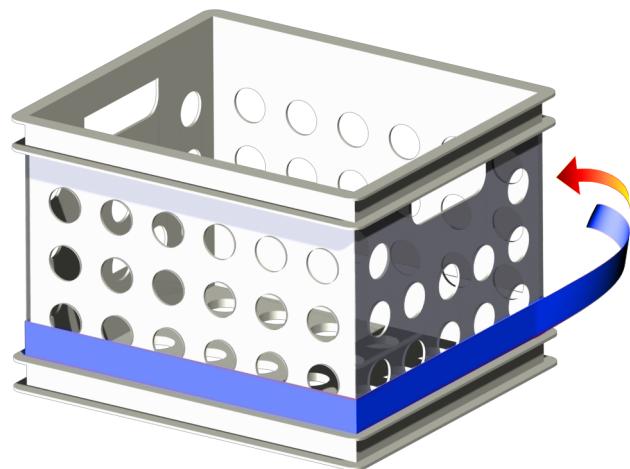
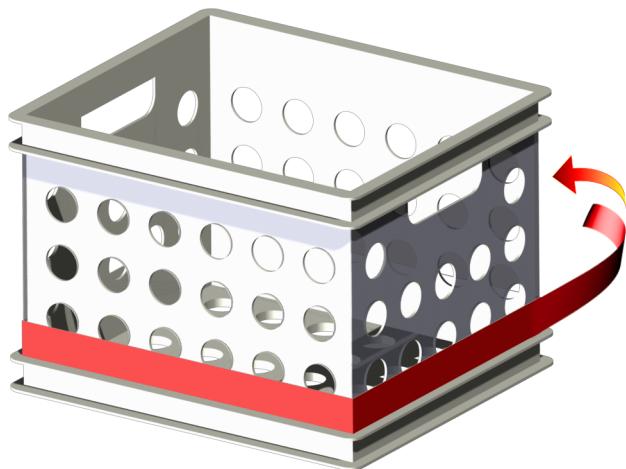
Use translucent mini crates for competitions. This allows the audience to see when balls are scored, and helps the referees to count quickly.

For unofficial events, or practice times, opaque or colored crates are fine. Be sure to use the tape on them so teams are used to working around covered holes.

## Prepare Crates for Competition

1

Wrap the appropriately colored gaffers tape around the crate along the lower ridge as illustrated. Note that some of the holes will be partially covered by the tape. Prepare 6 red and 6 blue crates for competition.

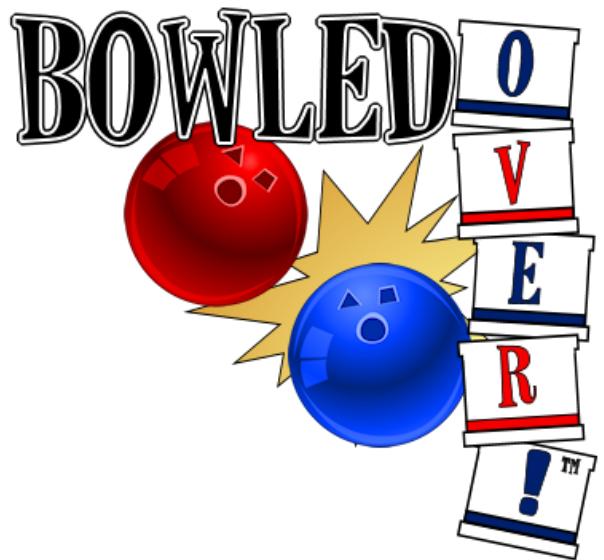


**TIP**

Wrap the gaffers tape around a couple of times to ensure it sticks securely to the crate.



FIRST® Tech Challenge



## Field Element Construction Guide

### G: Preparing the Bowling Balls



## Materials Needed for the Bowling Ball:

**Note: You will need 2 Bowling Balls per field, 1 red, 1 blue.**

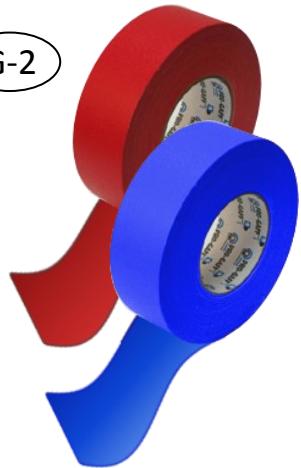
Item	Description	QTY	Notes / Suggested Source
G-1	6LB Bowling Ball	2	6 pounds w/ or w/o finger holes (Used or new) Suggest: Dick's Sporting Goods Ebonite ZOOM Dick's Sporting Goods Ebonite ZOOM (Bubble Gum)
G-2	1" Gaffers Tape	As needed	Www.findtape.com (~ \$9.00 / roll) Pro-Gaff Gaffers Tape - Electric Blue Pro-Gaff Gaffers Tape - Red

G-1



# NOTE

G-2



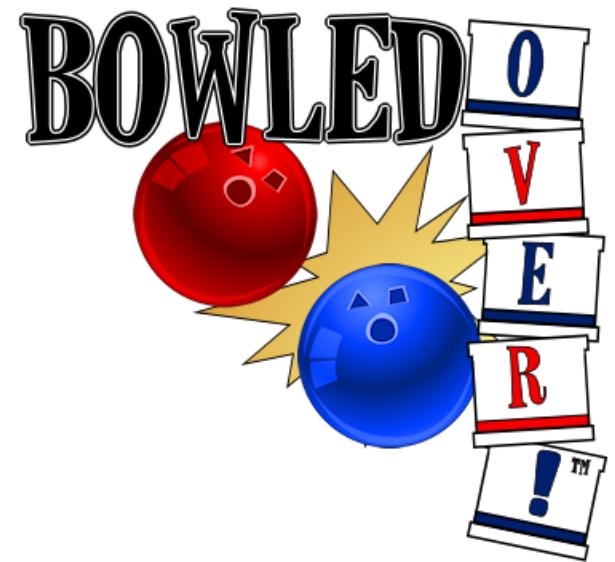
The bowling ball specified in the materials list is only a recommendation, and not to be considered the only acceptable option. You may use any 6lb bowling ball that is available, whether it be drilled or un-drilled, new or used. The color is not important. Alliance reference will be made by the colored gaffers tape.

## Wrap the Bowling Balls with Alliance Colors

1

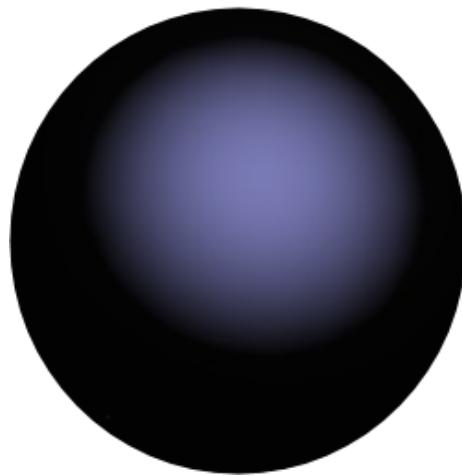
Using appropriately colored 1" gaffers tape, wrap each bowling ball twice as illustrated.





## Field Element Construction Guide

### H: Prepare Magnet Balls



***Read through all the instructions before you begin to build***

#### **Revision History**

<b>Revision</b>	<b>Date</b>	<b>Description</b>
1	9/1/2011	Initial Official Release

**Note: You will need to prepare 12 Magnet Balls per Field.**

Item	Description	QTY	Notes / Suggested Source
H-1	Purple Racquette Balls	100	Official Bowled Over! Racquet Ball kit is available from: <b>(I WILL ADD WEB ADDRESS FOR DIRECT PURCHASE OF FTC BALL KIT)</b>
H-2	Grade N50/N52 Magnets DC1-N52	12	<a href="http://www.kjmagnetics.com/proddetail.asp?prod=DC1-N52&amp;cat=168">http://www.kjmagnetics.com/proddetail.asp?prod=DC1-N52&amp;cat=168</a>
H-3	Loctite® Quicktite Superglue Gel	As needed	<a href="http://www.buyonlinenow.com/viewProduct.asp?SKU=LOC0130379">http://www.buyonlinenow.com/viewProduct.asp?SKU=LOC0130379</a>

(H-1)



(H-2)



(H-3)



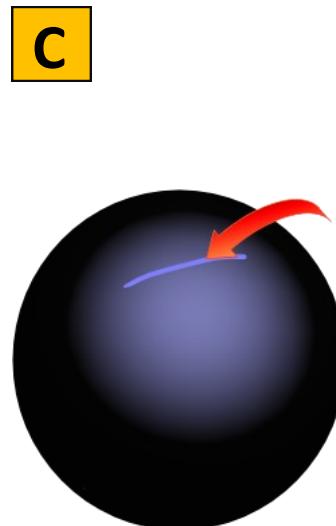
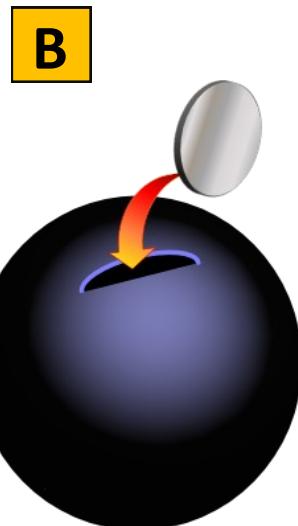
**TIP**

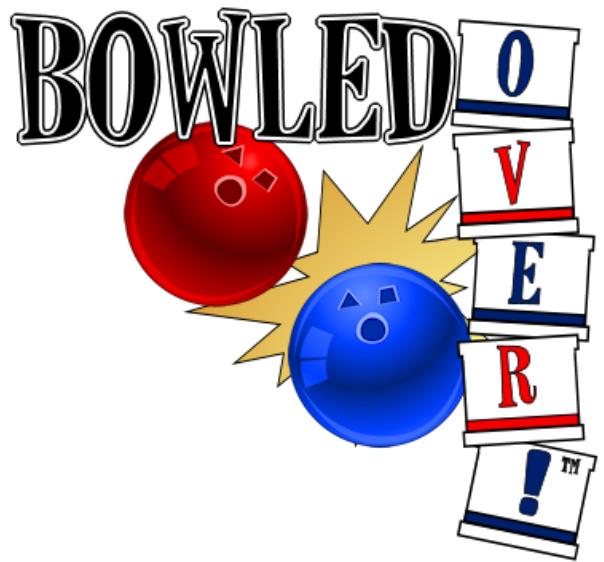
Only 12 magnet balls are used during competition per field, but make a few extra to have on hand!

## Insert Magnets into Racquet Balls

**1**

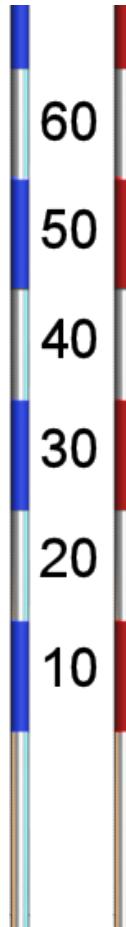
- Use a sharp utility knife to make a slit ~ 1" long into the racquet ball. **Important: Keep the slit as smooth and straight as possible. This will make it easier to seal.**
- Drop the magnet into the ball through the slit.
- Use the superglue to seal the cut. **Important: The seal must be closed cleanly so it is NOT readily visible.**





## Field Element Construction Guide

### I: Score Keeper's Scoring Stack Stick



## Materials Needed for the Score Keeper's Scoring Stack Stick:

**Note: You will need to prepare (at least) 2 Score Keeper Scoring Stack Sticks per Field.**

Item	Description	QTY	Notes / Suggested Source
I-1	Gaffers Tape	As Needed	Www.findtape.com (~ \$18.00 / roll) 2" Pro-Gaff Gaffers Tape - Electric Blue 2" Pro-Gaff Gaffers Tape - Red
I-2	8' x 1" PVC Pole	1	This will be used to construct the two 4' Scoring Sticks. You may use 1" x 8' PVC pipe, or wooden or fiberglass pole. The material is not critical, so long as it is long enough and appropriately marked.



## Prepare the stick

**1**

- Cut the 8' pole into two 4' lengths.
- Measure and mark the poles at the exact dimensions shown. Use appropriately colored gaffers tape to mark the scoring zones as shown.

