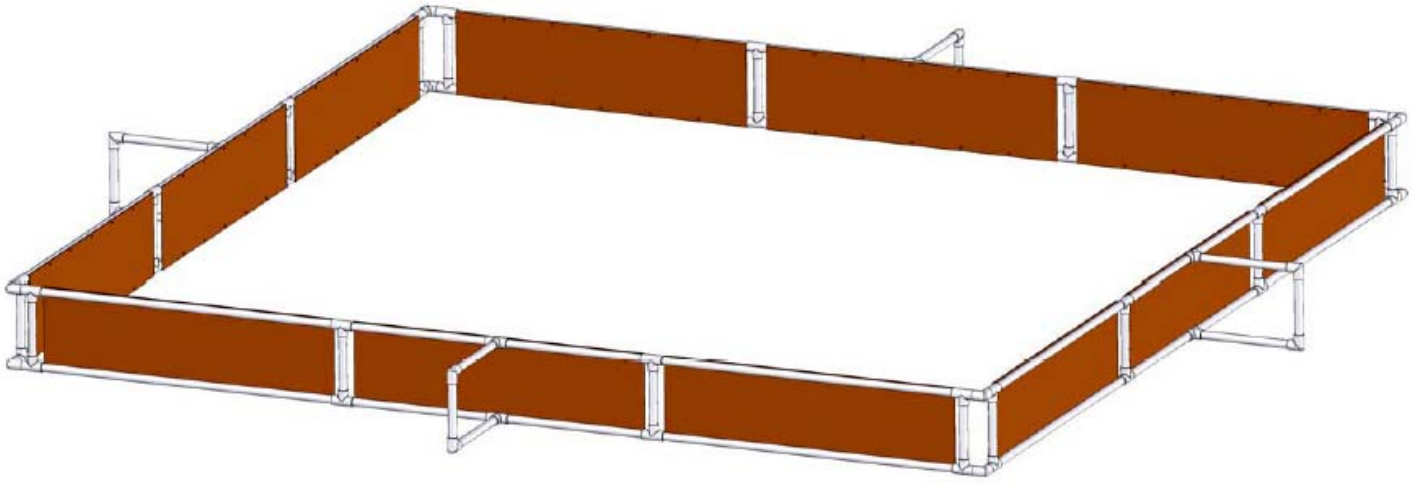
# Low-Cost Field Perimeter

## VEX Robotics Competition Field

## BOM & Assembly Instructions



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# Low-Cost Field Perimeter

## Introduction

The VEX Robotics Design System has its heritage in competitive robotics. As such, it is common for VEX robots to be used in all sorts of head-to-head challenges. To meet this demand, VEX Robotics offers the Competition Field Perimeter (278-1501). This perimeter is a reusable sheet-metal and lexan barrier designed to surround a 12 foot x 12 foot area which can be used as the border of a robotics competition field.

More information is available at www.vexrobotics.com/fields/

This high-end field perimeter in many cases is more than a customer needs. This guide will provide the details for a lower-cost perimeter which will work as a substitute for the VEX Competition Field Perimeter.

## Field Perimeter Cost Reductions

In some cases, a rigid perimeter wall isn't important. Many robotics competitions can be held with a simple perimeter of tape laid out on the floor. However, there are some times when a full perimeter is desired. The following instructions will outline a lower-cost method of building a perimeter from PVC Pipe, and hardboard paneling which mimics the functionality of the Competition Field Perimeter.

## Field Surface

There are a number of surfaces suitable for use in the playing field. In most cases it is appropriate and acceptable to simply use the surface which the field happens to be sitting on. There are times however when this is not possible. In these situations a square of low-pile carpet works great as a field surface. (Thicker carpets may get tangled in mechanical components.) Lay the carpet on the venue floor, and then place the perimeter on top of it.

Alternately, the 2'x2' foam tiles, available from www.vexrobotics.com, work great as a field surface (P/N: 278-1502). A 6 x 6 grid of tiles is designed to fit inside the VEX Competition Field Perimeter as well as the low-cost field design shown on the following pages. (The "interlocking tabs" that run along the perimeter of this 6 x 6 grid must be cut off to leave a smooth edge.)



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## Perimeter Modularity

The low-cost perimeter will break down into smaller sections easily. For a more permanent solution it is recommended that some of the PVC connections be secured together using PVC glue (available at any hardware store). When choosing which connections to glue, choose the ones which would not be disconnected when breaking the field down into smaller modules.

## Further Modifications

The design shown on the following pages is only one example of a possible lower-cost field perimeter. It is easy to see how this design could be adapted to a variety of field sizes. It may be found that the hardboard panels can be replaced by something like cardboard, for low-impact competitions.

The key thing to think about when designing a field perimeter is the following two questions:

1. What field-functionality do I actually need?
2. How can I achieve this functionality with the minimum effort & cost?

## Field Object Cost Reduction

These same two questions can also be considered when creating field objects & internal field components:

1. What field-functionality do I actually need?
2. How can I achieve this functionality with the minimum effort & cost?

There are many large-scale robotics competitions in the world which can be entered using the VEX platform. These different competitions frequently have 'official' field drawings and specifications. As with the basic field perimeter, in many cases these official spec field components are unnecessary for most customers to build. By analyzing the functionality needed, one can build a "stand-in" object which will interact with robots in the same manner as an 'official' component. These "stand-in" objects can be extremely useful during the design and prototyping phase of a Design.

## Further Questions

Any further questions should be directed to the VEX Technical Support & Community Forum at www.VEXforum.com. There is a section specifically for VEX Competitions.



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# Low Cost Field Perimeter - Bill of Materials

Materials needed to construct the field, and the necessary modifications are shown below:

| Low Cost Field Perimeter - Bill of Materials | | | | | |
|---|---|---|---|---|---|
| Description | Unit | | Qty | Total | |
| 3/4" x Sch-40 PVC Pipe - 10' Long | $ | 5.82 | 12 | $ | 69.84 |
| 3/4" x Sch-40 PVC T-Connector | $ | 0.43 | 40 | $ | 17.20 |
| 3/4" x Sch-40 PVC 90-Degree Connector | $ | 0.35 | 16 | $ | 5.60 |
| #8 x 1/2" Flathead Wood Screw (100 Pk) | $ | 2.81 | 1 | $ | 2.81 |
| 4' x 8' Sheet of 1/8" Thick Hardboard | $ | 6.67 | 2 | $ | 13.34 |
| | | | Approximate Total Price | | $108.79 |

Price & Source Information given as a reference only; these materials should be available at any hardware store, and pricing may vary.

1. **From the (2x) sheets of 1/8" Thick Hardboard, cut (9x) pieces which are (11.5" Tall x 41.75" Long)**
2. **The (12x) 10-foot lengths of PVC pipe must be cut into smaller sections for the field. These lengths and quantities are listed in the "PVC Lengths" table to the right.**

   **Ensure all cuts are square. Deburr pipe edges using a flat file or deburring tool.**

   **To get these shorter segments out of (12x) 10-foot lengths, refer to the table below.**

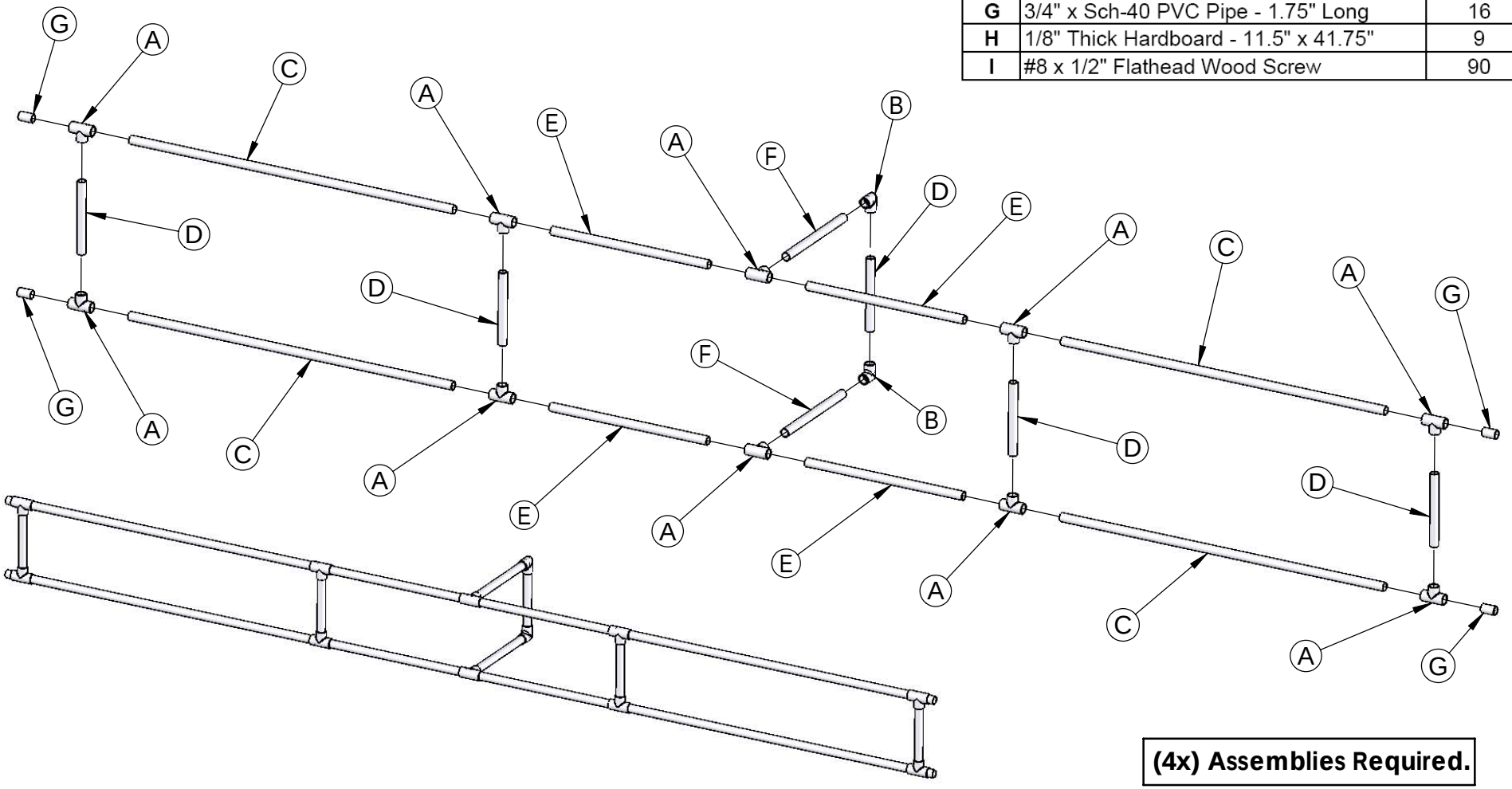
| PVC Lengths | |
|---|---|
| Length | Qty |
| 43.5" | (16x) |
| 9.25" | (20x) |
| 21.125" | (16x) |
| 14" | (8x) |
| 1.75" | (16x) |

| PVC Cut List - Smaller PVC Sections | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cut 1 | Cut 2 | Cut 3 | Cut 4 | Cut 5 | Cut 6 | Cut 7 | Cut 8 | Cut 9 | Cut 10 | Cut 11 | Cut 12 |
| 1 | 43.5 | 21.125 | 21.125 | 9.25 | 9.25 | 14 | | | | | | |
| 2 | 43.5 | 21.125 | 21.125 | 9.25 | 9.25 | 14 | | | | | | |
| 3 | 43.5 | 21.125 | 21.125 | 9.25 | 9.25 | 14 | | | | | | |
| 4 | 43.5 | 21.125 | 21.125 | 9.25 | 9.25 | 14 | | | | | | |
| 5 | 43.5 | 21.125 | 21.125 | 9.25 | 9.25 | 14 | | | | | | |
| 6 | 43.5 | 21.125 | 21.125 | 9.25 | 9.25 | 14 | | | | | | |
| 7 | 43.5 | 21.125 | 21.125 | 9.25 | 9.25 | 14 | | | | | | |
| 8 | 43.5 | 21.125 | 21.125 | 9.25 | 9.25 | 14 | | | | | | |
| 9 | 43.5 | 43.5 | 9.25 | 9.25 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 |
| 10 | 43.5 | 43.5 | 9.25 | 9.25 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 | 1.75 |
| 11 | 43.5 | 43.5 | | | | | | | | | | |
| 12 | 43.5 | 43.5 | | | | | | | | | | |

## Assemble (4x) Field Walls, as shown below.

Ensure that ALL Pipe-Lengths are fully inserted into their Connectors.

| Item | Description | Qty |
|---|---|---|
| A | 3/4" x Sch-40 PVC T-Connector | 40 |
| B | 3/4" x Sch-40 PVC 90-Degree Connector | 16 |
| C | 3/4" x Sch-40 PVC Pipe - 43.5" Long | 16 |
| D | 3/4" x Sch-40 PVC Pipe - 9.25" Long | 20 |
| E | 3/4" x Sch-40 PVC Pipe - 21.125" Long | 16 |
| F | 3/4" x Sch-40 PVC Pipe - 14" Long | 8 |
| G | 3/4" x Sch-40 PVC Pipe - 1.75" Long | 16 |
| H | 1/8" Thick Hardboard - 11.5" x 41.75" | 9 |
| I | #8 x 1/2" Flathead Wood Screw | 90 |



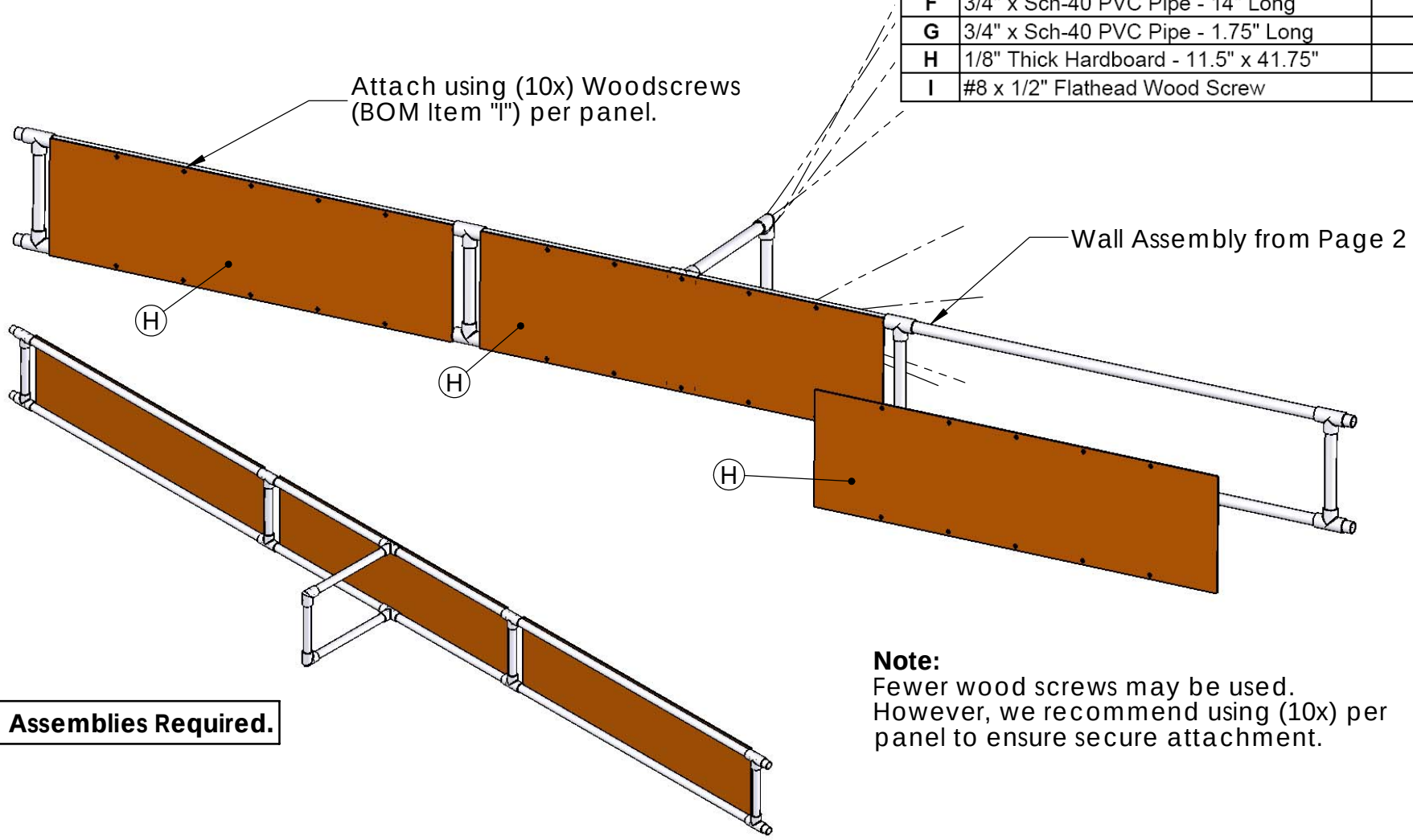

**(4x) Assemblies Required.**

| | | | |
|---|---|---|---|
| VEX ROBOTICS COMPETITION | Description: Field Wall Assembly | | |
| | Dwg No: LOW-COST-FIELD-ASSY | | |
| | Competition: VRC | | Sheet 2 of 5 |
| | Release: 4/9/2010 | ALL DIMENSIONS ARE IN INCHES. | |

## Attach (3x) Hardboard Panels to each of the (4x) Field Walls.

Position each panel so they are centered on each "section" of the wall.
Ensure that screw-heads are as flush with the surface as possible.

| Item | Description | Qty |
|---|---|---|
| A | 3/4" x Sch-40 PVC T-Connector | 40 |
| B | 3/4" x Sch-40 PVC 90-Degree Connector | 16 |
| C | 3/4" x Sch-40 PVC Pipe - 43.5" Long | 16 |
| D | 3/4" x Sch-40 PVC Pipe - 9.25" Long | 20 |
| E | 3/4" x Sch-40 PVC Pipe - 21.125" Long | 16 |
| F | 3/4" x Sch-40 PVC Pipe - 14" Long | 8 |
| G | 3/4" x Sch-40 PVC Pipe - 1.75" Long | 16 |
| H | 1/8" Thick Hardboard - 11.5" x 41.75" | 9 |
| I | #8 x 1/2" Flathead Wood Screw | 90 |




**(4x) Assemblies Required.**

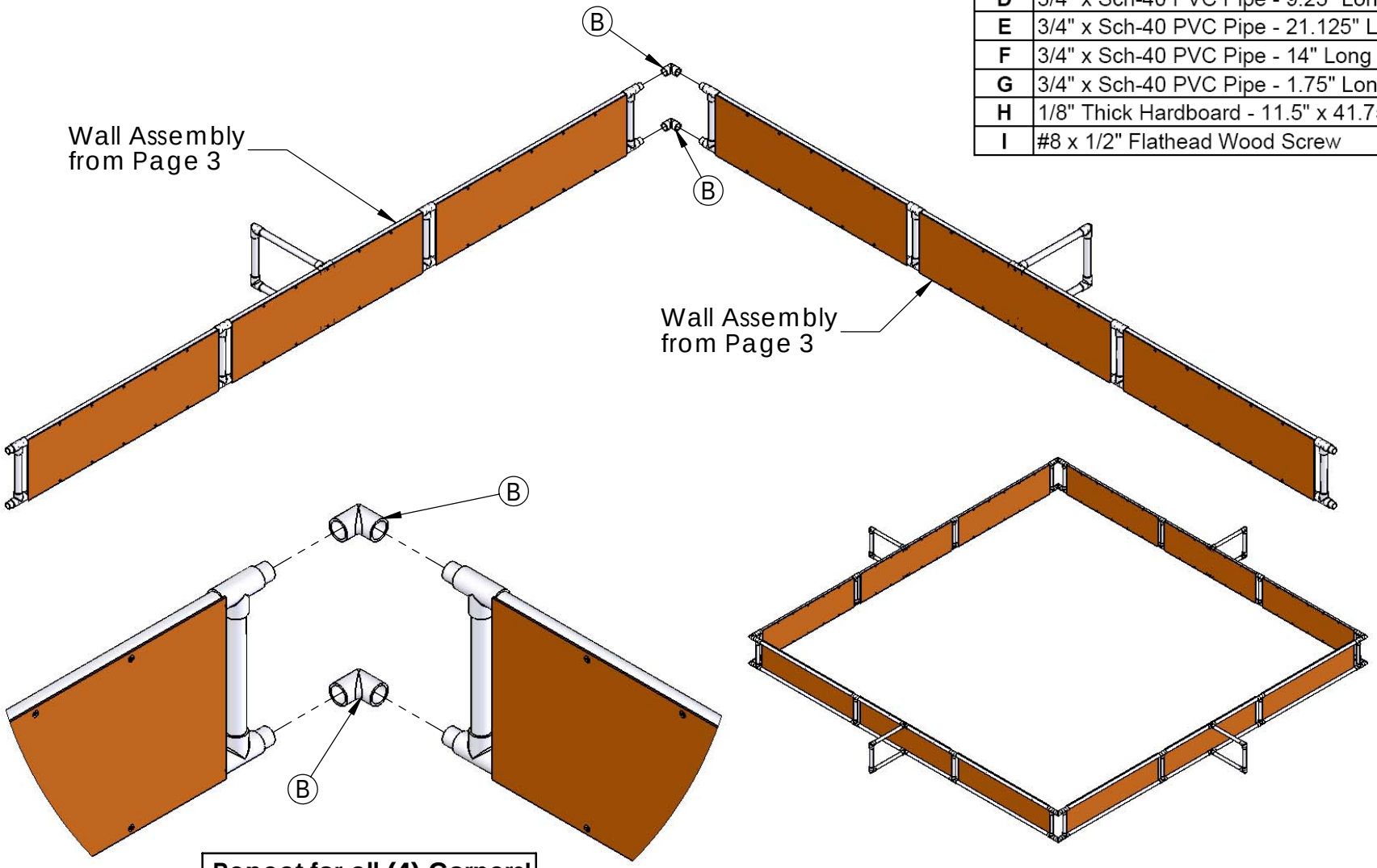
**Note:**
Fewer wood screws may be used.
However, we recommend using (10x) per panel to ensure secure attachment.

| | | | |
|---|---|---|---|
| VEX ROBOTICS COMPETITION | Description: Panel Attachment | | |
| | Dwg No: LOW-COST-FIELD-ASSY | | |
| | Competition: VRC | | Sheet 3 of 5 |
| | Release: 4/9/2010 | ALL DIMENSIONS ARE IN INCHES. | |

## Attach the (4x) Wall Assemblies together.

Position the (4x) walls such that they are approximately in the correct orientation. Ensure that the walls are perpendicular to each other. Ensure that ALL Pipe-Lengths are fully inserted into their Connectors.

| Item | Description | Qty |
|---|---|---|
| A | 3/4" x Sch-40 PVC T-Connector | 40 |
| B | 3/4" x Sch-40 PVC 90-Degree Connector | 16 |
| C | 3/4" x Sch-40 PVC Pipe - 43.5" Long | 16 |
| D | 3/4" x Sch-40 PVC Pipe - 9.25" Long | 20 |
| E | 3/4" x Sch-40 PVC Pipe - 21.125" Long | 16 |
| F | 3/4" x Sch-40 PVC Pipe - 14" Long | 8 |
| G | 3/4" x Sch-40 PVC Pipe - 1.75" Long | 16 |
| H | 1/8" Thick Hardboard - 11.5" x 41.75" | 9 |
| I | #8 x 1/2" Flathead Wood Screw | 90 |




**Repeat for all (4) Corners!**

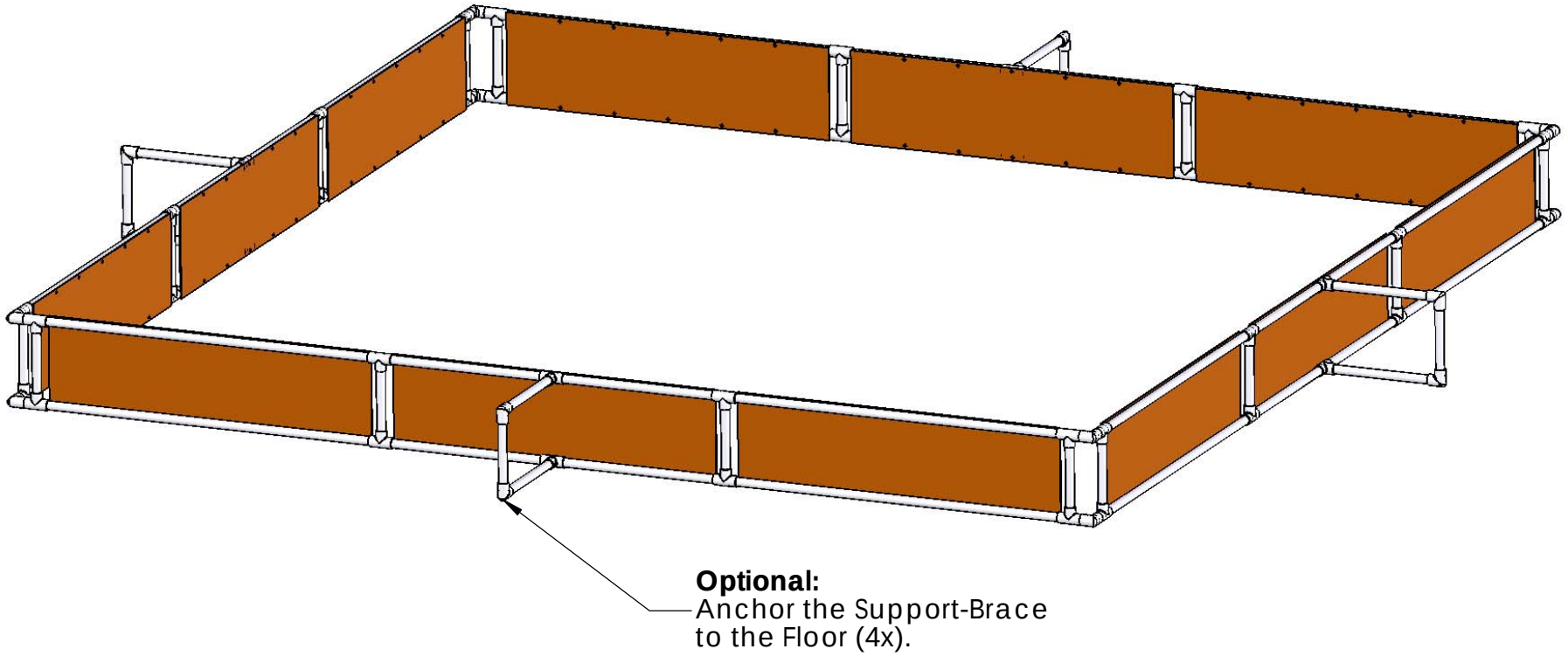
VEX ROBOTICS COMPETITION

| | | |
|---|---|---|
| Description | Perimeter Assembly | |
| Dwg No | LOW-COST-FIELD-ASSY | |
| Competition | VRC | Sheet 4 of 5 |
| Release | 4/9/2010 | ALL DIMENSIONS ARE IN INCHES. |

## Place Field Perimeter in Position.

After the field perimeter is in position, it may be necessary to anchor it in place.
One method would be to velcro or tape the support-braces to the floor.
Alternately, place weights on the support-braces to hold them in place.

Once field is anchored in place, install field interior components.




| | | | |
|---|---|---|---|
| VEX ROBOTICS COMPETITION | Description | Final Perimeter Assembly | |
| | Dwg No | LOW-COST-FIELD-ASSY | |
| | Competition | VRC | Sheet 5 of 5 |
| | Release | 4/9/2010 | ALL DIMENSIONS ARE IN INCHES. |