A Step-by-Step Construction Guide v3.0

Low-Cost Tilt-Top Vacuum Table

For Digital Capture of Newspapers, Photographs, Posters, Blueprints, and Works of Art on Paper

Click above for video of vacuum copy table in use

THE CENTER FOR THE IMAGE.ORG *with* WILHELM IMAGING RESEARCH, INC.

Grinnell, Iowa U.S.A.

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Design and Construction of the Tilt-Top Vacuum Table
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About the Cover

The digital camera in the photo on the cover is a Canon EOS 5D Mark II with a Canon Macro Lens EF 100mm ƒ2.8 L IS USM. This is a relatively expensive set-up which provides very high quality image captures. The Canon 5D Mark II camera is equipped with a 21.1 megapixel full-frame 35mm sensor and the Canon Macro lens was designed to cover the field of a full-frame sensor. The lens can also be used with Canon cameras with smaller sensors such as the 15.1 megapixel Canon EOS 50D; however the coverage of the smaller APS-C size sensor used with this camera results in an effective 1.6X magnification of the image when used with any given lens focal length.

In practical terms, the Canon 5D Mark II fitted with this lens can image a full two-page spread of a typical newspaper with the camera placed at a distance of approximately 8.5 feet from the vacuum table surface. To image the same two-page spread with the Canon 50D will require that the camera be 13 feet from the vacuum table, thus requiring a significantly larger space for the setup.

Cameras and lenses with similar specifications made by Nikon and other manufacturers are also suitable for this application.

The newspaper being imaged is the July 13, 2010 issue of the *Parsons Sun* (Vol. 139, Issue 19), a newspaper published in Parsons, Kansas. In terms of the history of photography, this newspaper is significant in that it chronicles the processing of the final rolls of Kodak Kodachrome film at Dwayne's Photo in Parsons, the last photo lab in the world to process Kodak Kodachrome film.

The Vacuum Table Copy System in Use

A set-up using the vacuum table is illustrated above. A variety of light sources can be used to illuminate the table surface. Here you see fluorescent lamps, Philips F40T12/C50 Colortone 40watt, 5000K, 48 inch, Philips Product # 20561-7. The lights should be set at an angle of approximately 45 degrees to the table. Glossy materials may require a lower illumination angle, especially if they have an uneven or rippled surface. Some glossy materials may require the use of polarizing filters over both the lights and camera lens. Detailed instructions about various ways to set up and use the vacuum table will be presented in a forthcoming guide.

Contents

1. Introduction

In an era when collectors, librarians, and archivists are digitizing more and more paper items, excellent scanners, copy stands, and vacuum tables are commercially available. However, large paper items continue to be difficult to digitize. Most scanners are not large enough to accommodate a full newspapers, posters, maps, blueprints and other engineering drawings, large photographs, large drawings, etc. Large vacuum tables with overhead-mounted cameras allow the copying of large paper items, but they are expensive and require a dedicated space with room for a high vertical extension.

With these challenges in mind, The Center for the Image working with Wilhelm Imaging Research has created a simple, affordable, portable, and efficient vacuum table that facilitates high-quality digital capture for large and/or fragile paper items.

The dimensions of the table were determined in order to copy full two-page newspaper spreads. The following plans can be used, however, with appropriate adjustments, to build tables of various sizes.

The advantages of the CFI vacuum table for copying large and/or fragile paper items are many, including:

- Vacuum suction rather than glass or acrylic is used to flatten paper items, which means there is no added reflective surface to degrade fidelity when photographing/digitizing.
- The lighting system allows simple adjustment to the angle of illumination and also makes it possible to use polarizing filters over both the lamps and the camera lens which will minimize surface reflections that can occur with some types of glossy surfaces, photographs that exhibit surface "silvering-out," and with materials that have wavy or uneven surfaces.
- The flexibility in illumination allows capture of paper with applied gold foil or other gilding.
- Vacuum suction allows original torn artifacts to be reassembled on the table and copied in a single camera exposure.
- The vacuum table copying system requires a minimum of handling of brittle or fragile paper items.
- The large table surface allows photographic capture of a large item in a single camera exposure, which means it is not necessary to spend time post-capture with software programs that stitch together scanned parts of the whole.
- The system uses a camera mounted on a moveable tripod, thus eliminating a large, complex and expensive copy stand. Maximum capture of items of various sizes is possible simply by moving the tripod.
- The system is flexible. Top-of-the-line or less expensive cameras can be used. (Note: Better cameras and lenses, used properly, yield better quality reproductions.)
- The vacuum table/camera-on-tripod system requires space when in use, but it can be conveniently stored when not in use. A permanent, dedicated space is not required.
- The system uses camera capture for digitization, which is much faster than scanning.

2. General Construction Guidance

Construction of this vacuum table, although not complicated, requires a basic proficiency in carpentry and experience in the safe use of hand tools, electric saws and drills. Many libraries, historical societies, museums, and corporate collections have staff members capable of handling such projects. It may also be possible to find a volunteer community member with experience in woodworking who would find building the vacuum table to be a fulfilling project. High school shop or industrial arts classes might also be interested in taking this on as an instructional project.

A carpenter or woodworking shop in your area could also be hired to acquire the necessary materials and construct the vacuum table.

To meet specific requirements, vacuum tables that are either smaller or larger than the standard 37" x 26" (width x height) table described here can be constructed following these general guidelines.

3. Basic Instructions for Using the Vacuum Table

1. Set up lighting, evenly illuminating the entire surface of the vacuum tabletop when it is in the vertical position.
2. Put the item to be copied on the vacuum tabletop (horizontal position).
3. Gently place a piece of matboard or cardboard on the item to be copied, and put a weight on top (for example, a one-foot length of a 2-by-4 wooden board). This will flatten the paper to the tabletop, in preparation for the vacuum.
4. Turn on the vacuum.
5. Remove the weights and cardboard. There should be a perfect, no-wrinkle connection between tabletop and item to be copied. If not, make the necessary adjustment.
6. Unlatch the tabletop and tilt it into the vertical position.
7. With camera on a tripod, facing the tabletop squarely (very important!), photograph the paper item.
8. Tilt the tabletop back to horizontal position, stop the vacuum suction, and remove the paper item from the table. Removal of the paper item without stopping the vacuum is possible, but to maintain the maximum safety of the paper item, stopping the vacuum is advised.
9. Detailed instructions will be presented in a separate, forthcoming guide.

4. Views of the Completed Vacuum Table: Front, Back, Sides

Figure 1
The completed vacuum table as seen from the front, with the top vertical.

Figure 2
The completed vacuum table as seen from the rear, with the top vertical.

Figure 3
The completed vacuum table as seen from the front, with the top horizontal.

Figure 4
The completed vacuum table, side view, with the top vertical.

Figure 5
The completed vacuum table, opposite side view, with the top vertical.

Figure 6
The completed vacuum table, side view, with the top horizontal.

Figure 7
The completed vacuum table, opposite side view, with the top horizontal.

5. General Information: Use and Assembly

The tilt-top vacuum table and plans for its construction have been created to assist archivists, librarians, and people with large-sized paper-based collections, digitize their collections in a manner which will yield an excellent result while being affordable and efficient. We chose the dimensions of the table based on the need to copy newspapers of various sizes. The vacuum table top is 37" x 26", comfortably accommodating most newspaper sizes, while leaving a border of black plastic all the way around the page, which is especially important when photographing (due to the possibility, otherwise, of flare in the lens and subsequent image degradation.)

None of the dimensions given are particularly critical, as long as everything fits together. Adjustments and trial fittings are recommended. Trial fittings revealed, for example, that the dimensions of PVC fittings (especially the 45˚elbows) vary somewhat by manufacturer.

PVC cement may be used for most or all of the PVC joints. PVC cement is a carcinogen–it should be used with adequate ventilation, and while wearing disposable Latex or Nitril gloves. An alternative is to fit the joints dry, and use self-tapping machine screws to secure the joint (for example: #6-32 or #8-32 x 1/2" or 5/8", one or two per joint.) The frame will not be as rigid, however, with screws as compared to using cement. PVC joints are made to be tight. The glue acts as a lubricant, but the setup time is extremely short, which makes this kind of assembly (where depth and rotation are important) very tricky.

The overall dimensions of this assembly are approximately 42" wide x 29" deep x 39-1/2" tall to the top of the base frame, 43" tall to top of table surface when horizontal, and 52" tall to top of table edge when vertical. The height to the centerline of the table when vertical is approximately 38-7/8". Due to the way the table hinges, and to keep the weight nearly neutral to avoid tiring the user, the height of the table surface when horizontal and the centerline when vertical are a compromise. If a higher centerline, for photographing convenience, is desired, the legs may be lengthened, but obviously this will also raise the table surface when horizontal. This additional height may require awkward handling of items to be copied.

The cost of materials for construction is approximately US $200.

6. Vacuum Source and Vacuum Hose Tips

A shop vacuum, available from a local hardware store, Home Depot, Lowes, Sears, Walmart, McMaster-Carr, etc., is suggested as a vacuum source. They range from small 1 gallon tanks to 20 gallons or more, priced from under 50 dollars to over 1000 dollars. It is reasonable to expect to spend from 100 to 200 dollars. A large tank is not necessary, nor is the wet capability, however most shop vacuums are wet/dry.

A common 10 gallon shop vac with 4.0 peak horsepower rating (nameplate rating of 9.6 Amps) works well, yielding about 1 horsepower. Peak HP (horsepower) ratings are not helpful for comparing vacuums, rather pay attention to the amperage ratings. At 120VAC (volts AC), a 10A rating yields about 1 HP (horsepower).

Consider the size of the vacuum hose. A vacuum with a nominal 2" inside diameter hose works well, but a 1-1/4" hose restricts the air flow and does not work as well. While many shop vacuums come with 1-1/4" or 1-1/2" hoses and accessories, they may have a vacuum port that will accept a larger-sized hose.

Shop vacuum hose sizes are commonly referred to as 1-1/4, 1-1/2, 2, 2-1/4, and 2-1/2 inches. Unfortunately, it is often not clear whether this is an inside or outside diameter. The hole in the table top must reasonably match the outside diameter of the hose to be used.

A shop vac, as it is generally called, is very noisy. Air circulation around the vacuum is necessary, as it will get quite warm with extended use. The vacuum can be moved to a greater distance from the work area, or in some situations it could be located in a separate room. This necessitates a longer hose, which will cut down on airflow and therefore vacuum power at the table. McMaster-Carr (www.mcmaster.com) does list some of their vacuums as "quiet", however we have no experience with these. They are expensive, with prices ranging from US $400 to $500.

7. Suggested Tool List

- Rubber or urethane mallet, or hammer and block of wood.
- Miter box and back saw.
- File or deburring tool.
- Electric drill, and drill bits as appropriate for the sizes of screws used. Specifically, a 1/16" high-speed steel bit for drilling the holes in the plastic, and a 5/64" or 3/32" bit (preferably carbide) for enlarging the holes in the hardboard, and a countersink for the flathead screws.
- #2 Phillips screwdriver, flat blade screwdriver.
- Woodworkers clamps, 2 or more, with an opening of at least 4-1/2".
- Hole saw, with appropriate diameter for the hose size of the vacuum cleaner used as the vacuum source, or an alternate way of cutting this round hole. (There are side-cutting bits for use in drills, saber saws, etc.)
- Saw for sawing the plywood and hardboard.
- Utility knife for scoring the plastic, and for cutting the rubber sheet.
- Straight-edge for use when scoring the plastic, and for laying out the holes.
- Wrenches for the various hardware items used.
- Awl, center punch, or nail for marking where holes will be drilled.
- Tape measure.
- Pencil.
- Level.

8. List of Materials

- 1 piece 3/4" plywood, 26" x 37". (Keep in mind that generally a better quality of wood has fewer cracks, warps, twists, splinters, voids, etc., which makes it easier to work with and to glue.)
- 1 piece 1/8" hardboard, 26" x 37".
- 1 piece 1/16" ABS/PVC plastic sheet, 26" x 37", static-dissipative, black, textured one side (such as 87265K43 from McMaster-Carr, which is 54" x 48", enough for 2 pieces).
- 2 pieces 1 x 4 pine, 35-1/2" long. (Pine is "dimensional" lumber, where a so-called 1 x 4 will actually measure approximately 3/4" x 3-1/2".)
- 2 pieces 1 x 4 pine, 26" long.
- 3/8" diameter x 48" long wooden dowel. (This will be cut into 12 pieces approximately 3-7/8" long.)
- A vacuum source, such as a vacuum cleaner or shop vac.
- Wood glue.
- 3 strap clamps, appropriate to fit over the approximate 1-5/16" diameter PVC pipe wrapped all the way around with 1/8" rubber.
- 3 pieces of 1/8" thick rubber, about 1" wide x about 4-1/2" long.
- 1 small pulley, suitable for 3/32" steel cable.
- 1 J-bolt, with nut and washer, suitable to hold the above pulley.
- 1 piece of 3/32" steel cable, approximately 7' long.
- 2 cable clamps for above 3/32" steel cable. (If steel cable other than 3/32" diameter is used, adjust pulley and clamps as appropriate.)
- 1 eyebolt, 1/4" x 4", with 2 nuts and a lock washer.
- 1 turnbuckle, approximately 6" eye-to-eye, when extended.
- 1 chain coupler, to connect turnbuckle to eyebolt.
- 1 gate latch. (This will probably include wood screws for attachment.)
- 1 1/4" U-bolt, with 4 nuts and 2 lock washers (or locknuts may be used).
- 20 deck screws, #8 x 2" or 2-1/2" long, Phillips flathead. (Used for plywood-to-pine and pine-to-pine.)
- 12 wood screws, #6 x 3/4" long, Phillips flathead. (These could be the same as the black drywall screws below.) Used for hardboard-to-pine.
- 6 drywall screws, #6 x 3/4" long, Phillips flathead, black. (e.g., McMaster-Carr 90305A112). Used for black plastic-to-hardboard/pine.
- 4 hose clamps, sized such that they will fit around the 1-5/16" diameter of the PVC pipe.
- PVC cement.

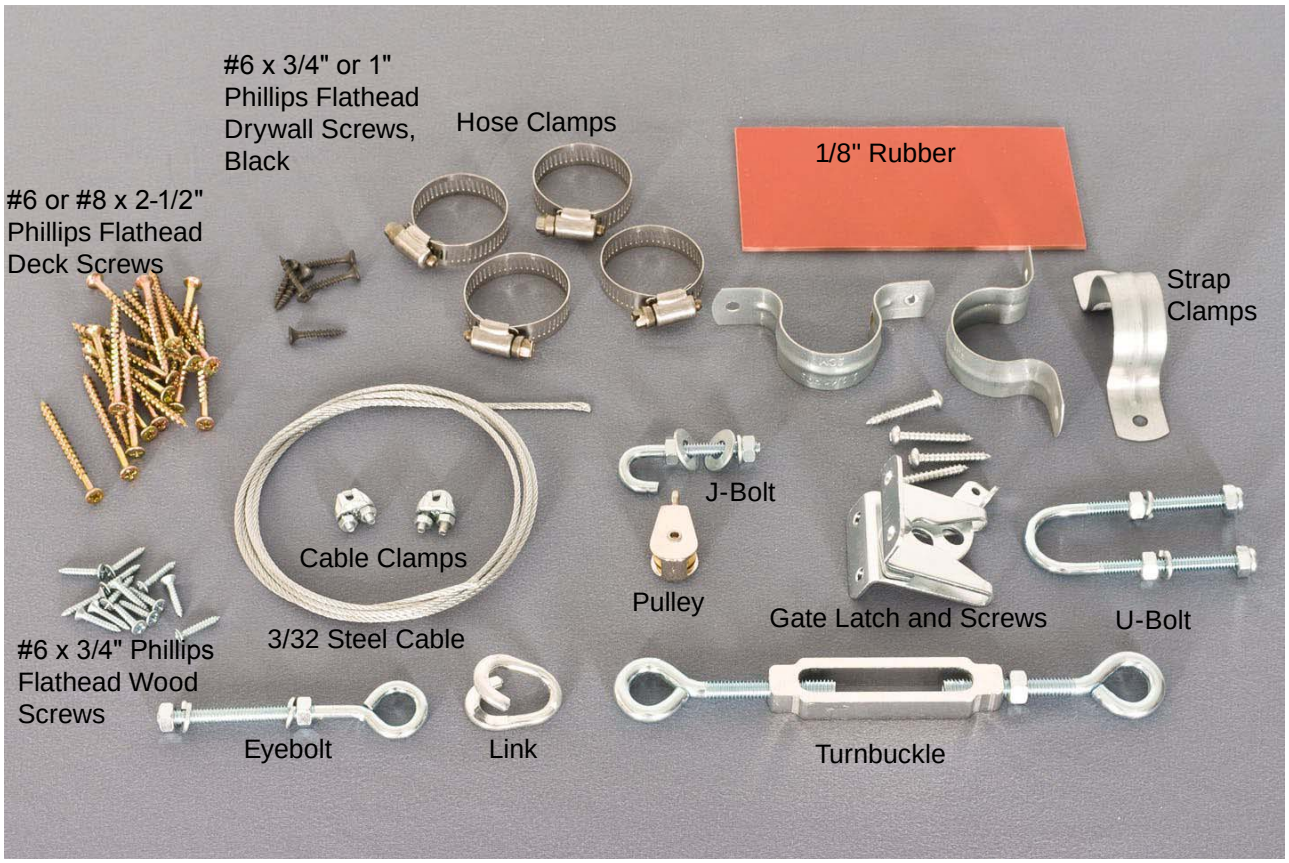


Figure 8 Hardware

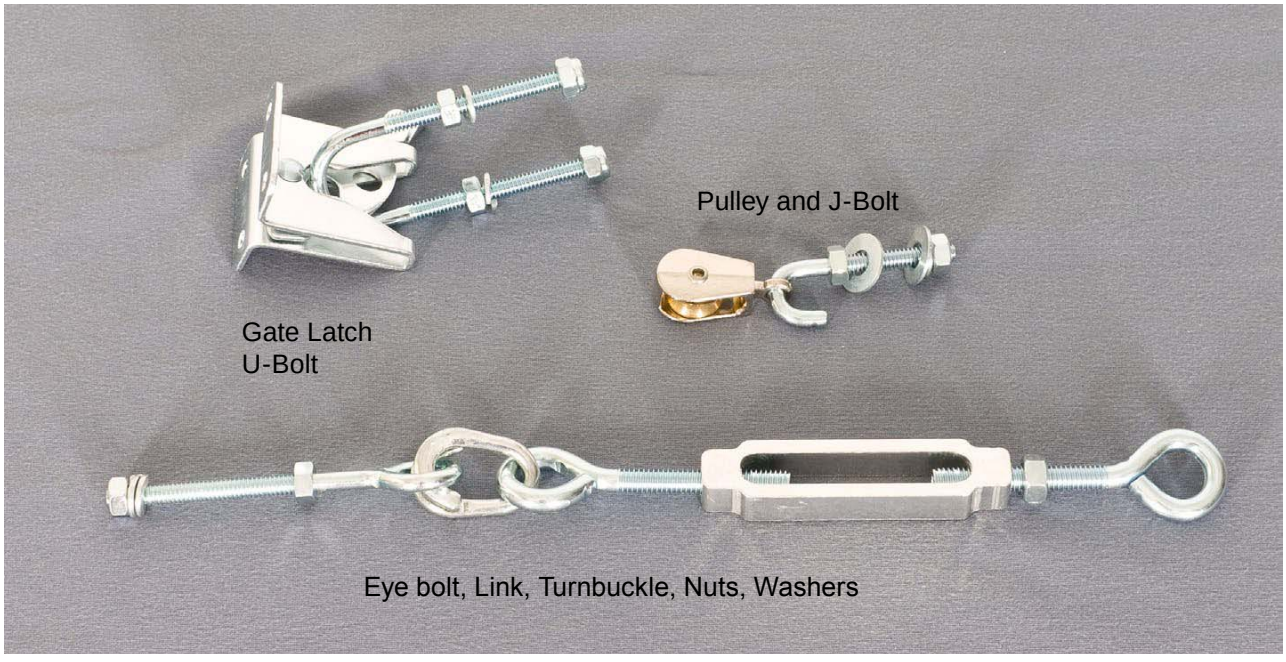


Figure 9 Assembled Hardware

9. Buying and Cutting PVC Pipe and Related Information

PVC Schedule 40 Plastic Pipe Fittings:

- 2 pieces- 90°(degree) fitting

- 8 pieces-45°(degree) fitting

- 24 pieces-"T" fitting

- 5 pieces-10 foot lengths

The pictured fittings are available at Ace Hardware. The 90˚ fittings and the "T" fittings have a 7/8" depth (where the pipe slips in and seats). The 45˚ fittings have a 1-1/8" depth. When cutting PVC pipe, these depths must be taken into account and must be considered as part of the total length of the pipe. It then becomes necessary to insure that when assembling, the pipe is forced all the way into the fitting. If gluing, there is very little time, and no forgiveness.

The lengths of the following 1" PVC Schedule 40 Plastic Pipe are dependant on the particular PVC fittings. The overall length of the fittings, and especially "depth" (where the pipe slips in) can vary between manufacturers. Some adjustment to lengths may be necessary, particularly to the double-45˚ sections of the sides. (So-called 1" PVC Schedule 40 is nominally about 1-5/16" in diameter.)

Approximately 50' of PVC Schedule 40 Plastic Pipe is needed. (PVC is usually available in 10' lengths–start with five 10' lengths.) It is recommended that the longest pieces be marked out first, then the second longest, etc. This will allow a cutting plan that results in the least waste. The lengths below include additional length for the slip-joints. Cut as follows:

- 4 pieces 39" (the side-to-side horizontal pieces).
- 2 pieces 25-1/8" (part of the side-to-side horizontals that are part of the bracing).
- 2 pieces 12-1/2" (part of the side-to-side horizontals that are part of the bracing).
- 2 pieces 19-7/8" (front-to-back horizontals).
- 4 pieces 9-1/4" (front-to-back horizontals, part of the bracing).
- 4 pieces 14-3/4" (the four longest pieces of the legs).
- 4 pieces 4-3/4" (the four lowest leg parts, which can be adjusted if different overall height dimensions are desired).
- 2 pieces 4-3/4" (rear, 45-degree upper frame, to 90-degree fittings).
- 4 pieces 4-1/2" (the four uppermost leg parts).
- 2 pieces 14-7/16" (front 45-degree elbow to 45-degree elbow, upper frame).
- 2 pieces 7-7/8" (rear 45-degree elbow to "T", upper frame, lower).
- 2 pieces 5-3/16" (rear 45-degree elbow to "T", upper frame, upper).
- 12 pieces approximately 1-1/2" to 1-5/8" coupler pieces for where fittings are butted together (45-degree elbow to "T", and "T" to "T" butted joints).
- 1 piece 41-7/8" (long "X" brace).
- 1 piece 25-1/8" (short "X" brace).

Figure 10
Use a miter box and backsaw to cut the PVC.

Figure 11
All the PVC cut and ready to assemble.

10. Assembly of the Table Top

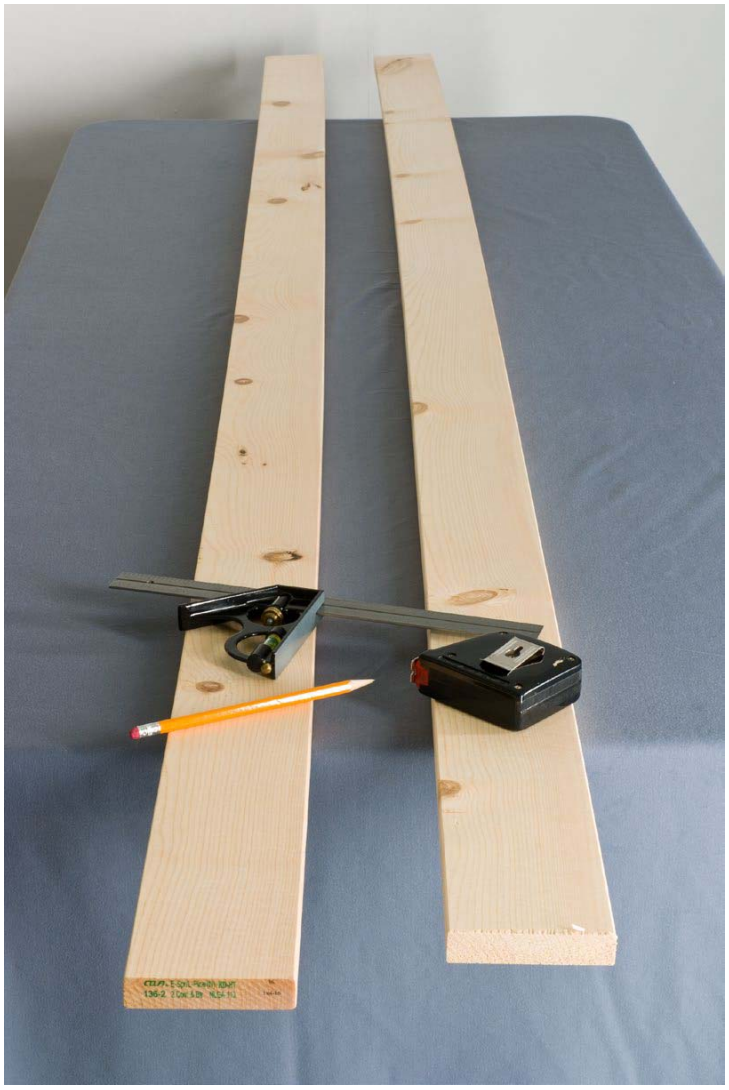


Figure 12
Start with two 8-foot lengths of 1"x 4" pine (actual dimensions 3/4" x 3-1/2"). Yields two pieces 26" long and two pieces 35 1/2" long.

Figure 13
Avoid the knots as much as possible.

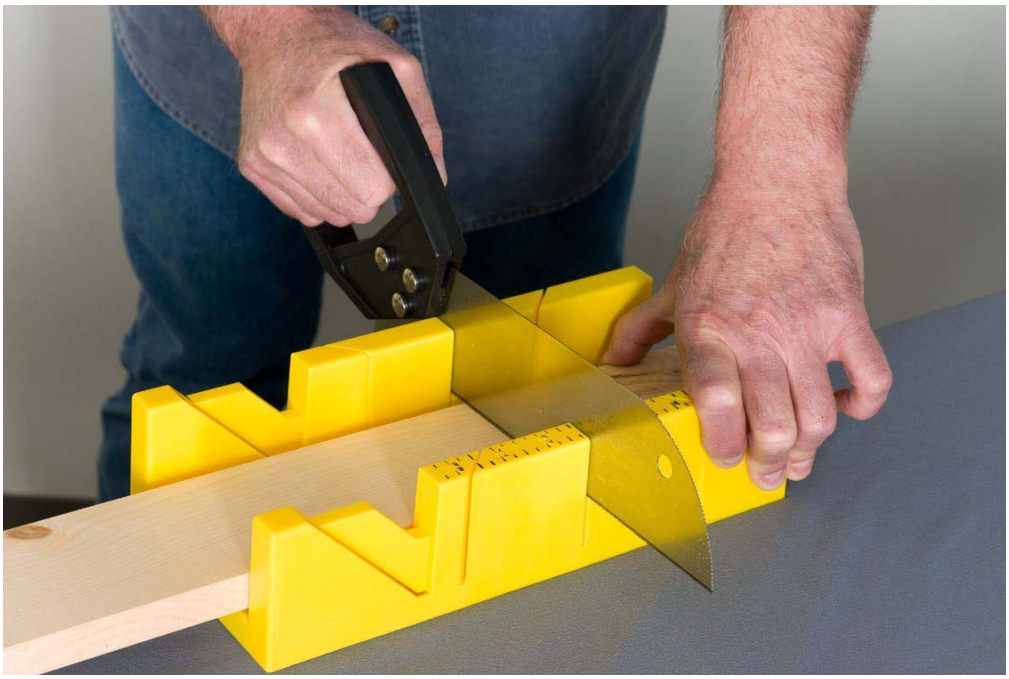


Figure 14
An inexpensive miter box and back saw used to cut the pine.

Figure 15
Pine ready for assembly.

Figure 16
A piece of 3/4" plywood and a piece of 1/8" hardboard are clamped together. The straight edge is positioned as a guide for the saw. A power saw shown here; however, a hand saw will also work.

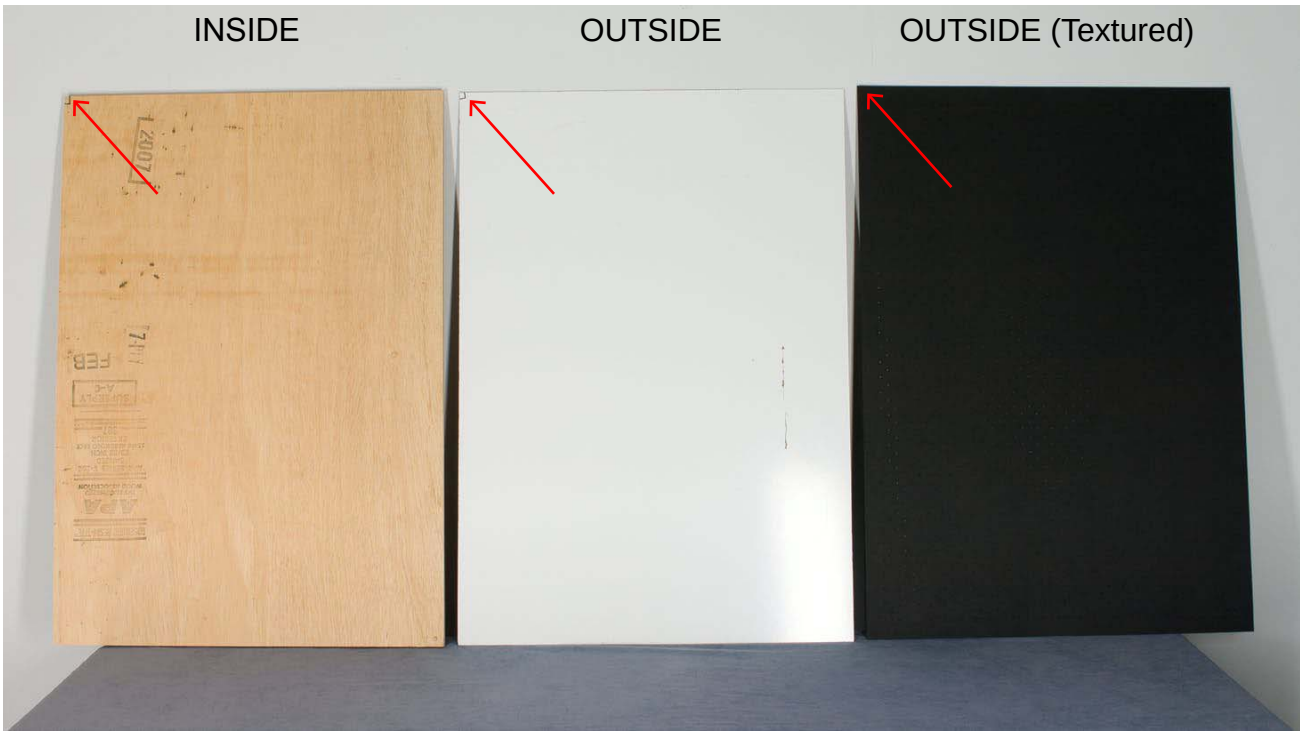


Figure 17
The plywood, hardboard and plastic, all cut to the same size. The plastic can be "scored" part way through with a utility knife, then carefully broken along the cut. Mark a corresponding corner of each piece, then keep this orientation from now on.

Figure 18
A screw in each corner. (See corner detail below.)

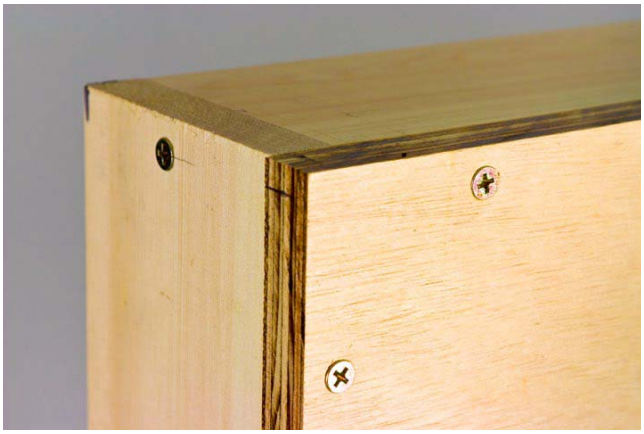
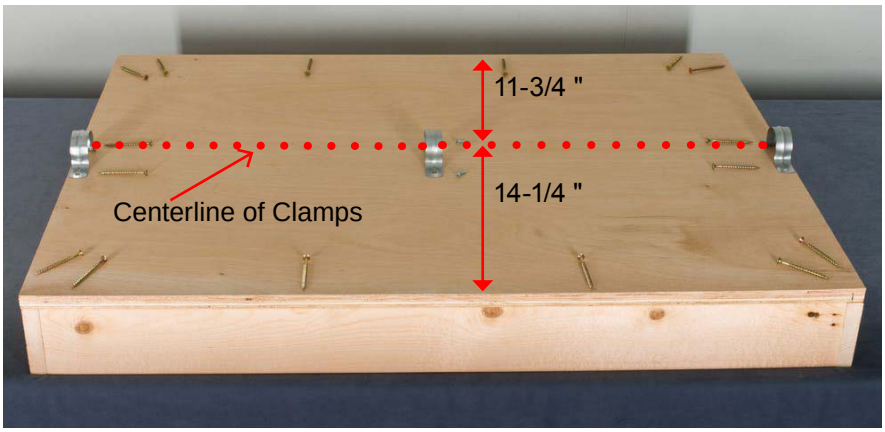


Figure 19
Corner detail.

Figure 20
Use 16 deck screws to attach the pine to the plywood, as pictured, including 4 deck screws to attach the outside clamps to the plywood. The center clamp is attached with two #6 x 3/4" flathead wood screws.



Drilling the Holes in the Table Top

Drill the black plastic and the 1/8" hardboard TO MATCH:

1. Lay out the black plastic with smooth side facing up. (This will be the non-showing inside.)
2. Mark a pattern of holes in rows 1 inch apart, with every other row staggered by one-half inch. See Figure 22. This will result in a pattern of diamonds.
3. Start and end the rows and columns 1-1/4" from the edges of the material. (That is, leave 1-1/4" of undrilled area along each edge.)
4. Place the black plastic with the smooth/marked side up, on top of scrap wood. Drill the black plastic with a 1/16" drill bit. (See Figure 23)

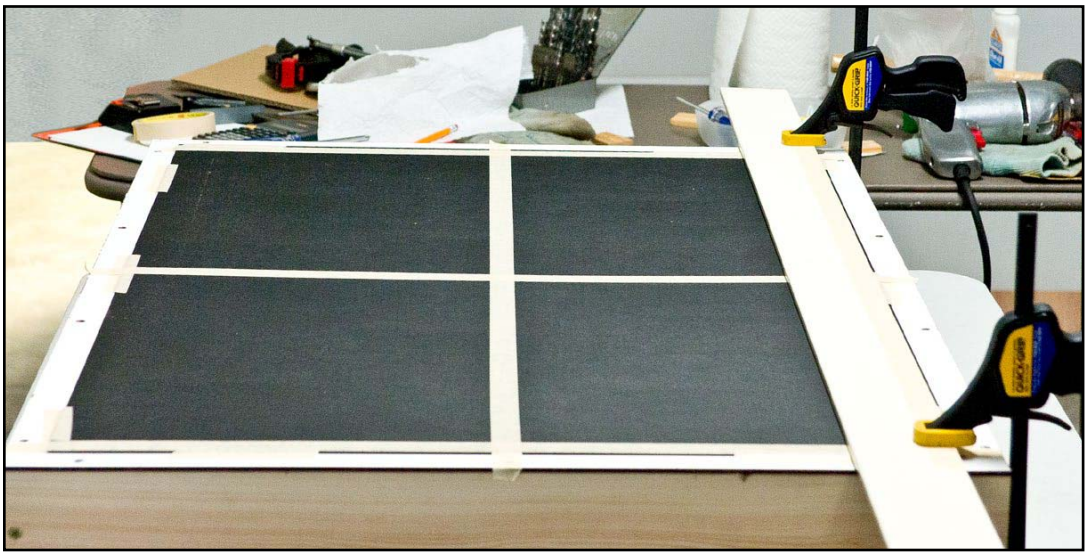


Figure 21
This set-up shows how a straight edge and masking tape are used to facilitate marking the pattern of holes on the black plastic.

5. Clamp together black plastic and hardboard, smooth side to smooth side, aligning the marked corners-shown in Figure 17. Using the holes in the plastic as a guide, re-drill through the black plastic and only a little into the hardboard–just enough to mark the hole location on the hardboard, using a 1/16" drill bit. See Figure 24.
6. When all holes have been drilled, remove the black plastic. Using the marks in the hardboard as starter holes, drill through the hardboard with a slightly larger bit (5/64" or 3/32"). See Figure 25.

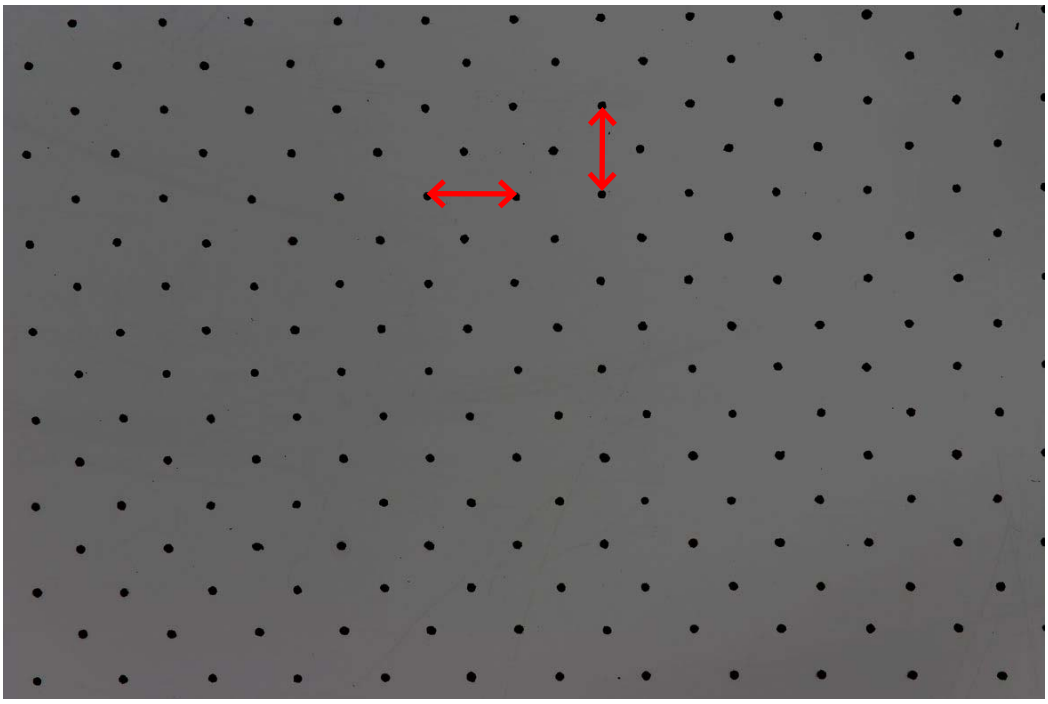


Figure 22
Hole pattern for black plastic. (For the sake of visibility, this photo shows the black piece as a charcoal grey, rather than the actual darker tone of the black plastic piece.)

Red arrows indicate 1" between holes.

Figure 23
Drilling holes through the black plastic, smooth side up. Note that scrap wood is placed underneath.

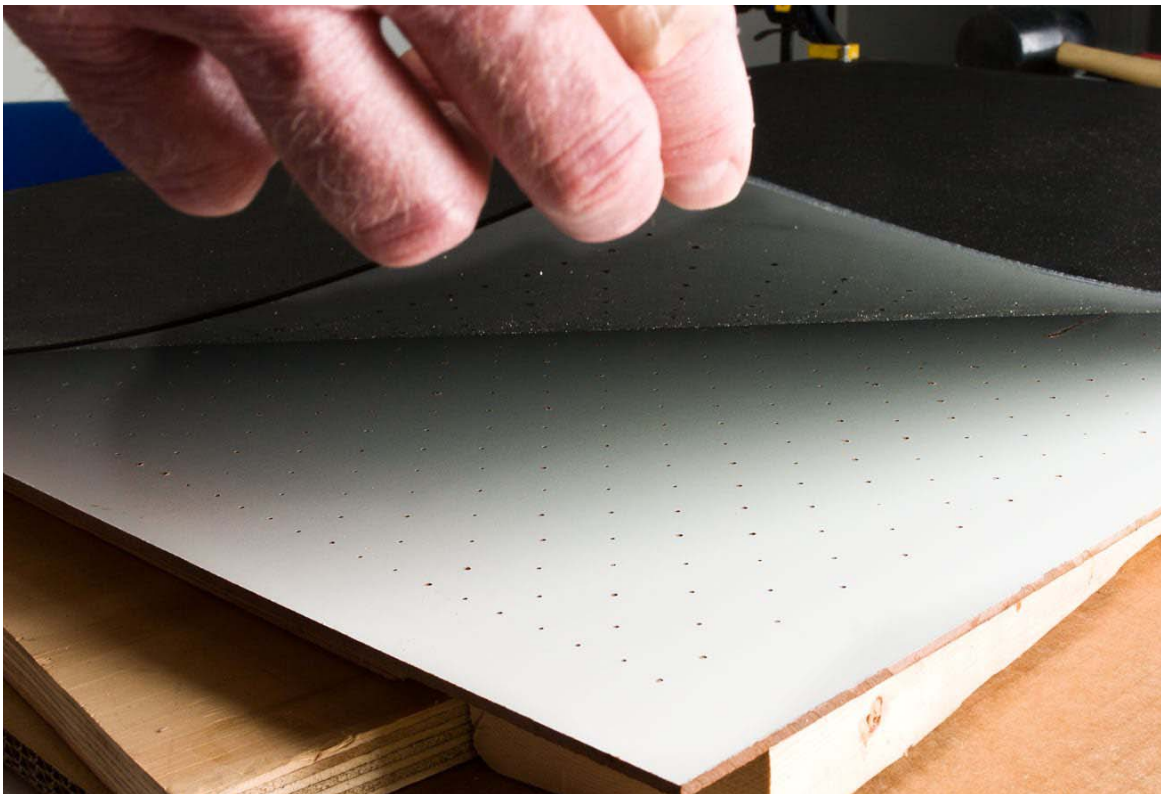


Figure 24
Plastic has been drilled with 1/16" bit, then used as a guide to drill through and mark a starter hole in the hardboard.

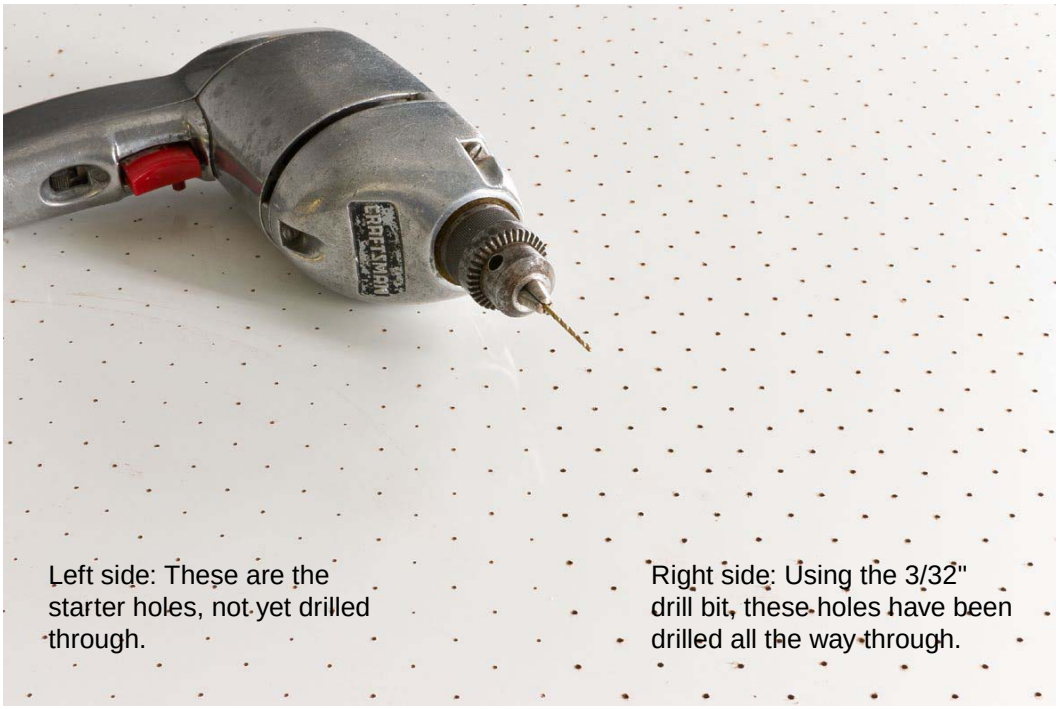


Figure 25
Hardboard starter holes drilled through with the 3/32" drill bit. Note: White or natural finished hardboard work equally well.

Installing Dowels Inside the Table Top

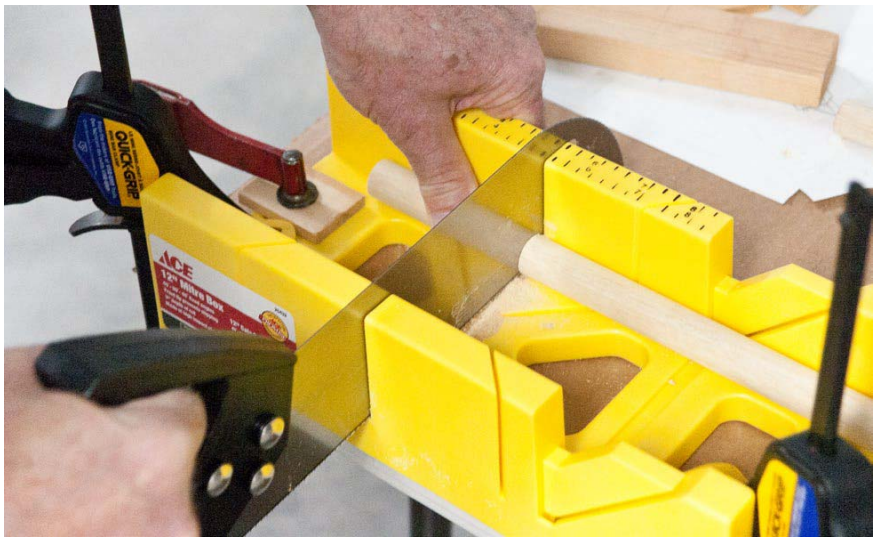


Figure 26
Cut 12 pieces of 3/8" doweling, approximately 3-7/8" long. (The exact length is dependent on how deep the holes are drilled–see following.)

Figure 27
Drill a pilot hole most of the way through the plywood in twelve places, approximately equally spaced, front to back and side to side. Use the black plastic to guide the layout of the dowels, so that the dowels do not block any of the holes in the plastic.

These photos illustrate the technique of masking the drill bit in order to gauge the proper drilling depth.

Figure 28
Enlarge the pilot holes. Use a 3/8" diameter drill bit to make holes for 3/8" dowels. Use the masking tape technique to prevent drilling all the way through the plywood.

Figure 29
Glue the dowels into the plywood. The top of the dowel should be even with the top edge of the pine.

Figure 30
Use a straight edge to check the dowel height. Tap the dowel in to the correct height, or trim if necessary with a saw or file.

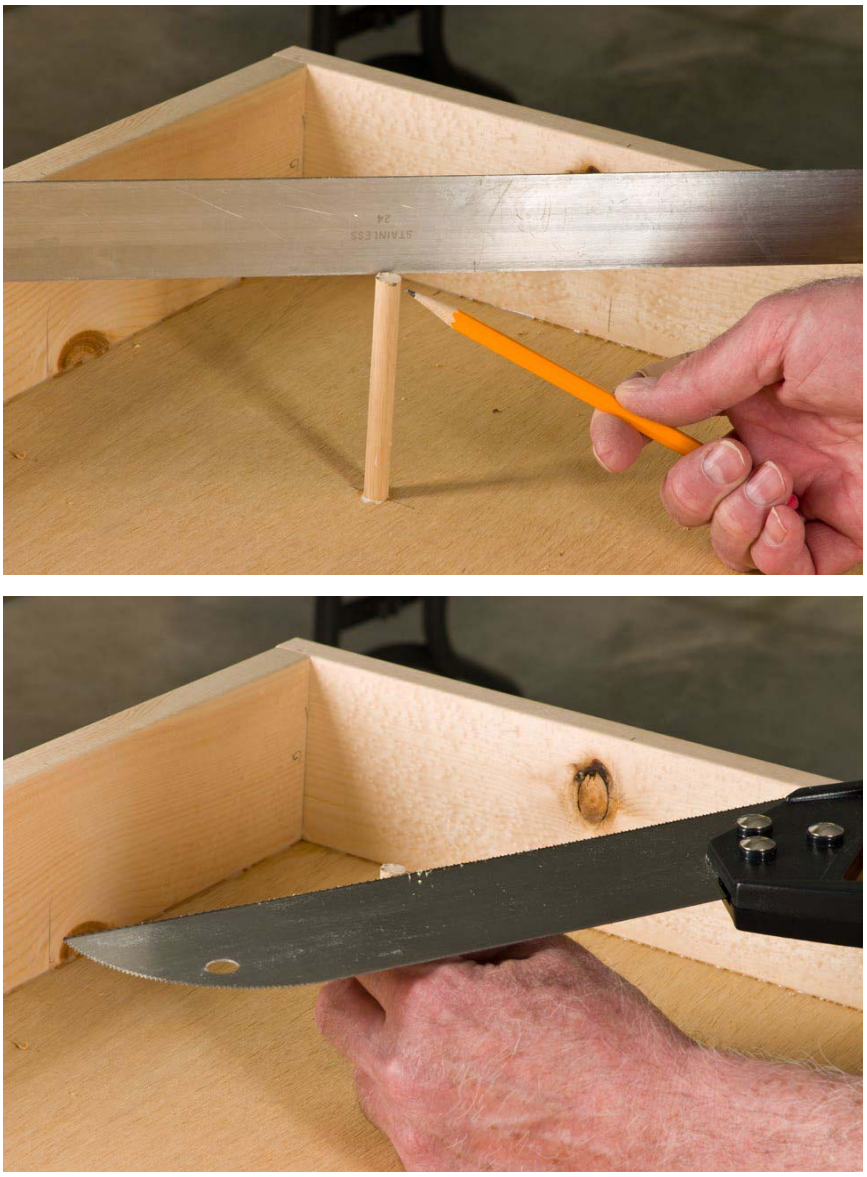
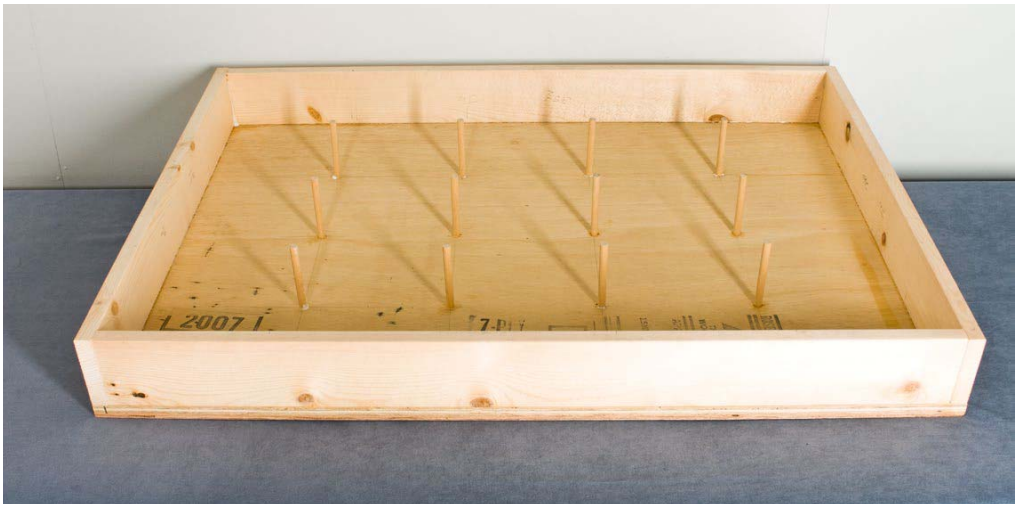


Figure 31
Here is the inside of the stand top after installing all the dowels.



Attaching Hardware to the Back of the Table Top

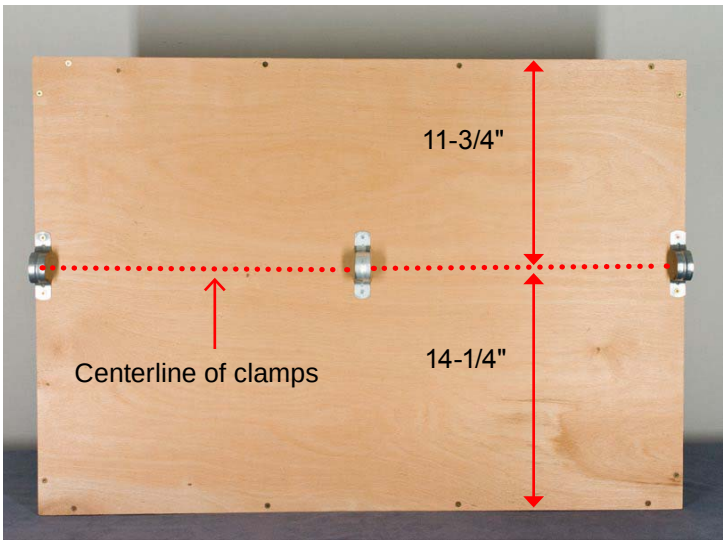


Figure 32
Strap Clamp locations.

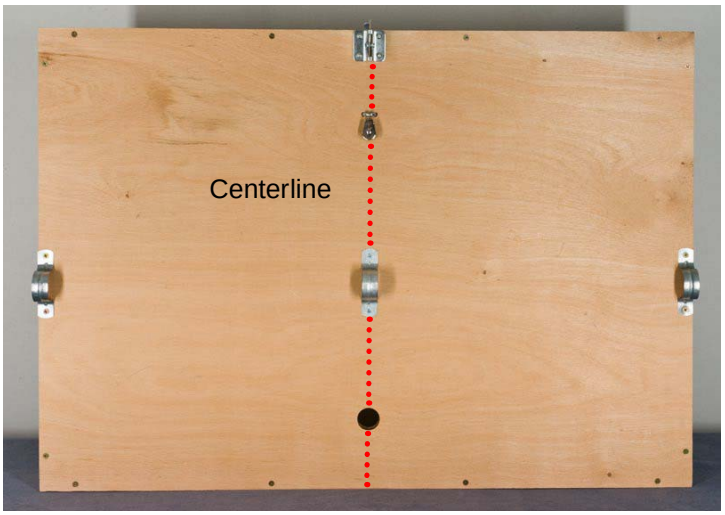


Figure 33
Note the hole for the shop vac hose. The hole shown here is for a small hose. After testing, we found that a larger hose works better, so we re-cut this hole to accommodate a larger hose. (Note comment in Suggested Tool List, page 11, concerning cutting this hole.)

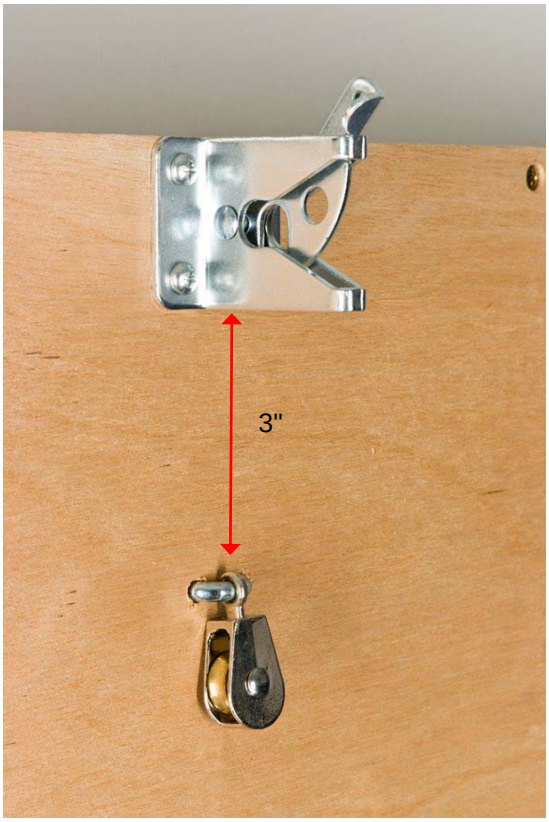


Figure 34
Pulley and Gate Latch, installed.

Finishing Steps for the Table Top

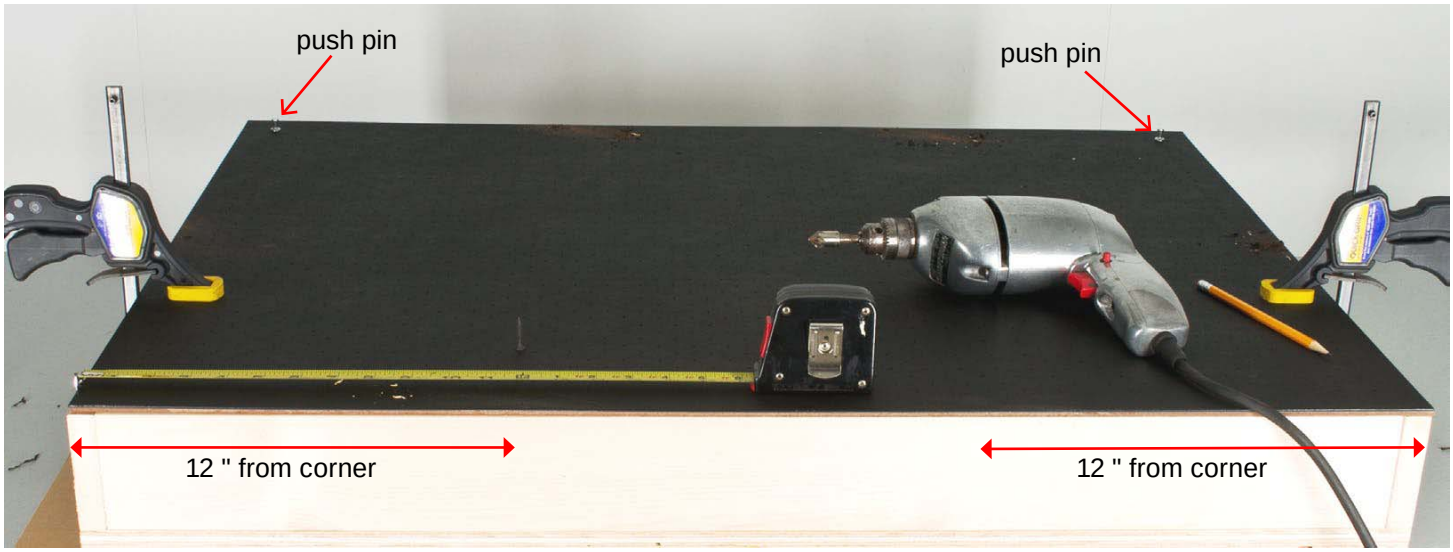
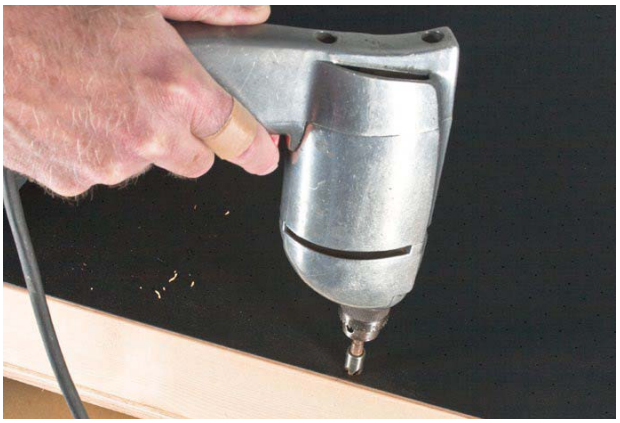
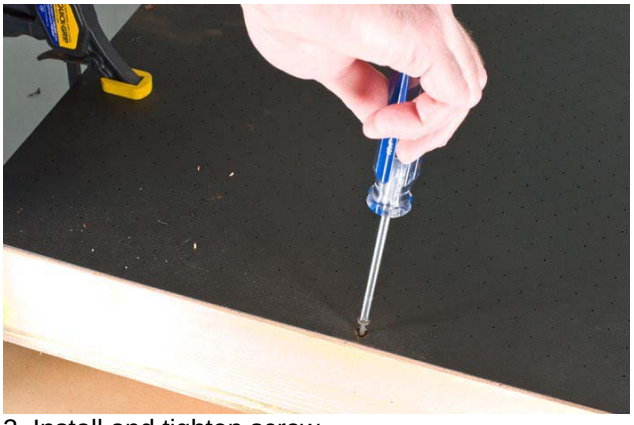
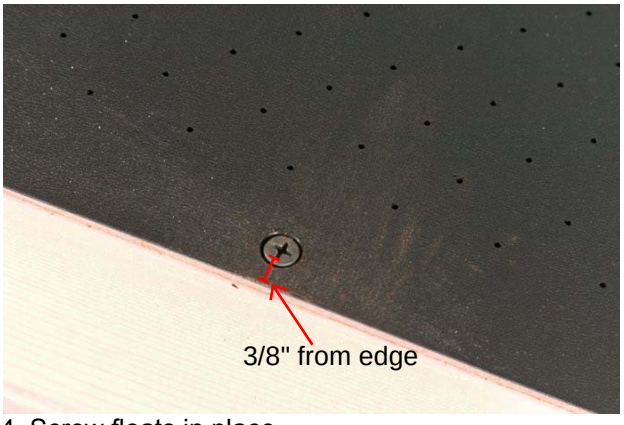


Figure 35
Align the black plastic textured side up (out) and the hardboard (smooth side touching the back of the black plastic) to the stand. Make sure the marked corners all match. Attach the plastic to the wood with only six black #6 x 1 drywall screws: 1 screw centered for each short side, and 2 screws per long side, placed 12" in from the corner. Make sure that the holes in the plastic and hardboard are in alignment–use push pins to help ensure alignment.


1. Drill screw hole.


2. Countersink.


3. Install and tighten screw.



4. Screw floats in place.

Figure 36
Drill holes 3/8" from edge, and countersink so that the screw is not quite snug. The plastic should "float" a little, and the screw heads are flush or a bit below the top surface of the plastic.

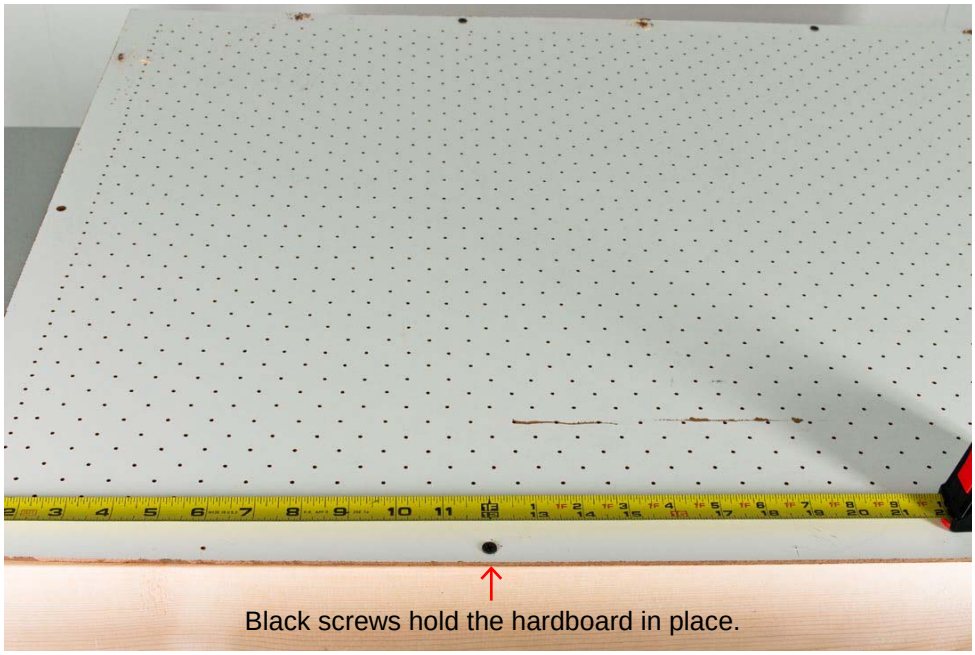
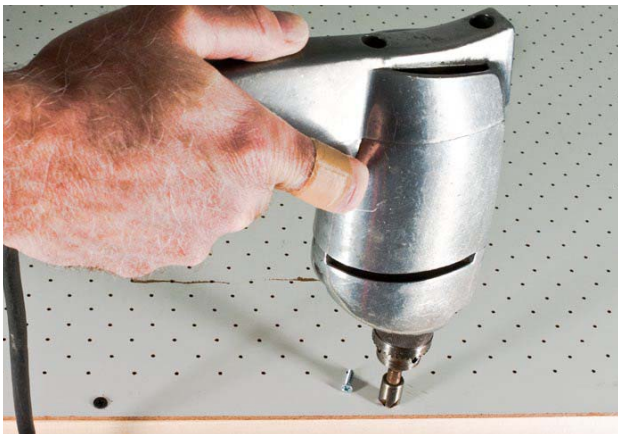
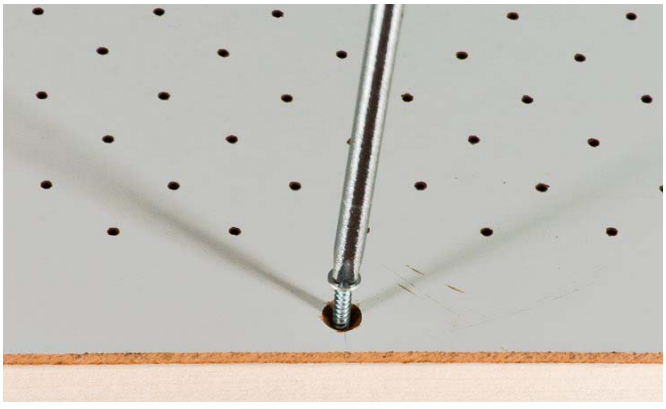


Figure 37
Remove the black plastic, then temporarily re-attach the hardboard and hold it in place using the black screws. Drill and countersink ten #6 wood screws in the hardboard–three for each long side, two for each short side. See below.

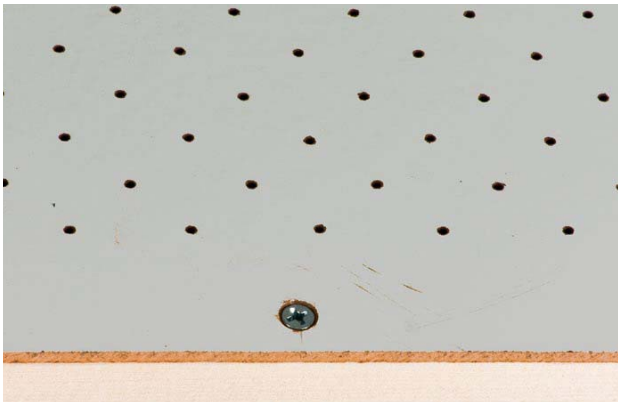
37A Drill.



37B Countersink.



37C Tighten Screw.



37D Here is the screw in place, at proper depth.

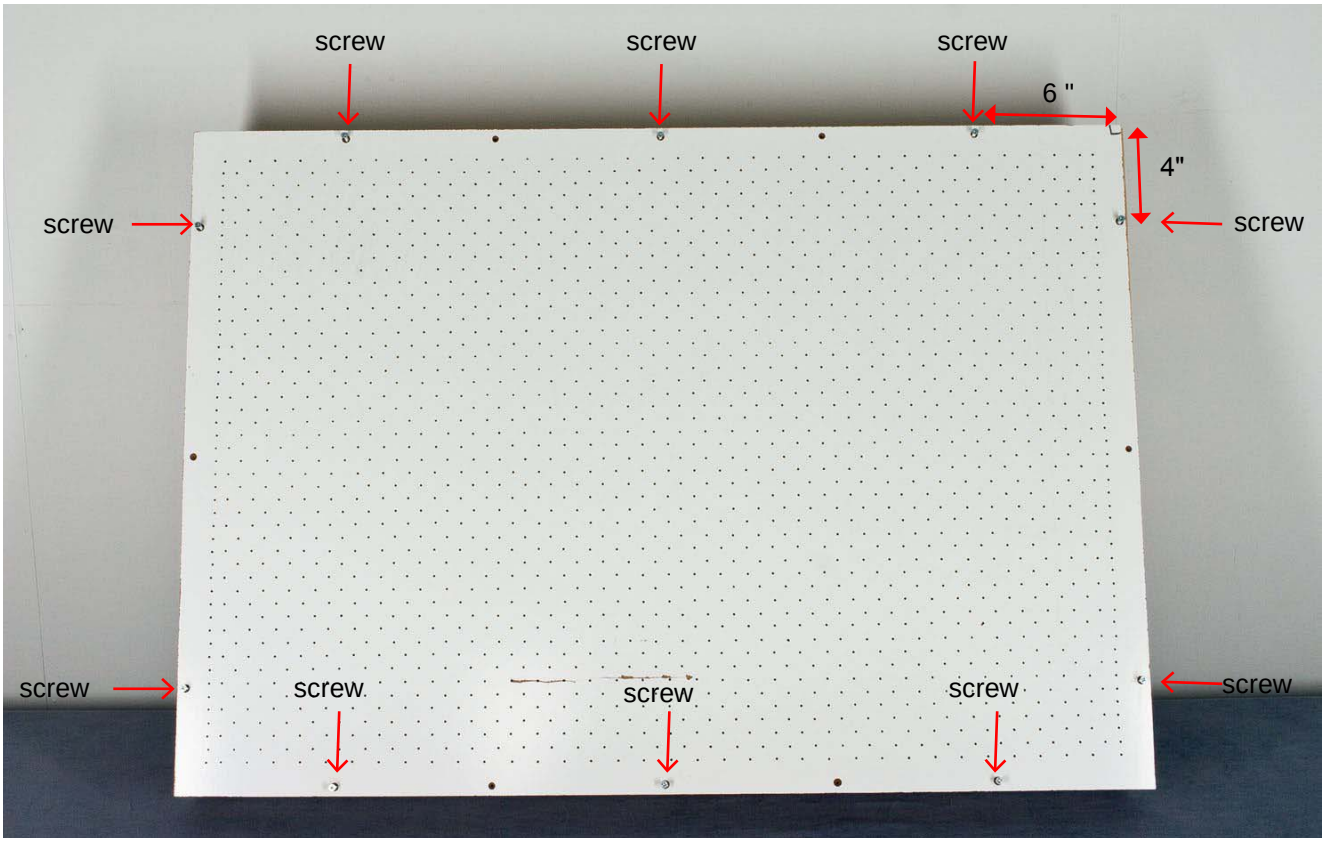


Figure 38
Holes have been drilled, screws ready to tighten.

Figure 39
After screwing the hardboard in place, screw the black plastic on top. This completes the table top.

11. Building the Base Frame of the Table

To build the base frame, use the fittings and PVC that have been precut (Refer to pages 11 and 12.) Deburr all cut ends. Lay the pieces out for the Right End, or Side, as Figure 39 illustrates. Assemble it dry. (See Figure 41.) It will be glued later. The most difficult step is to be sure that the PVC pipe fully seats in the 45˚elbows. A hammer and a block of wood is helpful when seating the 45˚ elbows. Then do the same for the Left End, or Side (Figures 42-43.)

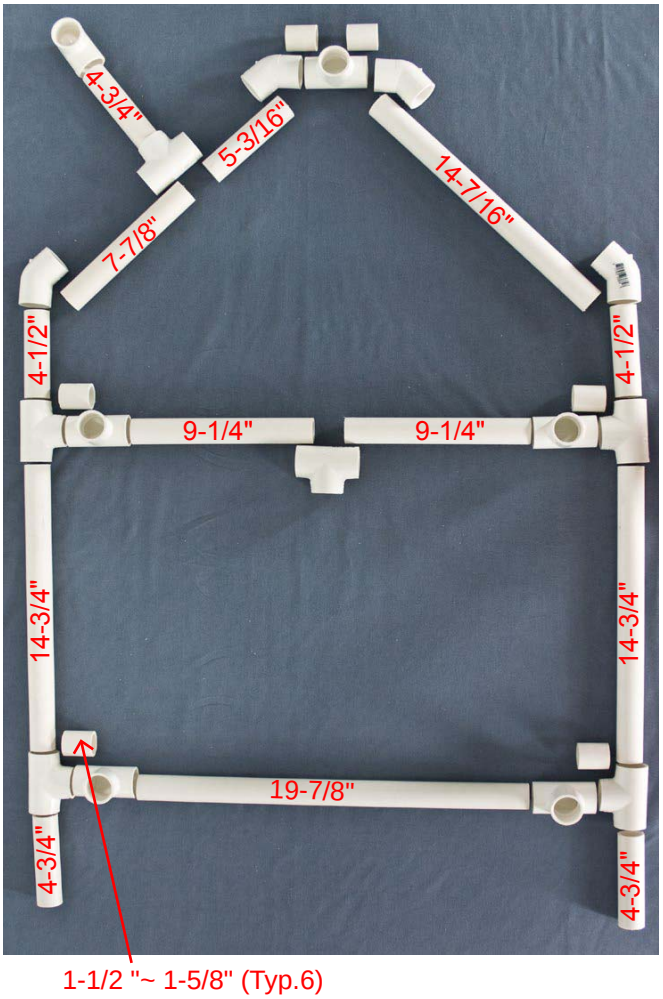


Figure 40
Right End or Side, laid out, ready to assemble.

Figure 41
Right End or Side, assembled.

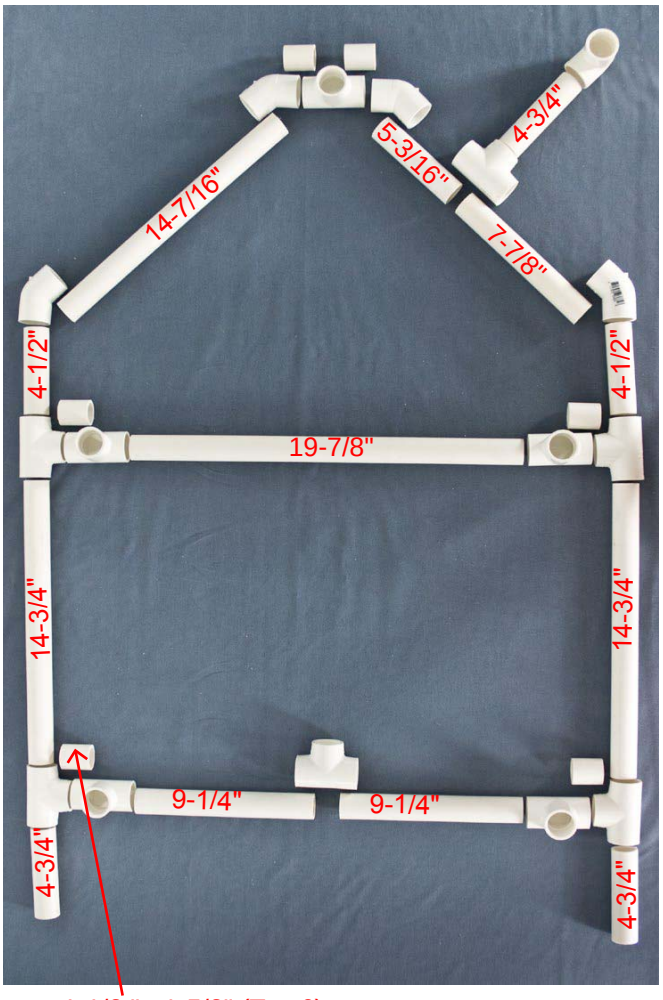


Figure 42
Left End or Side, laid out, ready to assemble.

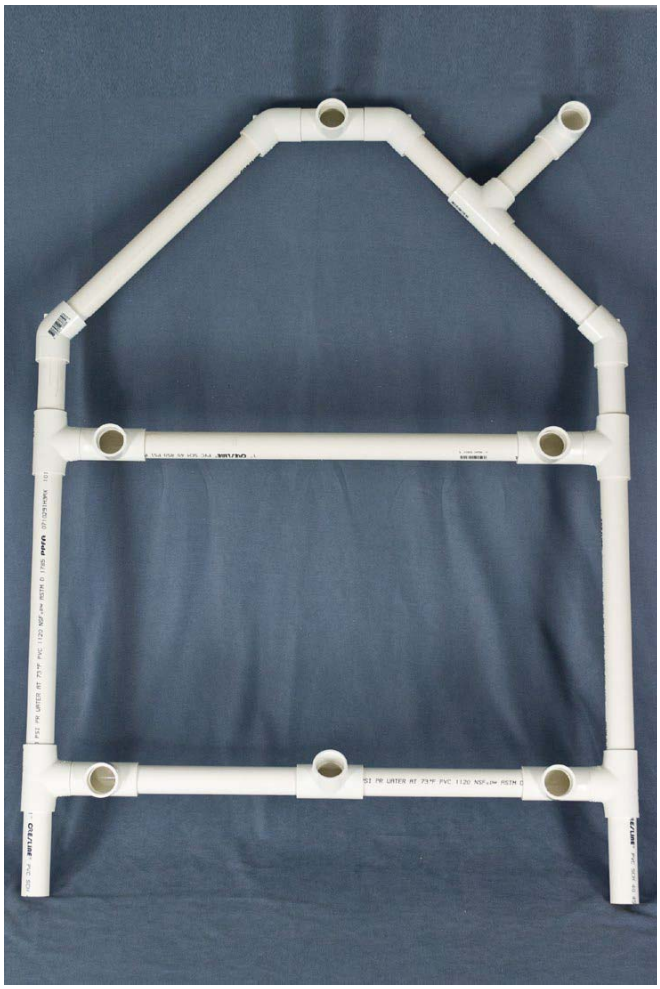


Figure 43
Left End or Side, assembled.

Figure 44
Attach Left End and cross pieces, and assemble one stabilizing crosspiece. (Do not glue yet.)

Figure 45
Complete the base frame assembly. Front view. (Do not glue yet.)

Figure 46
Completed base frame assembly, rear view. (Not yet glued.)

Temporarily remove the upper section of the base frame, in preparation for gluing the PVC. (See Figure 47) Carefully pull each joint apart, glue it, and make sure to keep the base frame square and aligned as you glue. Work your way through all the joints. (See next pages.) Mark each joint with masking tape once it's glued, so it's easy to see what is glued and what is not. The glue sets almost immediately, so have a hammer ready to pound the joints. They must seat fully.

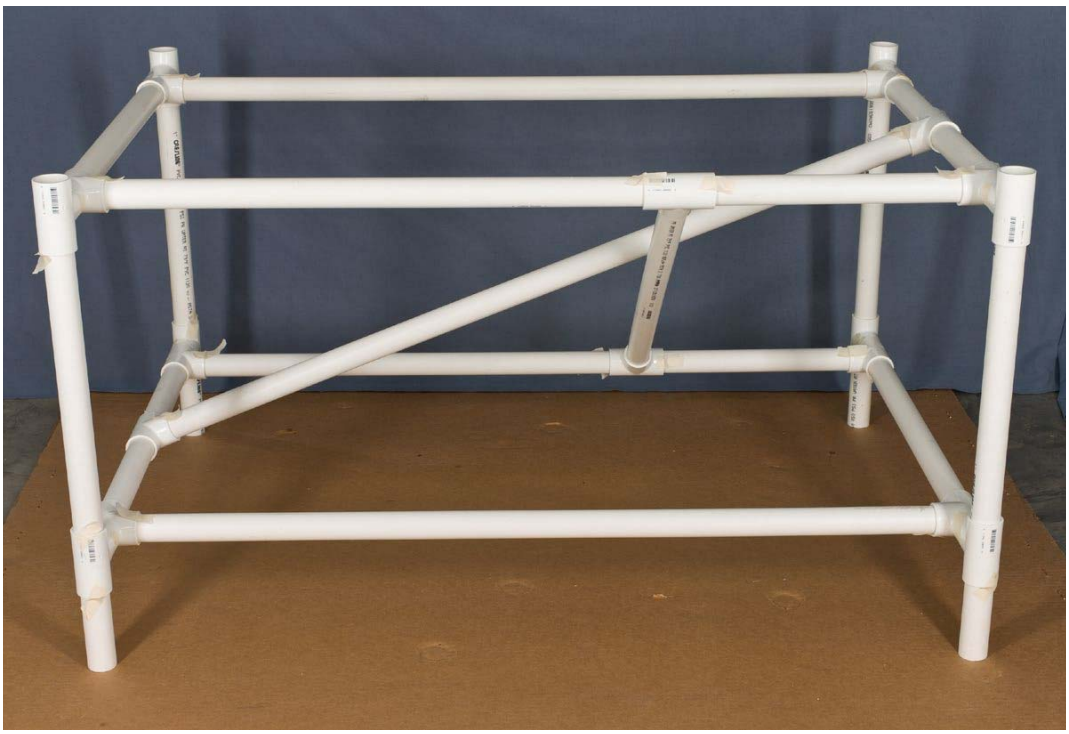


Figure 47
Temporarily remove the upper section of the base frame.

Figure 48
Pull apart one section. Have supplies ready, in preparation for gluing.

Figure 49
Wear gloves when gluing. Have adequate ventilation. Wear safety glasses. Be careful with PVC cement.

Figure 50
Work through the joints, glue them one by one. Note masking tape marks each joint which has been glued.

Figure 51
Pound so that the joints seat fully.

12. Putting the Table Top and the Base Frame Together

Figure 52
Assemble the table by laying the table top on a work table, upside down, and putting the base frame (also upside down) on the table top.

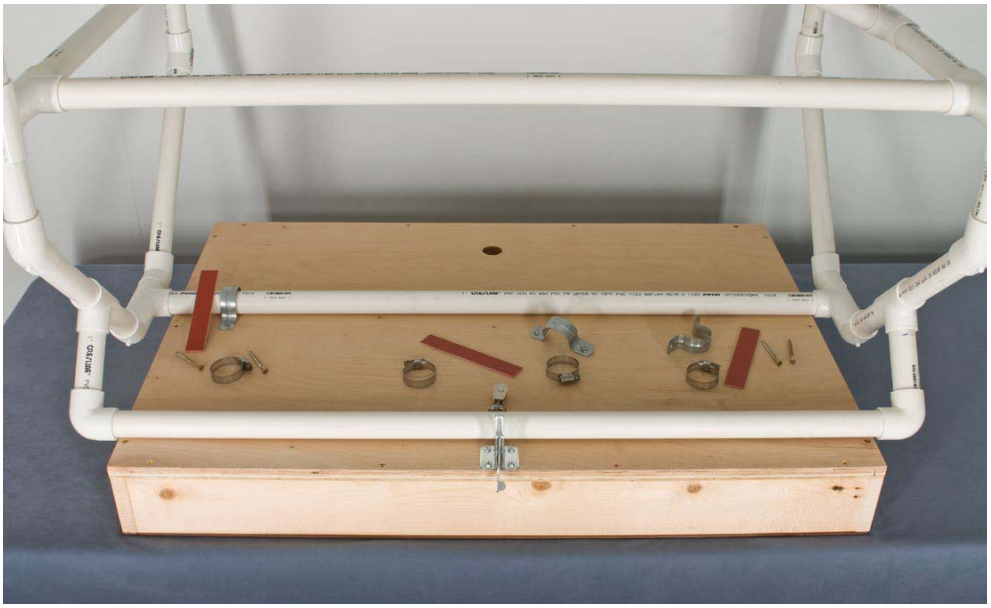


Figure 53
Temporarily remove the three strap clamps from the table top, and position the base frame. Be sure the orientation is correct.

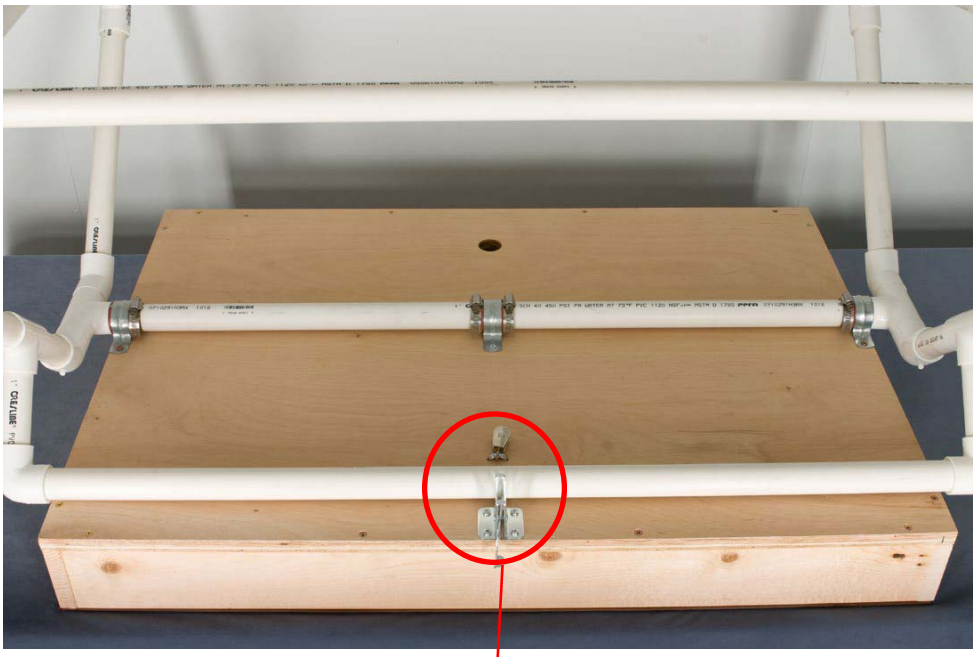


Figure 54
Attach the base frame to the table top. Notice the placement and the orientation of the hose clamps– they hold the rubber strips "captive" under the strap clamps.

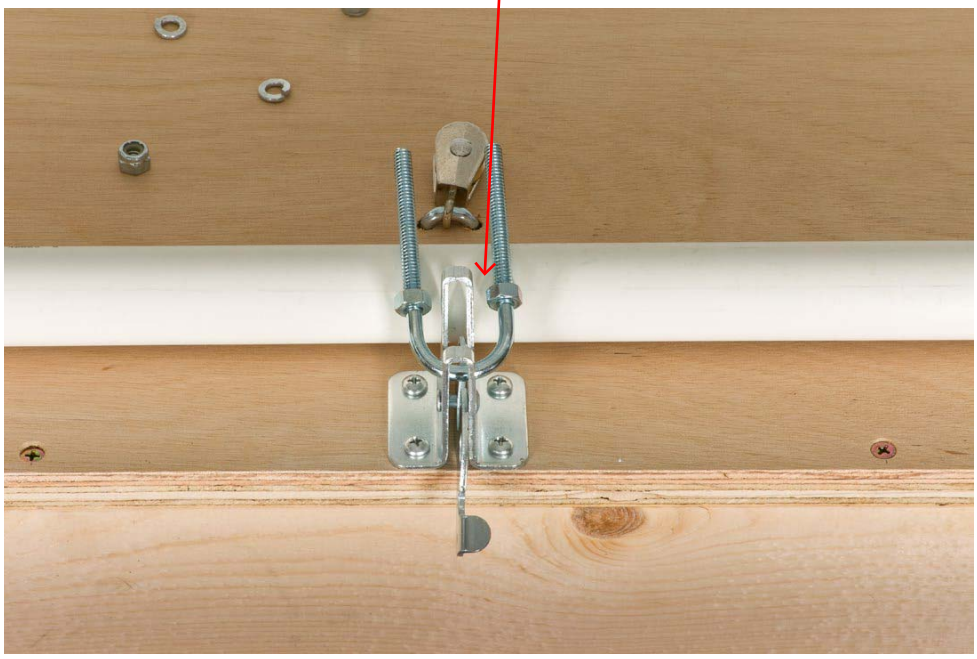
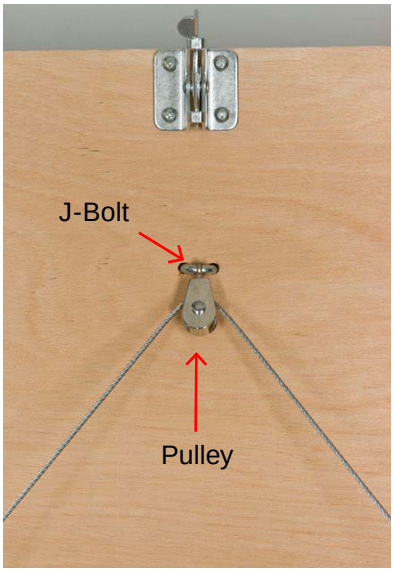


Figure 55
Mark the PVC for 2 holes to be drilled for the u-bolt. Drill through the PVC and attach the u-bolt. (See detail of u-bolt in place, below.)

Figure 56:
U-Bolt in place.

13. Finishing Steps

Figure 57
Drill a hole for the eyebolt. Install the cable. Adjust the turnbuckle so that the table top is perfectly vertical when in the upright, "photo" position.



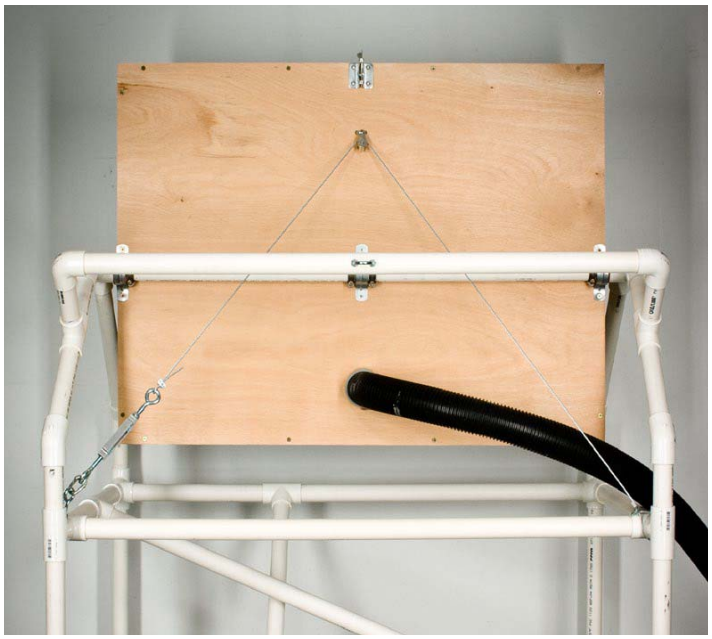


Figure 58 Back of the table top, completed.

The End