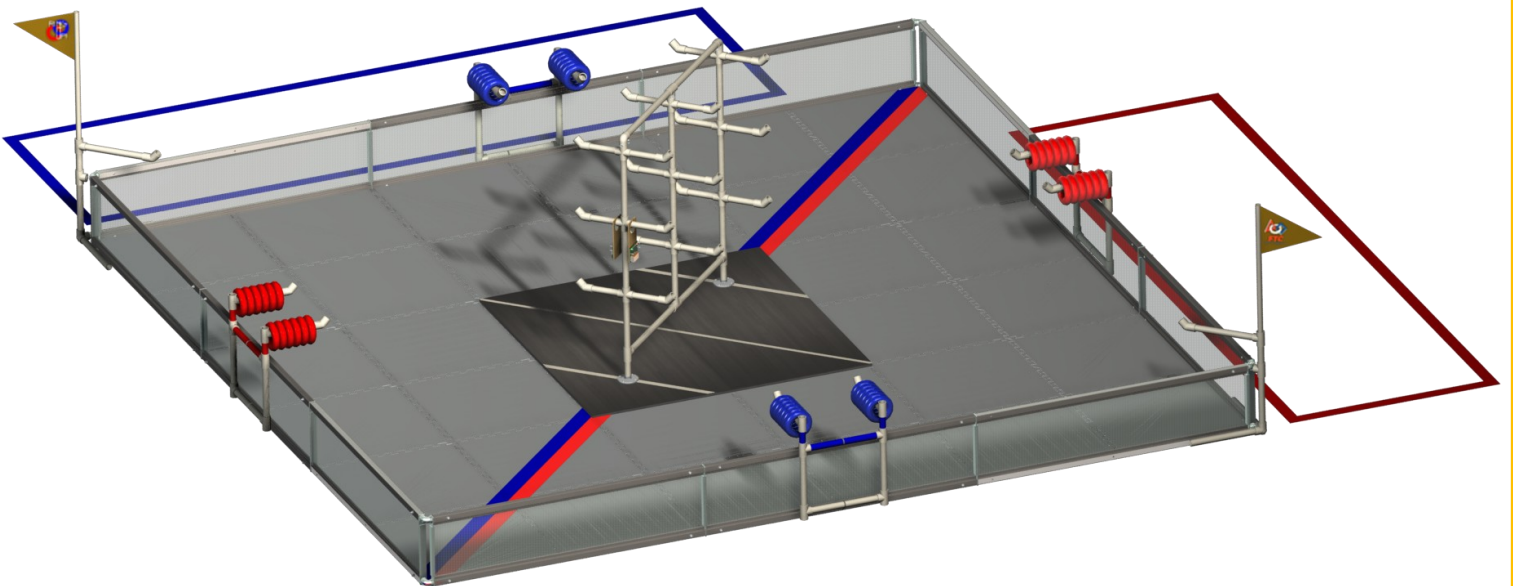




Build Guide

Ring it Up!



Read through all the instructions before you begin to build!

This guide is intended as instructions on building the field elements for the Ring it Up! game. Field electronics and game play setup will be described in separate documents.

Revision History

Revision	Date	Description
1	9/8/2012	Public Release

PVC Required: All PVC is Schedule 40

Item	Description	Center Rack Assembly (1 Per Field) Item QTY	Dispenser Assembly (4 Per Field) Item QTY	Corner Goal Assembly (2 Per Field) Item QTY	Field	Total	Notes
P1	1" PVC Schedule 40 Fitting: Tee-Joint	4	24	4		32	www.pvcfittingsdirect.com SKU: 401-010 Lowes: Item 23876 Home Depot: SKU # 187925
P2	1" PVC Schedule 40 Fitting: 90° Elbow Joint	2				2	www.pvcfittingsdirect.com SKU: 406-010 Lowes: Item #23870 Home Depot: SKU #187984
P3	1" PVC Schedule 40 Fitting: 45° Joint	18	8	2		28	www.pvcfittingsdirect.com SKU: 417-010 Lowes: Item #23892 Home Depot: SKU #188034
P4	1" PVC Schedule 40 Fitting: Cross Joint	9				9	www.pvcfittingsdirect.com SKU: 420-010 Lowes: Item # 22702
P5	1" PVC Schedule 40 Fitting: 3-Way Joint			2		2	www.pvcfittingsdirect.com SKU: 413-010 Lowes: Item # 315499
P6	1" PVC Schedule 40 pipe: 2" Length	3				3	Generally sold in 10-foot lengths. You will need approximately 57-feet total for each field build. Buy at least 6 10' lengths of pipe. Lowes: Item #23976 Home Depot: SKU #193755
P7	1" PVC Schedule 40 pipe: 4" Length	2	8			10	
P8	1" PVC Schedule 40 pipe: 6" Length	18		2		20	
P9	1" PVC Schedule 40 pipe: 9" Length		8	2		10	
P10	1" PVC Schedule 40 pipe: 10" Length	3	8			11	
P11	1" PVC Schedule 40 pipe: 12" Length	6	8	6		20	
P12	1" PVC Schedule 40 pipe: 19" Length	4				4	
P13	1/2" PVC Schedule 40 pipe: 40" Length Note: You may substitute 1/2" wooden dowel			2		2	To be used for Flagpole

Optional PVC Cleaning Supplies (See PVC Cleaning and Cementing Tips on page 25)

Household Powdered Cleanser							
Nylon scouring pads							
Acetone							
Steel wool—grade #0000 or #00							
3M Medium-Grade Sanding Pad							
Rubber Gloves							
Safety Glasses							

* All the PVC components listed here are available as a custom kit created specifically for this FTC Game from www.PVCFittingsDirect.com

- [AP-2012 Fittings and Pipe Kit \(pre-cut pipe\) \\$189.90 \(SKU #Kit1 2\)](#)
- [AP-2012 Fittings Only \\$79.90 \(SKU #Kit 1 2a\)](#)

You may still choose to purchase your PVC locally. SKU & Item numbers for Home Depot and Lowes are provided for your convenience.

Hardware Required

Item	Description	Center Rack Assembly (1 Per Field) Item QTY	Dispenser Assembly (4 Per Field) Item QTY	Corner Goal Assembly (2 Per Field) Item QTY	Field	Total	Notes
H1	1/2" x 36" Steel Threaded Pipe	2				2	Home Depot: SKU #349739
H2	1/2" Pipe Floor Flange	2				2	Home Depot: SKU #817902
H3	** 1-1/2" x 30" Piano Hinge	1				1	Home Depot: SKU #241415
H4	** Wood Screws for piano hinge	As Needed				As Needed	Provided with Hinge (Check length to ensure screws won't poke through the top of the wood. Purchase shorter screws if necessary).
H5	10-32 x 2" Spade-Head Thumb Screw	3				3	McMaster-Carr: Part Number: 96966A275
H6	10-32 Zinc-Plated Wing Nut	3				3	McMaster-Carr: Part Number: 90866A111
H7	#10 Flat Washer	6				6	McMaster-Carr: Part Number: 90107A011
H8	1/2" #8 Zinc-Plated Wood Screw	8				8	McMaster-Carr: Part Number: 90031A194
H9	13/64" Drill Bit					1	

Wood Required

Item	Description	Center Rack Assembly (1 Per Field) Item QTY	Dispenser Assembly (4 Per Field) Item QTY	Corner Goal Assembly (2 Per Field) Item QTY	Field	Total	Notes
W1	2' x 4' x 1/2" Plywood Handy Panel ** (OPTION: Use solid 4' x 4' x 1/2")	2				2	Wood should be flat. Use Better to Best grade. Do not use warped or rough and flawed wood.
W2	Wood Craft Door Hanger (For IR Beacon)	2				2	http://shop.hobbylobby.com/products/wood-door-hanger/
W2	Note: If you are unable to obtain these pre-made hangers, you may use a small piece of 1/4" wood to make them. Directions are included in the guide.	2				2	http://www.amazon.com/Hygloss-Wooden-Door-Hangers-3-125/dp/B0044S8AJW/ref=pd_sim_sbs_ac_1

** If you choose to use 4' x 4' for the base, you will not need the piano hinge. See page 9.

Gaffer's Tape Required

Item	Description	Center Rack Assembly (1 Per Field) QTY	Dispenser Assembly (4 Per Field) QTY	Corner Goal Assembly (2 Per Field) QTY	Field	Total	Notes
T1	1" White Gaffer's Tape	As Needed					www.findtape.com (Pro-Gaff Gaffers Tape)
T2	2" Red Gaffer's Tape		As Needed		As Needed	As Needed	www.findtape.com (Pro-Gaff Gaffers Tape)
T3	2" Electric Blue Gaffer's Tape		As Needed		As Needed	As Needed	www.findtape.com (Pro-Gaff Gaffers Tape)

Field Requirements

Item	Description	Center Rack Assembly (1 Per Field) Item QTY	Dispenser Assembly (4 Per Field) Item QTY	Corner Goal Assembly (2 Per Field) Item QTY	Field	Total	Notes
F1	FTC Field Perimeter				1	1	www.andymark.com
F2	5/8" Gray Soft Tiles				36	36	www.softtiles.com
F3	IR Beacon (Use 2 Masters)	2			2	2	www.hitechnic.com
F4	Red Rings				18 Regular 6 Heavy (+2 Pre-Load)	26	Official rings designed to exact specifications for this game must be purchased from: www.AndyMark.com Pre-load rings are prepared using regular rings: http://www.andymark.com/product-p/ftc-2012.htm
F5	Blue Rings				18 Regular 6 Heavy (+2 Pre-Load)	26	

Tools and Other Requirements

Item	Description	Center Rack Assembly (1 Per Field) Item QTY	Dispenser Assembly (4 Per Field) Item QTY	Corner Goal Assembly (2 Per Field) Item QTY	Field	Total	Notes
M1	PVC Cement	As Needed	As Needed			As Needed	Home Depot: SKU # 212369
M2	Black Paint	As Needed				As Needed	Behr Disney Color: Mouse Ears Semi-Gloss
M3	White 8 1/2" x 11" Card Stock			2		2	Flag
M4	Clear packing tape			As Needed		As Needed	For Flag
M5	Sticky Back Velcro					As Needed	For IR Beacon Hangers
M6	1" Self-Adhesive Vinyl Letters (Black)	1 Set				1 Set	Home Depot: SKU #836277
M8	8" Cable Ties				As Needed	As Needed	Home Depot: SKU #295648 Lowe's: Item #76023
M9	9V Batteries	See Note				See Note	9V battery life for the IR Beacons is about 4 hours. Be sure to have enough batteries on hand at your event to ensure the beacons perform consistently throughout the tournament.
Tools to have on hand:							
	Paint Brush						
	Electric Drill						
	Pencil						
	X-acto Knife						

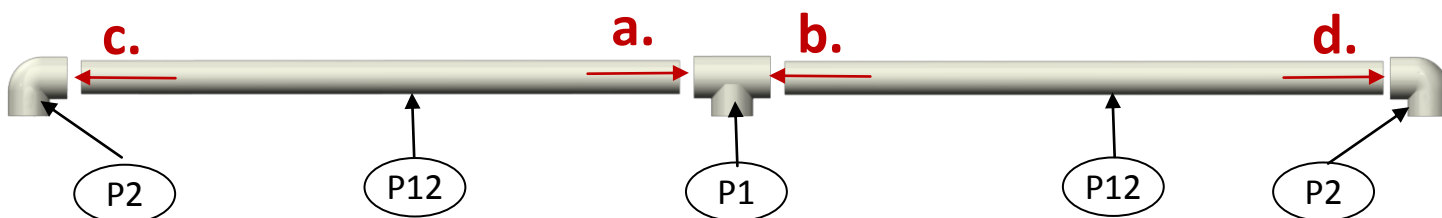


Center Rack Assembly

The center rack is assembled in these basic sub-sections:

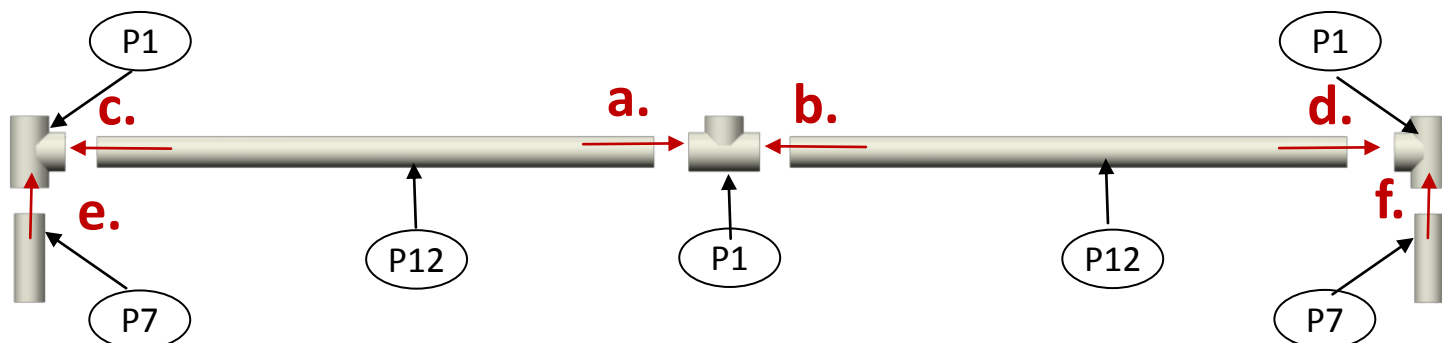
- Top Row
- Bottom Row
- Column

A Center Rack Assembly: Top Row - Build 1



Clean the PVC of all smudges as much as possible (See page 25 for cleaning tips.)

B Center Rack Assembly: Bottom Row - Build 1



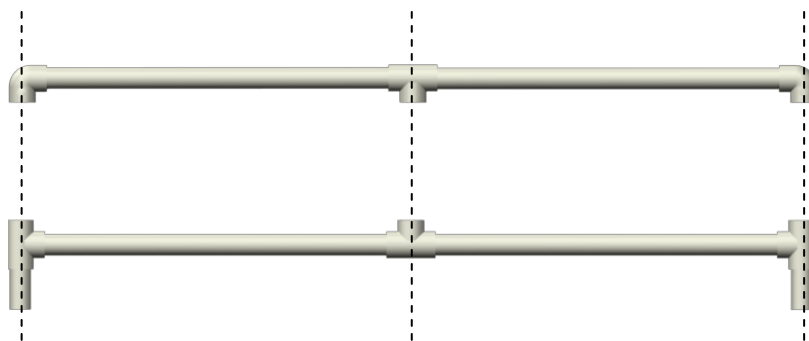
Parts Required for Bottom & Top Rows

Item	Qty	Description
P1	4	Tee-Joint
P2	2	Elbow Joint
P7	2	4" Pipe
P12	4	19" Pipe
M1	A/R	PVC Cleaner

A. Assemble the top row using items P1, P2 & P12. Apply PVC cement to the insides of the joints. Assemble in the recommended order shown. (a, b, c...)

B. Assemble the bottom row using items P1, P7, & P12. Apply PVC cement to the insides of the joints. Assemble in the recommended order shown. (a, b, c...)

NOTE: PVC cement cures very quickly. Do each joint individually as you install the pipes.

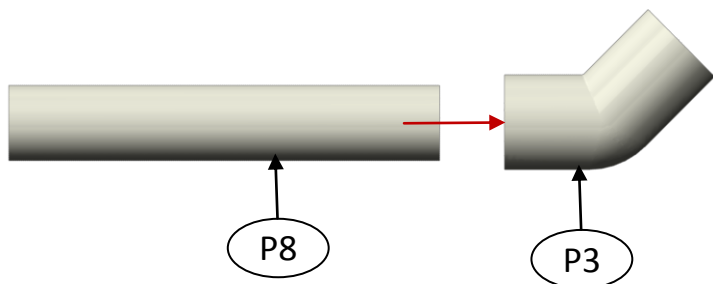


Note: Lay the pieces flat while assembling to ensure all the angles are straight. Ensure all pipes are seated fully into the fittings and the joints align properly as illustrated.



Center Rack Assembly (continued)

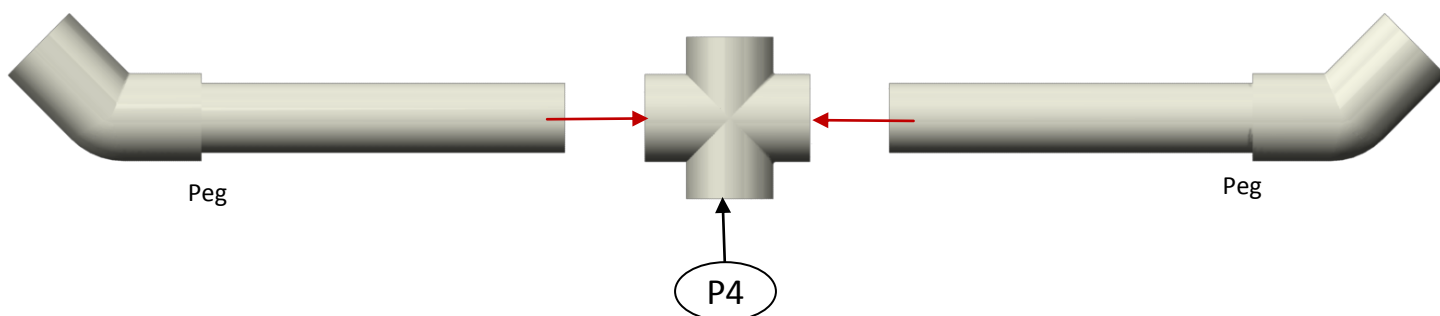
C Peg: Build 18



Clean the PVC of all smudges as much as possible (See page 25 for cleaning tips.)

D Cross Peg: Build 9

Tip: Lay the pieces on a flat surface to ensure they align properly.



Parts Required for Pegs

Item	Qty	Description
P3	18	45° Joint
P4	9	Cross Joint
P8	18	6" Pipe
M1	A/R	PVC Cement

NOTE: PVC cement cures very quickly. Do each joint individually as you install the pipes.

C. Build Pegs: Assemble 18 Pegs using items P8 & P3. Apply PVC cement to the insides of the joints.

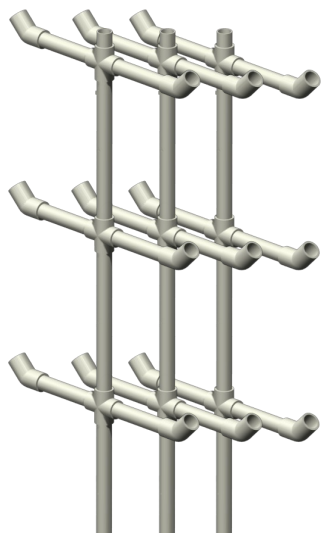
D. Build Cross Pegs: Join 2 Pegs with item P4. Apply PVC cement to the insides of the joints. Ensure pieces align properly as shown.



Center Rack Assembly (continued)

E

Column: Build 3



Note: Lay the pieces flat while assembling to ensure all the angles are straight. Ensure all pipes are seated fully into the fittings and Pegs on all columns align properly as illustrated.

Required Parts for Column

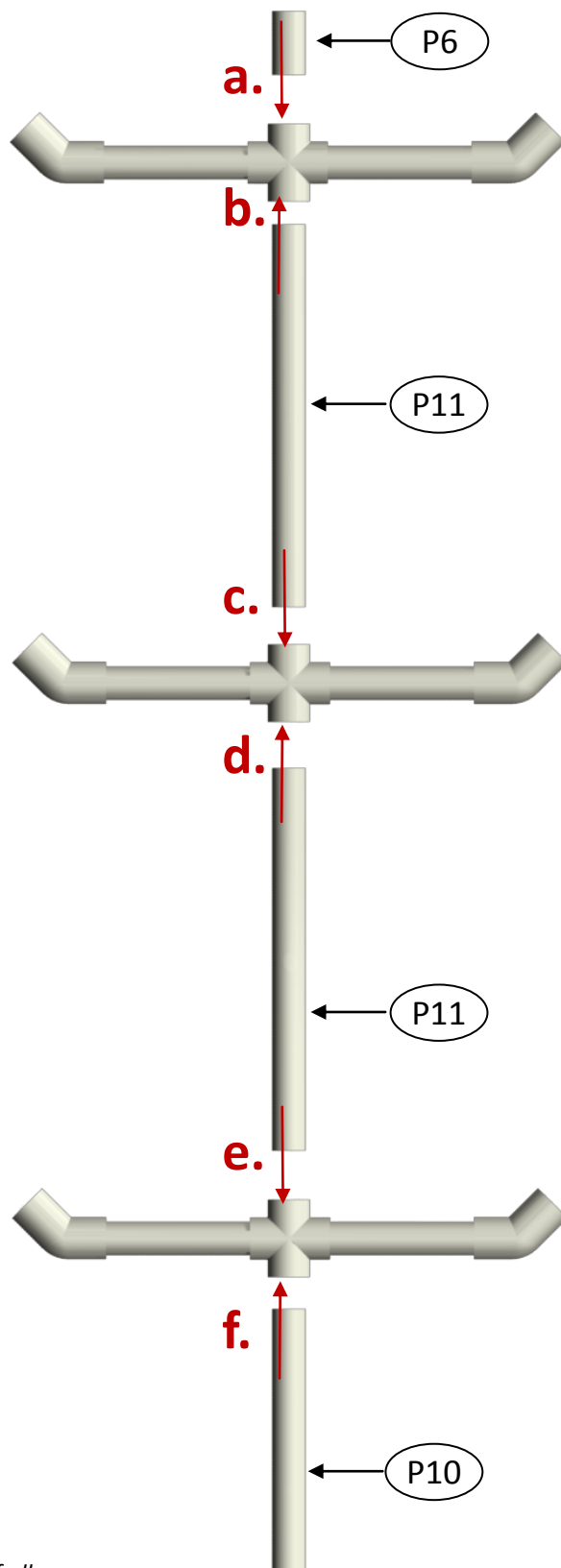
Item	Qty	Description
P6	3	2" Pipe
P10	3	10" Pipe
P11	6	12" Pipe
M1	A/R	PVC Cement

E. Build a column by joining 3 Cross Pegs with items P6, P10 & P11. Apply PVC cement to the insides of the joints. Assemble in the recommended order shown. (a, b, c. . .)

NOTE: PVC cement cures very quickly. Do each joint individually as you install the pipes.



Clean the PVC of all smudges as much as possible (See page 25 for cleaning tips.)



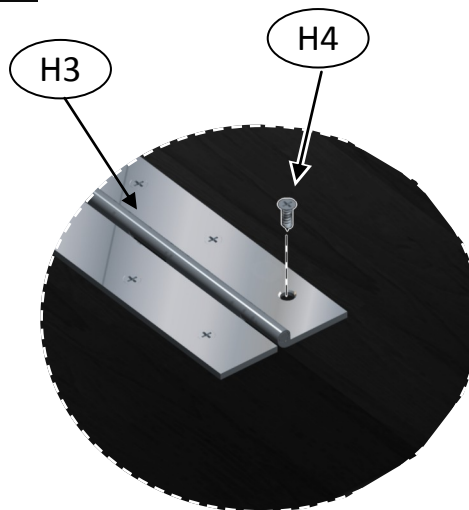
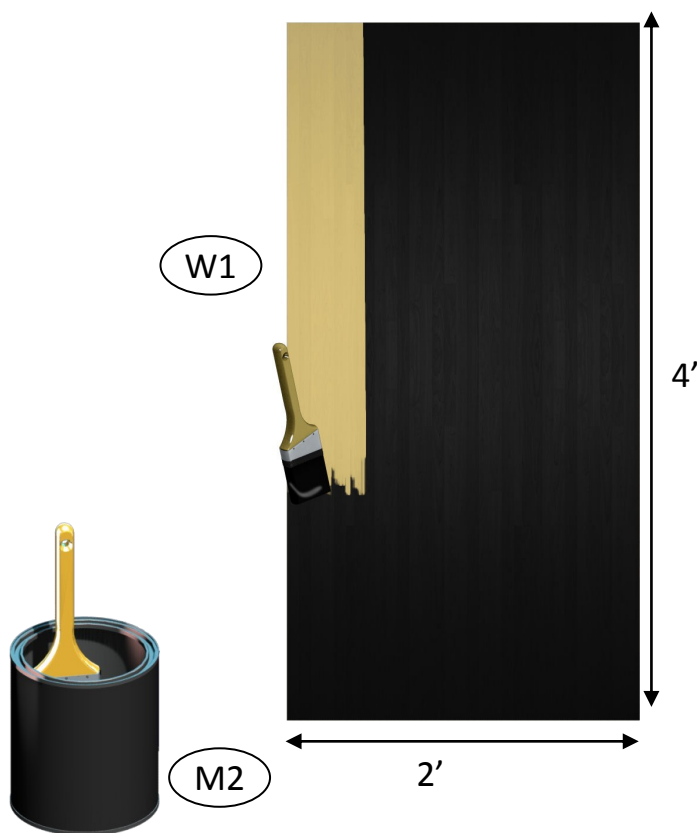


Center Rack Assembly: Base - Build 1

NOTE: If you choose to use one solid 4' x 4' board you may skip step B, and proceed to the next page.

A Paint

B Install Hinge



Position the pin portion of the hinge so that it is away from the boards and there is no gap between the boards.

TIP: When installing the hinge, do not tighten the screws completely on the first pass. Place them, then open and close the base boards checking for gaps or warps. Tighten the screws, alternating left to right once you've ensured smooth motion without gaps or warps.

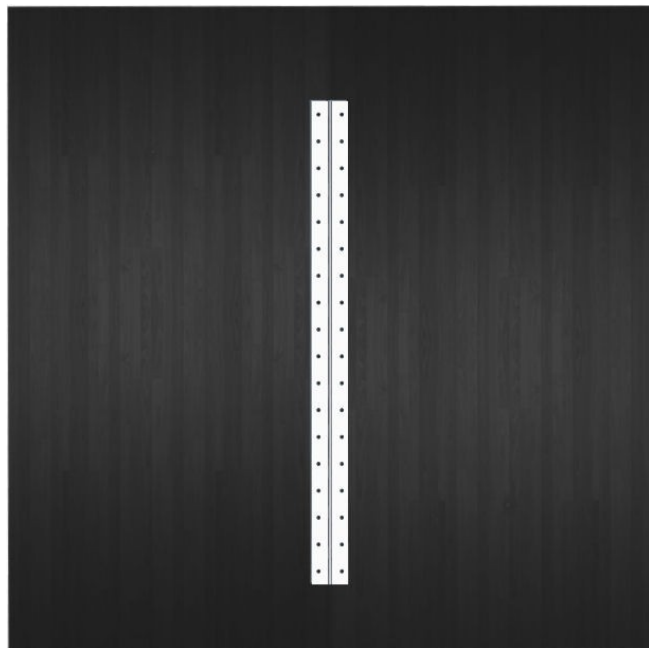
Note: Be sure to install the hinge on the bottom of the wood base. Reserve the 'best' surface for the top.

Required Parts for Center Assembly Base

Item	Qty	Description
W1	2	2' x 4' x 1/2" Plywood
M2	A/R	Black Paint
H3	1	1-1/2" x 30" Piano Hinge
H4	A/R	Hinge Screws

A. Paint **all surfaces** of the plywood with black paint. Allow ample time for the paint to dry before continuing. 2 coats recommended.

B. Lay painted plywood side by side, and install the 30" piano hinge using the wood screws.

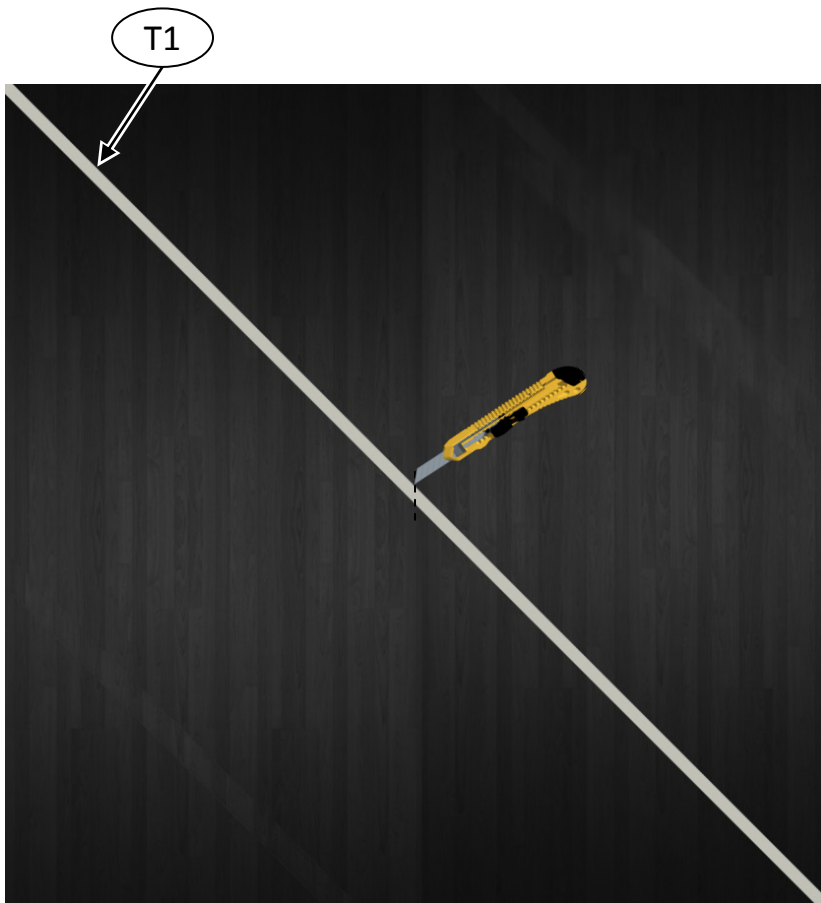




Center Rack Assembly: Base - Build 1 (continued)

Important: Allow the paint to dry completely before attempting to apply gaffer's tape.

C Tape Base Boards



Required Parts for Center Assembly Base

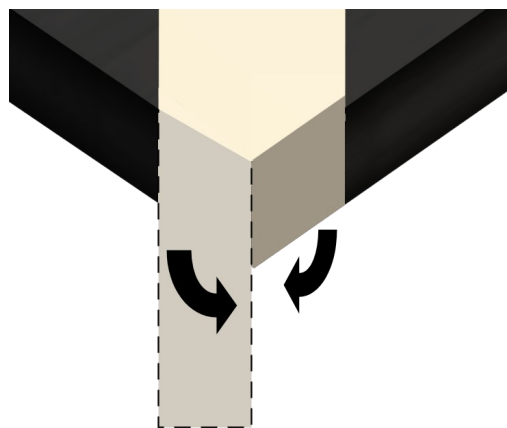
Item	Qty	Description
T1	A/R	1" White Gaffer's Tape

Apply 1" White Gaffer's Tape across the top surface of the assembled base board. Begin with the center stripe, placing the tape corner to corner as shown.

Use an X-acto knife to score the center line gaffer's tape where the piano hinge will fold.

Important: Allow enough length for the tape to wrap around the edge of the board to the underside. This will help prevent the edges from being lifted off the boards during game play.

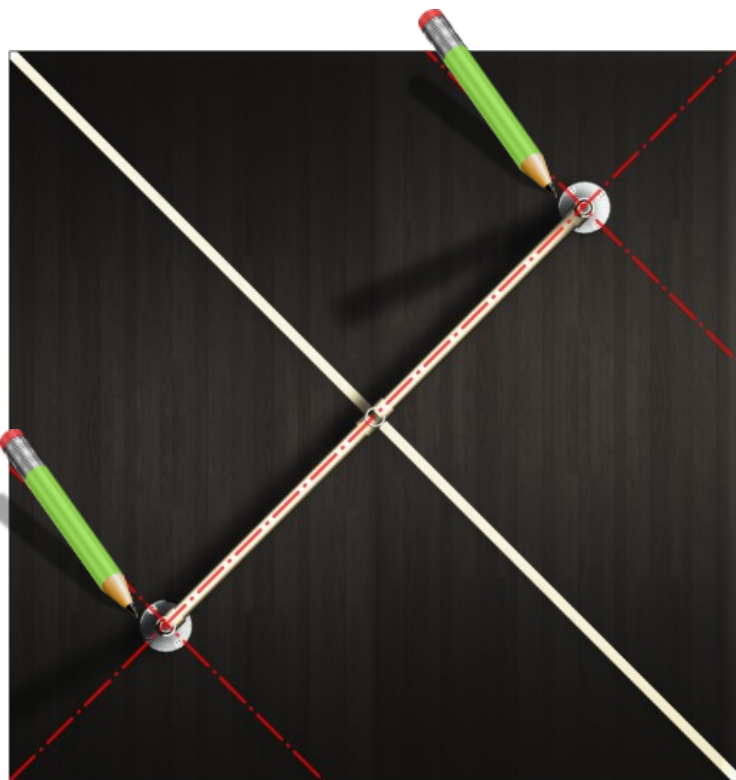
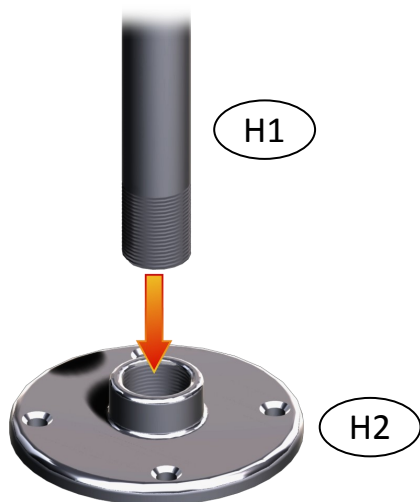
Split the tape at the corners to allow a clean wrap on the edge.





Center Rack Assembly: Base - Build 1 (continued)

D Place Threaded Pipe Supports



Required Parts for Center Assembly Base

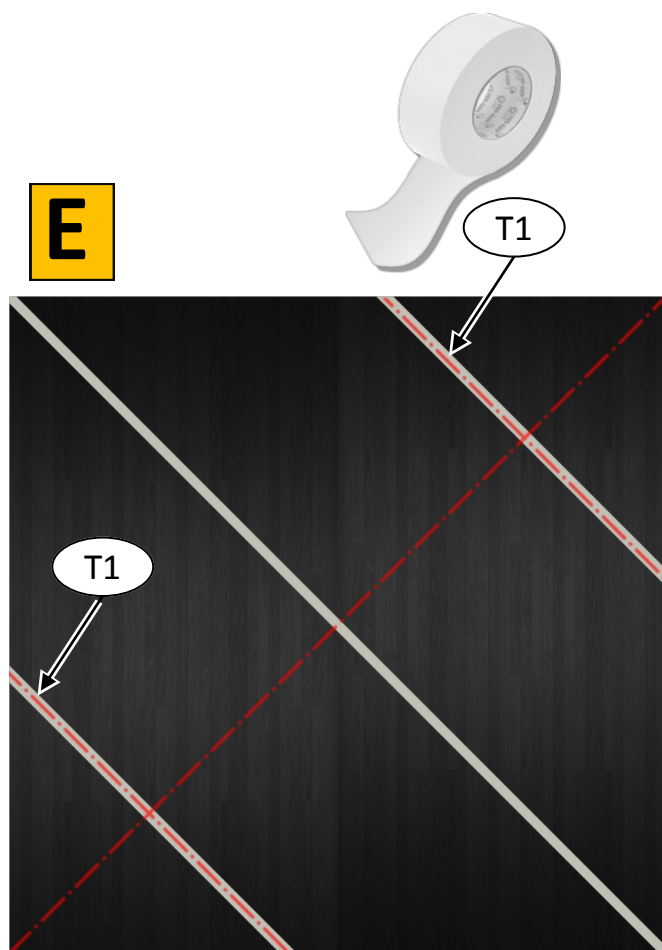
Item	Qty	Description
H1	2	1/2" x 36" Steel Threaded Pipe
H2	2	1/2" Pipe Floor Flange
T1	A/R	1" White Gaffer's Tape

Tip: To find an accurate placement for the pipe flanges and remaining Gaffer's Tape:

D. Insert the pipes into the flanges, then slide the Bottom row of the Center Rack assembly onto each support and place it as shown. Draw a circle around the flanges, then move them all aside.

E. Place the two outer white gaffer's tape stripes onto the base, parallel to the middle stripe as illustrated.

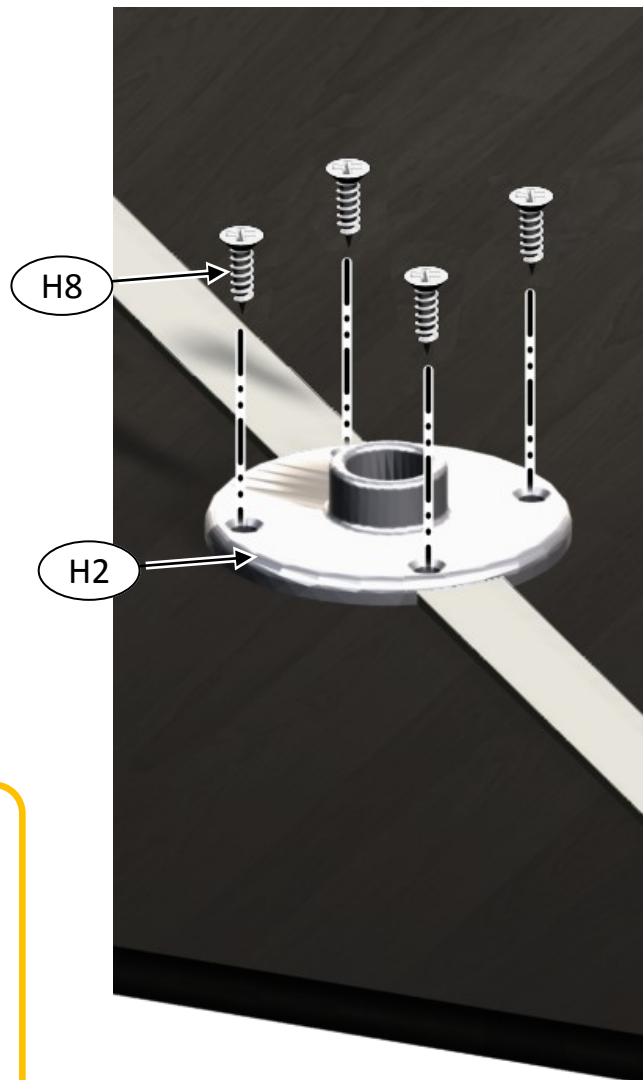
E





Center Rack Assembly: Base - Build 1 (continued)

F Place Threaded Pipe Supports



Required Parts for Center Assembly Base

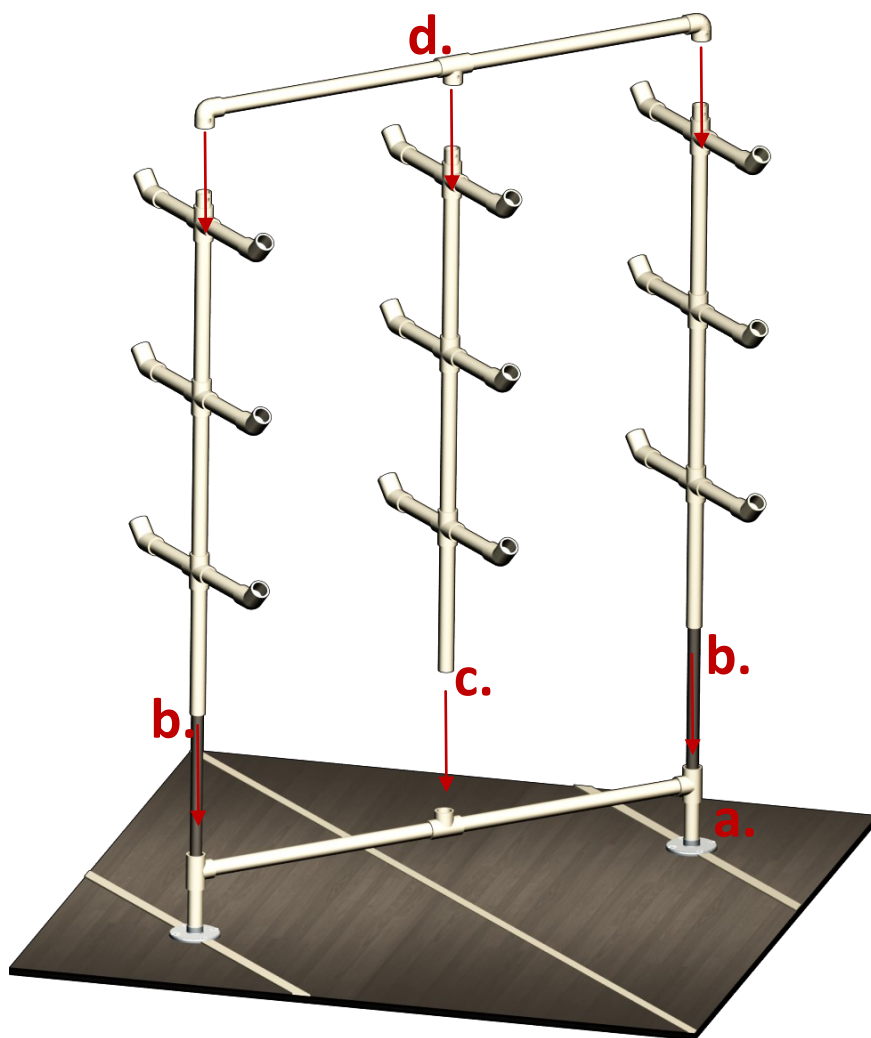
Item	Qty	Description
H2	2	1/2" Pipe Floor Flange
H8	8	1/2" #8 Wood Screws

F. Secure the flanges to the board using H8.



Center Rack Assembly: Setup

A Assemble Center Rack for Game Play



Do not use cement!

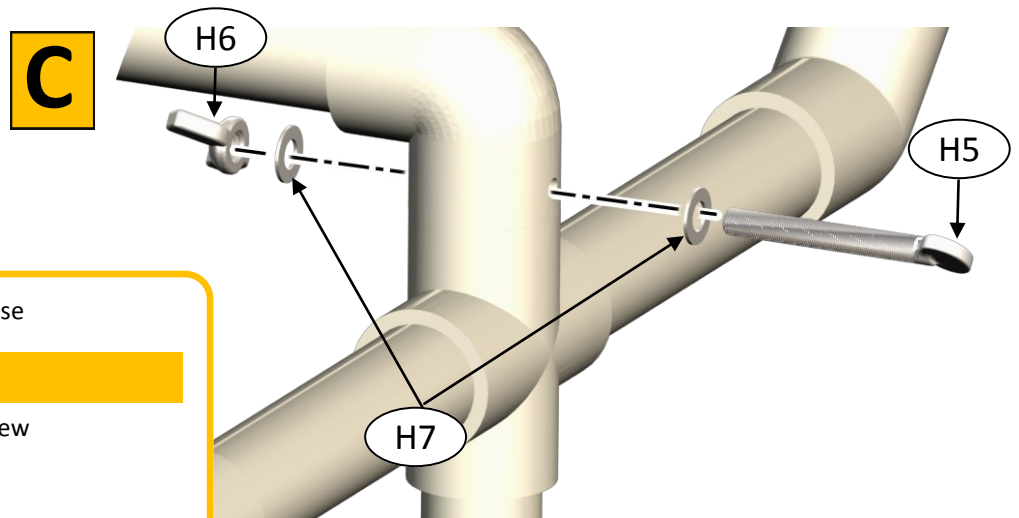
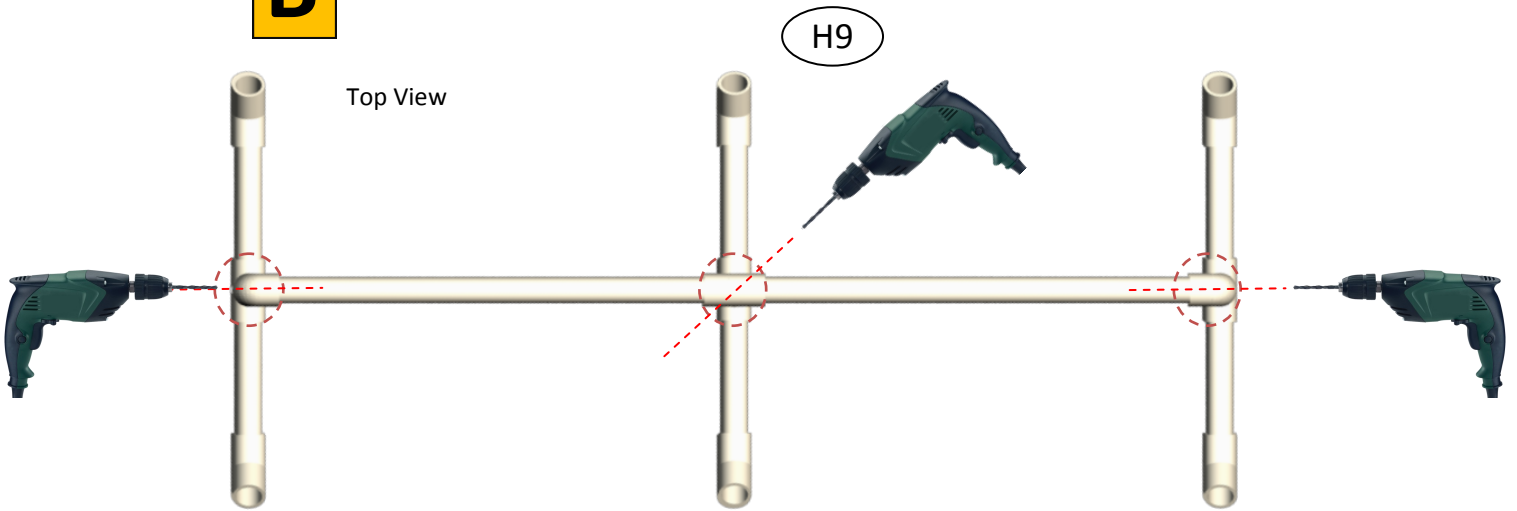
A. Assemble Center Rack

- a. Using the mounted pipes for support, install the bottom row of the Center Rack assembly.
- b. Install the two outer Columns first, sliding them over the pipe. Ensure they are positioned with the pegs oriented at a 90° to the bottom row.
- c. Install the center column into the bottom rack with the pegs positioned as illustrated.
- d. Install the top rack onto the assembly.



Center Rack Assembly: Setup (continued)

B Drill Holes



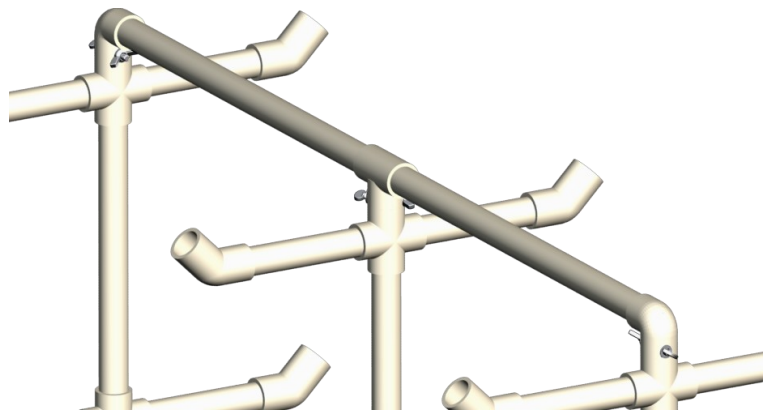
Required Parts for Center Assembly Base

Item	Qty	Description
H5	3	Spade-Head Thumb Screw
H6	3	Steel Wing Nut
H7	6	Flat Washer
H9	1	13/64" Drill Bit

B. Using a 13/64" drill bit, drill through the fittings, and the top 2" pipe on each column as illustrated.

C. Secure all with items H5, H6 and H7 as illustrated.

This provides stability for the structure, yet allows for easy dis-assembly after the event.

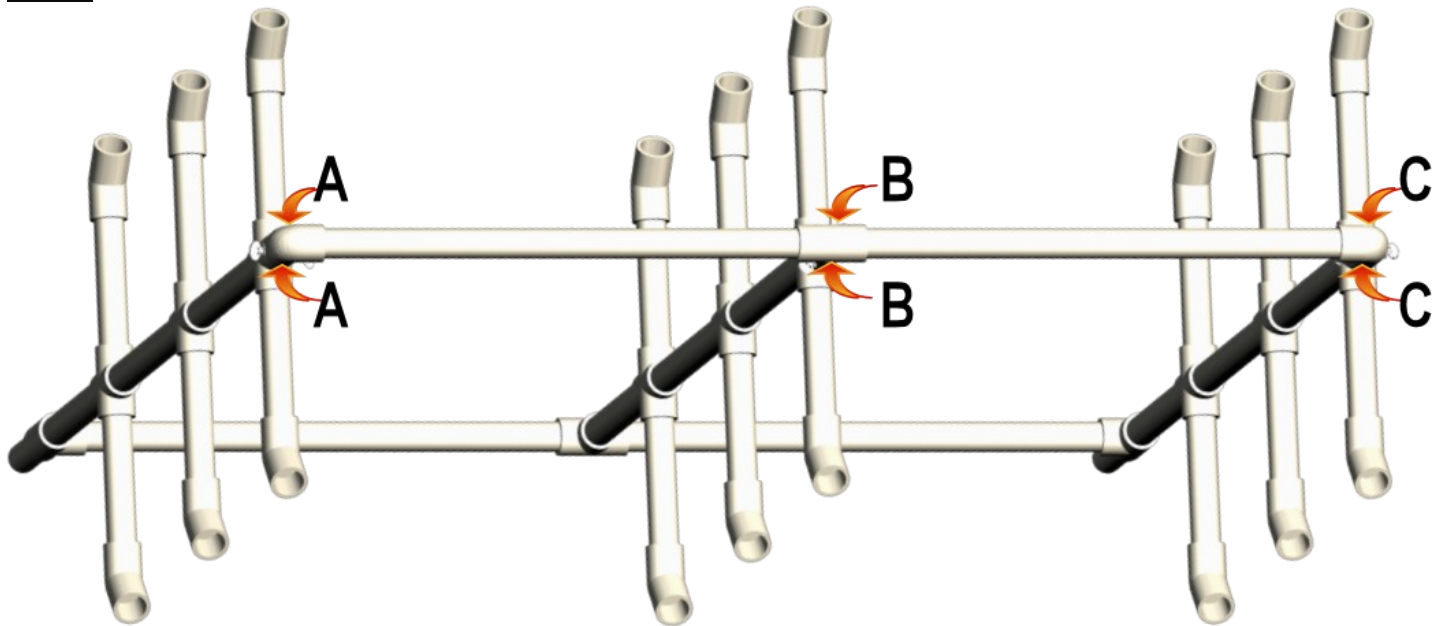




Center Rack Assembly: Setup (continued)

D

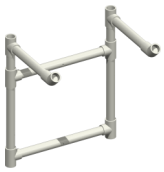
Place Column Letters



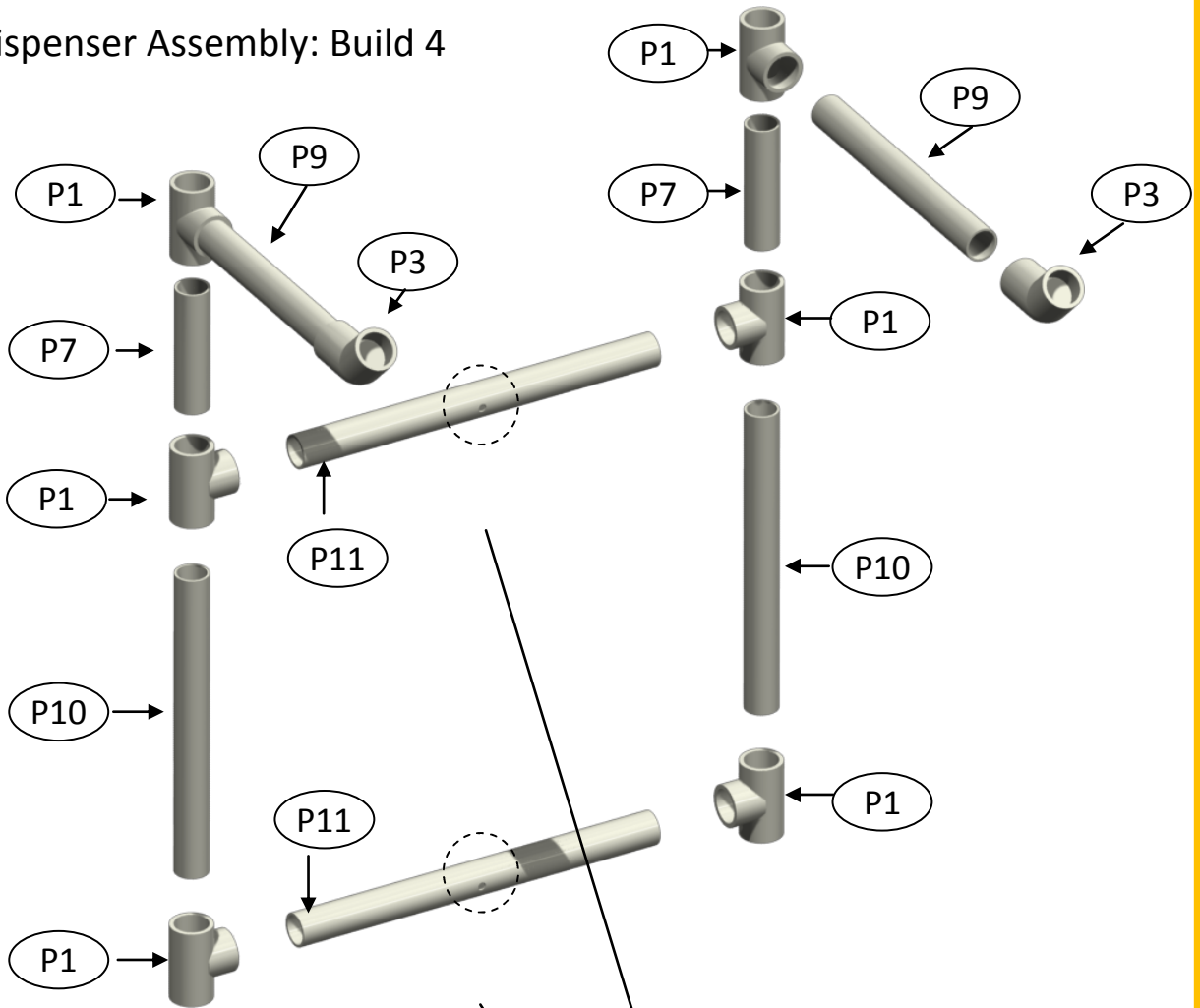
Required Parts for Center Assembly

Item	Qty	Description
M6	A/R	Self-Adhesive Vinyl Letters (Black)

D. Affix vinyl letters to the tops of each column as illustrated.



Side Dispenser Assembly: Build 4



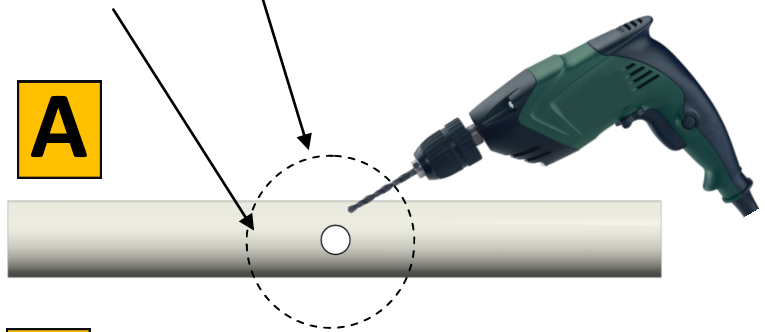
M1

Clean the PVC of all smudges as much as possible (See page 25 for cleaning tips.)

Parts Required (Per Assembly)

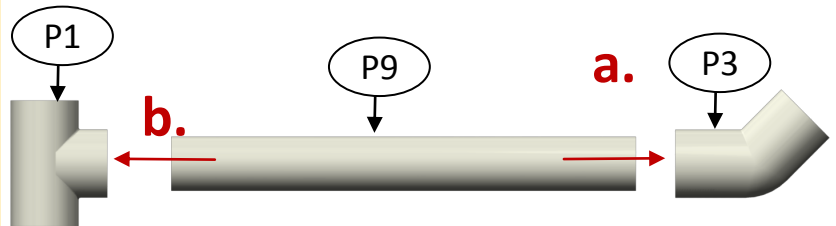
Item	Qty	Description
P1	6	Tee-Joint
P3	2	45° Joint
P7	2	4" Pipe
P9	2	9" Pipe
P10	2	10" Pipe
P11	2	12" Pipe
H9	1	13/64" Drill Bit
M1	A/R	PVC Cement

A



B

Dispenser Arms: (2 per Assembly)

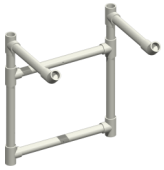


A. Drill a hole at the center of each P11 pipe (for tie-wrap access during field setup).

B. Assemble dispenser arms using items P3, P9 & P1. Apply PVC cement to the insides of the joints. Assemble in the recommended order shown. (a, b, c...)

TIP: Lay the PVC pieces on a flat surface while assembling, to ensure the angles remain straight.

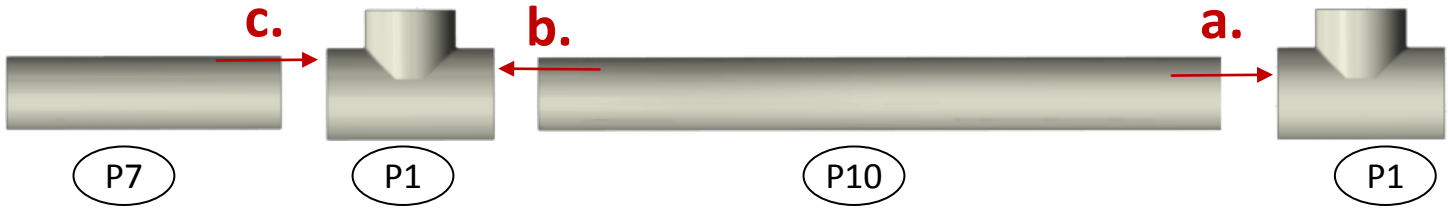
NOTE: PVC cement cures very quickly. Do each joint individually as you install the pipes.



Side Dispenser Assembly: Build 4 (continued)

C

Vertical Supports (2 per assembly)



M1

Clean the PVC of all smudges as much as possible (See page 25 for cleaning tips.)



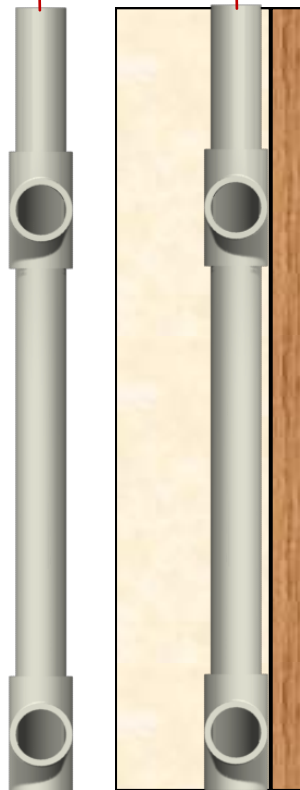
D

Parts Required (Per Assembly)

Item	Description
P1	Tee-Joint
P7	4" Pipe
P10	10" Pipe
M1	PVC Cement

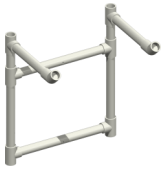
C. Assemble vertical supports using items P7, P10 & P1. Apply PVC cement to the insides of the joints. Assemble in the recommended order shown. (a, b, c. . .).

D. Lay the vertical supports on a flat surface with the Tee joints facing up. Using PVC cement, assemble the dispenser arms to the vertical supports in the positions illustrated.

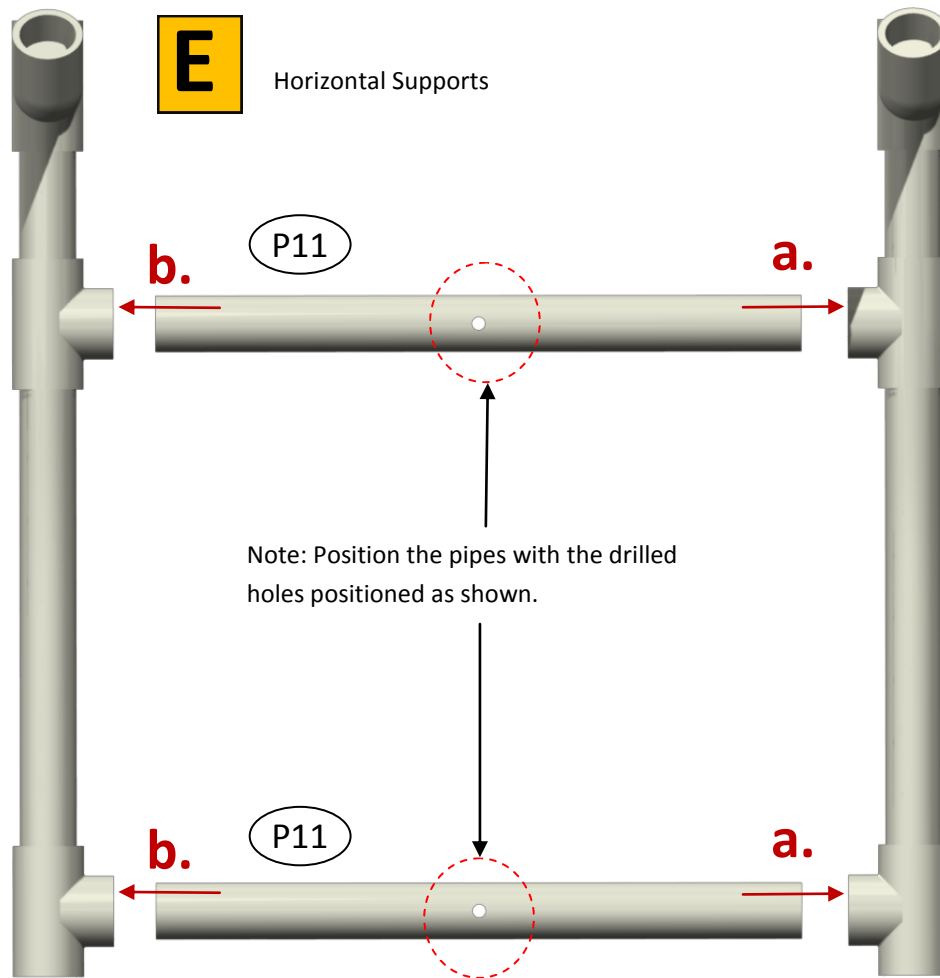


TIP: Lay the PVC pieces against a fence on a flat surface while assembling, to ensure the angles remain straight.

NOTE: PVC cement cures very quickly. Do each joint individually as you install the pipes.



Side Dispenser Assembly: Build 4 (continued)



NOTE: PVC cement cures very quickly. Do each joint individually as you install the pipes.

Parts Required

Item	Description
P11	12" Pipe
M1	PVC Cement



M1 Clean the PVC of all smudges as much as possible (See page 25 for cleaning tips.)

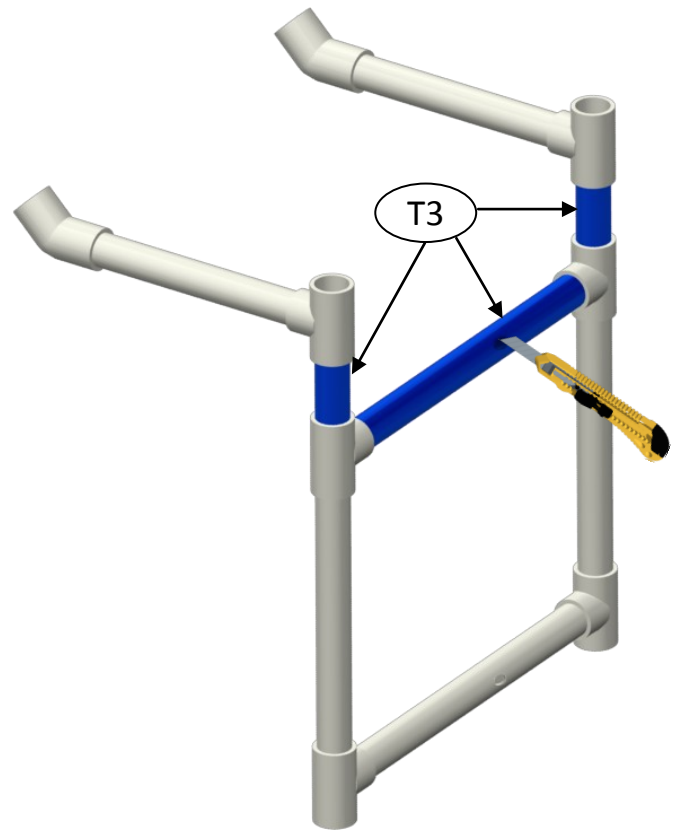
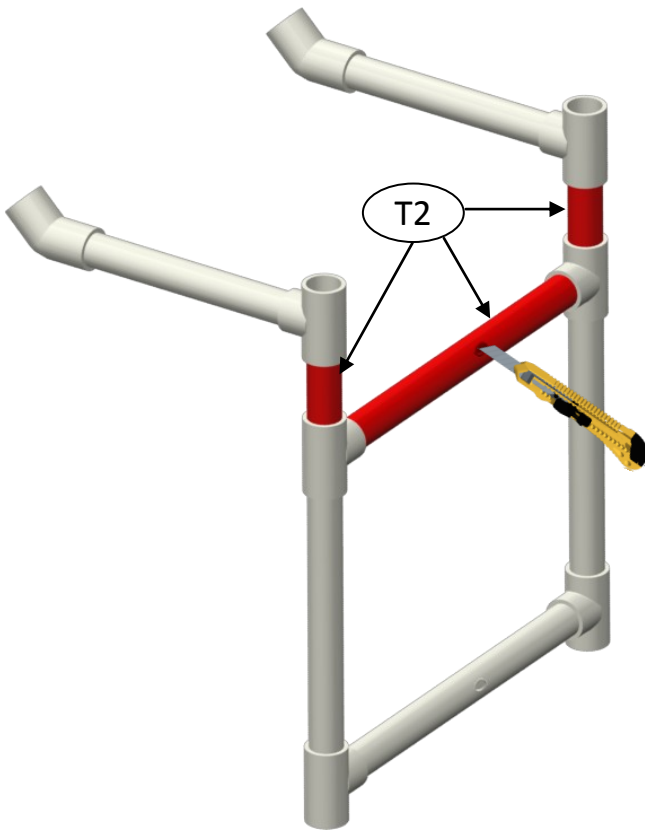
E. Assemble horizontal supports using the P11 pipes you drilled in step A. Apply PVC cement to the insides of the joints. Assemble in the recommended order shown. (**both a's and b's simultaneously**)



Side Dispenser Assembly: Build 4 (continued)

F

Apply Gaffer's Tape



Parts Required

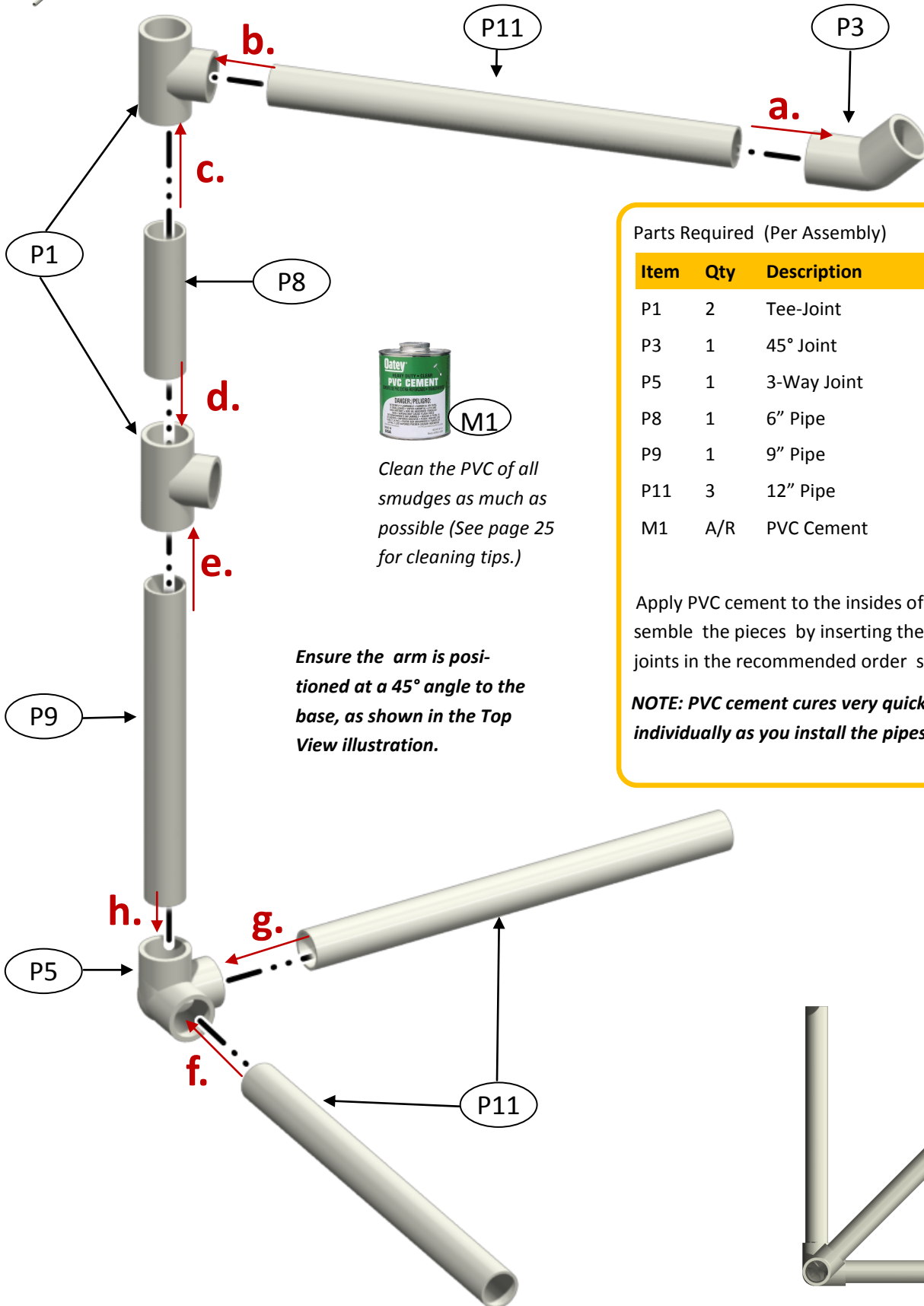
Item	Qty	Description
T2	A/R	2" Red Gaffer's Tape
T3	A/R	2" Electric Blue Gaffer's Tape

E. Apply the appropriate colored Gaffer's tape to the Side Dispensers on the areas indicated.

Be sure to cut away the tape over the drilled access hole.

Make 2 dispensers for each color.

Corner Goal Assembly: Build 2



Clean the PVC of all smudges as much as possible (See page 25 for cleaning tips.)

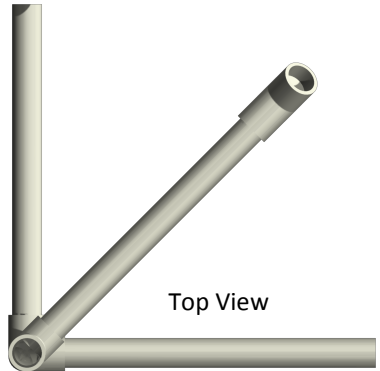
Ensure the arm is positioned at a 45° angle to the base, as shown in the Top View illustration.

Parts Required (Per Assembly)

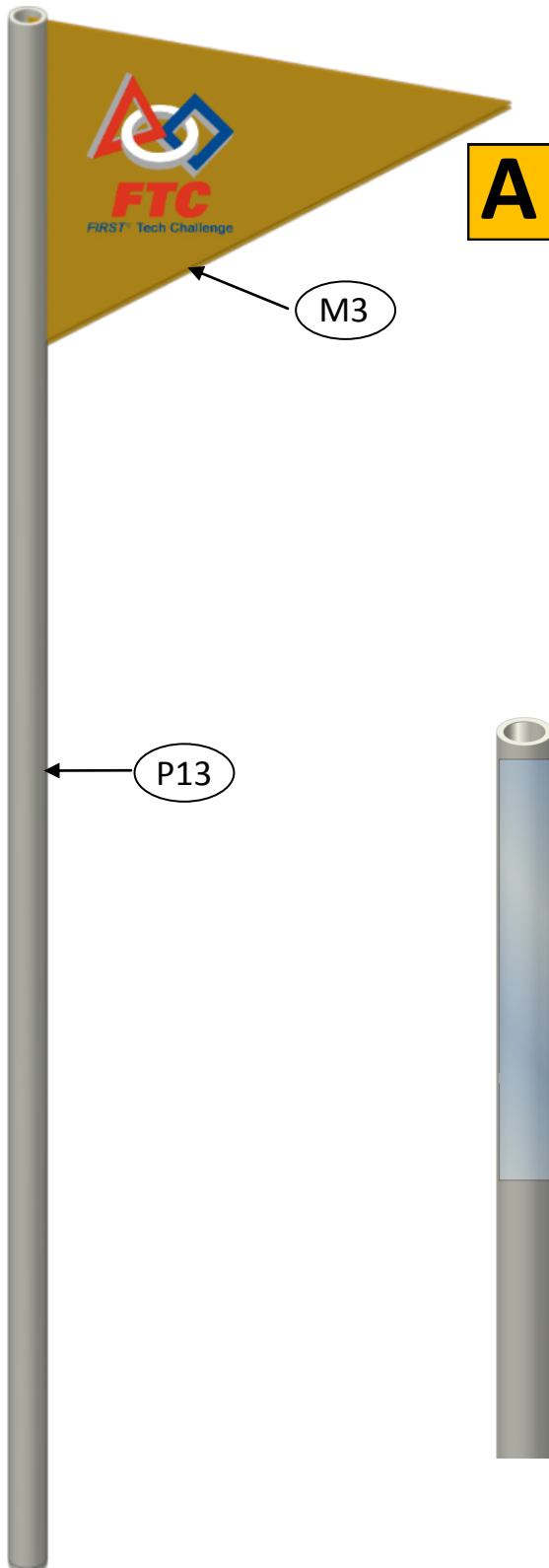
Item	Qty	Description
P1	2	Tee-Joint
P3	1	45° Joint
P5	1	3-Way Joint
P8	1	6" Pipe
P9	1	9" Pipe
P11	3	12" Pipe
M1	A/R	PVC Cement

Apply PVC cement to the insides of the joints, and assemble the pieces by inserting the pipes into the joints in the recommended order shown. (a, b, c...)

NOTE: PVC cement cures very quickly. Do each joint individually as you install the pipes.



Assemble Goal Flag: Build 2



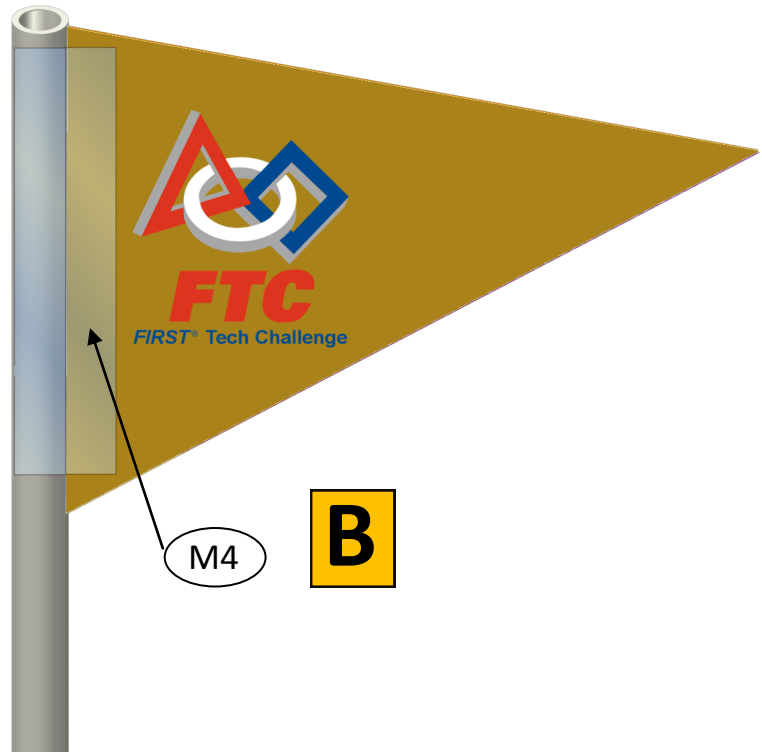
Parts Required

Item	Qty	Description
P13	2	1/2" Pipe (or dowel)
M3	2	White Card Stock
M4	AR	Clear packing tape.

A. Print the flag onto the card stock using the last two pages of this document. Use '2 sided' print. Cut out the triangular flag.

B. Apply wide, clear packing tape to both sides of the flag to affix it to the pole.

Optional: Use heat or self adhesive laminating sheets to make the flag more durable.



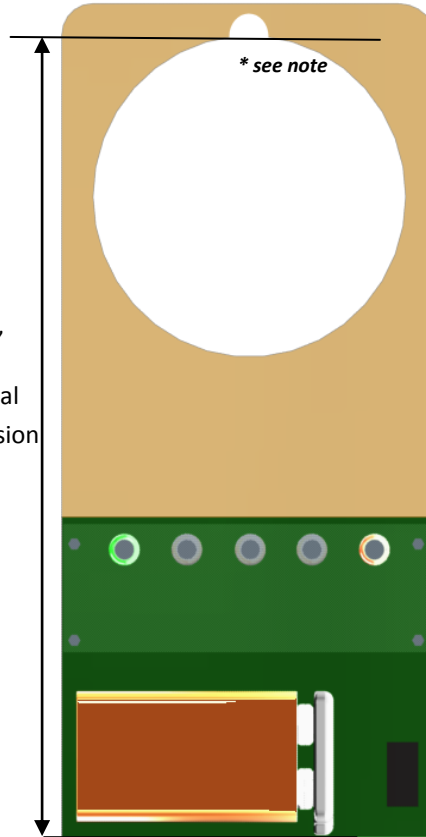
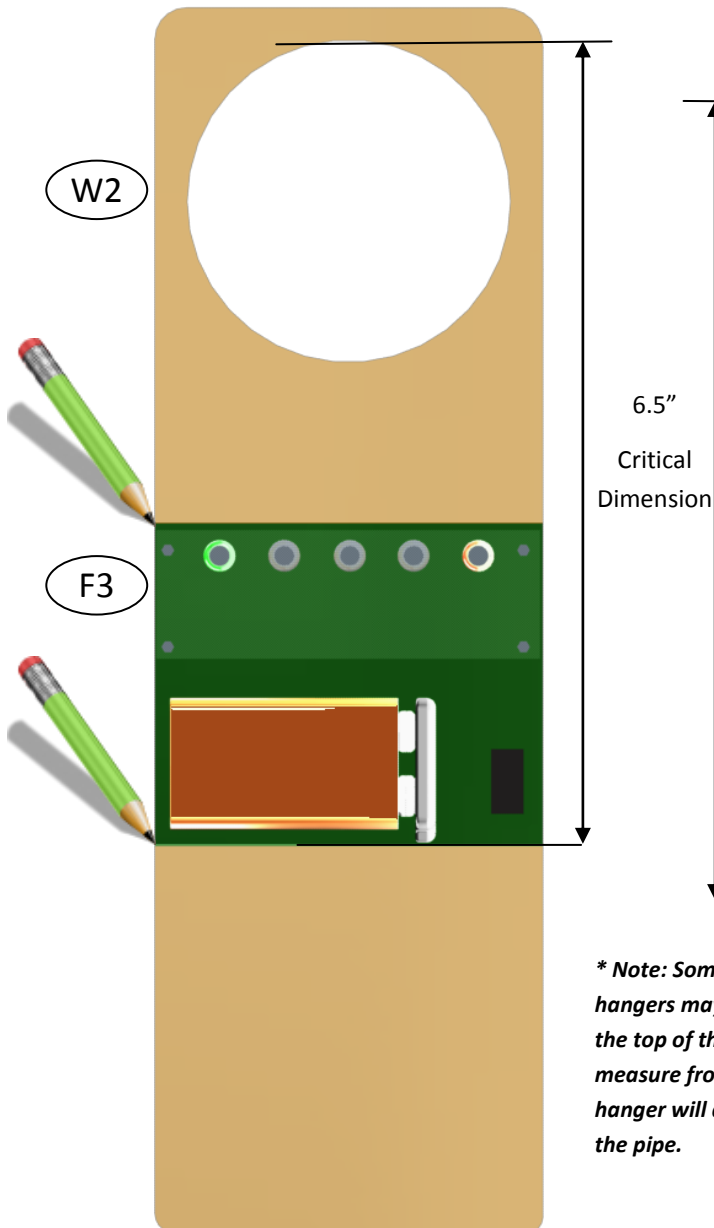
IR Beacon Hangers (Build 2)



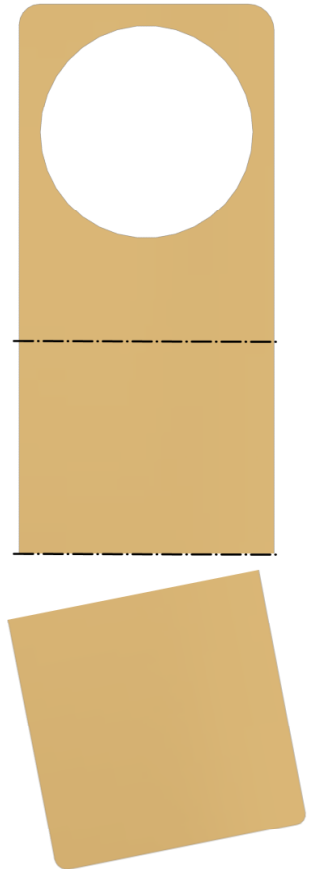
A Mark Beacon Placement

Note: You may use a pre-made wooden door hanger, for this assembly. These are readily available at many craft supply stores and on-line for a nominal cost. Please see the complete Bill of Materials for source links.

Dimensions to cut your own are given on the next page.



B Trim



** Note: Some pre-made hangers may have a notch at the top of the hole. Be sure to measure from where the hanger will actually rest on the pipe.*

Parts Required for IR Beacon

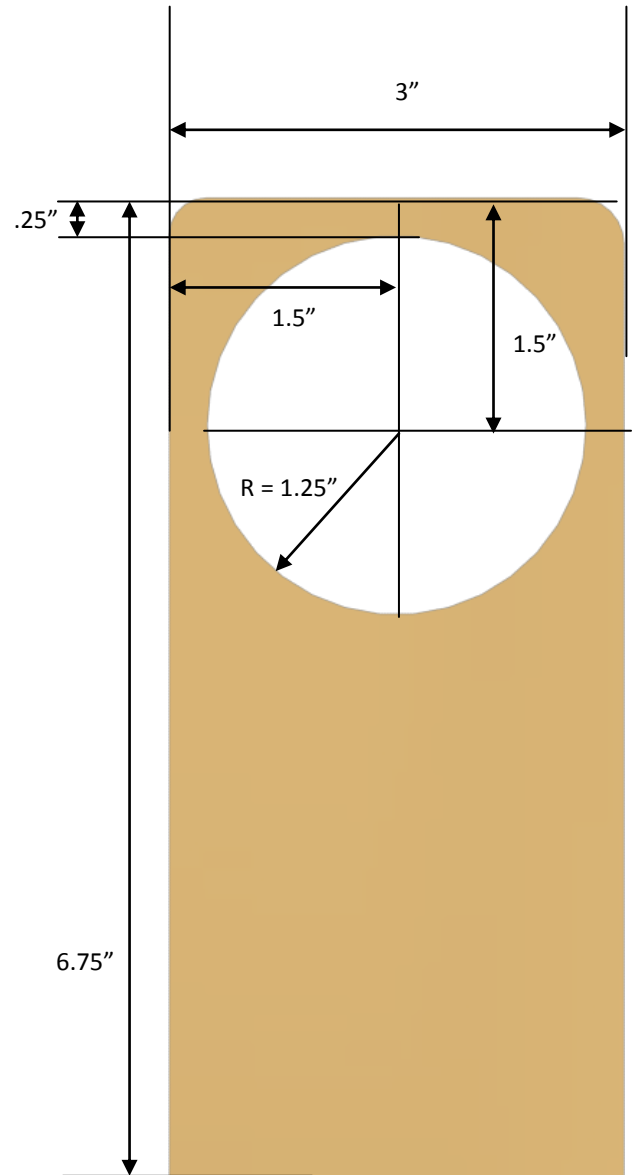
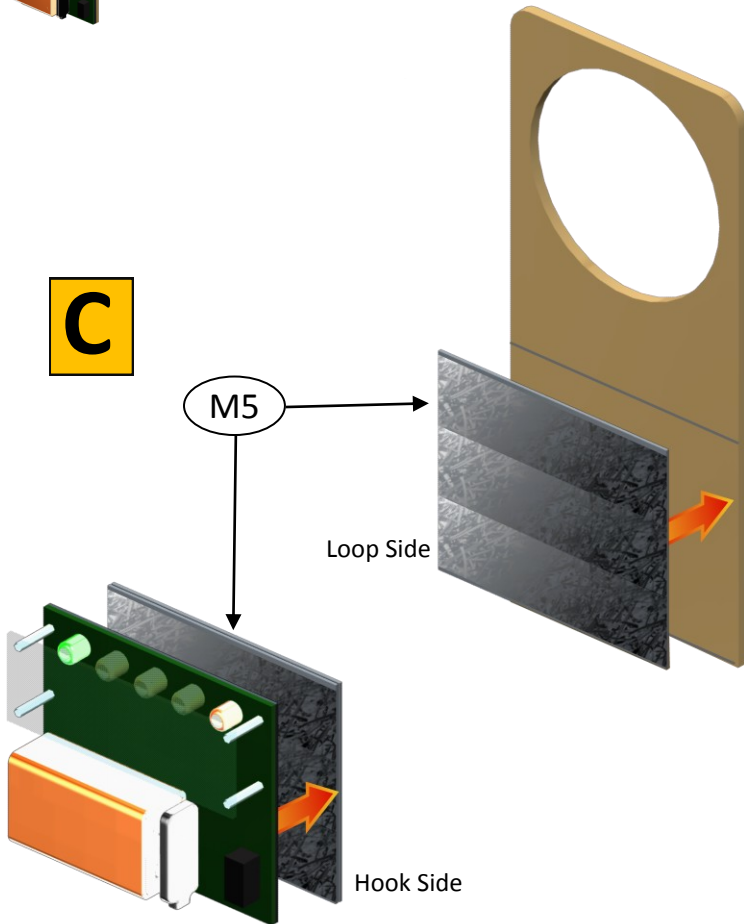
Item	Qty	Description
F3	2	IR Beacon Master
W2	2	Wood Hanger

- Place the IR Beacon Master onto the wooden hanger so the bottom edge of the Beacon is exactly 6.5" inches from the **TOP of the circular cut-out**. Use a pencil to mark the top and bottom of the beacon on the wood.
- Trim the excess from the bottom of the wood hanger.



IR Beacon Hangers (continued)

C



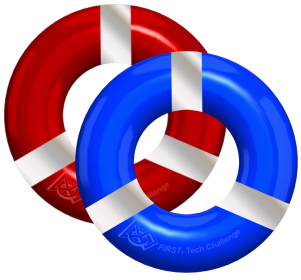
Parts Required for IR Beacon

Item	Qty	Description
M5	A/R	Sticky Back Velcro

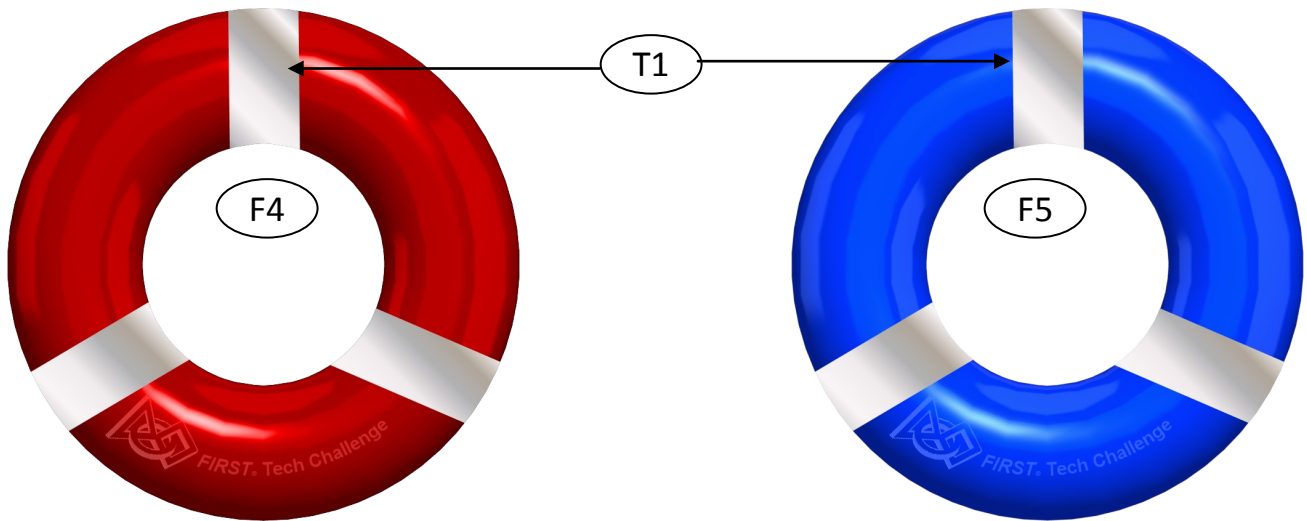
- C. Apply adhesive Velcro to the back of the IR Master Beacon, and to the IR Beacon Hanger between the pencil marks. Place the loop side of the Velcro onto the hanger, and the hook side on to the IR Beacon.

Important: Be sure to cover the entire back surface of the IR Beacon with Velcro.

Affix the IR Beacon to the Hanger.



Prepare Pre-Load Rings



Tip: Prepare a few extra autonomous rings for your event.

Parts Required (Per Playing Field)

Item	Qty	Description
T1	A/R	1" White Gaffer's Tape
F4	2	Red Ring (Regular)
F5	2	Blue Ring (Regular)

Prepare 2 pre-load rings for each alliance using white 1" Gaffer's tape as shown. Be sure not to obscure the embossed logo on the rings.

Note: Be sure you do not designate the special heavy rings as pre-load rings.

PVC Cleaning and Cementing Tips

Cleaning:

When you purchase PVC pipe, it is likely that it will be dirty and covered with manufacturer's markings. For best presentation at official competitions, it is best to clean the PVC as much as possible.

Here are a few suggestions on ways clean your PVC. If you have other techniques, please feel free to share them with us.

The Kitchen Sink Approach:

Wipe off any loose dust with a damp rag. Then dab a little household powdered cleanser onto a green nylon scouring pad, dampen and simply rub off the markings. Rinse with a damp rag. This method also removes most other marks and dirt without scratching the surface of the PVC.

Caution: Wear rubber gloves and safety glasses. Be sure to follow the directions on the cleanser.



For more difficult imprints:

- Soak a small chunk of fine steel wool (grade #0000 or #00) in acetone.
- Because the acetone dries quickly, work in short sections of 1 or 2 feet.
- Wipe smears quickly with a shop rag before the acetone dries.

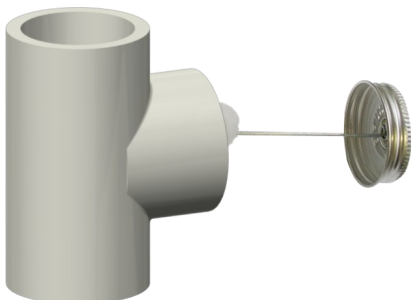
Caution: Wear rubber gloves and safety glasses. Be sure to follow the directions on the acetone container. *Work in a well ventilated area.*



A non-chemical alternative to cleaning the PVC:

Lightly sand blemishes and imprints with a low-cost 3M sanding pad. Use medium-grade for tougher inks, fine-grade for lighter inks. You'll find them at most hardware stores.

The sanding pads conform to the pipe's contour and will quickly remove markings with just a *light* pressure. Use a damp cloth to clean away dust left behind from the sanding.



Cementing:

Swab a *light* amount of glue to inside of *the fitting*, insert the pipe into the fitting. PVC cement dries fast, so you'll have to be quick. Hold the fitting and pipe together for a few seconds, then wipe off any excess glue *immediately* with a rag.

Caution: Wear rubber gloves and safety glasses. Be sure to follow the directions on the cement container. *Work in a well ventilated area.*





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